# CHAPTER 4. SURFACE WATER QUALITY ASSESSMENT

The following chapter 4.1 describes DEQ’s process for assessing the water quality of Virginia’s streams, lakes and estuaries. Results for the 2022 Integrated Report, broken down by region, are then provided and discussed (chapter 4.3). Chapter 4 also includes:

* An overall summary of the water quality assessment results (chapter 4.2),
* an overall “snapshot” of water quality captured by DEQ’s freshwater probabilistic monitoring (chapter 4.4),
* a summary of the weight-of-evidence assessments conducted in Virginia’s estuaries (chapter 4.5), and
* the assessment of the aquatic life designated uses in the Chesapeake Bay (chapter 4.6).

# CHAPTER 4.1. ASSESSMENT METHODOLOGY

Revisions to the assessment guidance manual have improved assessment methodologies, quality, and consistency. Additionally, the assessment guidance manual provides the public an opportunity to review and comment on the assessment criteria and methodologies used by DEQ to determine designated use attainment. The Draft 2022 Water Quality Assessment Guidance Manual was public-noticed in January 2021, and DEQ received public comments through February 2021. DEQ released the [Final 2022 Water Quality Assessment Guidance Manual](https://www.deq.virginia.gov/water/water-quality/assessments/wqa-guidance-manual) in May 2021.

# “Ten Percent Rule”

State and federal law requires DEQ to produce a biennial report on the condition of its waters to Virginia’s citizens and the EPA. The waters are evaluated in terms of whether the appropriate designated uses are met. The primary designated uses are: 1) wildlife, 2) aquatic life, 3) fish consumption, 4) shellfish harvest, 5) recreation (primary and secondary contact) and 6) public water supply use. There are additional sub-uses associated with the Chesapeake Bay. DEQ employs the “Percent Method” to assess conventional pollutant impacts in waters for two uses: aquatic life use and recreation use.

Previous EPA national guidance recommended that states use an assessment method based on assumptions about the kind and frequency of data needed to support an assessment. The objective of assessment is to determine whether waters are fully supporting or impaired for the designated uses of an assessment unit (AU). A 10.5% exceedance threshold is used for determining full support or impairment for conventional parameters (i.e., dissolved oxygen, pH, and temperature). An exceedance rate that is greater than 10.5% with at least 2 exceedances is considered impaired. This percentage rule is governed by the fact that sampling is associated with unknown equipment and human error, as well as an acknowledgment that designated uses are not impacted by infrequent, short-term exceedances of water quality standards.

# Rules Used to Assess Support of Designated Uses

Virginia bases its water quality assessment on the ability of the waters to support the associated designated uses. The specific decision rules and procedures are described in the Final 2022 Water Quality Assessment Guidance Manual. Designated use support is established on the waters meeting the criteria for each use as defined in the numeric and/or narrative water quality standards. The following is a general description of the criteria used to determine the quality of the waters relating to each of the designated uses. A summary is found in Table 4.1-1. Additional information related to the degree of use support can be found at the water quality standards website: <https://www.deq.virginia.gov/water/water-quality/water-quality-standards>.

**1. Not Assessed**

Waters with no data for any uses or with only a single sample (conventional parameters only) (Category 3A).

1. **Insufficient Information**

Waters that have a single exceedance in a small dataset (2-9 samples for conventional parameters) are considered insufficient data (Category 3B). Additionally, waters will be classified as insufficient data (Category 3B) where professional judgment is not sufficient to determine if a designated use is met. Waters where the data are not QA/QC approved but the data review indicates potential degradation are categorized as insufficient data but having observed effects (Category 3C). Waters where the data are not QA/QC approved but the assessment results indicate acceptable water quality will be considered insufficient data with no observed effects (Category 3D). Waters that were previously categorized as fully supporting a designated use (Category 2) will default to Category 3 after two assessment cycles of no new data.

### **3**. **Fully Supporting**

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting designated uses. These waters would be placed in Category 2A or 2C unless all designated uses are fully supporting, upon which the water would be placed in Category 1.

