

**Connecticut
Consolidated Assessment & Listing Methodology
for 305(b) and 303(d) Reporting
(CT CALM)**

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Introduction

This assessment and listing methodology documents the decision-making process for assessing the quality of surface waters for the *Connecticut Water Quality Report to Congress*, or "305(b) Report", and for generating the list of *Connecticut Waterbodies Not Meeting Water Quality Standards* or "303(d) List". In accordance with Sections 305(b) and 303(d) of the Federal Clean Water Act (CWA), the State of Connecticut Department of Environmental Protection (CT DEP) submits a 305(b) Report and 303(d) List to the United States Environmental Protection Agency (US EPA) on even numbered years. The 305(b) Report provides information regarding the quality of all assessed waters in the State relative to their designated uses as established in the Connecticut *Water Quality Standards* (CT WQS, CT DEP 2002a). The 303(d) List documents waters impaired for one or more designated uses. For waters impaired by a pollutant or pollutants, Section 303(d) further requires that a total maximum daily load (TMDL) for identified pollutant(s) be established and allocated among dischargers.

As with many states, the Connecticut 305(b) Report and 303(d) List have historically been developed independently of each other, with some but not complete overlap of information. Despite their relationship, the statutory requirements for information gathering and public participation are slightly different for the two Sections of the CWA. Starting in 2002, following a national effort to consolidate the methodologies for both Sections, the Connecticut 303(d) List has been generated as a subset of waters assessed for the 305(b) Report. The *Consolidated Assessment and Listing Methodology* described here is the procedure by which this is done. To understand this process, it is important to put it in the context of the Federal CWA and CT WQS.

The CWA is the primary federal law that protects our nation's surface waters, including lakes, rivers, and coastal areas. In authorizing the Act, the United States 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. The State of Connecticut adopted Water Quality Standards as required under Section 22a – 426 of the Connecticut General Statutes and Section 303 of the CWA to accomplish this and other water quality goals.

The CT WQS document contains policy statements concerning the protection of water quality and describes the Classification of State waters. Described for each Class are: 1) allowable discharges; 2) numeric or narrative criteria for various parameters, such as dissolved oxygen and indicator bacteria, to maintain water quality and; 3) designated uses that should be supported (Appendix A). For example, Class A surface waters have the following designated uses: habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreational use; and water supply for industry and agriculture. The extent to which waterbodies support their designated uses is the key element of 305(b)/303(d) assessments. Designated use support is effectively the measure of water quality used for assessment.

Designated Uses Assessed for 305(b) and 303(d) Reporting

There are slight differences in the wording for designated uses as they are stated in the CT WQS document and as they are described in 305(b)/303(d) assessments. Designated uses are listed in Table 1 as they appear in the CT WQS (CT DEP 2002a) and as they are tracked in the US EPA Assessment Database (ADB) for nation-wide 305(b)/303(d) assessments.

Table 1. Designated uses for surface waters as described in Connecticut Water Quality Standards (CT DEP 2002) and 305(b)/303(d) Reports.

305(b) Designated Use	CT WQS Designated Use	Applicable Class of Water	Functional Definition
Primary Contact Recreation	Recreation	AA, A, B, SA, SB	Swimming, water skiing, surfing or other full body contact activities.
Secondary Contact Recreation	Recreation	AA, A, B, SA, SB	Boating, canoeing, kayaking, fishing, aesthetic appreciation or other activities that do not require full body contact.
Aquatic Life Support	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	Not specified as a use, but implicit in "Habitat for fish and other..." ^a	AA, A, B, SA, SB	Waters supporting fish that do not contain concentrations of contaminants, which would limit consumption to protect human health.
Shellfishing	Shellfish harvesting for direct human consumption where authorized.	SA	Waters from which shellfish can be harvested and consumed directly without depuration or relay. Waters may be conditionally approved.
Shellfishing	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 (may be conditionally approved); also support seed oyster harvesting
Public Water Supply	Existing or proposed ^b drinking water supplies.	AA	Waters presently used for public drinking water supply or officially designated as potential public water supply.
Public Water Supply	Potential drinking water supplies.	A	Waters that have not been identified, officially, but may be considered for public drinking water supply in the future.
Navigation	Navigation	SA, SB	Waters capable of being used for shipping, travel or other transportation by private, military or commercial vessels.
Industrial	Water Supply for Industry	AA, A, B, SA, SB	Waters suitable for industrial supply.
Aesthetics	Not a designated use but included in narrative criteria.	AA, A, B, SA, SB	Appearance, odor or other characteristics of water, which impact human senses are acceptable.
Agricultural	Agriculture	AA, A, B	Waters suitable for general agricultural purposes.
Overall		AA, A, B, SA, SB	Waters supporting all of their designated uses.

^a Also addressed in CT WQS policy statement #14: 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 Potential drinking water supplies identified in the Long Range Plan for Management of Water Resources prepared and adopted pursuant to Section 22a-352 Section 25-32d of the Connecticut General Statutes (Water Quality Standards, CT DEP 2002a).

Levels of Use Support

In making water quality assessments, each designated use of a waterbody or waterbody segment is assigned a level of support (*e.g.*, full support, partial support), which characterizes the degree to which the water is suitable for that use. The following use support categories are currently used for 305(b) reporting. These are general definitions. Refer to the section in this report entitled *Assessment Methodology* (p. 9) for specific information regarding the criteria for determining levels of support for each designated use.

Full Support - the waterbody or waterbody segment is suitable for a designated use and will presumably continue to be suitable for that use in the future.

Threatened - the waterbody currently supports the designated use, but may not in the future due to degrading water quality or the existence of pollution threats that may impair water quality. This category is a subset of Full Support.

Partial Support - the waterbody or waterbody segment does not support the designated use at all times or under certain conditions, or the criteria used to assess support are only partially met.

Not Supporting - the waterbody or waterbody segment does not support the designated use.

Not Attainable * - the waterbody or waterbody segment has been altered to the point where there is no expectation that the use can be met (*e.g.*, a section of river that is piped underground).

* The Not Attainable designation does not imply that there has been a Use Attainability Analysis. This designation has been retained for 305(b) reporting because it provides information regarding river segments that are completely enclosed in conduits or that are documented to run dry due to diversions (*i.e.*, for all practical purposes are not attainable). For 303(d) listing however, these waters are grouped with Not Supporting so as not to be construed to have undergone a Use Attainability Analysis.

Not Assessed – Insufficient or no information exists to adequately assess use support.

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 parameters, benthic invertebrate and fish community, indicator bacteria, aquatic toxicity, tissue contaminant, sediment chemistry/toxicity and effluent analysis. Following guidance from US EPA (Wayland memo, 11/19/01), the following data and information are considered in conducting water quality assessments:

- ◆ The (most recent) Section 305(b) report, including the Section 314 lakes assessment;
- ◆ The most recent Section 303(d) list;
- ◆ The most recent Section 319(a) nonpoint assessment;
- ◆ Reports of water quality problems provided by local, state, territorial or federal agencies, volunteer monitoring networks, members of the public or academic institutions;
- ◆ Reports of dilution calculations or predictive models;
- ◆ Fish and shellfish advisories, restrictions on water sports or recreational contact;
- ◆ Reports of fish kills or abnormalities (cancers, lesions, tumors);

- ◆ Water quality management plans;
- ◆ Safe Drinking Water Act Section 1453 source water assessments;
- ◆ Superfund and Resource Conservation and Recovery Act reports; and
- ◆ The most recent Toxic Release Inventory.

The primary sources of assessment information for rivers are ambient monitoring data collected by CT DEP 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 DEP, 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) and recent studies by professional contractors. For estuaries, aquatic life use assessments are based primarily on physical and chemical monitoring by the CT DEP for the EPA National Estuary Program Long Island Sound Study. Shellfishing use support is based on bacteria monitoring and sanitary surveys conducted by the CT Department of Agriculture / Bureau of Aquaculture (CT DA-BA) for shellfish bed management.

