4 Assessment Methodologies

4.1 Data and Guidance for Assessment

4.1.1 Data Considered

Readily available data and information for the period of January 1, 2020, through December 31, 2024, are considered for the assessment of most designated uses. Data collected representing samples from lakes, rivers, stream, and estuaries are assessed using the same methods. Given that adequate water quality data may not be available in all cases, determinations of use attainment are made with an abundance of caution. Furthermore, a public request for data is made in advance of the assessment process. Data will be used if they are sent to the Department by the August 31, 2025, and meet the assessment methodology requirements described herein. The request will be made via email to specific organizations, posted on the Department's website and is advertised in the News Journal.

4.1.2 Data Quality and Quantity

The Department utilizes a variety of internal and external sources for updating assessments. For data to be considered, quality assurance and control methods must be used for collection and analyses of samples. Data from DNREC's Environmental Laboratory Section (ELS) are considered usable since samples are collected and analyzed in accordance with the DNREC ELS Quality Manual and associated SOPs.

4.1.3 Data Sources

4.1.3.1 Internal Data Sources

The Department routinely collects water quality samples at more than 130 GAMN stations throughout the state. DNREC's GAMN stations' data are collected and analyzed by the Department, but the data are hosted by the EPA and the USGS via the National Water Quality Portal (https://www.waterqualitydata.us). The analyzed parameters are joined with their respective Assessment Unit (AU) IDs, major basins, and watersheds. All analyses are performed to determine the assessment status in terms of the station location and associated with the appropriate AUs. These routine water quality samples provide the data for use in the 305(b) assessments. The Department considers data from the most recent five-year period, thus, at each station, there are usually data from 30 sampling dates or more. The Department considers small datasets on a case- by-case basis when evaluating water quality conditions.

4.1.3.2 External Data Sources

External data sources include any data sources not outlined within the State of Delaware Ambient Surface Water Quality Monitoring Plan.

For the 2026 assessment, the Department will consider any information received before August 31, 2025. External data will be used per the DNREC external data policy which is available here https://documents.dnrec.delaware.gov/Watershed/Assessment/External-Data-Policy.pdf.

The DRBC prepares 305(b) assessment reports every two years for the Delaware River and Delaware Bay. When provided, Delaware incorporates the most recent attainment

determinations made by the DRBC for the shared waters of the Delaware River and Delaware Bay into its Integrated Report. Delaware continues to work cooperatively with the DRBC, member states and stakeholders to develop and implement TMDLs in waters of the Delaware River and Delaware Bay that are determined to be impaired.

The Chesapeake Bay Program (CBP) completes assessments for waters in the Chesapeake Bay and nearby waters that drain into the Chesapeake Bay in cooperation with New York, Pennsylvania, Maryland, Virginia, West Virginia, Washington, D.C. and Delaware. When provided, Delaware incorporates the most recent use attainment determinations for waters of the state that drain to the Chesapeake Bay.

4.1.4 Use of EPA's Integrated Assessment Guidance when assessing monitoring data

U.S. EPA has guidance for preparation of Integrated Reports at the following URL: https://www.epa.gov/tmdl/integrated-reporting-guidance. Delaware utilizes this guidance in its assessment process.

The core recommendation of the guidance is to categorize all waters of the state according to the following five categories:

- Category 1: All designated uses are met.
- Category 2: Some of the designated uses are met but there is insufficient data to determine if remaining designated uses are met.
- Category 3: Insufficient data to determine whether any designated uses are met.
- Category 4: Water is impaired or threatened but a TMDL is not needed.
    - 4A: All TMDLs for this AU have been completed and EPA approved. Class 4A waters have all necessary TMDLs approved, but one or more impairments exist, despite the approved TMDLs.
    - 4B: Other required control measures are expected to result in the attainment of surface water quality standards in a reasonable period of time.
    - 4C: The impairment or threat is not caused by a pollutant.
- Category 5: Water is impaired or threatened and a TMDL is needed for at least one pollutant or stressor.
    - Category 5mnr: Water is impaired, but contaminant trends support monitored natural recovery (mnr) for short term attainment of water quality goals.
    - Category 5R: Water is impaired, and an Advance Restoration Plan has been developed and acknowledged by EPA.

The Department created the sub-Category 5mnr based on recommendations in a March 2018 report titled "An Evaluation of Clean Water Act Section 303(d) listings of Delaware Waters Affected by Fish Consumption Advisories". That evaluation recommended that a subcategory of impaired waters be created for those segments where fish tissue contaminants were expected to reach target levels within approximately five to ten years without implementing a TMDL. As implied by the name, the Department plans to continue monitoring fish tissue in those waterbodies in accordance with Watershed Approach to Toxic Assessment and Restoration (WATAR)/Fish Consumption Advisory program protocols until such time that the contaminants in the fish are no longer a concern. When the data supports removing the fish consumption

advisories, the Department will consider that information for delisting decisions. The Department also pursues remediation and other regulatory efforts in affected watersheds in accordance with the WATAR program, as discussed in other sections of this report and online at https://dnrec.delaware.gov/waste-hazardous/remediation/watar/. Waters in Category 5mnr remain in EPA Category 5 and as such will require a TMDL at a future date if expected decreases do not actually occur. If trends continue to decrease, then an Advance Restoration Plan (ARP) will be developed, and the water will be moved to Category 5R.

