COMPREHENSIVE ASSESSMENT AND LISTING METHODOLOGY (CALM):

PROCEDURES FOR ASSESSING WATER QUALITY STANDARDS ATTAINMENT FOR THE STATE OF NEW MEXICO CWA §303(d) /§305(b) INTEGRATED REPORT

PUBLIC COMMENT DRAFT

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

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Appendices

LIST OF COMMON ACRONYMS

4Q3	4-Day, 3-Year Low Flow
ATTAINS	EPA's Assessment, TMDL Tracking and Implementation System
AU	Assessment Unit
CALM	Comprehensive Assessment and Listing Methodology
C.F.R.	Code of Federal Regulations
CHL-A	Chlorophyll *a*
CWA	Clean Water Act
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
HP	Hydrology Protocol
LM	Listing Methodology
MASS	Monitoring, Assessment, and Standards Section
M-SCI	Mountain Stream Condition Index
MDL	Method Detection Limit
NHD	National Hydrographic Dataset
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statues Annotated
NPDES	National Pollutant Discharge Elimination System
PAH	Poly Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PQL	Practical Quantification Limit
QA	Quality Assurance
QAO	Quality Assurance Officer
QC	Quality Control
QAPP	Quality Assurance Project Plan
RBP	Rapid Bioassessment Protocols
ROD	Record of Decision
SDL	Sample Detection Limit
SEV	Severity of Ill Effects
SLD	Scientific Laboratory Division
SOPs	Standard Operating Procedures
SQUID	Surface water QUality Information Database
SSC	Suspended Sediment Concentration
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
U.S.C.	United States Code
USGS	United States Geological Survey
WQCC	New Mexico Water Quality Control Commission
WET	Whole Effluent Toxicity
WQC	Water Quality Criterion
WQS	Water Quality Standard(s)
WQX	Water Quality Exchange

1.0 ASSESSMENT PROCESS OVERVIEW

Pursuant to Section 106(e)(1) of the federal Water Pollution Control Act (Clean Water Act, or CWA), 33 U.S.C. § 1251 *et seq.* [1], the New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) has established appropriate monitoring methods, quality assurance/quality control (QA/QC) procedures, and listing methodologies in order to compile and analyze data on the quality of the surface waters of New Mexico.[2] SWQB has developed and implemented a water quality monitoring strategy for surface waters of the state in accordance with United States Environmental Protection Agency's (EPA's) "Elements of a State Water Monitoring and Assessment Program"[3]. The monitoring strategy establishes methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how SWQB uses these data to achieve three basic monitoring objectives: develop water quality-based controls, evaluate the effectiveness of such controls, and conduct water quality assessments (NMED/SWQB 2016a).

From approximately 1998 to the present, SWQB has primarily utilized a rotating basin system approach to water quality monitoring similar to several other states (WERF 2007). Per the 2016 Monitoring Strategy, SWQB monitored a select number of watersheds for two years each from 2017 – 2026 (NMED/SWQB 2016a). Revisions to the schedule are necessary based on staff and monetary resources that fluctuate annually, however watersheds are not ignored during the years in between sampling. SWQB supplements the rotating basin strategy with other data collection efforts such as data from United States Geological Survey (USGS) water quality monitoring stations and other external sources that meet SWQB's QA/QC requirements. SWQB has revised its approaches to monitoring and total maximum daily load (TMDL) prioritization in accordance with the EPA's) "New 303(d) Vision" program (EPA 2013a, NMED/SWQB 2024).

SWQB maintains current quality assurance and quality control plans that cover all monitoring activities. This document, called the *Quality Assurance Project Plan for Water Quality Management Programs* (QAPP), is revised as substantial technical or programmatic changes occur and approved by the EPA . When SWQB completes an intensive water quality survey, all data are checked against QA/QC measures identified in the QAPP and applicable SOPs[4] assessed to determine whether the waterbodies meet the designated uses detailed in the current *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (WQS)[5]. SWQB assesses surface water data according to the Comprehensive Assessment and Listing Methodology (CALM) and its associated appendices. The methodologies contained within the CALM cover the decision-making process for both listing and delisting causes of impairment. The results of the application of New Mexico's listing methodologies are then made available to the public through the *State of New Mexico CWA §303(d) /§305(b) Integrated Report* (Integrated Report). New Mexico's Integrated List, which is Appendix A of the Integrated Report and the report's primary focus, summarizes designated use attainment decisions by assessment unit (AU). SWQB's aims to prepare the Integrated Report by April 1st of every even-numbered calendar year as required by the CWA. Category 5 waterbodies on the Integrated List (see Section 4.0 for category definitions) constitute the *CWA §303(d) List of Impaired Waters*.

Although EPA does not officially approve individual state's listing methodologies, they do provide review and comment and consult the protocols when reviewing New Mexico's draft Integrated List. SWQB

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[1] Full text at https://www.govinfo.gov/app/collection/uscode/. Summary at https://www.epa.gov/laws-regulations/summary-clean-water-act.
[2] All available at https://www.env.nm.gov/surface-water-quality/.
[3] https://www.epa.gov/sites/default/files/2019-03/documents/elements-state-water-monitoring-assessment-program.pdf.
[4] https://www.env.nm.gov/surface-water-quality/sop/
[5] Available at 20.6.4 NMAC and https://www.env.nm.gov/surface-water-quality/wqs/.

reviews and revises the CALM every odd-numbered calendar year, based on current EPA assessment guidance. SWQB opens the main CALM document, and related appendices, for a 30-day public comment period. For the development of the Integrated Report and List, EPA recommends that states follow the 2006 Integrated Report guidance (EPA 2005), supplemented by biennial memoranda (EPA 2006a, 2009, 2011, 2013b, 2015, 2017, 2021, 2023, and 2025 respectively).

Assessment results are tracked and maintained by waterbody or AU (WERF 2007). The EPA first suggested the use of the term "assessment unit" (AU) in their 2002 listing guidance (EPA 2001). AUs can represent a single lake or reservoir, length of a stream reach or river, or surface waters within a delineated area such as a watershed. SWQB generally defines AUs through various factors such as hydrologic or watershed boundaries, water quality standards (WQS) found in 20.6.4 New Mexico Administrative Code (NMAC), geology, topography, incoming tributaries, surrounding land use/land management, etc. AUs are intended to represent surface waters with assumed homogenous water quality (WERF 2007). New Mexico defines the term "segment" within the state WQS at 20.6.4.7(S)(2) NMAC as a "classified water of the state described in 20.6.4.101 through 20.6.4.899 NMAC." In New Mexico, there are generally many AUs within any particular New Mexico WQS segment.

The EPA listing and reporting guidance requires states to organize their respective lists by AUs and electronically report specific assessment information to the EPA's Assessment, TMDL Tracking and Implementation System (ATTAINS). SWQB's Surface water Quality Information Database (SQUID) houses attainment data as well as SWQB-collected chemical, biological, and habitat data used to make attainment decisions. SQUID is also used to generate New Mexico's Integrated List and upload attainment data directly to EPA ATTAINS[6].

Part of EPA's 2018 listing cycle re-design of ATTAINS included nationwide standardization of a variety of database fields, including parameter names/causes of impairment, probable sources, waterbody types, etc. SQUID was updated to include these standardized terms. Assessment of quantitative data creates the basis of designated use attainment decisions. These assessments are based on data that reasonably reflect current surface water quality conditions given sampling limitations. These data are compared with the current EPA-approved WQS for the state of New Mexico (20.6.4 NMAC) regardless of what WQS were in effect at the actual time of sampling. Data types may include chemical/physical, biological, habitat, bacteriological, or toxicological data. SWQB collects most data used for assessments during its rotational water quality surveys. SWQB also utilizes data collected by other entities (partially listed below), provided the entity's sampling methods and data analysis procedures meet QA/QC requirements as detailed in the most recent QAPP. Appendix A of the CALM contains data quality and rigor information for use determinations.

In general, SWQB will not re-assess previously assessed datasets and will carry existing assessment conclusions onto the new draft list unless there are 1) more recent available data to add to the assessment dataset, or 2) assessment methodology or WQS for a specific parameter has significantly changed. SWQB first collates and assesses all readily available data not assessed for a previous listing cycle (Figure 1.1), then compares assessment conclusions to the conclusions of the previous list. If the assessment conclusions have not changed for a given water quality parameter within a particular AU, the conclusions of the previous assessment carry over to the current list. If the current assessment indicates a change in attainment status, SWQB combines the newer data for that water quality parameter at that site with the most recent five years of data (WERF 2007).

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[6] https://www.epa.gov/waterdata/assessment-and-total-maximum-daily-load-tracking-and-implementation-system-attains

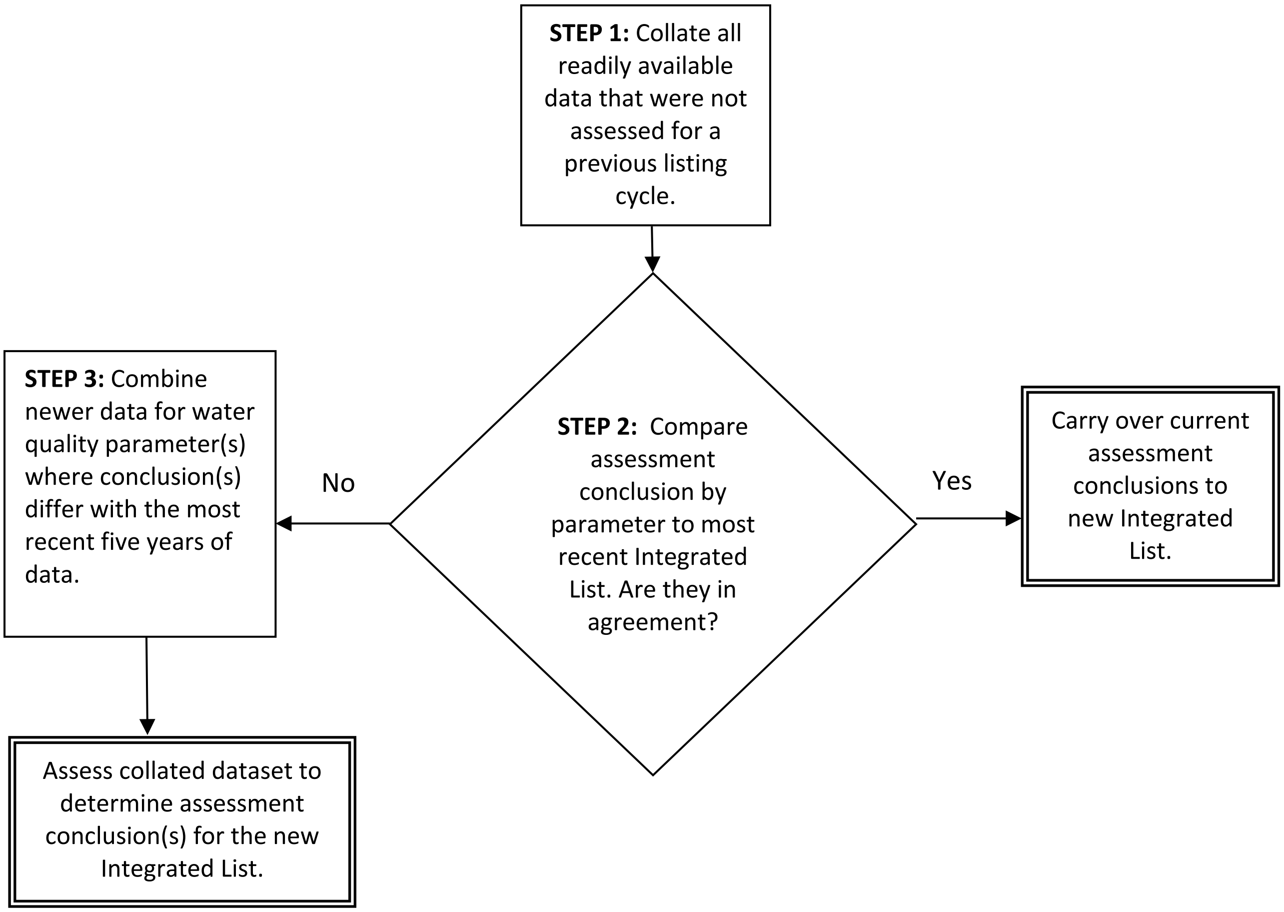


Figure 1.1. Decision process for determining assessment dataset

The specific years of data used are defined from the date data were collated for the upcoming listing cycle, typically June 1 of the year before the list is due. For example, verified and validated data from June 1, 2020 through June 1, 2025, will be collated to develop the draft 2026 Integrated List. This collated dataset will primarily form the basis of final impairment decisions. Data older than five years must meet data requirements and will only be considered on a case-by-case basis for the following reasons:

- No newer data exists for the waterbody segment/parameter, or the newer data does not meet the requirements of this listing methodology;
- The data are part of a larger dataset or long-term monitoring, which includes data less than five years old for the same waterbody/parameter; or
- Information or rationale is provided with the data to show that the data reflects current conditions and adheres to acceptable protocols.

SWQB may use data older than five years when necessary to determine historical conditions if the data met QA requirements for assessment purposes at the time of its collection. When SWQB must base decisions on historical data, it will only use data that meet QA requirements for assessment purposes.

The CWA requires that WQS protect designated uses during critical conditions such as years with below-average stream flow (see section 3.1.2.2 below for additional details). This distinction is important because it may not satisfy the intent of the CWA to use data collected in non-drought conditions to conclude no impairment when available data collected during low flow conditions indicate impairment. Recent data may take precedence over older data if newer data indicate a change in water quality or the older data fail to meet data quality requirements. If there was a temporary disturbance, such as a wildfire, or unintentional spill or discharge, and several consecutive years of data before and after the disturbance are available, SWQB may also consider data trends when determining attainment status. This consideration is consistent with recommendations in EPA guidance (EPA 2005). If there are only data greater than five years old available for a particular AU, SWQB will carry over the assessment conclusions based on these older data to the next list until more current data are available to assess.

SWQB opens a minimum 30-day public comment period on the draft Integrated Report and List. SWQB prepares a Response to Comments and submits the response to the EPA for review. SWQB also updates and submits an Assessment Rationale (formerly known as the "record of decision" or ROD). The Assessment Rationale is an additional, non-required document that SWQB provides to EPA, NMED personnel, and the public that explains when and why a particular cause of impairment was added to or removed from the Integrated List. All the above-mentioned documents developed and maintained by SWQB are available on SWQB web page: https://www.env.nm.gov/surface-water-quality/.

SWQB solicits outside sources of available data via public notice, usually at the same time as significant CALM revisions are public noticed, for a minimum 30-day period before preparing the draft Integrated List of surface waters (see Section 5.0 below). The SWQB Quality Assurance Officer (QAO) reviews all data submissions from outside sources to ensure the suitability of the QA/QC procedures. Specifically, the QAO reviews submitted documentation associated with the dataset to determine: (1) if there is documentation of QA/QC procedures that, at a minimum, meet the QA/QC requirements described in SWQB's most recent QAPP; and (2) if there is reasonable evidence or assurance that these procedures were followed. See https://www.env.nm.gov/surface-water-quality/data-submittals/ for additional information regarding how and what to submit. Although data generally must be received before the end of the public notice comment period to be considered for the upcoming listing cycle, data submittals for consideration on planning purposes or inclusion in a future list may be submitted at any time.

SWQB may use data received through this solicitation that meet QA/QC requirements to confirm a listing of impairment, confirm the absence of impairment, or initiate a new listing of impairment of a particular AU. Data that do not meet these requirements may be used for screening purposes to determine if additional data collection is warranted. Other water quality related data (e.g., habitat conditions, field observations, and fish communities) are also solicited and may be useful for characterizing water quality conditions and WQS development and refinement. Data packages submitted after the solicitation period and/or related to other watersheds in the state may be considered during development of subsequent Integrated Lists.

Quality data sources need to meet QA/QC requirements to be used for assessment, as stated above.

SWQB will not use provisional or preliminary data to make designated use support determinations. Quality data sources may include, but are not limited to, the following:

- Chemical/physical, biological, habitat, and bacteriological data collected by SWQB during watershed surveys or other recent studies using SWQB's standard operating procedures (SOPs) or otherwise accepted methods;
- Chemical/physical, biological, habitat, and bacteriological data collected by other organizations (including citizen and volunteer groups), contractors, tribes, or individuals during watershed surveys or other recent studies using SWQB's SOPs or otherwise accepted methods;
- Chemical/physical, biological, habitat, and bacteriological data collected by the USGS;
- Chemical/physical, biological, habitat, and bacteriological data collected by EPA or their contractors as part of National Aquatic Resources Surveys (NARS);
- In-stream (i.e., receiving water) data collected during National Pollutant Discharge Elimination System (NPDES) storm water or effluent permit monitoring efforts;
- In-stream water quality data from other NMED bureaus such as the Drinking Water Bureau (DWB), Ground Water Quality Bureau (GWQB), or the Department of Energy (DOE) Oversight Bureau.

2.0 DATA USABILITY AND QUALITY DETERMINATIONS

2.1 Data Management Rules

2.1.1 Data qualifiers and validation codes

SQUID houses water and fish tissue chemical data, as well as biological and habitat data. Most of these data are available in the Water Quality Portal[7], or available upon request if not in the Portal. This database also contains lab data qualifiers and internal validation codes added during the data validation process. Validated chemical/physical data collected by SWQB are uploaded to EPA's Water Quality Exchange (WQX) database. Any data with a qualifier code or data validation code that are used in an assessment should be noted in the assessment documentation. Refer to the current version of the QAPP and SWQB's Data Verification and Validation[8] for the current definition of SWQB data qualifier and data validation codes.

- Lab Qualifier Codes – In the past, sets of qualifier codes have varied between the individual sections at the State Laboratory Division (SLD). SWQB has encouraged SLD to determine a unified set of codes that will be reported consistently by all SLD sections. Standard lab qualifier codes for SLD and contract labs, as well as SWQB data validation codes are defined in the most recent QAPP. All data flagged as "rejected" during internal laboratory QA procedures will not be used for assessment purposes. Other flagged results are usable provided the appropriate caveats are documented in the assessment files and uncertainties in the data are discussed.

  Results from samples noted by the laboratory as "below the minimum quantification or reporting limit" (generally referred to as "minimum reporting limit" or MRL in SQUID) may only be used during the assessment process if the MRL is less than the applicable water quality criterion (WQC) or numeric threshold being assessed. For this listing methodology, the following terms related to analytical method sensitivity are considered synonymous and will be evaluated

[7] https://www.waterqualitydata.us/
[8] Available at https://www.env.nm.gov/surface-water-quality/sop/

on a case-by-case basis depending on the particular analytical lab because reporting practices can vary: "quantitation limit," "reporting limit," "level of quantitation," and "minimum level." Parameters detected above the method detection limit (MDL) but below the MRL are typically flagged with a J qualifier that indicates any reported quantitative concentration is an estimate. The concentration is estimated because the concentration being detected is below the lowest quantifiable concentration on the calibration curve. There is certainty as to the detection of the chemical but uncertainty as to the exact concentration. These reported values may be used in an assessment when the J flagged data is part of a summed parameter, or if the MRL is less than the applicable WQC. Otherwise, J flagged data will not be assessed. Assessment of summed J flagged parameters is allowable because the summed value of estimated concentrations will be biased neither high nor low; the additive nature allows for assimilation of bias resulting in a summed concentration that SWQB considers a reliable value. For example, it is common laboratory practice to include individual J flagged values when summing congeners to determine total PCB concentration using EPA Method 1668A, B, or C congener methods.

Results from samples that are flagged by the laboratory as "exceeded holding time" will be considered estimates and may be used during the assessment process unless the result is deemed "rejected" based on best professional judgment in accordance with the QAPPs and SOPs. Method holding times are different for each sample parameter. Sample analysis after the allowable holding time for a sample or sample set may be a result of laboratory oversight, delayed sample shipment, need for reanalysis, or poor planning. The data validator will consider the nature of the analysis, the extent of the noncompliance (e.g., considering the method holding time limit, whether the holding time was exceeded for one day vs. one month, and stability of the parameter in question), the sample matrix, any supporting data, and the purpose and goals of the sampling and analysis program (EPA 2002d). From the EPA's perspective, the time and expense associated with the sample collection and processing is forfeited when data exceeding the holding time are rejected even though the analytical results may in fact be accurate and usable (EPA 2002e). Therefore, data exceeding holding time may be considered for use in assessments, but any listings as a result of these qualified data will be noted as Category 5C – needing more data (see Section 4.0 for details). The exception to this holding time rule involves *E. coli* reported using Colilert methods. In this instance, SWQB adds a holding time qualifier to samples processed greater than 8 hours from collection; however, the method accepts holding times up to 24 hours for routine monitoring.

<u>SWQB Data Validation Codes (internal)</u> – SWQB validates all data for a particular water quality survey. Internal data validation procedures are detailed in the most recent QAPP and the Data Verification and Validation SOP. All data with internal SWQB validation codes will still be used for assessment purposes except data flagged as "rejected" (typically R1, R2, R3, RB1, or Er data validation codes). Also, SWQB bacteria results that are marked "Ea" due to incubation temperatures between 35.5 and 38 degrees Celsius ("°C") may only be used as supporting information for CWA §303(d)/§305(b) assessments.

2.1.2 Duplicates, compliance monitoring sampling data, and temporal independence

Studies designed to determine ambient conditions in surface waters should consider temporal independence. For the purposes of CWA §303(d)/§305(b) assessment, grab data or water chemistry data collected within a seven-day period are considered duplicate samples except in cases where the data are from distinct hydrologic events or in those cases where the data are used to calculate statistical criteria (e.g., bacteriological geometric means). The maximum (or minimum if the criterion is expressed as a minimum) value should be used in the assessment dataset. Examples include when QA/QC duplicates or multiple compliance monitoring samples for human health criteria are taken within a one-hour time frame. Assessing the maximum/minimum value of duplicate samples guarantees that any criterion exceedance is considered, thus avoiding the risk of incorrectly disregarding an exceedance (i.e., Type II error).

2.1.3 Continuous recording equipment (thermographs, data loggers, and sondes)

Periodic instantaneous data do not provide maximum or minimum daily parameter values, duration of exceedances, or diel fluctuations of water temperature and dissolved oxygen (DO). These aspects of water quality are pertinent to aquatic life use. Because of the limitations of grab data and the increasing availability of data loggers and sondes to collect long-term datasets, SWQB prefers assessments using data logger and sonde datasets.

SWQB has been deploying thermographs in streams since 1998. Continuously recording temperature data loggers (i.e., thermographs) are relatively inexpensive, readily available, and provide an extensive multiple-day record of hourly temperatures over the period when temperatures are generally highest. Monitoring staff program thermographs to record at least hourly (typically 15-minute data) and deploy them long enough to capture the summer season maximum temperature. The use of continuous data is more technically sound than simply applying percentages to limited instantaneous temperature data and allows consideration of magnitude, frequency, and duration in water quality monitoring and listing methods. The use of thermographs eliminates the biases introduced when using instantaneous data to assess water quality parameters with significant diel fluctuation. Starting with the 2010 listing cycle, the temperature listing methodology covers all temperature assessment scenarios, including procedures for both instantaneous grab and thermograph data for all types of aquatic life uses in either lotic (e.g., streams or rivers) or lentic (e.g., lake or reservoir) waterbodies (see Appendix B).

SWQB has been deploying multi-parameter sondes at select stations since 2000. In addition, DO and specific conductance data loggers have been deployed in recent years. Monitoring staff program these devices to record, at least hourly DO, pH, specific conductance, temperature, and/or turbidity values for a minimum of three days (72 hours); however longer deployments are preferred. SWQB typically deploys for sondes and single parameter loggers for three to fourteen days, and thermographs for three to six months. Based on the success of the thermograph-based listing methodology, SWQB developed additional large dataset listing methodologies to address parameters with known diel fluxes, namely DO and pH (Appendices E and F, respectively). Starting with the 2012 listing cycle, these protocols cover all assessment scenarios, including procedures for both instantaneous grab and sonde data for all types of aquatic life uses in either lotic (e.g., streams or rivers) or lentic (e.g., lake or reservoir) waterbodies.

2.1.4 Limited datasets

As stated above, SWQB also uses thermographs, multi-parameter sondes, and data loggers to generate large datasets for temperature, pH, DO, specific conductance, and turbidity. Regarding chemical data, SWQB strives for a minimum of four data points for core parameters such as metals and nutrients during rotating watershed surveys to make designated use determinations. Resource constraints typically limit data collection for radionuclides and organic parameters to two screening sampling events (with up to two follow up if there is an exceedance) over the monitoring period. The actual number of data points collected depends upon available resources, specific water quality concerns and land use activities in the watershed, and the hydrologic characteristics of a given waterbody during the survey year. For example, SWQB has observed an increasing number of streams with very low to no flow as the survey year progresses from March through October. The EPA does not recommend the use of rigid, across the board, minimum sample size requirements in the assessment process (EPA 2009). Target sample sizes should not be applied in an assessment methodology as absolute exclusionary rules (EPA 2003, 2005). The use of limited datasets is acceptable to the EPA, as limited financial, field, and laboratory resources often dictate the number of samples that can be collected and analyzed (EPA 2002a).

Generally, a minimum of four data points for field and chemical parameters is necessary to apply the procedures in Section 3.0 in order to determine and confirm attainment status for an associated AU parameter pair. The primary purpose of requiring four data points is to demonstrate repeatability of an observation and to provide a high probability of detecting pervasive impairments. Increased numbers of data points improve the statistical power for detecting lower probabilities of impairment. During the survey year, SWQB monitoring staff review data as they are received from the laboratory. As needed, staff investigate questionable results by contacting laboratory personnel directly to confirm the results and/or schedule appropriate modifications to survey sampling plans in order to acquire a minimum of four seasonally-distributed data points for each parameter sampled.

In most cases, if data from fewer than four sampling events are available ($n \leq 3$) to assess an applicable designated use, there are insufficient data to determine attainment status for that designated use. However, in some instances there may be sufficient data to determine nonsupport (e.g. two exceedances that would lead to nonsupport determination regardless of the number of additional samples collected). An example of chemical sampling parameters that require no more than $n=2$ are costly tests such as radionuclides, semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs), with up to two follow-up samples recommended if there is an exceedance. If there are not enough data to determine attainment or nonsupport, the use is noted as “Not Assessed” on the list. If there are no data at all, the AU falls under category 3A (i.e., no data). If data do not exceed any applicable criteria, the AU falls under Category 3B (i.e., limited data, no exceedances). If data from one or more sampling events exceeds one or more applicable criteria, the AU is assigned Category 3C (i.e., limited data, exceedances) and the parameter(s) of concern are noted in the AU Comments field. SWQB will collect additional data, as resources allow, in order to determine attainment status. See Section 4.0 for a description of the categories described above.

2.1.5 Application of WQS during low flow conditions

In terms of assessing designated use attainment in ambient surface waters, the WQS apply at all times under all flow conditions unless explicitly described in a particular WQS segment. Therefore, data collected during all flow conditions (except data collected during unstable conditions when assessing for chronic aquatic life use — see section 3.1.2.2 below for additional details), including low flow conditions, will be used to determine designated use attainment status during the assessment process. For a description of critical low flow calculations used to develop point source discharge requirements, see 20.6.4.11(B) NMAC.

2.1.6 Multiple stations in one AU

As stated in Section 1.0 above, SWQB has designated AUs to represent waters with assumed homogenous water quality (WERF 2007). Section 1.0 also describes the relationship between AUs and “segments” as defined in 20.6.4.7(S)(2) NMAC. SWQB typically does not have the resources to establish more than one monitoring station per river or stream AU during rotational watershed surveys. Still, there are occasions where more than one station with available data (typically chemical/physical data) is either established by SWQB or another data collection agency.

When this occurs in rivers or streams, the assessor will first assess data from each station individually to determine impairment(s) (Figure 2.1). Assessment units with homogenous landscape features are presumed to have homogenous water quality. However, multiple stations within an AU may indicate discrepancies in water quality due to point source discharges and/or lack of adequate, or no, best management practices (BMPs) that address non-point source pollution. If discrepancies arise and the attainment conclusions for every station in the AU (based on the most recent 5 years of data) are not in agreement (i.e., either all **Fully Supporting** or all **Not Supporting**), the AU as currently defined may not represent homogeneous water quality. In this case, the AU breaks should be examined and may be split appropriately, including special consideration of NPDES point source discharges, lack of non-point source BMPs, and available water quality and GIS data. The data will then be re-assessed based on the newly-defined AUs. Conflicting data from multiple stations in an AU will also be carefully re-examined and circumstances that may have affected data reliability evaluated. In the rare event that there are two or more stations less than one tenth of a mile (approximately 200 yards) apart, and grab data or chemical data for the same parameter are collected within a seven-day period from these stations, these data are considered replicates for assessment and the maximum (or minimum if the criterion is expressed as a minimum) value should be used for assessment purposes.

When multiple stations on a lake or reservoir are sampled on the same day or within the same seven-day period, those samples are considered replicates and the most conservative result and/or the location that most closely aligns with assessment objectives for each designated use is assessed. If one or both datasets indicate impairment, the impairment conclusion for the AU is **Not Supporting**. If there are conflicting assessment conclusions, it will be noted in the Record of Decisions. This approach in this section is applicable to all impairment determination procedures detailed in this document, as well as all appendices unless otherwise stated.

2.1.7 Blank-correction for constituents measured using ultra low-level procedures

When a constituent concentration is determined using ultra low-level methods which recommend blank-correction (such as EPA Method 1668A, B, or C for analysis of PCBs), the result will first be blank-corrected using the procedures in the method (preferred), assuming adequate data are available to perform the recommended procedure. SWQB will consider other acceptable, documented blank-correction procedures when the procedures recommended in the method are not used, and the resulting data will be used for assessment if approved by SWQB QAO. SWQB will then compare these blank-corrected values against New Mexico's WQS to determine impairment.

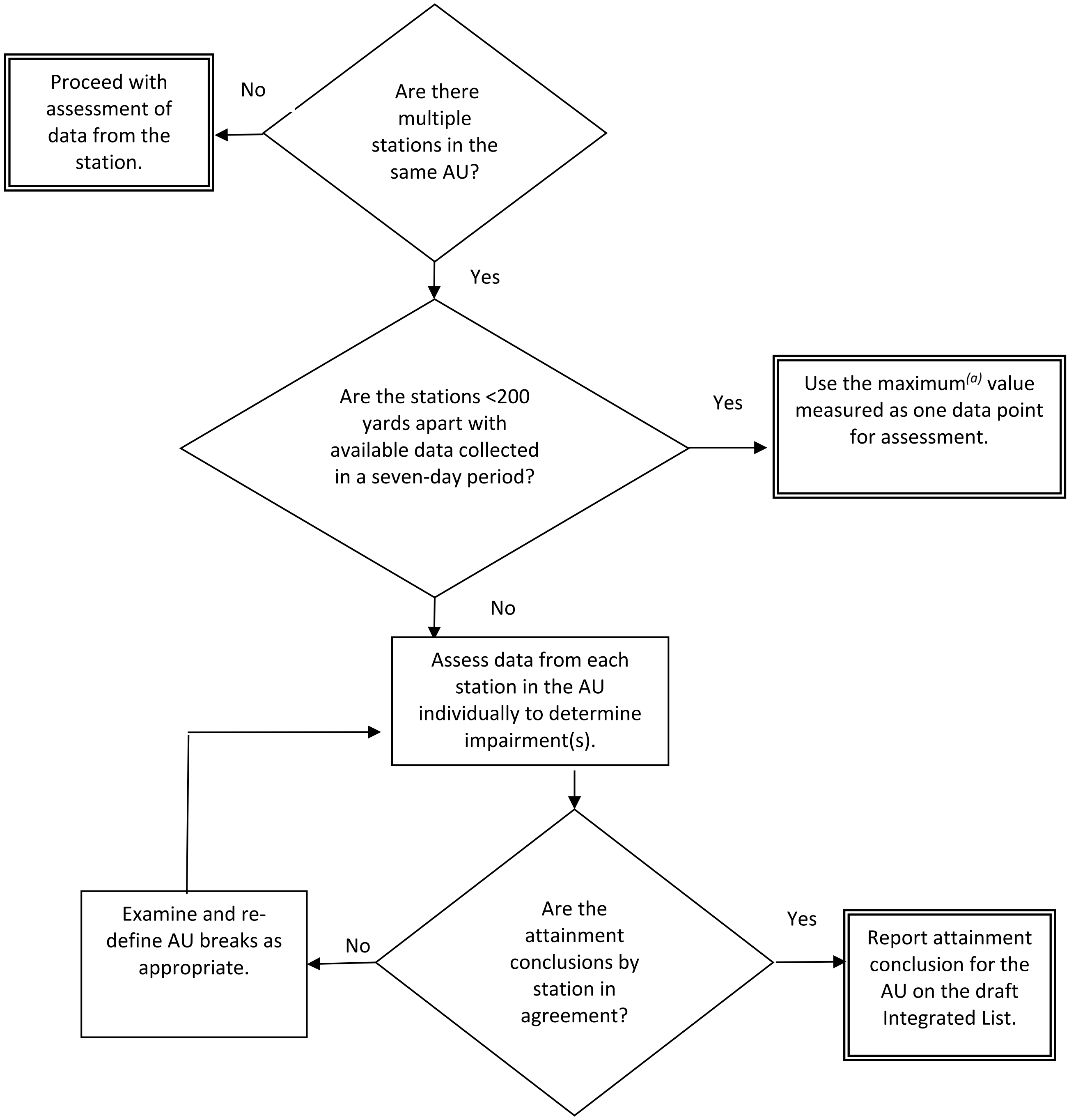
2.1.8 Non-representative data

Non-representative data include data collected within the mixing zone of a discharge. If available water chemistry data from an existing station appears highly influenced by groundwater from a nearby seep or spring, SWQB will review the data and associated sampling procedures to determine appropriateness for surface water assessment. If the data are from a SWQB sampling station, the station will be relocated when possible to ensure future sampling is representative of the stream water chemistry, or

SWQB may utilize the equal-width increment sampling method[9].

Some data collected during or immediately after temporary catastrophic events influencing a waterbody that are not representative of normal conditions are typically not used to make CWA §303(d) listing decisions. For example, biological or habitat data collected during or immediately after scouring storm flows which indicate the temporary diminished presence of aquatic life, or chemical data collected immediately after accidental spills would not be a basis upon which to list a waterbody as impaired.

[9] https://pubs.usgs.gov/of/2000/ofr00-213/manual_eng/collect.html#width



NOTES: [a] or minimum if the criterion is expressed as a minimum value.

Figure 2.1. Generalized decision tree for multiple stations in same assessment unit

Another instance of non-representative data may include wildfire burn areas, which can produce significant water quality changes that may impact fish and other aquatic organisms, drinking water supplies and wastewater treatment systems. These impacts are cumulative as a result of pollutants mobilized by the fire, chemicals used to fight the fire, and the post-fire response of the surrounding

environment. Responses include immediate/short-term responses as well as long-term (decade or more) impacts.
The magnitude of the effects of fire on water quality is primarily driven by fire severity (how much of the fuel is consumed) and fire intensity (how hot the fire burned) coupled with subsequent seasonal weather events (e.g., monsoon rainfall). In other words, the more severe the fire, the greater the amount of fuel consumed and nutrients released, making the watershed more susceptible to erosion of soil and nutrients into the stream, which in turn may negatively impact water quality. In addition to erosion and nutrient loading, fire intensity affects the formation of hydrophobic soils that repel water and increase the probability of storm water runoff and soil erosion in the watershed

Wildfires have become more frequent in New Mexico in recent years. Occasionally wildfires have occurred mid-way through SWQB's rotational watershed surveys, making it impossible to continue monitoring impacted AUs that survey year due to unsafe conditions, restricted access, or severe flooding. If planned sampling could not occur and resulted in a non-assessable data set, there will be insufficient data to determine attainment and this AU will be noted as "Not Assessed" and scheduled for additional data collection as resources, access, and recovery allow. These additional data will be collated with data from the original sampling year and assessed for the subsequent draft Integrated List.

Data collected during or immediately after fires, floods, extreme drought, or other catastrophic events are generally not be used to make attainment decisions because such data are not representative of ambient conditions after the initial impacts of the event have passed. When determining if an event is considered substantial enough to impact or alter the conditions that existed prior to the event, the following factors should be considered: severity of event, size of the affected area, distance of sampling sites from the event, hydrology, geomorphic effects that include soil types and slope. In the absence of data that characterize the conditions before an event, SWQB will utilize all available resources to determine those conditions.

Catastrophic events may be considered as a basis for listing in instances where nonattainment of standards arises from an irreversible source of pollutants. SWQB will make case-by-case decisions regarding whether data collected during or after an event are representative of normal conditions, as well as determinations of severity and longevity of impacts, in collaboration with stakeholders and EPA Region 6. Wildfires in particular may affect designated use attainment for several years after the fire, and thus most data collected for assessment post wildfire may be considered representative of ambient post-fire conditions.

2.1.9 Temporary water quality standards

During New Mexico's 2013 triennial review, WQCC 14-05 (R), the WQCC adopted a temporary standards provision in 20.6.4.10(H) NMAC. Per this provision, designated use attainment as reported in the IR shall be based on the underlying designated use and applicable criterion, not on any temporary standards. This requirement is consistent with federal regulations[10].

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[10] https://www.gpo.gov/fdsys/pkg/FR-2015-08-21/pdf/2015-19821.pdf, p. 51036.

2.2 Data Quality Criteria

As stated in Section 1.0, data must, at a minimum, meet the QA/QC requirements described in SWQB's most recent QAPP to be considered for use in the IR. In some cases, more than one type of data may be used to determine aquatic life use attainment. SWQB recognizes that not all data are of equal quality or rigor. The tables in Appendix A describe defined levels of data quality for biological, chemical/physical, and habitat data types that SWQB may use to determine designated use support. These tables contain elements of data quality as well as quantity. These tables are adapted from the *Consolidated Assessment and Listing Methodology: Towards a Compendium of Best Practices* guidance document (EPA 2002a) and modified with respect to SWQB's SOPs. It is important to evaluate data quality when an assessment performed with more than one data type results in conflicting use attainment decisions (see Section 3.1.5 for more detail).

3.0 INDIVIDUAL DESIGNATED USE SUPPORT DETERMINATIONS

The WQS are a triad of elements that work in concert to provide water quality protection. These three elements are: designated uses, numeric or narrative criteria, and an antidegradation policy. Designated uses are the defined uses of a particular surface waterbody. Each waterbody will have one or more designated uses. For example, Domestic Water Supply is a designated use. Designated use definitions and their assignment to various stream segments in New Mexico can be found in the *Standards for Interstate and Intrastate Surface Waters (*20.6.4 NMAC). The New Mexico Water Quality Control Commission (WQCC) adopted numeric and narrative criteria to protect these designated uses. There are both segment-specific criteria (detailed in 20.6.4.97 through 20.6.4.899 NMAC) and designated use-specific criteria (detailed in 20.6.4.900 NMAC) in New Mexico's WQS. All references to narrative or numeric criteria throughout this document refer to criteria found in 20.6.4 NMAC.

WQS segments described in 20.6.4.97 through 20.6.4.899 NMAC are further divided into AUs for use impairment determination and linked to the National Hydrographic Dataset (NHD) for national electronic reporting requirements. AUs are stream reaches, lakes, or reservoirs defined by various factors such as hydrologic or watershed boundaries, WQS, geology, topography, incoming tributaries, surrounding land use/land management, etc. Assessment units are designed to represent waters with assumed homogenous water quality (WERF 2007, EPA 2025). SWQB has begun converting some existing linear Assessment Units representing individual stream reaches into Assessment Unit sub-watersheds (typically based on 10- or 12- digit USGS HUCs) where appropriate. Key areas where this approach is appropriate include sub-watersheds where numerous intermittent or ephemeral tributaries converge to form a mainstem, perennial river or stream. The AU-watershed vs. AU-linear approach allows monitoring efforts to prioritize resources at the sub-watershed outlet sites to provide a more holistic assessment of the sub-watershed as a whole. Larger perennial rivers and streams will continue to exist as linear assessment units (for example, the Rio Grande, Pecos River, and the San Juan River).

As stated in Section 1.0, data collected at representative stations during SWQB water quality surveys along with acceptable external data form the basis of use support determinations for each AU. Linear stream or river AU total length is typically less than 25 miles unless there are no tributaries or land use changes to consider along or within the reach or delineated area, and subwatershed AU polygons are typically based on 10 or 12-digit HUCs. Multiple stations in one AU warrant special consideration as detailed in Section 2.1.6.

Numerous classified segments in 20.6.4 NMAC include only perennial waters, without specifically identifying which reaches are perennial. For example, the description of 20.6.4.109 NMAC states, "…all other perennial reaches of tributaries to the Rio Puerco…" Therefore, non-perennial reaches of these tributaries do not fall under this WQS segment and are subject to the designated uses and criteria in 20.6.4.98 NMAC unless they are specifically listed under 20.6.4.97 NMAC. If the perennial nature of a stream reach is unclear, the Hydrology Protocol (HP) should be used as described in New Mexico's Water Quality Management Plan (WQCC 2020) to determine whether a particular AU is perennial or non-perennial.

The following subsections provide guidelines used to interpret available data. SWQB uses these guidelines to determine use support for each designated use in each AU, utilizing the previously described datasets. Some level of flexibility is built into these guidelines to account for uncertainties such as the natural variability of water quality, the lack of extensive data necessary to make more definitive assessments, and the transitory nature of many pollutants. Each designated use has one or more tables with specific requirements for determining use attainment based on the type of data evaluated. When determining aquatic life use support, each type of data is first evaluated separately. Guidance on how to reconcile two or more data types with differing aquatic life use attainment determinations and guidance on how to handle assessment units where both cause and response variables are determined to be impaired is found in Section 3.1.6. In addition to the following subsections, SWQB has developed several specific listing methodologies to assess use attainment, including temperature, excessive nutrients, DO, pH, sedimentation/siltation (this habitat variable has historically been referred to as "stream bottom deposits"), and turbidity. See Appendices B through H, respectively, for details regarding aquatic life uses and waterbody types currently covered by these specific assessment protocols.

Integrated listing guidance from EPA recommends the following use attainment categories (EPA 2005 and subsequent biennial guidance): **Fully Supporting, Not Supporting, Insufficient Information,** and **Not Assessed.** For every AU detailed in the Integrated List, an attainment category is assigned to every designated use as stated in the applicable section of 20.6.4 NMAC or identified existing use. New Mexico does not use the **Insufficient Information** category because it is redundant with **Not Assessed**, meaning if there are insufficient data to assess, the AU is not assessed.

A determination of **Fully Supporting** or **Not Supporting** should not be made in the absence of data, however if data is not available for any assessment unit within a given assessment cycle previous assessment conclusions will be retained until newer data is available. It is understood that any assessment may involve some level of best professional judgment (BPJ). However, evaluations based on BPJ, literature statements, or public comments without data to support the decision shall not be the only basis for a listing or delisting. For those AUs with no/insufficient available data that meet the QA/QC requirements for any criteria within an applicable designated or existing use, a designation of **Not Assessed** will be assigned to that use.

Waterbodies may be delisted based on new information. Delisting only applies to situations where newer data indicate that water quality has improved and the currently listed waterbody is no longer impaired according to the current listing methodology, or the WQS have changed and reassessment indicates full support. Delisting decisions generally require the same information as listing decisions. However, as an artifact of small sample size the potential exists for some waterbodies to be delisted when the underlying impairment cause persists. An example of this is a waterbody that is impaired 50 percent of the time but has a binomial probability of 69 percent that at least two of four results are exceedances indicative of the impairment. A delisting requirement of fewer than two exceedances resampled under the same conditions would result in a 31 percent chance of delisting. To increase confidence in delisting decisions based on smaller datasets or delistings related to toxic pollutants, there must be no exceedances of the criteria for an AU to be delisted. Delisting requirements are further addressed in the following sections and parameter-specific appendices.

3.1 Assessing Aquatic Life Use (ALU) Support

Use assessment decisions should consider and integrate, whenever possible and appropriate, results of various data types. These include biological, chemical/physical, and toxicological data. Descriptions of data quality types can be found in Appendix A.

3.1.1 Biological data

In 2010, the WQCC adopted the following General Criterion (20.6.4.13(M) NMAC):

> *Biological integrity: Surface waters of the state shall support and maintain a balanced and integrated community of aquatic organisms with species composition, diversity and functional organization comparable to those of natural or minimally impacted water bodies of a similar type and region.*

Prior to the 2012 listing cycle, benthic macroinvertebrate sampling was the primary form of biomonitoring utilized by New Mexico. The extensive data set generated through those sampling efforts was a crucial component towards development of numeric translators for both narrative biological and sediment WQS. SWQB also monitors fish assemblages and algae in an increasing number of waterbodies to assist with WQS refinement, improve numeric translators for narrative nutrient standards, and to better assess potential impairment to aquatic communities.

3.1.1.1 Benthic macroinvertebrate communities

Two biological assessment approaches utilizing benthic macroinvertebrate communities are currently used in New Mexico for determining aquatic life use attainment, namely the reference site approach (i.e., comparing an individual waterbody to an appropriate individual reference site), and the reference condition approach (i.e., comparing an individual waterbody to a reference condition for class or group of waterbodies to which that waterbody belongs). Currently, New Mexico has only defined a reference condition for wadeable, perennial streams in the Mountain ecoregions. Wadeable, perennial streams located outside of the Mountain ecoregions continue to be assessed using the reference site approach from the original Rapid Bioassessment Protocol (RBP) (Plafkin et al. 1989) as modified by Jacobi (2009) when a suitable reference site has been identified and sampled as well. SWQB does not currently apply either method to large non-wadeable rivers, lakes and reservoirs, or non-perennial streams.

Reference Condition Approach

The reference condition approach expands on the original RBP methods to acknowledge the reality of a wider range of aquatic conditions that reflect more than minimal impacts, including historic and dominant land and water use activities (Barbour et al. 1999, Stoddard et al. 2006). This broader concept of reference condition allows for the definition of reasonable and attainable targets or goals by class or group in order to assess potential impairment to the aquatic community at a larger number of study sites.