Reasonable efforts are also made to incorporate data from other state and federal agencies, municipalities, utilities, consultants, academia, and volunteer monitoring groups. Volunteer groups and academics that receive funding through Section 319 of the CWA have data reporting requirements, which encourages the sharing of information for water quality assessments. The CT DEP also directs a monitoring program for volunteers from which usable assessment 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 DEP, Bureau of Water Management or online at <http://www.dep.state.ct.us/wtr/volunmon/volopp.htm>.

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 DEP staff may conduct effluent or ambient toxicity tests as follow-up to 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 combined sewer overflow (CSO) in a stream segment automatically precludes primary contact use support. Use restrictions, such as beach closures, are also taken into consideration.

Data Quality and Degree of Confidence

In tracking water quality assessments, a distinction is made between waters that are considered “monitored” and waters that are considered “evaluated”. A waterbody or waterbody segment is considered monitored if the assessment is based on “sufficient and credible” ambient water quality data that are less than five years old. “Sufficient and credible” means that the quantity and quality of information can support a scientifically defensible assessment by an experienced professional familiar with waters of similar characteristics. If the data are more than five years old, not considered high quality, reflect limited sampling events, or if the assessment is made using other types of information, such as knowledge of a pollution source, the waterbody or waterbody segment is considered evaluated.

In most cases a waterbody is considered monitored when ambient data is provided by CT DEP, USGS or CT DA-BA. When volunteer or academic monitors have an EPA-approved Quality Assurance Project Plan (QAPP), their data are usually considered reliable and the waters may be considered monitored.

Where and When Water Quality is Assessed

Waterbodies and Waterbody Segments

A waterbody is a stream/river, lake/pond or estuary/embayment, which may be divided into segments. The basic assessment unit is the segment, and each segment is considered to have homogenous water quality (*i.e.*, use support is uniform throughout the segment). Typically, streams are segmented by features that may cause a change in water quality, such as a confluence with a tributary, a point source discharge, an impoundment or a significant change in land use. For the 2004 reporting cycle, 242 rivers comprising 487 segments were assessed. Almost all 147 assessed lakes were considered to each consist of one segment. (The two exceptions were a large river impoundment partially affected by low oxygen and a pair of connected ponds separated by an earthen berm.) Long Island Sound and associated embayments and estuaries were divided in to 51 waterbodies with 112 segments, largely based on shellfish bed classifications.

Stream & Rivers: Rotating Basin and Probabilistic Approaches

In 2001, the CT DEP completed statewide monitoring in wadeable streams and rivers using a five-year rotating basin strategy. The state was divided into five hydrological assessment units, each unit representing one or two major drainage basins. A different hydrologic unit was targeted for monitoring each year during the five-year cycle. This allowed CT DEP to increase the miles of assessed perennial streams from 15% to more than 25%. A more detailed explanation of this approach is found in *Ambient Monitoring Strategy for Rivers and Streams, Rotating Basin Approach* (CT DEP 1999), and assessment information obtained during the full basin rotation was reported in the 2002 305(b) Report.

Even with the increase in monitored miles resulting from the rotating basin approach, the CWA requirement to provide a description of water quality of all navigable waters is not possible based on this type of focused monitoring. To work toward this comprehensive assessment goal, the CT DEP with funding and cooperation from US EPA Region I conducted a pilot statewide probabilistic monitoring effort in wadeable streams during 2002-2003. Through this approach, a statistically valid sample of streams was monitored to represent conditions of all wadeable streams in the State. During this two-year period, the rotating basin approach was suspended, although some focused monitoring was still conducted at reference sites, in rivers with known problems, as follow-up to effluent treatment upgrades, and as intensive monitoring prior to and following TMDL implementation. Because all laboratory and data analyses have not been completed for probabilistic sites, a full statistical assessment of all wadeable streams will not be done until the 2006 305(b) Report. However, data from each probabilistic site and any targeted monitoring conducted during the 2002-2003 were incorporated into stream assessments on a segment-by-segment basis for the 2004 report.

For regular ambient monitoring, whether under targeted or probabilistic designs, CT DEP generally samples streams quarterly for physical and chemical parameters, and indicator bacteria. At wadeable sites, benthic macroinvertebrate collections are made during the fall index period.

Benthic community structure is used as the primary indicator of biological integrity. Fish community sampling was added at all sites during the probabilistic approach, and at a subset of sites during the rotating basin schedule. Field surveys and collections of periphyton (benthic algae) were conducted at probabilistic sites during the summers of 2002 and 2003. Analysis of algae data is not complete and will be incorporated into assessments for the 2006 reporting cycle.

In addition to monitoring conducted by CT DEP staff, a cooperative DEP/USGS fixed-network provides physical, chemical and bacteria data from approximately thirty sites located across the State. This long-term program provides data from four to twelve sampling events at each site per year on major rivers and several wadeable streams.

Lakes

Historically, Connecticut has assessed 105 - 115 "significant" lakes statewide for 305(b) reporting. Significance is based on a lake having state or federal public access, or providing unique or otherwise important habitats. In incorporating previously listed 303(d) waters into the 305(b) assessment process in 2002, a number of lakes and ponds which are not considered "significant", but are believed to have impairments, were added to the lake assessment list. Additionally, lakes and ponds with locally monitored bathing beaches have been added.

Due to staff and funding constraints, there has been no statewide ambient lake-monitoring program in Connecticut for more than a decade, and many lake assessments fall into the "evaluated" category because existing information is more than five years old. However, there has been limited targeted monitoring by CT DEP and USGS staff in lakes with known problems. Also, the Lakes Management Grant Program, administered by CT DEP, funds intensive surveys and diagnostic studies in lakes identified as having special problems or special concern to communities. These studies provide valuable information regarding contamination, eutrophication, sedimentation, and extent of aquatic plant growth. Current beach closure data are also taken into consideration for determining primary contact use support.

In 2004, CT DEP will begin a statewide probabilistic lake-monitoring program whereby 20 lakes, chosen by a stratified random design, will be monitored each year for a three-year period. Resulting data will be incorporated into lake assessments for 305(b) reporting as appropriate. Following completion of this project, CT DEP will evaluate the utility of this type of monitoring in providing assessment information and whether it is feasible to continue.

Estuaries

Long Island Sound is monitored year-round on a monthly schedule for dissolved oxygen and nutrients at 17 fixed stations; 25 - 30 stations are added during summer months. Concurrent with this effort, CT DEP collects 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 Assessment (Strobel 2000). For the national assessment, representative stations in coastal harbors and offshore waters are chosen randomly to represent conditions of the entire Sound. This information provides the basis for aquatic life use assessments. Annual shellfish bed monitoring and sanitary surveys conducted by CT DA-BA provide assessment information for shellfish use support. Beach closure information as well as known sources of pollution, such as CSOs, is used to determine primary contact use support. All estuarine waters were re-assessed using the most current information for the 2004 reporting cycle.

Reservoirs, Beaches, Fish Kills

Beach closure, drinking water reservoir trophic status and closure, and fish kill information are solicited and reported for the entire State in separate tables in the 305(b) Report. This information is incorporated into individual waterbody assessments where appropriate.

Management of Assessment information

Assessment data (*e.g.*, segment descriptions, assessment methods, use-support, causes and sources of impairment) are stored electronically by waterbody segment in an Assessment Database (ADB) provided by the US EPA. These data are submitted annually in electronic format to EPA in addition to the written biennial 305(b) Report.

Efforts are ongoing to link assessment information stored in the ADB directly to a Geographic Information System (GIS). Connecticut is part of a national initiative to index assessed surface waters to the National Hydrography Dataset (NHD). Problems related to incompatibility of map scales at the state and national levels have delayed utilization of the NHD in Connecticut. A pilot version will be available for use beginning in 2004. However, for the 2004 reporting cycle, assessment information and waterbody segmentation will be represented by simple graphics using GIS.