Over the last several cycles, the Department has worked with the EPA to transition Delaware's 305(b) assessment and 303(d) listing information into EPA's Assessment, TMDL Tracking and Implementation System (ATTAINS) database. This database allows EPA and stakeholders to track the conditions of the Nation's surface waters. As part of that effort, the Department has converted the tabular list of impaired waters into a format more compatible with the ATTAINS database and geographical information systems (GIS). Future Integrated Reports are expected to be compiled largely within the ATTAINS system and reports for stakeholders will be prepared as needed for the public comment period.

The Department assesses data for a varying suite of parameters based upon available data for each AU. Data is primarily collected at each of the identified monitoring stations throughout the state. Based on the assessment results, each AU/parameter combination is assigned the appropriate EPA category, as identified above. This gives the Department more information about specific parameters of concern and allows more detailed tracking of those concerns over time. Each of Delaware's monitored waterbody AUs are assigned to the appropriate category for each designated use and then get assigned a final categorization for the AU. If there are multiple stations within an AU and one or more show impairment, then the entire AU is considered impaired.

4.2 Assessment Methodology

Herein, the word "average" regarding any parameters means a daily average (if there are multiple samples per day). Otherwise, a discrete value is considered the "average" for that day.

It is important to distinguish between marine and freshwater. For the purpose of this methodology, and per Delaware's Surface Water Quality Standards, salinity less than 5 ppt is considered freshwater and salinity 5 ppt or above is considered to be marine water. Application of fresh or marine criteria in stations with fluctuating salinity condition will be performed based on the current five-year salinity data. Stations' salinity data at the date/time of collection will be used when applying fresh vs marine water criteria, especially when applying for single sample.

For the purpose of this assessment, an AU is considered "fully supporting" designated use only if all stations' data that fall in that AU meet the criteria, if any of the stations fail then the AU would fail and is considered "not fully supporting".

4.2.1 Dissolved Oxygen Aquatic Life Use Support and Assessments of DO Criteria Attainment

The following types of Dissolved Oxygen (DO) data are available and will be used for analysis:

- Field measurements taken by personnel using handheld DO probes; and
- Continuous monitoring data collected using multiparameter monitoring systems that are

typically deployed for several days, weeks, or months. In order to get a more accurate picture of dissolved oxygen dynamics and other water quality parameters, the Department continues to increase its use of continuous monitoring systems.

For purposes of DO compliance in an assessment unit, if there is no continuous monitoring data, the field measurements for that day (as available) are representative of the daily average. If there is continuous DO monitoring data, the assessment will be performed as described below.

The methodology used to determine if DO Aquatic Life Use Support (ALUS) is meeting criteria consists of comparing measured DO concentrations, represented as the minimum DO concentration and the average DO concentration, to two different standards. Average DO concentrations are considered to meet ALUS if the 10th percentile of available data is above the applicable criteria of 5.0 mg/L for marine waters and 5.5 mg/L for fresh waters. The statewide minimum DO criterion for surface waters is 4.0 mg/L (at any time). The minimum DO criteria in the Murderkill River are lower than the statewide criteria for the period between May 16 and September 30. Data from that period are measured against a minimum criterion of 3.0 mg/L. When analyzing continuous DO data, stations are considered compliant if the minimum criterion was not exceeded by more than 1% of the measurements.

The following hypotheses is tested to identify if a station, or AU, meets the ALUS based on 10th percentile:

H0: X10 ≥ Criteria

H1: X10 < Criteria

Where X10= 10th percentile of available data.

The 10th percentile of available discrete DO data would be the lowest dissolved oxygen concentrations of the field measurement collected from a station. Furthermore, for example if 10th percentile from one station is equal to 5.5 mg/L, then one would assume the lowest 10% of that station's data are equal to or lower than 5.5. If X10 value is lower than criteria, then the station would fail to comply with the criteria. Comparing that value (i.e. X10) with the criteria would be the stringent approach.

In summary, if the following conditions are met for all stations within an AU, the AU will be "fully supporting" ALUS (Category 1) for dissolved oxygen, while if any station within an AU is not meeting those conditions, then the AU will be considered "not fully supporting" ALUS (Category 5). In summary, following are the conditions in which a station or AU would not meet ALUS.

- If the 10th percentile DO from a station is lower than the average DO criteria – 5 mg/L for marine and 5.5 mg/L for freshwater
- If two or more samples from a station in five years are less than the minimum DO criteria i.e., 4 mg/L throughout the state or 3 mg/L for Murderkill River watershed
- If the minimum DO criteria is violated by more than 1% of continuous monitoring data from a station
- If one or more sampling stations in a specific AU are not meeting the above-mentioned criteria, then that AU will be considered impaired in terms of DO.

4.2.2 Nutrient Enrichment Assessment

From a statewide perspective, nutrient over enrichment is one of the leading causes of water quality impairment. While nutrients are essential to the health of aquatic ecosystems, excessive nutrient loadings to surface waters can lead to an undesirable proliferation of aquatic flora, which in turn can result in oxygen depletion and associated impacts to fish and macroinvertebrate populations. Excessive aquatic plant growth can also preclude or seriously curtail water dependent activities such as fishing and boating when plant densities become so great that uses are not physically possible.