In order to determine reference condition, data from a continuum of reference to stressed sites in the ecoregion(s) of interest must be available. SWQB has been collecting benthic macroinvertebrate data since 1979. The formal process of developing numeric biological translators began in 2002 with assistance from EPA and Tetra Tech, Inc. In 2006, SWQB, in collaboration with Dr. Gerald Jacobi and Tetra Tech, Inc., developed a regional Mountain Stream Condition Index (M-SCI) to determine aquatic life use attainment for the Mountain biological region which consists of Ecoregions 21 and 23 (Southern Rockies and AZ/NM Mountains) (Jacobi et al. 2006, Griffith et al. 2006). This approach is similar to the approach currently utilized in Wyoming and Colorado.

The M-SCI was developed based on reference condition as determined by several reference sites. The Jacobi et al. (2006) report describes indices for three classes (bioregions) of streams based on elevation and watershed size. However, SWQB uses only the High Small (elevation and watershed, respectively) Index applied to the Mountain biological region which consists of Level III Ecoregions 21 (Southern Rockies) and 23 (AZ/NM Mountains). The available dataset, stream classification system, and reference site selection process did not sufficiently partition the variability and select an adequate number of sites to define the reference condition and a departure from this condition for the other biological region. Application of the High Small SCI in the report places study reaches in the same condition category for all tested streams in the Mountain region regardless of elevation or watershed size. Therefore, SWQB applies the “High Small SCI” in the report to determine Aquatic Life Use attainment of all wadeable, perennial streams in the Mountain region, and refers to this as the M-SCI. Any study site within approximately 20 kilometers of the boundary of Ecoregions 21 and 23 should be compared to the definitions for the various ecoregions to determine the proper bioregion designation for that site.

The M-SCI is composed of twelve individual metrics from five metric categories, representing community and species attributes such as Taxonomic Composition, Taxonomic Richness, Tolerance, Habit, and Functional Feeding Group. Individual metrics are listed in Table 3.1. For descriptions of these metrics, see Plafkin et al. 1989, Barbour et al. 1999, and Jacobi et al. 2006. % Sensitive EPT is an uncommon metric that was defined during the Jacobi et al. 2006 study. It is percent of individuals within orders Ephemeroptera, Plecoptera, or Trichoptera that have tolerance values of 0, 1, 2, 3, or 4 as determined by available references and best professional judgement at the time of the M-SCI determination (Jerry Jacobi, personal communication, 12/7/18).

Table 3.1 Metrics included in the M-SCI by metric categories

Taxonomic Composition	Taxonomic Richness	Tolerance	Habit	Functional Feeding Group
Shannon Diversity (log_2)	Ephemeroptera Taxa	% Sensitive EPT	Clinger Taxa	% Scraper
Pielou’s Evenness	Plecoptera Taxa	% Intolerant	Sprawler Taxa	Scraper Taxa
% Plecoptera			Swimmer Taxa	

M-SCI scores are normalized according to the formulas in Table 3.2 utilizing the 95th percentiles associated with each metric. Each metric is first calculated and normalized. All metrics are then summed and averaged to produce an M-SCI score between 0 and 100. The resulting score is then placed in a condition category of Very Good (100 – 78.36), Good (78.35 – 56.71), Fair (56.70 – 37.21), Poor (37.20 – 18.89), or Very Poor (18.90 – 0) based on the distribution of reference site index scores. Index scores above the 25th percentile threshold were rated as “Very Good” or “Good”; below the 25th percentile threshold scores were divided into three categories: “Fair”, “Poor”, or “Very Poor.” Therefore, sites with M-SCI ranking below the 25th percentile of reference sites (i.e., fair, poor, or very poor) are considered **Not Supporting** with respect to aquatic life use.

Table 3.2. Metric formulas and 95th percentiles for calculating the M-SCI score

METRIC	95th PERCENTILE	FORMULA[a]
Shannon Diversity (log_2)	3.89	if $X > X_{95}$, score = 100 if $X \le X_{95}$, score = $100 \times X/X_{95}$
Pielou's Evenness	0.50	
% Plecoptera	26.67	
Ephemeroptera Taxa	7.00	
Plecoptera Taxa	7.00	
% Sensitive EPT	78.46	
% Intolerant	57.17	
Clinger Taxa	17.00	
Sprawler Taxa	6.00	
Swimmer Taxa	4.00	
% Scraper	43.78	
Scraper Taxa	4.00	

NOTES: [a] X = metric value; X_{95} = 95th percentile of respective metric

Table 3.3 explains how to interpret macroinvertebrate data to assess aquatic life use support. Biological regions outside of the Mountains region will be assessed using the RBP approach as detailed in Plafkin et al. (1989) until SCIs can be developed for the Xeric and Plains regions. Additional data are needed to determine the specific pollutant or "pollution" of concern. If one or more pollutant(s) are identified, IR Category 5a is assigned and the identified pollutant(s) are listed as cause(s) of impairment. If a form of "pollution" (for example, flow alteration by EPA's definition) and no concurrent pollutant(s) have been identified as the reason for the biological impairment, IR Category 4c may be assigned (see Appendix J for more information). Otherwise, the AU is assigned IR Category 5c (more data needed). See Section 4.0 for more detail.

<u>Specific Reference Site Approach (sites not covered by the Reference Condition Approach)</u>

After the study site is selected, a specific reference site must be selected for comparison. The first step in determining a reference site is to identify a pool of best available sites in the same geographic region that have the lowest number of anthropogenic impacts to the stream's ecosystem. The reference and study sites should share analogous characteristics, to the extent possible, such as elevation, gradient, geology, hydrology, watershed size, in-stream habitat, and riparian vegetation. In particular, characteristics that cannot change over time should be used as primary attributes of similarity between reference and study sites. For this reason, the study site and the reference site should at a minimum be in the same ecoregion (Griffin et. al 2006).

Based on identification and enumeration of the benthic macroinvertebrates present in the two samples, biological response indicators (i.e., benthic macroinvertebrate metrics) are calculated and compared between the two sites. Under this approach, the reference site serves as a quantitative control or benchmark to which a site may be compared and evaluated. The eight metrics and scoring criteria New Mexico uses for the reference site approach are recommended in Plafkin et al. (1989) Figure 6.3-4 as modified in Jacobi (2009), excluding the Standing Crop and Community Loss metrics. The ratio between the score for the study site and the reference site provides a percent comparability measure for each study site. The study site is therefore assessed on the basis of its similarity to the reference site and its apparent potential to support an acceptable level of biological health. The resulting score is placed in a condition category based on percent of reference: Non Impaired (>83%), Slightly Impaired (54-79%), Moderately Impaired (21-50%), Severely Impaired (<17%). Sites in any of the impaired condition categories are considered to "Not Supporting" with respect to aquatic life use (see Table 3.3). Plafkin et al. (1989) recommends leaving 4% between each category to account for subjective judgment (i.e., BPJ) as to correct placement. Figure 3.1 provides two examples using the reference site approach.

Metrics	Fish Creek 10 m abv confluence with Trout Creek	Sunshine Creek immed abv USGS gage 0123456	Falls Creek 5m abv conflence with Rock Creek
	Reference Site	Study Site 1	Study Site 2
Diversity [Shannon Weiner (Log Base 2]	4.42	2.60	3.78
Total No. of Taxa	42	35	39
Total No. of EPT Taxa	7	4	6
Ratio EPT/EPT + Chironomidae	0.445	0.202	0.355
Ratio of Scrapers/Scrapers + Filterers	0.432	0.667	0.520
Ratio of Shredder/Total No. of Ind.	0.043	0.408	0.225
Percent Dominant Taxa	18.7	38.9	20.2
Hilsenhoff Biotic Index	5.7	5.7	5.4
% Comparison to Reference			
Total No. of Taxa	100	83	93
Total No. of EPT Taxa	100	57	86
Ratio EPT/EPT + Chironomidae	100	45	80
Ratio of Scrapers/Scrapers + Filterers	100	154	120
Ratio of Shredder/Total No. of Ind.	100	948	523
Hilsenhoff Biotic Index	100	100	106
Bioassessment Score (based on Plafkin et al 1989 Figure 6.3-4, as modified by Jacobi 2009)			
Diversity [Shannon Weiner (Log Base 2]	6	4	6
Total No. of Taxa	6	6	6
Total No. of EPT Taxa	6	0	4
Ratio EPT/EPT + Chironomidae	6	2	6
Ratio of Scrapers/Scrapers + Filterers	6	6	6
Ratio of Shredder/Total No. of Ind.	6	6	6
Percent Dominant Taxon	6	2	4
Hilsenhoff Biotic Index	6	6	6
Total	48	32	44
Bioscore % Comparison to Reference		**66.7**	**91.7**
ATTAINMENT STATUS ---->		**Non Support**	**Full Support**

NOTES: Ratio EPT/EPT + Chironomidae is calculated as EPT/ (EPT + Chironomidae).

Figure 3.1. Examples of reference site approach to determine attainment

Table 3.3. Interpreting benthic macroinvertebrate data to determine Aquatic Life Use Support in wadeable, perennial streams

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
Macroinvertebrate assemblages in Ecoregions 22, 24, 25, and 26[a]	Reliable data indicate functioning, sustainable macroinvertebrate assemblages not modified significantly beyond the natural range of reference condition (>83% of reference site(s)). [a]	Reliable data indicate macroinvertebrate assemblage with moderate to severe impairment when compared to reference condition (≤79% of reference site(s)). [a]	Reference condition is defined as the best situation to be expected within an ecoregion. Reference sites have balanced trophic structure and optimum community structure (composition & dominance) for stream size and habitat quality.
Macroinvertebrate assemblages in Ecoregions 21 and 23 using M-SCI[b]	Reliable data indicate functioning, sustainable macroinvertebrate assemblages not modified significantly beyond the natural range of reference condition (> 56.7 score).	Reliable data indicate macroinvertebrate assemblage with impairment when compared to reference condition (≤56.7 score).	

NOTES:
[a] Percentages and recommended 4% gap for BPJ are based on Plafkin et al. (1989).
[b] Percentages based on Jacobi et al. (2006).

3.1.1.2 Algae composition and blooms

Algae are an important biological component of surface waters as they provide a food source for fish and other organisms. Although some forms of algae are toxic, algae do not have to be toxic to be considered a harmful nuisance. Nontoxic algae can reproduce, or bloom, at such a high rate that they reach concentrations that reduce the amount of available oxygen, which can result in fish kills and other detrimental impacts to aquatic organisms. Likewise, some algae have spines or other protrusions that may cause fish kills simply by getting caught in or otherwise irritating fishes' gills.

New Mexico has been collecting periphyton and phytoplankton community data from select streams, lakes, and reservoirs since about 1975. Periphyton is an assemblage of organisms that grow on underwater surfaces and includes a complex matrix of algae and heterotrophic microbes including bacteria, fungi, protozoa, and other organisms (Allaby 1985). Phytoplankton is the assemblage of free-floating, photosynthetic organisms, including diatoms, desmids, and dinoflagellates. Periphyton and phytoplankton data from lentic systems have previously been used as a response variable for the lake and reservoir nutrient assessment protocol, however that approach is not being used as of the 2025 CALM revision (see Appendix D).

Blue-green algae (also known as cyanobacteria) are one of the largest and oldest groups of photosynthetic bacteria and form a portion of the planktonic community in New Mexico surface waters. Blooms (often referred to as harmful algal blooms, or HABs) can be blue, bright green, brown or red and may appear as green paint floating on water or washed on shore, foam or scum, or mats on the surface of freshwater lakes and ponds. Some blooms may not affect the appearance of the water but as algae in the blooms die, the water may have a noticeable odor. As single cells, large colonies and filaments, blue-green algae grow in a wide variety of conditions and can become the dominant algae in nutrient-rich lakes, ponds, and slow-moving streams when water is warm and stagnant. Some forms, but not all, can produce toxins that are poisonous to humans, pets, fish, and wildlife that ingest water contaminated with the toxins. Examples of cyanotoxins are microcystin and cylindrospermopsin, for which there are primary contact designated use criteria in 20.6.4.900(D) NMAC.

Physicochemical conditions, including excessive nutrients, can also stimulate growth of *Prymnesium parvum* which can produce toxins that cause significant fish and bivalve (i.e., clams and mussel) kills resulting in ecological and economic harm to the affected waterbodies; however, there is no evidence these toxins harm other wildlife, livestock or humans. Additional information regarding blue-green algae, *P. parvum* (golden algae) and SWQB's HAB monitoring program can be found at: https://www.env.nm.gov/surface-water-quality/habs/

20.6.4 NMAC does not contain any specific criteria related to the presence of toxic algae blooms or fish kills, therefore the SWQB currently does not list waterbodies as impaired due to these occurrences. However, per 20.6.4.900(D) NMAC associated cyanotoxin (microcystin and cylindrospermopsin) data may be used to assess recreational contact use in lakes and reservoirs, where conditions may be conducive to public health concerns. Documented HAB occurrences and fish kills are noted in AU Comments on the Integrated List and the corresponding Record of Decision entries for these particular waterbodies. SWQB will also continue to post information regarding these blooms on our web site.

3.1.1.3 Fish assemblages

SWQB has been collecting fish community data from select streams, lakes, and reservoirs since 2000. SWQB has collated available data to begin exploring the feasibility of biological assessment techniques using fish assemblages in select waterbody types. Cold water streams tend to be lacking in species diversity, making development of fish assemblage-based biological assessment challenging. In 2019 SWQB, EPA, and TetraTech worked together to develop a Biological Condition Gradient (BCG) for the Middle Rio Grande and other large, sandy-bottom rivers in the state using both fish and benthic macroinvertebrate assemblages.

3.1.1.4 Sandy-Bottom Rivers Biological Condition Gradient (BCG) Model

In 2019-2020, SWQB participated in a workgroup of regional and national macroinvertebrate and fish biology experts to develop a biological condition gradient (BCG) model for the Middle Rio Grande. The BCG is a useful tool in establishing restoration goals and assessment thresholds in the absence of reference conditions. The expert panels reviewed published taxa sensitivity and historic biological community data to assign ecological function scores to benthic macroinvertebrate and fish community samples from Middle Rio Grande sites. The workgroup then validated the BCG model using regional taxonomic assemblage data from the National Rivers and Streams Assessment (NRSA). As a result, the BCG model is applicable to sandy-bottom rivers in the southwest and may be used to develop thresholds applicable to other rivers in New Mexico. The BCG model underwent peer review for publication in a scientific journal (Hughes et al. 2022). In 2024 TetraTech developed an Rshiny app (https://tetratech-wtr-wne.shinyapps.io/NM_BCGCalc/) to calculate BCG scores for large sandy-bottom rivers using the BCG. SWQB and EPA are currently exploring ways to implement the BCG as well as potentially expand its application to a regional model. SWQB anticipates a delay in incorporation of the BCG into the CALM until its regional application is explored, at which time SWQB will include stakeholders in the implementation phase of the BCG model. The intent of including information on the BCG in this section of the CALM is to further inform stakeholders that this model is still in the initial stages of development. SWQB is not proposing to implement the model this assessment cycle. The report detailing the development, calibration, and validation of the model is available here.

3.1.2 Chemical/physical data

20.6.4.900 NMAC provides numeric criteria related to various chemical/physical parameters. Table 3.4 explains how to interpret chemical/physical grab data relative to these standards to assess aquatic life use support. This table is divided into conventional parameters, including field measurements, major ions and nutrients, and toxic substances such as trace metals and priority pollutants. Refer to the appropriate WQS segment number (20.6.4.97 through 20.6.4.899 NMAC) of the WQS for numeric criteria for conventional chemical/physical parameters that may differ from those listed in 20.6.4.900 NMAC.

Conventional parameters monitored to determine aquatic life use support include temperature, turbidity, pH, DO, specific conductance (SC), and total phosphorus (TP) (Table 3.4).

Assessment protocols for temperature, DO, and pH, are found in Appendices B, E, and F, respectively. Prior to the 2005 triennial review, New Mexico had established segment-specific numeric turbidity values for all water quality standard segments detailed in 20.6.4 NMAC. In 2005, the WQCC amended 20.6.4 NMAC to remove all the segment specific turbidity values and revise the turbidity subsection under the General Criteria section (20.6.4.13(J) NMAC). Because of this WQS change, SWQB developed an interim protocol with numeric translators to assess turbidity data from listing cycles 2006, 2008, and 2010. SWQB has since developed a revised turbidity assessment protocol for the 2012 cycle forward. Sedimentation/siltation and turbidity assessments are described in Appendices G and H, respectively. All other parameters are detailed in Table 3.4 and discussed below.

3.1.2.1 Hardness-dependent metal criteria

Hardness-dependent acute and chronic aquatic life criteria for metals are calculated using the hardness-dependent equations in 20.6.4.900(I) NMAC. Hardness values from the same sampling event are required for the assessment of hardness-dependent metals. The acute and chronic aquatic life criteria for dissolved aluminum (which can be found in the table at 20.6.4.900(J)(1) NMAC) only apply when the concurrent pH is less than 6.5 or greater than 9.0 S.U. If the concurrent pH is between 6.5 and 9.0 S.U. then the hardness-dependent total recoverable aluminum criteria in 20.6.4.900 I (1) and (2) apply.

20.6.4.900(I)(4) NMAC copper criteria apply to surface waters on the Pajarito Plateau, as described in that paragraph. These copper criteria are calculated using paired samples of dissolved copper, DOC (dissolved organic carbon), hardness, and pH.

AUs determined to be impaired due to exceedances of the previous dissolved aluminum criteria when concurrent pH was greater than 6.5 prior to the 2018 listing cycle were delisted with a delisting rationale of “WQS no longer applicable.” If total recoverable aluminum data are not available to assess, an AU Comment will be added indicating the change in WQS and need to prioritize the collection of total recoverable aluminum data.

20.6.4.900(J)(2)(e) NMAC states that the acute and chronic aquatic life criteria for aluminum are based on analysis of total recoverable aluminum in samples filtered to minimize mineral phases as specified by the department. SWQB's study of this issue concluded that a filter of 10-micron pore size minimizes mineral-phase aluminum without restricting amorphous or colloidal phases (NMED/SWQB 2012). If the turbidity of a sample is less than 30 NTU, no filtration is needed to minimize mineral phases. Samples from waters with turbidity greater than 30 NTU must be filtered with 10-micron disposable in-line capsule filters (rather than paper filters that are designed for use in plate or funnel-type filter holders) prior to analysis in order to determine impairment. Total aluminum results not exceeding the applicable water quality criterion may be used for assessment in the absence of concurrent turbidity data and/or filtering because filtering the sample prior to analysis would have resulted in a value even further below the applicable criterion. Similarly, samples filtered with a 10-micron filter regardless of turbidity levels that exceed the applicable criterion are assessable because unfiltered samples would have resulted in an even higher magnitude of exceedance.

Table 3.4 Interpreting chemical/physical data to assess Aquatic Life Use Support

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•**Conventional parameters** (e.g., specific conductance, total phosphorus[a]) **A)** 4 to 10 samples* **B)** >10 samples	For any one pollutant: **A)** No more than one (≤1) exceedance of the criterion. **B)** Criterion exceeded in <10% of measurements.	For any one pollutant: **A)** More than one (>1) exceedance of the criterion. **B)** Criterion exceeded in ≥ 10% of measurements.	For any one pollutant: **A)** No (<1) exceedance of the criterion. **B)** Criterion exceeded in <10% of measurements.	All **temperature, DO, and pH** listing methodologies are described in Appendices B, E, and F, respectively. Sampling biases in these parameters (such as diel flux) should be addressed by sampling with continuously-recording sondes, data loggers, and thermographs during the specified index period whenever possible. **Sedimentation/siltation (habitat)** and **turbidity** assessments are described in Appendices G and H, respectively. Chronic criterion samples should be taken during hydrologically stable conditions to be representative of the averaging period (see Section 3.1.2.2 below for additional discussion).
•**Toxic substance** (e.g., core and/or priority pollutants, ammonia[b], chlorine, metals[c], cyanide, pesticides) * ≥ 4 samples	For any one pollutant: • No (<1) exceedance of the **<u>acute</u>** criterion, <u>and</u> • No more than one exceedance of the **<u>chronic</u>** criterion in three years[d].	For any one pollutant: • One or more (≥1) exceedance(s) of the **<u>acute</u>** criterion, <u>or</u> • more than one (>1) exceedance of the **<u>chronic</u>** criterion in three years[d].	For any one pollutant: • No (<1) exceedance of the **<u>acute</u>** criterion, or • No exceedance (<1) of the **<u>chronic</u>** criterion in three years[d].	

NOTES: * Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details.

(a) Only for segment-specific total phosphorus values. Otherwise, see the nutrient listing methodologies in Appendices C and D.

(b) New Mexico's WQS for total ammonia consider sensitive freshwater mussel species in the family Unionidae, freshwater non-pulmonate snails, and *Oncorhynchus spp*. (a genus of fish in the family Salmonidae), hence further protecting the aquatic community. The total ammonia criteria magnitude is measured as Total Ammonia Nitrogen (TAN) mg/L. TAN is the sum of $NNNN$4+ and $NNNN$3. TAN mg/L magnitude is derived as a function of pH and temperature (EPA 2013). The acute aquatic life criteria for TAN (mg/L) was derived by the EPA (2013) as the one-hour average concentration of TAN mg/L that shall not be exceeded more than once every three years on average. The chronic aquatic life criteria for TAN (mg/L) was derived by the EPA (2013) as a thirty-day rolling average concentration of TAN mg/L that shall not be exceeded more than once every three years on average. In addition, the highest four-day average within the 30-day averaging period should not be more than 2.5 times the CCC (e.g., 2.5 x 1.9 mg TAN/L at pH 7 and

20°C, or 4.8 mg TAN/L) more than once in three years on average. Resource limitations will most often preclude the collection of multiple samples to calculate a 1-hr average, or a thirty-day average. Thus, a single grab sample shall be applied toward each average. To apply Table L(2) of 20.6.4.900 NMAC for assessment purposes, all waters designated as high quality coldwater aquatic life (HQCWAL) or coldwater aquatic life (CWAL) will be assumed "*Oncorhynchus spp.* Present," while all other aquatic life (AL) uses will be assumed "*Oncorhynchus spp.* Absent" and the criteria from Table L(1) apply. If actual or historic fisheries documentation indicates the presence of salmonids, the "*Oncorhynchus spp.* Present" column will be used regardless of the designated AL use. If the applicable uses translate to different criteria values, the most stringent criteria are used per 20.6.4.11(F) NMAC.

(c) See section 3.1.2.1 for additional information on assessment of hardness-dependent metal criteria and site-specific Copper criteria for Pajarito plateau surface waters.

(d) The most recent three-year period in the assessment dataset. 20.6.4.12 (B) NMAC states that "compliance with chronic water quality criteria shall be determined from the arithmetic mean of the analytical results of samples collected using applicable protocols."

3.1.2.2 Assessing chronic aquatic life WQS

The acute and chronic aquatic life criteria established in the WQS are based upon the nationally recommended criteria developed by the EPA (EPA 2006b). The acute criteria are intended to protect against short-term effects and are derived from tests of lethality or immobilization. The chronic criteria are intended to protect against long-term effects and are derived based upon longer term tests that measure survival, growth, or reproduction. The EPA recommends a one-hour averaging period for the acute criteria and a four-day averaging period for the chronic criteria. That is, the 4-day average exposure of aquatic life to a pollutant should not exceed the chronic criterion (EPA 1994).

During SWQB's watershed surveys, water chemistry samples are generally collected 4-6 times (depending on the parameter and site) to 1) best characterize the waterbody throughout the annual hydrograph, and 2) acquire data points that are more likely to be statistically independent with respect to time. Because of this sampling design, consecutive-day data are not available to calculate 4-day averages. Few states and tribes are able to obtain composite data over a 4-day sampling period for comparison to chronic aquatic life criteria primarily due to budget and staff time constraints. The EPA believes that multiple-day composites are not an absolute requirement for evaluating whether chronic criteria are being met (EPA 1997). Grab and composite samples can be used in water quality assessments if taken during stable conditions (EPA 1997) and should be representative of average conditions over the 4-day period surrounding the sampling event for assessment of chronic aquatic life.

New Mexico has developed a two-step process for assessing attainment of chronic aquatic life criteria after the dataset has been assembled following the data management rules in Sections 2 and Figure 3.2. The first step is to collate available data and assess against the chronic aquatic life WQS. If an assessable dataset includes more than one exceedance of a given criterion, these data then are evaluated to determine if the samples were collected during hydrologically stable conditions considered to be representative of the 4-day averaging period; this process is detailed below. If conditions were unstable during the time of sampling, the data are not assessed. If sample collection methodology was specifically designed to capture data from storm flow events (e.g., by using single stage or automated samplers deployed to capture storm events only), these data should not be used to assess chronic aquatic life criteria.

Potential outliers are also identified while assessing against chronic conditions. A potential outlier is defined as a measurement greater than the 75th percentile (Q3) of all the measurements of a particular parameter at a site, plus three times the inter-quartile range (IQR). The IQR is defined as the difference between the 25th percentile (Q1) and Q3 (Tukey 1977, Seo 2006). This approach is intended to 1) demonstrate the repeatability of an observation meant to represent chronic conditions; 2) screen for potential field equipment, collection, or laboratory analysis errors; and 3) take into consideration potential anomalies in the data set due to extreme deviations from seasonal norms, the natural consequences of extreme spring runoff conditions, the influence of storm events or other anomalous events such as runoff from catastrophic fire areas. SWQB will review potential outliers on a case-by-case basis and censor results from the assessment dataset only if a demonstration can be made that the data are not representative of ambient conditions. SWQB will document removal of validated data from the assessment dataset in the Assessment Rationale (formerly Record of Decision). Note that the above statements regarding the data exclusion process only apply to chronic criteria and all grab samples will be used to assess acute criteria regardless of hydrologic or anomalous conditions.

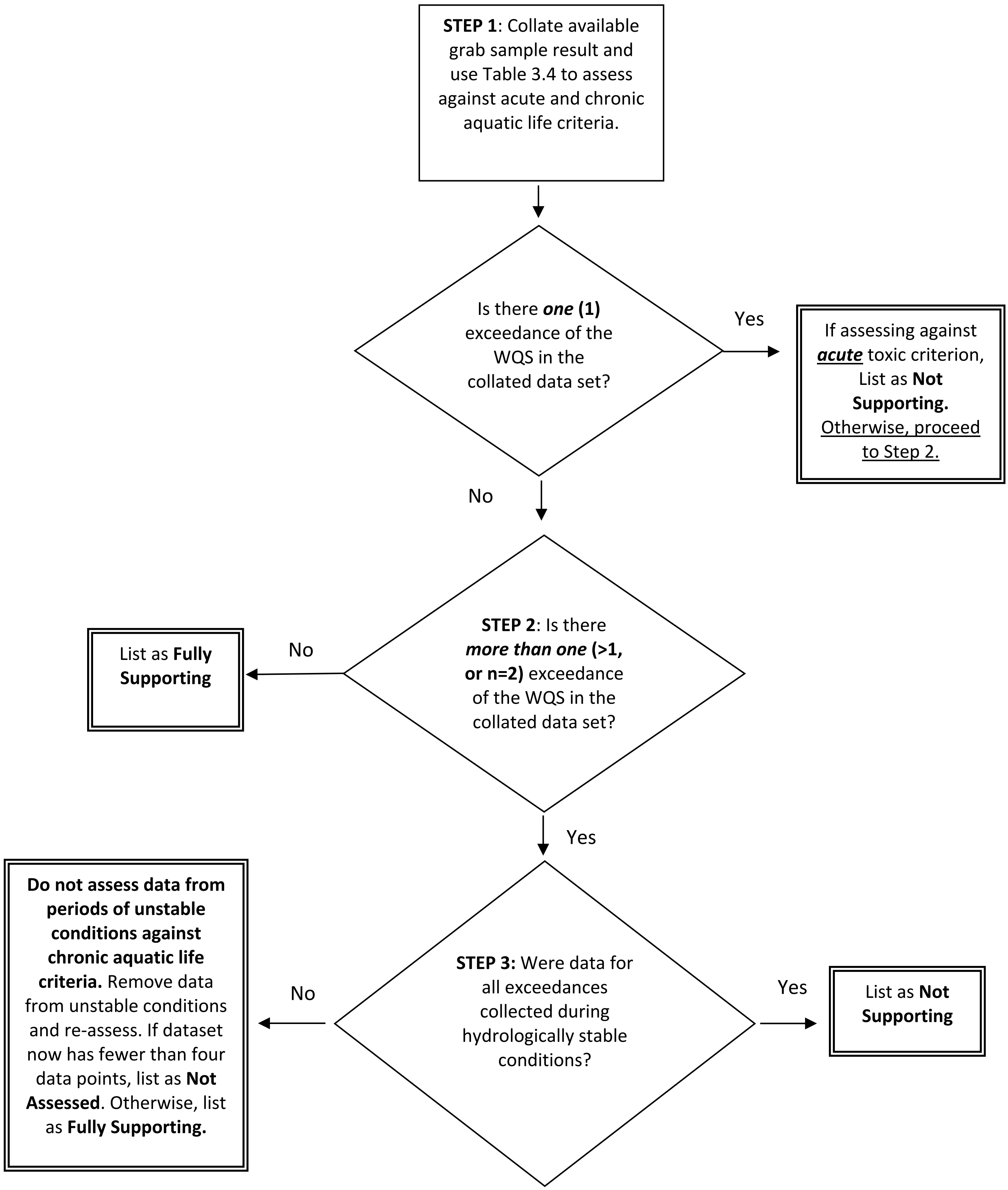

Figure 3.2 Decision tree for assessing acute and chronic aquatic life criteria attainment*

* Does not apply to delisting decisions. See Table 3.4.

Determining the representativeness of a sample is a qualitative assessment and is addressed primarily through the sample design, the selection of sampling sites, and the use of procedures that reflect the project goals and environment being sampled (NMED/SWQB 2024). These procedures ensure that a given sample represents a characteristic of a population, in this case the water in each AU at the time of sampling. The assessment of chronic aquatic life criteria adds an additional constraint that the sample(s) must be representative of conditions during a 4-day period. As such, these samples must be collected during periods when the water is well mixed and reasonably expected to represent conditions during the averaging period. Specifically, as stated in 20.6.4.14(C)(3) NMAC, lakes or reservoirs will be assessed for attainment of criteria for toxic pollutants using data collected either during periods of complete vertical mixing or by using depth-integrated samples during periods of stratification. With respect to stream or river chronic aquatic life assessments, grab samples are deemed representative for this application when there is an absence of contextual information indicating unstable hydrologic conditions. Examples of contextual information to be considered include but are not limited to: 1) stream flow measurements, gauge data, or flow ratings, 2) precipitation, 3) location of point source discharges in relationship to the monitoring site, and 4) the occurrence of a chemical spill or other unusual event (EPA 2005).

Specifically, if there are two or more exceedances of applicable chronic aquatic life criteria, SWQB will consider the following information to determine whether conditions were stable at the time of data collection:

- Point source discharge records in the reach or immediately upstream (if one or more point source discharges provide a significant contribution to the receiving water)
- Field notes and weather records regarding precipitation and runoff
- Flow measurements taken at the time of sampling
- Flow condition rating recorded at the time of sampling
- Gauge station records (when available)
- Land uses in the vicinity
- Records of chemical spills or other unusual events
- Historic patterns of pollutant concentrations, when available

If readily available contextual information indicates that the pollutant concentration and the stream flow likely remained generally constant over a 4-day period surrounding the sampling event, SWQB will conclude that the result of the grab sample, or the average of multiple day sampling events, is valid for assessing chronic aquatic life criteria.

Conversely, these data will not be used for assessing attainment of chronic aquatic life criteria when contextual data indicate unstable conditions. Examples of unstable conditions may include, but are not limited to, samples being collected during:

- A precipitation event with runoff lasting shorter than four days
    - NOTE: If the data were collected during several days of high flow, the sample would be assumed representative of the 4-day average condition to assess chronic aquatic life uses. If continuous gauge data are available, the procedure in the below paragraph would be performed vs. making assumptions about the longevity of the storm event
- The first flush of a precipitation event
- A short-lived but high flow monsoon event

One way to determine stable conditions is to examine the coefficient of variation (CV). When exceedances occur at or near a continuous flow gaging station and mean daily flow data are available, a stream may be considered hydrologically stable if the CV of the mean daily flow for a 4-day period surrounding the sampling collection is at or below 0.2. The CV is determined by dividing the standard deviation of the values by the mean of the values. This is a common statistical method to evaluate variability in datasets relative to the mean, and 0.2 is a common threshold below which data are considered to have minimal variability (ADEQ 2008).

The 4-day window that produces the lowest CV should be determined instead of always using a predetermined number of days before or after the sampling event. A floating 4-day window provides assurance that the sample was collected during a hydrologically stable 4-day period. See Table 3.5 below for an example using available gauge data for a grab sample collected on 8/2/07. In this example, the CV of the mean daily flows from 7/30/07 to 8/2/07 produced the lowest CV and is below 0.2, so this 4-day period surrounding the sampling event is determined to be stable. The hydrologic stability inference is about the entire 4-day period vs. just the sampling event. Utilizing the mean daily flow from 7/31/07 to 8/3/07 produces a CV of 0.22.

Table 3.5 Example of stable flow determination using gauge data

Date	Mean Daily Flow (cfs)	Mean [a]	Standard Deviation (SD) *	CV (SD / Mean) [a]
7/30/07	6.0	**7.7**	**1.3**	**0.17**
7/31/07	7.5			
8/1/07	9.2			
8/2/07	**8.1**			
8/3/07	12.0			
8/4/07	11.3			

NOTES: [a] for mean daily flow data collected 7/30/07 – 8/2/07

If one or more point source discharges provide a significant contribution to the receiving water, the facility discharge record(s) should be reviewed to determine whether flow and associated pollutant discharges were relatively consistent during the 4-day period when the exceedance occurred. Other evidence concerning unstable flow or pollutant discharges may be provided by the facility.

3.1.2.3 Assessing human health criteria

“Human health” is not defined as a designated use according to the current version of 20.6.4 NMAC. Instead, human health criteria apply to all waters with a designated, existing or attainable aquatic life use. Human health criteria for persistent toxic pollutants as identified in 20.6.4.900(J) NMAC also apply to all tributaries of waters with a designated, existing, or attainable aquatic life use (20.6.4.11(G) NMAC). Refer to 20.6.4.900(J) NMAC for the numeric criteria related to human health. Human health criteria proposed by the EPA are presumed to have exposure durations of a year or more (EPA 2005) and were generally established to protect for exposure over the period of a human lifetime, so a percentage-based assessment approach is appropriate when the sample size is greater than 10 samples. Table 3.6 explains how to interpret chemical/physical data to determine if these criteria are met.

Table 3.6 Interpreting chemical/physical data to assess human health criteria

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•Toxic substance (e.g., cyanide, PAHs, pesticides, VOCs and SVOCs, PCBs, metals)	For any one pollutant:	For any one pollutant:	For any one pollutant:	
A) 4 to 10 samples*	**A)** No more than one (≤1) exceedance of the criterion.	**A)** More than one (>1) exceedance of the criterion.	**A**) No (<1) exceedance of the criterion.	
B) >10 samples	**B**) Criterion exceeded in <10% of measurements.	**B**) Criterion exceeded in ≥ 10% of measurements.	**B**) Criterion exceeded in <10% of measurements.	

NOTES: * Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details.

3.1.3 Toxicological data

Table 3.7 explains how to interpret toxicological data to assess aquatic life use support with respect to the narrative general standard found at 20.6.4.13(F)(1) NMAC, which states "surface waters of the state shall be free of toxic pollutants from other than natural causes in amounts, duration, concentrations, or combinations which affect the propagation of fish…" Results from ambient toxicity testing are a valuable indicator for assessing and protecting against impacts on water quality and designated uses caused by the aggregate toxic effect of pollutants. Contaminants may flow directly from industrial and municipal waste dischargers, may come from polluted runoff in urban and agricultural areas, or may collect in the sediments. Toxicity evaluations can be used to assess the type and extent of degraded water quality (EPA 2002a). Acute toxicities of substances are determined using at least two species, one vertebrate and one invertebrate, tested in whole effluent and/or ambient stream water as well as a series of dilutions. The reason for two distinctly different species is to account for the diverse species that inhabit waterbodies. In general, fish and other vertebrates are sensitive to many compounds such as those similar to their waste material, namely ammonia or ammonium complexes. Although ammonia is toxic to invertebrates, not all invertebrates are as sensitive as fish. Conversely, invertebrates are generally more sensitive to pesticides than fish. Toxicological data for New Mexico can be downloaded from: https://www.epa.gov/regionallabs/epa-region-6-laboratory-biomonitoring-lab.

While ambient toxicity testing results are a valuable indicator, they are only the first step towards identification of a water quality concern. These listings were noted as Category 5C on previous listing cycles (see Section 4.0) because the pollutant(s) leading to the toxicity must be identified in order to take the next steps, such as development of TMDL documents to develop a plan to address the problem. In past surveys, SWQB collected water and sediment samples that were subjected to the EPA toxicity tests during the survey year for a particular watershed, while concurrently sampling surface waters for a variety of chemical constituents. SWQB has found that when there is nothing in the chemical data to indicate the source of toxicity, a false positive result from the toxicity test must be considered. There are also instances where toxicity tests fail in receiving waters due to a known issue with an upstream discharger. Once the permittee corrects the issue/malfunction, repeat toxicity testing is necessary to determine whether the impairment still exists. For these reasons, benthic macroinvertebrate data indicating nonsupport using the factors in Table 3.3 must also be available to determine impairment.

Table 3.7 Interpreting toxicological data to assess Aquatic Life Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Acute and/or chronic toxicity testing**	Significant effect noted in no more than one (≤1) acute water test as compared to controls or reference conditions, and in no more than one (≤1) chronic water test in three years as compared to controls or reference conditions.	Significant effect noted in more than one (>1) acute water test as compared to controls or reference conditions, or in more than one (>1) chronic water test in three years as compared to controls or reference conditions, and available benthic macroinvertebrate data indicate nonsupport per Table 3.3.	Significant effect refers to a statistically significant difference in a primary endpoint as defined in the latest EPA procedures documents for acute and chronic toxicity testing in water (EPA 2002b, 2002c). Reference controls will be used to compensate for possible toxic effects from naturally occurring conditions (i.e., high salinity). If toxicity testing results are from multiple years, the most recent results will be used to make the final impairment determination for the reasons stated in Section 3.1.3.

For lakes and reservoirs, impairment may be demonstrated where acute conditions (typically low DO levels) result in significant fish kills. Fish kills associated with accidental spills or isolated unauthorized discharges of toxics, or due to runoff after catastrophic wildfire, will not typically be considered a basis for CWA §303(d) listings because other regulatory or restorative mechanisms are typically utilized.

3.1.4 Listing Methodology for Fish Consumption Advisories

The EPA considers fish or shellfish consumption advisories with supporting fish tissue data to be existing and readily available data that demonstrate non-attainment of CWA goals stating that waters should be "fishable" (CWA Section 101(a)(2), EPA 2000, EPA 2005). The EPA also acknowledges that in some cases, fish and shellfish consumption advisories may not demonstrate that a section 101(a)(2) "fishable" use is not being attained in an individual segment when, for example, a state uses a higher fish consumption value in determining the need for an advisory compared to the value used in establishing water quality criteria for the protection of human health (EPA 2000, EPA 2005). Therefore, all waterbodies for which an advisory has been issued are listed as impaired for each fish tissue contaminant for which there is an advisory except in cases where there is a consumption advisory due to mercury, but fish tissue data indicate the methylmercury criterion of 0.3 mg/kg in fish tissue is not exceeded. SWQB's current protocol for developing fish consumption advisories require that contaminant concentrations that fall within the EPA guidance of 4 meals[11] per month or fewer (≤ 4) be included in the fish consumption advisory, however if the recommendation is for greater than 4 meals per month, no advisory is issued. Additionally, the fish consumption advisory will list all contaminants that are found at levels high enough to warrant an advisory (i.e., ≤ 4 meals/month) instead of any one contaminant that results in the most stringent advisory. For example, if there is a recommended number of meals per month ≤ 4 for both mercury and DDT, the advisory will list both contaminants as the parameter of concern using the most stringent number of meals per month out of the two parameters as the guidance. Therefore, each waterbody with an advisory will also be listed as impaired for each fish tissue contaminant for which there is an advisory.

Newer data indicating there is no advisory, or removal of an advisory will be required to delist a waterbody for fish tissue contaminants (except in cases where there is a consumption advisory due to mercury but the methylmercury criterion of 0.3 mg/kg in fish tissue is not exceeded, in which case delisting is possible). Table 3.8 shows the listing methodology for fish consumption advisories. In acknowledgement of the need for data to support a listing, fish tissue impairment listings will only be applied to the AU where fish tissue data are available and for which there are current advisories. Especially for stream/river AUs, the advisory may include different (oftentimes smaller) geographic extents. This information will be noted in the Assessment Rationale, if available.

Many of New Mexico's current fish consumption advisories are based on mercury levels in fish (NMED et al. 2025); however, there are also listings for PCBs, DDT, or some combination thereof, in fish tissues. The current fish consumption advisory, as well as additional information on how New Mexico develops these advisories, can be found at: https://www.env.nm.gov/surface-water-quality/fish-consumption-advisories/. Fish tissue advisories for other parameters of concern may be forthcoming. The Integrated List will be updated whenever the advisory is revised.

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[11] Defined as a pre-cooked weight of 8 ounces of fish.

Table 3.8 Listing Methodology for Fish Consumption Advisories

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•Advisory for contaminants of concern (e.g., Hg, PCBs, or DDT ≤ 4 meals/month)		For any one contaminant, an advisory recommendation of ≤ 4 meals per month.		If advisory exists, list as impaired except in cases where consumption advisory is due to mercury, but fish tissue data indicate the methylmercury criterion of 0.3 mg/kg in fish tissue is not exceeded.
•No advisory	For any one contaminant, “no advisory.”		For any one contaminant, removal of an advisory resulting in “no advisory.”	When delisting, if an advisory remains in place for at least one contaminant, an impairment listing will remain for that contaminant.

3.1.5 Special considerations for lake data

Lentic waterbodies in New Mexico have historically been studied using the methods and approaches specified in the *Clean Lakes Program Guidance Manual* (EPA 1987), and more recently utilizing the *National Lakes Assessment* methods (EPA 2024). For purposes of this document, the term “lake” shall include natural lakes as well as reservoirs, impoundments, and any other human-made lentic waterbodies.

Lake water quality surveys usually contain a station in the deepest portion and/or midpoint of the lake (termed the “Index Site”) (see SWQB SOP 12.1). During periods of lake stratification, 20.6.4 NMAC requires depth-integrated composite samples for assessment of toxic pollutants (e.g., organic compounds, ammonia, metals, cyanide, radionuclides, etc.). Water quality measurements taken at intervals are averaged for the epilimnion, or in the absence of an epilimnion, for the upper one-third of the water column of the lake to determine attainment of criteria, per 20.6.4.14(C)(3) NMAC. In cases where multiple stations per lake are sampled, the applicable listing methodology shall be applied to the Index Site for toxic pollutants, however other designated uses (e.g. primary contact) may be assessed at the most appropriate station for that particular use.

3.1.6 Conflicting or duplicative aquatic use support determinations

For aquatic life use assessments, it is possible that data of differing types may lead to differing use attainment determinations for the same assessment unit. For example, there may be chemical/physical data that indicate **Not Supporting** and biological data that indicate **Fully Supporting**. If two or more data types are available for assessment, a weight-of-evidence approach is adopted when conventional parameter data (for example, non-toxic substances such as temperature, pH, or specific conductance), or habitat parameters such as sedimentation/siltation, indicate impairment. This approach considers data type, quality, quantity, and confidence of assessment methods in reaching a final aquatic life use determination. Data types with higher data quality are given more weight (see Appendix A for data quality descriptions). Typically, data quality of level 3 or 4 are used to make listing determinations. Chemical/physical data with quality level 2 may be used to list as impaired under IR Category 5c (e.g., needs more data to confirm). Chemical/physical data of quality 1, and biological or physical data of quality 1 or 2, will not be used to make designated use attainment decisions. Figure 3.3 displays a generalized flowchart for considering different data types and their quality when determining aquatic life use support. Biological assessments provide an integrated assessment of ecological health and have the potential to provide a direct measure of the designated goal of providing for the protection and propagation of aquatic life uses, especially when evidence of impairment due to non-toxic chemical/physical parameters is weak or based on low data quality. In the case of toxic substance chemical data (e.g., priority pollutants, ammonia, chlorine, metals, cyanide), the weight-of-evidence approach is not applied.

In addition, if exceedances of one or more causal variables (such as nutrients, temperature, or turbidity) as well as related response variables (such as DO, pH, or benthic macroinvertebrates) are identified, the AU will be listed for the causal variable(s). For example, if an AU is determined to be impaired due to excessive nutrients following the procedures in Appendix C for rivers/streams or Appendix D for lakes/reservoirs, the AU will be listed for nutrients vs. the individual response variables. However, if only the response variable with established water quality criteria has been identified as impaired, the AU will be listed for that particular variable.