Raw monitoring data are managed by means of a Microsoft Access database developed by the Water Monitoring and Assessment Section of the CT DEP. This database contains sampling results and meta-data collected by the Monitoring and Assessment Section since 1997, and has greatly facilitated the assessment process. While CT DEP uses this in-house Microsoft Access database for normal monitoring and assessment purposes, EPA's STORET national water quality database is the ultimate repository for all monitoring results. Migration of CT DEP monitoring data to STORET began in 2003, with all beach data. All monitoring station information will be added in early 2004, followed by chemical, physical, and bacterial data and finally biological community information.

CT DEP TMDL staff maintains a Microsoft Access database to document progress of TMDL development and implementation. The database stores pertinent information regarding participants, waterbodies, ambient and facility monitoring data, and the status of Best Management Practices (BMPs) in achieving TMDL goals. It allows tracking participants from many programs within DEP, other government agencies and interest groups.

Assessment Methodology

Assessment procedures generally follow guidance provided by US EPA (1997) using a variety of information and data types. The CT DEP applies a "weight of evidence" approach 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 fully credible (see Data Quality section, p. 6). For example, if available indicator bacteria data do not exceed criteria, but a CSO is present, the waterbody segment is considered impaired. If the benthic invertebrate community is just meeting standards, and the fish community shows impairment, the waterbody is considered impaired. 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, the waterbody segment is flagged for further monitoring.

Aquatic Life Use Support

River 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). CT DEP has used benthic macroinvertebrate community structure as the primary indicator of biological integrity since the mid-1970s. These data provide a relatively direct characterization of impairment and use support through comparison of sample communities to reference communities (Table 2). Occasionally, where habitat conditions are not optimal, a non-quantitative assessment may be used to infer aquatic life use support. Such assessments fall into the "evaluated" category. It is important to note that while CT DEP employs the methods described in US EPA's Rapid Bioassessment Protocols (RBP, Plafkin *et al.* 1989), the actual criteria for benthic invertebrates in the CT WQS (CT DEP 2002a) are narrative community descriptions, rather than numeric values.

Beginning in 1999, fish community sampling has been conducted at wadeable sites by means of a cooperative project with the DEP Fisheries Division. CT DEP intends to develop a numerical index for assessing fish community data in the future, but currently relies on the best professional judgment of fisheries and water quality monitoring staff biologists to evaluate community structure. In general, fish populations from sampled streams are compared to what would be expected in an unimpaired or minimally impaired stream of similar size. Fisheries assessments are used to support benthic information and in some cases provide the primary method to assess ALUS. Methods for both benthic invertebrate and fish monitoring are described in CT DEP (1996, 2001), Plafkin *et al.* (1989) and Barbour *et al.* (1999).

Indirect measurements of ALUS such as ambient physical/chemical data, discharge monitoring reports, aquatic toxicity monitoring reports, and sediment data are also evaluated against water quality criteria established in CT WQS (CT DEP 2002a). Decision criteria used in making ALUS assessments are provided in Table 2.

Table 2. Aquatic life use support categories and contributing decision criteria for wadeable streams.

Aquatic Life Use	Criteria / Indicators
Fully Supporting	<ul style="list-style-type: none"> • Benthic community: bioassessment indicates community is non-impaired or slightly impaired^a, and meets narrative criteria in CT WQS; RBP III Community Score (Plafkin <i>et al.</i> 1989) > 54 % of Reference Condition. • Fish community: species composition, trophic structure, and age class distribution as expected for a non-impacted stream of similar size. • Conventional physical/chemical criteria not exceeded. • Measured toxicants do not exceed chronic toxicity criteria. • No record of catastrophic events (<i>e.g.</i>, chemical spills, fish kills) • No evidence of flow diversion
Threatened	<ul style="list-style-type: none"> • Benthic community: non-impaired or lightly impaired, but still meets narrative criteria in CT WQS; RBP III Community Score (Plafkin <i>et al.</i> 1989) > 54 % of Reference Condition, and conditions exist that may impact the community in the future. • Fish community as above, but documented trend is downward or conditions exist that may impact the community in the future. • Slight exceedences of either conventional or toxicant criteria in < 10% of samples; exceedences difficult to discern from expected analytical variability or error. • Discharge effluent constitutes >20% of stream flow. • Land use conditions exist that may cause impairment.

	<ul style="list-style-type: none"> • Flow reductions due to diversions have been observed.
Partially Supporting	<ul style="list-style-type: none"> • Benthic community: bioassessment indicates community is moderately impaired; RBP III Community Score (Plafkin <i>et al.</i> 1989) 21- 50% of Reference Condition ^b. • Fish community: species composition, trophic structure and age class distribution significantly less than expected for a non-impacted stream of similar size; diversity and abundance of intolerant species reduced; top carnivores rare; trophic structure skewed toward omnivory. • Either fish or benthic communities meet above conditions, and the other community is fully supporting. • Conventional physical/chemical criteria exceeded in > 10% but < 25% of samples. • Measured toxicants exceed chronic criteria < 10% of samples. • Flow is reduced significantly during drought conditions.
Not Supporting	<ul style="list-style-type: none"> • Benthic community: bioassessment indicates community is severely impaired; RBP III Community Score (Plafkin <i>et al.</i> 1989) < 17% of Reference Condition. • Fish community: species composition, age class distribution and trophic structure greatly impaired in comparison to a non or minimally impacted stream of similar size; community dominated by highly tolerant species, omnivores and habitat generalists; in extreme cases, few species present and/or diseased fish common. • Conventional physical/chemical criteria exceeded in > 25% of samples • Measured toxicants exceed chronic criteria >10% of samples • Stream known to dry completely for significant periods. • Documented catastrophic event (<i>e.g.</i>, chemical spill, fish kill)
Not Attainable	<p>Stream completely enclosed in conduit or cleared concrete trough.</p> <p>Stream is dewatered most of the time due to and upstream impoundment or diversion.</p>

a. “Slightly impaired” refers to a bioassessment category (Plafkin *et al.*1989) represented by a benthic macroinvertebrate community that may show some loss of pollution-intolerant forms. In Connecticut, a slightly impaired assessment may still meet water quality standards given habitat restrictions.

b. When a bioassessment falls on the border between two use support categories, use support is determined by staff biologists with consideration site conditions and other available data.

Lakes

Levels of support for aquatic life use are based almost exclusively on the best professional judgement of CT DEP lake management staff based on the most recent available information from government agencies and/or reliable contractors and lake associations. Other factors taken into consideration are known problems, such as chronic algal blooms, extensive establishment of exotic invasive plants, severe sedimentation, and surveys of fisheries biologists.

Trophic Assessments in Lakes

Lake trophic classifications, as listed in the CT WQS (CT DEP 2002a, Appendix A) 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 is 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 increased eutrophy may indicate an impairment or a threat to aquatic life. Whereas, a naturally eutrophic lake, having nutrient concentrations that support high levels of biological activity without any significant anthropogenic source, would not be considered impaired.

Estuaries

Aquatic life use assessments for estuaries are based primarily on oxygen and nutrient data collected by CT DEP's Long Island Sound monitoring staff. In cases where State water quality criteria are violated for a specific parameter as defined in the CT WQS (CT DEP 2002a), the waterbody is identified as impaired. Low dissolved oxygen, or hypoxia, in offshore waters and some embayments is the most frequently cited impairment of aquatic life. CT DEP revised its dissolved oxygen criteria in 2001 (Appendix A) for offshore bottom waters, based on risk assessment criteria published by EPA (U.S. EPA 2000). Because hypoxia is a seasonal phenomenon, affected waters are considered partially supporting rather than not supporting. 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.

Table 3. Aquatic life use support in estuaries as determined by dissolved oxygen levels.

Aquatic Life Use Assessment	Dissolved Oxygen Criteria
Fully Supporting	Waters not affected by hypoxic events.
Partially Supporting	Waters affected by hypoxia for some period during the year.

