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

ASSESSMENT PROTOCOL

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

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Appendices

1.0 ASSESSMENT PROCESS OVERVIEW

Pursuant to Section 106(e)(1) of the Federal Clean Water Act (CWA), the Surface Water Quality Bureau (SWQB) has established appropriate monitoring methods (NMED/SWQB 2011a), quality assurance/ quality control (QA/QC) procedures (NMED/SWQB 2011b), and assessment methodologies (this document) in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the *New Mexico Water Quality Act* (NMSA 1978), the SWQB has developed and implemented a water quality monitoring strategy for surface waters of the state (NMED/SWQB 2010). 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 these data are used toward three basic monitoring objectives to: develop water quality-based controls, evaluate the effectiveness of such controls, and conduct water quality assessments.

From approximately 1998 to present, SWQB has primarily utilized a rotating basin system approach to water quality monitoring similar to several other states (WERF 2007). Using this approach, a select number of watersheds are monitored each year with an established return frequency of approximately eight years. Revisions to the schedule are necessary based on staff and monetary resources that fluctuate on an annual basis. It should also be noted that a watershed is not necessarily ignored during the years in between sampling. The rotating basin strategy is supplemented with other data collection efforts such as the funding of long-term United States Geological Survey (USGS) water quality monitoring stations for long-term trend data.

SWQB maintains current quality assurance and quality control plans that cover all monitoring activities. This document called the *Quality Assurance Project Plan* (QAPP) is updated and approved annually by United States Environmental Protection Agency (USEPA) Region 6 (NMED/SWQB 2011b). When an intensive survey is completed, all data are checked against QA/QC measures identified in the QAPP and assessed to determine whether or not designated uses detailed in the current *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMWQCC 2011a) are being met. In New Mexico, surface water data are assessed according to this document -- *Procedures of Assessing Standards Attainment for the State of New Mexico CWA §303(d) /§305(b) Integrated Report* (otherwise known as the "assessment protocol"). The results are then made available to the public through the *State of New Mexico CWA §303(d) /§305(b) Integrated Report* (otherwise known as the "Integrated Report"). The Integrated List which details individual water bodies can be found in Appendix B of the Integrated Report. The purpose of this assessment protocol document is to detail the process that the SWQB employs to determine whether or not designated uses are being attained in surface waters of the state. Therefore, these protocols cover the decision making process for both listing and de-listing.

USEPA does not officially approve individual state's assessment protocols, but USEPA does provide review and comment on the protocols and consults the protocols when reviewing the state's draft Integrated List. The assessment protocol is periodically updated and is generally based on current USEPA assessment guidance. For development of the 2012 Integrated Report and List, USEPA recommends that states follow the 2006 Integrated Report guidance (USEPA 2005) which is supplemented by memoranda regarding development of the 2008, 2010, and 2012 Integrated Reports (USEPA 2006a, 2009, and 2011, respectively).

Similar to other states, summary assessment data are housed in the USEPA-developed Assessment Database version 2.1.4 (ADB v.2.1.4) by "assessment unit" (WERF 2007). USEPA first suggested the use of this term in their 2002 listing guidance (USEPA 2001, RTI 2002). This term is also utilized in ADB. USEPA listing guidance documents recommend that states organize their respective lists by assessment units and house the information in ADB (USEPA 2001, 2003, 2005, 2006a). Assessment units (AUs) can represent a single lake or reservoir, or miles of a stream reach or river. AUs are generally defined by various factors such as hydrologic or watershed boundaries, water quality standards

(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). With respect to 40 CFR 130.2, New Mexico's use of the term "assessment unit" is equivalent to "water quality-limited segment." New Mexico specifically defines the term "segment" within the state water quality standards at 20.6.4.7.ZZ NMAC. In New Mexico, there are generally many assessment units within a water quality standard segment (20.6.4.97 through 20.6.4.899 NMAC).

Use attainment decisions are then summarized by assessment unit in the *State of New Mexico CWA §303(d)/ §305(b) Integrated Report*. This report is prepared every even numbered calendar year as required by the CWA. Category 5 AUs on this Integrated List (see Section 4.0 for category definitions) constitute the *CWA §303(d) List of Impaired Waters*. The Integrated List portion of the Integrated Report is opened for a minimum 30-day public comment period. Response to Comments are prepared by SWQB and submitted to USEPA Region 6 for review. SWQB also updates and submits the Record of Decision (ROD) document. The ROD is an additional, non-required document that SWQB provides to USEPA and the public which explains why and when a particular assessment unit was added to and, if applicable, why and when it was removed from Category 5 of the Integrated List. An outline of the basic assessment process that SWQB Project Leaders and the Assessment Coordinator follow when performing assessments is contained in Appendix H. All the above-mentioned documents developed and maintained by the SWQB are available on the SWQB web page: http://www.nmenv.state.nm.us/SWQB/.

Assessment of data forms the basis of designated use attainment decisions. These assessments are based on data that reasonably reflect current surface water quality conditions. These data are compared to current USEPA-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.

The bulk of the data used for assessments are data collected by SWQB during rotational water quality surveys. SWQB will also utilize 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 (NMED/SWQB 2011b). In general, all readily available data that were not assessed for a previous listing cycle will first be collated and assessed (Figure 1.1). Assessment conclusions will be compared to the conclusions of the previous list. If they have not changed for a given water quality parameter within particular AU, the conclusions of the current assessment will carry over to the current list. If the current assessment indicates a change in attainment status, the new data for that particular water quality parameter at that site will be combined with the most recent five years of data (WERF 2007). The specific years of data to use are defined from the date data were collated for the upcoming listing cycle, typically May 1 of the year before the list is due. For example, data from May 1, 2006 through May 1, 2011, would be collated for development of the draft 2012 Integrated List. This collated dataset will form the basis of final impairment decision.

The CWA requires water quality standards protect designated uses during critical conditions such as years with below average stream flow. This distinction is important because it would not meet the intent of the CWA to use data collected in non-drought conditions to draw a conclusion of no impairment when available data collected during low flow conditions indicates impairment. Recent data may take precedence over older data if new data indicate a change to water quality or the older data fail to meet data quality requirements. If several consecutive years of data are available and the most recent data are less than applicable numeric water quality criteria, SWQB may also consider data trends when determining impairment if the data indicate a clear pattern of recovery after a temporary disturbance.

This is consistent with recommendations in USEPA guidance (USEPA 2005). If there are only data greater than five years old available for a particular assessment unit, the assessment conclusions based on these older data will be carried over to the next list until more current data are available to assess.