*Conventional Parameters*:

Waters that are fully supporting their designated uses can have up to 10.5% exceedances of water quality criteria for conventional parameters dissolved oxygen, temperature and pH (aquatic life use) without negatively affecting designated uses. Natural variability can cause exceedances of these criteria in the 0-10.5% range and still fully support the aquatic life designated use. All data assessed as fully supporting must be QA/QC approved.

Numerical criteria for DO, pH and Temperature (9 VAC 25-260-50) do not apply at < 7Q10 flow. 7Q10 is the lowest flow averaged (arithmetic mean) over a period of seven consecutive days that can be statistically expected to occur once every 10 climatic years (a climatic year begins April 1 and ends March 31). Data for these parameters that are from flow conditions below 7Q10 will not be used in the Integrated Report.

Bacteria:

An E. coli or enterococci dataset with 10 or more samples, no geometric mean exceedances and a Statistical Threshold Value (STV) exceedance rate of less than 10% in a 90-day period is considered fully supporting the recreation use. Both the geometric mean and STV criteria must be met for the water to be considered fully supporting.

Toxic Pollutants:

For toxic pollutant assessment in free-flowing streams, waters where there are two or more samples and no exceedances of aquatic life criteria within a running 3-year period, using grab samples or Semipermeable Membrane Device (SPMD) data, are considered fully supporting for aquatic life and wildlife use. For public water supply and human health-related criteria in other surface waters, two or more samples and no exceedances during the reporting period, using grab samples or SPMD data, are considered fully supporting for Public Water Supply (PWS) and/or fish consumption use. For toxic pollutant assessment in estuarine waters, where there are several types of toxic data available, a “weight of evidence” approach is used.

*Fish Tissue/Sediment Contamination:*

Waters with two or more samples, with no exceedances of the fish or fish tissue screening values or sediment screening values are considered fully supporting.

*Biological Evaluation*:

For free-flowing stream biological community assessment, data for the overall assessment period are rated as not impaired where no biological assemblage (e.g. macro-invertebrates) has been modified beyond the natural range of reference conditions based on the Virginia Stream Condition Index (VSCI) or the Virginia Coastal Plain Macroinvertebrate Index (VCPMI) methodology.

*Fish Advisories:*

Waters where the VDH has not issued any fish consumption advisories or prohibitions are assessed as fully supporting for the fish consumption use.

*Shellfish Advisories*:

Those growing areas are considered fully supporting for the shellfish consumption use where no restriction or prohibition (condemnation) on shellfish harvesting is imposed as indicated by the Department of Shellfish Sanitation (DSS) summary dated December 2020.

Beach Closures/Advisories:

Beach waters are assessed as fully supporting the recreation use when no VDH beach closures were issued and/or geometric mean exceedances occurred, based on QA/QC approved sampling data, during the assessment period.

Public Water Supply Source Closures:

If no VDH public water supply source closures were issued based on sampling data during the assessment period, waters are rated as fully supporting the public water supply use.

*Swimming Advisories due to Harmful Algal Blooms (HABs):*

No advisories in the two most recent years in the assessment window in a waterbody that previously had an advisory or impairment.

#### 4. Fully Supporting but Having an Observed Effect

The following is a description of the types of data and the acceptable criteria used to assess waters as fully supporting but having an observed effect for a designated use(s). It is the intent of the agency to focus additionally available monitoring resources on the waters that are identified as having an observed effect, based on initial monitoring data analysis. These waters would be placed in the federal Category 2 and the Virginia sub-category 2B.

*Conventional Screening Parameters*:

Free-flowing waters with one or more exceedances for sediment and/or toxicity test are considered fully supporting but having an observed effect for aquatic life use if (Category 2B) if other aquatic life criteria are met. This designation is deemed appropriate because the causative agent(s) of toxicity of an environmental sample is rarely known.

Bacteria:

A single STV exceedance in a 90-day period with a dataset with less than 10 samples.