Fish Consumption

Fish consumption use support is determined by consumption advisories issued by the Connecticut Department of Public Health (CT DPH). Consumption advisories are in turn 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 the mid-1990s due to mercury contamination. This advisory was based on statewide surveys of mercury contamination in fish from lakes (Neumann 1996), and rivers (CT DEP unpublished). Therefore, in addition to fish consumption use support as determined by the criteria below (Table 4), all freshwaters of the State should technically be considered as partially supporting for fish consumption due to mercury contamination. Likewise, all estuarine waters are technically partially supporting for fish consumption due to PCB contamination in migratory striped bass and bluefish, as well as lobster tomalley.

Table 4. Fish consumption use support and criteria.

Fish Consumption Assessment	Criteria
Fully Supporting	No consumption advisory for any fish species or any consumer group, other than the statewide advisory for Mercury in freshwater fish or PCBs in migratory saltwater fish.
Threatened	No consumption advisory for any fish species or any consumer group, other than the statewide advisory for Mercury in freshwater fish or PCBs in migratory saltwater fish, but sediments contain detectable levels of contaminants known to bioaccumulate in fish.
Partially Supporting	A consumption advisory exists for some fish species or for certain risk consumer groups, in addition to the statewide advisory for Mercury in freshwater fish or PCBs in migratory saltwater fish.
Not Supporting	A fish consumption advisory exists for all fish species for all consumer groups.

Shellfishing (in Estuaries)

The responsibility for regulating shellfish harvest is assigned to the Department of Agriculture. The Department of Agriculture, Bureau of Aquaculture (CT DA-BA) collects fecal coliform data to assess nearshore waters to determine openings and closures of shellfish grounds

(Appendix B). Shellfish beds are classified with respect to the restrictions on harvest. There are four general classifications: 1) Approved for direct human consumption; 2) Conditionally approved for human consumption based upon rainfall, sewage treatment plant operations, season or other conditions, 3) Restricted-relay or restricted-relay/depuration operations (may also be conditional), and 4) Prohibited (may be used for oyster seed harvest). Shellfish growing water classifications are based on seawater sampling and analyses, shoreline surveys and pollution source evaluations conducted by CT DA-BA, in conformance with the Interstate Shellfish Sanitation Conference Model Ordinance. CT DEP applies these classifications to SA and SB waters to assess shellfishing use support (Table 5).

Table 5. Shellfishing use support as determined by shellfish bed classifications.

Shellfishing	Criteria
Fully Supporting	SA waters approved for direct harvest. SB waters approved for direct harvest, conditional harvest, or restricted to relay or depuration operations.
Partially Supporting	SA waters conditionally approved for direct harvest.
Not Supporting	SA waters prohibited to shellfishing, seed oyster harvesting or certain aquaculture operations; or approved only for relay operations. SB waters prohibited to shellfishing, seed oyster harvesting or certain aquaculture operations.

In a number of towns, the CT DA-BA has placed 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 305(b)/303(d) purposes, shellfishing 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.

Primary Contact Recreation

Assessment of the designated use for primary contact recreation is based, for the most part, on indicator bacteria data provided by CT DEP quarterly sampling, USGS monitoring, volunteer monitoring, and municipal monitoring (Table 6). Following the adoption of revised CT WQS in 2002, enterococci group bacteria are now used as the primary indicator organism in salt (estuarine) water, and *Escherichia coli* in fresh water. For salt water, 104 Colony Forming Units or CFU/100 ml of enterococci is the single sample criteria for designated bathing areas, 500 CFU/100 ml for other recreational uses, and 35 CFU/100 ml is the geometric mean criteria for any primary contact use. In fresh water, 235 Colony Forming Units or CFU/100 ml of *Escherichia coli* is the single sample criteria 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 criteria for any primary contact use. Fecal coliform data, where it exists, may be used to confirm use support determinations.

For waterbodies or waterbody segments with designated bathing areas, beach closure information rather than actual indicator bacteria data is generally used to determine use support. Public bathing areas are sampled for indicator bacteria on a weekly basis during the swimming season, which serves as the basis for determining closures (CT DPH and CT DEP 2003). Some local health departments have implemented administrative beach closures, which take effect after

rainfall events of some pre-determined magnitude. In these cases, precipitation during the swimming season is also considered in evaluating beach closure information.

Additionally, beach personnel routinely conduct physical inspections of shoreline bathing areas (minimally once per day) for evidence of contamination. State and local officials also utilize sanitary surveys of shorelines and watersheds as a primary tool to determine sanitary quality. Discovery of waste materials indicative of untreated sewage or human fecal contamination (e.g., medical waste, disposed condoms, tampon applicators, or diapers, sewage discharged from a boat holding tank or sewage grease balls) can be sufficient justification to support a beach closure decision by local or state authorities.

There is a distinction between occasional, small quantities of temporary and/or transient sources of human fecal contamination transported to a site (e.g., diapers, tampons), and “significant” sources of contamination that originate from a fixed location within the water body (e.g., a CSO or a community with failing septic systems). Any contamination determined to be of human origin would likely result in a beach closure, whereas the presence of a “significant” source would result in a water body segment being assessed as impaired.

All types of closures, whether based on bacterial exceedences or the presence of a contamination source, are included in the annual closure statistics used to assess primary contact use support. A complete discussion of Connecticut's practices related to beach closure may be found in "Guidelines for Monitoring Bathing Waters and Closure Protocol" developed jointly by the Connecticut Department of Health, the DEP, the Connecticut Environmental Health Association, the Connecticut Association of Directors of Health (CT DPH and CT DEP 2003).

In some lakes, primary contact use may also be impaired by excessive growth of aquatic invasive plants or algae. Lakes for which no bacteria data exist may be considered fully supporting of primary contact if the lake is situated completely within an undeveloped area or if there have been no complaints of illness or excessive aquatic plant growth.

Table 6. Decision criteria for various categories of primary contact use support.

Primary Contact Recreation Assessment	Criteria / Indicators for designated public bathing areas
Fully Supporting	<ul style="list-style-type: none"> Designated bathing area closed 5% of swimming season or less; and Sanitary survey indicates no significant source* of human fecal contamination.
Threatened	<ul style="list-style-type: none"> Designated bathing area closed between 6% and 10% of swimming season; and Sanitary survey indicates no significant source of human fecal contamination. Land use or environmental conditions exist that may cause impairment. This may include excessive growth of aquatic weeds that threaten swimming use.
Partially Supporting	<ul style="list-style-type: none"> Designated bathing area closed between 10% and 25% of swimming season; or Sanitary survey indicates minor potential for significant source of human fecal contamination.
Not Supporting	<ul style="list-style-type: none"> Designated bathing area closed more than 25% of swimming season; or Sanitary survey indicates potential for significant source of human fecal contamination.
	Criteria / Indicators for areas not designated as public bathing areas
Fully Supporting	<ul style="list-style-type: none"> Sanitary survey indicates no significant source of human fecal contamination; and CT DEP and /or USGS ambient monitoring data show no exceedences of indicator bacteria.
Threatened	<ul style="list-style-type: none"> Sanitary survey indicates no significant source of human fecal contamination; and

	<ul style="list-style-type: none"> • CT DEP quarterly monitoring data show a single sample exceedence of indicator bacteria; or • Limited data from another source show exceedences; or • Land use or environmental conditions exist that may cause impairment. (This may include excessive growth of aquatic weeds that threaten swimming use.); or • Stream flow comprises >20% treated sewage effluent.
Partially Supporting	<ul style="list-style-type: none"> • Sanitary survey indicates minor potential for significant source of human fecal contamination; or • Monthly or frequent ambient monitoring data from USGS or another reliable source show a single sample exceedence or an exceedence of the geometric mean for indicator bacteria; or • CT DEP quarterly ambient monitoring data show two extremely high or three moderate single sample exceedences of indicator bacteria. • Land use or environmental conditions exist that may cause impairment. This may include excessive growth of aquatic weeds that preclude swimming.
Not Supporting	<ul style="list-style-type: none"> • Sanitary survey indicates potential for significant source of human fecal contamination; or • Ambient monitoring data from USGS or another reliable source show one or more single sample exceedences and an exceedence of the geometric mean for indicator bacteria; or • Land use conditions exist known to cause impairment.
Not Attainable	<ul style="list-style-type: none"> • Full body contact not possible; river enclosed in conduit.