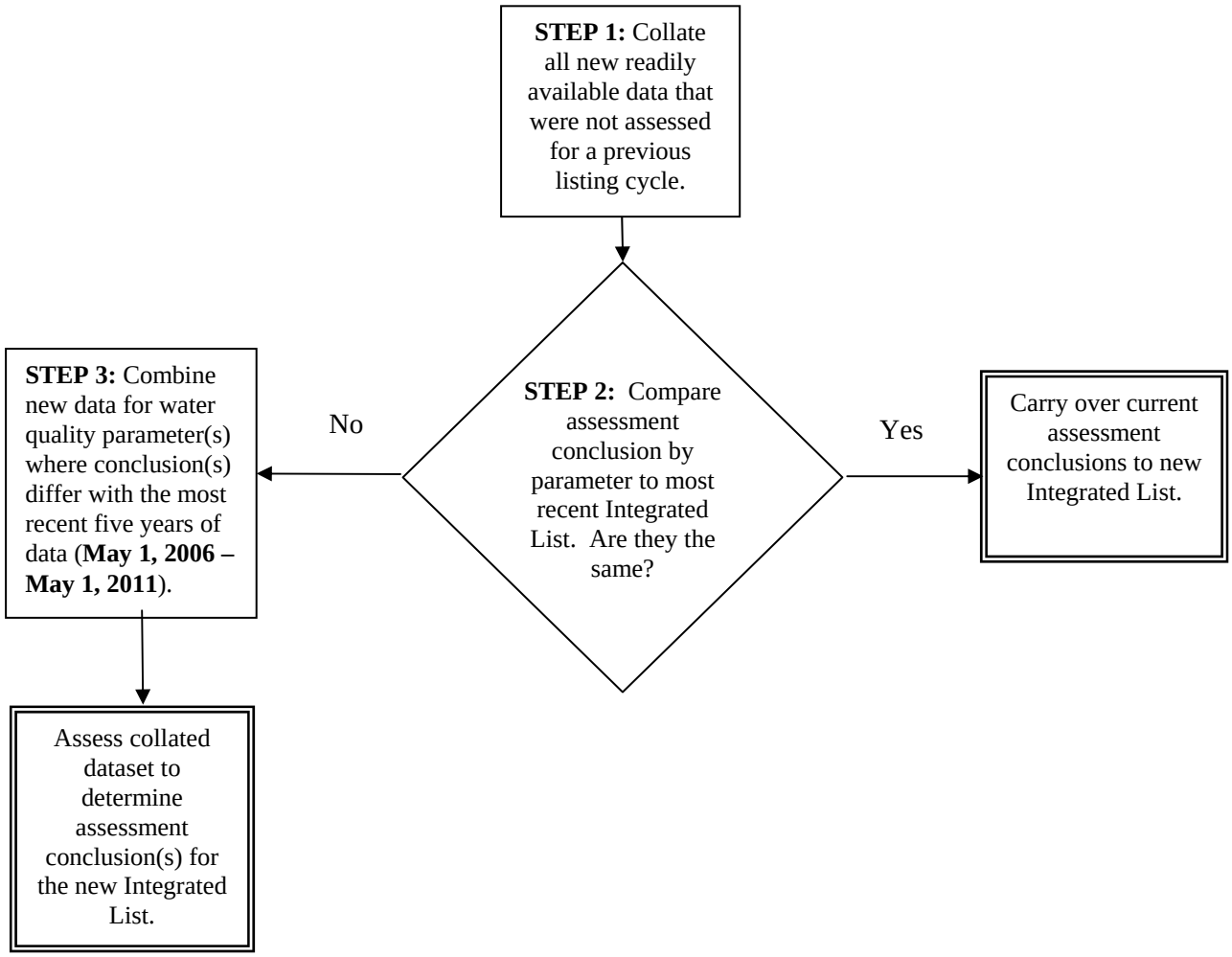


Figure 1.1. Decision process for determining assessment dataset

Outside sources of available data are solicited via public notice of a minimum 30-day period before the draft Integrated List of surface waters is prepared. All data submissions from outside sources will be reviewed by the SWQB QA Officer to ensure the suitability of the QA/QC procedures under which the data were collected. Specifically, submitted documentation associated with the dataset will be reviewed to determine: (1) if there is documentation of QA/QC procedures that, at a minimum, meet the QA/QC requirements described in the SWQB's most recent QAPP; and (2) if there is reasonable evidence or assurance that these procedures were followed.

Quality data received through this solicitation may be used 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. Non-chemical/physical water quality related data (e.g., habitat conditions, field observations, macroinvertebrate, and fish communities) are also solicited and may be useful for characterizing water

quality conditions and for water quality standards 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 could include, but are not limited, to the following. These data would need to meet QA/QC requirements to be used for assessment as stated above.

- NMED SWQB chemical/physical, biological, habitat, bacteriological, or toxicological data collected during intensive watershed surveys using approved or otherwise accepted quantitative methods;
- Chemical/physical data from recent studies by NMED or other organizations, contractors, tribes, or individuals;
- USGS water quality data (provisional data shall not be used to make designated use support determinations);
- Benthic macroinvertebrate, fish community, and/or fish tissue data collected by NMED or other organizations, contractors, tribes, or individuals;
- EPA-recognized protocols such as Environmental Monitoring and Assessment Program (EMAP), Rapid Bioassessment Protocols (RBP), or other biological/habitat data collected by NMED and other organizations, contractors, tribes, or individuals;
- In-stream (i.e., receiving water) data collected during NMED effluent monitoring efforts;
- NPDES storm water permit compliance monitoring data for receiving waters;
- In-stream water quality data from other NMED bureaus such as the Drinking Water, Ground Water, and/or the Department of Energy (DOE) Oversight bureaus; and
- Citizen or volunteer data.

2.0 DATA USABILITY AND QUALITY DETERMINATIONS

2.1 Data Management Rules

2.1.1 Data qualifiers and validation codes

SWQB has developed an in-house water quality database to house water, sediment, and fish tissue chemical data. These data are available upon request. This database also contains lab data qualifiers and internal validation codes that are added during the data validation process (NMED/SWQB 2011b). Chemical/physical data collected by SWQB are eventually uploaded to the national STORET database, which was replaced by USEPA's WQX database in September 2009. The current version of STORET/WQX does not have a standard lab remark code field. Per suggestion of the STORET/WQX user's group, SWQB has put user-defined information on data qualifiers and internal validation codes into STORET/WQX field entitled "Results Comments." Any data with a qualifier code or data validation code that are used in an assessment should be noted on the respective Assessment Form (see Appendix H for forms). Refer to the current version of the QAPP for the current definition of all data qualifier and data validation codes (NMED/SWQB 2011b).

- Lab Qualifier Codes – In the past, sets of qualifier codes have varied between the individual sections at 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.

  Concentrations detected at a level below which an accurate quantification can be given are typically flagged with a "J" qualifier that indicates the reported concentration is an estimated concentration. The concentration is reported as estimated because the concentration being detected is below the lowest concentration on the calibration curve. There is certainty as to the identification of the chemical but uncertainty as to the reported concentration. These reported values may be used in an assessment when the detection limit is greater than the applicable water quality criterion (WQC) because the concentration is known to be greater than the WQC even though it is an estimate. An example would be a parameter with an applicable WQC of 0.5 mg/L, with a detection limit of 1.0 mg/L and quantitation limit of 3.0 mg/L. If the result were 2.0 mg/L with a "J" flag, this data would be used for assessment because although it's an estimate, it is known to be greater than the WQC of 0.5 mg/L because the detection limit is 1.0 mg/L. For calculating total PCB concentration using USEPA Method 1668A, B or C congener methods, "J" flagged values for individual congeners are to be included in the sum which is used for assessment.

  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 (NMED/SWQB 2011a, 2011b). 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 take into account the nature of the analysis, the extent of the noncompliance (for example, 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 (USEPA 2002d). From USEPA'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 (USEPA 2002e). Therefore, data exceeding holding time may be considered for use in assessments.

- SWQB Data Validation Codes (internal) – SWQB validates all data for a particular water quality survey. Internal data validation procedures are detailed in the most recent QAPP. All data with internal SWQB validation codes will still be used for assessment purposes except data flagged as "rejected" (typically R1, R2, or R3 data validation codes).

2.1.2 Duplicates and compliance monitoring sampling data

There may be cases where there are multiple data values on the same day at the same station within a one hour period (Figure 2.1). For the purposes of assessment, these are considered duplicate samples and the maximum (or minimum if the criterion is expressed as a minimum) value should be used in the assessment dataset. An example would be when QA/QC duplicates are taken within a one hour time frame. These data are considered replicates for the purpose of assessment and the maximum value should be used for assessment purposes to be conservative.