4.2.2.1 Total Nitrogen and Total Phosphorus Assessment

For most of the waters of the state, the Department has developed and implemented nutrient TMDLs to achieve DO targets. The state utilizes threshold values of 3 mg/L for total nitrogen and 0.2 mg/L for total phosphorus to meet TMDL goals. These threshold values were developed in order to implement the narrative provisions in Delaware's Surface Water Quality Standards. For those stations with sampling events on at least ten different days during the five-year assessment period, data are averaged, and lower confidence limits calculated at 95% confidence level (i.e. $\alpha = 0.05$) and compared to the threshold values.

- Stations whose lower confidence limit for the 5-year average total nitrogen or total phosphorus levels are above established threshold levels will not be fully supporting the aquatic life use (Category 4a, as Delaware has existing EPA approved nutrient TMDL).
- AUs with one or more stations whose lower confidence limit for the average nutrient concentrations are above the established threshold values do not fully support the aquatic life use (Category 4a, as Delaware has existing EPA approved nutrient TMDL).

Any of the following conditions will also result in an AU being listed in Category 4a, as Delaware has an existing EPA approved nutrient TMDL:

1. If there were documented cases of nuisance algal blooms or excessive macrophyte growth. These cases violate Section 4.1.1.3 of Delaware's Surface Water Quality Standards which require waters of the state to be free from substances that may result in a dominance of nuisance species.
2. If detailed, site-specific monitoring studies indicated a strong linkage between nutrient levels and indicators of eutrophication such as high chlorophyll-a concentrations, extreme daily variation in DO levels, and high sediment oxygen demand.
3. For waters of exceptional recreational or ecological significance (ERES), if a long-term trend analysis indicates a statistically significant increase in nutrient levels over time. Such increases are inconsistent with the short-term goal of "holding the line" on water quality in ERES waters. Such increases are also inconsistent with the long-term goal of restoring those waters, to the extent feasible, to their natural state.

4.2.2.2 Dissolved Nutrient Assessment in Inland Bays

For tidal portions of the Indian River, Indian River Bay, and Rehoboth Bay watersheds, the water quality criterion for dissolved inorganic nitrogen is a seasonal average of 0.14 mg/L, and for dissolved inorganic phosphorus a seasonal average of 0.01 mg/L. For those stations where sampling events occur on at least ten different days during the assessment period, the available data for the period between March 1 and October 31 from each station are averaged and 95% confidence level are calculated. The lower confidence limit is compared to the above seasonal

criteria to assess attainment of desired dissolved nutrient levels in those waters. AUs with one or more stations whose lower confidence limit are above the seasonal criteria do not fully support the aquatic life use (Category 4a, as Delaware has existing EPA approved nutrient TMDL).

4.2.3 Assessments of Total Suspended Solids in the Tidal Inland Bays Watershed

For tidal portions of the Indian River, Indian River Bay, and Rehoboth Bay watersheds, the water quality criterion for total suspended solids (TSS) is a seasonal average of 20mg/L between March 1 and October 31. For those stations where sampling events occurred on at least ten different days during the assessment period, the available data for the months of March through October from each station are averaged and 95% confidence level are calculated. The lower confidence limit on the averages is compared to the above value to assess attainment of desired TSS levels in these waters. AUs with one or more stations whose lower confidence limit are above the seasonal criteria do not fully support the aquatic life use (Category 5).

4.2.4 Temperature Assessments

Delaware's Surface Water Quality Standards indicate that, in freshwaters, no human induced increase of the daily maximum temperature above 86 degrees F (30.0 degrees C) shall be allowed. For marine waters, no human-induced increase of the daily maximum temperature above 87 degrees F (30.6 degrees C) shall be allowed. Stations for which two or more sampling events are above the criteria and whose AUs receive thermal discharges are deemed not in support of the aquatic life use.

4.2.5 Aquatic Life Assessments for Toxicity

Currently, the Department performs water column data assessment for ammonia, copper, lead, arsenic and zinc at certain monitoring stations. Aquatic life criteria for toxics shall not be exceeded more than once in a three-year period. Some criteria are based on a formula that accounts for factors like pH, hardness, temperature or in the case of the Biotic Ligand Model (BLM), multiple chemicals of interest. The Department collects additional required parameters to calculate criteria and toxic chemicals in the same date and time. While some other chemical criteria are based on measured quantities of the pollutant alone. For this cycle, formulas will be used for ammonia, lead, copper, and zinc in freshwater; fixed criteria will be used for copper, zinc and lead in marine waters; and fixed criteria will be used for arsenic in fresh and marine waters. Where two or more sampling events are above the fixed or calculated criteria in three years, it is determined that the criteria do not fully support the aquatic life use in the AU for the pollutant of interest.

4.2.5.1 Ammonia Assessment

In freshwater, ammonia's toxicity is controlled by both the temperature and pH of the water. Delaware's ammonia criteria should not be exceeded more than one time in a three- year period. The 30-days average applicable criterion, calculated using equation 1, will be determined for each sampling event at each station. If two or more sampling events (i.e., 30-days average) from the same station result in exceedances of the calculated criteria within three years, the station is deemed not supporting for the ALUS.