Toxic Pollutants:

For toxic pollutant assessment in free-flowing streams, a single exceedance of aquatic life criteria (in a sample size of at least two observations) within a 3-year period, using grab samples or SPMD data, is considered fully supporting but having an observed effect for aquatic life and wildlife. For public water supply use or human health criteria in other surface waters, a single exceedance (in a sample size of at least two observations) is considered fully supporting but having an observed effect for PWS and fish consumption use.

For toxic pollutant assessment in estuarine waters, where there are several types of toxic data available, a “weight of evidence” approach is used. If no additional toxic data is available, the water would be assessed the same as the free-flowing waters.

Fish Tissue/Sediment Contamination:

Waters with a single exceedance of a water quality standards-based tissue value or tissue screening value found in the Final 2020 Water Quality Assessment Guidance Manual, Appendix E-1 or E-2 from one or more fish tissue or SPMD samples, or an exceedance of a screening value for sediment found in Appendix F, are fully supporting but having an observed effect for fish consumption and aquatic life, respectively.

*Biological Evaluation*:

VSCI or CPMI assessment scores below the impairment threshold but the biologist’s best professional judgment has determined a lack of confidence in the biological survey due to natural conditions is considered fully supporting with observed effects. If impairment was discovered from the last two samples, a documented justification for not assessing as impaired is expected. Another biological assessment should be scheduled to make a final aquatic life use determination for waters assessed as fully supporting but having an observed effect for aquatic life use.

*Fish Advisories:*

A VDH fish consumption advisory, where a general advisory has been issued but fish consumption is not limited, are considered fully supporting but having an observed effect. This would include the kepone advisory for the tidal James River.

Shellfish Advisories:

Those growing areas, as indicated by the VDH Division of Shellfish Sanitation (DSS) summary dated December 2018, that have been classified as conditionally approved (seasonal condemnations) are considered fully supporting but having an observed effect.

*Beach Closures/Advisories*:

One short term (less than one week in duration) beach closure and/or two short term (less than one week in duration) swimming advisories due to bacteria contamination that, based on QA/QC approved data within the 6-year assessment cycle, have a low probability that the pollution will recur (based on best professional judgment) are considered fully supporting with observed effects. Best professional judgment decisions will be based on scientific data indicating the source of the pollution causing the closure/advisory is transient and there are no plans to implement pollution reduction measures or other controls, or documentation shows that mitigation has occurred and the two most recent years of water quality data, subsequent to the mitigation, show an improvement that fully supports the designated use.

Public Water Supply Source Closure:

One short term VDH public water supply source closure during the 6-year assessment cycle with a low probability that the pollution will recur is considered fully supporting but having an observed effect. The source of the pollution is generally transient and there are no VDH plans to implement pollution reduction measures or other controls.

*Swimming Advisories due to Harmful Algal Blooms (HABs):*

A VDH advisory that is lifted after the minimum follow-up sampling events in the two most recent years of the assessment window would deem a water fully supporting with an observed effect for the recreation use.

*Other Criteria for Waters having Observed Effects*

Waters for which “evaluated” data, trend analysis for parameters with no water quality standards but with screening criteria, or other water quality indicators appear to indicate an apparent effect on designated use(s) or a potential for water quality problems are considered to have “observed effects”. Waters can be designated as having observed effects where there is a possible loss of a designated use documented by ancillary data such as fish kills with unknown causes and/or pollution potential documented by non- QA/QC approved non-agency studies or reports. These waters are considered insufficient data with observed effects (Category 3C). For monitoring purposes, waters with observed effects should be considered in the next regional monitoring plan for additional or continued monitoring during the next reporting period as resources allow.

**5**. **Pollutant Caused Impaired or Threatened Waters Not Needing a TMDL**

Impaired or threatened waters not needing a TMDL are listed in the federal Category 4. These are waters that are impaired but a TMDL has been developed and approved by EPA (Category 4A), waters where other pollutant control requirements are reasonably expected to result in attainment of designated use(s) (Category 4B) and waters that are naturally impaired (Category 4C).