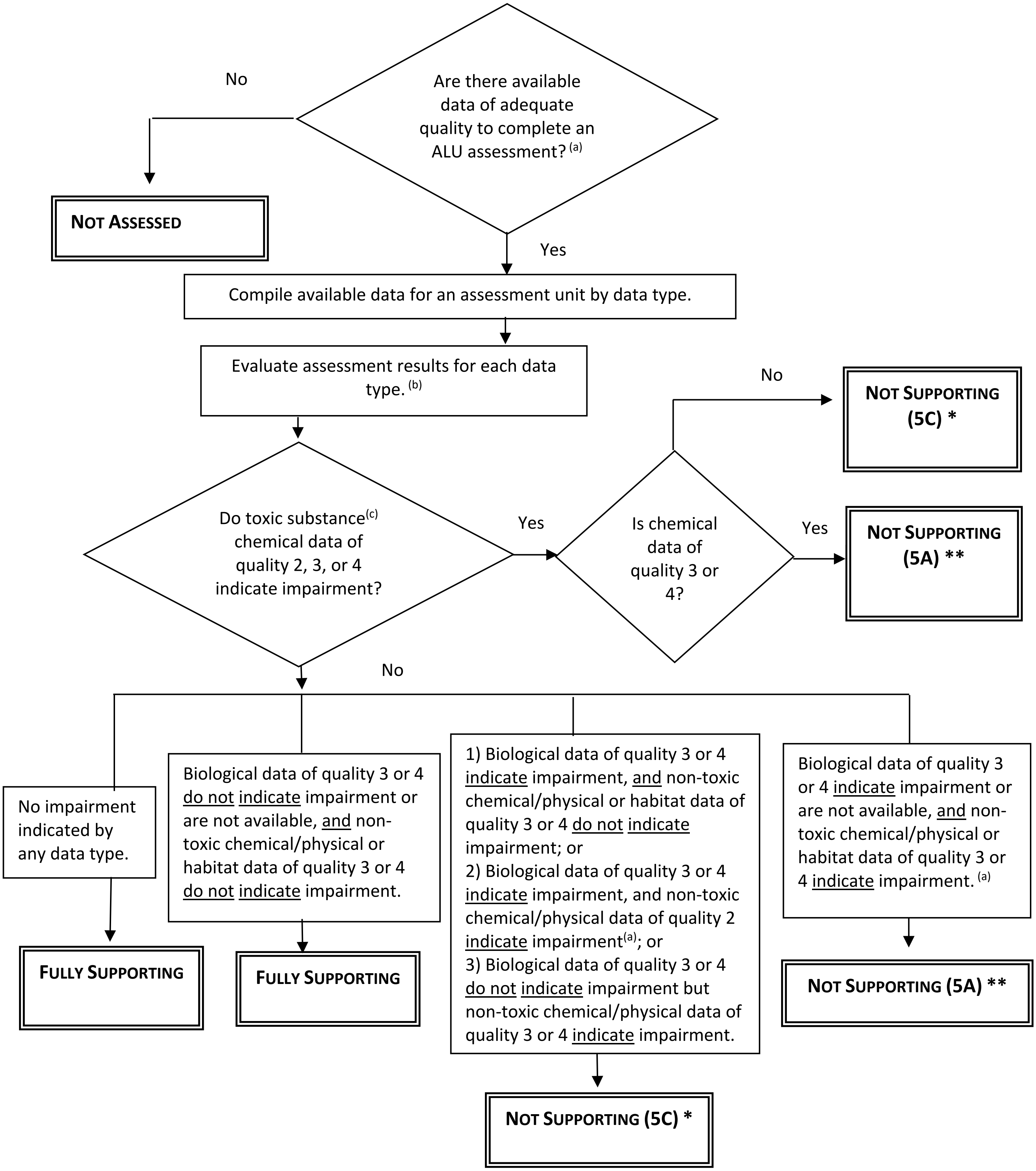

Figure 3.3 Generalized flowchart for determining Aquatic Life Use Support ^

NOTES: ^ Does not apply to delisting decisions. * Additional data are needed to determine the specific pollutant or "pollution" of concern. If a form of "pollution" (for example, flow alteration by EPA's definition) and no concurrent pollutant(s) are determined to be the reason for the biological impairment, IR Category 4c may be assigned. Otherwise, the AU is assigned IR Category 5c (more data needed). See Section 4.0 and Appendix J for more detail.

** TMDL or TMDL alternative ready to be scheduled for the cause(s) of impairment. See Section 4.0.
(a) Data quality determined per Appendix A. Chemical/physical data of quality 1, and biological or habitat data of quality 1 or 2, will not be used to make designated use attainment decisions. Data collected via SWQB SOPs are generally between data quality 3 and 4.
(b) Per Tables 3.3 through 3.6, and referenced associated appendices.
(c) Toxic substances include parameters such as priority pollutants, ammonia, chlorine, metals, cyanide (Table 3.4).

3.2 Assessing Domestic Water Supply Use Support

Table 3.9 explains how to interpret chemical/physical data to assess domestic water supply use support. Refer to 20.6.4.900(B) and (J) NMAC for numeric domestic water supply criteria.

Table 3.9 Interpreting chemical/physical data to assess Domestic Water Supply Use Support

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•Toxic substance (e.g., radionuclides[(a)], priority pollutants, metals, cyanide) ≥ 4 samples*	For any one pollutant: • No more than (≤1) one exceedance of the criterion.	For any one pollutant: • More than one (>1) exceedance of the criterion.	For any one pollutant: • No (<1) exceedance of the criterion.	
•Nitrate ≥ 4 samples*	• No more than (≤1) one exceedance of the criterion.	• More than one (>1) exceedance of the criterion.	• No (<1) exceedance of the criterion.	

NOTES: *Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details.

(a) When radionuclides are analyzed using SM7110 B or EPA Method 900.0 (recommended, and equivalent to SM7110 B according to SLD), gross alpha results generated using a natural uranium or thorium-230 reference standard and gross beta results generated using a Sr/Y-90 reference standard, are preferred for purposes of assessing WQS attainment because these are recommended in the method description. Plutonium-239 and americium-241 also are widely used and acceptable as reference standards for gross alpha. If the reference type information is not available and multiple reported values are provided, the highest reported value available will be used for assessment. Also, the water quality criterion in 20.6.4.900(J) NMAC is for "adjusted gross alpha", as defined at 20.6.4.7(A)(6) NMAC. Therefore, gross alpha data should be adjusted by subtracting contributions from natural uranium, as well as any measured special nuclear and by-product material, as set out in 20.6.4.7(A)(6) NMAC, prior to assessment. To convert uranium concentrations reported in µg/L to picocuries per micrograms ("pCi/µg") prior to subtraction, use a conversion factor of 0.67. In the absence of uranium data to subtract in order to adjust gross alpha, U-238 data can be used because this is the most common form of uranium in the natural environment. If negative values are reported for special nuclear materials, zero will be substituted as the subtraction value used to adjust gross alpha.

3.3 Assessing Primary and Secondary Contact Use Support

Table 3.10 explains how to interpret bacteriological, pH and cyanotoxins (microcystin and cylindrospermopsin) data to assess recreational contact use support. Refer to Subsection B under the appropriate WQS segment number (20.6.4.97 through 20.6.4.899 NMAC) and 20.6.4.900(D) and (E) NMAC for numeric primary and secondary contact use criteria, respectively. For primary contact use under 20.6.4.900(D) NMAC, *E. coli*, microcystin, cylindrospermopsin and pH apply; for secondary contact use under 20.6.4.900(E) NMAC, only *E. coli* numeric criteria apply.

Microcystin and cylindrospermopsin data can be used to assess recreational contact use in lakes and reservoirs, where conditions may be conducive to public health concerns. The SWQB predominantly lists for primary contact using *E. coli* data.

Table 3.10 Interpreting bacteriological, pH and cyanotoxin data to assess Primary and/or Secondary Contact Use Support

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•Bacteria **A)** 4 to 10 samples^ **B**) > 10 samples	**A**) No more than one (≤1) exceedance of the single sample criterion. **B**) Single sample criterion exceeded in <10% of samples or geometric mean criterion is met.	**A**) More than one (>1) exceedance of the single sample criterion. **B**) Single sample criterion exceeded in ≥ 10% of measurements or geometric mean criterion is not met.	**A**) No (<1) exceedance of the single sample criterion. **B**) Single sample criterion exceeded in <10% of samples or geometric mean criterion is met.	The monthly geometric mean shall be used in assessing attainment of criteria when a minimum of five samples is collected in a 30-day period (20.6.4.14(B) NMAC).
•pH* **A)** 4 to 10 samples^ **B**) > 10 samples	**A**) No more than one (≤1) exceedance of the criterion. **B**) Criterion exceeded in <10% of samples.	**A**) More than one (>1) exceedance of the criterion. **B**) Criterion exceeded in ≥ 10% of measurements.	**A**) No (<1) exceedance of the criterion. **B**) Criterion exceeded in <10% of samples.	*pH only applies when assessing primary contact use attainment.
Microcystins or Cylindrospermopsin* > 3 samples	No more than three (≤ 3) exceedances of the single-sample total microcystins criterion (8 µg/L) or single-sample cylindrospermopsin criterion (15 µg/L) within a 12-month period.	More than three (>3) exceedances of the single-sample total microcystins criterion (8 µg/L) or single-sample cylindrospermopsin criterion (15 µg/L) within a 12-month period.	No exceedance (<1) of the single-sample criterion within a 12-month period.	*Microcystins or Cylindrospermopsin only apply when assessing primary contact use attainment.

NOTES: ^Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details. Also, SWQB bacteria results that are marked "Ea" due to incubation temperatures between 35.5 and 38°C may only be used to support assessment conclusions (i.e., no new listing or delisting may occur because of the data itself – the data may only used as supporting information).

3.4 Assessing Irrigation and Irrigation Storage Use Support

Table 3.11 explains how to interpret chemical/physical data to assess irrigation use support. Refer to 20.6.4.900(C) and (J) NMAC for numeric criteria for irrigation use.

Table 3.11 Interpreting chemical/physical to assess Irrigation Use Support

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•**Toxic substance** (e.g., metals) ≥ 4 samples	For any one pollutant: • no more than one (≤ 1) exceedance of the criterion.	For any one pollutant: • more than one (>1) exceedance of the criterion.	For any one pollutant: • no (<1) exceedance of the criterion.	
•**Salinity parameters** (e.g., total dissolved solids, sulfate, chloride) **A)** 4 to 10 samples **B**) > 10 samples	For any one pollutant: **A**) No more than one (≤ 1) exceedance of the criterion. **B**) Criterion exceeded in <10% of measurements.	For any one pollutant: **A**) More than one (>1) exceedance of the criterion. **B**) Criterion exceeded in ≥ 10% of measurements.	For any one pollutant: **A**) No (<1) exceedance of the criterion. **B**) Criterion exceeded in <10% of measurements.	Salinity parameters are segment-specific criteria included in a few individual WQS segments based on flow qualifiers.

NOTES: * Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details.

3.5 Assessing Wildlife Habitat Use Support

Table 3.12 explains how to interpret chemical/physical data to assess wildlife habitat use support. Refer to 20.6.4.900(G) NMAC for narrative criteria and 20.6.4.900(J) NMAC for numeric criteria for wildlife habitat use.

Table 3.12 Interpreting chemical/physical data to assess Wildlife Habitat Use Support

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•**Toxic substance** (e.g., PCBs, DDT, cyanide, chlorine, metals) ≥ 4 samples	For any one pollutant: • no more than one (≤ 1) exceedance of the criterion.	For any one pollutant: • more than one (>1) exceedance of the criterion.	For any one pollutant: • no (<1) exceedance of the criterion.	

NOTES: * Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details.

3.6 Assessing Livestock Watering Use Support

Table 3.13 explains how to interpret chemical/physical data to assess livestock watering use support. Refer to 20.6.4.900(F) and (J) NMAC for the numeric criteria for livestock watering use.

Table 3.13 Interpreting chemical/physical data to assess Livestock Watering Use Support

TYPE OF DATA*	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•**Conventional parameters** (e.g., nitrite + nitrate)	For any one pollutant:	For any one pollutant:	For any one pollutant:	
A) 4 to 10 samples	**A**) No more than one (≤ 1) exceedance of the criterion.	**A**) More than one (>1) exceedance of the criterion.	**A**) No (<1) exceedance of the criterion.	
B) > 10 samples	**B**) Criterion exceeded in <10% of measurements.	**B**) Criterion exceeded in ≥ 10% of measurements.	**B**) Criterion exceeded in <10% of measurements.	
•**Toxic substance** (e.g., radionuclides[a], priority pollutants, metals) ≥ 4 samples	For any one pollutant: • No more than one (≤ 1) exceedance of the criterion.	For any one pollutant: • More than one (>1) exceedance of the criterion.	For any one pollutant: • No (<1) exceedance of the criterion.	

NOTES: *Fewer than 4 samples = not assessed for full support attainment. See Section 2.1.4 for details.

(a) When radionuclides are analyzed using SM7110 B or EPA Method 900.0 (recommended, and equivalent to SM7110 B according to SLD), gross alpha results generated using a natural uranium or thorium-230 reference standard and gross beta results generated using a Sr/Y-90 reference standard, are preferred for purposes of assessing WQS attainment because these are recommended in the method description. Plutonium-239 and americium-241 also are widely used and acceptable as reference standards for gross alpha. If the reference type information is not available and multiple reported values are provided, the highest reported value available will be used for assessment. Also, the water quality criterion in 20.6.4.900 (J) NMAC is for "adjusted gross alpha", as defined at 20.6.4.7(A)(6) NMAC. Therefore, gross alpha data should be adjusted by subtracting contributions from natural uranium, as well as any measured special nuclear and by-product material, as set out in 20.6.4.7(A)(6) NMAC, prior to assessment. To convert uranium concentrations reported in µg/L to pCi/µg prior to subtraction, use a conversion factor of 0.67. In the absence of uranium data to subtract in order to adjust gross alpha, U-238 data can be used because this is the most common form of uranium in the natural environment. If negative values are reported for special nuclear materials, zero will be substituted as the subtraction value used to adjust gross alpha.

3.7 Assessing Fish Culture, and Public or Industrial Water Supply Uses

For applicable AUs, all Fish Culture, Public Water Supply, and Industrial Water Supply designated uses have been assigned "Not Assessed" because no numeric criteria apply uniquely to these uses (see 20.6.4.900(A) NMAC). The Rio Grande from Cochiti Pueblo boundary upstream to Rio Pueblo de Taos (20.6.4.114 NMAC) includes public water supply radionuclide concern levels for monitoring and disclosure only. Available data will be compared to these disclosure values and noted in the AU Comments on the Integrated List.

3.8 Assessing Numeric Criteria Under Multiple Use Designations

40 C.F.R. § 131.11(a)(1) addresses instances where there are different water quality criteria for a particular parameter for two or more uses applicable to an AU. In these cases, the criteria used to make the final impairment decision for the AU should support the most sensitive use. In New Mexico, 20.6.4.11(F) NMAC equally states:

> ***Multiple Uses****: When a surface water of the state has more than a single designated use, the applicable <u>numeric</u> criteria shall be the most stringent of those established for such water.* (Emphasis added).

For example, surface waters with both wildlife habitat and livestock watering designated uses are assessed against the lower 0.77 µg/L wildlife habitat total mercury criterion instead of only the 10 µg/L livestock watering criterion to make a total mercury impairment determination.

4.0 ASSESSMENT UNIT CATEGORY DETERMINATIONS FOR INTEGRATED LIST

The determination of individual use support using Section 3.0 and other specified protocols are combined to determine the overall WQS attainment category for each AU (EPA 2001, Figure 4.1).

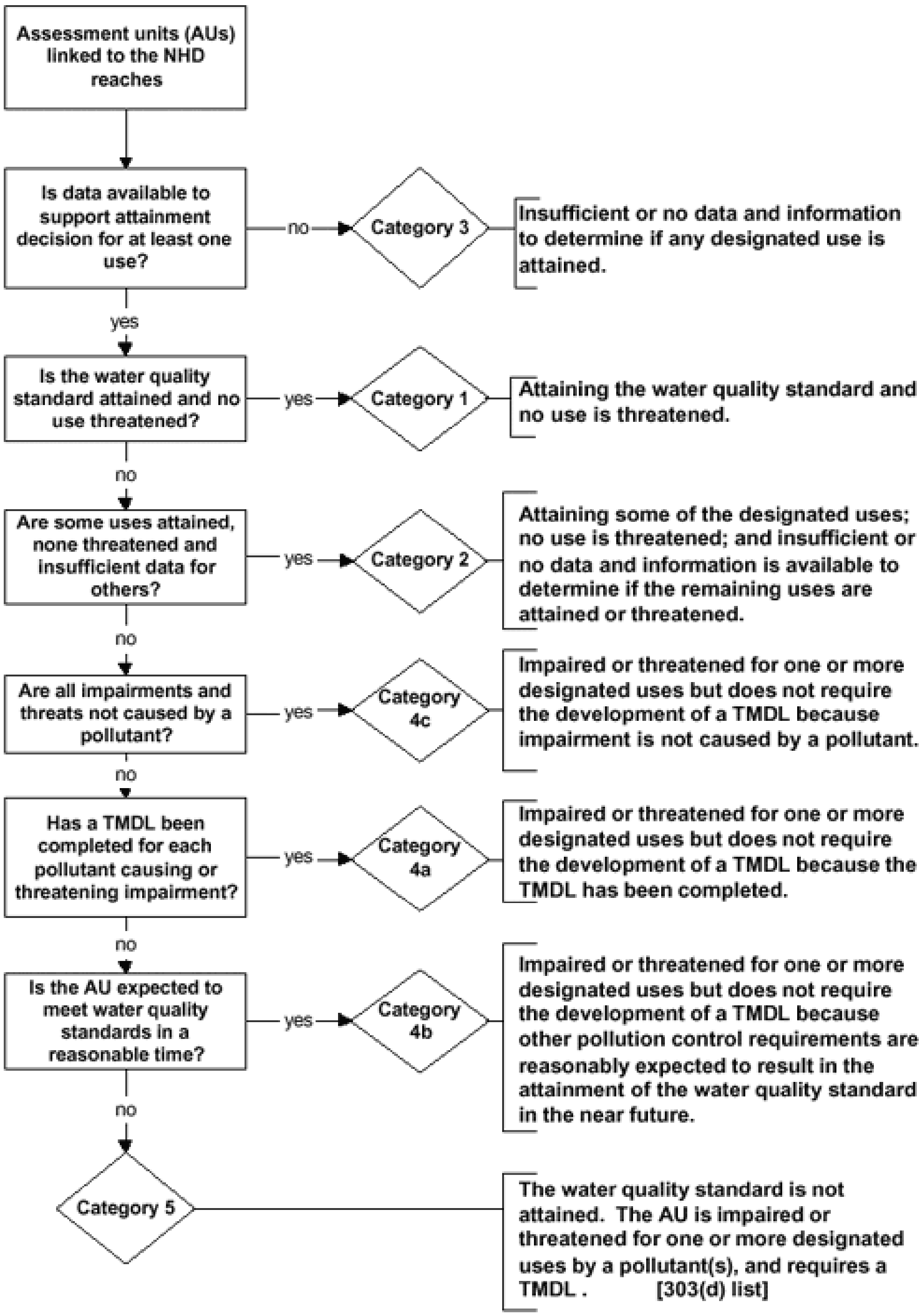

Figure 4.1. Attainment category logic (EPA 2001).

Several states, including New Mexico, further divide the EPA's recommended integrated reporting categories. New Mexico's specific reporting category interpretations are described below.

1. **Attaining the WQS for all designated and existing uses.** AUs are listed in this category if there are data and information that meet all requirements of the assessment and listing methodology, and those data support a water quality criteria attainment determination based on the numeric and narrative water quality criteria that were tested.

2. Attaining some of the designated or existing uses based on numeric and narrative parameters that were tested, and no reliable monitored data are available to determine if the remaining uses are attained or threatened. AUs are listed in this category if there are data and information that meet requirements of the assessment and listing methodology to support a determination that some, but not all, uses are attained based on the numeric and narrative water quality criteria that were tested. Attainment status of the remaining uses is unknown because there is no reliable monitored data with which to make a determination.

2A. **Attaining with prior action still in place**. Parameters are assigned to this category when the current data and listing methodology indicate the waterbody is no longer impaired for this parameter, and a previously-developed action (e.g., Approved TMDL, Advance Restoration Plan, etc.) exists.

3. **Insufficient or no reliable data and/or information to determine if any designated or existing use is attained.** AUs are listed in this category where sufficient data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology. In order to relay additional information to stakeholders including SWQB staff, Category 3 is further broken down in New Mexico into the following categories:

3A. **No data (n = 0) available**. AUs are listed in this subcategory when there are no available data to assess. These are considered high priority for follow up monitoring.

3B. **Limited data (n = 1 to 3) available, no exceedances**. AUs are listed in this subcategory when there are no exceedances of any applicable criteria in the limited data set. Their priority for follow up monitoring depends on the parameter and concentration (for example, measurements near the criteria would increase the priority for additional sampling).

3C. **Limited data (n = 1 to 3) available, exceedance(s)**. AUs are listed in this subcategory when there are exceedances of one or more applicable criteria in the limited data set. These are considered high priority for follow up monitoring.

4. **Impaired for one or more designated uses, but does not require development of a TMDL because:**

4A. **TMDL has been completed and approved.** AUs are listed in this subcategory once all TMDL(s) have been developed and approved by the WQCC and the 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 an AU, the AU remains in Category 5 (see below) until all TMDLs for each pollutant have been completed and approved by the WQCC and the EPA.

4B. **Other pollution control requirements are reasonably expected to result in attainment of**

the water quality standard in the near future. Consistent with 40 C.F.R. § 130.7(b)(1)(i),(ii), and (iii), , AUs are listed in this subcategory where other pollution control measures required by local, state, or federal authority are stringent enough to implement any WQS applicable to such waters. Details regarding the specific documentation and timeline needed to propose a Category 4b listing can be found in Appendix I.

4C. Impairment is not caused by a pollutant. AUs are listed in this subcategory if available data and information demonstrate that the use impairment is not associated with one or more pollutants, and is attributable only to other types of "pollution" (e.g., flow or habitat alteration). For example, if the narrative biological water quality criterion found at 20.6.4.13(M) NMAC is demonstrated to not be met due to pollution and no concurrent pollutant(s) are identified, the AU may be assigned Category 4c. Details regarding the specific protocol for assigning IR Category 4c can be found in Appendix J.

5. **Impaired for one or more designated or existing uses**. The AU is not supporting one or more of its designated uses because one or more WQS are not attained according to current WQS and assessment methodologies. **This category constitutes the *CWA §303(d) List of Impaired Waters*.** In order to relay additional information to stakeholders including SWQB staff, Category 5 is further broken down in New Mexico into the following categories:

5A. A TMDL is underway or scheduled. AUs are listed in this category if the AU is impaired for one or more designated uses by a pollutant. Where more than one pollutant is associated with the impairment of a single AU, the AU remains in Category 5A until TMDLs for all pollutants have been completed and approved by the EPA.

5B. A review of the water quality standard will be scheduled. AUs are listed in this category when it is likely that WQS are not being met because one or more current designated uses are not existing or attainable, or if available data indicate background processes are causing criteria exceedances. AUs in this category usually also have additional data needs.

5C. Additional data will be collected before a TMDL is scheduled. AUs are listed in this category if there is not enough data and information to determine the specific pollutant of concern (for example, AUs with biological impairment but inadequate data to determine the cause of this response, n<4, etc.), complete a weight-of-evidence assessment, or determine if the impairment falls under the exemption in 20.6.4.11(I) NMAC.

5-R. Restoration approach is in progress or under development. EPA created this optional subcategory as an organizing tool to clearly articulate which impaired waterbodies have or will have alternative approaches to attain WQS (EPA 2015). The Advance Restoration Plan (ARP) approach needs to clearly demonstrate how the WQS will be achieved. The description of the advance restoration approach and the waters to which it applies will be included during public review of the draft Integrated Report, so that the public has an opportunity to view the proposed advance restoration approaches. Additional details on what must be included in the description are found in EPA's listing guidance (EPA 2015).

This reporting approach was developed in response to a National Research Council (NRC) report and a desire to provide a clearer summary of the nation's water quality status and management actions necessary to protect and restore them (NRC 2001, EPA 2001, WERF 2007). With a few additions and minor changes in terminology, the information requested in the *Integrated Listing* guidance (EPA 2001) and Consolidated Assessment and Listing Methodology guidance (EPA 2002a) were previously suggested in earlier section

305(b) reporting guidance (EPA 1997). The earlier guidance formed the basis of previous SWQB listing methodology.

Assessment information is housed in SWQB's in-house database, SQUID. This database was designed to implement suggestions in the *Integrated Listing* guidance (EPA 2006a, 2009, 2011, 2013b, 2015, 2017, 2021, and 2023, and 2025), and to provide a means to directly upload New Mexico's use attainment information to the EPA's ATTAINs database. SQUID is first populated with AU information, associated designated uses, comments, and any supporting documentation. Individual use attainment decisions (i.e., **Fully Supporting**, **Not Supporting**, or **Not Assessed**) are then assigned for each AU based on assessment of data following these listing methodologies. SQUID then automatically determines the integrated reporting category for each AU based on the information entered for each applicable use.

CWA § 303(d)(1) requires states to establish a priority ranking for AUs determined to be impaired, and to schedule TMDL development in accordance with the priority ranking(33 U.S.C. § 1313(d)(1)). New Mexico expresses this ranking, including indicating which waters bodies are targeted for TMDL development in the following years, in the form of an estimated TMDL completion year per the EPA's recommendation (EPA 2005). This information is housed in SQUID and reported under "TMDL Date" for all AU-pollutant pairs noted as **Not Supporting** on the Integrated List. If a TMDL has already been completed and approved, the EPA approval date is displayed.

5.0 PUBLIC PARTICIPATION

The listing methodologies are periodically revised based on new EPA guidance, changes to the WQS, and the need to clarify various assessment procedures for staff. When the protocols are significantly revised, a draft is first sent to the EPA for initial review and comment. If significant changes to the overall assessment procedures and/or format of the document are being proposed, SWQB also releases a public comment draft to solicit public review and comment. For example, a draft of this listing methodology opened for a 30-day public comment period from June 16 to July 16, 2025. Consequent revisions to the main listing methodology are noted in the revision history below. See individual appendices for revision histories related to those respective methodologies.

The final version of this protocol is provided to the EPA Region 6, who then considers the listing methodologies in its review and approval of Category 5 waters in the Integrated Report. The listing methodology is also posted on SWQB website: https://www.env.nm.gov/surface-water-quality/calm/.

REVISION HISTORY:

2014 listing cycle – Pre-public comment: Moved aquatic life use data quality tables from main document to attachment. Added description of SQUID (SWQB's merger of ADB and NMEDAS databases). Added link to new data submittal website. Added information regarding assessment of hardness-dependent metals criteria (specifically, clarified that samples from waters with turbidity greater than 30 NTU must be filtered with 10-µm disposable in-line capsule filters prior to analysis). Minor revision to wording in Figure 3.3 - Generalized flowchart for determining Aquatic Life Use Support. Added protocols for determining nutrient impairment in lakes/reservoirs, and for proposing IR Category 4b. **Post- public comment:** Several minor wording and flowchart clarifications. Revisions to Limited Dataset section and associated addition of Integrated Report subcategories 3A and 3B. Added description of reference site approach to Bioassessment section. Clarified when Category 5C would be assigned. Additional clarification to Figure 3.3, clarified relationship between Data Quality Levels (Attachment A) and aquatic life use attainment decisions when conflicting conclusions from various data types, and indicated SWQB's general data quality level.

2016 listing cycle – Pre-public comment: Moved List of Common Acronyms (previously Appendix A) to the beginning of Main AP. Moved Data Quality Levels (previously Attachment A) to Appendix A. Re-named all appendices. Added section regarding wildfire. Clarified assessing when multiple applicable numeric WQC for the same parameter. Added additional clarification to Integrated Report category descriptions. Removed reference to "unclassified" segments to match proposed triennial review clarification.

2018 listing cycle – Pre-public comment: Changed "Assessment Protocol" to "Listing Methodology" throughout. Clarified how to handle data reported below the MRL when data are part of an additive parameter, and when MRL is greater than the applicable WQC. Clarified when J flagged data would be used. Added additional information regarding non-representative data, and when data older than five years would be assessed. Clarified the relationship between temporary standards and the Integrated Report listing process. Added IR Category 5-alt, and expanded IR Category 3 to 3a, 3b, and 3c to better explain handling of n=1. Changed Tables 3.4 to 3.12 from "1 to 10" to "2 to 10" because n=2 is a minimum data requirement for assessment. Updated impairment determination logic in Table 3.8 for consistency with other assessment tables. **Post- public comment:** Clarified that this document was previously referred to as the "Assessment Protocol." Added the following footnote to Tables 3.4 – 3.12 to refer the reader to the appropriate section detailing the handling of limited datasets (n=1) with respect to assessment: "* Fewer than 2 samples = not assessed for attainment. See Section 2.1.4 for details." Clarified how SWQB will assess aluminum in waters with concurrent pH < 6.5 in Section 3.1.2.1. Based on this additional discussion, SWQB will also delist old dissolved aluminum listings for waters with concurrent pH >6.5 because the dissolved aluminum criterion is no longer applicable as stated in this revised section.

2020 listing cycle – Pre-Public Comment: Changed minimum number of assessable sampling results for assessment to 4; revised the assessment tables in Section 3, as well as IR Category 3B, 3C, and 5C accordingly. Added temporal independence language. Clarified the handling of temporary WQS. Added outlier identification to chronic ALU assessments. Clarified the handling of concurrent hardness and turbidity data for total recoverable aluminum exceedance determination. Removed intermediate "Not Assessed" confirmation requirement category for biological assessments. Clarified the "Ea" validation code for bacteria assessments. Clarified how adjusted gross alpha is determined in assessment table footnotes. **Post-Public Comment:** In Section 1.0, clarified that data will be re-assessed if the assessment methodology for a specific parameter has significantly changed, and clarified which data older than five years old will be considered for assessment purposes. In Section 2.1.2, clarified that data from distinct hydrologic events collected within a seven-day period are not considered duplicates. In Section 2.1.4, added additional discussion regarding setting the minimum number of data points needed to assess. In Section 2.1.5, added reference to the critical low flow calculations used to develop point source discharge requirements. In Section 2.1.6, clarified that available water quality and GIS data may be used to help determine AU breaks. In Section 2.1.8, added a discussion of the handling of surface water highly influenced by groundwater input with respect to assessment, as well as adding “extreme drought” to the list of catastrophic events. In the beginning of Section 3.0, clarified that the entire WQMP update in progress will have a separate public participation process, and that Appendices B through H contains information regarding the specific aquatic life uses and stream types covered in these respective appendices. The assessment step regarding the handling of consecutive-day sampling data in Table 3.4 and Section 3.1.2.2 was removed because it was confusing and these types of data sets have never been, and are not anticipated to be, available for assessment in New Mexico.

2022 listing cycle – Pre-Public Comment: Language about delisting methods added to Section 3 and associated tables. Clarifications were added regarding hydrologically stable periods, outlier calculation and treatment, clarification regarding the use of *E. coli* results exceeding the 8-hour holding time, and chronic assessment dataset timeframe. Added discussion section for the Sandy-Bottom River BCG Model. Added discussion and table on listing methodology for fish consumption advisories; re-numbered tables following addition of new Table 3.8. Where Data Quality Tables (Appendix A) are mentioned, minor modifications to language to clarify that data levels apply to all use support determinations, not just aquatic life uses. **Post-Public Comment:** Changed instances of the term “new data” to “newer data” because “newer” implies assessable data is not limited to the most recent two years of data (i.e., the most recent IR cycle) and is the most accurate term. Added clarification and reasoning for cases in which entire dataset is J flagged but still assessable. Added clarification regarding the intent of including section 3.1.1.4 in the CALM, an update on the current BCG model status, and reiteration that SWQB is not proposing to implement the model this assessment cycle. In section 3.3 “Assessing Primary and Secondary Contact Use Support” added a correction that for primary contact use under NMAC 20.6.4.900 (D), both *E. coli* and pH apply, and added table row for assessing pH primary contact use support. Revised header of Table 3.10 to reflect this change.

2024 listing cycle – Pre-Public Comment: Provided information on the updated EPA guidance containing human health and recreation use recommendations for microcystin and cylindrospermopsin exposure, addition of numeric criteria to the WQS during the 2020 triennial review (with subsequent 2023 EPA-approval), and their application to primary contact use assessments. Added these primary contact criteria to section 3.3, table 3.10. Added updated citations for and discussion of the Sandy-Bottom River BCG Model. Minor wording revisions and clarifications.
Post-Public Comment: No changes.

2026 listing cycle – Pre-Public Comment: Updated language concerning the statewide monitoring rotation and water quality monitoring strategy. Added language regarding the Pajarito Plateau site-specific copper criterion), and total ammonia nitrogen (TAN) criterion assessments. Updated Table 3.4 and Figure 3.2 to reflect toxic acute exceedance allowance. According to EPA's *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (1985), acute criteria represent concentrations above which short-term exposures are expected to cause significant mortality to aquatic life. These criteria are typically based on the Final Acute Value (FAV) derived from the most sensitive tested species. As such, exceedances, even of short duration, may result in acute toxicity and are considered violations of water quality standards. Acute criterion frequencies were revised to reflect that the magnitude should not be exceeded at any time. Updated lake sampling language. Minor wording revisions and clarifications.
Post-Public Comment:

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APPENDIX A

PUBLIC COMMENT DRAFT

DATA QUALITY TABLES

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document contains the criteria for rating the quality of data to determine whether data may be used for assessment of water quality to determine attainment of designated uses. Multiple data types are currently recognized and utilized. Tables 1 through 3 specify the criteria required to achieve specific data quality levels for the following data types: biological, chemical, bacteriological, logger, and habitat. The tables utilize three key elements: 1) technical components, 2) spatial/temporal coverage, and 3) data quality indicators to distinguish between data quality levels. The criteria specified under the technical component column for each table provides the required specifics for determining initial usability, the spatial/temporal criteria explain the required level of effort and frequency for data collections required by the SWQB, and the criteria for data quality indicators provide acceptable performance requirements that meet the SWQB Data Quality Objectives (NMED/SWQB 2024 or most current). Criteria requirements detailed in tables 1 through 3 have been defined by EPA (EPA 2002), with minor modifications specific to the SWQB's Quality Assurance Project Plan (QAPP), standard operating procedures (SOPs), and hydrological environment. Level 4 (excellent) represents data of the highest rigor and the highest level of quality while Level 1 (low) represents the lowest level of quality. Although the table structures imply that data at Level 2 (Fair), for example, would have the technical components, spatial/temporal coverage, and data quality indicator listed for that data level, it is possible to have different levels of quality for each of the three components. SWQB data collected during Monitoring, Assessment and Standards Section (MASS) rotational surveys are bolded in each table and are a combination of Levels 3 and 4 depending on specific survey needs detailed in the associated Field Sampling Plan(s).

Data that is collected by the SWQB and/or obtained from outside organizations to make listing determinations will require a determination of data quality level by the SWQB QA Officer (QAO), with the exception of data collected during the SWQB MASS rotational surveys. Datasets considered for the 305(b) Integrated Report and List must be accompanied by supporting documentation for determination of data quality level by the QAO. Specifically, submitted documentation associated with the dataset will be reviewed to determine the data quality level according to criteria described in tables 1-3. Data types with higher data quality are given more weight. Typically, data of a quality level 3 or 4 will be used to make listing determinations. Data of a quality level 2 may be used as supporting information or for planning, screening, or prioritizing further sampling. Data of a quality level 1 will not be used to make designated use attainment decisions. Once data packages are received by SWQB, the QAO will review the dataset and supporting documentation using the three components in tables 1-3 (as applicable) and rate the overall quality of the data from 1 to 4. The evaluations for determining data quality will be documented by the QAO in a data quality determination letter.

Table 1. Bioassessment data quality levels for evaluation of designated use attainment

QUALITY LEVEL	TECHNICAL COMPONENTS	SPATIAL/TEMPORAL COVERAGE	DATA QUALITY INDICATORS
1 LOW	Visual observation of biota; reference conditions not used; simple documentation	Limited monitoring; extrapolation from other sites	Unknown or low precision and sensitivity; professional biologist not required. Methods not documented.
2 FAIR	One assemblage (usually invertebrates); reference conditions pre-established by professional biologist; biotic index or narrative evaluation of historical records	Limited to a single sampling; limited sampling for site-specific studies; identifications to family level	Low to moderate precision and sensitivity; professional biologist may provide oversight. Acceptable SOPs documented and followed.
3 GOOD	**Single assemblage usually the norm; reference conditions may be site specific, or composite of sites; biotic index (interpretation may be supplemented by narrative evaluation of historical records)**	**Monitoring of targeted sites during a single season*; may be limited sampling for site-specific studies; may include limited spatial coverage for watershed-level assessments; identifications to genus and species level**	**Moderate precision and sensitivity; professional biologist performs survey or provides training for sampling; professional biologist performs identification.** **QA/QC protocols followed; QA/QC results adequate.** **Approved SOPs used in field**
4 EXCELLENT	Generally two assemblages, but may be one if high data quality; regional (usually based on index sites) **reference conditions used; biotic index (single dimension or multi metric index)**	Monitoring during 2 sampling seasons*; broad coverage of sites for either site-specific or watershed assessments; **identifications to genus and species level; conducive to regional assessments using targeted or probabilistic design**	**High precision and sensitivity; professional biologist performs survey and identification.** **QA/QC protocols followed; QA/QC results adequate.** **Approved SOPs used in field.** **Verification and Validation of data following SOPs.**

NOTES: *Seasons are defined as October – December, January – March, April – June, and July – September.

Table 2. Chemical/bacteriological/logger data quality levels for evaluation of designated use attainment

Quality Level	Technical Components	Spatial/temporal Coverage[1]	Data Quality Indicators
1 LOW	Any one of the following: • Water quality monitoring using grab sampling. • Water data extrapolated from upstream or downstream station where homogeneous conditions are expected. • BPJ based on land use data, location of sources	Low spatial and temporal coverage: • Quarterly or less frequent sampling with limited period of record (e.g., 1 day) • Limited data during key periods or at high or low flow (critical hydrological regimes) • Data are >5 years old and likely not reflective of current conditions	Approved QA/QC protocols are not followed, or QA/QC results are inadequate. Methods not documented. Inadequate metadata.
2 FAIR	Any one of the following: • Water quality monitoring using grab sampling. • Rotating basin surveys involving single visits. • Synthesis of existing or historical information on fish tissue contamination levels • Screening models based on loadings data (not calibrated or verified) • Verified volunteer data	Moderate spatial and temporal coverage: • Bimonthly or quarterly sampling at fixed stations, or few data points (n<4, or n<2 for lakes) • Sampling during a key period (e.g., fish spawning seasons, high and/or low flow) • Stream basin coverage, multiple sites in a basin	Low precision and sensitivity, data do not meet the method and detection limit requirements identified in the SWQB QAPP. QA/QC protocols followed; QA/QC results adequate. Approved SOPs used for field and lab; limited training. Adequate metadata.
3 GOOD	Any one of the following: • Water quality monitoring using grab sampling. • **Rotating basin surveys involving multiple visits or automatic sampling (may include ISCO grab sampling).** • Calibrated models (calibration data <5 years old) • Limited use of continuous monitoring instrumentation • Verified volunteer data	**Broad spatial and temporal coverage of site with sufficient frequency and coverage to capture acute events:** • **Bimonthly or monthly sampling during key periods (e.g., critical hydrological regimes, growing seasons or fish spawning seasons); multiple samples at high and low flows; grab samples n ≥ 4 or n ≥ 2 for lakes** • **Period of sampling adequate to monitor for chronic concerns*** • Lengthy period of record for fixed station sites (sampling over a period of months)	Moderate precision and sensitivity, data meet the detection limit requirements identified in the SWQB QAPP. QA/QC protocols followed; QA/QC results adequate. Approved SOPs used for field and lab. Verification and Validation of data. Adequate metadata. Analytical sampling and analysis methods do not fall under 20.6.4.14.A NMAC.
4 EXCELLENT	All of the following: • **Water quality monitoring** using composite samples**, series of grab samples, or continuous monitoring devices.** • Follow-up sediment quality sampling or fish tissue analyses at sites with high probability of contamination	Broad spatial coverage (several sites) and temporal (long-term, e.g., 5-years) coverage of fixed sites with sufficient frequency and coverage to capture acute events, chronic conditions, and all other potential chemical/physical impacts: • **Monthly sampling during key periods (e.g., spawning, critical hydrological regimes, growing season) including multiple samples at high and low flows.** • **Grab sample n>5 for radionuclides and organics, >6 for all others; continuous monitoring (e.g., use of loggers – thermographs, sondes, or similar devices)**	**High precision and sensitivity, data meet the analytical method and detection limit requirements identified in the SWQB QAPP.** **QA/QC protocols followed; QA/QC results adequate.** **Approved SOPs used for field and lab; samplers well trained.** **Adequate metadata.** **Verification and Validation of data following SOPs.** **Analytical sampling and analysis methods fall under 20.6.4.14.A NMAC.**

NOTES: [1] Data from multiple projects may be combined (if available) to address a data quality level of 2 resulting from a small dataset that would otherwise be unassessable. *See section 3.1.2.2 of the main CALM for additional information. The same data levels are used to make all designated use attainment decisions.

Table 3. Habitat data quality levels for evaluation of designated use attainment

Quality Level	Technical Components	Spatial/temporal Coverage	Data Quality Indicators
1 LOW	Visual observation of habitat characteristics; no true assessment; documentation of readily discernable land use characteristics that might alter habitat quality; no reference conditions	Sporadic visits: sites are mostly from road crossings or other easy access	Unknown or low precision and sensitivity; professional scientist not required. Methods not documented.
2 FAIR	Visual observation of habitat characteristics and simple assessment; use of land use maps for characterizing watershed condition; reference conditions pre-established by professional scientist	Limited to annual visits non-specific to season; generally easy access; limited spatial coverage and/or site-specific studies	Low precision and sensitivity; professional scientist not involved, or only by correspondence. Acceptable SOPs documented and followed.
3 GOOD	Visual-based habitat assessment using SOPs; may be supplemented with quantitative measurements of selected parameters; **data on land use may be compiled and used to supplement assessment**	**Assessment during single season usually the norm; spatial coverage may be limited sampling or broad and usually commensurate with biological sampling; assessment may be regional or site-specific**	Moderate precision and sensitivity; professional scientist performs survey or provides oversight and training. QA/QC protocols followed; QA/QC results adequate. Approved SOPs used in field. Verification and Validation of data.
4 EXCELLENT	**Assessment of habitat based on quantitative measurements of in-stream parameters, channel morphology, and floodplain characteristics;** usually conducted with bioassessment**; data on land use compiled and used to supplement assessment; reference condition used as a basis for assessment**	Assessment during 1-2 seasons; spatial coverage broad and **commensurate with biological sampling; assessment may be regional or site-specific**	**High precision and sensitivity; professional scientist performs survey and assessment.** **QA/QC protocols followed; QA/QC results adequate.** **Approved SOPs used in field.** **Verification and Validation of data following SOPs.**

REVISION HISTORY:

2016 listing cycle – Moved from Main AP Attachment A to separate appendix. Removed toxicological data level table because SWQB does not make impairment decisions based on toxicological testing. Clarified that chemical/physical of data quality 1, and biological or habitat data of quality 1 or 2, are not used to make designated use attainment decisions.

2018 listing cycle – Minor clarifications added to first paragraph.

2020 listing cycle – Clarified and added additional Data Quality components to each data type. Added chemical/physical data sampling and analysis reference to 20.6.4.14.A NMAC. Clarified that data of data quality 2 are not used to make impairment determinations.

2022 listing cycle – **Pre-Public Comment:** Minor clarifications made in the first paragraph. Added verification and validation of data following SOPs to data quality level 4. Modified titles of tables to clarify data may be used for assessing attainment for all designated uses, as applicable, not necessarily just aquatic life use. **Post-Public Comment:** Added clarification that grab data generated using automated sampling (e.g., ISCO sampling) may be eligible for data quality level 3.

2024 listing cycle – **Pre-Public Comment:** Minor editorial changes.
Post-Public Comment: No changes.

2026 listing cycle – **Pre-Public Comment:** Modifications to level 3 and level 4 sampling frequency requirements to align with SWQB data collection capabilities.
Post-Public Comment:

REFERENCES:

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APPENDIX B

PUBLIC COMMENT DRAFT

TEMPERATURE LISTING METHODOLOGY

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document establishes a listing methodology for determining temperature impairment in streams, rivers, lakes, and reservoirs. This protocol is not applicable to streams with limited aquatic life use, wetlands, or other water bodies without applicable temperature criteria because the research and implementation procedures necessary have not been investigated or developed by the Surface Water Quality Bureau (SWQB) or adopted in 20.6.4 NMAC.

1.0 Introduction

Water temperature influences the metabolism, behavior, and mortality of fish and other aquatic organisms. Natural temperatures of a waterbody fluctuate daily and seasonally. These natural fluctuations do not necessarily affect the presence of endemic populations but may affect existing community structure and geographical distribution of species. In fact, such temperature cycles are often necessary to induce reproductive cycles and may regulate other aspects of life history (Mount 1969). Behnke and Zarn (1976), in a discussion of temperature requirements for threatened and endangered western native trout, recognized that populations cannot persist in waters where maximum temperatures consistently exceed 21-22° Celsius (C), but they may survive brief daily periods of higher temperatures (25.5-26.7° C). Anthropogenic impacts can lead to modifications of these natural temperature cycles, often leading to deleterious impacts on the aquatic community. Such modifications may contribute to changes in geographical distribution of species and their ability to persist in the presence of introduced species. The SWQB prepared a comprehensive summary of temperature thresholds for sensitive salmonids found in New Mexico as part of the 2009 triennial review of water quality standards process (NMED/SWQB 2009).

2.0 Data Collection Procedures and Considerations

For rivers and streams, the SWQB uses long-term thermograph or other datalogger datasets to assess and determine attainment. Grab data can be used to determine non-support. Long-term data are required to confirm temperature impairment determinations prior to TMDL development. Data loggers are deployed and the data reviewed following the guidelines specified in the SWQB's Standard Operating Procedures (SOPs), available at https://www.env.nm.gov/surface-water-quality/sop/. This includes locating the datalogger in the shade when possible, but the primary consideration is to place the datalogger in a location such that it will remain submerged in an area with adequate flow for the duration of the data recording period while not becoming buried in sediment or covered with debris. Available flow records, temperature change rate, and supportive coincident data (such as specific conductance) can be used to confirm whether the datalogger recorded periods of exposure, burial, or flow isolation. Temperature data from periods where the record indicates that the data logger was exposed, buried, or otherwise not indicative of ambient conditions will be censored and not used for assessment.