Equation 1:

$$CCC = 0.8876 \times \left(\frac{0.0278}{1 + 10^{7.688-pH}} + \frac{1.1994}{1 + 10^{pH-7.688}}\right) \times (2.126 \times 10^{0.028\times(20-MAX(T,7))})$$

Where:
CCC = Ammonia Chronic Criteria
pH= pH of interest
T= temperature degrees Celsius

4.2.5.2 Zinc Assessment

Freshwater zinc acute and chronic criteria are based on hardness and are calculated using the equations below. For stations whose average salinity during the assessment period is below 5 ppt (i.e. freshwater), measured dissolved zinc concentrations will be compared to the calculated acute and chronic criteria. If two or more sampling events from the same station result in exceedances of the calculated criteria within three years, the station will be deemed not supporting for the ALUS. A marine zinc chronic criterion of 81 µg/L will be used for waters with a salinity greater than 5 ppt (i.e. marine).

Equation 2:

$$Zinc\ Acute\ Criteria = 0.978 \times EXP^{(0.8473\times LN(hardness)+0.884)}$$

Equation 3:

$$Zinc\ Chronic\ Criteria = 0.986 \times EXP^{(0.8473\times LN(hardness)+0.884}$$

Where:
EXP = e = 2.71828
LN = natural log base e

4.2.5.3 Copper Assessment

The dissolved copper criterion for marine waters is fixed at 3.1 µg/L. For stations with average salinity during the assessment period above 5 ppt (i.e. marine), available dissolved copper data will be compared to the 3.1 µg/L standard. If two or more sampling events from the same station result in exceedances of the criteria within three years, the station will be deemed not supporting for the ALUS.

For freshwater, EPA has an approved BLM to be used to calculate the freshwater copper criterion. BLM is a predictive model requiring the input of water temperature, pH, Humic acid (HA) fraction, dissolved organic carbon, major cations (calcium, magnesium, sodium, and potassium), major anions (sulphate and chloride), alkalinity, and sulfide data. A Humic acid fraction of 10% and sulfide of 1.0E-10 mg/L are used to run the model.

4.2.5.4 Lead Assessment

Similar to Zinc, the dissolved lead freshwater criteria are based on hardness in surface water and are calculated using the equations below. For stations whose average salinity during the assessment period is below 5 ppt (i.e. freshwater), measured lead concentrations will be compared to the calculated acute and chronic criteria.

Equation 4:

$$Lead\ Acute\ Criteria = (1.46203 - \ln(Hardness) \times 0.145712 \times EXP^{(1.273 \times LN(hardness) - 1.46}$$

Equation 5:

$$Lead\ Chronic\ Criteria = (1.46203 - \ln(Hardness) \times 0.145712 \times EXP^{(1.273 \times LN(hardness) - 4.705}$$

Lead data for marine waters will be compared to the marine acute and chronic criteria of 210 and 8.1 µg/L, respectively. Water column lead data will be compared with the forementioned criteria and if two or more samples exceed the criteria it will be deemed not supporting aquatic life.

4.2.5.5 Arsenic Assessment

Delaware's acute and chronic surface water quality standards for dissolved arsenic in freshwaters are 340 and 150 µg/L, respectively. For marine waters those standards are 69 and 36 µg/L, respectively. Water column dissolved arsenic data will be compared with the forementioned criteria and if two or more samples exceed the criteria in three years it will be deemed not supporting aquatic life.

Dissolved arsenic concentrations in freshwater stations in Brandywine Creek, Red Clay Creek, White Clay Creek, and Christina River were assessed for public water supply use as well. The stations' dissolved arsenic concentrations were compared with EPA drinking water criterion maximum contaminated level (MCL) value of 10 µg/L. If 2 or more measurements exceeded that criterion, then the station is not fully supporting public water supply uses.

4.2.6 Primary Contact Recreation Use Assessments

Because Delaware has designated all surface waters of the state for both the "primary" and "secondary contact recreation" uses standards, the more stringent primary contact recreational use standard is utilized for listing decisions. Water samples are collected and analyzed for total enterococcus fecal indicator bacteria multiple times each year at each monitoring station. Sampling for primary contact designated use is designed to capture the ambient bacterial water quality condition to represent the condition of the associated AU.

If at least ten sampling events occurred on different days during the assessment period, the geometric mean and single-sample value of the available enterococcus (colonies/100 mL) data for each monitoring station will be compared to the criteria shown in the table below. If the geometric mean is more than the criteria or if more than ten percent of samples for a monitoring station are more than the single-sample value, the assessment unit will be considered not supporting for the primary contact recreation designated use (Category 5 if there is no TMDL for that segment or AU, otherwise in Category 4a).