* a significant source of human fecal contamination is one that originates from a fixed location and is transported to or within the water body (e.g., a CSO or a community with failing septic systems).

Secondary Contact Recreation

Secondary contact recreation (boating, fishing, *etc.*) is assessed for all lakes. Excessive growth of invasive aquatic plants may threaten or impair secondary contact uses, such as fishing or boating. The degree of impairment is based upon the best professional judgment of CT DEP lakes management staff. Also, in some rivers, where water diversions prevent normal use by canoeists and kayakers, secondary contact has been determined to be impaired. This use is assumed to be supported in all other Connecticut waters.

Drinking Water Supply

The CT DPH, in cooperation with the CT DEP, implements the federal Safe Drinking Water Act (SDWA) in Connecticut. The DPH tracks and reports on the water quality of public drinking water supplies within the context of the SDWA. Because CT DEP does not have direct access to ambient water quality information for these waterbodies, they are not tracked as waterbodies in the ADB for 305(b) assessments. However, CT DEP periodically surveys water utilities for information concerning closures, trophic status, and potential causes and sources of pollution. Trophic status is reported in a separate table in the 305(b) Report.

A number of Class AA and A tributaries to drinking water reservoirs are tracked and assessed in the ADB for 305(b) reporting. Assessment of these streams is based on standard measures of water quality (physical/chemical parameters, macroinvertebrate community, fish community, *etc.* where available), plus consideration of the potential causes and sources of pollution noted on water utility surveys.

Aesthetics

“Aesthetics” is not a designated use of waters in Connecticut WQS, rather a narrative criteria (Appendix A). Due to the ambiguous nature of measuring aesthetic use support, it is not routinely assessed for 305(b) / 303(d) reporting. For lakes, however, aesthetics is evaluated by lake managers based on best professional judgment and complaints received from the public. Complaints are usually due to excessive growth of aquatic plants or chronic algal blooms.

Navigation

Navigation is assumed to be fully supported for all SA and SB waters.

Agriculture, Industry

Agricultural and industrial supply uses are assumed to be fully supported for all AA, A, and B waters.

Overall Use Support

Overall use support is an integrated assessment that considers all designated uses in aggregate: aquatic life, primary contact, fish consumption and shellfishing (estuaries only)(Table 7). Secondary contact and aesthetics are taken into consideration for this integrated use, especially in lakes with algal or aquatic weed problems.

Table 7. Overall use support categories.

Overall Use	Criteria
Fully Supporting	All designated uses fully supported.
Threatened	All designated uses met, but data may show a decline in integrity. One or more uses threatened.
Partially Supporting	One designated use not supported (Estuaries); one or more uses partially supported (Rivers and Lakes)
Not Supporting	One or more designated uses not supported (Rivers and Lakes); more than one use not supported (Estuaries)
Not Attainable*	Streams that are completely dewatered due to a diversion, enclosed in a conduit or regularly cleared concrete trough.
Not Assessed	Some or none of the designated uses were assessed.

* The Not Attainable designation does not imply that there has been a Use Attainability Analysis. This designation has been retained for 305(b) reporting because it provides information regarding river segments that are completely enclosed in conduits or that are documented to run dry due to diversions (*i.e.*, for all practical purposes are not attainable). For 303(d) listing however, these waters are grouped with Not Supporting so as not to be construed to have a Use Attainability Analysis.

Listing of Unimpaired and Impaired Waters

Based on the above assessment methodology, all waters of the State may be placed in one of five categories described in the US EPA guidance (Wayland memo, 11/19/01). For 2002 and 2004 reporting, only impaired waters have been categorized pursuant to this guidance (see categories 4 and 5) for submission with the 303(d) List. All assessed waters, impaired and unimpaired waters are reported in the 305(b) report in a traditional listing by drainage basin. The five EPA categories and the subsequent monitoring recommended to support water quality management are described below:

1. Fully supporting of all uses (may be threatened for some uses ^a). Reliable data and information support a determination that the water quality standards are attained for the Class designation. These waters will be monitored in the future, in accordance with the ambient monitoring strategy adopted by the CT DEP. Waters with threatened uses may be prioritized to determine trends in water quality.
2. Fully supporting of some designated uses (may be threatened for some uses ^a); and insufficient or no data and information available to assess remaining uses. Reliable data and information exist to support a determination that some uses are attained. These waters will be monitored in the future, in accordance with the ambient monitoring strategy adopted by the CT DEP. Waters with threatened uses may be prioritized to determine trends in water quality, or better define attainment status.
3. Not assessed, insufficient or no information exists to determine if any designated use is attained. These waters may be prioritized for monitoring as considered appropriate by CT DEP staff, or may be monitored in accordance with the ambient monitoring strategy adopted by the CT DEP. Following a probabilistic approach, these waters may be assessed through statistical representation.
4. Impaired for one or more designated uses, TMDL development not required for one of the following reasons:
 - a. (CT DEP Tier 1) ^b TMDL has been completed. Waters for which TMDL(s) have been developed and approved by EPA that, when implemented, are expected to result in full attainment of the standard. Where more than one pollutant is associated with the impairment of the waterbody or waterbody segment, it will remain in Category 5 until TMDLs for all pollutants have been completed and approved by EPA. Follow-up monitoring will be scheduled as specified in the approved TMDL implementation and monitoring plan, to verify that the water quality standard is met after implementation.
 - b. (CT DEP Tier 4) ^b Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. These are waters where other pollution controls required by local, state, or federal authority are stringent enough to attain any water quality standard applicable to such waters. The pollution controls required are specifically applicable to the particular water quality problem. Monitoring will be scheduled for these waters to verify that the water quality standard is attained as expected.
 - c. (CT DEP Tier 5) ^b Impairment is not caused by a pollutant, but by a stressor not directly related to water quality (e.g., habitat modification, hydraulic modification). These waters will be monitored in the future, in accordance with the ambient monitoring strategy adopted by the CT DEP.
5. Impaired for one or more designated uses, TMDL development required. The water quality standard is not attained. This category constitutes the subset of impaired waters for which one or more TMDLs are needed (*i.e.*, the 303(d) List). Waters in this category

will be prioritized for TMDL development based on threats to human health, the potential for a TMDL analysis to result in improved water quality and the comments received during the public review of the proposed 303(d) list. A schedule will be developed for the establishment of TMDLs, describing when data and information will be collected to support TMDL establishment and to determine if standards are attained. This schedule will reflect the priority ranking of the listed waters. Waters in this category are further divided into the two following subcategories:

- a. (CT DEP Tier 2) ^b It has been determined through methodology described below, that the impairment is caused by a pollutant stressor (*e.g.*, chemical, clean sediment, temperature), a surrogate indicator (*e.g.*, indicator bacteria), or can be attributed to a source that contributes multiple pollutants to a waterbody such that implementing a TMDL for one or more pollutants can reasonably be expected to result in attainment of uses. Where more than one pollutant is associated with the impairment, the waterbody or waterbody segment will remain in this category until TMDLs for all pollutants have been completed and approved by EPA. Further investigative monitoring, if necessary, will be scheduled to confirm causes. Follow-up monitoring will be scheduled to determine if standards are attained following TMDL implementation.
- b. (CT DEP Tier 3) ^b The waterbody or waterbody segment does not support a use based on biological or other information, and the cause is unknown. It is uncertain whether the impairment is caused by a pollutant. Additional monitoring will be scheduled to identify the cause of impairment. If the additional monitoring determines the cause of the impairment to be a pollutant(s), and other pollution control requirements can not reasonably be expected to result in attainment of standards in the near future, the State will complete a TMDL(s) for the pollutant(s). If the additional monitoring determines the impairment is not caused by a pollutant, the waterbody or waterbody segment will be moved Category 4c.