The SWQB ideally collects temperature data from June through August to capture the seasonal maximum water temperature. For a lake profile or a stream/river datalogger dataset to be used to determine full support, it must include the portion of the year with the highest temperatures. This usually occurs between early June and late August in New Mexico, depending on the site elevation, aspect, topography, and adjacent vegetation. In recognition that datalogger deployment is not usually possible in lakes, grab temperature data collected only in July or August may be assessable for full support attainment, while non support may be determined using grab data collected anytime during the sampling season. For SWQB collected data, additional information regarding the preferred timing of sonde deployment is typically provided in applicable SOPs, Field Sampling Plans or Water Quality Survey Reports (available at: https://www.env.nm.gov/surface-water-quality/water-quality-monitoring/).

Ensuring that the warmest stream temperatures of the year were captured can be easily discerned by plotting the data and observing a seasonal temperature increase from late spring through summer followed by a gradual decrease in temperature towards autumn (ascending and descending limbs of the thermograph). For example, if the period of record starts at a low point in the early season, rises to a high point and then descends to a low point later in the season, the data will be considered assessable for either full or non-support (Figure 1). Alternatively, if the plotted dataset does not capture the summer season maximum temperature, the dataset can only be used to determine non-support because even though the dataset did not cover the entire warm season, additional data would not change the non-support determination (Figure 2).

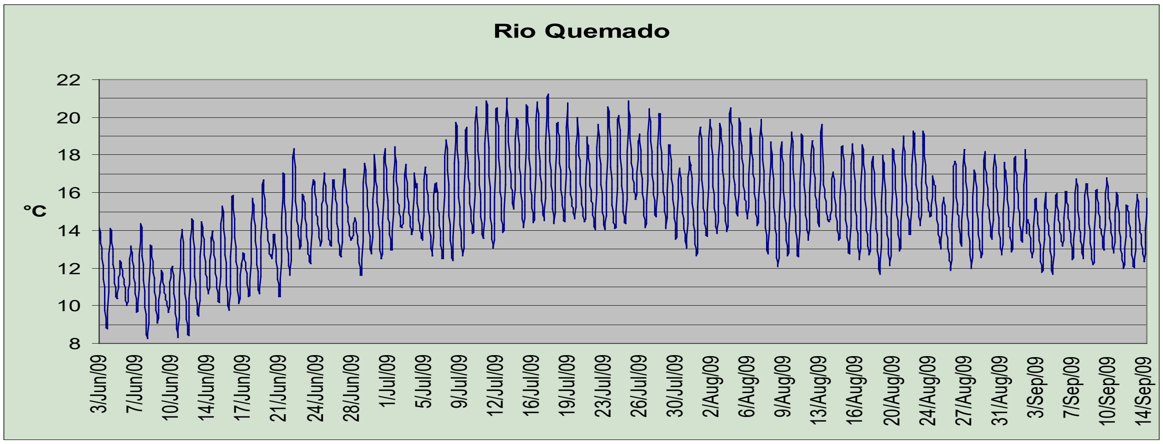


Figure 1. Example of assessable dataset for full support determination (adequate duration and includes summer season maximum temperature less than applicable maximum criterion of 23°C for high quality coldwater aquatic life use)

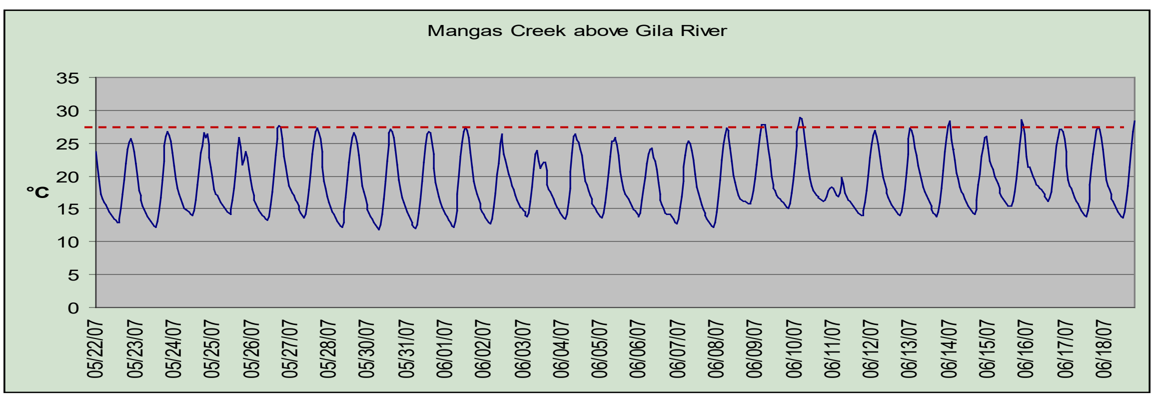


Figure 2. Example of assessable dataset for non-support determination *only* (applicable segment-specific maximum criterion of 28°C is exceeded on more than one day in this limited duration dataset)

For lakes and reservoirs, data are collected at one-meter vertical intervals as specified in the SWQB SOP for Lake Sampling (SOP 12.1; available at: https://www.env.nm.gov/surface-water-quality/sop/). Measurements are taken from the surface to within one meter of the bottom of the lake, or to the maximum depth allowed by sampling equipment.

3.0 Assessment of Temperature Data to Determine Aquatic Life Use Support

Numeric temperature criteria per aquatic life use (ALU) are summarized in Table 1 and detailed in 20.6.4.900(H) NMAC (https://www.env.nm.gov/surface-water-quality/wqs/). “4T3 temperature” is defined as the temperature not to be exceeded for four or more consecutive hours in a 24-hour period on more than three consecutive days, and the "6T3 temperature" is defined as the temperature not to be exceeded for six or more consecutive hours in a 24-hour period on more than three consecutive days (20.6.4.7(A) NMAC).

Table 1. New Mexico's temperature criteria by ALU (from 20.6.4.900(H) NMAC)

AQUATIC LIFE USE	MAXIMUM TEMPERATURE (°C)	4T3[(a)] (°C)	6T3[(a)] (°C)
High Quality Coldwater (HQCWAL)	23	20	
Coldwater (CWAL)	24		20
Marginal Coldwater (MCWAL)	29		25[(b)]
Coolwater (CoolWAL)	29		
Warmwater (WWAL)	32.2		
Marginal Warmwater (MWWAL)	Routinely exceeds 32.2[(c)]		
Limited	No default established		

NOTES: [(a)]Default 4T3 and 6T3 values are not applicable in cases where segment-specific maximum temperature criteria exist in 20.6.4.97 - 20.6.4.899 NMAC per 20.6.4.900.H(1)(2)(3).
[(b)] With the exception of segment 20.6.4.114 NMAC, which contains a segment-specific 6T3 of 22°C.
[(c)] The MWWAL description in 20.6.4.7(M)(2) NMAC previously defined marginal warmwater as "…historical water quality data routinely exceed 32.2 degrees C" and the associated temperature criterion in 20.6.4.900(H)(6) NMAC stated a "…maximum temperature of 32.2 degrees C." The SWQB proposed revisions during the 2020 triennial review to correct these inconsistencies. The associated temperature criterion in 20.6.4.900(H)(6) NMAC now reads "…temperatures that may routinely exceed 32.2°C (90°F)." For assessment purposes, "routinely" will be defined as half the time, or 50%, and greater than "routinely" will be defined as more than half the time, or greater than 50%. Therefore, the MWWAL maximum temperature threshold will apply to temperatures that exceed the 32.2 °C criteria >50% of the time (i.e., greater than 50% of available thermograph data, or greater than 50% of eligible grab data points). See figure 4 and table 7 for more information.

4T3/6T3 criteria have only been established for HQCWAL, CWAL, and MCWAL. Continuous data are needed to determine the 4T3/6T3 in streams and rivers. A determination of non-support is made if the measured 4T3 or 6T3 exceeds the applicable temperature criteria. However, where a single segment-specific temperature criterion is indicated in 20.6.4.101-899 NMAC, it is the maximum temperature and no 4T3 or 6T3 temperature applies.

The "maximum temperature" is defined as the maximum instantaneous temperature, unless otherwise identified in a segment-specific temperature criterion. For continuous data a determination of non-support is made if the maximum temperature criterion is exceeded on more than one day during the same calendar year and the daily maximum temperatures are not statistical outliers. Each dataset is evaluated for the presence of statistical outliers, which are reviewed and censored if not representative of ambient conditions. A potential outlier is defined as a temperature greater than the 75th percentile (Q3) of the measured daily maximum temperatures plus three times the inter-quartile range (IQR). The IQR is defined as the difference between the 25th percentile (Q1) and 75th percentile (Q3) (Tukey 1977, Seo 2006). This approach is intended to 1) reduce the influence from autocorrelation of continuous data, 2) demonstrate the repeatability of an observation and 3) take into consideration potential anomalies in the thermograph data set due to extreme air temperatures deviating from seasonal norms, other anomalous events such as runoff from catastrophic fire areas, or instrument errors. Potential statistical outliers are determined in either the 15 min or 1-hour SWQB Long-term

Dataset (LTD) Data Management Spreadsheet based on the sampling interval[1]. Non-assessable data are omitted from all calculations to generate the final assessment dataset. A generalized flowchart for assessing thermograph data in rivers and streams is provided in Figure 3.

The SWQB does not routinely utilize long-term temperature loggers in lakes and reservoirs and 20.6.4.14(C)(3) NMAC dictates assessment of lake/reservoir data. The assessor examines the profile for the presence of a thermocline (greater than 1°C change per meter). If present, temperature measurements taken within the epilimnion (above the thermocline) are averaged. If absent (i.e., the lake is well mixed), measurements taken from the upper one-third of the depth profile are averaged. Therefore, the "grab" sample used to assess is actually an average value. This average value is assumed equivalent to and compared against the 4T3/6T3 criterion as opposed to the applicable ALU maximum criterion (unless there is a segment-specific maximum or there is no applicable 4T3 or 6T3) to be the most protective of aquatic life. If there is no thermocline present the upper one-third of a lake is usually considered well-mixed. Fish and other aquatic life often have potential thermal refugia, as they can move deeper if surface temperatures are too high depending on depth and conditions of the lake.

The SWQB is exploring the feasibility of continuous data collection (buoy deployments) in lakes and reservoirs. If it is determined that sondes or data loggers can be safely deployed in this waterbody type and generate data that can meet 20.6.4.14(C)(3) NMAC, the SWQB will develop a standard operating procedure and listing methodologies for lake continuous monitoring data.

The assessment procedures for each ALU with applicable temperature criteria for both lotic and lentic waters are detailed in Tables 2 – 7 below. For temperature in both rivers/streams and lakes/reservoirs, delisting criteria are the same as listing criteria.

[1] Available at: https://www.env.nm.gov/surface-water-quality/sop/.

Table 2. Assessing temperature data to determine HQCWAL Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•Instantaneous (grab) temperature data **A)** Rivers or streams **B**) Lakes or reservoirs	**A)** Not assessable (cannot determine fully supporting with grab data only) **B)** No (<1) temperature measurement greater than 20.0°C[b] (or the segment-specific maximum temperature).	**A)** One or more (≥1) temperature measurement greater than 23.0°C (or the segment-specific maximum temperature) [a] **B)** One or more temperature (≥1) measurement greater than 20.0°C[b] (or the segment-specific maximum temperature).	[a] IR Category 5C – needs thermograph data to confirm. [b] Because lake temperature measurements are averaged over the epilimnion or the upper 1/3 of the water column, the measured value is assumed be equivalent to the 4T3 value and thus this criterion is used when there is not a segment-specific maximum. See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. For lakes, only temperature grab data collected in July or August will be used to determine full support attainment, ensuring that the warmest part of the year is assessed, while non support may be determined using grab data collected anytime during the sampling season. [c] Plotted dataset must capture the summer season maximum temperature. [d] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet.
•Thermograph data (≤one-hour frequency interval)	Maximum daily temperatures, excluding confirmed outliers[d], do not exceed 23.0°C (or the segment-specific maximum temperature), on more than one day during the calendar year <u>and</u> 4T3 does not exceed 20.0°C if there is no segment-specific maximum temperature. [c]	Maximum daily temperatures exceed 23.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year and are not confirmed outliers[d]**,** <u>or</u> 4T3 exceeds 20.0°C if there is no segment-specific maximum temperature.	

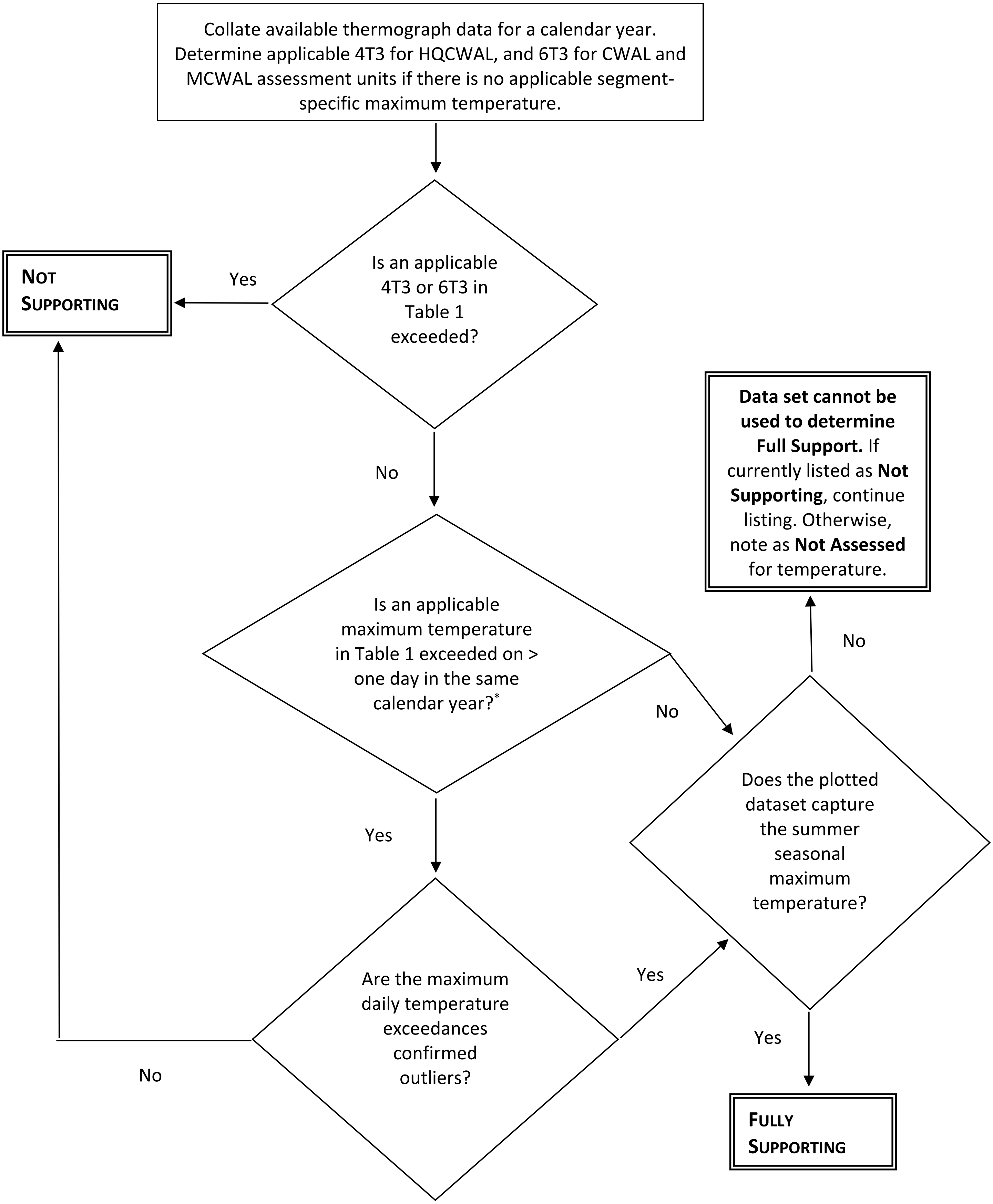


Figure 3. Generalized flowchart for assessing thermograph data in rivers and streams
*with the exception of MWWAL, which must exceed the maximum temperature more than half of the time (>50%)

Table 3. Assessing temperature data to determine CWAL Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) temperature data** **A)** Rivers or streams **B**) Lakes or reservoirs	**A)** Not assessable (cannot determine fully supporting with grab data only). **B)** No (<1) temperature measurement greater than 20.0°C [b] (or the segment-specific maximum temperature).	**A)** One or more (≥1) temperature measurement greater than 24.0°C (or the segment-specific maximum temperature). [a] **B)** One or more (≥1) temperature measurement greater than 20.0° C [b] (or the segment-specific maximum temperature).	[a] IR Category 5C – needs thermograph data to confirm. [b] Because lake temperature measurements are averaged over the epilimnion or the upper 1/3 of the water column, the measured value is assumed be equivalent to the 6T3 value and thus this criterion is used when there is not a segment-specific maximum. See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. . For lakes, only temperature grab data collected in July or August will be used to determine full support attainment, ensuring that the warmest part of the year is assessed, while non support may be determined using grab data collected anytime during the sampling season. [c] Plotted dataset must capture the summer season maximum temperature. [d] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet.
•**Thermograph data** (≤one-hour frequency interval)	Maximum daily temperatures, excluding confirmed outliers[d], do not exceed 24.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year, and 6T3 does not exceed 20.0°C if there is no segment-specific maximum temperature. [c]	Maximum daily temperatures exceed 24.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year and are not confirmed outliers[d], or 6T3 exceeds 20.0°C if there is no segment-specific maximum temperature.	

Table 4. Assessing temperature data to determine MCWAL Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•Instantaneous (grab) temperature data			[a] IR Category 5C – needs thermograph data to confirm. [b]Because lake temperature measurements are averaged over the epilimnion or the upper 1/3 of the water column, the measured value is assumed be equivalent to the 6T3 value and thus this criterion is used when there is not a segment-specific maximum. See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. For lakes, only temperature grab data collected in July or August will be used to determine full support attainment, ensuring that the warmest part of the year is assessed, while non support may be determined using grab data collected anytime during the sampling season. [c] Plotted dataset must capture the summer season maximum temperature. [d] With the exception of segment 20.6.4.114 NMAC, which contains a segment-specific 6T3 of 22°C. [e] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet.
A) Rivers or streams	**A)** Not assessable (cannot determine fully supporting with grab data only)	**A)** One or more (≥1) temperature measurement greater than 29.0°C (or the segment-specific maximum temperature). [a]	
B) Lakes or reservoirs	**B)** No (<1) temperature measurement greater than 25.0°C[b] (or the segment-specific maximum temperature).	**B)** One or more (≥1) temperature measurement greater than 25.0°C[b] (or the segment-specific maximum temperature).	
•Thermograph data (≤one-hour frequency interval)	Maximum daily temperatures, excluding confirmed outliers[e], do not exceed 29.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year, <u>and</u> 6T3 does not exceed 25.0°C if there is no segment-specific maximum temperature. [c] [d]	Maximum daily temperatures exceed 29.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year and are not confirmed outliers[e], <u>or</u> 6T3 exceeds 25.0°C if there is no segment-specific maximum temperature.	

Table 5. Assessing temperature data to determine CoolWAL Aquatic Life Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•Instantaneous (grab) temperature data			[a] IR Category 5C – needs thermograph data to confirm [b] See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. For lakes, only temperature grab data collected in July or August will be used to determine full support attainment, ensuring that the warmest part of the year is assessed, while non support may be determined using grab data collected anytime during the sampling season. [c] Plotted dataset must capture the summer season maximum temperature. [d] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet.
A) Rivers or streams	**A)** Not assessable (cannot determine fully supporting with grab data only)	**A)** One or more (≥1) temperature measurement greater than 29.0°C (or the segment-specific maximum temperature). [a]	
B) Lakes or reservoirs[c]	**B)** No (<1) temperature measurement greater than 29.0°C [b] (or the segment-specific maximum temperature).	**B)** One or more (≥1) temperature measurement greater than 29.0°C[b] (or the segment-specific maximum temperature).	
•Thermograph data (≤one-hour frequency interval)	Maximum daily temperatures, excluding confirmed outliers[d], do not exceed 29.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year. [c]	Maximum daily temperatures exceed 29.0°C (or the segment-specific maximum temperature) on more than one day during the calendar year and are not confirmed outliers[d].	

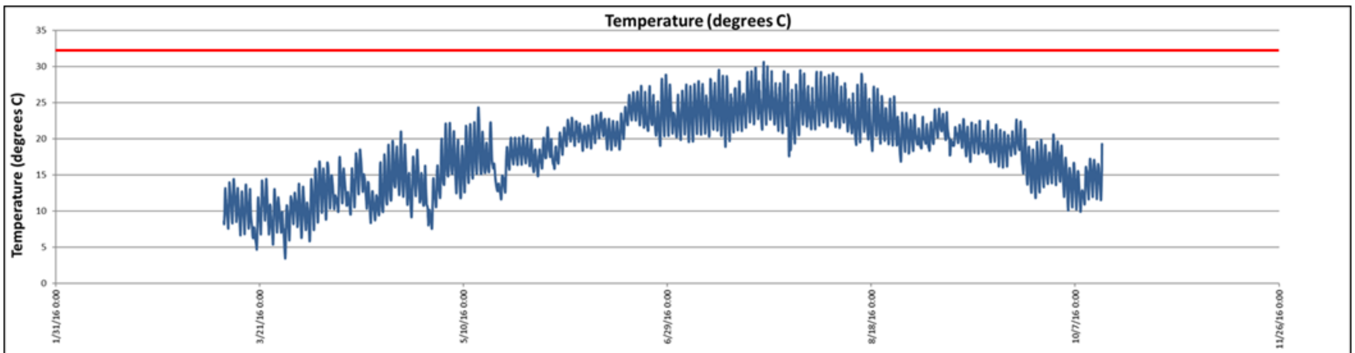
Table 6. Assessing temperature data to determine WWAL Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) temperature data**			[a] IR Category 5C – needs thermograph data to confirm
A) Rivers or streams	**A)** Not assessable (cannot determine fully supporting with grab data only)	**A)** One or more (≥1) temperature measurement greater than 32.2°C (or the segment-specific maximum temperature) [a]	[b] See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. For lakes, only temperature grab data collected in July or August will be used to determine full support attainment, ensuring that the warmest part of the year is assessed, while non support may be determined using grab data collected anytime during the sampling season.
B) Lakes or reservoirs	**B)** No (<1) temperature measurement greater than 32.2°C[b] (or the segment-specific maximum temperature)	**B)** One or more (≥1) temperature measurement greater than 32.2°C[b] (or the segment-specific maximum temperature)	
•**Thermograph data** (≤one-hour frequency interval)	Maximum daily temperatures, excluding confirmed outliers[c], do not exceed 32.2°C (or the segment-specific maximum temperature) on more than one day during the calendar year. [d]	Maximum daily temperatures exceed 32.2°C (or the segment-specific maximum temperature) on more than one day during the calendar year and are not confirmed outliers[c].	[c] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet. [d] Plotted dataset must capture the summer season maximum temperature.

Table 7. Assessing temperature data to determine MWWAL[a] Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•Instantaneous (grab) temperature data			[a] For the purposes of this assessment protocol, "routinely" will be defined half the time, or 50%, and greater than "routinely" is more than half the time, or greater than 50%. Therefore, the MWWAL maximum temperature threshold will apply to temperatures that exceed the 32.2 °C criteria >50% of the time (see Figure 4). [b] IR Category 5C – needs thermograph data to confirm [c] See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. For lakes, only temperature grab data collected in July or August will be used to determine full support attainment, ensuring that the warmest part of the year is assessed, while non support may be determined using grab data collected anytime during the sampling season. [d] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet. [e] Plotted dataset must capture the summer season maximum temperature.
A) Rivers or streams	**A)** Not assessable (cannot determine fully supporting with grab data only).	**A)** More than 50% (>50%) of temperature measurements greater than 32.2°C (or the segment-specific maximum temperature) (e.g., 3 out of 4 grab measurements) collected at least 3 weeks apart. [a, b]	
B) Lakes or reservoirs	**B)** No (<1) temperature measurement greater than 32.2°C[c] (or the segment-specific maximum temperature) for more than 50% of recorded measurements collected at least 3 weeks apart.	**B)** More than 50% (>50%) of temperature measurements greater than 32.2°C[c] (or the segment-specific maximum temperature) (e.g., 3 out of 4 grab measurements) collected at least 3 weeks apart.	
•Thermograph data (≤one-hour frequency interval)	Maximum daily temperatures, excluding confirmed outliers[d], do not exceed 32.2°C (or the segment-specific maximum temperature) for more than 50% (≤50%) of the time. [a, e] See Figure 4.	Maximum daily temperatures exceed 32.2°C (or the segment-specific maximum temperature) more than 50% (>50%) of the time (excluding confirmed outliers[d]). See Figure 4.	

a. 0/20,675 measurements are >32.2°C = 0% exceeding, full support MWWAL



b. 12,870/20,675 measurements are > 32.2°C = 62.25% exceeding, not supporting MWWAL

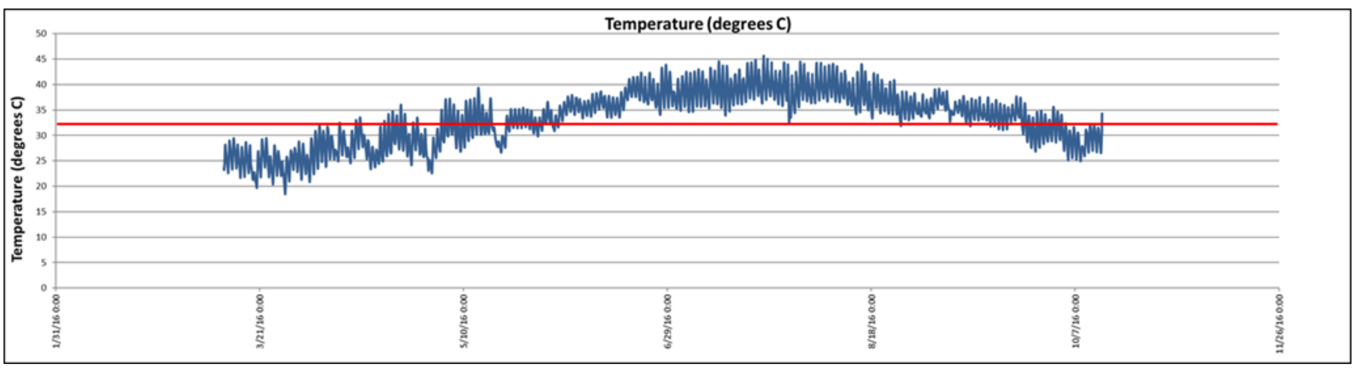


Figure 4. Determining MWWAL full support or non-support using thermograph data (>50% of data points exceeding 32.2°C maximum temperature criteria (red line))

<u>REVISION HISTORY</u>:

2014 listing cycle – Clarified data requirements for thermograph datasets to be assessable (removed 72-hour minimum); clarified that no 4T3 or 6T3 applies when segment-specific maximum exists, except for 20.6.4.114 NMAC; various minor word changes and clarifications.

2016 listing cycle – Added temperature criteria table and clarified use of segment-specific maximum temperatures when assessing data. Added additional description of lake data collection and assumption that averaged values are equivalent to 4T3/6T3.

2018 listing cycle – Changed "Assessment Protocol" to "Listing Methodology." For thermograph data, added provision regarding when there is only one day where the temperature exceeds the applicable maximum temperature criterion to demonstrate repeatability of observation and account for the autocorrelation of time series data. Also, added a provision to test for outliers in a temperature dataset. Added a generalized assessment flowchart for assessing thermograph data in rivers and streams. Clarified that stream/river impairment determinations based on grab data must be confirmed with thermograph dataset prior to TMDL development.

2020 listing cycle – Clarified that other long-term data loggers also record temperature data that can be used for assessment. Added reference to SWQB Field Sampling Plans for additional sonde deployment information. Clarified how statistical outliers in a long-term temperature dataset are identified prior to assessment. Added a note to the MWWAL assessment table to highlight the 20.6.4 NMAC discrepancy.

2022 listing cycle – Pre-Public Comment: Clarified that statistical outliers must be confirmed before removal. Added note regarding delisting. Various minor word changes and clarifications. **Post-Public Comment:** No changes made.

2024 listing cycle – Pre-Public Comment: Incorporated revisions to 20.6.4.7(M)(2) NMAC and the associated temperature criterion in 20.6.4.900(H)(6) NMAC as a result of the 2020 triennial review, which included the addition of Table 7 and Figure 4. Various minor word changes and clarifications. **Post-Public Comment**: No changes.

2026 listing cycle – Pre-Public Comment: Added clarification to Tables 2-7 notes that grab temperature data collected in lakes will only be assessable for full support attainment if collected in peak temperature months. Various minor word changes and clarifications. **Post-Public Comment**:

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APPENDIX C

PUBLIC COMMENT DRAFT

NUTRIENT LISTING METHODOLOGY FOR STREAMS AND RIVERS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document establishes a listing methodology for determining impairment due to excessive plant nutrients in perennial streams and selected river segments. This assessment is only applied to perennial streams and selected river segments at this time because the research used to develop this listing methodology is based upon data and information collected from these waterbody types.

This protocol was developed to support interpretation of the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* narrative standard for nutrients found at 20.6.4.13 NMAC (https://www.env.nm.gov/surface-water-quality/wqs/):

> ***E. Plant Nutrients:*** *Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state.*

Nutrients are essential for proper functioning of ecosystems. However, excess amounts of nitrogen and phosphorus can cause undesirable aquatic life (e.g., community composition shifts or toxic algal blooms) and/or result in a dominance of nuisance species (e.g., excessive and/or unsightly algal mats, both attached and detached, or surface algal scums). The magnitude of nutrient concentration that constitutes "excess" is difficult to determine because natural nutrient concentrations vary widely and interact with many biological and physical variables. Nutrient pollution results in a continuum of undesirable effects depending on numerous factors. For example, nutrient concentrations that would not cause a problem in rapidly flowing, well-shaded headwater streams can create major algae blooms in lower gradient, slow moving streams, and rivers with little or no forest canopy.

In 2015 and 2016, the Surface Water Quality Bureau (SWQB) collaborated with Tetra Tech, Inc., the United States Environmental Protection Agency (EPA) Region 6, and EPA's National Nutrient Criteria Program Nutrient Scientific Technical Exchange Partnership and Support (N-STEPS) program on a project to revise nutrient impairment thresholds in New Mexico. This project follows EPA's nutrient criteria guidance (EPA 2010) and Empirical Approaches for Nutrient Criteria Derivation (EPA 2009). Statistical analyses of available state and regional data were conducted to refine nutrient thresholds using defined reference conditions, relationships between cause and response variables and a verified classification system. The resultant candidate thresholds were evaluated by SWQB staff, and the selected thresholds were used to revise this nutrient listing methodology.

Exclusions

The thresholds and methodology detailed below are not directly applicable to the following waterbody types because 1) the necessary research and implementation procedures have either not been investigated by the SWQB or are not yet developed, or 2) a methodology specific to the waterbody type resides elsewhere:

- Lakes or reservoirs (see Appendix D)
- Certain large rivers (low gradient, non-wadeable)
- Intermittent streams which include waterbodies under 20.6.4.98, 20.6.4.106, 20.6.4.128, 20.6.4.140, or 20.6.4.808 NMAC
- Ephemeral streams which include waterbodies under 20.6.4.97, 20.6.4.128, 20.6.4.136, or 20.6.4.809 NMAC
- Wetlands or playas

When it is unclear whether a stream reach is perennial, the hydrology protocol[1] should be performed prior to completing a nutrient assessment using the thresholds and methodology detailed below.

For monitoring and assessment purposes, the SWQB typically distinguishes rivers from streams by defining systems that cannot be monitored effectively with the biological and habitat methods developed for wadeable streams. These rivers also generally meet the Simon and Lyons (1995) definition of great rivers as those having drainage areas greater than 2,300 square miles (mi^2), although many systems in New Mexico meet this definition but are suitable for wadeable stream monitoring and assessment methods due to the arid nature of the region and subsequent channel characteristics. Therefore, the thresholds and methodology detailed below are not directly applied to the below waterbodies for assessment purposes, except in cases noted below:

1. San Juan River from the Navajo Nation to Navajo Reservoir,
2. Rio Grande in New Mexico,
3. Pecos River from the Texas border to Sumner Reservoir,
4. Rio Chama from the Rio Grande to El Vado Reservoir (due to flow augmentation from the San Juan/Chama project),
5. Canadian River from the Texas border to the Cimarron River, and
6. Gila River from the Arizona border to Mogollon Creek.

To address SWQB's[2] and EPA's[3] nutrient pollution reduction prioritization, waterbodies on the above list that are also wastewater treatment plants (WWTPs) receiving waters (current or planned) that have one or more data points that exceed the below thresholds will be listed under IR Category 5C and prioritized for further data collection and information prior to developing a TMDL. Additional data collection and analysis are on-going to propose specific assessment thresholds for these river reaches in subsequent listing methodologies. SWQB is currently undertaking a probabilistic data collection effort and subsequent NSTEPs analysis in the Rio Grande, which is anticipated to result in proposed thresholds for one or more sections of the Rio Grande in New Mexico. In a semi-arid hydrologic setting such as New Mexico, some perennial streams naturally have very shallow or low flow. If this flow pattern is truly natural (i.e., there are no upstream diversions, etc.), the influence of extreme low flow and resultant higher water temperature or higher amount of organic matter on nutrient levels and dynamics should be considered on a case-by-case basis to determine if the below nutrient thresholds are applicable. Similarly, site-specific approaches to determining nutrient impairment may be warranted in effluent-dominated systems, based on the receiving waterbody's ability to assimilate nutrients and achieve reference or near reference condition. Any resultant nutrient impairment in these systems will also be listed under IR category 5C and prioritized for further data collection and information prior to developing a TMDL.

A separate nutrient listing methodology for lakes and reservoirs (Appendix D of the Listing Methodologies) is available at: https://www.env.nm.gov/surface-water-quality/calm/. Additional information on nutrient threshold development is available on the SWQB's website at: https://www.env.nm.gov/surface-water-quality/nutrients/.

[1] https://www.env.nm.gov/surface-water-quality/hp/
[2] https://www.env.nm.gov/wp-content/uploads/sites/25/2019/04/NutrientReductionStrategy-2014.pdf
[3] https://www.epa.gov/system/files/documents/2022-04/accelerating-nutrient-reductions-4-2022.pdf

1.0 Introduction

Nutrient pollution can be described as excess amounts of nitrogen and phosphorus and the resultant high algal biomass. Nutrient impairment occurs when algae and other aquatic vegetation (macrophytes) interfere with designated uses such as domestic water supply or aquatic life. Algal blooms can produce toxins harmful to human and animal uses and can also cause taste and odor problems in drinking water supplies. One of the most expensive problems caused by nutrient enrichment is increased treatment required for drinking water.

The variables referred to in this document are measurable water quality parameters that can be used to evaluate the degree of eutrophication in perennial streams and applicable rivers. Eutrophication is the process by which a body of water becomes enriched with nutrients that stimulate the growth of aquatic plant life. During the day, aquatic vegetation produces oxygen, sometimes leading to supersaturation. At night, however, excessive algal growth can deplete dissolved oxygen (DO) in the waterbody through respiration and decay of dead algal cells and other organic matter. Low DO concentrations and increased diel fluctuations can cause shifts in community composition and, in severe cases, the death of organisms such as macroinvertebrates and fish. Eutrophication can be a natural incremental process for a waterbody, but human activities may greatly enhance the process to the detriment of aquatic life (Art 1993).

Enrichment from excess nutrient levels in streams may lead to loss of biodiversity and native taxa; changes in algae, aquatic plant, invertebrate, and fish community structure; and subsequent loss of ecosystem function. Nutrient enrichment can also lead to excessive phytoplankton growth that can reduce light penetration and consequently limit the growth of submerged aquatic plants in slow moving waters, decreasing available habitat and shelter for certain fish and their prey (Sand-Jensen et al. 2000). A possible direct effect of nutrient enrichment in streams is dominance of nuisance filamentous benthic algae during the peak summer growing season, which can alter the flow environment and negatively impact the physical benthic habitat used by both invertebrate and vertebrate organisms (Welch et al. 1989, Chessman et al. 1992) and cause a subsequent shift in community composition towards less desirable aquatic life. For example, excessive nutrients can lead to shifts in the dominant benthic macroinvertebrate community from more pollution sensitive species such as mayflies, stoneflies, and caddisflies to more pollution tolerant (and less desirable) species such as aquatic worms, midge fly larvae, and pouch snails (Sabater et al. 2005; Miltner and Rankin 1998).

Nutrient enrichment results in excessive growth of primary producers as well as certain heterotrophic microorganisms, which increases the metabolic activity of surface waters and can lead to a depletion of DO (Mallin et al. 2006). Because algal biomass above nuisance levels often produces large diel fluctuations in DO concentration (daily delta DO), caused by high maximum rates of productivity (Pmax) and respiration (Rmax), these response variables are often used as indicators of nuisance levels of algal biomass. While nutrient enrichment may benefit the growth and reproduction of certain fish species in the short term, the ecological consequence of excessive nutrients can have detrimental impacts on stream ecosystems, especially through the reduction in DO levels which would exclude or reduce more sensitive taxa (Stockner et al. 2000). In addition, excess algal growth could reduce or eliminate critical food sources and protective habitat, impacting survivorship of sensitive species such as trout.

2.0 Nutrient Scientific Technical Exchange Partnership & Support (N-STEPS) Project Summary

Narrative criteria should be translated to numeric thresholds to develop consistent impairment determination protocols. The 2018 major revision of thresholds and the associated listing methodology was needed to better define nutrients from “other than natural causes,” and link nutrient concentrations with the impairment of designated uses. The N-STEPS analysis consisted of two major approaches: reference conditions and stressor-response relationships. The reference condition approach derived candidate thresholds from distributions of nutrient concentrations from least disturbed sites which are the best estimate of “natural” conditions.

Stressor-response analyses derived candidate thresholds by defining the relationships between total nitrogen (TN) or total phosphorus (TP) concentrations (i.e., causal variables) and response variables and determining the level of the causal variable that corresponds to a change in the response variable.

Diatom and benthic macroinvertebrate community metrics, DO, and chlorophyll *a* (chl-a) concentrations were among the response variables explored in the N-STEPS analysis. Response variables represent the relative integrity of the aquatic community and indicate when designated aquatic life uses are protected, thereby prohibiting "undesirable aquatic life" or "dominance of nuisance species." DO is an applicable, indirect response variable and was used as a surrogate for nuisance algae because increases in algal biomass lead to increases in benthic chl-a concentrations which are correlated with several DO metrics, specifically minimum daily DO, daily change in DO (delta DO), and Pmax. Daily delta DO is defined as the difference between the maximum and minimum DO concentration within a 24-hour period. In the N-STEPS analysis, all three of these DO metrics were correlated to each other as well as to chl-a concentrations and a variety of benthic macroinvertebrate indices.

The steps used to identify nutrient thresholds for perennial streams and rivers in New Mexico included:

1. Selecting and evaluating data
2. Defining the human disturbance gradient
3. Forming site classes
4. Developing frequency distributions of least disturbed sites
5. Evaluating estimated stressor–response relationships
6. Synthesizing multiple thresholds and identifying the most appropriate for NM waters

These steps are based on the EPA guidance for developing numeric nutrient thresholds and criteria (EPA 2009, 2010). The details of each step are available in summary form or in entirety in separate documents available on the SWQB web site (NMED/SWQB 2016 and Jessup et al. 2015, respectively): https://www.env.nm.gov/surface-water-quality/nutrients/.

Data were collected between 1990 and 2012 within New Mexico and shared ecoregions in surrounding states by SWQB and national monitoring programs, including the National Rivers and Streams Assessment (NRSA), the Wadeable Streams Assessment (WSA), and Environmental Monitoring and Assessment Program (EMAP). A geographic information system (GIS) analysis of sites and their catchments was conducted to characterize environmental conditions for use in disturbance gradient designations and site classification.

The reference site and human disturbance gradient analysis of 542 sites resulted in 31% of sites being identified as least disturbed (i.e., reference or near reference) sites. Analyses of least disturbed sites were used to determine site classes based on nutrient conditions and landscape classification variables such as geology, land slope and ecoregion. For nitrogen, concentrations were associated with average catchment (i.e., watershed) land slope, and three TN classes were identified as TN Flat, TN Moderate, and TN Steep (Table 1, Figure 1).

Table 1. Site classes for TN

Site Class	Description
TN Flat	Sites with average catchment land slopes less than <15%
TN Moderate	Sites with average catchment land slopes from 15% to 32%
TN Steep	Sites with average catchment land slopes > 32%

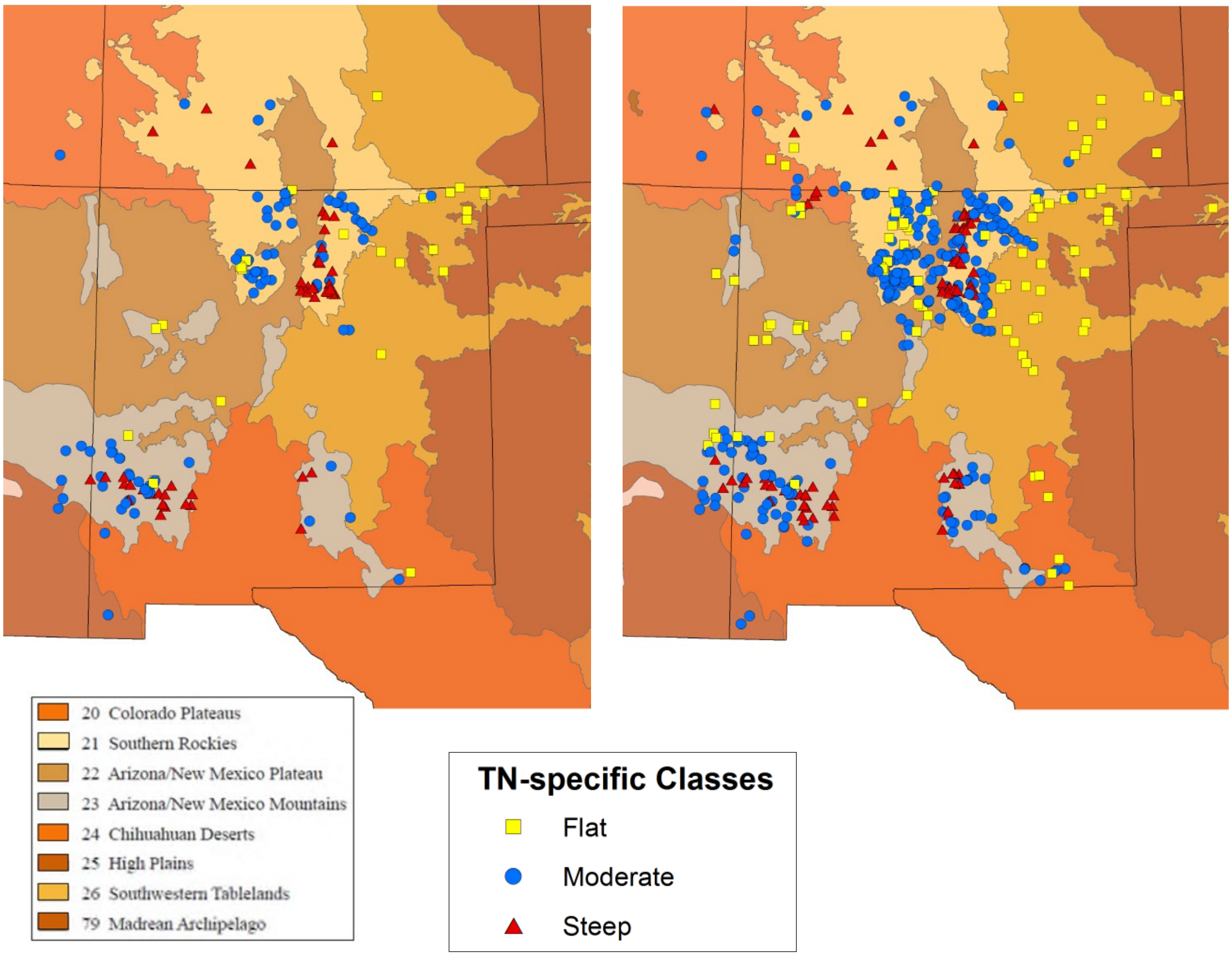

Figure 1. Least disturbed sites (left) and all sites (right) by the TN-specific site classes (from Jessup et al. 2015).

For phosphorus, volcanic geology and the concentration of TP in soil were important in addition to average catchment land slope, resulting in three different nutrient classes identified as TP High-Volcanic, TP Flat-Moderate, and TP Steep (Table 2, Figure 2).

Table 2. Site classes for TP (and delta DO)

Site Class	Description
TP High-Volcanic	All sites in the San Antonio and Conejos, Upper Gila, Upper Gila-Mangas, San Francisco, and Mimbres watersheds (HUCs 13020202, 13010005, 15040001, 15040002, 15040004, and 13030202, respectively). In the Upper Gila watershed, it excludes sites in the Diamond, Taylor and Beaver Creek sub-watersheds (HUCs 150400010404, 150400010406, 150400010402, 150400010403, 150400010305, and 150400010302).
TP Flat-Moderate	Sites with average catchment land slopes ≤ 29% average land slope that are not in the TP High-Volcanic site class. Also includes sites in three drainages of the Jemez basin: the Vallecitos, Pajarito, and Sulphur/Redondo sub-basins (HUCS 130202020204, 130202010204, and 130202020202).
TP Steep	Sites with average catchment land slopes > 29% that are not in the TP High-Volcanic site class.