Water Type	Single-sample value (Enterococcus colonies/100 ml) Criteria for Primary Contact Use	Geometric Mean (Enterococcus colonies/100 ml) Criteria for Primary Contact Use
Fresh	185	100

Marine	104	35

In addition, samples are collected for all guarded beaches and many unguarded beaches throughout the state. Sampling occurs more frequently from mid-May through mid-September as part of beach monitoring activities pursuant to the Beaches Environmental Assessment and Coastal Health (BEACH) Act but includes both BEACH Act and non-BEACH Act recreational beaches. The assessment of the water quality at recreational beaches for primary contact recreation use is not designed to monitor ambient water quality of an AU, rather this sampling focuses on the condition of nearshore waters. These conditions can vary spatially and temporally, based on nearby inputs such as wildlife, resuspension of indicator bacteria in shoreline sediment and other environmental factors. In order to determine these inputs, the state has conducted extensive sanitary surveys of these recreational beaches to identify both point and nonpoint sources of bacteria, including whether the source is from anthropogenic or wildlife origins. The result of this work has shown that beaches are not impacted by point sources, with inputs instead originating primarily from wildlife. Delaware's narrative criteria for primary contact recreation identify that the numeric standards apply to "enterococcus bacteria determined by the Department to be of non-wildlife origin based on best scientific judgment using available information." For the reasons stated above, data collected for designated beaches is used by the state for notification to the public of short-term changes in water quality and not for long-term assessments of ambient water quality to determine impairments of assessment units.

4.2.7 Assessment of Harvestable Shellfish Waters Use Support

Delaware is a member of the Interstate Shellfish Sanitation Conference (ISSC), the administrative body of the National Shellfish Sanitation Program (NSSP). Delaware's Shellfish Sanitation Regulations are administered as per ISSC/NSSP standards and practices. Section 3.2.1.3 of said regulations specifies data collection/closure criteria for Delaware shellfish waters, which include parameters constituting administrative closure of shellfish waters. Parameters that would trigger administrative closures in compliance with ISSC/NSSP standards may include theoretical pollution loading, sanitary shoreline survey information and numerical coliform data. All Delaware shellfish waters designated as other-than-Approved, which may include Prohibited, Seasonally Approved, Conditionally Approved, or Restricted, are so designated based on administrative decisions. Specifically, these criteria include:

- Theoretical pollution loading, which is determined to be the potential for intermittent pollution discharges, making detection of said theoretical releases non-detectable via conventional sampling methodology.
- Sanitary shoreline survey findings which indicate potential for theoretical pollution loading, also non-detectable via conventional sampling methodology.
- The dilution of theoretical virus discharges from point sources; however, not corresponding to increases in total coliform levels.

In order to comply with ISSC/NSSP requirements, Delaware samples all shellfish waters not administratively closed for fecal coliform bacteria. Delaware's Shellfish Program is assessed under the auspices of the U.S. Food and Drug Administration, as per ISSC/NSSP standards and practices, and submits bacteriological water quality data to the U.S. Food and Drug Administration to demonstrate compliance.

To assess the harvestable shellfish designated use, the Department considers the data and reports to FDA for waters that are not administratively closed. Waters that were administratively closed for shellfish harvesting as a result of coliform exceedances during the assessment period will be assessed as Category 5.

4.2.8 Listing Criteria for Waters and Fish Consumption Advisories

DNREC utilizes fish tissue and water data for toxic contaminant listing purposes. In developing Delaware's Integrated 305(b) Report and 303(d) List, the issuance of any fish consumption advisory will be interpreted as a violation of Section 4.5.9.2.3 and Section 4.1.1.3 of Delaware's Surface Water Quality Standards. Those two narrative provisions provide that:

1. Waters of the state shall be maintained to prevent adverse toxic effects on human health resulting from ingestion of chemically contaminated aquatic organisms.
2. Any pollutants, including those of a thermal, toxic, corrosive, bacteriological, radiological, or other nature, that may interfere with attainment and maintenance of designated uses of the water, may impart undesirable odors, tastes, or colors to the water or to aquatic life found therein, may endanger public health, or may result in dominance of nuisance species.

4.2.8.1 Fish tissue data

Fish tissue data evaluations and risk assessments are conducted in accordance with Delaware's Technical Procedures for Evaluating Human Health Risk Associated with the Consumption of Chemically Contaminated Fish and Shellfish (DNREC 2017).

In general, individual fish sample weights and lengths are recorded in the field at each sample location. Fish samples are subsequently prepared for contaminant analysis by filleting or otherwise retaining the edible portions to be analyzed and then homogenizing the resulting subsamples to produce a uniform sample (per species, per location). The homogenized tissue samples are shipped to a contracted commercial laboratory for chemical analysis.

Delaware's risk assessment procedures consider both cancer and non-cancer effects and also consider different receptors including an average adult angler, women of childbearing age, and young children. It is important to note that Delaware's procedures assume that health risk among various chemicals is additive, meaning that the risk associated with individual chemicals in the fish tissue combine to produce an aggregate risk for all chemicals in the fish tissue. Aggregate risk for cancer is considered separately from aggregate risk for non-cancer effects.

A key feature of Delaware's technical procedure is to back-calculate a "safe" number of meals that can be consumed per unit of time while maintaining an aggregate cancer risk and non-cancer risk at low levels. "Low levels" in Delaware's procedures equates to an aggregate cancer risk less than 1-in- 100,000 (i.e., 10^{-5}) and an aggregate non-cancer risk less than 1 (i.e., Hazard Index < 1).