^a The US EPA ranking system does not consider threatened waters in category 1 or 2, but places these waters in category 4 or 5. CT DEP considers waters threatened for some uses as meeting water quality standards and does not place them in the impaired waters categories.

^b US EPA categories 4 and 5 constitute the "Impaired Waters List" (IWL) for the State of Connecticut, documented in the *2002 List of Connecticut Waterbodies Not Meeting Water Quality Standards* (CT DEP 2002). The "Tier" designation refers to the categories used in the Connecticut IWL.

Determining Causes and Sources of Impairment

A primary focus of CT DEP monitoring and assessment staff is the evaluation of existing data and information to make use support assessments. In some cases, ambient biological community data indicate impairment, but the cause(s) and source(s) are unknown or, more often, multiple potential causes/sources exist but a direct link to impairment is lacking. Therefore, for many impaired waters listed in the 305(b)/303(d) Report, the causes and sources indicated are the best estimations of DEP monitoring staff based on a weight of evidence approach. Once a waterbody or segment is designated for TMDL development, a more thorough investigative

study is conducted to identify causes and sources of impairment. These investigations may include more intensive ambient water quality sampling, aquatic toxicity studies, sediment or fish tissue analysis and/or dilution calculations of known discharges. In some cases the determination of causes and sources may not be possible.

Delisting of Impaired (303(d)) Waters

The assessment of surface waters for 305(b) reporting is an on-going process that will result in the removal of some waterbodies from the 303(d) portion of the impaired waters list (IWL), and the addition of others. A waterbody is removed from the 303(d) List when management efforts result in water quality meeting water quality standards. Additionally, a waterbody can be delisted for one of the following reasons:

- 1) An error was made in the initial listing causing an erroneous listing. Erroneous listings include those based on anecdotal information (information, often transmitted orally and undocumented, that can not be confirmed through direct observation or measurement using generally accepted, reproducible analytical methods).
- 2) Quality controlled data, which are acceptable to CT DEP, demonstrate that designated uses are being met for the waterbody (with or without implementation of a TMDL).
- 3) Revisions in Water Quality Standards and Criteria may cause a waterbody to come into compliance with Water Quality Standards.
- 4) The waterbody or waterbody segment meets conditions described in 4a - 4c in the listing methodology above.

Reconciliation of Past and Present 303(d) Lists

Apart from the ongoing process of listing and delisting 303(d) waterbodies described in the previous sections, there are cases where a waterbody may be moved to another category based on re-assessment of available information. This occurred in several cases for waters listed as impaired in 1998 based on anecdotal information. In these circumstances, the waterbody usually was moved into 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).

Public Participation

As described previously, the CT DEP solicits data and information from a variety of sources, including volunteer groups, municipalities, utilities, and academia to incorporate into the assessment process. Additionally, there is a public review process for the 303(d) List and listing methodology. Public comments are considered to the degree feasible, in providing a final 305(b)/303(d) Report to the US EPA in April 2004.

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Appendix A: Applicable Water Quality Standards and Criteria for Assessed Waters

The information provided in this appendix has been excerpted from the Connecticut Water Quality Standards (2002) to provide reference material for the Consolidated Assessment & Listing Methodology (2004). Refer to the full text of the Connecticut Water Quality Standards (<http://www.dep.state.ct.us/wtr/wq/wqs.pdf>) for further information and policy statements.

Allowable Discharges to Surface Waters:

- (A) Class AA, A and SA surface waters: discharges may be permitted by the Commissioner from public or private drinking water treatment systems, dredging activity and dredge material dewatering operations, including the discharge of dredged or fill material and clean water discharges. In Class AA surface waters such discharges shall be subject to the approval of the Commissioner of Health Services. The Commissioner may authorize other discharges to surface waters with a Classification of SA, A or AA provided the Commissioner finds such discharge will be of short duration and is necessary to remediate surface water or ground water pollution. Any such discharge shall be treated or controlled to a level which in the judgment of the Commissioner, protects aquatic life and public health.
- (B) Class B and SB surface waters: discharges may be permitted for all those allowed in Class AA, A and SA surface waters, cooling water discharges, discharges from municipal and industrial wastewater treatment systems and other discharges subject to the provisions of Section 22a-430 of the Connecticut General Statutes.

INLAND SURFACE WATERS CLASSES AND CRITERIA

CLASS AA

Designated Uses- These surface waters are designated for: existing or proposed drinking water supplies; habitat for fish and other aquatic life and wildlife; recreation; and water supply for industry and agriculture.

<u>Parameter</u>	<u>Criteria</u>
1. Aesthetics	Uniformly excellent.
2. Dissolved oxygen	Not less than 5 mg/l at any time.
3. Sludge deposits-solid refuse- floating solids-oils and grease-scum	None other than of natural origin.
4. Color	None other than of natural origin.

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| 5. | Suspended and settleable solids | None in concentrations or combinations which would impair designated uses; none aesthetically objectionable; none which would significantly alter the physical or chemical composition of the bottom; none which would adversely impact aquatic organisms living in or on the bottom substrate. |
| 6. | Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity or dredging activity or discharge of dredged or fill materials provided all reasonable controls or Best Management Practices are used in such activities and all designated uses are protected and maintained. |
| 7. | Turbidity | Shall not exceed 5 NTU over ambient levels and none exceeding levels necessary to protect and maintain all designated uses. All reasonable controls or Best Management Practices are to be used to control turbidity. |
| 8. | Indicator bacteria | See Appendix B. |
| 9. | Taste and odor | None other than of natural origin. |
| 10. | pH | As naturally occurs. |
| 11. | Allowable temperature increase | There shall be no changes from natural conditions that would impair any existing or designated uses assigned to this Class and, in no case exceed 85 degrees F, or in any case raise the temperature of surface water more than 4 degrees F. |
| 12. | Chemical constituents | None in concentrations or combinations which would be harmful to designated uses. Refer to Water Quality Standards (2002) numbers 10, 12, 13, and 19. |
| | (a) Phosphorus | None other than of natural origin |
| | (b) Sodium | Not to exceed 20 mg/l |
| 13. | Benthic invertebrates which inhabit lotic waters | A wide variety of macroinvertebrate taxa should normally be present and all functional feeding groups should normally be well represented. Presence and |

productivity of aquatic species is not limited except by natural conditions, permitted flow regulation or irreversible cultural impacts. Water quality shall be sufficient to sustain a diverse macroinvertebrate community of indigenous species. Taxa within the Orders Plecoptera (stoneflies), Ephemeroptera (mayflies), Coleoptera (beetles) and Trichoptera (caddisflies) should be well represented.

CLASS A

Designated Uses - These surface waters are designated for: habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreation; and water supply for industry and agriculture.

<u>Parameter</u>	<u>Criteria</u>
1. Aesthetics	Uniformly excellent.
2. Dissolved oxygen	Not less than 5 mg/l at any time.
3. Sludge deposits – solid refuse – floating solids – oils and grease-scum.	None other than of natural origin.
4. Color	None other than of natural origin
5. Suspended and settleable solids	None in concentrations or combinations which would impair designated uses; none aesthetically objectionable; none which would significantly alter the physical or chemical composition of the bottom; none which would adversely impact aquatic organisms living in or on the bottom substrate.
6. Silt or sand deposits	None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, dredging activity or the discharge of dredged or fill materials provided all reasonable controls or best management practices are used in such activities and all designated uses are protected and maintained.
7. Turbidity	Shall not exceed 5 NTU over ambient levels and none exceeding levels necessary to protect and maintain all designated uses. All

reasonable controls or Best Management Practices are to be used to control turbidity.