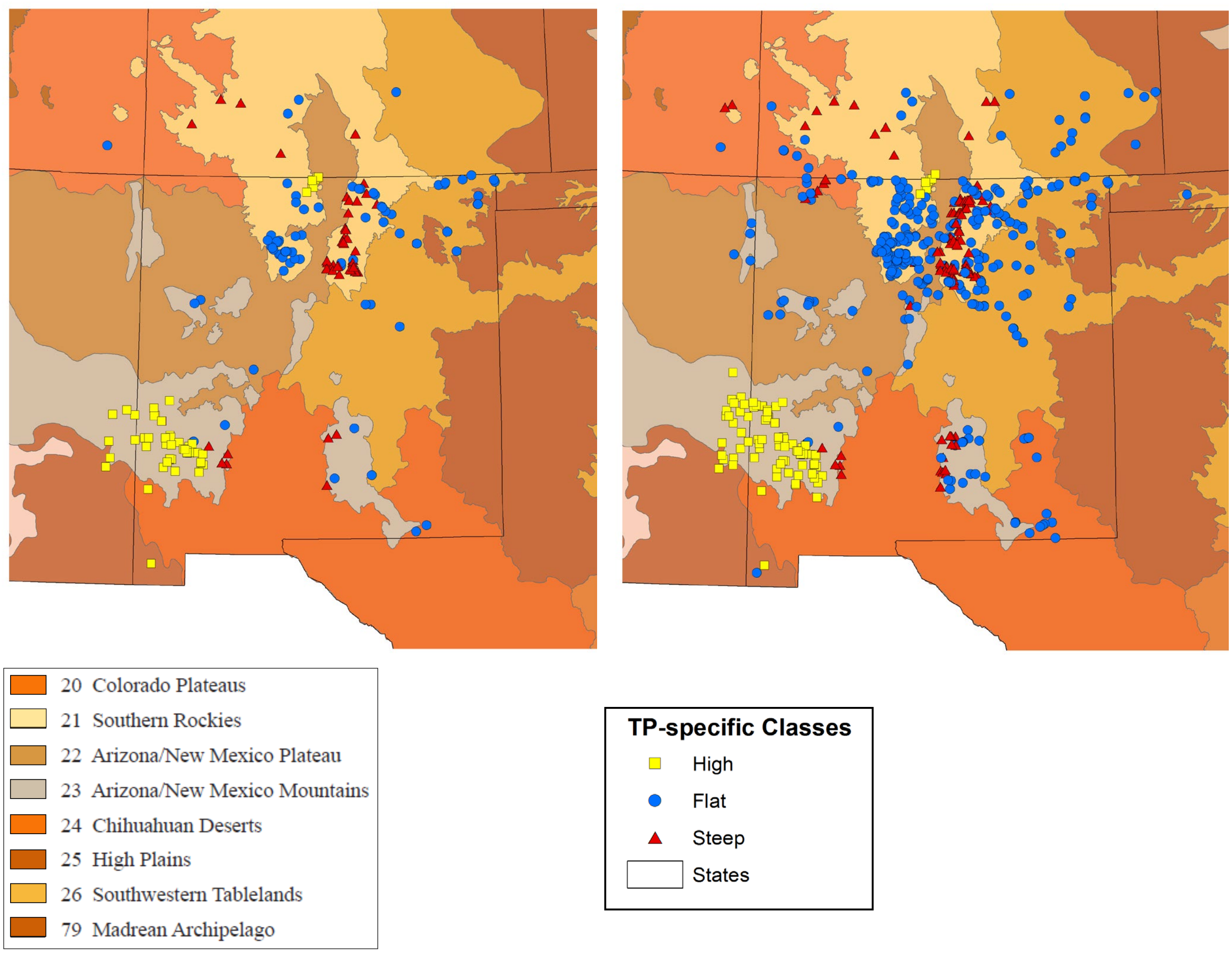

Figure 2. Least disturbed sites (left) and all sites (right) by the TP-specific site classes (from Jessup et al. 2015). Sites noted as “Flat” in the legend include the entire TP Flat-Moderate class.

TN and TP candidate thresholds were derived for each site class using frequency distributions of nutrient conditions, defined as the median site value (Jessup et al. 2015), in least disturbed sites. Correlation and other multivariate techniques supported major linkages between nutrient concentrations, chl-a, delta DO, diatoms, and macroinvertebrates. Although chl-a relationships supported some causal linkages between nutrients and DO, the relationships between nutrient concentration and chl-a were too weak and inconsistent to support its use as indicator of nutrient impairment (Jessup et al. 2015). Multiple regression interpolations and change-point analyses for macroinvertebrates, diatoms, and delta DO in response to nutrient concentrations resulted in multiple candidate TN and TP thresholds in each site class.

For each site class combination, candidate thresholds were evaluated against stressor-response analyses to select the impairment thresholds shown in Tables 3 and 4. NMED chose the 90th quantile for candidate thresholds. Ultimate quantile selection for threshold development is dependent upon the data used to develop the quantiles, the confidence that these data accurately reflect reference condition, and the best alignment of the quantile with the benthic macroinvertebrate and diatom change point analyses to provide assumed protection of the applicable designated aquatic life use(s). Selecting a quantile in the upper boundary of the reference population provides confidence that the threshold adequately represents an impaired condition and recognizes the challenge of reducing nutrients to a lower quantile threshold in streams with naturally high nutrients, as suggested by the high reference-derived thresholds in site classes (Jessup et al. 2015). Additionally, the N-STEPS project used site medians vs. individual TN and TP data values in the analyses (Jessup et al. 2015). Comparing site medians rather than individual sampling events to numeric thresholds is better aligned with the intention of identifying chronic excessive nutrients conditions (Table 3). The selected daily delta DO response thresholds in Table 4 are applied by TP site class because daily delta DO was found to be significantly correlated with TP; therefore, TP site classes were used to determine appropriate delta DO thresholds (Jessup et al. 2015).

Table 3. TN and TP causal thresholds by site class

Parameter and Site Class	Site Median Threshold (90th quantile) (mg/L)
TN Flat	0.69
TN Moderate	0.42
TN Steep	0.30
TP High-Volcanic	0.105
TP Flat-Moderate	0.061
TP Steep	0.030

Table 4. DO response thresholds by site class

Site Class	Daily Delta DO* Threshold (mg/L)
TP High-Volcanic	5.02
TP Flat-Moderate	4.08
TP Steep	1.79

NOTES: *The daily delta DO threshold is defined as the difference between the maximum and minimum DO concentration within a 24-hour period.

3.0 Data Collection Procedures and Considerations

Nutrient grab samples and DO long-term data are collected during regular SWQB watershed surveys following the SWQB's Standard Operating Procedures (SOPs) (http://www.nmenv.state.nm.us/swqb/SOP/).
Algal biomass above nuisance levels often produces large diel fluctuations in DO. Accordingly, diel DO data are collected using continuous recording devices (sondes or DO data loggers) to observe diel fluctuations as opposed to the "snapshot" that grab data provide. After all data are received from the lab or field staff, validated/verified, and upload to SWQB's in-house database (SQUID), nutrient and DO data are downloaded via a series of SQUID assessment reports. TN and TP site classes have been determined with assistance from NMED's IT Department and stored in SQUID.

3.1 Long-term dissolved oxygen data

Sonde or DO logger deployments are preferably conducted during the growing season of the deployment site class (Table 5). Assessments of delta DO are made with a minimum of 72 hours of sonde or DO logger data, collected during the growing season, with a maximum interval of one hour between data points. The SWQB typically deploys sondes or DO loggers for three to fourteen days to record at least hourly DO values. For SWQB collected data, additional information regarding the preferred timing of sonde deployment is typically provided in applicable Field Sampling Plans or Water Quality Survey Reports (available at: https://www.env.nm.gov/surface-water-quality/water-quality-monitoring/).

Table 5. Growing seasons for New Mexico ecoregions and elevations

Site Class	Level 3 Omernick Ecoregion	Growing Season
Mountain >7500 ft	22 & 23	July 1-Oct 15
Mountains <7500 ft & Plateau	20, 21, 22 & 23	Jun 15-Nov 1
Southern Deserts and Plains	24, 25, 26, & 79	May 15-Nov 15

3.2 Total nitrogen and total phosphorus data

There is no numeric criterion or definition of "total nitrogen" in 20.6.4 NMAC. An approved definition for total nitrogen (TN) is not found in 40 C.F.R. Part 136 but it is usually taken to mean the sum of Total Kjeldahl Nitrogen (TKN) and Nitrate+Nitrite (NO_3+NO_2). Therefore, for nutrient assessments, the SWQB determines "TN Calculated" as the sum of NO_3+NO_2 and TKN. Additionally, the TKN and NO_3+NO_2 reporting limits, referred to as the minimum reporting limit [MRL] in SQUID, are added together to determine a "TN Calculated MRL." For this listing methodology, the following terms related to analytical method sensitivity may be synonymous and will be evaluated on a case-by-case basis depending on the analytical lab: "quantitation limit," "reporting limit," "level of quantitation," and "minimum level." For assessment purposes, in the absence of estimated TN data, the TKN and NO_3+NO_2 MRLs are added together to determine the "TN Calculated MRL." If either TKN or NO_3+NO_2 are reported as below the MRL, the respective MRL value is used to determine the TN Calculated value for the assessment dataset.

4.0 Assessment Procedure

To determine if there is a plant nutrient impairment in a stream reach, two levels of assessment are performed in sequential order (Figure 3). The first step considers causal indicators alone (TN and TP). If the TN or TP causal thresholds are exceeded the second step considers a response indicator (delta and minimum DO).

TN, TP, and DO concentrations and variability can all be influenced by storm events. Outliers were removed from the respective datasets prior to threshold development (Jessup et al. 2015). The developed thresholds are intended to assess an on-going condition of excessive nutrients rather than spikes in concentrations or DO swings as a result of isolated weather events. Each dataset is evaluated for the presence of statistical outliers, which are reviewed and censored if not representative of ambient conditions. For nutrient assessments, statistical outliers are defined as TN, TP, or delta DO values greater than the 75th percentile (Q3) of the respective value plus three times the inter-quartile range (IQR). The IQR is defined as the difference between the 25th percentile (Q1) and the 75th percentile (Q3) (Tukey 1977, Seo 2006). This approach is intended to 1) reduce the influence from autocorrelation of continuous DO data, 2) demonstrate the repeatability of an observation, and 3) take into consideration potential anomalies in the data set due to extreme deviations from seasonal norms, other anomalous events such as runoff from catastrophic fire areas, or instrument errors. TN and TP site medians are first compared to the applicable assessment thresholds shown in Table 3, as described in the assessment flowchart (Figure 3) and Table 6. If enrichment is indicated, the assessor determines if there is a response in the assessed Assessment Unit (AU) by comparing available daily delta DO data to the applicable threshold in Table 4 as shown in Figure 3 and Table 7.

If a delta DO response is documented, the AU is noted as **Not Supporting** for nutrients. If not, it is noted as **Fully Supporting** (prioritized for additional sampling as resources allow) because the high nutrients do not appear to result in a dissolved oxygen effect. In certain cases where the monitoring site may not fully characterize the impacts of assimilated nutrients within the AU, additional downstream monitoring may be considered to more accurately identify nutrient effects. It is prudent to consider downstream AU responses because the displacement of effects from excessive nutrient input is a common and challenging problem with nutrient impairment determinations. For example, excessive point or non-point nutrient inputs that result in TN or TP levels well above their respective thresholds in an upstream AU may not result in excessive algal growth and concurrent DO impacts in that particular stream reach due to substrate type or shading (e.g., a sandy stream bed that is not conducive to algal growth). In these cases, a downstream stream reach with a more conducive substrate or exposure can experience excessive vegetative growth that will take up the nutrients and result in low in-stream TN and TP values. A goal of the nutrient listing methodology is to correctly identify the AU where the nutrient input(s) are occurring to address this displacement effect. In some cases, a DO impairment in an AU immediately downstream of an AU with nutrients thresholds median exceedances may be attributed to nutrients impairment upstream. Potential displacement effects may be further explored during subsequent total maximum daily load (TMDL) development.

If enrichment is not indicated for TN or TP, the AU is noted as **Fully Supporting** for nutrients. If enrichment is indicated for TN or TP, available daily delta DO data are compared to the applicable threshold (Table 4) as shown in Figure 3 and Table 7. If a response is not indicated by the daily delta DO, the AU is noted as **Fully Supporting** for nutrients; however, if a response is indicated, the AU is noted as **Not Supporting** for nutrients.

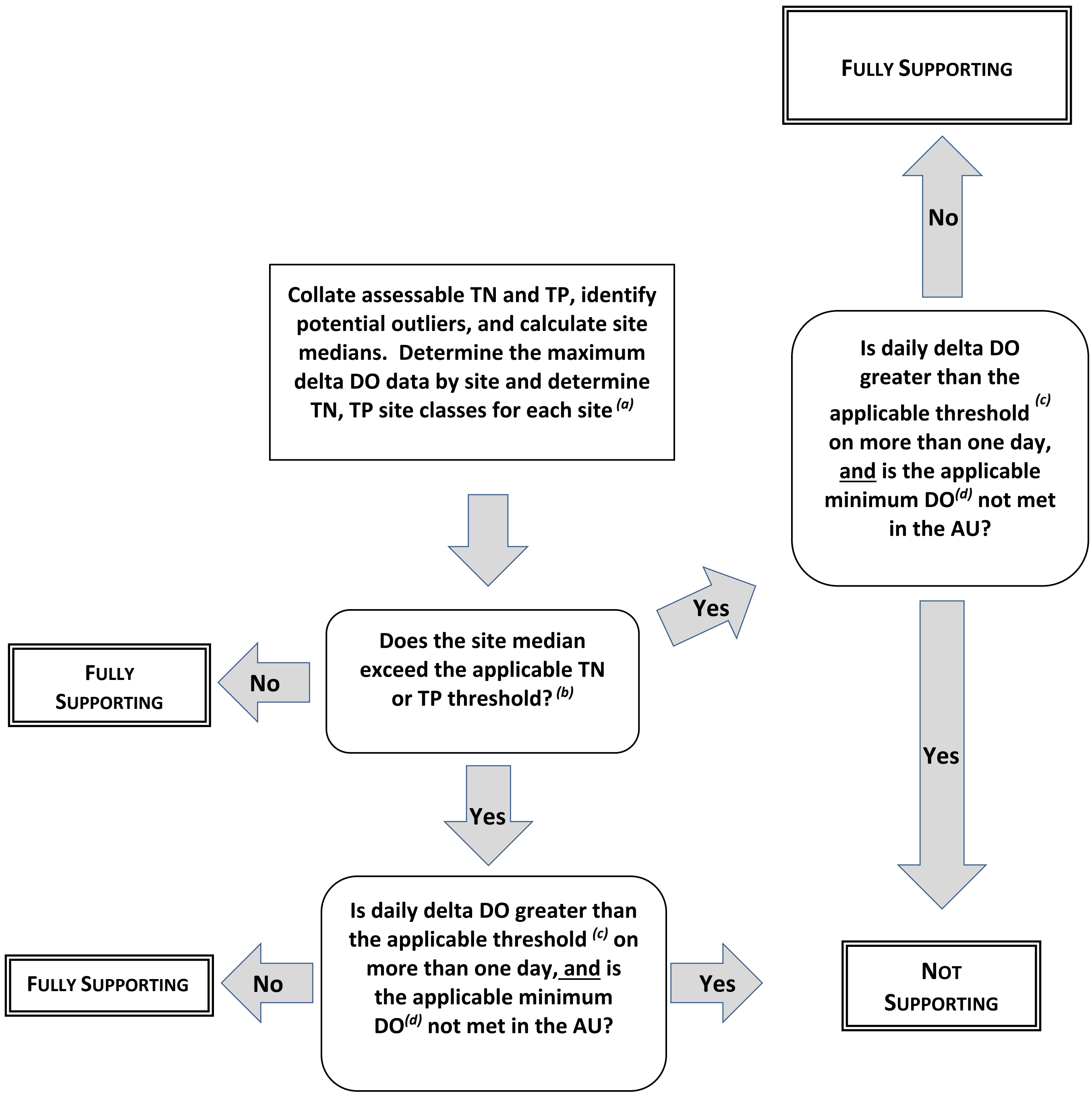

Figure 3. Generalized flowchart for determining nutrient impairment

NOTES: [a] Based on Table 1 and 2. [b] Based on Table 3. Site medians are determined using a minimum of 4 samples. [c] Based on Table 4. [d] Based on 20.6.4.900(H) NMAC. Data should be collected before any potential influence from site-specific influences such as incoming major tributaries, diversions, ground water influences, etc. Data must be from an AU that falls within the scope of this protocol (i.e., not an exempted river, or lake/reservoir). DO impairments in downstream AUs may be an indication of upstream nutrient impairment. Thus, if TN or TP medians exceed thresholds in the adjacent upstream AU the downstream AU DO impairment may be attributed to the upstream AU and that AU placed in IR category 5C (continuous DO data collection needed).

Water quality criteria for DO concentrations are found in 20.6.4.900(H) NMAC. DO concentrations will also be assessed separately from nutrients following the procedures detailed in the DO Listing Methodology (https://www.env.nm.gov/surface-water-quality/calm/, Appendix E). If DO concentration and nutrients are both determined to be **Not Supporting** via their respective listing methodologies, the AU will be listed for nutrients because the minimum DO is likely a response to excessive nutrients.

Waterbodies may be delisted for nutrient impairment based on new information. Delisting only applies to situations where new data indicate that water quality has improved and a currently listed waterbody is no longer impaired according to the current listing methodology, or a water quality standard has changed and reassessment indicates full support. Delisting decisions require the same information as listing decisions. However, due to the relatively low number of samples collected, some waterbodies may be delisted when the impairment cause persists. To increase confidence in delisting decisions for nutrients, a currently listed waterbody must meet all assessment thresholds (i.e., no exceedances of site median TN and TP numeric thresholds, delta DO response, and minimum DO concentration) to be delisted. In addition, SWQB requires 72 hours of continuous DO monitoring data to delist a nutrient impaired waterbody.

There are a few instances of segment-specific TP criteria in 20.6.4.101 - 20.6.4.899 NMAC. These will not be used to determine impairment of the narrative nutrient criteria found at 20.6.4.13(E). TP will also be assessed as a separate parameter in these cases, following the procedures detailed in Section 3.1 of the main Listing Methodology (https://www.env.nm.gov/surface-water-quality/calm/.)

Table 6. Interpreting nutrient causal data

TYPE OF DATA	DOES NOT INDICATE ENRICHMENT	INDICATES ENRICHMENT	DELISTING	NOTES
•Nutrients (total nitrogen or total phosphorus[a])				
A) 0 to 3 samples	**A**) Not assessed.	**A**) Not assessed.	A) Cannot delist with only grab data.	Applicable thresholds are found in Table 3.
B) >3 samples[b]	**B**) Site median does not exceed threshold value.	**B**) Site median exceeds threshold value.	B) Site median does not exceed threshold value and delisting criteria in Table 7 are met.	

NOTES:

[a] Segment-specific TP criteria in 20.6.4.101 - 20.6.4.899 NMAC will not be used to determine impairment of the narrative nutrient criteria found at 20.6.4.13(E) NMAC.

[b] Site medians are determined using a minimum of 4 samples.

Table 7. Assessing daily delta DO response data

TYPE OF DATA	DOES NOT INDICATE ENRICHMENT	INDICATES ENRICHMENT	DELISTING	NOTES
• **DO** Continuously recorded data (≥72 hours, ≤ one-hour frequency interval) (*)	Daily delta DO (**) is less than or equal to the applicable threshold.	Daily delta DO is greater than the applicable threshold for more than one day, and the applicable DO criterion is not met.	Delta DO is less than or equal to the applicable threshold, the applicable DO criterion is met, and delisting criteria in Table 6 are met.	Applicable delta DO thresholds are found in Table 4, using TP site classes. Applicable DO criteria are found at 20.6.4.900(H) NMAC.

NOTES:
(*) SWQB requires a minimum of 72 hours of continuous DO monitoring data to delist a nutrient impaired waterbody.
(**) Daily delta DO is defined as the difference between the maximum and minimum DO concentration within a 24-hour period. SWQB performs this calculation in the LTD management spreadsheet: (https://www.env.nm.gov/surface-water-quality/sop/)
If there are multiple monitoring sites in the AU and the assessment results are not in agreement, the AU as currently defined may not represent homogeneous water quality. In this case, potential AU breaks will be examined. If none can be determined, the assessment for the downstream station will be given priority.

REVISION HISTORY:

2012 listing cycle - Substantially re-organized protocol.

2014 listing cycle – **Pre-Public Comment**: Changed terminology from "Level 1 Nutrient Assessment" to "Nutrient Screening," and "Level 2 Nutrient Assessment" to "Nutrient Assessment." Full Support determinations from Nutrient Screenings are now considered preliminary and must be confirmed once all laboratory data are available. Changed data requirement to clarify that all Level 2 Nutrient Survey parameters – TN/TP, DO and pH sonde data (>72 hours), and chlorophyll *a* data – collected at the same station are required in order to perform a full Nutrient Assessment. Changed the chlorophyll *a* indicator to whether or not the upper limit of the threshold range is exceeded. Added clarification on how to assess multiple chlorophyll *a* samples when available. **Post Public Comment:** Minor wording clarifications/revisions. Clarified how the assessment approach addresses the "…*from other than natural* …" portion of the WQS. Changing wording in Table 6 to more clearly explain how multiple chlorophyll *a* samples are assessed.

2016 listing cycle – Revised to indicate that all indicators must be available to determine Full Support while Non Support can be determined with a partial dataset. Revised to include alternative collection time (two weeks into the growing season), and alternative Dissolved Inorganic Nitrogen calculation in the absence of useable TKN data. Added discussion of Future Direction and status of collaborative threshold revision project with EPA. Removed pH as a response variable based on analyses done as part of this project by (Ben Jessup, personal communication) combined with the lack of demonstration as a useful indicator in nutrient assessments completed between 2004 and 2014.

2018 listing cycle – **Pre-Public Comment**: Complete re-write to incorporate revised TN, TP, and delta DO thresholds based on stressor-response analyses completed collaboratively with Tetra Tech, Inc., EPA Region 6, and the EPA Office of Water Nutrient Scientific Technical Exchange Partnership and Support (N-STEPS) program. Removed alternative TN calculation using Dissolved Inorganic Nitrogen in the absence of useable

TKN data based on rarity of occurrence and consistency with how missing data are handled in other listing methodologies. Term "assessment protocol" changed to "listing methodology" throughout. Changed Table 6 from "1 to 10" to "2 to 10" because n=2 is a minimum data requirement for assessment (added related footnote). Added discussions on persulfate digestion TPN method, how to handle MRLs above the application threshold, and how to assess concurrent TN Calculated and TN persulfate data. **Post Public Comment** Clarified why certain river segments are assessable using this revised listing methodology. Added additional description of quantile selection to the N-STEPS section in 2.0. Added an additional assessment step of verifying the presence of a downstream response when the upstream AU response is not documented due to displacement effects. Revised to note that it is necessary to document nutrient enrichment with a concurrent response (either in the AU or downstream AU) to determine impairment. Added additional information on persulfate digestion TPN method.

2020 listing cycle – **Pre-Public Comment:** Added additional information in the Exclusion section regarding streams that are naturally extremely shallow or low flow. Clarified TP High-Volcanic class, which now includes entire Jemez sub-basin as was the original intent. Revised DO sonde deployment table to clarify the preferred deployment is during the growing season. Added reference to SWQB Field Sampling Plans for additional sonde deployment information. Revised TN Flat, TN Moderate, and TP High-Volcanic thresholds to the 90th quantile to acknowledge evidence of naturally higher levels of nutrients in these site classes, and changed the threshold comparisons to site medians, based on the NSTEPS analyses (Jessup et al. 2015). Added discussion of J-flagged data and clarified detection limit concerns and approaches when determining TN Calculated. Added approach to identify potential outliers. Added clarification that delta DO must be exceeded on more than one day, and that the min DO must also not be met to be considered an indication of enrichment. **Post-Public Comment:** Clarified that waters under 20.6.4.136 and 20.6.4.137 NMAC are excluded due to their ephemeral and intermittent stream types, respectively. Reverted the river reach exclusions list back to the 2015 listing methodology to allow adequate time for future consideration of the applicability of the N-STEPS thresholds developed in Jessup et al. (2015) to these larger systems, to incorporate the results of the large river biological condition gradient study in progress, and to consider additional weight-of-evidence parameters into subsequent proposed nutrient assessment approaches for these larger systems. Changed the minimum number of samples required to determine a site median from 8 to 4 to be consistent with the minimum requirement for assessment of other parameters.

2022 listing cycle – Pre-Public Comment: Added new information and requirements for delisting decisions. Delisting criteria added to Table 6 and Table 7. Updated TN MRL, J-flagged data and estimated data information. Removed Table 3 since it is no longer applicable. Clarified outlier information. Minor wording clarifications/revisions. **Post-Public Comment:** The requirement of two-weeks of continuous data for the dissolved oxygen portion of the nutrient delisting criteria was revised to a minimum of 72 hours. In Table 7, revised wording of the first portion of the "Delisting" category to be consistent with "does not indicate enrichment" category wording.

2024 listing cycle – Pre-Public Comment: Clarified which waterbodies are excluded from this protocol based on updated WQS references. Corrected site classes to align with original TetraTech report and publication. Updated the introduction with language about nutrients in large rivers. **Post-Public Comment:** No changes.

2026 listing cycle – Pre-Public Comment: Minor revisions/clarifications. Removed reference to upper thresholds, requirement for review of downstream DO data, and simplified Figure 3. **Post-Public Comment:**

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APPENDIX D

PUBLIC COMMENT DRAFT

NUTRIENT LISTING METHODOLOGY FOR LAKES AND RESERVOIRS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

1.0 Purpose and Applicability

Nutrient impairment occurs when excess nutrients, particularly nitrogen and phosphorus, disrupt designated water uses such as recreation, water supply, or aquatic life. Elevated nutrient levels can foster the growth of toxic algal blooms and shifts in community composition, leading to the dominance of nuisance species such as unsightly algal mats or surface plankton scums. Excessive algal growth can also cause anaerobic conditions, resulting in fish kills or the loss of sensitive species.

This document outlines a methodology for assessing the nutrient impairment status of lakes and reservoirs in New Mexico. While some lakes have segment-specific numeric criteria for total phosphorus (TP), there are currently no general numeric nutrient criteria in the state. The narrative criterion in the *State of New Mexico Standards for Interstate and Intrastate Surface Waters*, found in 20.6.4.13 NMAC, (available at: https://www.env.nm.gov/surface-water-quality/wqs/) states:

> *Plant nutrients from other than natural causes shall not be present in concentrations which will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state.*

The methodology outlined in this document will be used to assess whether a waterbody meets the narrative criterion. Impairment threshold values are established to translate the narrative criterion into measurable endpoints that are designed to protect aquatic life and other designated uses. Nutrient enrichment indicators, total phosphorus (TP) and total nitrogen (TN), are compared against their respective ecoregion-specific single-value thresholds to determine enrichment. Response variables such as chlorophyll *a*, DO or pH are used in making final support decisions. If a water body is determined to be not attaining, it will be added to the Integrated Clean Water Act §303(d)/§305(b) List of Assessed Waters (Integrated List) as impaired for plant nutrients.

Nutrient enrichment threshold values are derived from an analysis of a combination of national and New Mexico historical and current lake and reservoir data, including data collected over several decades through regular monitoring efforts and the National Lakes Assessment (NLA) (2025 NSTEPS analysis). Impacts to designated uses are captured within the TN, TP and chlorophyll *a* thresholds which are specifically designed to be protective of the most sensitive designated uses in each ecoregion.

To address the “from other than natural causes” component of 20.6.4.13 NMAC, waterbody sites are classified using Ecoregion Level III. This classification helps define reference conditions that account for New Mexico’s diverse landscape and rich biodiversity while aligning with the NLA model. To address the “undesirable aquatic life or dominance of nuisance species” aspect of the criterion, the assessment methodology employs a rigorously tested stressor-response modeling approach that has been tested on a national and statewide scale. This approach captures the dynamics of community shifts toward undesirable aquatic life, such as cyanobacteria, and the loss of balanced trophic relationships between phytoplankton and zooplankton in response to increased nutrient concentrations.

This protocol is a dynamic document and subject to refinement as more data are collected and analyzed, enabling more precise classification of lentic systems and clearer definition of the relationships between nutrient concentrations, indicators, and impairments of New Mexico lakes and reservoirs.

This protocol is <u>only</u> applicable to the following water body types:

- Lakes
- Reservoirs

This protocol is not applicable to the following water body types:

- Perennial, wadeable streams
- Wetlands and playas
- Large rivers

A separate nutrient listing methodology for streams and rivers (Appendix C of this CALM) is available at: https://www.env.nm.gov/surface-water-quality/calm/. Additional information on nutrient threshold development is available on the SWQB website at: https://www.env.nm.gov/surface-water-quality/nutrients/.

2. Introduction/Background

The presence of some aquatic vegetation is normal in lakes and reservoirs. Algae and macrophytes provide habitat and food for other aquatic organisms. However, excessive aquatic vegetation is not beneficial to most aquatic life and may change the associated community structure. High nutrient concentrations may promote an overabundance of algae and floating or rooted macrophytes. The types and amounts of aquatic vegetation often reflect the level of nutrient enrichment. Algae cause most problems related to excessive nutrient enrichment, either directly (excessive periphyton mats or surface plankton scums) or indirectly (diel swings of dissolved oxygen and pH as well as high turbidity).

Algal blooms can also cause taste and odor problems in drinking water supplies. One of the most expensive problems caused by nutrient enrichment is increased treatment required for drinking water. Blooms of certain types of blue-green (cyanobacteria, sometimes referred to as “Harmful Algal Blooms” or “HABs”) and golden (*Prymnesium* spp.) algae can produce toxins that are detrimental to fisheries and human health (Graham et al. 2016). In 2019, EPA released documents on “Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin” (EPA 2019). Based on those recommendations, SWQB added cyanotoxins to primary contact use WQS in 2020, the CALM “Primary Contact Use Support” section (see Main CALM) in 2023.

Limited increases in primary productivity (e.g., aquatic plants or algae) can boost the abundance of aquatic life like invertebrates and fish in lakes and reservoirs. However, excessive plant growth and decomposition can also reduce aquatic populations by depleting dissolved oxygen (DO) through plant respiration and the breakdown of dead vegetation. Lack of DO stresses aquatic organisms and can cause fish kills; even relatively small reductions in DO can have adverse effects on both invertebrate and fish communities. Nocturnal respiration can cause oxygen depletion in waters with high primary productivity and low aeration rates. Development of anaerobic conditions alters a wide range of chemical equilibria, including pH, may mobilize certain pollutants, and generate noxious odors (EPA 1991).

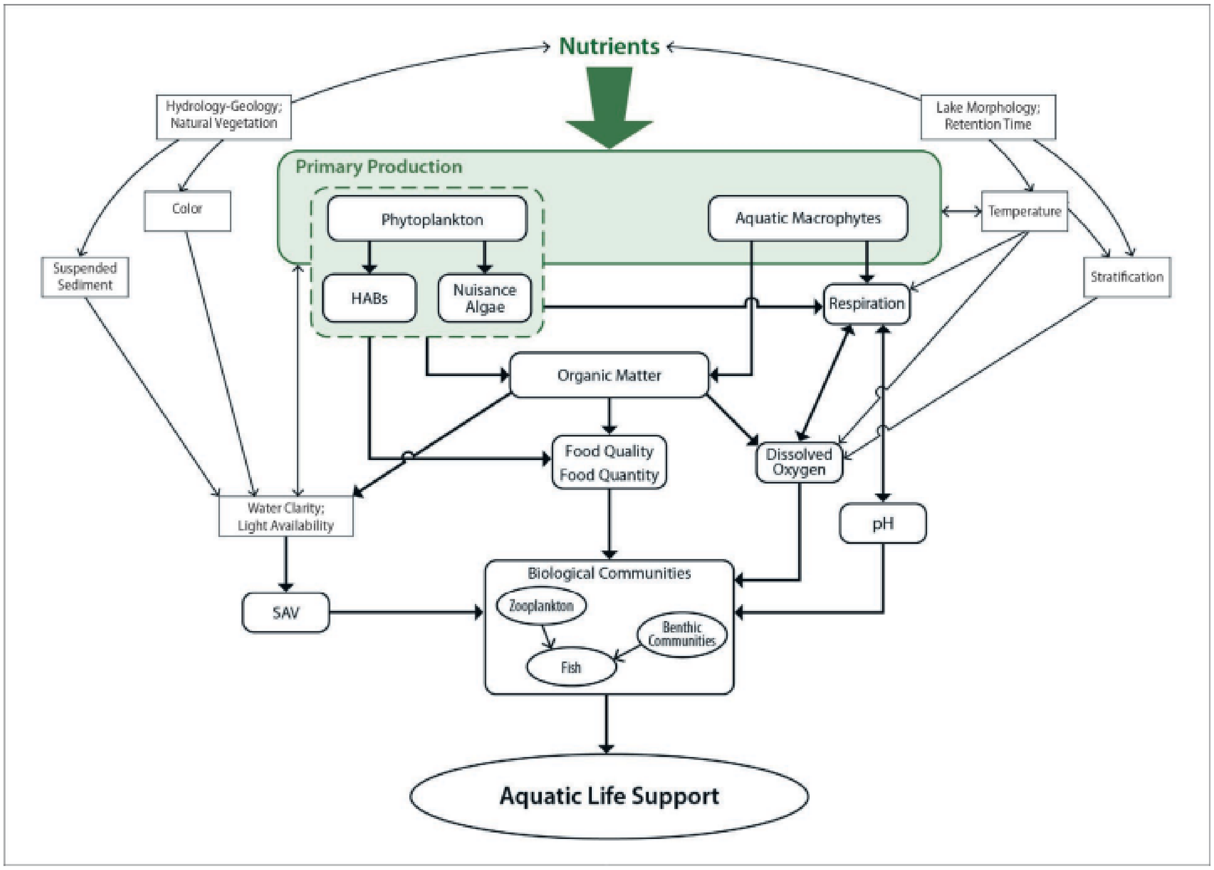

Figure 1. Conceptual model linking increased nutrients to aquatic life use (Source: EPA 2010, adapted for EPA 2021a).

3.0 Refinement of the Numeric Thresholds

New Mexico's previous nutrient impairment assessment methodology was developed over a decade ago (Scott and Haggard 2011). Since then, the state has accumulated extensive data from regular monitoring efforts and the National Lakes Assessment (NLA). In 2021, the EPA released the "Ambient Water Quality Criteria to Address Nutrient Pollution in Lakes and Reservoirs," featuring five Bayesian stressor-response models based on NLA data from 2007 to 2017 (EPA 2021a). This presented New Mexico with the opportunity to refine nutrient thresholds. To this end, New Mexico participated in EPA's Nutrient Scientific Technical Exchange Partnership and Support (NSTEPS) program beginning in 2023 to integrate state data into these models and refine nutrient impairment thresholds (Tetra Tech 2025). The candidate thresholds and results of the NSTEPs analysis are discussed below.

Modeling candidate thresholds

Of the three available models to determine candidate chlorophyll targets, the zooplankton vs. chlorophyll *a* model yielded the most useful results for lakes and reservoirs in New Mexico (Tetra Tech 2025). That model showed that zooplankton biomass increases with chlorophyll until decoupling occurs at high concentrations, indicating a shift in community composition (and thus concentrations that may produce undesirable aquatic life or nuisance species). This model was chosen over the other candidate models because it yielded the most sensitive chlorophyll targets, which were then used for setting the chlorophyll *a* targets used in the TN and TP model for nutrient thresholds.

The microcystin vs. chlorophyll *a* model identified chlorophyll targets to prevent harmful algal blooms. The microcystin target was set at 8 µg/L in alignment with New Mexico's water quality standard for primary contact recreation, which allows for up to three exceedances over a 12-month period (NM Water Quality Control Commission 2025). This standard is based on the EPA's national recreational cyanotoxin criteria (EPA 2019). This model was ultimately not chosen because high chlorophyll *a* target concentrations provided by the model suggested that cyanotoxin issues likely will not arise in New Mexico lakes unless a lake becomes heavily eutrophied.

The dissolved oxygen vs. chlorophyll model assesses the impact of chlorophyll on oxygen depletion (hypoxia). Model output indicated that regardless of chlorophyll concentration, fish species in New Mexico lakes were generally anticipated to have sufficient temperature and DO conditions supportive of the range of aquatic life uses in the state. Thus, no chlorophyll targets were identified for hypoxia.

Ecoregion-Based Approach

The ecoregion-specific models (based on Ecoregion level III classification) were adopted in lieu of the previous lake temperature groupings. This waterbody classification system will enable a more regionally specific and streamlined assessment. Because these models incorporate national and additional state data over many decades, they are more robust than the previous temperature-based approach (Tetra Tech 2025).

Removal of Percent Cyanobacteria as a Response Variable

The previous methodology included percent cyanobacteria as a response variable, assuming it could indicate nutrient enrichment. However, further work associated with the NSTEPS analysis found no statistically significant relationship between cyanobacteria proportion or cell count and TN/TP concentrations (Tetra Tech 2025). With only 1-3 percent of the variability in percent cyanobacteria explained by nutrient levels, it was determined that percent cyanobacteria is not a reliable response variable, and it was removed from the assessment framework. This decision was further supported by regression analyses demonstrating that even in lakes with high TN/TP concentrations, cyanobacteria presence was inconsistent, suggesting that factors beyond nutrient levels influence cyanobacteria dynamics. Additionally, modeling outputs indicated that chlorophyll *a* was a more reliable predictor of microcystin levels, reinforcing the shift toward chlorophyll *a* as the primary response variable in making support determinations.

Merits of Secchi depth as a Response Variable

Secchi depth was included as a separate response variable in the initial lake nutrient listing methodology (2014) but removed during the 2016 listing cycle. This water clarity measurement is affected by algae, soil particles, and other materials suspended in the water. Although Secchi depth can be used as an indicator of algal abundance and general lake productivity, high concentrations of non-algal suspended materials such as clay or organic matter can increase turbidity and weaken the relationship between Secchi depth and chlorophyll production (Lee 1995). If reduced Secchi depth is due to increased algal levels, there should be a concurrent increase in chlorophyll *a* concentration. Non-algal turbidity is a prominent characteristic of many impoundments in arid Western States (EPA 2000a). The amount of non-algal suspended material can be influenced by weather (i.e., rain, strong winds) or time of day.

Secchi depth will continue to be measured and remains an influential parameter because it is used to estimate the extent of the euphotic zone indicating where to sample for phytoplankton and zooplankton.

Nutrient threshold refinement results

The zooplankton model was favored over the microcystin and hypoxia models because it produced the most sensitive chlorophyll targets. SWQB selected a 10 µg/L chlorophyll target based on the zooplankton model, using a 0.2 slope threshold and a 95% certainty level (Tetra Tech 2025). This target is intended to balance Type I and Type II errors while ensuring protection against trophic decoupling and ensuring practical assessment criteria. Chlorophyll targets derived from similar slope thresholds, certainty levels, and lake temperature groupings varied by only 2-3 µg/L from the selected 10 µg/L target. An analysis of historical data confirmed that chlorophyll *a* targets within this range led to no differences in exceedances, supporting the robustness of the selected target in identifying “true” nutrient impairments.

Studies have determined that a mean chlorophyll *a* concentration below 10 µg/L reduces the frequency and intensity of taste and odor issues as a result of excessive algal growth, and that these issues begin to arise with chlorophyll concentrations of 15-20 µg/L (Smith, et al. 2002; USGS 2006). A recent study analyzing data from 2,192 U.S. lakes found that lakes with chlorophyll *a* concentrations exceeding 10 µg/L had a higher probability of surpassing the World Health Organization's threshold of 20,000 cyanobacteria cells per mL (Handler et al. 2024). This serves as further evidence that chlorophyll *a* target concentrations below 10 µg/L should be used as a numeric threshold to protect against excessive plant nutrients and the resulting undesirable effects in New Mexico’s lentic waterbodies**.**

Using the 10 µg/L chlorophyll target as the basis for the TN and TP models, TN targets ranged from 192-690 µg/L (cold- and coolwater uses were generally associated with lower TN targets than warmwater uses), while TP targets ranged from 18-41 µg/L. TP targets were highest in ecoregion 23, but TP targets did not generally differ by temperature aquatic life use. Further analysis showed minimal differences in threshold exceedances within these TN and TP ranges, leading to the selection of their median values as single-value thresholds for each ecoregion (Table 1).

The revised numeric thresholds in Table 1 and the associated updated assessment framework provide a streamlined approach to evaluating nutrient impairment in New Mexico’s lakes and reservoirs to support Clean Water Act §303(d)/§305(b) assessments. By incorporating recent national and state-level data analysis and removing weak indicators, this approach ensures assessments align with the latest science, guiding future evaluations and adaptive management strategies.

4.0 Assessment Procedures

The following parameters may be used to assess nutrient enrichment and its effects: total nitrogen (TN), total phosphorus (TP), chlorophyll *a* (chl-*a*), dissolved oxygen (DO), and pH. The interpretation of each set of indicators is detailed below. Table 1 presents ecoregion-specific thresholds for TN, TP, and chl-*a* data, Tables 2–3 provide guidance for interpreting these data, and Tables 4–7 outline criteria and interpretation for DO and pH data.

Assessment of the DO and pH response variables are dependent upon the designated aquatic life use and associated numeric criteria in 20.6.4.900 NMAC; established procedures for assessment are discussed elsewhere in the CALM and appendices. If a lake/reservoir is determined to be impaired for plant nutrients as well as DO or pH following respective listing methodologies, the AU will be listed for the causal variable (nutrients) rather than the response variable (DO or pH).

To align with the NLA methodology and ensure accurate nutrient assessments, lake and reservoirs will be sampled during the summer growing season (June–September), with a minimum of two samples collected. Exceedance allowances and associated dataset sizes in this methodology have been designed to reflect the current lake sampling methodology (SOP) and a reduced sampling season of <18 weeks. Despite reduced sample size, this optimized monitoring schema can still provide meaningful assessments of lake eutrophication since sampling is strategically timed to capture peak nutrient effects (EPA 2000b).

Table 1. Nutrient-related impairment threshold values for New Mexico lake and reservoirs

Nutrient Enrichment Indicator (Causal Variables)				**Response Variables**	
Level III Ecoregion	**TN (mg/L)**	**TP (mg/L)***	**chl-*a* (µg/L)**	**Dissolved Oxygen (DO)** (mg/L)**	**pH ****
Colorado Plateaus (20)	≤ 0.463	≤ 0.023	≤ 10	*See NMAC for applicable DO and pH criterion (or see Tables 4 and 6 below)*	
Southern Rockies (21)	≤ 0.387	≤ 0.025	≤ 10		
Arizona/New Mexico Plateau (22)	≤ 0.385	≤ 0.022	≤ 10		
Arizona/New Mexico Mountains (23)	≤ 0.481	≤ 0.04	≤ 10		
Chihuahuan Deserts (24)	≤ 0.488	≤ 0.02	≤ 10		
Southwestern Tablelands (26)	≤ 0.561	≤ 0.021	≤ 10		

NOTES:

***** There are a few instances of segment-specific TP criteria in 20.6.4.97 - 20.6.4.899 NMAC. The SWQB does not use these to determine impairment of the narrative nutrient criteria found at 20.6.4.13(E) NMAC. TP will also be assessed as a separate parameter in these cases, following the procedures detailed in Section 3.1 of the main CALM (https://www.env.nm.gov/surface-water-quality/calm/).

******Dissolved oxygen and pH criteria are based on the designated aquatic life use(s) of the waterbody as assigned in 20.6.4.900(H) NMAC. Additionally, supersaturation of the waterbody (indicated by an average epilimnion DO % saturation greater than 120%, adjusted for elevation, temperature and salinity) may be used as evidence (response variable) for a nutrient impairment.

4.1 Total nitrogen and Total phosphorus concentrations

There is no numeric criterion or definition of "total nitrogen" in 20.6.4 NMAC, nor does 40 C.F.R. Part 136 provide an approved definition. However, TN is generally understood as the sum of Total Kjeldahl Nitrogen (TKN) and Nitrate+Nitrite (NO_3+NO_2). For nutrient assessments, the SWQB calculates "TN Calculated" by summing NO_3+NO_2 and TKN. If either TKN or NO_3+NO_2 is unavailable for a sampling event, TN Calculated is recorded as a "missing data point" and is not assessed under this listing methodology.

The SWQB adds the TKN and NO_3+NO_2 reporting limits, referred to as the minimum reporting limit (MRL) in SQUID, together to determine the "TN Calculated MRL." For this listing methodology, terms related to analytical method sensitivity such as "quantitation limit," "reporting limit," "level of quantitation," and "minimum level" may be synonymous and will be evaluated case by case depending on the analytical laboratory. If the laboratory reports either TKN or NO_3+NO_2 as below the MRL, the SWQB uses the respective MRL value to determine the TN Calculated value for the assessment dataset. If both TKN and NO_3+NO_2 are reported below the MRL, the TN Calculated value is noted as "below the MRL." The respective TP and TN data MRLs for a particular sampling event must be equal to or less than the threshold to be useful for assessment.

The assessor will compare the calculated TN or TP concentration to the threshold values in Table 1 and use Table 2 to interpret TN and TP data to determine if nutrient enrichment is indicated.

Table 2. Interpreting nutrient causal data

Type of Data*	Does not indicate enrichment	Indicates Enrichment	Delisting	Notes
•**Nutrients** (total nitrogen or total phosphorus) **A)** 2-4 samples	**A**) No exceedances (<1) of a threshold value.	**A**) One or more (≥ 1) exceedance of a threshold value.	**A)** No exceedance (<1) of the threshold value(s).	Applicable thresholds are found in Table 1.
B) >4 samples	**B**) Threshold value(s) exceeded in <2 measurements.	**B**) Threshold value(s) exceeded in ≥ 2 measurements.	**B)** No exceedance (<1) of the threshold value(s).	

NOTES: Due to limited sampling resources and a constrictive sampling season (4 months) a minimum of two samples are permissible for this assessment methodology. See Section 2.1.4 Main Listing Methodology (CALM) for details.