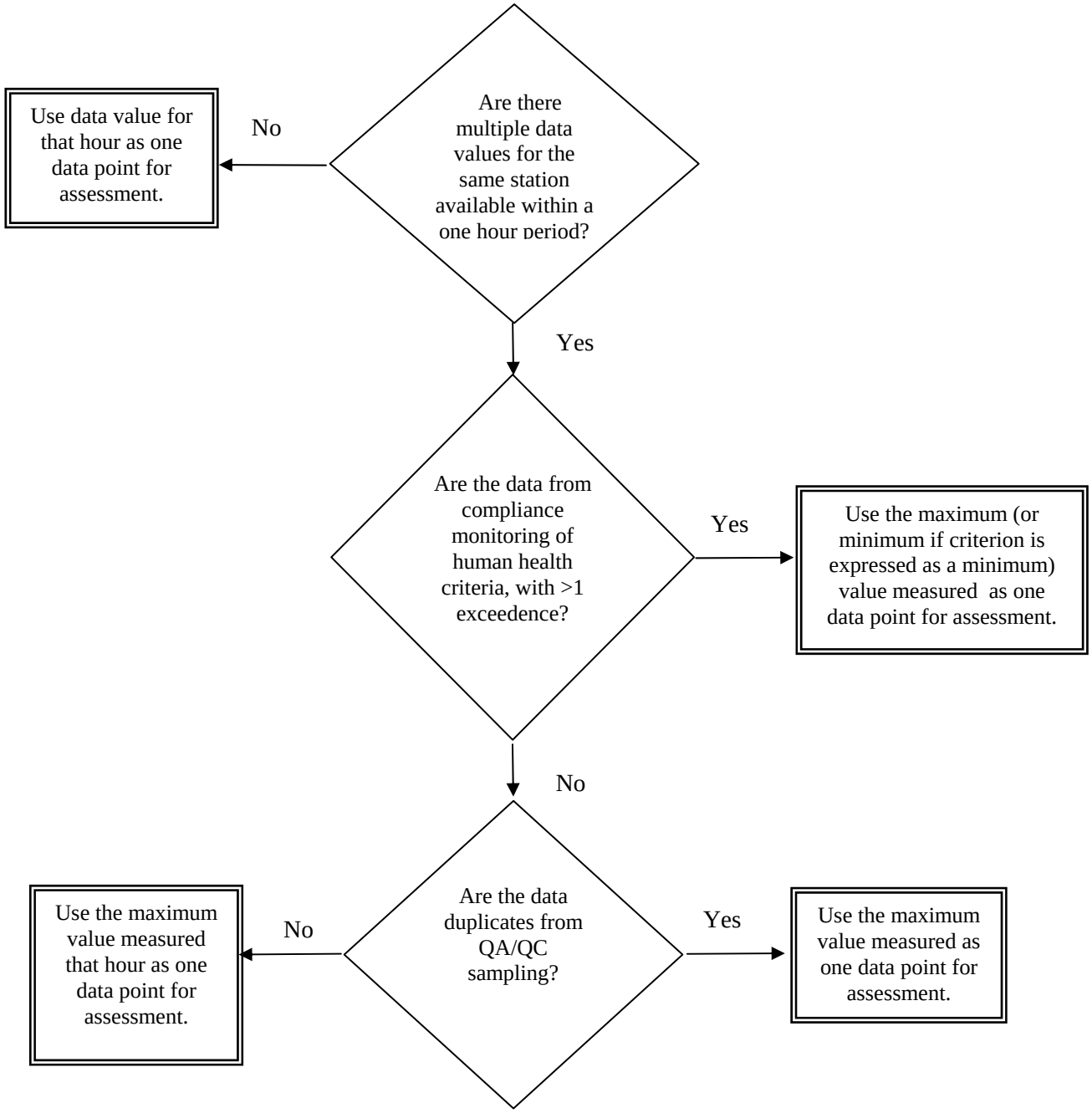


Figure 2.1. Decision process for multiple data values from the same station collected in one hour

2.1.3 Continuous recording equipment (thermographs and sondes)

Prior to 1998, water temperature was measured once during each site visit and designated use support status related to temperature criteria was determined by applying a percent-of-exceedences formula to these instantaneous temperature data. Periodic instantaneous temperature data do not provide information on maximum daily temperatures, duration of excessive temperatures, or diurnal fluctuations of water temperature. These aspects of temperature are pertinent to aquatic life use. Continuously recording temperature data loggers (i.e., thermographs) are now readily available and provide an extensive multiple-day record of hourly temperatures over the critical time period when temperatures are generally highest.

The SWQB has been deploying thermographs in streams and applying the temperature assessment protocol since the 2000-2002 CWA §303(d) listing cycle (see Appendix B). SWQB initially developed a temperature assessment protocol that only addressed assessment of thermograph data from streams with high quality coldwater aquatic life (HQCWAL) or coldwater aquatic life (CWAL) designated uses. This approach is more technically sound than simply applying percentages to limited instantaneous temperature data and incorporates magnitude, frequency and duration of exposure into water quality monitoring and assessment. The use of thermographs eliminates the biases introduced when using instantaneous data to assess water quality parameters with significant diurnal fluctuation. For the 2010 listing cycle, this temperature protocol was expanded to cover 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) water bodies.

The SWQB has been deploying sondes at select stations since 2000. Monitoring staff typically program these devices to record hourly dissolved oxygen, pH, specific conductance, temperature, and turbidity values for a minimum of three days (72 hours). Based on the success of the thermograph-based assessment protocol, additional large dataset assessment protocols were developed to address parameters with known diurnal fluxes, namely dissolved oxygen and pH (Appendices E and F, respectively). For the 2012 listing cycle, these protocols were expanded to 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) water bodies.

Because of the limitations of grab data and the increasing availability of sonde and thermograph data, assessments using sonde and thermograph data are generally preferred. Data from a deployment of a minimum of three days (72 hours) with a data collection frequency interval of no more than one hour are required to assess with the large dataset assessment methods. If this amount of sonde dissolved oxygen data is not available, the instantaneous grab method is used to determine attainment.

2.1.4 Limited datasets

A minimum of two data points for field and chemical parameters is necessary to apply the procedures in Section 3.0 in order to determine attainment status for an associated designated use in a particular AU. The primary purpose of requiring two data points is to protect against the occurrence of false positives. 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 staff directly to confirm the results and/or scheduling appropriate modifications to survey sampling plans. If data from only one sampling event are available (n=1) to assess an applicable designated use, there are insufficient data to determine attainment status for that particular designated use. The use will be noted as "Not Assessed" on the list as well as noted in the associated AU Comments field. If there are data from more than one sampling event available (n>1) with one exceedence, the attainment status will be noted as "Full Support" according to the procedures in Section 3.0. The exceedence will be noted in the AU Comments field and additional data will be collected as resources allow to determine impairment status. An exception is the assessment of Domestic Water Supply which only requires one exceedence and therefore one data point to list as impaired (see Section 3.2). Other cases where only one data point is

needed to determine attainment status include pH values greater than 9.5, and temperature values greater than the maximum temperature per applicable aquatic life use in 20.6.4.900 NMAC (see Appendix F and B, respectively, for details).

Through the current rotating watershed survey strategy, SWQB strives for a minimum of four to eight chemical data points for core parameters such as metals and nutrients to make designated use determinations. SWQB also uses thermographs and multi-parameter sondes to generate large datasets for temperature, pH, dissolved oxygen, specific conductance, and turbidity. USEPA does not recommend the use of rigid, across the board, minimum sample size requirements in the assessment process (USEPA 2009). Target sample sizes should not be applied in an assessment methodology as absolute exclusionary rules (USEPA 2003, 2005). The use of limited datasets is acceptable to USEPA as limited financial, field, and laboratory resources often dictate the number of samples that can be collected and analyzed (USEPA 2002a).

2.1.5 Application of WQS during low flow conditions

Data collected during all flow conditions (except data collected during unstable conditions when assessing for chronic aquatic life use -- see section 3.1.2.1 below for additional details), including low flow conditions (i.e., flows below the 4Q3), will be used to determine designated use attainment status during the assessment process. 4Q3 values are to be utilized as minimum dilution assumptions for developing discharge permit effluent limitations. In terms of assessing designated use attainment in ambient surface waters, WQS apply at all times under all flow conditions unless a flow qualifier is specified in a particular section of the WQS.

2.1.6 Multiple stations in one assessment unit

As stated in Section 1.0 above, assessment units (AUs) are designed 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.ZZ NMAC. SWQB typically does not have the resources to establish more than one monitoring station in any particular perennial AU during rotational watershed surveys, but there are occasions where more than one river or stream station with available data (typically chemical/physical data) is either established by SWQB or some other data collection agency (Figure 2.2).

When this occurs, the assessor will first assess data from each station individually to determine impairment(s). Assessment units with homogenous landscape features are likely to have homogenous water quality. However, multiple stations within an AU may indicate otherwise due to point source discharges and/or lack of adequate, or no, best management practices (BMPs) that address non-point source pollution. If conflicts arise and the attainment conclusions for every station in the AU are not in agreement (i.e., either all Full Support or all Non Support), 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 or non-point source BMPs. The data will then be re-assessed based on the newly-defined AUs.

In the rare event that there are two or more stations less than one tenth of a mile (approximately 200 yards) apart and data for the same parameter are collected within a one hour time frame from these stations, these data are considered replicates for the purpose of assessment and the maximum (or minimum if criterion is expressed as a minimum) value should be used for assessment purposes.

When multiple stations exist on a lake or reservoir (i.e., there is often one "shallow" and one "deep" station in the same AU), they are usually sampled on the same day or within the same seven-day period. For the purposes of assessment, data from multiple stations on a lake or reservoir will be treated as replicate samples and the maximum (or minimum if criterion is expressed as a minimum) value should be used in the assessment dataset.

The approach in this section is applicable to all impairment determination procedures detailed in this Main Assessment Protocol, as well as all appendices unless otherwise stated.