#### 6. Pollutant Caused Impaired or Threatened Waters Needing a TMDL

Those waters impaired or threatened by pollutant(s) and needing a TMDL are included in the 303(d) list. These waters are placed in the federal Category 5 (needing a TMDL) and the Virginia sub-categories of 5A, 5B, 5D and possibly 5C and 5E. The following is a description of the types of QA/QC-approved data and the acceptable criteria used to assess waters as impaired or threatened for the designated uses.

*Conventional Parameters*:

Waters with long-term or chronic pollutant-related problems based on the assessment of monitored data are considered impaired and needing a TMDL. For conventional parameters, at least two exceedances of water quality standards and exceedances >10.5% are considered impaired and needing a TMDL.

Bacteria:

Waters with E. coli or enterococci datasets that have 10 or more samples in a 90-day period and one or more exceedances of the geometric mean are considered impaired. In addition, waters with E. coli or enterococci datasets that have two or more samples and an STV exceedance rate greater than 10% in a 90-day period are considered impaired. Both criteria are used to assess the recreation use, but only one has to fail for a water to be impaired.

Toxic Pollutants:

Virginia will declare waters impaired for aquatic life use and included in Category 5A if 1) an acute criterion is exceeded two or more times within a three-year period based on either grab samples or samples collected with a 30-day semi-permeable membrane device (SPMD) or if 2) a chronic criterion is exceeded two or more times within a three-year period based on either multiple grab samples collected within two separate four-day periods or multiple samples collected with a 30-day semi-permeable membrane device (SPMD). For public water supply or human health criteria in other surface waters, two or more exceedances of the same criteria within the reporting period using grab samples or SPMD data are considered impaired and needing a TMDL for PWS or fish consumption use. For toxic pollutant assessment in estuarine waters, where there are several types of toxic data available, a “weight of evidence” approach is used.

Fish Tissue Contamination:

Waters exceeding the same toxic human health criteria-based tissue value (TV), listed in Appendix E-1 of the Final 2020 Water Quality Assessment Guidance Manual, two or more times are impaired for fish consumption. For example, the following situations would qualify as impaired under these guidelines: 1) two or more tissue samples from different fish species exceeding the same TV during one sampling event; or 2) two or more samples of the same or different species exceeding the same TV from different sampling events within the assessment period.

*Biological Data*:

For free-flowing waters where the biological community VSCI or CPMI survey data are confirmed to be moderately or severely impaired, are considered impaired and needing a TMDL. Based on professional judgment and/or other supplemental data, a second survey may be required to confirm moderate impairment and pollutant related causes. In this case, the initial assessment would be considered fully supporting but having an observed effect and follow-up monitoring scheduled.

*Fish Advisories:*

Virginia Department of Health (VDH) fish consumption prohibitions and/or advisories, where fish consumption is specifically limited, are considered evidence of non-attainment of the designated use and are therefore considered impaired and needing a TMDL.

*Shellfish Advisories*:

Those growing areas, as indicated by the DSS summary dated December 2018 that have been classified as prohibited or restricted (condemnations) based on bacteria data are considered impaired and needing a TMDL. Restricted areas that have been administratively condemned due solely to the presence of a VPDES permitted outfall or administrative closure where no data is available will not be assessed as the shellfish use has been administratively removed.

Beach Closures/Advisories:

One or more geometric mean exceedances, one or more beach closures of one week or more duration, or two or more swimming advisories of one week or more duration due to bacteria contamination, and, based on QA/QC approved data within the assessment cycle, there is a medium to high probability that the closure/advisory will recur (based on best professional judgment) are considered evidence of impaired recreation use and a TMDL is needed.

*Public Water Supply Source Closure*:

One or more VDH public water supply source closures within the assessment cycle with a medium to high probability that the pollution will recur indicate non-attainment and a TMDL is needed. There are plans to implement pollution reduction measures or controls.

*Swimming Advisories due to Harmful Algal Blooms (HABs):*

A water is considered impaired for the recreation use if a VDH advisory issued for HABs persists past the minimum follow-up sampling events and extends for at least a 30-day period in the two most recent years of the assessment window.

*Chesapeake Bay Aquatic Life:*

See Chapter 4.5 of this report, or Section 6.4 of the Final 2022 Water Quality Assessment Guidance Manual.