4.2 Chlorophyll *a*

In lakes and reservoirs, phytoplankton community composition and biomass are useful parameters for monitoring changes in water quality. Chl-*a* concentration is used as a surrogate for phytoplankton biomass and is generally the most appropriate variable to monitor (EPA 2000a). Chl-*a* levels along with Secchi depths and TP are the measurements most used to characterize the trophic status of lakes and reservoirs. The assessor will compare the chl-*a* concentration to the threshold values in Table 1 and use Table 3 to interpret chl-*a* data to determine if enrichment is indicated**.**

Table 3. Interpreting chlorophyll *a* data

Type of Data	Does not indicate enrichment	Indicates Enrichment	Delisting	Notes
• **Chlorophyll *a*** **A)** 2-4 samples	**A)** chl-*a* concentration does not exceed the applicable threshold value (<1 exceedance).	**A)** chl-*a* concentration is greater than the applicable threshold value in one or more samples (≥ 1 exceedance).	**A)** No exceedance of the applicable threshold.	Applicable threshold values for chlorophyll *a* are found in Table 1.
B) >4 samples	**B**) Threshold value(s) exceeded in <2 measurements.	**B**) Threshold value(s) exceeded in ≥ 2 measurements.	**B)** No exceedance of the applicable threshold.	

NOTES: Due to limited sampling resources and a constrictive sampling season (4 months) a minimum of two samples are permissible for this assessment methodology. See Section 2.1.4 Main Listing Methodology (CALM) for details.

4.3 Dissolved oxygen data

DO levels are a useful indicator of excessive nutrient levels because nutrient enrichment often triggers algal blooms, which deplete oxygen as they decompose, creating unsuitable conditions for aquatic life (hypoxia or anoxia). Although biological impairments related to dissolved oxygen usually result from insufficient DO levels, too much DO, or supersaturation (resulting from extremely high levels of oxygen-generating photosynthesis) also results in negative aquatic life impacts (Cornacchia and Colt 1984). Rapid or large increases in DO may affect organisms by contributing to stressful fluctuations in DO levels, altering redox potentials and bioavailability of potentially toxic substances (e.g., metals), or leading to gas bubble disease (EPA 2021b). DO criteria are based on the designated aquatic life use(s) of the lake or reservoir, as detailed in 20.6.4.900(H) NMAC (Table 6). To determine attainment of DO criteria, the SWQB averages DO measurements taken at vertical intervals for the epilimnion, or in the absence of an epilimnion, for the upper one-third of the water column of the lake. The SWQB assesses DO data following the procedures detailed in the DO Listing Methodology (https://www.env.nm.gov/surface-water-quality/calm/, Appendix E). The SWQB uses information in Tables 4 and 5 to interpret DO data and to determine if nutrient enrichment is indicated. In the cases of dual aquatic life use, the most conservative criterion for the lake is used. Additionally, supersaturation of the waterbody (indicated by an average epilimnion DO % saturation greater than 120%, adjusted for elevation, temperature and salinity[1]) will be examined on a case-by-case basis and may be used as evidence (response variable) for a nutrient impairment.

Table 4. Criteria for dissolved oxygen concentration (20.6.4.900 NMAC)

Aquatic Life Use	DO Criterion
High Quality Coldwater Coldwater Marginal Coldwater	6.0 mg/L
Coolwater Warmwater Marginal Warmwater	5.0 mg/L

Table 5. Interpreting DO response data

Type of Data	Does not indicate enrichment	Indicates enrichment	Delisting	Notes
• **DO data**	DO is "Fully Supporting" according to the *Dissolved Oxygen Listing Methodology.* *	DO is "Not Supporting" according to the *Dissolved Oxygen Listing Methodology.* *	DO is delisted according to the *Dissolved Oxygen Listing Methodology.* *	See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling.

NOTES: * Available at https://www.env.nm.gov/surface-water-quality/calm/, Appendix E. Indication of enrichment based on data points when concurrently-measured percent oxygen saturation ≥ 120% will be further examined to determine the site-specific reason for the high percent saturation.

[1] SWQB sondes and DO logger data software automatically adjust percent saturation and concentration

4.4 pH Grab Data

Waterbody pH level is a useful indicator of excessive nutrient levels because nutrient-driven shifts in primary production and organic matter decomposition can influence pH levels, thereby affecting aquatic health. The criteria for pH are based on the designated aquatic life use(s) of the lake or reservoir, as detailed in 20.6.4.900(H) NMAC. To determine attainment of pH criteria, pH measurements taken at vertical intervals are averaged for the epilimnion, or in the absence of an epilimnion, for the upper one-third of the water column. Data for pH are assessed according to the *pH Listing Methodology* (https://www.env.nm.gov/surface-water-quality/calm/, Appendix F). The information in Tables 6 and 7 is used to interpret pH data and to determine if enrichment is indicated.

Table 6. Criteria for pH (per 20.6.4.900 NMAC)

Aquatic Life Use	**pH Range**
High Quality Coldwater	6.6 to 8.8
Coldwater	
Marginal Coldwater	6.6. to 9.0
Coolwater	
Warmwater	
Marginal Warmwater	

Table 7. Interpreting pH response data

Type of Data	Does not indicate enrichment	Indicates enrichment	Delisting	Notes
• **pH data**	pH is "Fully Supporting" according to the *pH Listing Methodology.**.	pH is "Not Supporting" according to the *pH Listing Methodology.**.	pH is delisted according to the *pH Listing Methodology.* *	See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling.

NOTES: * Available at https://www.env.nm.gov/surface-water-quality/calm/, Appendix F.

4. 5 Analysis and Interpretation

SWQB applies the threshold values selected for New Mexico lakes and reservoirs listed in Table 1 in a weight-of-evidence approach to assess data collected at the representative station which is typically the shallow/beach station when data are available. The SWQB strives to collect the full suite of causal and response indicators during nutrient surveys. Occasionally, data may be missing for a particular indicator due to equipment malfunction, sampling complications, or laboratory errors. While the full suite of parameters must be available to determine *Fully Supporting* using this listing methodology, it is permissible to determine *Not Supporting* using a partial dataset as detailed below. When multiple monitoring stations exist on a lake or reservoir they are usually sampled on the same day or within the same seven-day period. The nutrient listing methodology shall be applied to the station that is considered most representative of impacts to the designated use being assessed.

A lake or reservoir is **Fully Supporting** with respect to New Mexico's narrative nutrient standard if the minimum number of samples with assessable data for all indicators were collected concurrently, and assessment results in one of the following for all assessable data: 1) one or none of the variables (causal or response) indicating enrichment, or 2) total nitrogen and/or total phosphorus (causal indicator) indicate enrichment, but there was no indication of a biological or chemical response to elevated nutrients (i.e., no *chl-a* or response variables indicate enrichment). For 2-4 assessable datasets there may be no non-support conclusions, and for >4 assessable datasets there may be only one non-support conclusion for the waterbody to be listed as full support for plant nutrients.

A lake or reservoir is **Not Supporting** if at least the minimum number of samples were collected concurrently, and assessment results in one of the following for all assessable data: (1) *at least* one causal variable (TN or TP) and one response variable (or *chl-a*) indicating enrichment, or (2) if chl-*a* and one other response variable (DO or pH) indicate enrichment. This second scenario is intended to account for situations in which the lake is receiving a significant nutrient load, but the nutrients are quickly being assimilated into the biomass of the lake, hence nutrient concentrations below the thresholds but undesirable effects (refer to example "Lake Two" in Table 8). For 2-4 assessable datasets there must be one or more non-support conclusions, and for >4 assessable datasets there must be two or more non-support conclusions for the waterbody to be listed as impaired for plant nutrients.

The assessor compares each available indicator to the associated impairment threshold using Tables 1 – 7 to determine if any variables indicate potential nutrient enrichment. Nutrient concentrations (TP and TN) are considered causal variables. Chl-*a*, pH and DO are considered response variables.

Waterbodies may be delisted for nutrient impairment based on new information. Delisting only applies to situations where new data indicate that water quality has improved and a currently listed waterbody is no longer impaired according to the current listing methodology, or a water quality standard has changed, and reassessment indicates full support. Delisting decisions require the same information as listing decisions. However, due to the relatively low number of samples collected, some waterbodies may be delisted when the impairment cause persists. To increase confidence in delisting decisions for nutrients, a currently listed waterbody must meet all assessment thresholds (i.e., site TN and TP numeric thresholds, chlorophyll *a*, DO, and pH thresholds) for delisting.

Figure 2 contains a generalized flowchart for determining nutrient impairment. Table 8 provides several examples of how nutrient assessments will be conducted following these rules.

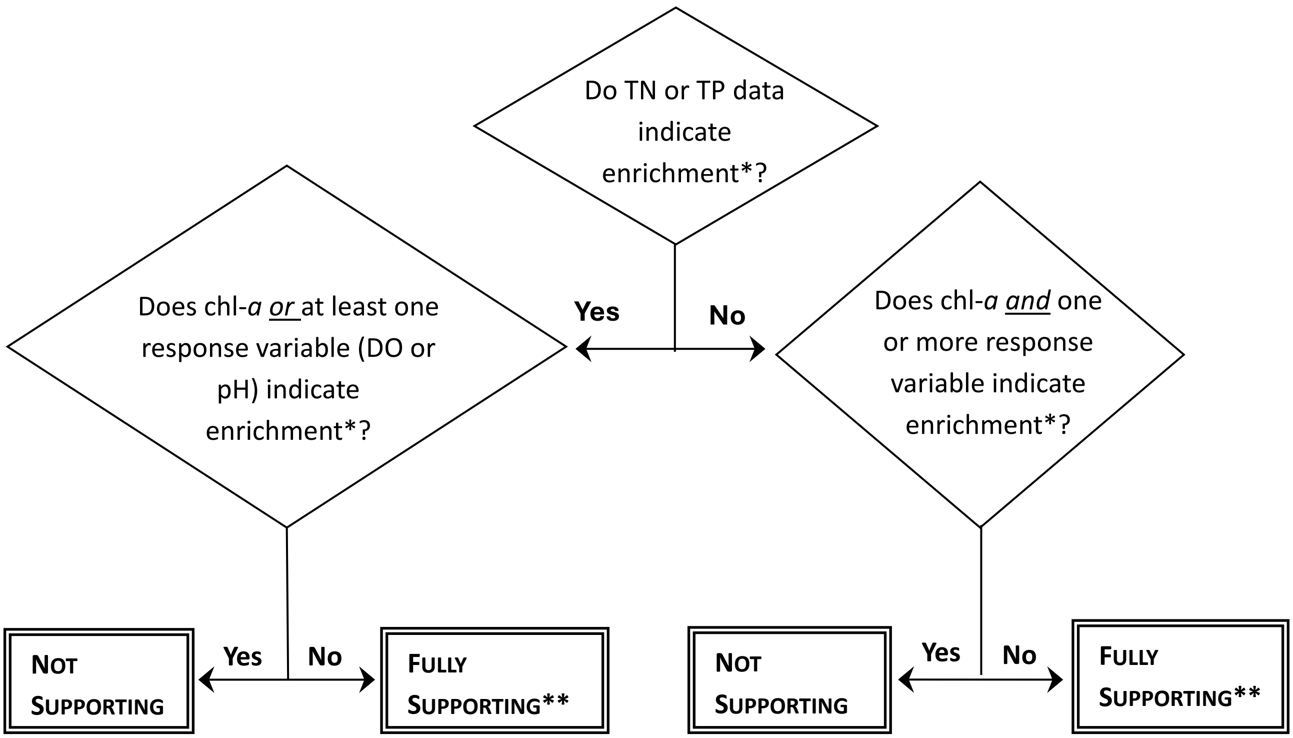

Figure 2. Generalized flowchart for determining nutrient impairment in NM lakes and reservoirs

NOTES: *Enrichment is determined using Tables 1-7.
**All indicators ("assessable dataset") must be sampled concurrently to determine Fully Supporting.

Table 8. Examples of lake and reservoir nutrient assessments*

Indicators	**Lake One** *Ecoregion 20*	**Lake Two** *Ecoregion 21*	**Lake Three** *Ecoregion 23*	**Lake Four** *Ecoregion 24*
TP (mg/L)	0.015	0.023	0.02	**<u>0.051</u>**
TN (mg/L)	0.249	0.35	0.29	**<u>2.06</u>**
Chlorophyll *a* (µg/L)	0.28	**<u>15.4</u>**	**<u>12</u>**	**<u>23</u>**
DO impairment per DO AP	**<u>Yes^</u>**	**<u>Yes</u>**	No	No
pH impairment per pH AP	No	No	No	No
Nutrient Impairment Determination	Full Support^	**Non Support**	Full Support	**Non Support**

NOTES: *Each value in this table represents one sample, and each lake in this example has fewer than 5 assessable datasets. Actual lake nutrient assessments will typically have one to four values for each indicator. The SWQB uses Tables 1 – 7 to interpret data. Exceedances of the applicable threshold values are **bolded and <u>underlined</u>**.

^In this example, DO would be noted as impaired per the DO listing methodology. If excessive nutrients (TN or TP) are determined to be the cause of the impairment (as evidenced by either surpassing their respective thresholds) then the lake will be listed for plant nutrients only.

<u>REVISION HISTORY:</u>

2014 listing cycle – **Pre-Public Comment**: Original. **Post Public Comment**: Minor edits and clarification to various sections, including DO assessment procedures and lake groups.

2016 listing cycle – Revised to indicate that all indicators must be available to determine Full Support while Non Support can be determined with a partial dataset. Removed application to deep station only. pH added as a response variable. Secchi depth was removed as a specific response variable (see details in Section 2.0). Added alternative Dissolved Inorganic Nitrogen calculation in the absence of usable TKN data.

2018 listing cycle – “Assessment Protocol” changed to “Listing Methodology.” Minor wording clarifications. Addition of 2016 USGS cyanobacteria reference. Removed alternative TN calculation using Dissolved Inorganic Nitrogen in the absence of useable TKN data based on rarity of occurrence and consistency with how missing data are handled in other listing methodologies. Changed Table 4 from “1 to 10” to “2 to 10” because n=2 is a minimum data requirement for assessment (added related footnote).

2020 listing cycle – Website address changes only. Minor wording revisions and clarifications. Increased minimum n from 2 to 4 samples.

2022 listing cycle – **Pre-Public Comment**: Delisting criteria added to Tables 4, 5, 7, and 9. Added narrative information regarding delisting. Provided information on draft EPA national nutrient criteria. Added information regarding 2019 EPA documents recommending criteria for microcystins and cylindrospermopsin (added to references) and the subsequent SWQB proposal to add numeric criteria to the WQS during the 2020 triennial review process. **Post-Public Comment**: No changes.

2024 listing cycle – **Pre-Public Comment**: Provided information on the updated EPA 304(a) lake nutrient criteria and their applications to updated lake nutrient assessment thresholds (ongoing project). Provided information on the updated EPA guidance containing human health and recreation use recommendations for microcystin and cylindrospermopsin exposure, addition of numeric criteria to the WQS during the 2020 triennial review (subsequent 2023 EPA-approval), and their application to primary contact use assessments. Corrected a typographical error in Table 5 row 2 in which the type of data should read >10 samples (since the criteria above was 1-10 samples). Minor wording revisions and clarifications. **Post-Public Comment:** No changes.

2026 listing cycle – **Pre-Public Comment**: Significantly revised listing methodology and thresholds for TN, TP and chl-*a* based on updated EPA 304(a) lake nutrient criterion models. Revised methodology and tables to align with EPA 304(a) models and additional state-specific work (NSTEPS project), including grouping lakes and reservoirs via ecoregion level III instead of temperature class. All sections were significantly revised for clarity. Removed percent cyanobacteria as response indicators. Exceedance allowances and associated dataset sizes were revised to reflect the current lake sampling methodology and a reduced sampling season of <18 weeks. **Post-Public Comment:**

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APPENDIX E

PUBLIC COMMENT DRAFT

DISSOLVED OXYGEN LISTING METHODOLOGY

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document establishes a listing methodology for determining impairment due to dissolved oxygen (DO) excursions in streams, rivers, lakes, and reservoirs. This protocol is not applicable to streams with limited aquatic life use and wetlands because the research and implementation procedures necessary have not been investigated or developed by the Surface Water Quality Bureau (SWQB) or adopted in 20.6.4 NMAC.

1.0 Introduction/Background

Oxygen content in fresh waters is determined by several factors acting in concert. These factors include temperature, atmospheric pressure, salinity, turbulence, and photosynthetic activity of algae and plants in the water. Healthy aquatic systems have DO content that is at or near 100% saturation[1]. Oxygen content may fall substantially below 100% saturation during the night when oxygen consumption coupled to the heterotrophic decay of organic matter, and other ecosystem respirations, reduce DO in the water column (Deas and Orlob 1999). Diel changes in DO content are normal and can be particularly pronounced in systems with excessive nutrient enrichment and consequent enhanced algal and plant growth (DO "supersaturation"). See the SWQB Nutrient Listing Methodologies (available at: https://www.env.nm.gov/surface-water-quality/calm/) for more details.

Currently, New Mexico's criteria for DO are expressed only in units of mass per volume (mg/L). However, in certain circumstances such as high altitudes where atmospheric pressure is comparatively low or where high air temperatures reduce oxygen solubility (and particularly when these two conditions are both present), DO may be reduced so much so that the concentration-based criterion is physically impossible to attain. New Mexico's listing methodology also considers concurrent percent saturation because this integrates several naturally-occurring factors that influence the amount of oxygen that water can contain. Specifically, the SWQB will further examine listing based on data points when concurrently measured percent saturation was greater than or equal to 90%, to determine the site-specific reason for the high percent saturation. Surrounding states have also incorporated percent saturation into their impairment determinations. For example, water quality criteria for DO concentration in Arizona are considered to be met if the measured DO percent saturation is equal to or greater than 90 percent. Arizona has incorporated this approach into their water quality standards (AAC 2013). In addition to ensuring adequate DO percent saturation, SWQB may also consider DO supersaturation (>120%) when assessing nutrient enrichment (see Appendix D for nutrients in lakes and reservoirs for more information).

2.0 Data Collection Procedures and Considerations

In flowing waters with excessive aquatic plant growth, DO data typically exhibit a diel pattern that is usually at its lowest (i.e., most likely to not meet the criteria) in the early morning. For these reasons, continuous recording devices (sondes or data loggers) are used to record diel fluctuations, especially where excessive aquatic plant growth is suspected or evident.

SWQB typically deploys sondes or DO data loggers in streams and rivers to record parameters including DO, pH, specific conductance, temperature, and turbidity. If DO is the only parameter of concern, DO data loggers may be deployed instead of sondes. Sondes and DO data loggers are deployed and the data reviewed following the guidelines specified in the SWQB Standard Operating Procedures (SOPs, available at: https://www.env.nm.gov/surface-water-quality/sop/). DO data from periods where the record indicates

[1] All references to saturation are defined as percent saturation at the local elevation, as opposed to global percent saturation (the percent saturation a given concentration would be at sea level).

that the sonde or DO data logger was exposed or buried are censored and not used for assessment. Sondes or DO data loggers should be used to collect DO data in order to observe diel fluctuations, as opposed to the “snapshot” that grab data provide; however, in some cases only grab data are available. The preferred sonde deployment period for measuring DO is within the growing season to capture any effects of potential excessive aquatic plant growth, however, growing season and ideal deployment windows may vary depending on elevation (Table 1). Additionally, SWQB will monitor atmospheric temperature and use best professional judgment to ensure sondes or DO data loggers are deployed when temperatures are high enough to ensure adequate effects of temperature on DO are captured during the deployment.

Table 1. Growing seasons for New Mexico river and streams site classes

Site Class	Level 3 Omernik Ecoregion	Growing Season
Mountain >7500 ft	22 & 23	July 1-Oct 15
Mountains <7500 ft & Plateau	20, 21, 22 & 23	Jun 15-Nov 1
S. Deserts and Plains	24, 25, 26, & 79	May 15-Nov 15

For rivers and streams, sonde or DO data logger data sets deployed for ≥72 hours with a maximum one-hour frequency interval are preferred for assessment purposes and required to determine Full Support of the applicable criteria. The likelihood of capturing adequate data to determine natural vs. anthropogenic influences on DO concentrations increases with more sonde or DO data logger data, so longer deployments with interim equipment checks and data downloads are encouraged. DO listings based on grab data from streams or rivers will be noted as Category 5C (needing sonde or DO data logger data to confirm).

Reviewers of long-term data should make note of other factors that may cause DO excursions due to natural increases in biological oxygen demand (BOD), such as deciduous litter drop or post-fire stormflow events. If these conditions were present during data collection, the reviewer should include a sampling event comment.

The SWQB is exploring the feasibility of continuous data collection (sonde deployments) in lakes and reservoirs. If it is determined that sondes or DO data loggers can be safely deployed in this waterbody type and generate data that can meet 20.6.4.14(C)(3) NMAC, the SWQB will develop a standard operating procedure and listing methodologies for lake continuous monitoring data.

3.0 Assessment Procedure

New Mexico DO criteria found in 20.6.4.900(H) NMAC (available at: https://www.env.nm.gov/surface-water-quality/wqs/) are based on the water body's aquatic life use designation (Table 2). The SWQB typically deploys sondes or DO loggers for three (≥ 72 hours) to seven days to record at least hourly DO values. Sonde or data logger data sets greater than 72 hours with a maximum one-hour frequency interval are required to use the continuously recorded data set assessment method in Table 3. If sonde DO data with this level of resolution is not available, the instantaneous grab method is used to determine attainment. DO impairment listings determined from grab data from streams or rivers will be noted as Category 5C and prioritized for sonde or logger deployment to confirm the assessment.

Table 2. New Mexico's DO criteria

Aquatic Life Use	DO Criterion*
High Quality Coldwater Coldwater Marginal Coldwater	6.0 mg/L or more
Coolwater Warmwater Marginal Warmwater	5.0 mg/L or more
Limited	No default established

NOTES: * Listing based on data points when concurrently-measured percent saturation was greater than or equal to 90% will be further examined to determine the site-specific reason for the high percent saturation.

A determination of Not Supporting is made if there are DO criteria excursions for four or more consecutive hours on more than one day. Each dataset is evaluated for the presence of statistical outliers, which are reviewed and censored if not representative of ambient conditions. A potential outlier is defined as a DO value lower than the 25th percentile (Q1) of the measured daily minimum DO values minus three times the inter-quartile range (IQR). The IQR is defined as the difference between the 25th percentile (Q1) and the 75th percentile (Q3) (Tukey 1977, Seo 2006). This approach is intended to 1) reduce the influence from autocorrelation of continuous data, 2) demonstrate the repeatability of an observation and 3) take into consideration potential anomalies in the DO data set due to extreme deviations from seasonal norms, other anomalous events such as runoff from catastrophic fire areas, or instrument errors. Anomalies are determined in either the 15-min or 1-hour SWQB Long-term Dataset (LTD) Data Management Spreadsheet based on the sampling interval[2]. Non-assessable data are censored to generate the final assessment dataset.

Waterbodies may be delisted for DO impairment based on new information. Delisting only applies to situations where new data indicate that water quality has improved and a currently listed waterbody is no longer impaired according to the current listing methodology, or a water quality standard has changed and reassessment indicates full support. Delisting decisions require the same information as listing decisions. However, due to the relatively low number of samples collected and short periods represented by continuous data, some waterbodies may be delisted when the impairment cause persists. To increase confidence in delisting decisions, delisting requires a minimum of 72-hours of continuous 15-minute or

[2] For a copy of this spreadsheet, please visit https://www.env.nm.gov/surface-water-quality/sop/.

hourly data with DO criteria excursions below the applicable criterion for fewer than four consecutive hours on more than one day.

Table 3. Determination of aquatic life use support using DO data

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•Instantaneous (grab) DO data **A)** Rivers or streams	**A)** Not assessable (cannot determine Fully Supporting with grab data only)	**A)** DO criteria excursions in ≥ 10% of measurements, or more than one (>1) measurement if 4 to 10 data points are available. [a]	**A)** Cannot delist with grab data only.	[a] DO listings based on grab data will be noted as Category 5C (need sonde data to confirm). Fewer than 4 samples = not assessed for full support. See Section 2.1.4 Main Listing Methodology (CALM) for details. [b] Lakes are typically sampled once in the spring, fall, and summer. DO measurements taken at intervals are averaged for the epilimnion, or in the absence of an epilimnion, for the upper one-third of the water column of the lake to determine attainment of DO criteria. See 20.6.4.14(C)(3) NMAC for additional information.
B) Lakes or reservoirs[b]	**B)** No (<1) DO criteria excursions[b]	**B)** 1 or more (≥1) DO criteria excursions[b]	**B)** No (<1) DO criteria excursions	
•Continuously recorded DO data (≥72 hours, ≤1 hour frequency interval)	No DO criteria excursion(s) for four or more consecutive hours on more than one day.	DO criteria excursions for four or more consecutive hours on more than one day, and the excursions are not outliers. [c] [d]	≥72 hours of valid data required. DO criteria excursion(s) for fewer than four consecutive hours on more than one day.	[c] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet. Listing based on data points when concurrently-measured percent saturation was greater than or equal to 90% will be further examined to determine the site-specific reason. [d] If an AU is determined to be impaired for both excessive nutrients and DO following respective listing methodologies, the AU will be listed for the causal variable (nutrients) rather than the response variable (DO).

REVISION HISTORY:

2014 listing cycle – Clarified concurrent minimum approach (i.e., ≥90% saturation = no excursion of criterion). Removed "Additional Thresholds Under Consideration" section (passed on to the SWQB Standards and Reporting Team for evaluation). Clarified relationship between nutrient and DO assessments.

2016 listing cycle – Minor wording clarifications. Reduced grab data Non Support for lakes to 1 or more excursions because lakes are typically sampled once in the spring and fall, and twice in the summer; each seasonal sampling event is intended to be representative of the entire season. Changed ≥90% saturation = no excursion of criterion exclusion to further review of associated data vs. censoring of these data from the assessment dataset.

2018 listing cycle – "Assessment Protocol" changed to "Listing Methodology." Added reference to data logger. Removed reference to segment-specific DO criteria in 20.6.4.113 NMAC because they no longer exist. Changed Table 2 from "10 or fewer" to "2 to 10" because n=2 is a minimum data requirement for assessment (added related footnote).

2020 listing cycle – Clarified that growing season is preferred sonde deployment period. Added reference to the SWQB Field Sampling Plans for additional sonde deployment information.
Added a provision to test and remove statistical outliers in long-term DO dataset prior to assessment.

2022 listing cycle – **Pre-Public Comment:** Delisting criteria added to Table 3. Added delisting narrative description. Clarified treatment of statistical outliers. **Post-Public Comment:** The requirement for delisting dissolved oxygen was revised to a minimum of 72 hours continuous data.

2024 listing cycle – Pre-Public Comment: No changes made. **Post-Public Comment:** No changes.

2026 listing cycle – Pre-Public Comment: Minor clarifications and corrections. Added clarification that n<4 grab data cannot be used for full support determinations in rivers/streams. **Post-Public Comment:**

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APPENDIX F

PUBLIC COMMENT DRAFT

pH LISTING METHODOLOGY

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document establishes a listing methodology for determining impairment due to pH excursions in streams, rivers, lakes, and reservoirs. This protocol is not applicable to streams with limited aquatic life use and wetlands because the research and implementation procedures necessary have not been investigated or developed by the Surface Water Quality Bureau (SWQB) or adopted in 20.6.4 NMAC.

1.0 Introduction/Background

The pH of a solution is a measure of its acidity or basicity and is calculated as the inverse log of the hydronium ion concentration ($pH = -\log_{10} [H_3O^+]$). In water, pH is a measure of the acid-base equilibrium resulting from various dissolved compounds and gases. A pH value of 7.0 is considered neutral. That is, at pH 7, the concentration of hydrogen ions ($[H^+]$) is equal to that of hydroxide ions ($[OH^-]$). The principal buffering system regulating pH in natural waters is the carbonate-bicarbonate system, composed of carbon dioxide (CO_2), carbonic acid (H_2CO_3), bicarbonate ion (HCO_3), and carbonate ion (CO_3). Gradual, non-linear deterioration of a water's ability to support aquatic life occurs as pH values depart from neutral. A range of pH values from 5.0 to 9.0 is not directly lethal to fish; however, the toxicity of some pollutants (e.g., ammonia or copper) can be substantially affected by pH changes within this range (EPA 1986). At pH values above 9.0, fish have difficulty excreting ammonia across the gill epithelium.

In New Mexico, typical pH values in surface waters that are largely unaffected by anthropogenic disturbance vary approximately from 7.5 to 8.7. An exception, Sulphur Creek in the Jemez River watershed, has documented natural background pH values as low as 2.4 as a result of parent lithology and geothermal influences. Accordingly, segment-specific criteria have been established for this stream.

2.0 Data Collection Procedures and Considerations

An increase in pH values can result from the decrease of carbonic acid when carbon dioxide, carbonate, and bicarbonate are used by plants during photosynthesis. Thus, when high levels of nutrients lead to excessive plant productivity, pH values above 9.0 may occur during daylight hours. During the night, when photosynthesis does not occur, the pH value drops. The result is a daily or "diel" fluctuation of pH values that lags behind the diel fluctuation observed in dissolved oxygen concentrations. Dissolved oxygen (DO) concentration is at its lowest in the early morning in areas of excessive aquatic plant growth. This contrasts with the diel pattern of pH values, which are most likely to have an excursion of the criteria late in the day. For these reasons, it is best to use continuous recording devices (sondes) to record pH values, especially where excessive aquatic plant growth is evident.

The SWQB typically deploys sondes to record DO, pH, specific conductance, temperature, and turbidity values over a specific period of time. Sondes are deployed and the data reviewed following the guidelines specified in the SWQB Standard Operating Procedures (SOPs, available at: https://www.env.nm.gov/surface-water-quality/sop/). Sondes should be used to collect pH data to observe a more complete picture of any diel fluctuations, as opposed to the "snapshot" that grab data provide; however, in some cases only grab data are available. For rivers and streams, sonde data sets deployed for ≥72 hours with a maximum one-hour frequency interval are preferred for assessment purposes and required to determine Full Support of the applicable criteria. For SWQB collected data, additional information regarding the preferred timing of sonde deployment is typically provided in applicable Field Sampling Plans or Water Quality Survey Reports (available at: https://www.env.nm.gov/surface-water-quality/water-quality-monitoring/). The likelihood of capturing adequate data to determine natural vs. anthropogenic influences on pH concentrations increases with more sonde data, so longer sonde deployments with interim equipment checks and data downloads are encouraged. pH listings based on grab data from streams or rivers will be noted as Category 5C (i.e., needing sonde data to confirm).

The SWQB is exploring the feasibility of continuous data collection (sonde deployments) in lakes and reservoirs. If it is determined that sondes can be safely deployed in this waterbody type and generate data that can meet 20.6.4.14(C)(3) NMAC, the SWQB will develop a standard operating procedure and listing methodologies for lake continuous monitoring data.

3.0 Assessment Procedure

New Mexico pH criteria found in 20.6.4.900(H) NMAC (available at: https://www.env.nm.gov/surface-water-quality/wqs/) are based on the aquatic life designated use (Table 1). There are two segment-specific pH criteria for Sulphur Creek (20.6.4.108 and 20.6.4.124 NMAC).

Table 1. New Mexico's pH criteria

Aquatic Life Use	pH Range
High Quality Coldwater Coldwater	6.6 to 8.8
Marginal Coldwater Coolwater Warmwater Marginal Warmwater	6.6. to 9.0
Limited	No default established

Sonde data sets greater than or equal to 72 hours with a maximum one-hour frequency interval are required to assess using the continuously recorded data set assessment method in Table 2. If sonde pH data with this level of resolution is not available, the instantaneous grab method is used to determine attainment. pH impairment listings determined from grab data for streams and rivers will be noted as Category 5C and prioritized for sonde deployment to confirm the assessment.

Waterbodies may be delisted for pH impairment based on new information. Delisting only applies to situations where new data indicate that water quality has improved and a currently listed waterbody is no longer impaired according to the current listing methodology, or a water quality standard has changed and reassessment indicates full support. Delisting decisions require the same information as listing decisions. However, due to the relatively low number of samples collected and short periods represented by continuous data, some waterbodies may be delisted when the impairment cause persists. To increase confidence in delisting decisions, delisting requires a minimum of 72 hours of continuous 15-minute or hourly data with no pH criteria excursions beyond the applicable criterion for greater than four consecutive hours on more than one day.

Table 2. Determination of aquatic life use support using pH data

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
•Instantaneous (grab) pH data **A)** Rivers or streams[a] **B**) Lakes or reservoirs[b]	**A)** Not assessable (cannot determine Fully Supporting with grab data only) **B)** No (<1) pH criteria excursions[b]	**A)** pH criteria excursions in ≥10% of measurements, or more than one (>1) measurement if 4* to 10 data points are available. [a] **B)** 1 or more (≥1) pH criteria excursions[b]	A) Cannot delist with grab data only. **B)** No (<1) pH criteria excursions	[a]pH listings in rivers and streams based on grab data will be noted as Category 5C (need sonde data to confirm). Fewer than 4 samples = not assessed for full support. See Section 2.1.4 Main Listing Methodology (CALM) for details. [b] Lakes are typically sampled once in the spring, summer and fall. pH measurements taken at intervals are averaged for the epilimnion, or in the absence of an epilimnion, for the upper one-third of the water column of the lake to determine attainment of pH criteria. See 20.6.4.14(C)(3) NMAC for additional information regarding lake sampling. [c] Statistical outliers are identified prior to assessment via the SWQB LTD Data Management Spreadsheet.
•Continuously recorded pH data (≥72 hours, ≤ one hour frequency interval)	No pH criteria excursion(s) for four or more consecutive hours on more than one day	pH criteria excursions for four or more consecutive hours on more than one day, and the excursions are not outliers. [c]	≥72 hours of valid data required. No pH criteria excursion(s) for four or more consecutive hours on more than one day	

REVISION HISTORY:

2014 listing cycle – Minor clarifications.

2016 listing cycle – Removed pH 9.5 upper threshold because not supported in EPA's pH criteria guidance (EPA 1986). Reduced grab data Non-Support for lakes and reservoirs to 1 or more excursions because lakes and reservoirs are typically sampled once in the spring and fall, and twice in the summer; each seasonal sampling event is intended to be representative of the entire season. Changed 24-hour floating average approach to more conservative 4 consecutive hour approach to better align with existing pH water quality standards and DO assessment protocol.

2018 listing cycle – "Assessment Protocol" changed to "Listing Methodology." Removed Table 2 note regarding pH as a nutrient response variable because pH is no longer a response variable in the nutrient listing methodology. Changed Table 2 from "10 or fewer" to "2 to 10" because n=2 is a minimum data requirement for assessment (added related footnote).
2020 listing cycle – Added reference to SWQB Field Sampling Plans for additional sonde deployment information.

2022 listing cycle - **Pre-Public Comment:** Delisting narrative added, and delisting criteria added to Table 2. Minor clarifications, rewording, and updated links. **Post-Public Comment:** The requirement for delisting pH was revised to a minimum of 72 hours of continuous data.

2024 listing cycle – Pre-Public Comment: No changes made. **Post-Public Comment:** No changes made.

2026 listing cycle – Pre-Public Comment: Minor clarifications and corrections. Added clarification that n<4 grab data cannot be used for full support determinations in rivers/streams. **Post-Public Comment:**

REFERENCES:

U.S. Environmental Protection Agency (EPA). 1986. Quality criteria for water 1986. Washington, D.C. Available at: http://water.epa.gov/scitech/swguidance/standards/criteria/current/upload/2009_01_13_criteria_redbook.pdf.

APPENDIX G

PUBLIC COMMENT DRAFT

SEDIMENTATION/SILTATION LISTING METHODOLOGY FOR STREAMS AND RIVERS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document establishes a listing methodology for determining impairment due to excessive sedimentation/siltation (otherwise referred to as stream bottom deposits or SBD) in wadeable, perennial streams. This assessment is only conducted in wadeable, perennial streams at this time because the research used to develop this listing methodology is based upon data and information collected in perennial streams. The Surface Water Quality Bureau (SWQB) will include other waterbody types as additional information becomes available and applicable assessment thresholds are developed.

This protocol was developed to support an interpretation of the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* narrative standard for bottom deposits found at 20.6.4.13 NMAC (https://www.env.nm.gov/surface-water-quality/wqs/):

> ***A. Bottom Deposits and Suspended or Settleable Solids:***
> *(1) Surface waters of the state shall be free of water contaminants including fine sediment particles (less than two millimeters in diameter), precipitates or organic or inorganic solids from other than natural causes that have settled to form layers on or fill the interstices of the natural or dominant substrate in quantities that damage or impair the normal growth, function, or reproduction of aquatic life or significantly alter the physical or chemical properties of the bottom.*

In 2008, the SWQB Sediment Workgroup was formed to review the previous sedimentation/siltation listing methodology and recommend an approach for revision. As a result of workgroup discussions, the SWQB and the U.S. Environmental Protection Agency (EPA) Region 6 contracted with Tetra Tech, Inc. to develop sediment translators or thresholds. Tetra Tech, Inc. generally followed the steps provided in EPA's Framework for developing suspended and bedded sediment (SABS) water quality criteria (EPA 2006). To address the "*from other than natural causes*" portion of the criterion, Level IV ecoregions were used to classify and group sites to examine distributions and define reference conditions that account for New Mexico's varied associated geological and physiographic characteristics around the state. Several staff from Tetra Tech, Inc., EPA Region 6, and the SWQB worked as a team to complete this effort.

This effort included the identification of sediment characteristics that can be expected under the range of environmental settings in New Mexico, especially in undisturbed or best available reference streams. The goal of this characterization was to enable the SWQB to identify situations where sedimentation/siltation expectations are not met, using sediment indicators that show responsiveness to disturbance. Examining the relationships between biological measures and sediment indicators helped to identify where disturbance caused sediment imbalance and biologically-relevant habitat degradation. The results of these analyses led to quantitative sedimentation indicator threshold recommendations for New Mexico perennial streams.

The 100+ page report (Jessup et al. 2010) detailing this effort, plus information on additional bedded sediment indictors as well as suspended sediment indicators, is available at https://www.env.nm.gov/surface-water-quality/sedimentation/. The SWQB also generated a Sedimentation/ Siltation Thresholds Development Plan (NMED/SWQB 2011), which summarizes the seven steps taken to develop recommended bedded sediment thresholds, available at the same web site. For historical purposes, this plan includes an abbreviated description of the previous sedimentation listing methodology utilized during the 1998 – 2010 listing cycles as Attachment A.

Exclusions

This protocol is not applicable to the following water body types because the necessary research and assessment methods are not yet developed for New Mexico:

- Lakes or reservoirs
- Large rivers (non-wadeable)
- Intermittent streams which include water bodies under 20.6.4.98 or 20.6.4.128 NMAC
- Ephemeral streams which include water bodies under 20.6.4.97 or 20.6.4.128 NMAC
- Wetlands or playas

The SWQB is distinguishing rivers from streams by defining systems that cannot be monitored effectively with the biological and habitat methods developed for wadeable streams. These rivers also generally meet the Simon and Lyons (1995) definition of great rivers as those having drainage areas greater than 2,300 square miles (mi^2). There are many systems is in New Mexico that meet the great river definition but are usually suitable to wadeable stream monitoring methods due to the arid nature of the region. For sedimentation monitoring and assessment purposes, the systems included in the "Large Rivers" water body type, and consequently exempt from this protocol, are the non-wadeable portions of the:

1. San Juan River from below Navajo Reservoir to the Navajo Nation boundary near Four Corners,
2. Animas River from the Colorado border to the San Juan River,
3. Rio Grande in New Mexico,
4. Pecos River from below Sumner Reservoir to the Texas border,
5. Rio Chama from below El Vado Reservoir to the Rio Grande,
6. Canadian River below the Cimarron River, and
7. Gila River below Mogollon Creek.

Fine sediment benchmarks in representative riffle areas were previously developed for the San Juan and Animas Rivers. In 2002, the SWQB received a grant to develop a protocol for the determination of sedimentation impairment in these rivers. The SWQB contracted with the U.S. Department of Agriculture (USDA) National Sedimentation Lab (NSL) to provide technical support on the project (Heins et al. 2004). The SWQB used the results of this study to develop a repeatable, quantitative assessment procedure for determining whether New Mexico's current narrative sedimentation standard is being attained in the San Juan and Animas rivers. The NSL study resulted in the determination of fine sediment benchmarks for representative riffles areas in Ecoregion 22 as well as various river reaches in the San Juan River basin. The SWQB used these benchmarks to establish one fine sediment threshold for the San Juan and Animas Rivers and compared the measured bed material characteristics of the stream reach of concern to this fine sediment threshold. This procedure was used to assess the San Juan and Animas rivers for development of the 2004-2006 Integrated List and was applied to subsequent data collected during non-wadeable conditions with comparable sampling methods to determine potential sedimentation impairment in these rivers. This document and the entire NSL report is available at: https://www.env.nm.gov/surface-water-quality/sedimentation/. A hybrid approach was used to assess the San Juan and Animas Rivers for sedimentation on the 2012-2014 Integrated Report following the 2010 watershed survey (see the Assessment Rationale for these assessment units for details). The SWQB hopes to develop a sedimentation listing methodology applicable to all non-wadeable river reaches listed above in the future. However, the hybrid approach will continue to be used until a non-wadeable rivers methodology is developed and listings resulting from the hybrid approach will be placed in IR category 5C with a note that further data collection is needed.

1.0 Introduction/Background

Excessive fine sediment filling the interstitial spaces in stream bottom substrate provides sub-optimum habitat for many fish and aquatic insect communities. Excessive fine sediment occurs when biologically-important habitat components, such as spawning gravels and cobble surfaces, are physically covered by fine particles (Chapman and McLeod 1987). Excessive fine sediment can result in decreased inter-gravel oxygen, as well as reduced or eliminated quality and quantity of habitat for fish, macroinvertebrates, and algae (Lisle 1989, Waters 1995). Chapman and McLeod (1987) found that bed material size is related to habitat suitability for fish and macroinvertebrates and that excess sediment decreased both density and diversity of aquatic insects. Specific aspects of sediment-invertebrate relationships can be described as follows: 1) abundance of certain invertebrate taxa is correlated with substrate particle size; 2) fine sediment reduces the abundance of sediment intolerant taxa by reducing interstitial habitat normally available in large-particle substrate (e.g., gravel or cobbles); and 3) community composition changes as substrate particle size changes from large to small (e.g., sand, silt, or clay) (Waters 1995).

Sediment loads that exceed a stream's sediment transport capacity can trigger changes in stream morphology (Leopold et al. 1964). Streams that become overwhelmed with sediment often go through a period of accelerated channel widening and streambank erosion before returning to a stable form (Rosgen 1994). These morphological changes can accelerate erosion, reduce habitat diversity (e.g., pools, riffles, etc.), and place additional stress on the designated aquatic life use.

Substrate characteristics may be considered impacted at a site if they are: 1) not similar to expectations for undisturbed sites in the same environmental setting; or 2) measurably affecting the biota. In the first case, substrate may be more fine, more coarse, more unstable, or more stable than expected under broadly recognized, undisturbed conditions (i.e., reference or best available conditions) for that particular environmental setting. In the second case, biotic responses to disturbed substrates can be variable, but sub-optimal biotic conditions are often associated with unbalanced sediment loads.

Bedded sediments cannot be treated as introduced pollutants such as pesticides because they are not uniquely generated through human input or disturbance. Rather, bedded sediments are components of natural systems that are present even in pristine settings and to which stream organisms have evolved and adapted. Therefore, the detection of a sediment imbalance is more complicated than detecting an absolute concentration or percentage that represents a clear biological impact (Jessup et al. 2010).

The approach used to identify sedimentation/siltation thresholds for wadeable, perennial streams in New Mexico followed seven basic steps:

1. Review background information
2. Assemble datasets
3. Establish reference sites
4. Classify sites
5. Characterize sediments
6. Describe stressor-response relationships
7. Recommend thresholds or benchmarks

These steps are generally based on the EPA Framework for developing SABS water quality criteria (EPA 2006). The details of each step are available in summary form or in entirety in separate documents available on the SWQB web site (NMED/SWQB 2011 and Jessup et al. 2010): https://www.env.nm.gov/surface-water-quality/sedimentation/.

Multiple sediment indicators were analyzed for their responsiveness to site disturbance and effects on benthic macroinvertebrates. The analysis used reference distributions, quantile regression, and change-point analysis, and resulted in the threshold recommendations for two bedded sediment indicators (Table 1) – % Sand and Fines (%SaFN) and log Relative Bed Stability calculated without bedrock (LRBS_NOR) – in three sediment site classes, Mountains, Foothills, and Xeric areas (Table 2, Figure 1). The site classes are defined by Level III and IV ecoregions (Griffith et al. 2006) and distinguish bedded sediment expectations across New Mexico. Site classes were identified through a principal component analysis (PCA) of environmental conditions and the bedded sediment indicators. The Foothills and Xeric site class definitions were modified slightly from Jessup et al. 2010 to further divide ecoregion 22 based on site characteristics used in the PCA (see NMED/SWQB 2011 for additional details). Site locations near sediment site class boundaries warrant additional scrutiny. Any study site within approximately twenty kilometers of a boundary should be compared to the adjacent ecoregion definition to determine the appropriate ecoregion and associated bedded sediment site class designation for that particular site. Assessment conclusions for these sites will be reviewed on a case-by-case basis. Sediment site class assignments that deviate from Table 2 will be documented in the SWQB's in-house database (SQUID).

Table 1. Bedded sediment indicators

Sediment Indicator	Description
Percent Sand & Fines (%SaFN)	**The percentage of systematically selected streambed substrate particles that are ≤2.0 mm in diameter from reach-wide pebble count.**
Log Relative Bed Stability (LRBS)	**A measure of the relationship of the median particle size in a stream reach compared to the critical particle size calculated to be mobilized by standardized fluvial stresses in the reach.** Median particle size is determined using a reach-wide pebble count (Peck et al. 2006). Critical particle size is calculated from channel dimensions, flow characteristics, and channel roughness factors (Kaufmann et al. 2008). The measure is expressed as a logarithm of the ratio of geometric mean to critical particle size.
LRBS_NOR	**RBS without bedrock or hardpan (log10).** This measure regards only the potentially mobile streambed particles in determining the geometric mean particle size, and improved associations between the bedded sediment measure and biological responses in the TetraTech analyses (see Jessup et al. 2010 for additional discussion of LRBS_NOR).