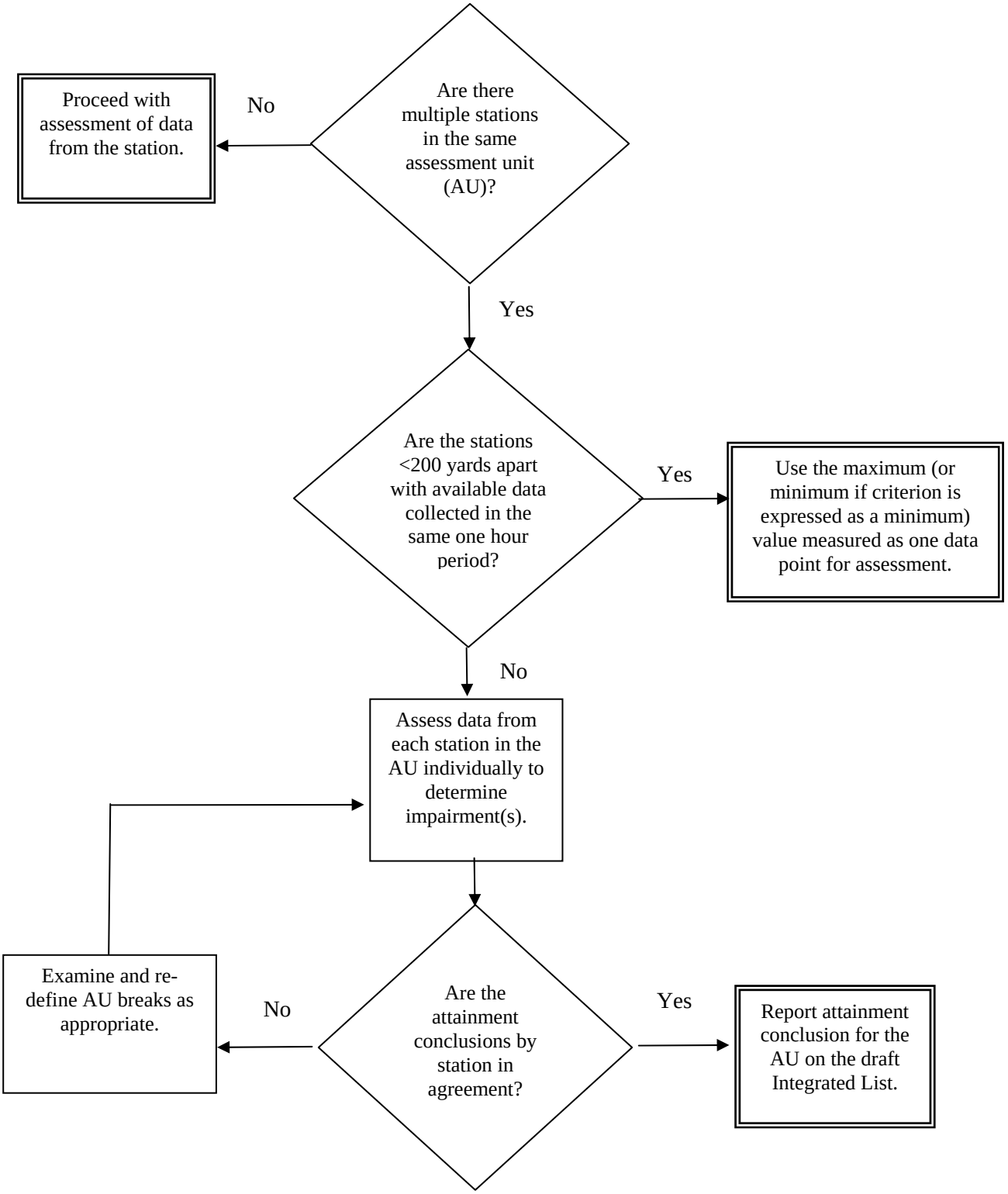


Figure 2.2. Decision process for multiple stream or river stations in same assessment unit

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

When a constituent concentration is determined using an ultra-low level method which recommends blank-correction (such as USEPA 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. Other acceptable, documented blank-correction procedures will be considered when the procedures recommended in the method are not used, and the resulting data will be used for assessment if approved by the SWQB QA Officer. These blank-corrected values will then be compared against New Mexico's water quality standards (WQS) to determine impairment.

2.1.8 "Non detects" from a method with a detection limit greater than the criterion

If the detection limit is above the applicable criterion and the laboratory result is reported as below this limit, the result cannot be used for a listing decision (for example, when the detection limit is 8.0 mg/L, the result is reported as <8.0 mg/L, and the criterion is 5 mg/L). In this situation, this datum contains no information about the magnitude relative to the applicable water quality criterion.

2.1.9 Hydrology Protocol

Numerous classified segments in the water quality standards include only perennial waters, without specifically identifying which reaches are perennial. For example, the description of Segment 20.6.4.109 NMAC states, "all other perennial reaches of tributaries to the Rio Puerco." Non-perennial reaches of these tributaries remain unclassified. In such a case, the Hydrology Protocol can be used, as described in NMWQCC (2011b), to determine whether a particular reach is perennial and therefore included in the classified segment, or non-perennial and therefore subject to the designated uses and criteria for unclassified waters in 20.6.4.98 NMAC. Such a determination does not require a use attainability analysis (UAA) or a hearing because it does not change the designated uses or criteria; it merely allows for the applicable uses to be properly identified. It is similar to determining whether a reach of stream is under tribal or state jurisdiction, a determination which may also require field verification. The applicable water quality standards will be documented in the Integrated Report.

If a non-perennial reach is found to be ephemeral, then the expedited UAA process may be followed as described in NMWQCC (2011b) to place the stream under 20.6.4.97 NMAC.

2.2 Data Quality Levels

2.2.1 Aquatic life use data types

As stated in Section 1.0 above, data must, at a minimum, meet the QA/QC requirements described in the SWQB's most recent QAPP to be considered for development of the Integrated Report (NMED/SWQB 2011b). In some cases, more than one type of data can be used to determine aquatic life use attainment. It is recognized that not all data are of equal quality or rigor. The following tables describe defined levels of data quality for each type of data recognized in making aquatic life support determinations. These tables contain both 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 (USEPA 2002a). Tables for determining the level of data quality for biological, habitat, chemical/physical, and toxicological data types are presented. 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). These tables are included only for aquatic life use determinations because it is the only use for which multiple data types are currently recognized and utilized.

Tables 2.2 through 2.5 classify the data level or rigor of a data type by its technical components and describe the level of effort (spatial or temporal coverage) necessary to achieve each level as defined by USEPA with minor modifications specific to New Mexico (USEPA 2002a). Although the table structures imply that data at Level 2 (Fair) level of information, for example, would have the technical components, spatial/temporal coverage, and data quality listed for that data level, it is possible to have different levels of information for each of the three components. Level 4 represents data of the highest rigor and the highest level of quality while Level 1 represents the lowest level of quality.

Table 2.2 Hierarchy of bioassessment approaches for evaluation of aquatic life use attainment

LEVEL OF INFO	TECHNICAL COMPONENTS	SPATIAL/TEMPORAL COVERAGE	DATA QUALITY
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.
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
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 assessment
4 EXLNT	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 assessment

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

Table 2.3 Hierarchy of habitat assessment approaches for evaluation of aquatic life use attainment

LEVEL OF INFO	TECHNICAL COMPONENTS	SPATIAL/TEMPORAL COVERAGE	DATA QUALITY
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.
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
3 GOOD	Visual-based habitat assessment using SOPs; may be supplemented with quantitative measurements of selected parameters; conducted with bioassessment; 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 commensurate with biological sampling; assessment may be regional or site-specific	Moderate precision and sensitivity; professional scientist performs survey or provides oversight and training

4 EXLNT	Assessment of habitat based on quantitative measurements of in-stream parameters, channel morphology, and floodplain characteristics; 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

Table 2.4 Hierarchy of chemical/physical data levels for evaluation of use attainment

LEVEL OF INFO	TECHNICAL COMPONENTS	SPATIAL/TEMPORAL COVERAGE	DATA QUALITY
1 LOW	Any one of the following: • Water quality monitoring using grab sampling • Water data extrapolated from up stream 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 • 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 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 • Calibrated models (calibration data <5 years old) • Limited use of continuous monitoring instrumentation	Broad spatial and temporal coverage of site with sufficient frequency and coverage to capture acute events: • Monthly sampling during key periods (e.g. critical hydrological regimes and fish spawning seasons), multiple samples at high and low flows • 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 QA/QC protocols followed, QA/QC results adequate Approved SOPs used for field and lab Adequate metadata
4 EXLNT	All of the following: • Water quality monitoring using composite samples, series of grab samples, and 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) including multiple samples at high and low flows • Continuous monitoring (e.g. use of thermographs, sondes, or similar devices)	High precision and sensitivity QA/QC protocols followed, QA/QC results adequate Approved SOPs used for field and lab; samplers well trained Adequate metadata

NOTES: *See section 3.1.2.1 for additional information.