**Table 4.1-1 Summary of the designated use assessment methodology**

| **Designated Use** | **Parameter/Data Type** | **Fully Supporting** | **Observed Effects (either as supporting or with insufficient data)** | **Impaired** |
| --- | --- | --- | --- | --- |
| **Aquatic Life**  **Wildlife (toxics only)** | Conventional1 | • n > 2, exceedance  rate < 10.5% for field  parameters  • Median lacustrine TP2  below criterion  • 90th percentile lacustrine  chlorophyll a below  criterion | • Level II3 data with an  exceedance rate > 10.5%  • Single exceedance in small  dataset (n <10) | • n > 2, exceedance  rate > 10.5% for field  parameters, with a minimum of two exceedances  • Median lacustrine TP  above criterion  • 90th percentile  lacustrine chlorophyll a  above criterion |
| Biological | Benthic index scores > impairment threshold | • Level II3 data suggest  degraded community  • Benthic index score conflicts  with biologist’s best  professional judgment | Benthic index score < impairment threshold |
| Toxics | n > 2, no exceedances of the same chronic or acute aquatic life criteria in a 3-year period | • A single exceedance of  chronic aquatic life use  criteria using temporally  aggregated water column  grab samples in a 3-year  period or one SPMD  sample exceedance of  chronic aquatic life use  criteria in a 3-year period  •Single water column  grab or SPMD sample  exceedance of acute  aquatic life use criteria in a  3-year period  • One or more sediment toxicity  tests or screening value  exceedances (aquatic life  only) | Two or more grab or SPMD exceedances of the same chronic or acute aquatic life criteria in a 3-year period |
| **Recreation** | Bacteria | • n > 10, no geometric mean exceedances and STV exceedance rate < 10% in a 90-day period | • Level II3 data with one or more geometric mean exceedances or STV exceedance rate > 10% in a 90-day period (n > 10)  • Single STV exceedance in a 90-day period in small dataset (n <10) | • n > 10, one or more geometric mean exceedance(s) in a 90-day period  • n > 2, STV exceedance rate > 10% in a 90-day period, with a minimum of two exceedances |
| VDH notice (Bacteria) | No closures/advisories and bacteria data meet criteria. | A single short-term (< 1 week) VDH closure/advisory with low probability of recurrence, based on bacteria data | One or more closure(s) and/or two or more advisories > 1 week duration with medium or high probability of recurrence, based on bacteria data |
| VDH notice  (HABs) | No advisories in the two most recent years in the assessment window in a waterbody that previously had an advisory or impairment. | A VDH advisory that is lifted after minimum follow-up sampling events in the two most recent years of the assessment window. | A VDH advisory that persists past the minimum follow-up sampling events and extends for at least a 30-day period in the two most recent years of the assessment window. |
| **Shellfishing**  **Fish**  **Consumption** | VDH notice | Approved shellfish harvest waters | Area classified as “conditionally condemned or seasonally restricted” | Areas classified as “restricted” or “prohibited”—excluding VPDES5 outfalls and administrations closures where no data are available |
| Toxics | No exceedances of fish tissue criteria | • Single exceedance of a  human health criterion  using grab sample or SPMD  data  • Single exceedance of a  tissue value or tissue  screening value | • Two or more  exceedances of a  human health criterion  using grab sample or  SPMD data  • Two or more  exceedances of a  tissue value |
| **Public Water**  **Supply** | VDH notice | No advisories and fish tissue data meet toxics criteria. | A VDH advisory which does not limit consumption is in effect, based on fish tissue data | A VDH advisory or restriction limiting or prohibiting consumption, based on fish tissue data |
| Toxics | n > 2, no exceedances | A single exceedance of human health criteria using grab or SPMD data | Two or more exceedances of the same human health criteria using grab samples or SPMD data |

1Refer to the Final 2022 Water Quality Assessment Guidance Manual for assessment methodology specific to lakes and reservoirs, continuous monitoring data and Chesapeake Bay criteria.

2TP = total phosphorus concentration. Along with lacustrine chlorophyll a, only data from the most recent two years are aggregated.