Table 2. Definition of bedded sediment site classes

Site Class	Definition
Mountains	Ecoregions 21 and 23, ***except*** *21d, 23a, 23b and 23e*
Foothills	Ecoregions 21d, 22a, 22b, 22f, 23a, 23b, 23e and 79
Xeric	Ecoregions 20, 22, 24, 25, and 26, ***except*** *22a, 22b, 22f*
Ecoregion number	**Ecoregion Name***
20	Colorado Plateaus
21	Southern Rockies
21d	Foothill Woodlands and Shrublands
22a	San Luis Shrublands and Hills
22b	San Luis Alluvial Flats and Wetlands
22f	Taos Plateau
23	Arizona/New Mexico Mountains
23a	Chihuahuan Desert Slopes
23b	Madrean Lower Montane Woodlands
23e	Conifer Woodlands and Savannas
24	Chihuahuan Deserts
25	High Plains
26	Southwestern Tablelands
79	Madrean Archipelago

NOTES: * Additional written descriptions of level 4 ecoregions in New Mexico are available at: https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/nm/nm_back.pdf

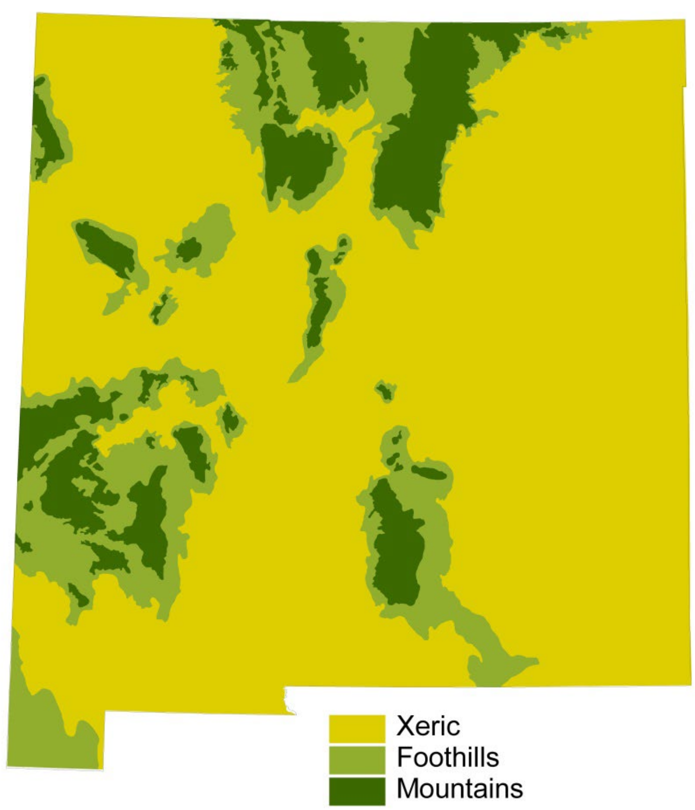

Figure 1. New Mexico Mountain, Foothills, and Xeric site class map

The recommended thresholds by site class resulted from a weight-of-evidence approach that considered multiple analytical approaches and the strength of each analysis. Corroborating evidence for selection of thresholds from reference conditions was found in the analysis of relationships between sediment and biological indicators. Biological effects are indirect indicators of required sediment conditions because biota is affected by other environmental conditions besides sediment conditions (Jessup et al. 2010).

2.0 Assessment Procedure

To determine if there is excessive sedimentation/siltation in the study stream reach, two levels of assessment are performed in sequential order (Figure 2). The first level ("Level 1") considers the simpler indicator of biological impairment, and the second level ("Level 2") considers geomorphic impairment if the Level 1 threshold is exceeded. If the %SaFN site class thresholds are not exceeded in a Level 1 assessment, the assessment is complete, and it is unnecessary to proceed to a Level 2 assessment. Delisting requirements are the same as the those required for listing.

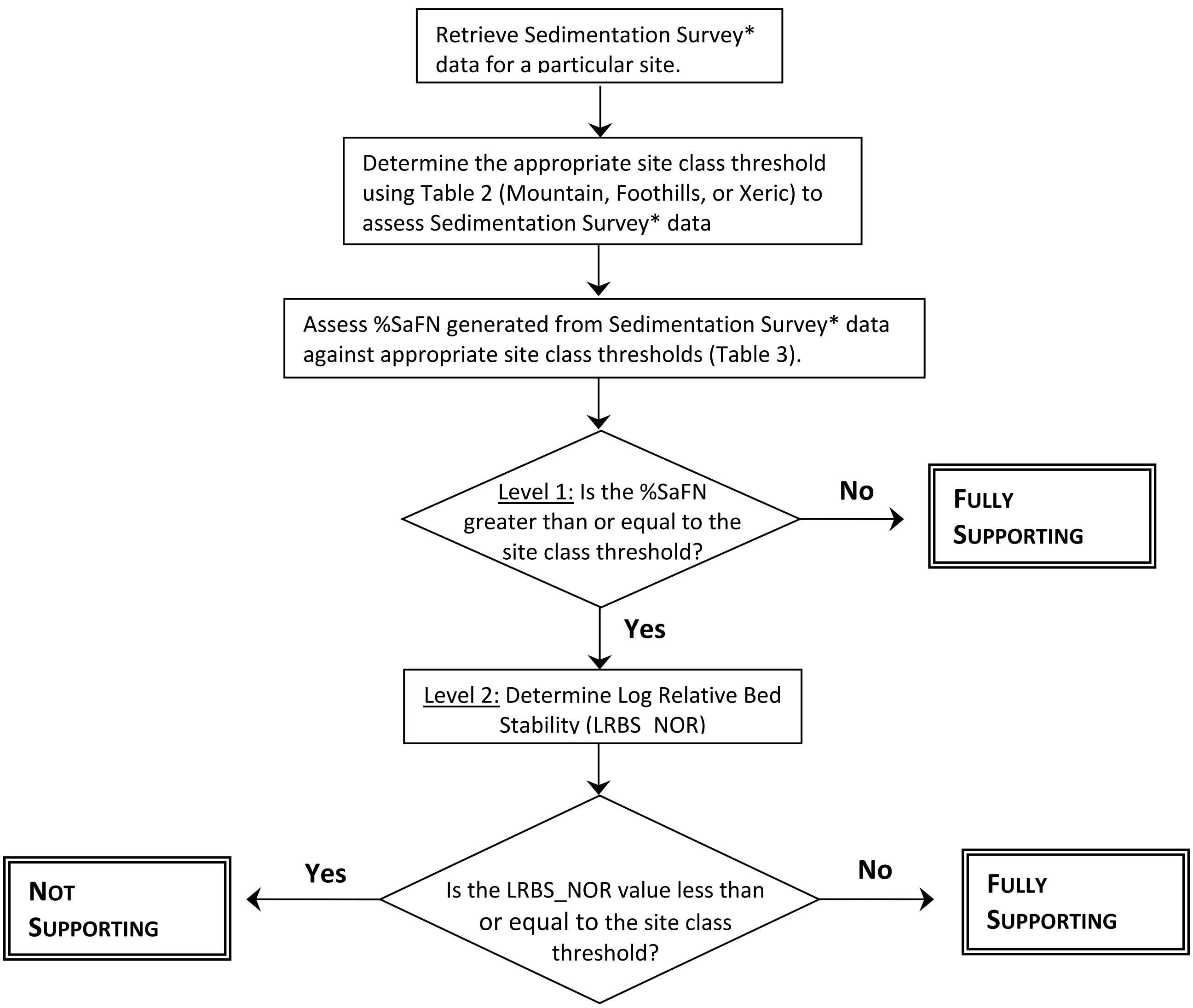

Figure 2. Two-tiered assessment approach for determining sedimentation/siltation impairment
NOTES: * As described in the SWQB's Physical Habitat SOP (https://www.env.nm.gov/surface-water-quality/sop/) or equivalent.

The %SaFN sediment indicator is used in the Level 1 assessment because it is easily measured and correlates strongly with biological metrics. If the %SaFN indicates excessive fine sediment in the stream bed by exceeding thresholds, a Level 2 sedimentation assessment is performed. Level 2 assessments require the collation of Sedimentation Survey data to calculate the log Relative Bed Stability without bedrock (LRBS_NOR) value for a specific site. The LRBS_NOR indicator is an equation that considers site-specific hydraulic potential for moving bed sediments, so that the observed amounts of sand and fine sediments are considered impaired when the streambed is more easily mobilized and transported than expected. The LRBS_NOR measure is appropriate as a second-tier indicator because it is scaled to hydro-geomorphic factors of the individual sites, as well as to the broader site classes, thus allowing evaluation of the potential of the specific site in terms of retaining or flushing fine sediments. When used as a second-tier sediment indicator, LRBS_NOR helps explain whether high %SaFN were expected for a given site or are a result of disturbed conditions (Jessup et al. 2010). Sediment condition relative to the fluvial potential is a better estimate of system stability and imbalance than absolute measures of fine sediment concentration alone, because they intrinsically account for site-specific natural settings. In contrast to LRBS_NOR, the %SaFN measure is an absolute quantity, which is more susceptible to spatial and temporal variations (Jessup et al. 2010) exceeding the natural variability captured by site classification.

Another way to present how the two indicators are applied in a tiered approach is to consider the quadrants when the two indicators are graphed against one another (Figure 3).

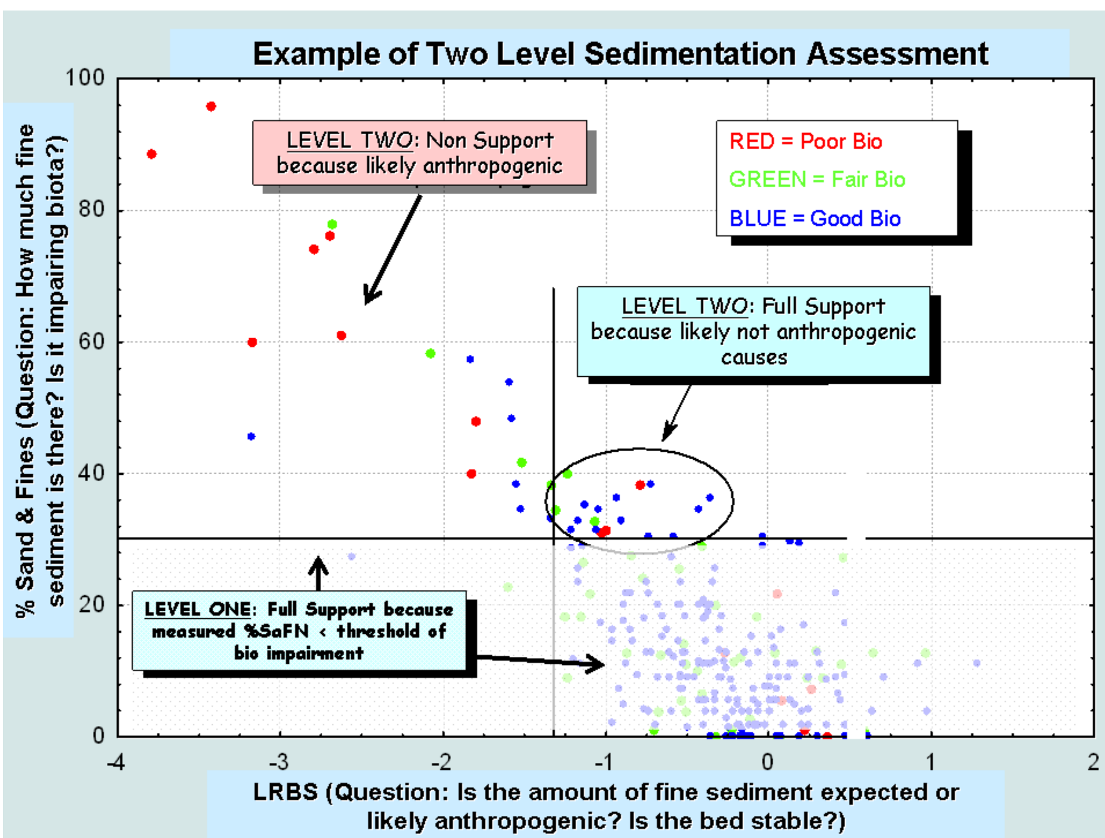

Figure 3. Graphical example of two indicator tiered assessment approach

In Figure 3, sites falling in the upper left quadrant represent **Non Support** (impaired) for sedimentation/siltation because they fail both the Level 1 and Level 2 thresholds (i.e., have both high %SaFN and low LRBS_NOR values). Sites in the other three quadrants are considered **Full Support** (unimpaired). Specifically, sites that fall in the lower quadrants are considered unimpaired because they have low %SaFN (passing the Level 1 threshold). These sites are considered unimpaired because the measured %SaFN values are below the threshold for biological impairment. Observations in the upper right quadrant indicate potential impairment using the Level 1 (%SaFN) threshold but are considered unimpaired based on the Level 2 (LRBS_NOR) threshold because LRBS_NOR values greater than the threshold suggest that the higher %SaFN values may be natural and therefore expected for those sites.

2.1 Level 1 Sedimentation Assessment

Sedimentation surveys are conducted during regular SWQB watershed surveys according to the SWQB's Standard Operating Procedure (SOP) 5.0 Physical Habitat (https://www.env.nm.gov/surface-water-quality/sop) or equivalent. The SWQB's physical habitat surveys are completed during stable low flow conditions between August 15 and November 15 if concurrent biological monitoring is planned, because this is the SWQB's historic biomonitoring index period. If no biological monitoring is planned or needed at a particular site, physical habitat surveys may be conducted during baseflow conditions after snowmelt runoff and prior to the monsoon season (generally mid-May through early-July), or late- fall to early-winter depending on location and weather patterns. However, physical habitat surveys that include canopy cover measurements and have deciduous trees present should be performed before leaves fall which further restricts the survey season. Excessive sedimentation noted following wildfire will be documented in assessment comments and may be assessed for a sedimentation impairment on a case-by-case basis. Data collected during or immediately after fires, floods, extreme drought, or other catastrophic events are generally not used to make attainment decisions because such data are not representative of ambient conditions, however, data collected after the initial impacts of the event have passed (>4 weeks) may be assessed because it can be considered indicative of ambient conditions thereafter. See Main CALM section 2.1.8 "Non-representative data" for more information.

The %SaFN is calculated onsite based on the 105-particle count and recorded on the appropriate field sampling sheet. The %SaFN is an appropriate sediment indicator because it is essentially equivalent to New Mexico's definition of "…fine sediment particles (less than two millimeters in diameter) …" found at 20.6.4.13 NMAC. In a slight deviation from 20.6.4.13 NMAC, this listing methodology includes particles that are less than or equal to 2mm in diameter (Table 3), to be conservative and to match EPA's definition and TetraTech, Inc.'s analyses (Peck et al. 2006, Jessup et al. 2010).

Table 3. Percent Sand & Fines (Level 1) thresholds

Site Class	Measured % Sand & Fines	Number of particles ≤ 2mm diameter based on a 105-particle count
Mountain	< 20% Sand & Fines	< 21 particles
Foothill	< 37% Sand & Fines	< 39 particles
Xeric	< 74% Sand & Fines	< 78 particles

Level 1 Analysis & Interpretation

If the measured %SaFN is less than the applicable site class threshold in Table 3, the sediment assessment is complete, and the assessment unit is considered to be **Full Support** with respect to New Mexico's narrative sedimentation/siltation standard found at 20.6.4.13 NMAC. If the measured %SaFN is greater than or equal to the applicable site class threshold in Table 3, the assessment is inconclusive and the assessment proceeds to Level 2.

2.2 Level 2 Sedimentation Assessment

Data collected from the sedimentation survey or equivalent (e.g., cross section profile, thalweg profile, large woody debris, slope, and sediment size) are used to calculate LRBS_NOR. Because fluvial conditions are major determinants of the substrate conditions in stream channels, the critical particle size calculated from fluvial characteristics is a predictor of dominant and stable substrate conditions. In essence, the LRBS_NOR calculation is used to predict the expected sediment particle size that would be moved during a bankfull flow event. This expected or "critical" particle size is calculated from channel dimensions, roughness factors, and shear stresses (Kaufmann et al. 2008). The logarithm ratio of the measured particle size to the expected particle size is a measure of the relative stability of the stream bed.

In minimally disturbed streams, the measured geometric mean stream bottom particle size should trend towards the expected particle size (i.e., the size a stream is capable of moving as bedload at bankfull flows). Thus, LRBS_NOR values near zero indicate a stable stream bed, whereas increasingly negative values indicate excess fine sediment. For example, a LRBS_NOR value of -1 means that the measured geometric mean bedded sediment particle size is ten times (10X) finer than the expected particle size that would be moved during bankfull flow events. Calculated LRBS values less than -3 indicate that the bed substrate may be moving even during low flow events.

LRBS_NOR was selected as a sediment impairment indicator because this measure considers only the potentially mobile streambed particles in determining the geometric mean particle size and produces improved associations between the bedded sediment measure and biological responses when compared to the LRBS calculated with bedrock (Jessup et al. 2010). LRBS_NOR threshold values by site class are listed in Table 4.

Table 4. LRBS_NOR (Level 2) thresholds

Site Class	LRBS_NOR Units
Mountain	> -1.1
Foothill	> -1.3
Xeric	> -2.5

Level 2 Analysis & Interpretation

If the calculated LRBS_NOR is greater than the applicable site class threshold in Table 4, the assessment unit is regarded as **Full Support** with respect to New Mexico's narrative sedimentation/siltation standard found at 20.6.4.13 NMAC. If the calculated LRBS_NOR is less than or equal to the applicable site class threshold, the assessment unit is considered **Non Support**.

REVISION HISTORY:

2012 listing cycle – Protocol was substantially revised based on Jessup et al. (2010).

2014 listing cycle – Minor clarifications and re-formatting.

2016 listing cycle – Minor clarifications.

2018 listing cycle – "Assessment Protocol" changed to "Listing Methodology." Clarified application of Heins et al. 2004 study to waters in the San Juan River basin. Clarified potential re-assignment and documentation of sediment site class for a particular site.

2020 listing cycle – Minor clarifications.

2022 listing cycle – **Pre-Public Comment:** Removed reference to Level 1 and 2 sedimentation surveys (to align with current SOP) and added clarification that Level 1 and 2 are still steps in the assessment procedure; Updated figure 2 to reflect this. Note about delisting added. Minor clarifications and rewording throughout. **Post-Public Comment:** No changes.

2024 listing cycle – Pre-Public Comment: Added a note about sedimentation assessment following wildfires in section 2.1. **Post-Public Comment:** No changes.

2026 listing cycle – Pre-Public Comment: Provided clarification on hybrid approach to assessing sedimentation in non-wadeable rivers. Revised the note about sedimentation assessment following wildfires in section 2.1. **Post-Public Comment:**

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APPENDIX H

PUBLIC COMMENT DRAFT

TURBIDITY LISTING METHODOLOGY FOR STREAMS AND RIVERS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

This document establishes a listing methodology for determining impairment due to excessive turbidity perennial streams and rivers with high quality coldwater, coldwater, and marginal coldwater designated uses. This protocol was developed to assess the first sentence of the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* narrative criterion for turbidity found at 20.6.4.13(J) NMAC (available at: https://www.env.nm.gov/surface-water-quality/wqs/):

> ***Turbidity**: Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water.* Activities or discharges shall not cause turbidity to increase more than 10 NTU[1] over background turbidity when the background turbidity, measured at a point immediately upstream of the activity, is 50 NTU or less, nor to increase more than 20 percent when the background turbidity is more than 50 NTU. However, limited-duration turbidity increases caused by dredging, construction or other similar activities may be allowed provided all practicable turbidity control techniques have been applied and all appropriate permits, certifications and approvals have been obtained.

The rest of the narrative turbidity standard at 20.6.4.13(J) NMAC is generally used to determine whether anthropogenic activities in the riparian corridor of a river or stream cause a deleterious effect.

Exclusions

This protocol is not applicable to the following water body types because the necessary research and implementation procedures have either not been investigated by the Surface Water Quality Bureau (SWQB) or are not yet developed. As resources allow, the scope will be expanded to include these water body types:

- Lakes, reservoirs, and playas;
- Intermittent streams;
- Ephemeral streams;
- Wetlands; and
- Stream segments with a coolwater (or dual coldwater and warmwater), warmwater, or marginal warmwater designated aquatic life use in the current version of 20.6.4 NMAC.

1.0 Introduction/Background

Prior to the 2005 triennial review of water quality standards, New Mexico had numeric turbidity criteria for certain aquatic life uses. These numeric criteria were removed, and it became necessary to develop numeric translators or thresholds for the narrative criterion found at 20.6.4.13 NMAC in order to continue making impairment determinations for turbidity. Water quality criteria for turbidity and total suspended sediments vary greatly among states. New Mexico is one of many states that do not have absolute numeric criteria for turbidity or total suspended solids (EPA 2006). No other examples of states assessing a similar narrative turbidity criterion in order to determine aquatic life use attainment for Clean Water Act §303(d) purposes could be found when this listing methodology was initially developed for the 2012 listing cycle.

[1] Nephelometric turbidity unit.

There is a documented relationship between total suspended sediment (TSS) and turbidity in New Mexico (Jessup et al. 2010). New Mexico also has a narrative TSS criterion found at 20.6.4.13(A)(2) NMAC. Turbidity and TSS data were collated and examined to determine potential sediment benchmarks or thresholds in New Mexico following EPA's guidance (EPA 2006). Unfortunately, data available at the time were not sufficient for identifying a biologically based low-flow or high-flow turbidity or TSS threshold using this approach (Jessup et al. 2010). The SWQB hopes to revisit this approach as well as other potential approaches such as Schwartz et al. (2008) as resources allow.

The approach described below relies on the use of biotranslators to derive numeric thresholds for New Mexico's narrative turbidity criterion. A biotranslator is most simply obtained in controlled experiments that isolate a physical or chemical water quality parameter and determine a threshold level of that parameter above which a quantifiable attribute of an indicator organism is impaired. This approach has been used with a wide variety of fish species to define lethal doses (LD_{50}) and lethal concentrations (LC_{50}) values that have in turn been used to establish water quality standards criteria for parameters such as temperature, dissolved oxygen, metals and organic compounds. In turbidity studies, a less distinct endpoint is usually defined based on observations of behavior, and the resulting values are referred to as Effect Levels (EL).

To minimize the potential for the effects of bedded sediment to confound turbidity assessment, this protocol considers primarily those biotranslators which have been developed from experiments on biota that isolated turbidity from other water quality parameters. These experiments used fish because the effects of turbidity in the water column can be observed as changes in feeding, growth, or social interactions. Benthic macroinvertebrate data from turbidity studies that controlled for effects from sedimentation and other parameters are also considered.

Several aquatic life uses, including High Quality Coldwater (HQCW), Coldwater (CW), Marginal Coldwater (MCW), Coolwater, Warmwater, and Marginal Warmwater, are defined in 20.6.4.7 NMAC. The correlation between temperature tolerance and turbidity tolerance is not well documented. Also, there is a wide variation in trophic levels among temperature classes of fish species. A correlation may exist between coldwater species and turbidity tolerance due to the fact that all coldwater species in New Mexico (with the exception of Southern redbelly dace) are salmonids, and salmonids are known to have low turbidity tolerances. A literature search was conducted to find turbidity tolerance biotranslators for fish species native to New Mexico. When data on native species were unavailable, well-established introduced species were considered. Additionally, the Oregon Department of Environmental Quality has prepared a thorough turbidity technical review which includes a comprehensive summary of turbidity studies (OR DEQ 2014).

1.1 Coldwater (including Marginal and High Quality) Species

Most coldwater species in New Mexico are generally considered sensitive to parameters such as increased siltation, temperature, turbidity, or lowered dissolved oxygen (Sublette et al. 1990, Zaroban et al. 1999), and their abundance tends to be greatly reduced in association with human disturbance (Karr et al. 1986). The most representative fish to use in determining the appropriate turbidity thresholds for stream segments assigned to these aquatic life uses are salmonids. The majority of studies on the effects of turbidity on fish have been conducted with salmonids due to their economic importance and relatively low tolerance to elevated turbidity. Data on several species of salmonids indicate that at turbidities in the vicinity of 10 NTU reactive distance is halved, and passive feeding is replaced with active feeding. This turbidity level, if maintained for a sufficient duration, results in impaired growth (Berg and Northcote 1985, Sweka and Hartman 2001, Newcombe 2003). Brown trout, a non-native species, are widespread throughout New Mexico. Reduced feeding was observed in brown trout at 7.5 NTU (Bachman 1984) indicating that growth could potentially be impaired at lower turbidity levels. This suggests a long duration threshold of <10 NTU is appropriate for waters with these aquatic life uses. Additional support for a threshold near 10 NTU is provided in a study of benthic macroinvertebrates above and below clay-laden discharges from placer mines (Quinn et al. 1992). In this study, invertebrate densities were halved at turbidity levels between 0 and 7 NTU. No physical effects of sediment were found on macroinvertebrates, indicating that the observed reductions in density were due to reduced food production as a result of reduced light transmission.

1.2 Coolwater Species

Smallmouth bass may be considered a coolwater aquatic life species based on temperature needs and may be a useful indicator of limited to moderate disturbance based on intermediate tolerance to parameters such as increased siltation, temperature, turbidity, or lowered dissolved oxygen (Zaroban et al. 1999). Changes in smallmouth bass prey selection between round goby, golden shiner, and northern crayfish were noted at various turbidity levels between 0 and 40 NTU. Although this study was not designed to directly test long-term feeding rates, correlation revealed a negative relationship between turbidity and feeding rate with a significant difference between 0 and 5 NTU (Carter et al. 2009).

1.3 Warmwater and Marginal Warmwater Species

Bluegill typically occupy warmwater aquatic life habitat and are native to New Mexico. Bluegill feeding activity was reduced approximately 20% at 60 NTU relative to clear water conditions (Gardner 1981). A second warmwater species is the Largemouth bass, although this species is not native to New Mexico. No changes in feeding behavior were observed in Largemouth bass exposed to turbidities ranging from 0-37 NTU (Reid et al. 1999), indicating that an upper threshold for warmwater aquatic life habitat should be at least 37 NTU and possibly higher. Conversely, other native New Mexican warmwater species such as the Sand shiner, Arkansas River shiner, Red shiner and Flathead chub, all showed little or no change in prey consumption rate at turbidities ranging from 0-1,000 NTU, and prey consumption was enhanced in Arkansas River shiner as turbidity increased from 0-2,000 NTU (Bonner and Wilde 2002).

2.0 Turbidity Thresholds for Perennial Streams with Coldwater (including Marginal or High Quality Coldwater) Designated Aquatic Life Uses based on Newcombe (2003)

Duration of exposure to turbidity can vary greatly from study to study, making it difficult to compare results. In addition, information on duration is not always provided (OR DEQ 2014). In order to generate a larger dataset for use in developing a severity of ill effects (SEV) index that describes the combined effects of turbidity levels and duration of exposure on clear water fishes, Newcombe (2003) used the information cited in some of the above studies as well as others. Turbidity effects considered for the model include fish reactive distance, predator prey dynamics, egg and larval development growth rates, and habitat alteration effects. Newcombe (2003) assigned SEV scores to the results of the studies and then regressed against water clarity measurements and exposure durations from published research to develop a log-linear regression (OR DEQ 2014).

Newcombe states that only data from fishes with one or more life stages intolerant of cloudy conditions, or those usually found in clear water systems that "…perhaps benefit from seasonal improvements in water clarity…" were available in sufficient quantities to develop the index. Coldwater (i.e., typically pollution sensitive) fish species in New Mexico meet this definition, whereas coolwater fish species cover a wider range of pollution tolerances and there is no direct translation between temperature and turbidity tolerances. Therefore, Newcombe's SEV index is evidently applicable to coldwater aquatic life, including high quality and marginal designated uses. The limited availability of data for coolwater and warmwater fish species native to New Mexico, together with conflicting tolerances and needs for turbidity among species for which data are available, prevents derivation of a suitable biotranslator and SEV index for coolwater and warmwater aquatic life designations. This assessment approach derived from the SEV index will not be applied to stream segments that list both a coldwater and a warmwater designated aquatic life use because these dual aquatic life use waters are currently under water quality standards review to determine the most appropriate aquatic life use designation. As resources and research allow, SWQB hopes to develop turbidity assessment approaches for coolwater and warmwater fish species in the future.

An SEV index value of 3.5 was selected to develop thresholds for turbidity assessment in New Mexico. This value corresponds to the boundary between conditions that produce changes in feeding and those that reduce growth rate and habitat size. The SWQB's selection of the 3.5 SEV index value balances the potential for type I and II error with respect to impairment listings, is conservative given the scale provided in Newcombe (2003), and addresses the goal of 20.6.4.13(J) NMAC. Aquatic organisms are adapted to episodic disruptions in feeding, especially in southwest streams that experience intense, short-duration, localized precipitation events.

The power relationship between turbidity and duration for a severity index of 3.5 is given in Equation 1:

Equation 1. Relationship of turbidity and allowable duration for SEV = 3.5:

$$x = (37{,}382)*(y^{-1.9887}) \quad \text{or} \quad y = (199.2)*(x^{-0.5028})$$

where x = duration in hours and y = turbidity in NTU.

Solving Equation 1 for various turbidities and durations gives a range of thresholds for clear water fish species. If the turbidity threshold (y) is exceeded consecutively for more than the corresponding allowable duration (x), the water body is documented as impaired. Similarly, if the maximum of all recorded minimum turbidity values for a given duration (x) is greater than the corresponding allowable turbidity threshold (y), the water body is documented as impaired. Impairment thresholds were determined using Equation 1 with a minimum duration (x) of 72 hours (three days) and a minimum turbidity threshold (y) of 7 NTU (Table 1). Sonde data that do not meet this minimum duration cannot be used to make final impairment or de-listing determinations.

Table 1. Turbidity impairment thresholds and durations at which ill effects (SEV = 3.5) are expected to occur in clear water fish, based on Newcombe (2003).

Turbidity Threshold (y) (NTUs)	Allowable Duration (x) (consecutive hours)	Allowable Duration (consecutive days)
23	72[(a)]	3
20	96	4
18	120	5
16	144	6
15	168	7
11	336	14
7	720[(b)]	30

NOTES:

(*a*) Turbidity levels above this duration are assumed to impact feeding behavior while turbidity levels for shorter-duration turbidity excursions are unlikely to impair the growth and reproduction of aquatic life as required by New Mexico's narrative turbidity water quality criterion.

(*b*) Thresholds for duration longer than this result in turbidity values lower than supported by the literature review presented in section 1.0.

A graph of the relationship between turbidity and duration for a severity index of 3.5 within the turbidity threshold and duration limits in Table 1 is shown in Figure 1.

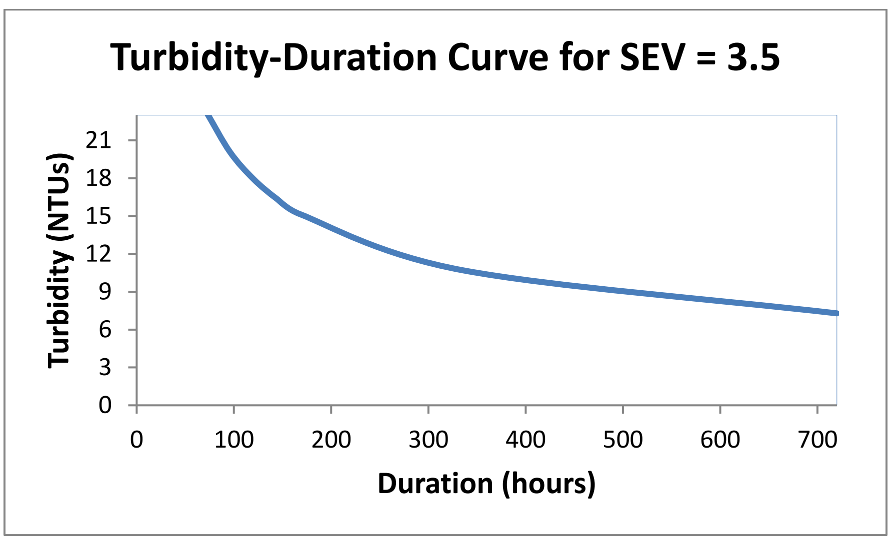

Figure 1. Chart of turbidity impairment thresholds and durations at which ill effects (SEV = 3.5) are expected to occur in clear water fish, based on Newcombe (2003).

3.0 Assessment Procedure

The first step is to collate available instantaneous (grab) and continuous (sonde) monitoring turbidity data (Figure 2). The SWQB generally collects grab turbidity measurements 3-4 times during water quality surveys. The SWQB typically deploys sondes for three (≥ 72 hours) to seven days to record at least hourly parameter values. Only validated datasets that meet the QA/QC requirements described in the SWQB's current quality assurance project plan (QAPP), available at: https://www.env.nm.gov/surface-water-quality/protocols-and-planning/) are used for assessment purposes.

Sonde (long-term) data

The SWQB deploys sondes in streams and rivers to record DO, pH, specific conductance, temperature, and turbidity values over a specific period of time. Sondes are deployed and the data reviewed following the guidelines specified in the SWQB's SOPs. The preferred sonde deployment period is within the site class growing season to capture concurrent dissolved oxygen and pH data (Table 2) and outside of spring runoff (March-June, depending on site elevation).

Table 2. Growing seasons for New Mexico site classes

Site Class	Level 3 Omernik Ecoregion	Growing Season
Mountain >7500 ft	22 & 23	July 1-Oct 15
Mountains <7500 ft & Plateau	20, 21, 22 & 23	Jun 15-Nov 1
S. Deserts and Plains	24, 25, 26, & 79	May 15-Nov 15

If at least 72 hours (3 days) of turbidity sonde data with a maximum one-hour frequency interval are available, these data are evaluated to determine impairment status. The likelihood of capturing a variety of turbidity events and conditions increases with longer sonde deployment so SWQB targets longer deployments. The data are evaluated against impairment thresholds in Table 1 and attainment status is determined according to Table 3 (also see Figure 2). If less than 72 hours of data are available, the data will only be evaluated to determine priority for subsequent longer sonde deployment.

The assessor will evaluate a sonde dataset with sufficient data against the impairment thresholds, by determining the maximum extent of all recorded minimum turbidity values (i.e., turbidity duration maximum) for each duration in Table 1. The SWQB provides a Long-Term Dataset (LTD) Data Management Spreadsheet tool[2] to assist with the calculation. If this turbidity duration maximum is less than the corresponding turbidity threshold in Table 1, the assessment conclusion is **Fully Supporting**. If the corresponding turbidity threshold has been exceeded, the assessment conclusion is **Not Supporting**.

Excessive turbidity noted following wildfire will be documented in assessment comments and may be assessed for a turbidity impairment on a case-by-case basis. Data collected during or immediately after fires, floods, extreme drought, or other catastrophic events are generally not used to make attainment decisions because such data are not representative of ambient conditions, however, data collected after the initial impacts of the event have passed may be assessed because it can be considered indicative of ambient conditions thereafter. See Main CALM section 2.1.8 "Non-representative data" for more information.

[2] For a copy of this spreadsheet, please visit https://www.env.nm.gov/surface-water-quality/sop/.

Instantaneous (grab) data

If less than 72 hours of sonde data are available, grab data may be evaluated to determine Non Support and to prioritize future sonde deployments. Only grab data collected during low flow or baseflow conditions will be assessed. All flood flow samples (i.e., high flow in response to recent precipitation) will be removed from the dataset prior to assessment. This may be determined by checking the flow condition rating associated with the sampling event in SQUID or by analysis of available quantitative flow data. If there are at least four assessable data points that were collected at least 21 days apart (to ensure temporal independence of the grab data) within the same calendar year, and four or more consecutive values are greater than 7 NTU, the assessment unit (i.e., stream reach) will be noted as **Not Supporting** (IR category 5C) for turbidity and prioritized for sonde deployment. **Fully Supporting** cannot be determined with grab data. In cases where both continuous data and instantaneous data are available, continuous data will be used for assessment.

Delisting

Waterbodies may be delisted for turbidity impairment based on new information. Delisting only applies to situations where new data indicate that water quality has improved and a currently listed waterbody is no longer impaired according to the current listing methodology, or a water quality standard has changed and reassessment indicates full support. Delisting decisions require the same information as listing decisions. However, due to the relatively low number of samples collected and short periods represented by continuous data, some waterbodies may be delisted when the impairment cause persists. To increase confidence in delisting decisions, delisting requires a minimum of two weeks of continuous 15-minute or hourly data with no exceedance of the applicable thresholds. Because grab data does not allow for consideration of exceedance durations of the applicable turbidity thresholds, it cannot be used as the sole data source for delisting.

Table 3. Assessing turbidity data to determine HQCW, CW, or MCW Aquatic Life Use Support [a]

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	DELISTING	NOTES
Continuously recorded turbidity data (≥72 hours, ≤one-hour frequency interval)	Turbidity duration maximum does not exceed any turbidity impairment thresholds in Table 1.	Turbidity duration maximum exceeds one or more turbidity impairment thresholds in Table 1. [b]	A minimum of two weeks of valid data required. Turbidity duration maximum does not exceed any turbidity impairment thresholds in Table 1.	[a] As stated in Section 2.0, this assessment approach derived from the SEV index will not be applied to stream segments that list both a coldwater and a warmwater designated aquatic life use. [b] The AU may also be listed as Not Supporting on a case-by-case basis if the data set clearly indicates that an impairment threshold would be exceeded had the sonde remained in the water based on the trend of the data at retrieval. [c] At least four assessable data points were collected at least 21 days apart (to ensure temporal independence of the grab data) within the same calendar year. Only grab data collected during low or baseflow conditions will be assessed. Turbidity listings based on grab data will be noted as Category 5C (need continuous sonde data to confirm).
Instantaneous (grab) turbidity data **A)** ≥ 4 samples in the same calendar year <u>and</u> data points ≥ 21-days apart **B)** < 4 samples in same calendar year <u>or</u> data < 21-days apart	**A)** Not assessable (cannot determine Fully Supporting with grab data only) **B)** Not Assessed	**A)** ≥ 4 consecutive measurements > 7 NTU [c] **B)** Not Assessed	**A)** Cannot delist with grab data only. **B)** Cannot delist with grab data only.	

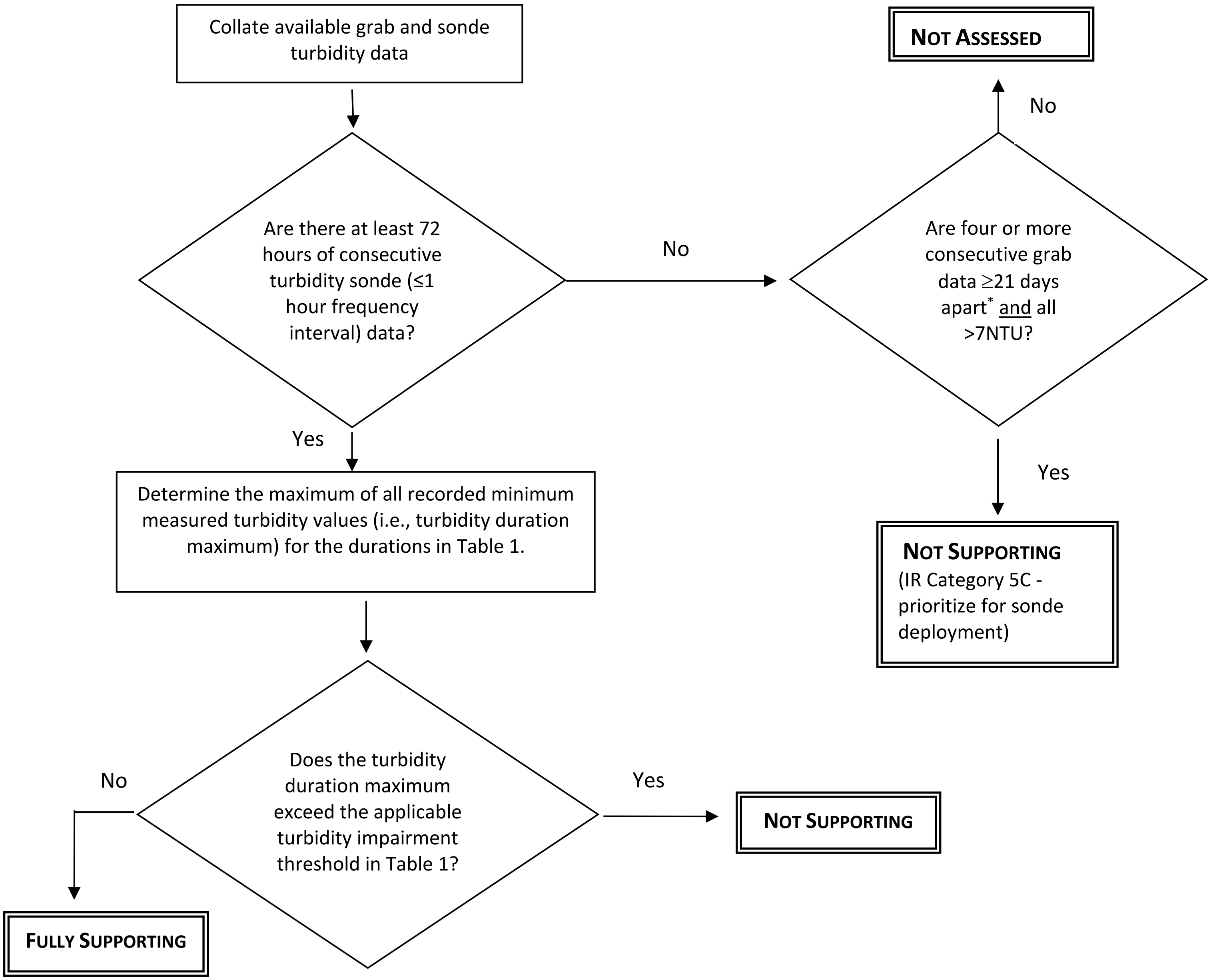

Figure 2. Generalized flowchart for determining turbidity attainment status

NOTE: * within the same calendar year

REVSION HISTORY:

2012 listing cycle – Initial protocol using SEV translator approach.

2014 listing cycle – Removed application to coolwater aquatic life. Minor clarifications and re-organization.

2016 listing cycle – Minor clarifications/revisions. Added history of NM's turbidity and TSS criteria, and TetraTech analyses based on EPA's suspended and bedded sediments (SABS) guidance.

2018 listing cycle – "Assessment Protocol" changed to "Listing Methodology." Clarified that < 72 hours of sonde data cannot be used to make final impairment or de-listing determinations.

2020 listing cycle – Added description of "turbidity duration maximum" and how to use determine this value using the SWQB's LTD Data Management Spreadsheet to assess turbidity sonde data. Clarified that growing season is preferred sonde deployment period. Revised instantaneous (grab) data assessment approach to better match other protocols where grab data can only be used to determine impairment (i.e., IR Category 5C and prioritized for future sonde collection). Added acknowledgement that elevated turbidity may be natural during snowmelt runoff. Updated ORDEQ reference to latest edition that is available online.

2022 listing cycle– **Pre-Public Comment:** Added delisting narrative description; added delisting criteria added to Table 3. Minor clarifications/revisions. Fixed figure and table numbering. **Post-Public Comment:** Added explanation for why grab data cannot be sole source for delisting using turbidity thresholds. In Table 3, added language defining temporal independence of grab data is considered for assessment.

2024 listing cycle– **Pre-Public Comment:** Added a note about increased turbidity following wildfires in section 3.0. **Post-Public Comment:** No changes.

2026 listing cycle– **Pre-Public Comment:** Minor clarifications/revisions. Noted that data collected post-wildfire may be indicative of future ambient conditions. **Post-Public Comment:**

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APPENDIX I

PUBLIC COMMENT DRAFT

PROCEDURE FOR CWA §303(D) /§305(B) INTEGRATED LIST CATEGORY 4B (NO TMDL REQUIRED) REQUESTS DEVELOPED BY THIRD PARTIES

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose

The New Mexico Environment Department Surface Water Quality Bureau (SWQB) has prepared this guidance document to assist stakeholders interested in submitting a justification for an Integrated Reporting Category 4b determination for an impaired assessment unit. Interested stakeholders are encouraged to first read through this document and then contact the SWQB to discuss the potential Category 4b requests prior to development of the submittal. The process described here is the same one that the SWQB follows when developing IR Category 4b demonstrations.

1.0 Introduction / Background

The State of New Mexico Clean Water Act §303(d)/ §305(b) Integrated Report (IR) satisfies the statutory requirements of §§ 303(d), 305(b), and 314 of the federal Water Pollution Control Act [33 U.S.C. §§ 1251-1376 (2006), also known as the Clean Water Act (CWA)]. The IR also conveys basic information on water quality and water pollution control programs in New Mexico to the United States Environmental Protection Agency (EPA) and the United States Congress, as well as to the general public. The IR is first approved by the New Mexico Water Quality Control Commission (WQCC) and then submitted to EPA Region 6 by April 1 of every even-numbered year.

The core of the IR is the CWA §303(d)/ §305(b) Integrated List. In accordance with EPA integrated listing guidance, New Mexico first determines Fully Supporting, Not Supporting, and Not Assessed for each individual designated use to then assign an IR category to every assessment unit (i.e., waterbody) on the Integrated List (USEPA 2001). IR determination is explained in Figure 1.

Assessment units that are assigned Category 5 constitute New Mexico's CWA §303(d) List of Impaired Waters. Section 303(d) and supporting regulations require states to develop a total maximum daily load (TMDL) for each impaired assessment unit-pollutant combination in IR Category 5. New Mexico further subdivides IR Category 5 to indicate whether a TMDL should be developed as soon as possible (IR Category 5a), the impaired waterbody needs to be evaluated to determine if changes to the standard may be appropriate (IR Category 5b), more data collection is necessary to complete and confirm the impairment (IR Category 5c), or an advance restoration plan (ARP) is planned or in place to attain WQS prior to TMDL development (IR category 5r). TMDLs establish pollution reduction goals and load allocations necessary for an impaired water to attain applicable WQS.