Table 2.5 Hierarchy of toxicological approaches and levels for evaluation of aquatic life use attainment

LEVEL OF INFO	TECHNICAL COMPONENTS	SPATIAL/TEMPORAL COVERAGE	DATA QUALITY
1 LOW	Any one of the following: • Acute or chronic WET for effluent dominated channel • Acute ambient water	One (1) ambient water sample tested in an assessment unit or site	Unknown/Low; minimal replication used; laboratory quality or expertise unknown
2 FAIR	Any one of the following: • Acute and chronic WET for effluent dominated channel	Two (2) ambient water samples tested in an assessment unit or site on 2 different dates	Low/moderate; little replication used within a site; laboratory quality or expertise unknown or low
3 GOOD	Any one of the following: • Acute and chronic WET for effluent dominated system • Acute or chronic ambient water	Three (3) ambient water samples tested in an assessment unit or site on 3 different dates	Moderate/high; replication used; trained personnel and good laboratory quality
4 EXLNT	Both of the following: • Acute and chronic ambient water	Four or more (≥ 4) tests in total based on samples collected in a assessment unit or site on 4 different dates	High; replication used; trained personnel and good lab quality

2.2.2 Contact use data type

Pathogen data are needed to determine use support for Primary Contact and Secondary Contact designated uses. Pathogen data typically consists of fecal coliform and/or *E. coli* data. The Consolidated Assessment and Listing Methodology (CALM) guidance does not contain any examples of data quality criteria to discern low to excellent data quality for parameters related to contact use (USEPA 2002a). Currently, the only data type used to make contact use attainment decisions in New Mexico is *E. coli* data because there are no contact use water quality standards for non-pathogen data. Therefore, there cannot be conflicting contact use attainment conclusions from various types of data as there can be in aquatic life use attainment decisions, therefore, this protocol does not need to include criteria to evaluate pathogen data quality.

3.0 INDIVIDUAL DESIGNATED USE SUPPORT DETERMINATIONS

Water Quality Standards (WQS) are a triad of elements that work in concert to provide water quality protection. These three elements are: designated uses, numeric and narrative criteria, and an antidegradation policy. Designated uses are the defined uses of a particular surface water body. Each water body 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* published in the New Mexico Administrative Code (NMAC) at 20.6.4 NMAC (NMWQCC 2011a). The NMWQCC 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. The antidegradation policy ensures that existing uses[1] and levels of water quality necessary to protect these uses will be maintained and protected (20.6.4.8 NMAC).

WQS segments defined in 20.6.4 NMAC are further divided into assessment units (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). 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. Stream or river AUs are typically no more than 25 miles in length, unless there are no tributaries or land use changes to consider along the reach. Multiple stations in one AU warrant special consideration as detailed in Section 2.1.6 above.

The following subsections provide guidelines used to interpret available data. These guidelines will be used to make determinations of 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 being 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, as well as 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, several specific assessment protocols for temperature, sedimentation/siltation (also referred to as "stream bottom deposits") in perennial wadeable streams, excessive nutrients in perennial wadeable streams, dissolved oxygen, pH, and turbidity have been developed. These protocols are included in appendices B through G.

Integrated listing guidance from USEPA recommends the following use attainment categories (USEPA 2001, USEPA 2002a, USEPA 2003, USEPA 2005): **Fully Supporting, Not Supporting, Insufficient Information, and Not Assessed.** For every AU detailed in the Integrated List, one of these four categories is assigned to every designated use as stated in the applicable section of 20.6.4 NMAC, or identified existing use.

[1] "Existing use" (defined at 20.6.4.7(Y) NMAC) means "a use actually attained in a surface water of the state on or after November 28, 1975, whether or not it is a designated use." An existing use may be identified by SWQB staff or other sources based on observation, data, and/or documentation.

A determination of Fully Supporting or Not Supporting should not be made in the absence of data. 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 de-listing. To those AUs for which there are no 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 that use.

3.1 Assessing Aquatic Life Use 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. Data quality associated with these types can be found in Section 2.2.1.

3.1.1 Biological data

In 2010, the New Mexico WQCC adopted the following General Criteria (20.6.4.13 Subsection M):

> *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.*

To date, benthic macroinvertebrate sampling has been the primary form of biomonitoring utilized by New Mexico. SWQB also monitors fish assemblages and algae in an increasing number of streams.

3.1.1.1 Benthic macroinvertebrate communities

Two biological assessment approaches utilizing benthic macroinvertebrate communities are currently used in NM for determining aquatic life use attainment, namely the reference condition approach and the reference site approach. Both approaches are based on the concept of comparing actual condition of a specific waterbody to a reference condition, if developed, or a reference site, if available. Currently NM has only developed a reference condition for wadeable, perennial streams in the Mountain ecoregions. Wadeable, perennial streams located outside of the Mountain ecoregions are assessed using the reference site approach from the Rapid Bioassessment Protocol approach (RBP) (Plafkin et al. 1989) described in more detail below. SWQB does not apply this method to large non-wadeable rivers, lakes and reservoirs, or non-perennial streams at this time.

When the Rapid Bioassessment Protocol (RBP) method was first introduced, the concept of reference condition was typically limited to pristine streams (Plafkin et al. 1989). This concept was updated 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 to assess potential impairment to the aquatic community. SWQB is exploring the development of a Human Disturbance Gradient through GIS and by on-site verification through the use of the Site Condition Class Verification and Probable Source Field sheet to better determine reference conditions following methods modified from Drake (2004).

SWQB has been collecting benthic macroinvertebrate data since 1979. The formal process of developing biological criteria began in 2002 with assistance from USEPA Region 6 and Tetra Tech, Inc., Ecological Services Division. In 2006, SWQB, in collaboration with Drs. Jacobi and Tetra Tech, 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 a number of 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 Ecoregions 21 and 23 (Southern Rockies and 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 bioregions. Application of the High Small SCI in the Jacobi 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 Jacobi et al. (2006) report to determine Aquatic Life Use attainment of all wadeable perennial streams in the Mountain region, and refers to this as the mountain stream condition index (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 metrics from five categories representing community and species attributes including Taxonomic Composition, Taxonomic Richness, Tolerance, Habit, and Functional Feeding Group. Individual metrics are listed in Table 3.1.

Table 3.1 Metrics included in the M-SCI

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 – 78.35), Good (78.35 – 56.70), Fair (56.70 – 37.20), Poor (37.20 – 18.90), Very Poor (18.90 – 0) based on the distribution of reference site scores. Sites with M-SCI ranking of poor or very poor are considered to not supporting of an aquatic life use. Sites falling in the fair range are considered "Not Assessed" until a second sample can be taken. These sites will be listed as "Not Supporting" if a second sample within a 5-year period confirms a value in this range.

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

METRIC	95th PERCENTILE	FORMULA
Shannon Diversity (log_2)	3.89	if $X > X_{95}$, score = 100 if $X \leq X_{95}$, 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: 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.

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

TYPE OF DATA	FULLY SUPPORTING	NOT ASSESSED***	NOT SUPPORTING	NOTES
Macroinvertebrate assemblages in Ecoregions 22, 24, 25, and 26*	Reliable data indicate functioning, sustainable macroinvertebrate assemblages not modified significantly beyond the natural range of reference condition (>83% of reference site(s)).*	Reliable data indicate macroinvertebrate assemblages might be modified beyond the natural range of reference condition (≤83% and >79% of reference site(s)).	Reliable data indicate macroinvertebrate assemblage with moderate to severe impairment when compared to reference condition (≤79% of reference site(s)). *	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**	Reliable data indicate functioning, sustainable macroinvertebrate assemblages not modified significantly beyond the natural range of reference condition (> 56.7 score).	Reliable data indicate macroinvertebrate assemblages might be modified beyond the natural range of reference condition (≤56.7 and >37.2 score).	Reliable data indicate macroinvertebrate assemblage with impairment when compared to reference condition (≤37.2 score).	

NOTE: *Percentages are based on Plafkin et al. (1989).
** Percentages based on Jacobi et al. (2006).
*** List as Not Supporting if a second sample within a 5-year period confirms value in this range.

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. SWQB currently uses periphyton data as a response variable in nutrient surveys and assessments in wadeable streams (see Appendix D). Periphyton and phytoplankton data from rivers and lakes have also been collated and explored as response variables for nutrient river and lake protocols under development and lake trophic state evaluation.

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 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 fresh water 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, fish, and wildlife that ingest water contaminated with the toxins. Additional information regarding blue-green algae can be found on the SWQB website at: ftp://ftp.nmenv.state.nm.us/www/swqb/BlueGreenAlgae/BlueGreenAlgaeFAQ.pdf.

Prymnesium parvum, a golden alga found worldwide in estuarine waters and in some freshwater bodies that have relatively high salt content, had its first confirmed freshwater blooms in North America in the Pecos River basin in Texas in 1985. This microscopic flagellated alga is a relatively new invasive species and has appeared in some waters of New Mexico where salinity and nutrient conditions provide suitable habitat for periodic blooms. Physicochemical conditions, including excessive nutrients, can stimulate growth of *P. 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. Research is under way to better understand, detect and manage *P. parvum* blooms. Additional information regarding this toxic golden alga can be found on the SWQB website at: ftp://ftp.nmenv.state.nm.us/www/swqb/GoldenAlgae/GoldenAlgaeFactSheet.pdf.