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| 8. | Indicator Bacteria | See Appendix B. |
| 9. | Taste and odor | None other than of natural origin. |
| 10. | pH | As naturally occurs. |
| 11. | Allowable temperature increase | There shall be no changes from natural conditions that would impair any existing or designated uses assigned to this Class and, in no case exceed 85 degrees F, or in any case raise the temperature of surface water more than 4 degrees F. |
| 12. | Chemical constituents | None in concentrations or combinations which would be harmful to designated uses. Refer to Water Quality Standards (2002) numbers 10, 12, 13, and 19. |
| | (a) Phosphorus | None other than of natural origin. |
| | (b) Sodium | None other than of natural origin. |
| 13. | Benthic invertebrates which inhabit lotic waters. | A wide variety of macroinvertebrate taxa should normally be present and all functional feeding groups should normally be well represented. Presence and productivity of aquatic species is not limited except by natural conditions, permitted flow regulation or irreversible cultural impacts. Water quality shall be sufficient to sustain a diverse macroinvertebrate community of indigenous species. Taxa within the Orders Plecoptera (stoneflies), Ephemeroptera (mayflies), Coleoptera (beetles) and Trichoptera (caddisflies) should be well represented. |

CLASS B

Designated Uses - These surface waters are designated for: habitat for fish and other aquatic life and wildlife; recreation; and industrial and agricultural water supply.

Parameter	Criteria
1. Aesthetics	Good to excellent
2. Dissolved oxygen	Not less than 5 mg/l at any time.
3. Sludge deposits - solid refuse -	None except for small amounts that may result from the discharge from a permitted waste treatment facility and none

	floating solids - oil and grease – scum	exceeding levels necessary to protect and maintain all designated uses.
4.	Color	None which causes visible discoloration of the surface water outside of any designated zone of influence.
5.	Suspended and settleable solids	None in concentrations or combinations which would impair the most sensitive designated use; none aesthetically objectionable; none which would significantly alter the physical or chemical composition of the bottom; and none which would adversely impact aquatic organisms living in or on the bottom sediments; shall not exceed 10 mg/l over ambient concentrations.
6.	Silt or sand deposits	None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, dredging activity or discharge of dredged or fill materials provided all reasonable controls or Best Management Practices are used in such activities and all designated uses are protected and maintained.
7.	Turbidity	Shall not exceed 5 NTU over ambient levels and none exceeding levels necessary to protect and maintain all designated uses. All reasonable controls or Best Management Practices are to be used to control turbidity.
8.	Indicator bacteria	See Appendix B.
9.	Taste and odor	None that would impair any uses specifically assigned to this Class.
10.	pH	6.5 - 8.0
11.	Allowable temperature increase	There shall be no changes from natural conditions that would impair any existing or designated uses assigned to this Class and, in no case exceed 85 degrees F, or in any case raise the temperature of the receiving water more than 4 degrees F.
12.	Chemical constituents	None in concentrations or combinations which would be harmful to designated uses. Refer to Water Quality Standards (2002) numbers 10, 11, 12, 13, 17, and 19.
13.	Benthic invertebrates which inhabit lotic waters	Water quality shall be sufficient to sustain a diverse macroinvertebrate community of indigenous species. All functional feeding groups and a wide variety of macroinvertebrate taxa shall be present, however one or more

may be disproportionate in abundance. Waters which currently support a high quality aquatic community shall be maintained at that high quality. Presence and productivity of taxa within the Orders Plecoptera (stoneflies), Ephemeroptera (mayflies); and pollution intolerant Coleoptera (beetles) and Trichoptera (caddis- flies) may be limited due to cultural activities. Macroinvertebrate communities in waters impaired by cultural activities shall be restored to the extent practical through implementation of the department's procedures for control of pollutant discharges to surface waters and through Best Management Practices for non-point sources of pollution.

LAKE TROPHIC CATEGORIES

Criteria for Total Phosphorus, Total Nitrogen, Chlorophyll-a, and Secchi Disk Transparency appearing in the table below represent acceptable ranges for these parameters within which recreational uses will be fully supported and maintained for lakes in each trophic category. For the purpose of determining consistency with the water quality standards for lakes classified AA, A or B, an assessment of the natural trophic category of the lake, absent significant cultural impacts, must be performed to determine which criteria apply.

OLIGOTROPHIC

May be Class AA, Class A, or Class B water. Low in plant nutrients. Low biological productivity characterized by the absence of macrophyte beds. High potential for water contact recreation.

<u>Parameters</u>	<u>Criteria</u>
1. Total Phosphorus	0-10 ug/l spring and summer
2. Total Nitrogen	0-200 ug/l spring and summer
3. Chlorophyll-a	0-2 ug/l mid-summer
4. Secchi Disk Transparency	6 + meters mid-summer

MESOTROPHIC

May be Class AA, Class A, or Class B water. Moderately enriched with plant nutrients. Moderate biological productivity characterized by intermittent blooms of algae and/or small areas of macrophyte beds. Good potential for water contact recreation.

<u>Parameters</u>	<u>Criteria</u>
1. Total Phosphorus	10-30 ug/l spring and summer
2. Total Nitrogen	200-600 ug/l spring and summer
3. Chlorophyll-a	2-15 ug/l mid-summer
4. Secchi Disk Transparency	2-6 meters mid-summer

EUTROPHIC

May be Class AA, Class A, or Class B water. Highly enriched with plant nutrients. High biological productivity characterized by frequent blooms of algae and/or extensive areas of dense macrophyte beds. Water contact recreation opportunities may be limited.

<u>Parameters</u>	<u>Criteria</u>
1. Total Phosphorus	30-50 ug/l spring and summer
2. Total Nitrogen	600-1000 ug/l spring and summer
3. Chlorophyll-a	15-30- ug/l mid-summer
4. Secchi Disk Transparency	1-2 meters mid-summer

HIGHLY EUTROPHIC

May be Class AA, Class A, or Class B water. Excessive enrichment with plant nutrients. High biological productivity, characterized by severe blooms of algae and/or extensive areas of dense macrophyte beds. Water contact recreation may be extremely limited.

<u>Parameters</u>	<u>Criteria</u>
1. Total Phosphorus	50 + ug/l spring and summer
2. Total Nitrogen	1000 + ug/l spring and summer
3. Chlorophyll-a	0-1 meters mid-summer

COASTAL WATERS, CLASSES & CRITERIA.

CLASS SA -

Designated Uses - These surface waters are designated for: habitat for marine fish, other aquatic life and wildlife; shellfish harvesting for direct human consumption where authorized; recreation; industrial water supply; and navigation.

<u>Parameter</u>	<u>Criteria</u>
1. Aesthetics	Uniformly excellent.
2. Dissolved Oxygen	Not less than 6.0 mg/l at any time in the nearshore waters of Long Island Sound, including harbors, embayments and estuarine tributaries.

Not less than 6.0 mg/l at any time in the offshore waters of Long Island Sound, above the seasonal pycnocline and throughout the Sound when no pycnocline is established.

Not less than 3.5 mg/l for offshore waters within and below the seasonal pycnocline. Cumulative periods of dissolved oxygen in the 3.5 - 4.8 mg/l range shall not exceed exposure parameters detailed in the *Dissolved Oxygen (DO) Criteria for Offshore Coastal Waters* at the end of this appendix.

3. Sludge Deposits-
solid-refuse, floating-
solids, oils and grease
scum None other than of natural origin.
4. Color None other than of natural origin.
5. Suspended and
settleable solids None, other than of natural origin.
6. Silt or sand deposits None other than of natural origin except as may result from normal agricultural. Road maintenance, construction activity, dredging activity or discharge of dredged or fill materials provided all reasonable controls or Best Management Practices are used in such activities and all designated uses are protected and maintained.
7. Turbidity None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity, dredging activity or discharge of dredged or fill materials provided all reasonable controls and Best Management Practices are used to control turbidity and none exceeding levels necessary to protect and maintain all designated uses.
8. Indicator bacteria See Appendix B.
9. Taste and odor As naturally occurs.
10. pH 6.8 - 8.5
11. Allowable
temperature
increase There shall be no changes from natural conditions that would impair any existing or designated uses assigned to this Class and in no case exceed 83 degrees F, or in any case raise the temperature of the receiving water more than 4 degrees F. During the period including July, August, and September, the temperature of the receiving water shall not be raised more than 1.5 degrees F unless it can be shown that spawning and growth of

indigenous organisms will not be significantly affected.