EPA regulations recognize that alternative pollution control requirements that are stringent enough, in place, and monitored may make the development of a TMDL unnecessary because both mechanisms would essentially achieve the same surface water quality goal. Specifically, TMDLs are not required if technology-based effluent limitations, more stringent effluent limitations, or other pollution control requirements (*e.g.*, best management practices) required by local, State, or Federal authority are stringent enough to implement an applicable water quality standard (WQS) (see 40 CFR 130.7(b)(1)) within a reasonable period of time.

If there is adequate information provided to ensure that pollution control requirements other than TMDLs are stringent enough to achieve an applicable WQS, these assessment unit-pollutant combinations may be assigned Category 4b on the Integrated List instead of Category 5. Assessment units – pollutant combinations assigned Category 4b do not require TMDL development.

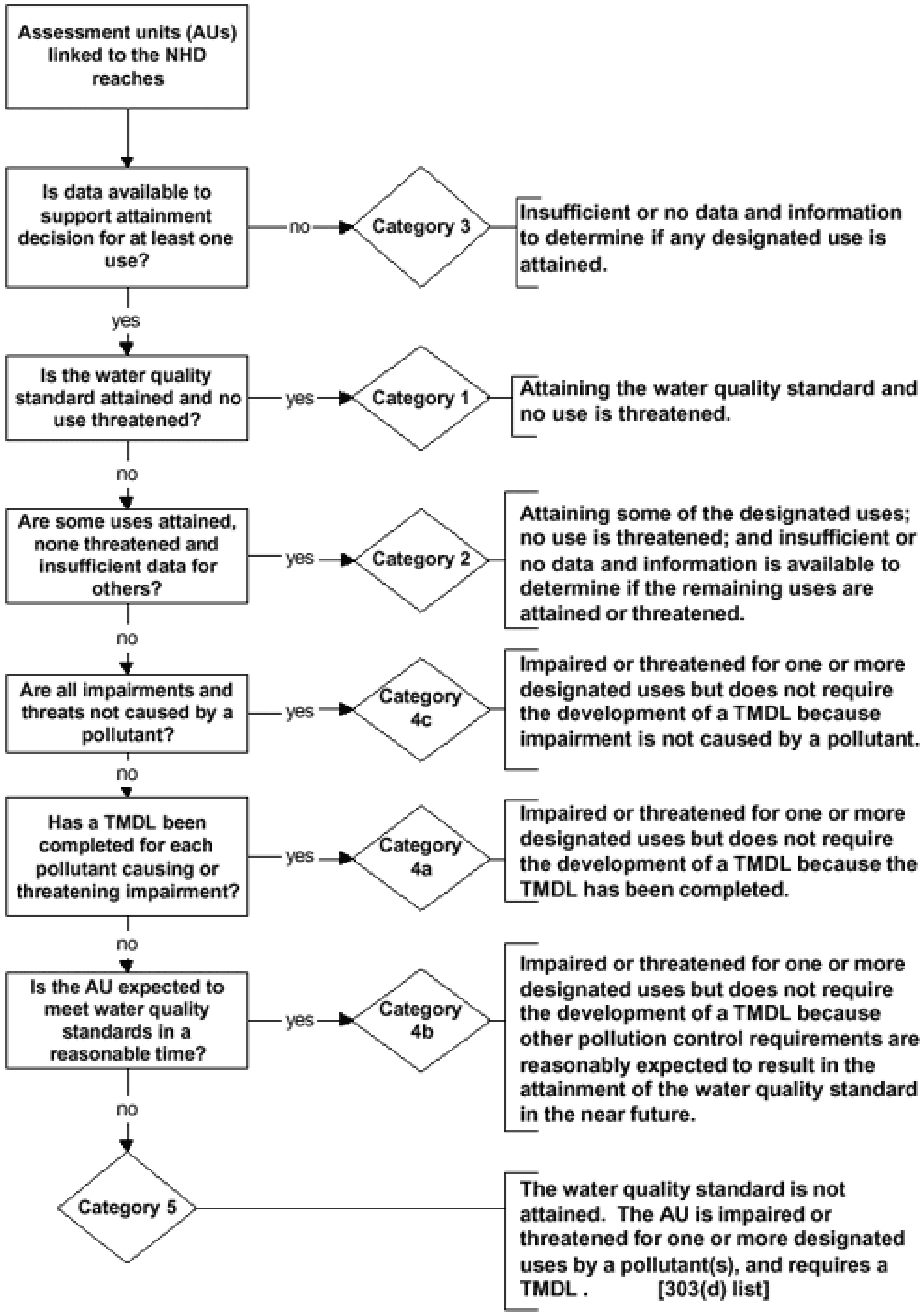

Figure 1. Generalized summary of logic for IR attainment categories (EPA 2001)

In addition, States have the opportunity to assign impaired waters to IR Category 4b where controls sufficient to achieve WQS in a reasonable period of time are already in place. Specifically, controls relied upon for IR Category 4b demonstrations do not always need to occur pursuant to binding legal authority (EPA 2006). States may choose to rely on controls that have already been implemented where there is sufficient certainty that implementation will continue until WQS are achieved and will not be reversed. Because the controls are already in place and achieving progress, EPA may consider such controls to be requirements even if their implementation did not occur pursuant to a specific binding legal authority (EPA 2006).

Watershed-based plans are also amenable to IR Category 4b provided they address the six IR Category 4b elements outlined in the 2006 IR guidance (EPA 2005) as well as the nine elements outlined in national non-point source program guidance (EPA 2013) for an acceptable watershed-based plan to address NPS (EPA 2007, 2008). This includes identification of non-point sources of pollution where present, and estimating pollutant load reductions for management measures used to reduce non-point source pollution loading. For an example of this scenario, see Texas' Plum Creek Watershed Protection Plan (PCWP 2008).

In New Mexico, the IR and TMDL documents are both incorporated into the Water Quality Management Plan and Continuing Planning Process (WQMP-CPP) by reference (NMWQCC 2020). As IR Category 4b demonstrations are part of the IR via their inclusion on the §303(d)/ §305(b) Integrated List (Appendix A of the IR), the SWQB views these documents as part of the New Mexico WQMP-CPP. As such, IR Category 4b demonstrations and TMDLs have equal standing for EPA's development of NPDES permits as well as State Certification under §401 of the Clean Water Act (40 CFR 124.53(e)(1)). Current IR category 4b demonstrations can be found at https://www.env.nm.gov/surface-water-quality/303d-305b/ under "supporting documents and websites."

2.0 Procedure

2.1 Required Documentation

New Mexico must submit any Category 4b demonstrations with their IR submission, and must work closely with EPA Region 6 to ensure that Category 4b demonstrations are adequate to support the decision not to include these impaired waters on the state´s § 303(d) list. The six required elements include:

1. Identification of assessment unit and statement of problem causing the impairment;
2. Description of pollution controls and how they will achieve WQS;
3. An estimate or projection of the time when WQS will be met;
4. Schedule for implementing pollution controls;
5. Monitoring plan to track effectiveness of pollution controls; and
6. Commitment to revise pollution controls, as necessary.

Attachment A describes in more detail the core information that must be submitted to the SWQB and EPA Region 6 to support placing an assessment unit in Category 4b. The EPA has compiled a list of examples by control mechanism and pollutants of concern (Monschein and Reems 2009). EPA Region 6 may require additional information to demonstrate good cause not to include those assessment units on the list (40 CFR 130.7(b)(6)(iv)).

2.2 Process and Timeline

In New Mexico, the SWQB is responsible for developing and submitting the Integrated List by April 1 every even-numbered year. Stakeholders, including public or private agencies, institutions, or organizations, may request that the SWQB consider an impaired water for Category 4b provided they follow this procedure. The level of rigor necessary to support a Category 4b determination will vary depending on the complexity of the impairments and corresponding implementation strategies. Therefore, close and early coordination between first the SWQB and the submitter, and then the SWQB and EPA Region 6 will promote development and timely review of Category 4b demonstrations that successfully address each of the six elements detailed in Attachment A. The specific process and timeline for Category 4b requests is as follows:

1. To be considered in time for the next Integrated List, complete Category 4b requests should be submitted to SWQB by July 1 of odd-numbered years. This deadline is necessary to allow adequate time for SWQB/EPA Region 6 review, consultation, and revision (as needed) prior to public noticing of the draft Integrated List, which typically occurs in December of odd-numbered years.
2. The proposed Category 4b request must address the six elements detailed in Attachment A of this procedure.
3. The SWQB will make the final decision regarding whether or not the Category 4b demonstration will be submitted as part of the draft Integrated List to EPA Region 6 following review and discussion of the request with the submitter to ensure the appropriateness and adequacy of the request.
4. The Category 4b demonstration must be a stand-alone document that will be available to the public during the public comment period for the entire Integrated List. The public should also be able to access supporting documentation via web links or other means.
5. The Category 4b request will be included as part of the draft Integrated List presentation to the New Mexico WQCC. If the SWQB believes the Category 4b request may be contentious, the SWQB may provide the Category 4b information to the WQCC earlier than this time for a separate discussion as to not hold up approval of the rest of the draft Integrated List.
6. Upon approval by the WQCC, the entire Integrated List, including Category 4b demonstrations and other supporting documentation, will be submitted to EPA for review. While reviewing the § 303(d) portion of the submitted list for approval (i.e., IR Category 5 waters), the EPA Region 6 evaluates the state's decision to place any impaired assessment unit-pollutant combinations in Category 4b since this is a removal of an impairment from the § 303(d) portion of the Integrated List and will make the final determination of this action. Final Category 4b demonstrations will be posted to SWQB's Integrated List website.
7. For any Category 4b assessment unit – pollutant pair, a progress report must be submitted to SWQB no later than July 1 of every odd-numbered year until the assessment unit is removed from Category 4b. To continue placing an assessment unit-pollutant pair in Category 4b, the progress report must demonstrate that the six elements are still being addressed and that adequate progress is being made towards the goal of WQS attainment. The SWQB TMDL and Assessment Team will consult with EPA Region 6 to make this determination.
8. If the WQS are eventually attained according to the assessment of available data in accordance with New Mexico's most recent listing methodology, the assessment unit-

pollutant pair can be removed from Category 4b and assigned either Category 1 or 2 accordingly. In addition, an assessment unit can be moved from Category 4b to Category 5 if the original Category 4b determination can no longer be supported.

REVISION HISTORY:

2014 cycle – Original.

2016 cycle – Minor revisions, reference additions, and clarification of EPA review process as well as NPDES permit ramifications related to IR Category 5 versus 4b. Changed IR Category 4b demonstration and progress report deadline from May 1 to July 1.

2018 cycle – "Assessment protocol" changed to "listing methodology".

2020 cycle – No changes.

2022 cycle – No changes.

2024 cycle – Added a sentence clarifying watershed-based plans requirements for addressing IR Category 4b impairments.

2026 cycle – Added information on advance restoration plans (previously known at alternative restoration plans) and IR category 5r. Added up to date information on accessing current 4b demonstrations.

REFERENCES:

Monschein, E., and S. Reems. 2009. Category 4b – Current status and trends. Proceedings: Water Environment Federation TMDL 2009 Conference. Available at: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/11A.pdf.

New Mexico Water Quality Control Commission (NMWQCC). 2011 (revisions in process). State of New Mexico Statewide water quality management plan and continuing planning process. Santa Fe, NM. Available at: https://www.env.nm.gov/surface-water-quality/wqmp-cpp/.

Plum Creek Watershed Partnership (PCWP). 2008. Plum Creek Watershed Protection Plan. Lockhart, TX. Available at: http://pcwp.tamu.edu/wpp/.

U.S. Environmental Protection Agency (EPA). 2001. 2002 Integrated water quality monitoring and assessment report guidance. Memorandum from Robert H. Wayland, Office of Wetlands, Oceans, and Watersheds. Washington, D.C. Available at: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/guidance.cfm.

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———. 2007. Enclosure to memorandum from Mr. Miguel Flores, Director, Water Quality Protection Division, EPA Region 6, to Region 6 State Water Quality Program Managers, "EPA Region 6 Process for Review of Watershed-based Plans in lieu of TMDL's." May 23, 2007. Dallas, TX. Available at: http://www.tsswcb.texas.gov/files/contentimages/WPP_4b_Process.pdf.

———. 2008. Handbook for Developing Watershed Plans to Restore and Protect our Waters. EPA 841-B-08-002, March. Available at: http://water.epa.gov/polwaste/nps/handbook_index.cfm.

———. 2013. National Nonpoint Source Program Guidelines, April. Washington, D.C. Available at: http://water.epa.gov/polwaste/nps/cwact.cfm.

<u>**Attachment A**</u>

REQUIRED ELEMENTS FOR CATEGORY 4B DEMONSTRATIONS

The following list of required elements is taken largely from EPA's 2008 IR guidance (EPA 2006). It provides a structure for submitting all the information the SWQB and EPA will need to determine if Category 4b is the correct determination.

All requests for Category 4b determinations on New Mexico's Integrated List must include the following six elements:

1. Identification of assessment unit and statement of problem causing the impairment;
2. Description of pollution controls and how they will achieve WQS;
3. An estimate or projection of the time when WQS will be met;
4. Schedule for implementing pollution controls;
5. Monitoring plan to track effectiveness of pollution controls; and
6. Commitment to revise pollution controls, as necessary.

Additional details for each of the six elements are provided below.

Category 4b demonstrations should be submitted as a stand-alone document. In situations where data and information for a Category 4b demonstration are contained in existing documents developed under separate programs (e.g., NPDES permit, Superfund Record of Decision), summarize relevant information in the Category 4b demonstration and reference the appropriate supporting documentation that provides that information. The supporting documentation should be included as part of the State's administrative record supporting the Category 4b determination.

1. Identification of Assessment unit and Statement of Problem Causing Impairment

1.1 Assessment Unit Description

The demonstration should identify the impaired assessment unit, including name, general location in the State, and State-specific location identifier (i.e., AU_ID).

1.2 Impairment and pollutant causing impairment

The demonstration should identify the applicable WQS not supported for each assessment unit and associated pollutant causing the impairment.

1.3 Sources of pollutant causing impairment

The demonstration should include a description of the known and likely point, nonpoint, and background (upstream inputs) sources of the pollutant causing the impairment, including the potential magnitude and locations of the sources. In cases where some portion of the impairment may result from naturally occurring sources (natural background), the demonstration should include a description of the naturally occurring sources of the pollutant to the impaired assessment unit.

2. Description of Pollution Controls and How They Will Achieve WQS

2.1 Water quality target

The demonstration should identify a numeric water quality target(s), which is a quantitative value used to measure whether or not the applicable WQS is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical contained in the WQS. The demonstration should express the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target.

In cases where the impairment is based on non-attainment of a narrative (non-numeric) water quality criterion, the Category 4b demonstration should identify one or more appropriate numeric water quality target levels or translators that will be used to evaluate attainment of the narrative water quality criteria. The Category 4b demonstration should also describe the basis for selecting these surrogates.

2.2 Point and nonpoint source loadings that when implemented will achieve WQS

The demonstration should describe the cause-and-effect relationship between the WQS (and numeric water quality target as discussed above) and the identified pollutant sources and, based on this linkage, identify what loadings are acceptable to achieve the WQS. The cause-and-effect relationship may be used to determine the loading capacity of the assessment unit for the pollutant of concern. However, a loading capacity may not be relevant in all circumstances. For example, a loading capacity would not be relevant in situations where the pollutant source will be completely removed. The demonstration should identify the loading capacity of the assessment unit for the applicable pollutant or describe why determination of the loading capacity is not relevant to ensure that the controls are sufficient to meet the applicable WQS.

The demonstration should also contain or reference documentation supporting the analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling or data analysis.

2.3 Controls that will achieve WQS

The demonstration should describe the controls already in place, or scheduled for implementation, that will result in reductions of pollutant loadings to a level that achieves the numeric WQS. The demonstration should also describe the basis upon which the State concludes that the controls will result in the necessary reductions.

2.4 Description of requirements under which pollution controls will be implemented

The demonstration should describe the basis for concluding that the pollution controls are requirements or why other types of controls already in place may be sufficient, as discussed below.

As discussed in the 2006 IR guidance (EPA 2005), EPA will consider a number of factors in evaluating whether a particular set of pollution controls are in fact "requirements" as specified in EPA´s regulations, including: (1) authority (local, state, federal) under which the controls are required and will be implemented with respect to sources contributing to the water quality impairment (examples may include: self-executing state or local regulations, permits, and contracts and grant/funding agreements that require implementation of necessary controls); (2) existing commitments made by the sources to implement the controls (including an analysis of the amount of actual implementation that has already occurred); (3) availability of dedicated funding for the implementation of the controls; and (4) other relevant factors as determined by EPA depending on case-specific circumstances.

Since the overriding objective of the IR Category 4b alternative is to promote implementation activities designed to achieve WQS in a reasonable period of time, for all the factors listed above, EPA will evaluate each IR Category 4b alternative on a case-by-case basis, including in particular the existence of identifiable consequences for the failure to implement the proposed pollution controls. Depending on the specific situation, "other pollution control requirements" may be requirements other than those based on statutory or regulatory provisions, if some combination of the factors listed above are present and will lead to achievement of WQS within a reasonable period of time. For example, established plans of government agencies that require attainment of WQS within a reasonable period of time may qualify even when their components include incentive-based actions by private parties. States may also choose to rely on controls that have already been implemented where there is sufficient certainty that implementation will continue until WQS are achieved and will not be reversed. Because the controls are already in place and achieving progress, EPA may consider such controls to be requirements even if their implementation did not occur pursuant to binding legal authority.

3. Estimate or Projection of Time When WQS Will Be Met

EPA expects that assessment units impaired by a pollutant but not listed under § 303(d) based on the implementation of existing control requirements will attain WQS within a reasonable period of time. The demonstration should provide a time estimate by which the controls will result in WQS attainment, including an explanation of the basis for the conclusion.

The demonstration should also describe why the time estimate for the controls to achieve WQS is reasonable. EPA will evaluate on a case-specific basis whether the estimated time for WQS attainment is reasonable. What constitutes a "reasonable time" will vary depending on factors such as the initial severity of the impairment, the cause of the impairment (*e.g.*, point source discharges, in place sediment fluxes, atmospheric deposition, nonpoint source runoff), riparian condition, channel condition, the nature and behavior of the specific pollutant (*e.g.*, conservative, reactive), the size and complexity of the assessment unit (*e.g.*, a simple first-order stream, a large thermally stratified lake, a density-stratified estuary, and tidally influenced coastal assessment unit), the nature of the control action, cost, public interest, etc.

4. Schedule for Implementing Pollution Controls

The demonstration should describe, as appropriate, the schedule by which the pollution controls will be implemented and/or which controls are already in place.

5. Monitoring Plan to Track Effectiveness of Pollution Controls

The demonstration should include a description of, and schedule for, monitoring milestones to track effectiveness of the pollution controls. The demonstration should describe water quality monitoring that will be performed to determine the combined effectiveness of the pollution controls on ambient water quality. If additional monitoring will be conducted to evaluate the effectiveness of individual pollution controls, EPA encourages States to include a description of these efforts as well. The demonstration should identify how and when assessment results from the monitoring will be reported to the public and EPA.

6. Commitment to Revise Pollution Controls, as Necessary

The demonstration should provide a statement that the State commits to revising the pollution controls, as necessary, if progress towards meeting WQS is not being shown. Also, the demonstration should identify how any changes to the pollution controls, and any other element of the original demonstration, will be reported to the public and EPA.

APPENDIX J

PUBLIC COMMENT DRAFT

PROCEDURE FOR ASSESSING HYDROLOGIC ALTERATION IN LOTIC WATERBODIES

NEW MEXICO ENVIRONMENT DEPARTMENT

SURFACE WATER QUALITY BUREAU

JUNE 16, 2025

Purpose and Applicability

The New Mexico Environment Department Surface Water Quality Bureau (SWQB) prepared this listing methodology to document the procedure used to determine an Integrated Reporting Category 4C impairment due to hydrologic alteration in wadeable streams.

1.0 Introduction / Background

The core of the IR is the CWA §303(d)/ §305(b) Integrated List. In accordance with EPA integrated listing guidance, New Mexico first determines Fully Supporting, Not Supporting, and Not Assessed for each individual designated use and then assigns an IR category to every assessment unit (i.e., waterbody) on the Integrated List (EPA 2001). Figure 1 summarizes IR category determinations.

Assessment units (AUs) that are assigned Category 5 constitute New Mexico's CWA §303(d) List of Impaired Waters. Section 303(d) and supporting regulations require states to develop a total maximum daily load (TMDL) for each impaired assessment unit-pollutant combination in IR Category 5. New Mexico further subdivides IR Category 5 to indicate whether the SWQB should develop a TMDL as soon as possible (IR Category 5A), further evaluate the impaired waterbody needs to determine if changes to the respective water quality standard may be appropriate (IR Category 5B), collect more data to complete and confirm the impairment (IR Category 5C), or complete an alternative restoration plan prior to development of a TMDL (5R). Waterbodies classified as IR Category 5 (e.g., 5A, 5B, 5C, 5R) officially constitute the CWA §303(d) List of Impaired Waters, however, New Mexico and the EPA recognize waterbodies assigned IR Category 4 are also still impaired (Figure 1). In this case, a Total Maximum Daily Load (TMDL) planning document is either already in place (IR Category 4A), not required because the impairment is not caused by a "pollutant" [1] (IR Category 4C), or other pollution control requirements are in place (appropriate 4B plan) and expected to result in attainment of the water quality standard within a reasonable amount of time (IR Category 4B) (EPA 2005).

IR category 4C waters do not require a TMDL because the impairment is due to "pollution" defined by the CWA as "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water" (Section 502 (19); U.S.C. 1948). As New Mexico's waters face an increasing degree of stress from the effects of climate change coupled with other stressors, it is important to understand and document the impacts and causes of all types of pollution, including those not caused by identifiable and conventional pollutants. The most common example of waters impaired by pollution are those waterbodies not attaining their designated uses due to anthropogenic hydrologic and/or habitat alteration, including waterbodies impaired solely due to stream channelization or lack of adequate flow (EPA 2023).

EPA recognizes through regulations that non-attainment of one or more designated uses in waterbodies is increasingly due to the modification of the natural flow regime, more broadly termed "hydrologic alteration," rather than a specific pollutant. Hydrologic alteration is a change to an aquatic system, often more common in arid Western states, which can result in any of the following effects: an increase or decrease in water volume, seasonal pulse flow disruption, dramatic variation in water temperature, or other flow-dependent factors. Hydrologic alteration is a form of pollution because it modifies the physical and biological integrity of the waterbody (Section 502 (19); U.S.C. 1948). This pollution is

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[1] The term "pollutant" is broadly defined to include "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste." (40 CFR § 122.2)

pervasive in the U.S.; a report by the U.S. Geological Survey and EPA found anthropogenic hydrologic alteration to be a primary contributor to the aquatic life impairment of waterbodies (USGS 2016). Examples of hydrologic alteration that can lead to ecological impairment include water withdrawals and/or increased return volume, impoundments, increased impervious surfaces in the contributing watershed altering the magnitude and timing for runoff, or channelization and stream bank destabilization that alters the stream bed and banks, and causes a loss of habitat or floodplain connectivity – properly functioning floodplains naturally filter contaminants and enhance the uptake of nutrients by riparian vegetation which improves water quality for downstream users.

Aquatic life stresses associated with hydrologic alteration are further intensified through climate change. Recent climate trends have included the change in frequency and duration of extreme weather events, such as droughts, floods, and high-severity fires, which can have an impact on flow and affect aquatic life (USGS 2016, Singleton et al., 2019). New Mexico also recognizes climate change in the state surface water quality standards (WQS), which "…serve to respond to the inherent threats of climate change and provide resiliency for the continued protection and enhancement of water quality" (20.6.4.6 (D) NMAC). Climate change exacerbates the water quality effects of hydrologic and habitat alteration. Waters not meeting applicable WQS due to anthropogenic hydrologic or habitat alteration may also experience increased pollutant loadings and pollutant concentrations as a result (e.g., a reduction in riparian vegetation and riparian canopy results in more solar radiation reaching the waterbody which increases the surface water temperature, a reduction in vegetation and plant roots which stabilize the soil results in increased sediment, and reduced water availability results in reduced assimilative capacity of waterbodies to dilute contaminants) (EPA 2023). In these cases, the IR category 4C impairment indicates that designated use impairments stem from the lack of a natural flow regime; however, these AUs may also be listed as impaired for the associated designated uses and specific pollutants. Recognizing the interplay between pollutants (e.g., sediment, temperature, nutrients, etc.) and pollution (e.g., hydrologic and habitat alteration), SWQB is committed to monitoring, assessing, and reporting the impacts of all types of water quality pollution on WQS attainment, thereby improving the opportunities for increasing resilience and successfully restoring these waters.

The SWQB prepared this assessment methodology to clarify the process of assessing and assigning waters to IR Category 4C when SWQB determines a failure to meet an applicable water quality standard is caused by pollution (hydrologic alteration) versus or in combination with an identified pollutant in wadeable streams. When discussing causes that contribute to the impairment of a designated use in a waterbody, EPA defines "flow alteration" as "frequent changes in flow or chronic reductions in flow that impact aquatic life" (EPA 1997). Hydrologic alteration is the current term in the state of the science for flow alteration, which also includes impacts to aquatic life as well as recreation, drinking water, etc. In cases where designated uses are impaired due to hydrologic alteration, the development of a TMDL is not required (as indicated by IR Category 4C) (EPA 2023), however SWQB may develop an Advance Restoration Plan (ARP) or similar watershed-based planning document to address designated use impairments as a result of hydrologic alteration.

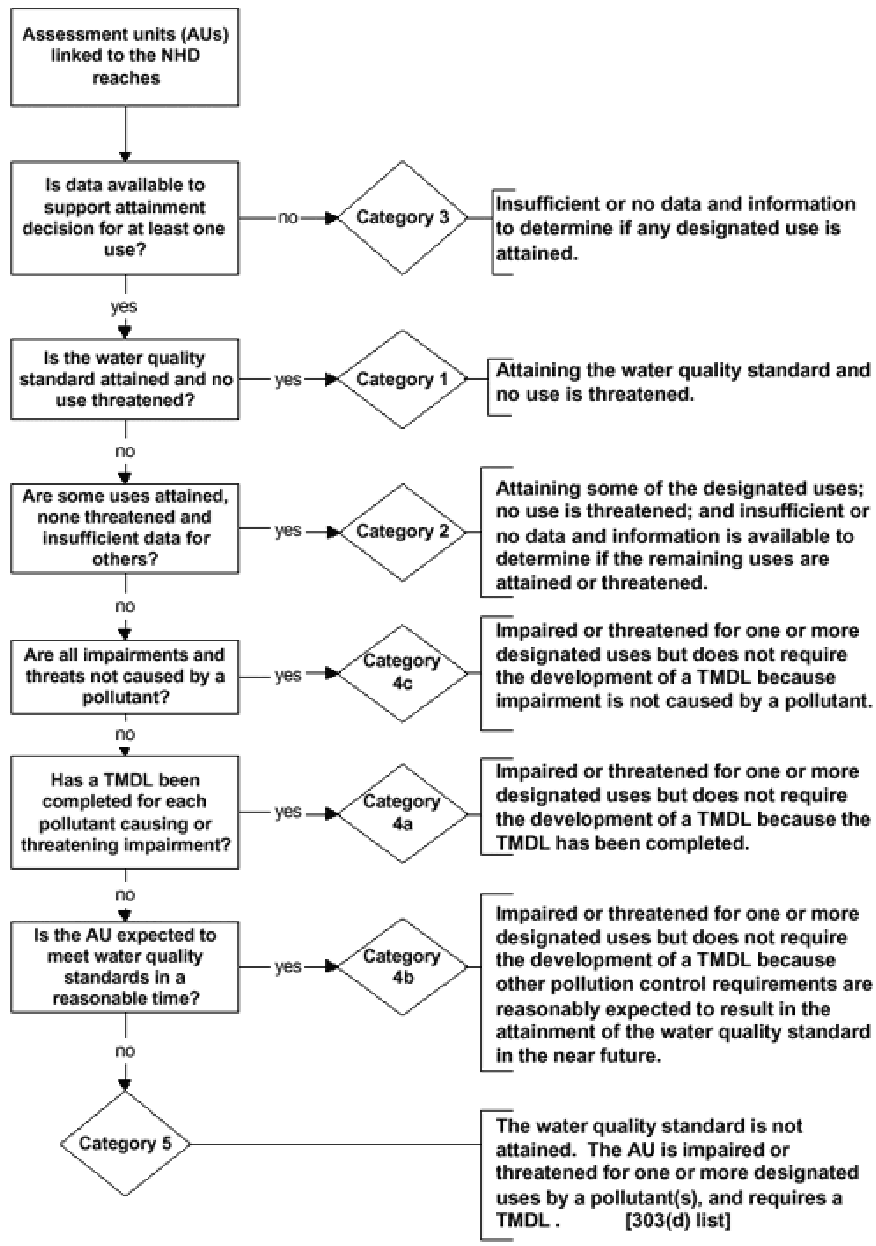

Figure 1. Summary flowchart for IR attainment categories (EPA 2001)

2.0 Data sources and compiling evidence to support IR category 4C listing (hydrologic alteration)

Flow data in New Mexico is limited and many points of diversion may not be monitored. However, primary sources of existing and readily available flow information in New Mexico include the NM Office of the State Engineer (OSE), irrigation districts, the U.S. Geological Survey (USGS), and SWQB. The SWQB will utilize the below data sources to make a weight-of-evidence determination regarding whether anthropogenic flow alteration (e.g., diversion) is causing a hydrologic alteration impairment (IR category 4C).

2.1 SWQB Flow Data and Observations

The SWQB Monitoring Team collects flow measurements and information during all water quality sampling events in wadeable streams (see SOP 7.0 “Flow” and SOP 8.2 “Chemical Sampling in Lotic Environments” at: https://www.env.nm.gov/surface-water-quality/sop/) unless data are available from a USGS gage for that AU. USGS gage data are used in lieu of field measurements for discharge where a gage is present nearby in the same AU. The Monitoring Team observes and measures flow during baseflow conditions as much as practicable. These are the most heavily-weighted pieces of information used to make an IR Category 4C determination. In addition to measuring discharge, staff document one of the following flow ratings on the Stream/River Field Data Form if there is observed no or low flow: “0” indicating a “Dry Channel” (no surface or shallow subsurface water apparent), “1” indicating “No Flow” with “interrupted/isolated pools with no connection,” or “2” indicating “Low Flow” with “little surface/subsurface flow between isolated pools.” These three flow condition ratings (0, 1, 2) are strong indicators of a dry or drying channel, especially if staff previously documented sufficient flow (i.e., flow condition ratings 3, 4, or 5). The Monitoring Team creates a Flow Sampling Event record in SQUID to document flow ratings which includes the specific monitoring station, date and time of observation, the field staff present, and any field staff comments or observations.

A hydrologic alteration and a 4C listing may be based upon (1) the flow condition ratings falling two or more rating levels (e.g., from a 3 to a 1) since monitoring of the waterbody began, and/or (2) the presence of a diversion altering flow determined by the best available tools, data, and site investigations (see Sections 2.2-2.5 below).

2.2 Water quality monitoring data or records

2.2.1 Qualitative records

The SWQB will utilize both qualitative and quantitative data and information to list an assessment unit in IR Category 4C (possibly in combination with IR category 5-R) using a weight-of-evidence approach. The SWQB may consider various submitted data and documentation, including photos, landowner testimony, or historical records, which indicate that a lotic waterbody has undergone anthropogenic hydrologic alterations that have rendered the waterbody incapable of meeting its designated uses. The SWQB will pair qualitative data and information with more concrete lines of evidence, such as flow ratings, flow measurements, or electronic records of diversion (Sections 2.3-2.5) to make a final assessment determination.

2.2.2 Quantitative data or records

In addition to measuring discharge, the SWQB Monitoring Team deploys multiple loggers or sondes throughout each watershed being sampled in a survey (see SOP 6.2 "Sonde Deployment", SOP 6.3 "Thermographs" and SOP 6.4 "Long-term Deployment Data Logger QA & Upload" at: https://www.env.nm.gov/surface-water-quality/sop/). These loggers provide an incidental record of channel drying/going completely dry as a function of recording air temperatures instead of water temperatures; and specific conductance or turbidity (as applicable) measuring 0 for these parameters. Monitoring Team staff are trained to recognize these sonde/logger air exposures or channel drying events and SWQB staff document sondes/logger deployments associated with these events in the respective logger upload form and upload these data to SQUID. See SOP 6.4 for more detailed information on determining exposure and indications of channel drying using sondes/loggers. Sonde/logger data indicating suspected channel drying and/or exposure of a properly deployed logger to air are moderately-weighted pieces of evidence which can be used to support a 4C listing for hydrologic alteration paired with one other piece of evidence indicating hydrologic alteration and subsequent non-attainment of designated uses (Sections 2.3-2.5).

2.3 New Mexico Office of the State Engineer (OSE) Point of Diversion (POD) GIS Coverage

Electronically accessible data on existing surface water diversions may be used as supporting evidence for an IR category 4C listing after the SWQB Monitoring Team, or other group collecting and submitting data in support of the IR, observes channel drying or alteration of flow. The New Mexico Office of the State Engineer maintains a database of point-of-diversion for all water diversions including surface declarations and/or permits and groundwater permits. This data can be referenced at the following location: https://geospatialdata-ose.opendata.arcgis.com/datasets/ose-pods/explore?location=35.516921%2C-105.940972%2C11.00. Surface Declarations are a declaration of a non-permitted/non-adjudicated surface water right where the declarant may or may not be currently diverting water.

2.4 NM Office of the State Engineer (OSE) Acequia GIS Coverage

The New Mexico Office of the State Engineer maintains a map of acequia and conveyance coverage which may be used as supporting evidence in an IR category 4C listing indicating anthropogenic diversion:
https://ose.maps.arcgis.com/apps/Cascade/index.html?appid=b6f0edf3d28a49dd822c558658b9a35d

Spanish colonies introduced acequias (i.e., irrigation ditches), which remain a critical way to supply water to many communities of the southwest. Acequias are communally managed irrigation systems that use gravity flow and local customs to share water from a common water source such as a river or spring. They are defined as local governments (political subdivisions of the State) in New Mexico, operate as local water democracies, and are responsible for local water management. It should be noted that the acequia culture in New Mexico is an important cultural heritage and for many, acequias are still an essential part of identity and subsistence. Currently, around 800 acequias exist for agricultural uses in northern New Mexico alone, and these ditches may also serve to replenish aquifers and restore riparian areas. [2] The inclusion of acequias in this weight-of-evidence approach to documenting anthropogenic hydrological alteration of surface waters in New Mexico is not a condemnation of acequias, but rather an acknowledgment that the balance of cultural/traditional uses of water with maintaining adequate flow to support other designated uses in natural surface waters has become increasingly difficult as increasing water demand, climate change, and drought impact the semi-arid southwest.

2.5 NM Office of the State Engineer (OSE) Hydrographic Survey

The first stage of the OSE adjudication process is the completion of the hydrographic survey. During this process, OSE Hydrographic Survey Bureau and the Litigation and Adjudication Program staff gather all the information used to legally describe a water right and record it in the report and associated maps filed with the court. All new hydrographic surveys are based on geographic information systems (GIS) technology and all field measurements are currently conducted using global positioning systems (GPS) receivers. The maps are not interactive (i.e., static); however, they portray the most recent hydrographic survey results and display active water rights and ditches that may be active sources of stream or river dewatering. The OSE prepares hydrographic surveys by watershed and provides them here: https://www.ose.state.nm.us/HydroSurvey/index.php. Hydrographic surveys may be useful as supporting evidence in IR category 4C listing determinations.

3.0 Assessment procedure – a Weight of-Evidence approach for IR category 4C listing (hydrologic alteration)

EPA encourages States to evaluate all existing and readily available data and/or information when determining the attainment status of a waterbody. Thus, the SWQB will use all readily available data and/or information documenting significant hydrologic alteration and report these data in the administrative record. This listing methodology describes the weight-of-evidence approach for making those decisions using two steps: 1) evidence of hydrologic alteration and 2) evidence that the waterbody ("assessment unit") is not attaining one or more designated uses as a result.

[2] https://alcaldesc.nmsu.edu/projects/acequia.html

3.1 Documenting hydrologic alteration

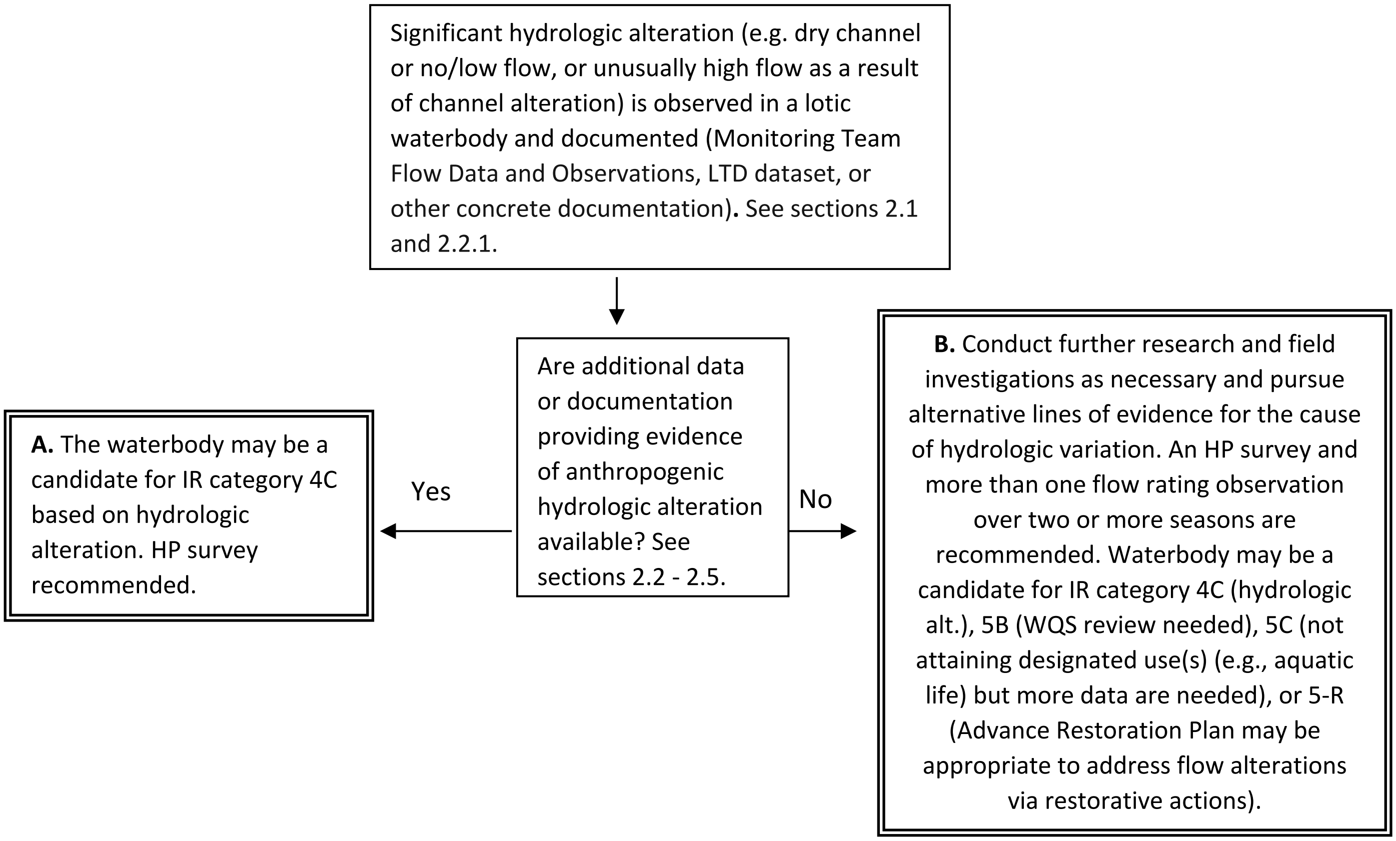

Figure 2. Decision tree for documenting evidence of hydrologic alteration

3.2 Designated use attainment determinations

The ability of a waterbody to support aquatic life is tied to the maintenance of key flow components. The natural flow regime supports the integrity of aquatic life by maintaining habitats of sufficient size, character, diversity, and connectivity. A variety of human activities that change pathways and rates of runoff, modify channel storage and dimensions, or directly add water to or remove water from streams can alter the natural flow regime, which may lead to changes in water temperature and chemistry or the physical properties of streams and adjacent riparian areas and flood plains. Changes to stream chemical and physical conditions following flow alteration can lead to the reduction, elimination, or disconnection of optimal habitat for aquatic biota. Biological responses to flow-mediated changes in stream chemistry and physical habitat can also affect aquatic life survival, growth, and reproduction. Changes in flow volume may result in loss of designated uses, such as when perennial streams or rivers are anthropogenically dewatered, flow regimes are altered effecting aquatic life recruitment, or intermittent streams are dewatered permanently or well beyond their natural variability (USGS 2016). Catastrophic (acute and chronic) flooding post wildfire are appropriate to list using this methodology because those waters are considered hydrologically altered for the foreseeable future. This procedure documents the process for evaluating major potential sources of flow alteration and their typical effects on the natural flow regime.

Per CWA regulations, the SWQB considers a waterbody or assessment unit (AU) impaired when the applicable WQS are not met, regardless of whether the WQS are based on narrative or numeric criteria. When assessing for impacts caused by hydrologic alteration in New Mexico, the SWQB will evaluate whether narrative or numeric criteria for designated uses, or numeric flow criteria (where applicable) are met. It is possible to have an impaired designated use that may not be determined through the assessment of available numeric and narrative criteria alone (e.g., if a perennial stream is dry or has no flow and field staff are not able to collect a sample, then assessment of the designated use based solely on the sample results and evaluation numeric criteria may not be possible). However, data and information based on visual observations of low/no water in a perennial stream are evidence of the physical condition of the stream, and sufficient to demonstrate the biological integrity of the stream is not attaining, and thus the aquatic life use is impaired.

IR Category 4C impairments for hydrologic alteration may apply to livestock watering, wildlife habitat, and aquatic life uses, if applicable to that waterbody or assessment unit. IR category 4C waters will be considered impaired for aquatic life use on the basis that this designed use is not attaining because the biological integrity of surface waters of the state is not being maintained. 20.6.4.13 (M) NMAC states that the biological integrity of surface waters must be maintained and that “[s]urface waters of the state shall support and maintain a balanced and integrated community of aquatic organisms with species composition, diversity and functional organization comparable to those of natural or minimally impacted waterbodies of a similar type and region.” 20.6.4.900 (H) NMAC (Aquatic Life Use) states that “Surface waters of the state with a designated, existing or attainable use of aquatic life shall be free from any substances at concentrations that can impair the community of plants and animals in or the ecological integrity of surface waters of the state.” Waterbodies not maintaining levels of flow adequate to meet the WQS will be considered impaired for aquatic life use due to hydrologic alteration (and may also be placed in IR category 5B, 5C, or 5-R).

Waterbodies may be delisted based on new information. Delisting only applies to situations where newer data indicate that water condition has improved (e.g., management or agency implemented in-stream flow requirements) and the currently listed waterbody is no longer impaired according to the current listing methodology, or the WQS have changed and reassessment indicates full support. Delisting decisions require the same information as listing decisions. The SWQB may delist waterbodies in IR category 4C if new information indicates that the aquatic life designated use is being met due to adequate and sustained levels of flow.

4.0 Implementation and watershed planning

Once a waterbody is listed as IR category 4C, a TMDL may be written (albeit is not required), or an alternative planning document, such as an ARP or alternative Watershed-Based Plan (WBP), may be developed to address the impairment. An ARP utilizes a watershed-scale approach to identify strategies for addressing nonpoint source pollution that will cumulatively achieve the water quality targets. It is a near-term description of actions, with a schedule and milestones, that is more immediately beneficial or practicable to achieving water quality standards, and is particularly appropriate in watersheds with active, engaged stakeholders. Alternative WBPs are five element plans that specify water quality goals and restoration or protection actions to achieve them. These plans identify the sources or causes of the impairment(s), propose management measures or best management practices (BMPs) to implement to address the impairment(s), outline a schedule of milestones and projects to achieve the water quality goals, and identify water quality monitoring that will measure the success of implementing the plan within the watershed. EPA Watershed-based plans are a viable planning document to address IR Category 4C impairments provided they address the six IR Category 4C elements outlined in the 2006 IR guidance (EPA 2005) and the nine elements outlined for watershed-based plans addressing nonpoint sources (NPS) per national NPS program guidance (EPA 2013, 2008, 2024). IR Category 4C assessment units are generally available for CWA §319 funding (see 2024 NPS Management Plan for the most recent approach[3]). New Mexico will continue to monitor these waterbodies or AUs to confirm hydrologic alteration is causing non-attainment of water quality standards. The SWQB will prioritize additional data collection and verification of information used for the initial placement of the AU each listing cycle as resources allow, and the AU will be re-categorized based on additional data and/or information.

REVISION HISTORY:

2024 cycle – Original. This initial assessment protocol focuses on hydrologic alteration in wadeable streams. **Post-Public Comment:** No changes.

2026 cycle – **Pre-Public Comment:** Revisions to the title of the document and throughout reflecting a change in scope to list as IR category 4C for Hydrologic alteration in a variety of scenarios, including channel modifications and changes to hydrology as a result of wildfire. Added language about Advance Restoration Plans (ARPs) and Alternative 5-element Watershed Based Plans (WBPs). Removed Figure 3 due to overly prescriptive process that did not account for alternative scenarios including increases in flow due to hydrologic alteration.

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