New Mexico's water quality standards do not contain any specific criteria related to the presence of toxic algae or fish kills. SWQB currently does not list water bodies as impaired due to these occurrences. Documented occurrences 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

New Mexico 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 water body types. Cold water streams tend to be lacking in variety of species, making development of fish assemblage-based biological assessment challenging. Therefore, biological assessment development efforts will initially be focused cool and/or warm water streams.

3.1.2 Chemical/physical data

WQS Section 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, which includes field measurements as well as major ions and nutrients, and toxic substances such as trace metals and priority pollutants. Refer to the appropriate water quality standard segment number (20.6.4.97 through 20.6.4.806 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, dissolved oxygen, specific conductance, and total phosphorus. Assessment protocols for temperature, dissolved oxygen (DO), and pH, are found in Appendices B, E, and F respectively. For the 2010 listing cycle, SWQB developed an interim turbidity assessment protocol to assess turbidity data from listing cycles 2006, 2008, and 2010. Prior to the 2005 triennial review of water quality standards, New Mexico had established segment-specific numeric turbidity values for all water quality standard segments detailed in 20.6.4 NMAC. In 2005, the NMWQCC amended the water quality standards to remove all the segment specific turbidity values and revise the turbidity subsection under the General Criteria section (20.6.4.13 Subsection J NMAC). Because of this change in our water quality standards, a protocol with numeric translators for turbidity was developed. SWQB has since developed a revised turbidity assessment protocol for the 2012 cycle forward (Appendix G). All other parameters are detailed in Table 3.4 and discussed below.

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

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Conventional parameters** (e.g., specific conductance, total phosphorus*)			All temperature pH, and DO assessment protocols 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 and thermographs during the specified index period whenever possible.
A) 1 to 10 samples	**A**) For any one pollutant, no more than one exceedence of the criterion.	**A**) For any one pollutant, more than one exceedence of the criterion.	
B) >10 samples	**B**) For any one pollutant, criterion exceeded in <10% of measurements.	**B**) For any one pollutant, criterion exceeded in ≥ 10% of measurements.	Turbidity assessments are described in Appendix G.
•**Toxic substance** (e.g., priority pollutants, ammonia**, chlorine, metals, cyanide)	For any one pollutant, no more than one exceedence of the **acute** criterion, and no more than one exceedence of the **chronic** criterion in three years.	For any one pollutant, more than one exceedence of the **acute** criterion, or more than one exceedence of the **chronic** criterion in three years.	The **chronic criterion** shall be applied to either 1) the arithmetic mean of the analytical results of consecutive-day samples when available, or 2) the result of individual grab samples. Samples should be taken during hydrologically stable conditions to be representative of the averaging period (see Section 3.1.2.1 below for additional discussion).

NOTES:

*Only for segment-specific total phosphorus values. Otherwise, see the nutrient assessment protocol in Appendix D.

**New Mexico's WQS require consideration of the presence of salmonids to assess against acute ammonia criteria, and the presence of fish in early life stages to assess against chronic ammonia criteria. To apply Table K of 20.6.4.900 NMAC for assessment purposes, all waters designated as HQCWAL or CWAL will be assumed "Salmonids Present," while all other AL uses will be assumed "Salmonids Absent." If actual or historic fisheries documentation indicates the presence of salmonids, the "Salmonids Present" column will be used regardless of the designated AL use. To decide whether to apply Table L or M 20.6.4.900 NMAC for assessment purposes, "Fish Early Life Stages" will be assumed present from November 1 to June 30 for HQCWAL and CWAL. "Fish Early Life Stages" will be assumed present from March 1 to August 31 for all other AL uses. If actual fisheries documentation generated during the time of ammonia sample collection, or historic fisheries documentation generated during the same date in a previous year, indicate the presence of early life stages outside of these date ranges, the criteria in Table L of 20.6.4.900 NMAC will be applied regardless of the date of collection. If the applicable uses translate to different criteria values, the most stringent criteria is used per 20.6.4.11.F NMAC.

3.1.2.1 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 USEPA (USEPA 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. USEPA 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 (USEPA 1994).

During the 2000 and 2001 SWQB intensive watershed surveys, the sampling regime generally consisted of two consecutive days of sampling in the spring, three days in the summer, and three days in the fall in order to gather consecutive day data. Starting with the 2002 SWQB intensive watershed surveys, the sampling regime was adjusted to sample once per month over an eight-month period in order to 1) better 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 scheme, consecutive-day data are usually not available to calculate 4-day averages. Few states and tribes are obtaining composite data over a 4-day sampling period for comparison to chronic aquatic life criteria due primarily to budget and staff time constraints. USEPA believes that 4-day composites are not an absolute requirement for evaluating whether chronic criteria are being met (USEPA 1997). Grab and composite samples can be used in water quality assessments if taken during stable conditions (USEPA 1997). Available sample results should be representative of average conditions over the 4-day period for assessment of chronic aquatic life.

New Mexico has developed a three-step process for assessing attainment of chronic aquatic life criteria (Figure 3.1) after the dataset has been assembled following the rules in Sections 2.1.2 and 2.1.6 above. The first step is to average the results of any samples collected within a 4-day period. These averaged data as well as any individual grab samples are then assessed against the chronic aquatic life WQS. If a datum to be averaged was reported as less than the detection limit and the WQC is greater than this limit, a value of ½ of the detection limit should be used to calculate the average value (Gilbert 1987). If the WQC is less than the detection limit, this datum would not be used for assessment (see section 2.1.8).

If two or more samples represent an exceedence of a given criterion, these data 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., through the use of single stage or automated samplers deployed to capture storm events only), these data should not be used to assess chronic aquatic life criteria. Note that the above statements and data process only apply to chronic criteria and that all grab samples will be used to assess acute criteria regardless of hydrologic conditions.