One benefit of considering aggregate risk is that the contribution of each chemical to the aggregate risk can then be easily calculated. Chemicals responsible for greater than 10% of the aggregate risk are referred to as "risk drivers". Knowing the risk drivers is important from a water quality and waste remediation perspective because it provides focus for regulatory and non-regulatory programs.

Further, any AU for which fish consumption advisories are in place as of the publishing of the Integrated Report will be placed in Category 5 for each of the risk driving chemicals of concern

included in each advisory. If fish consumption advisories are lifted/removed, or any chemical of concern is removed from an advisory for more than one monitoring cycle, then any requirements to develop a TMDL for that chemical in that AU will be removed (assuming that the fish tissue data was originally the sole cause for placement of the assessment unit on the 303(d) list).

4.2.8.2 Surface water data

Human health water quality criteria are expressed in terms of concentration (magnitude) only. They do not explicitly include duration and frequency. However, human health water quality criteria are designed to protect against long-term exposure to low concentrations. As such, the duration implicit in these criteria is continuous.

When appropriate quality and quantity of surface water sample data is available, if at least two samples exceed the applicable criterion within a three-year period, then a segment will be considered a candidate for listing under category 5. Within the context of this methodology, a candidate for listing under category 5 means simply that additional factors need to be considered to make a final use support determination. DNREC seeks to make the best possible scientific determination based upon the totality of information available at the time. The analysis and integration of this information ultimately depends on the application of sound science and professional judgment.

4.2.9 Assessments of Aquatic Life Use Support Using Site-Specific Data That Results from Environmental Assessments and Other Programs

In the normal course of business, the Department requests, receives and evaluates water quality data for various environmental programs. Similar data may also come from other parties (e.g., state, federal or local agencies). The Department uses those site-specific studies to compare water quality data to the applicable water quality standard(s) and makes assessment and listing decisions for the affected AUs.

- If the data show no water quality criteria are exceeded and no uses are impaired, no further listing action will be taken.
- If the data are ambiguous or inconclusive, the AU will be listed in Category 3.
- If water quality criteria are exceeded or uses are impaired as a result of a contaminated site, and the owners of the site are making substantial progress (as determined by the Department) toward correcting the pollution problem, the AU will be listed in Category 4
- If it appears that there is a water quality problem related to a contaminated site, and substantial progress is not likely in the near future, the AU will be listed in Category 5.

4.2.10 Assessments of Biology and Habitat

Beginning in 1991, DNREC has used biological and habitat indices to assess and classify the health of perennial, non-tidal streams throughout the State. The biological index (BI), also known as an index of biotic integrity (IBI), is a multi-metric approach (Barbour, et.al., 1999) with metrics calculated based on the abundance and diversity of macroinvertebrates found in the stream. The habitat index (HI) consists of abiotic and biotic structural characteristics of the stream and the contiguous land known to influence the structure and function of the biological community in the stream. Both the biological and habitat indices result in multiple metric scores that places the

stream into condition classification categories of "excellent," "good," "moderately degraded" or "severely degraded." Sites that are classified as moderately or severely degraded have historically been recommended for inclusion in the State's 303(d) list of impaired waters.

Delaware's habitat and biology assessments primarily took place in the 1990s and early 2000s. Due to more pressing contaminant concerns in the state, work on habitat and biology indices stalled, and some stream segments have not been re-evaluated in nearly 20 years. DNREC, with the assistance of the EPA Region 3, has made it a priority to revitalize Delaware's Habitat and Biology Program.

Between 2022 and 2024, more than 60 existing and new sites in the Piedmont ecoregion have been evaluated for stream health. Geologically, Delaware exists within two ecoregions, the Northern Piedmont and the Middle-Atlantic Coastal Plain, and the protocols used in assessing stream health are specific to each ecoregion. With 3 years' worth of new data to characterize and assess streams, it is Delaware's priority to develop a statistically valid IBI for the Piedmont ecoregion of the State. It is anticipated that the Piedmont IBI will be developed, trialed, and calibrated in 2025 and 2026. The Piedmont ecoregion is the initial focus and a re-evaluation of Coastal Plain ecoregion of Delaware is expected to begin once the Piedmont region has been completed.

As new or updated assessments are developed, appropriate measures will be taken to address these listings. Where no specific pollutant can be determined, the Department will move those AUs to category 4B or 4C as appropriate and address water quality issues through restoration efforts as funding is available. If specific pollutants can be determined, TMDLs, ARPs or other actions will be taken to address them.

4.2.11 Setting Priorities for Water Quality Limited Assessment Units Still Needing TMDLs

The Department has set TMDL and ARP priority rankings for assessment units that remain in Category 5 or 5mnr. Justification for the priority rankings is outlined below. For AUs in Category 5mnr, concentrations of toxic contaminants of concern in fish tissue are expected to drop below screening criteria within approximately five to ten years. As such, a priority ranking of "Low" is assigned, and ARPs will be drafted as new monitoring data become available from WATAR and DNRECs Fish Consumption Advisory Program. To date, all AU/parameter pairs listed prior to 2014 have been evaluated for a Category 5mnr designation. For AUs in Category 5, priority is given to the segments where information is sufficient to develop TMDLs, or where DNREC has otherwise committed to extending its resources.