12. Chemical constituents None in concentrations or combinations which would be harmful to designated uses. Refer to Water Quality Standards (2002) numbers 10, 12, 13, and 19.

CLASS SB

Designated Uses - These waters are designated for: habitat for marine fish, other aquatic life and wildlife; commercial shellfish harvesting where authorized; recreation; industrial water supply; and navigation.

Parameter	Criteria
1. Aesthetics	Good to excellent.
2. Dissolved Oxygen	Not less than 5.0 mg/l at any time in the near shore water of Long Island Sound, including harbors, embayments and estuarine tributaries. Not less than 5.0 mg/l at any time in the offshore waters of Long Island Sound above the seasonal pycnocline and throughout the Sound when no pycnocline is established. Not less than 3.5 mg/l for offshore waters within and below the seasonal pycnocline. Cumulative periods of dissolved oxygen exposure in the 3.5 – 4.8 mg/l range shall not exceed parameters detailed in Appendix C.
3. Sludge deposits solid refuse – floating solids – oils and grease-scum	None except for small amounts that may result from the discharge from a grease waste treatment facility providing appropriate treatment and none exceeding levels necessary to protect and maintain all designated uses.
4. Color	None resulting in obvious discoloration of the surface water outside of any designated zone of influence.
5. Suspended and settleable solids	None in concentrations or combinations which would impair the designated uses; none aesthetically objectionable; none which would significantly alter the physical or chemical composition of bottom sediments; none which would adversely impact organisms living in or on the bottom sediment.

- | | | |
|-----|--------------------------------|--|
| 6. | Silt or sand deposits | None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, dredging activity or discharge of dredged or fill materials provided all reasonable controls or Best Management Practices are used in such activities and all designated uses are protected and maintained. |
| 7. | Turbidity | None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity, or discharge from a waste treatment facility providing appropriate treatment, dredging activity or discharge of dredged or fill materials provided all reasonable controls and Best Management Practices are used to control turbidity and none exceeding levels necessary to protect and maintain all designated uses. |
| 8. | Indicator bacteria | See Appendix B. |
| 9. | Taste and odor | As naturally occurs. None that would impair any uses specifically assigned to this Class. |
| 10. | pH | 6.8 - 8.5 |
| 11. | Allowable temperature increase | There shall be no changes from natural conditions that would impair any existing or designated uses assigned to this Class and, in no case exceed 83 degrees F, or in any case raise the temperature of the receiving water more than 4 degrees F. During the period including July, August, and September, the temperature of the receiving water shall not be raised more than 1.5 degrees F unless it can be shown that spawning and growth of indigenous organisms will not be significantly affected. |
| 12. | Chemical constituents | None in concentrations or combinations which would be harmful to the designated uses. Refer to Water Quality Standards (2002) numbers 10, 12, 13, and 19. |

Appendix B: Water Quality Criteria for Bacterial Indicators of Sanitary Quality
SEE ALSO STANDARDS # 23 AND 25

DESIGNATED USE	CLASS	INDICATOR	CRITERIA
<u>Freshwater</u>			
Drinking Water Supply (1)			
Existing / Proposed	AA	Total Coliform	Monthly Moving Average less than 100/100 ml Single Sample Maximum 500/100ml
Potential	A	----	-----
Recreation (2)(3)			
Designated Swimming (4)	AA, A, B	<i>Escherichia coli</i>	Geometric Mean less than 126/100ml Single Sample Maximum 235/100ml
Non-designated Swimming (5)	AA, A, B	<i>Escherichia coli</i>	Geometric Mean less than 126/100ml Single Sample Maximum 406/100ml
All Other Recreational Uses	AA, A, B	<i>Escherichia coli</i>	Geometric Mean less than 126/100ml Single Sample Maximum 576/100ml
<u>Saltwater</u>			
Shellfishing			
Direct Consumption	SA	Fecal Coliform	Geometric Mean less than 14/100ml 90% of Samples less than 43/100ml
Commercial Harvesting	SB	Fecal Coliform	Geometric Mean less than 88/100ml 90% of Samples less than 260/100ml
Recreation			
Designated Swimming (4)	SA, SB	Enterococci	Geometric Mean less than 35/100ml Single Sample Maximum 104/100ml
All Other Recreational Uses	SA, SB	Enterococci	Geometric Mean less than 35/100ml Single Sample Maximum 500/100ml

- Table Notes:**
- (1) Criteria applies only at the drinking water supply intake structure.
 - (2) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23.
 - (3) See Standard # 25.
 - (4) Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protection and the Department of Public Health, May 1989, revised June 1992.
 - (5) Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

Guidelines for Use of Indicator Bacteria Criteria

Water Quality Classifications are reviewed approximately every three years at which time all available water quality monitoring data is considered along with other relevant information. Relevant information includes but is not limited to federal guidance concerning the scientific basis for deriving the criteria and the potential health risks associated with excursions above the criteria, recommended implementation procedures, and the results of sanitary surveys or other investigations into sources of indicator bacteria in the watershed. Public input is also solicited and considered in determining the existing water quality conditions and water quality goals. Nevertheless, the Water Quality Classification may not be an accurate representation of current water quality conditions at any particular site. For this reason, the Water Quality Classification should not be considered as a certification of quality by the State or an approval to engage in certain activities such as swimming or shellfish harvest

Appendix C: Dissolved Oxygen (DO) Criteria for Offshore Coastal Waters

Background: Offshore Coastal DO criteria are based on the Environmental Protection Agency's *Ambient Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras*, noticed November 30, 2000 in the Federal Register (65(231):71317-71321).

Area Affected: DO criteria different from the 6.0 mg/l and 5.0 mg/l minimums for Class SA and SB offshore waters apply only in and below the pycnocline of Long Island Sound (LIS) where stratification occurs during warm, summer conditions. Offshore waters are defined as areas of LIS greater than 5m in depth at mean low water. Offshore waters above the pycnocline generally have ample DO from photosynthesis and wave-driven diffusion.

Cumulative DO exposure parameters: DO conditions in the area affected do not readily lend themselves to a single numeric criterion as is often done with toxic contaminants. Aquatic organisms are harmed based on a combination of minimum oxygen concentration and duration of the low DO excursion. A DO concentration of 4.8 mg/l would meet the chronic criteria for growth and protect estuarine organisms resident in LIS regardless of duration. If oxygen fell within a 0.5 mg/l incremental range below 4.8 mg/l (*i.e.*, between 4.3 and 4.8 mg/l), a duration of 21 days or less would meet resource protection goals. Based upon the EPA research and data, similar exposure allowances were used by the Connecticut DEP for each 0.5 mg/l increment (see Table 1). The minimum DO level that can be associated with the draft EPA DO criteria document (*i.e.* the level below which there would be no exposure period consistent with resource protection) is 2.3 mg/l. Given the environmental variability, DEP has used more protective minimum DO criteria of 3.5-3.8 mg/l with no more than 5 days exposure.

Because estuarine systems are variable, DO levels are unlikely to remain within one of the three incremental ranges presented in Table 1. Typically, DO conditions would fall through a range to a minimum and then begin to rebound depending on weather and stratification conditions. To account for this, the number of days within each incremental DO range is pro-rated, as follows. A decimal fraction is calculated for each range, *e.g.*, 10.5 days in the 4.3-4.8 mg/l range would produce a decimal fraction of 0.50 (10.5 days/21 days). As long as the sum of those fractions calculated for each range is less than 1.0, resource protection goals are maintained for larval recruitment.

Table 1. DO incremental ranges and duration (exposure) data to be applied to LIS in the area affected to ensure protection of larval recruitment.		
DO Range (mg/l)		No. of Days Allowed
Maximum	Minimum	
4.8	4.3	21
4.3	3.8	11
3.8	3.5	5