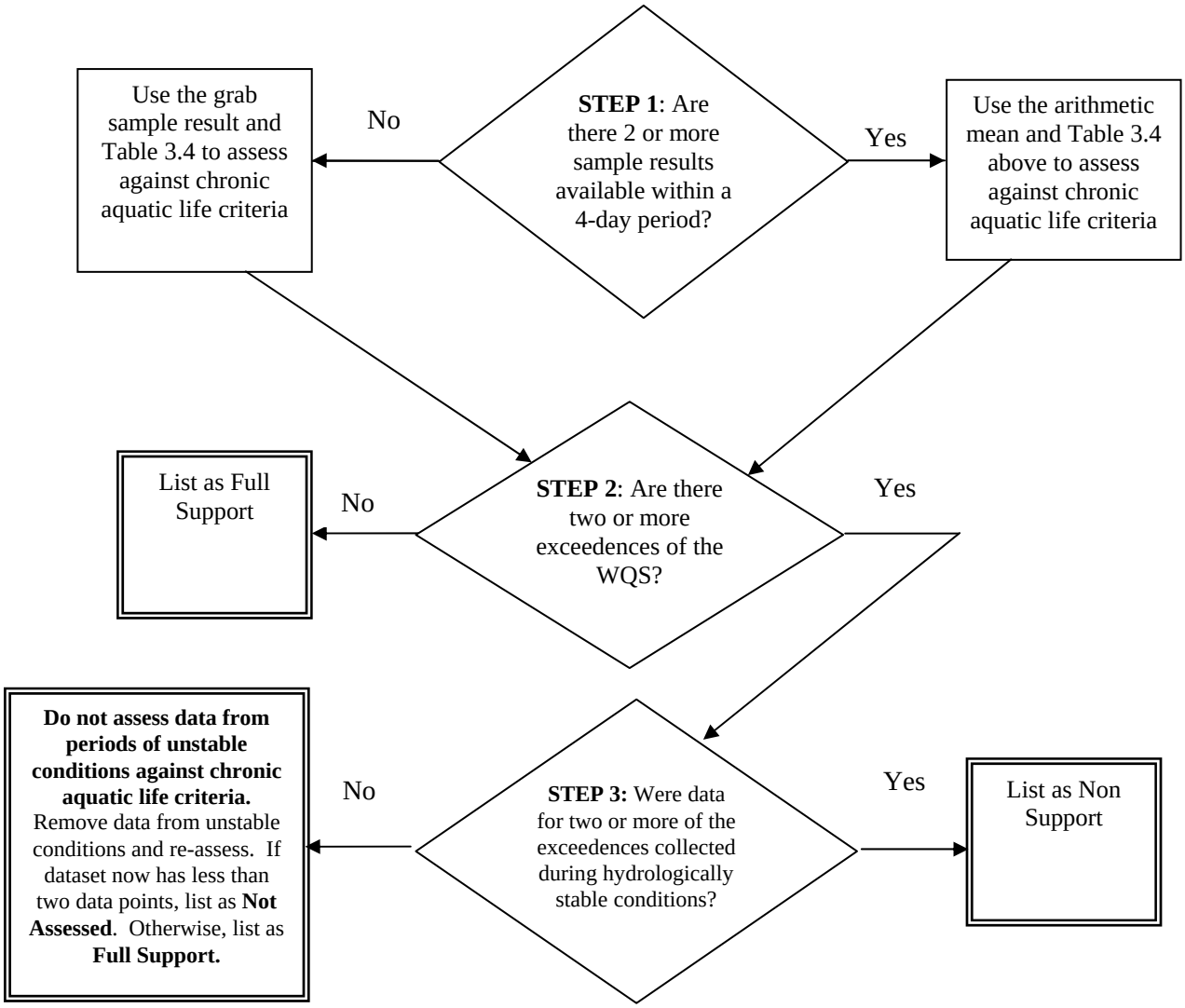


Figure 3.1. Decision process for assessing against chronic aquatic life criteria

Determining the representativeness of a sample is a qualitative assessment and is addressed primarily in the sample design, through the selection of sampling sites, and through use of procedures that reflect the project goals and environment being sampled (NMED/SWQB 2011b). These procedures ensure that a given sample represents a characteristic of a population, in this case the water in a given 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 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, lakes or reservoirs, as stated in Paragraph 3 of Subsection C of 20.6.4.14, will be assessed for attainment of criteria for toxic pollutants using data that were collected during periods of complete vertical mixing. 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, 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 (USEPA 2005).

Specifically, if there are <u>two or more</u> exceedences of applicable chronic aquatic life criteria based on grab or arithmetic mean data, 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
- Gage station records (when available)

- Land uses in the vicinity
- Records of chemical spills or other unusual events; and
- 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 four-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.

Alternatively, 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 4-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 gage 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

One way to determine stable conditions is to examine the coefficient of variation (CV). When exceedences 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 number below which data are considered to have minimal variability (ADEQ 2008).

The 4-day window that produces the lowest CV should be determined vs. always using a predetermined number of days before or after the sampling event. See table 3.5 below for an example using available gage 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 Gage Data

Date	Mean Daily Flow (cfs)	Mean *	Standard Deviation (SD) *	CV (SD / Mean) *
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: * = 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 four-day period when the exceedence occurred. Other evidence concerning unstable flow or pollutant discharges can be provided by the facility.

3.1.3 Toxicological data

Table 3.6 explains how to interpret toxicological data to assess aquatic life use support. Refer to 20.6.4.13.F NMAC for the narrative general standards which states "Surface waters of the state shall be free of toxic pollutants from other than natural causes in amounts, 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 (USEPA 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 species in general. Similarly, invertebrates are generally more sensitive to pesticides than fish. Toxicological data for New Mexico can be downloaded from
http://www.epa.gov/earth1r6/6wq/ecopro/watershd/monitrng/toxnet/index.htm.

While ambient toxicity testing results are a valuable indicator, they are only the first step towards identification of a water quality concern. The particular pollutant(s) leading to the toxicity must be identified in order to take the next steps, such as development of total maximum daily load (TMDL) documents to develop a plan to address the problem. In past surveys, the SWQB collected water and sediment samples that were subjected to the USEPA 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 where 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, repeat toxicity testing is necessary to verify that the water is correctly listed due to acute or chronic toxicity. In the event that re-testing again provides a conclusion of non-support, SWQB will evaluate available benthic macroinvertebrate data using the factors in Table 3.3.

Table 3.6 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 acute water test as compared to controls or reference conditions, and in no more than one chronic water test in three years as compared to controls or reference conditions.	Significant effect noted in more than one acute water test as compared to controls or reference conditions, or in more than one chronic water test in three years as compared to controls or reference conditions.	Significant effect refers to a statistically significant difference in a primary endpoint as defined in the latest USEPA procedures documents for acute and chronic toxicity testing in water (USEPA 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.

3.1.4 Fish consumption advisories

Per guidance, USEPA 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), USEPA 2000, USEPA 2005). USEPA 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 (USEPA 2000, USEPA 2005). Therefore, all water bodies for which an advisory has been issued are listed as impaired due to the specific fish tissue contaminant on the Integrated List 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. In acknowledgement of the need for data to support the listing, the impairment listing will be applied to the AU where fish tissue data are available, noting that, especially for stream/river AUs, the advisory may include different geographic extents.

The majority of New Mexico's current fish consumption advisories are based on mercury levels in fish (NMDOH et al. 2010); 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: http://www.nmenv.state.nm.us/swqb/advisories/. Fish tissue advisories for other parameters of concern may be forthcoming. The Integrated List will be updated whenever the advisory is revised.

3.1.5 Special considerations for lake data

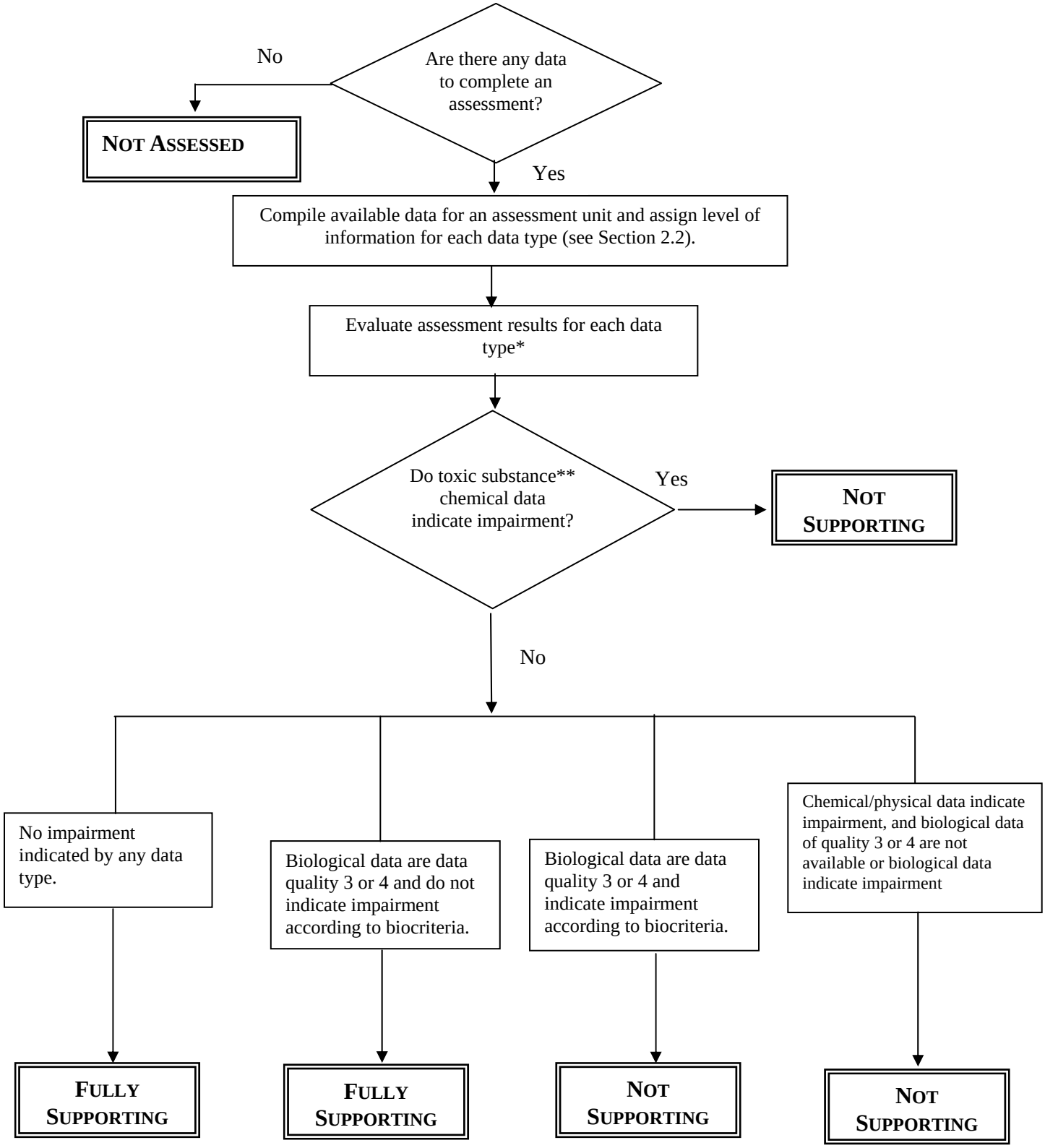
Lentic waterbodies in New Mexico have historically been, and continue to be, studied following methods and approaches specified in the *Clean Lakes Program Guidance Manual* (USEPA 1987). For purposes of consistency and comparability, classic limnological methods for water quality standards attainment continue to be used in monitoring practices. 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 should at least contain a station in the deepest portion of the lake. Additional sample locations may be needed if the reservoir is large, contains multiple arms with multiple inflows, or the lake is divided by narrow connectors resulting in pools with unique characteristics. Additional stations may be established as needed to evaluate conditions of concern. At each station, a field-calibrated multi-parametric sonde and data logger are used to measure dissolved oxygen concentration, specific conductance, temperature, turbidity, and pH at one-meter intervals. Additionally, at each station, depth-integrated composite samples of the water column are collected for various water quality analyses, such as nutrients, metals, and radionuclides. 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 (Paragraph 3 of 20.6.4.14.C NMAC). The attainment of criteria for all other pollutants (e.g., nutrients, metals, radionuclides, semi-volatile and volatile organics compounds) is assessed using the depth-integrated composite samples. When multiple stations exist on a lake, they are usually sampled on the same day or within the same seven-day period. For the purposes of assessment, data from multiple stations will be treated as replicate samples and the maximum (or minimum if criterion is expressed as a minimum) value should be used in the assessment dataset.