4.2.12 Rationale Used to Designate a Lower Category for Assessment Units Previously Designated for TMDL Development

The Department may move AUs from prior 303(d) Lists (equivalent to Category 5) to another category based on any of the following factors and will document the reasons for doing so on a case-by-case basis. Once a TMDL has been approved by the EPA, it is in place until it has been rescinded by the Department following applicable Departmental procedures.

- The assessment and interpretation of more recent or more accurate data demonstrate that the applicable WQS(s) is being met.

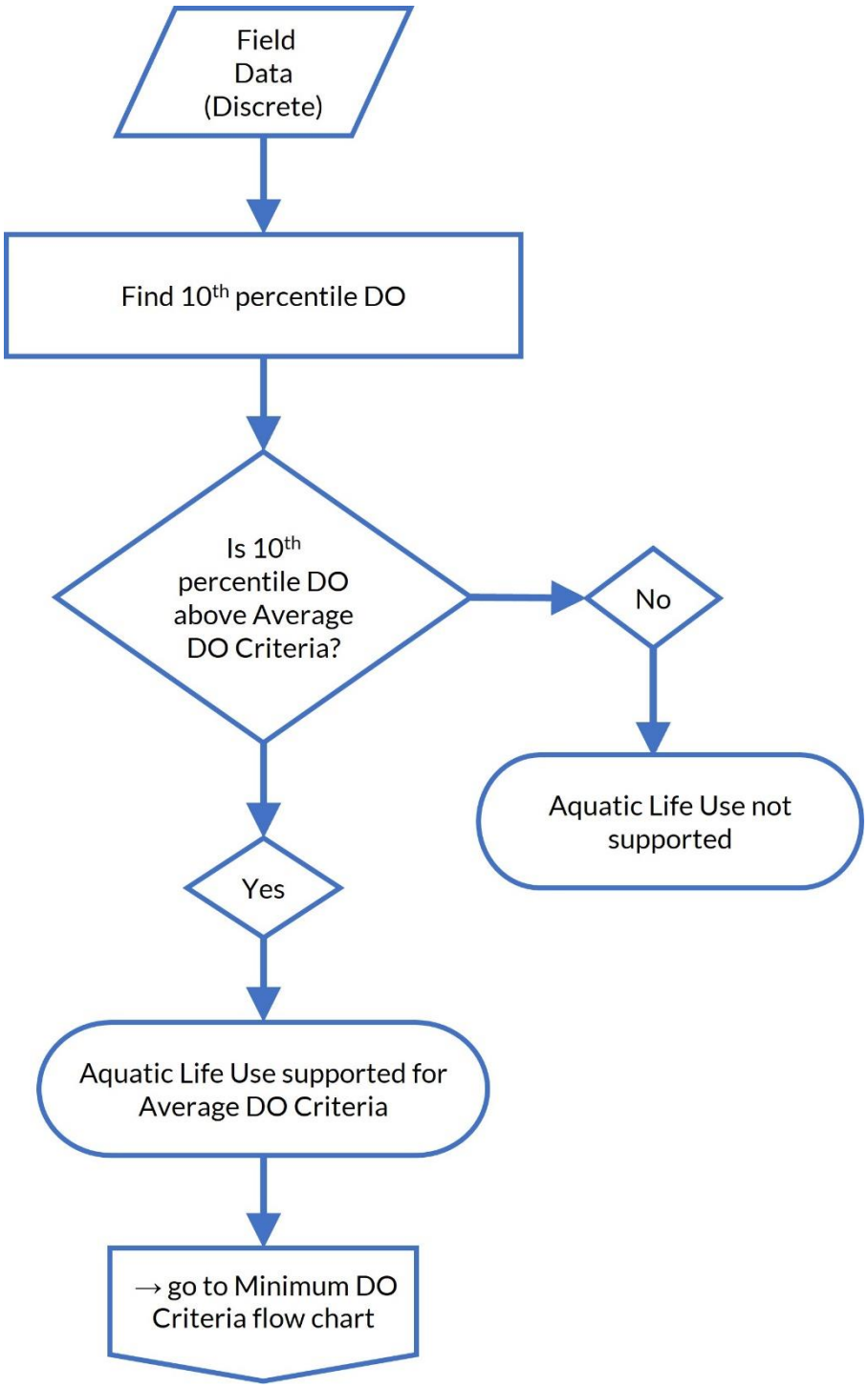
→ Move to Category 1

- The results of more sophisticated water quality modeling demonstrate that the applicable WQS(s) is being met.
  → Move to Category 1
- Demonstration that flaws in the original analysis of data and information led to the water being incorrectly listed.
  → Move to Category 1
- The development of a new listing methodology, consistent with state WQSs and federal listing requirements, and a reassessment of the data that led to the prior listing, concluding that WQSs are now attained.
  → Move to appropriate category
- A demonstration pursuant to 40 CFR 130.7(b)(1)(ii) that there are effluent limitations required by state or local authorities that are more stringent than technology-based effluent limitations required by the CWA and that these more stringent effluent limitations will result in the attainment of WQSs for the pollutant causing the impairment.