3Evaluated data are any Level II data submitted to DEQ. See Chapter 3.5 for more information.

4SPMD = semi-permeable membrane device (an instrument that passively samples ambient toxics over some length of time)

5VPDES=Virginia Pollution Discharge Elimination System

**EPA Assessment Categories and Virginia Subcategories**

**FULLY SUPPORTING - Waters are supporting one or more designated uses**

**EPA Category 1** - Attaining all associated designated uses and no designated use is threatened.

**Va. Category 1A** - waters are attaining all uses and a TMDL has been developed for one or more uses.

**EPA Category 2** – Available data and/or other information indicate that some, but not all of the designated uses are supported.

**Va. Category 2A** - waters are supporting all of the uses for which they are monitored.

**Va. Category 2B** - waters are of concern to the state but no water quality standard exists for a specific pollutant, or the water exceeds a state screening value or toxicity test.

**Va. Category 2C** - waters are now attaining the use(s) for which they were originally 303(d) listed and the TMDL is EPA approved but other applicable use(s) were not monitored and assessed.

**INDETERMINATE - Waters needing additional information**

**EPA Category 3** - Insufficient data and/or information to determine whether any designated uses are met.

**Va. Category 3A** - no data are available within the data window of the current assessment to determine if any designated use is attained and the water was not previously listed as impaired.

**Va. Category 3B** - some data exists but it is insufficient to determine support of any designated uses. Such waters will be prioritized for follow up monitoring.

**Va. Category 3C** - data collected by a citizen monitoring or other organization indicate water quality problems may exist but the methodology and/or data quality has not been approved for a determination of support of designated use(s). These waters are considered as having insufficient data with observed effects. Such waters will be prioritized by DEQ for follow up monitoring.

**Va. Category 3D** - data collected by a citizen monitoring or other organization indicate designated use(s) are being attained but the methodology and/or data quality has not been approved for such a determination.

**IMPAIRED - Waters are impaired or threatened but a TMDL is not required**

**EPA Category 4A** - water is impaired or threatened for one or more designated uses but does not require a TMDL because the TMDL for specific pollutant(s) is complete and US EPA approved.

**EPA Category 4B** - water is impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements (such as VPDES limits under a compliance schedule) are reasonably expected to result in attainment of the water quality standard by the next reporting period or permit cycle.

**EPA Category 4C** - water is impaired or threatened for one or more designated uses but does not require a TMDL because the impairment is not caused by a pollutant and/or is determined to be caused by natural conditions.

**Va. Category 4D** - part(s) of a water quality standard is attained for a pollutant with a TMDL, but the remaining criteria for the standard were not assessed due to insufficient information. (Only to be applied to dissolved oxygen in tidal waters of the Chesapeake Bay).

**IMPAIRED - Waters are impaired or threatened and require a TMDL**

**EPA Category 5 -** **Waters are impaired or threatened and a TMDL is needed.**

**Va. Category 5A** - a water quality standard is not attained. The water is impaired or threatened for one or more designated uses by a pollutant(s) and requires a TMDL (303d list).

**Va. Category 5B** - the water quality standard for shellfish use is not attained. One or more pollutants causing impairment require TMDL development.

**Va. Category 5C** - the water quality standard is not attained due to “suspected” natural conditions. The water is impaired for one or more designated uses by a pollutant(s) and may require a TMDL (303d list). Water quality standards for these waters may be re-evaluated due to the presence of natural conditions.

**Va. Category 5D** - a water quality standard is not attained where TMDLs for a pollutant(s) have been developed, but one or more pollutants are still causing impairment requiring additional TMDL development.

**Va. Category 5F** - the water quality standard is attained for a pollutant(s) with a TMDL and 303(d) delisting approved, but the water remains impaired for additional pollutant(s) requiring TMDL development.

**Va. Category 5R** - the Water Quality Standard is not attained and the water is impaired, and implementation of an EPA-accepted restoration plan is expected to result in attainment.  A status update will be provided each 303(d) cycle to evaluate progress.

**EPA Category 5M** - waters impaired due to atmospheric mercury.