  → Move to category 4A or 4B until data and analysis support move to Category 1
- A demonstration pursuant to 40 CFR 130.7(b)(1)(iii) that there are other pollution control requirements required by state, local, or federal authority that will result in attainment of WQSs for a specific pollutant(s) within a reasonable time.
  → Move to category 4B until data and analysis either support move to Category 1 or a return to Category 5 if attainment of WQS is no longer expected within a reasonable time
- Documentation that the state included on a previous Section 303(d) List an impaired water that was not required to be listed by EPA regulations, e.g., waters where there is no pollutant associated with the impairment.
  → Move to Category 1 or Category 4C as appropriate
- Approval or establishment by EPA of a TMDL since the last Section 303(d) List.
  → Move to Category 4A until data and analysis support move to Category 1

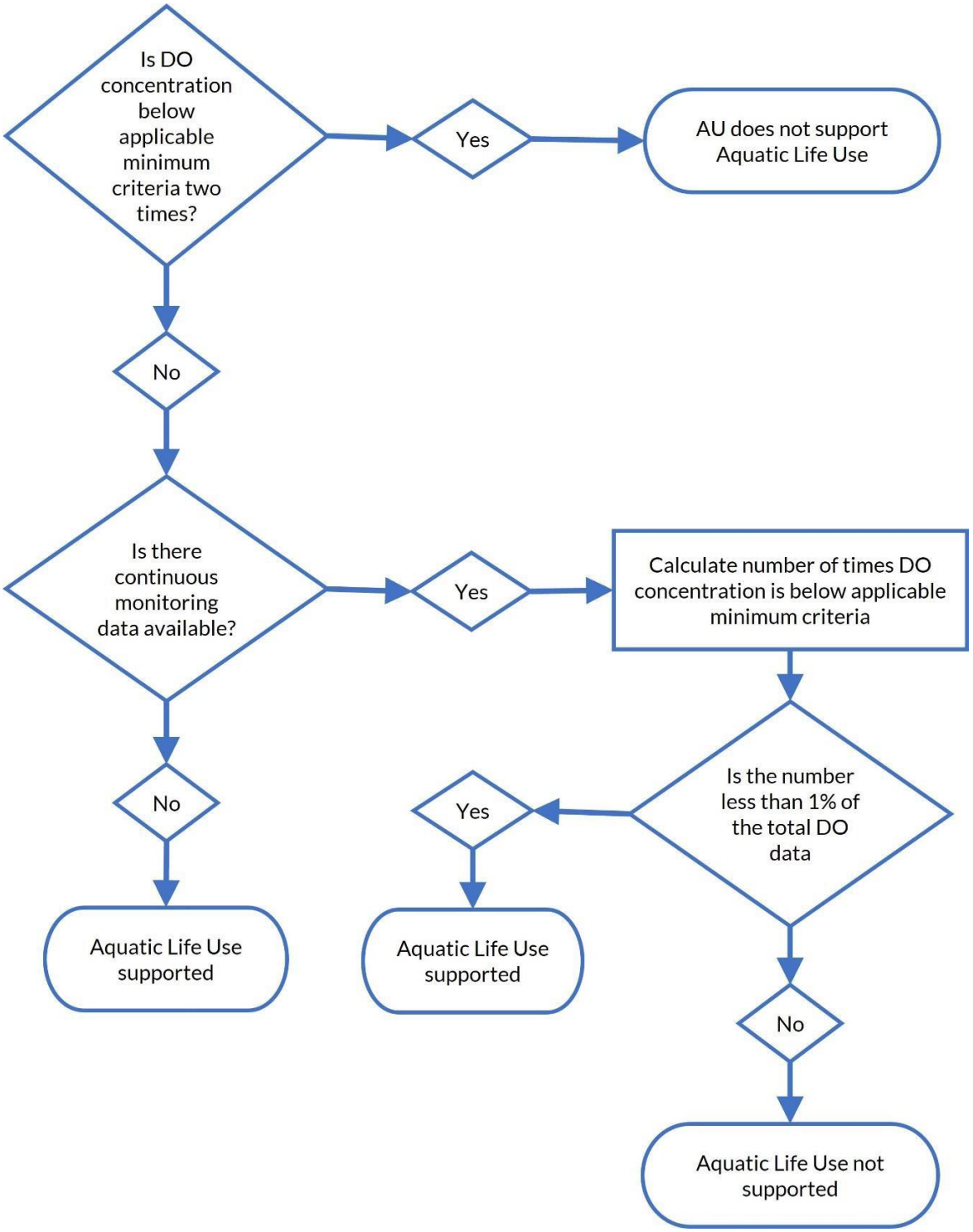
Other factors may also be used to change categories on a case-by-case basis, subject to EPA approval and appropriate stakeholder involvement.

4.2.13 Flow Charts for Designated Use Attainment

Assessment of Aquatic Life Use Support Using Average Dissolved Oxygen Criteria



Assessment of Aquatic Life Use Support Using Minimum Dissolved Oxygen Criteria and Continuous Monitoring Data



Assessment of Primary Contact Use Support for Assessment Units Outside of the Recreational Waters Program