3.1.6 Conflicting and/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 more than two data types are available for assessment, a weight-of-evidence approach is adopted when chemical/physical data for conventional parameters indicate impairment. This approach considers data type, quality, and quantity in reaching a final aquatic life use determination. Data types with higher data quality may be given more weight. Figure 3.2 displays a generalized flowchart for considering different data types 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. In the case of toxic substance data (e.g., priority pollutants, ammonia, chlorine, metals, cyanide), the weight-of-evidence approach is not applied.

If there are multiple identified impairments for both cause (such as nutrients) and response (such as DO, pH, and benthic macroinvertebrate) variables, the AU will be listed for the cause variable. For example, if an AU is determined to be impaired due to excessive nutrients following the procedures in Appendix D, the AU will be listed for nutrients vs. any of the individual response variables (often DO). However, if only the response variable is identified as impaired, the AU will be listed for that variable.



NOTES: * Per Tables 3.3 through 3.5. Data collected according to SWQB SOPs are generally between data quality 3 and 4.
**Toxic substances include parameters such as priority pollutants, ammonia, chlorine, metals, cyanide (Table 3.4).

Figure 3.2 Generalized flowchart for determining Aquatic Life Use Support

3.2 Assessing Domestic Water Supply Use Support

Table 3.7 explains how to interpret chemical/physical data to assess domestic water supply use support. Refer to Subsections B and J of 20.6.4.900 NMAC of the WQS for the numeric criteria for domestic water supply.

Table 3.7 Interpreting chemical/physical data to assess Domestic Water Supply Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Toxic substance** (e.g., radionuclides*, priority pollutants, metals, cyanide)	For any one pollutant, no exceedence of the criterion.	For any one pollutant, one or more exceedence(s) of the criterion.	
•**Nitrate**	No exceedence of the criterion.	One or more exceedence(s) of the criterion.	

NOTES:

*When radionuclides are analyzed using EPA Method 900.0 (recommended), gross alpha and gross beta results generated using an Am-241 reference and a Sr/Y-90 reference, respectively, will be used for purposes of assessing standards attainment because these references are prescribed in the method description. If the information is not available for the type of reference used to generate a reported value, the highest value available will be assessed. Also, the water quality criterion in 20.6.4.900.J is for "adjusted gross alpha." Gross alpha data must be adjusted by subtracting contributions from natural uranium, as well as any measured special nuclear and by-product material, as called for in the definition in 20.6.4.7.B NMAC. To convert uranium concentrations reported in ug/L to pCi/ug a conversion factor of 0.67 is used. In the absence of U-mass to correct for adjusted gross alpha, U-238 can be used because this is the most common form of uranium radiation in the natural environment In the event that negative values are reported for special nuclear materials are reported, zero will be substituted for purposes of adjusting gross alpha radiation.

3.3 Assessing Primary and Secondary Contact Use Support

Refer to Subsection B under the appropriate stream segment number and to Subsections D and E of 20.6.4.900 NMAC of the WQS for criteria to determine use support for primary and secondary contact recreation. Table 3.8 explains how to interpret bacteriological data to assess recreational contact use support. The associated water quality criteria for contract use support were changed from fecal coliform to *E. coli* during the 2005 triennial review of New Mexico's WQS. Assessment units determined to be impaired prior to the 2006 listing cycle due to fecal coliform data will continue to be noted as impaired for fecal coliform, with a note indicating the change in WQS and need to collect *E. coli* data as there is no direct translator available to convert fecal coliform data to *E. coli* data.

Table 3.8 Interpreting bacteriological data to assess Contact Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Bacteria** **A)** 1 to 10 samples **B**) > 10 samples	**A**) No more than one exceedence of the single sample criterion. **B**) Single sample criterion is exceeded in <10% of samples and/or geometric mean criterion is met	**A**) More than one exceedence of the single sample criterion. **B**) Single sample criterion exceeded in ≥ 10% of measurements and/or geometric mean criterion is not 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).

3.4 Assessing Irrigation Use Support

Table 3.9 explains how to interpret chemical/physical data to assess irrigation use support. Refer to Subsections C and J of 20.6.4.900 NMAC of the WQS for the numeric criteria for the protection of irrigation use.

Table 3.9 Interpreting chemical/physical to assess Irrigation Use Support

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

3.5 Assessing Livestock Watering Support

Table 3.10 explains how to interpret chemical/physical data to assess livestock watering use support. Refer to Subsections F and J of 20.6.4.900 NMAC of the WQS for the numeric criteria for the protection of livestock watering.

Table 3.10 Interpreting chemical/physical data to assess Livestock Watering Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Conventional parameters** (e.g., nitrite + nitrate) **A)** 1 to 10 samples **B**) > 10 samples	**A**) For any one pollutant, no more than one exceedence of the criterion. **B**) For any one pollutant, criterion exceeded in <10% of measurements.	**A**) For any one pollutant, more than one exceedence of the criterion. **B**) For any one pollutant, criterion exceeded in ≥ 10% of measurements.	
•**Toxic substance** (e.g., radionuclides*, priority pollutants, metals)	For any one pollutant, no more than one exceedence of the criterion.	For any one pollutant, more than one exceedence of the criterion.	

NOTES:

*When radionuclides are analyzed using EPA Method 900.0 (recommended), gross alpha and gross beta results generated using an Am-241 reference and a Sr/Y-90 reference, respectively, will be used for purposes of assessing standards attainment because these references are prescribed in the method description. If the information is not available for the type of reference used to generate a reported value, the highest value available will be assessed. Also, the water quality criterion in 20.6.4.900.J is for "adjusted gross alpha." Gross alpha data must be adjusted by subtracting contributions from natural uranium, as well as any measured special nuclear and by-product material, as called for in the definition in 20.6.4.7.B NMAC. To convert uranium concentrations reported in ug/L to pCi/ug a conversion factor of 0.67 is used. In the absence of U-mass to correct for adjusted gross alpha, U-238 can be used because this is the most common form of uranium radiation in the natural environment In the event that negative values are reported for special nuclear materials are reported, zero will be substituted for purposes of adjusting gross alpha radiation.

3.6 Assessing Wildlife Habitat Use Support

Refer to Subsection 20.6.4.900.G NMAC of the WQS for narrative criteria and Subsection 20.6.4.900.J NMAC for numeric criteria for the protection of wildlife habitat use. Table 3.11 explains how to interpret chemical/physical data to assess wildlife habitat use support.

Table 3.11 Interpreting chemical/physical data to assess Wildlife Habitat Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Toxic substance** (e.g., PCBs, DDT, cyanide, chlorine, metals)	For any one pollutant, no more than one exceedence of the criterion.	For any one pollutant, more than one exceedence of the criterion.	

3.7 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 Subsection 20.6.4.900.J NMAC of the WQS for the numeric criteria related to human health. Human health criteria proposed by the USEPA are presumed to have exposure durations of a year or more (USEPA 2005), and were generally established to protect for exposure over the period of a human lifetime. Table 3.12 explains how to interpret chemical/physical data to determine if these criteria are met.

Table 3.12 Interpreting chemical/physical data to assess Human Health Criteria

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Toxic substance** (e.g., cyanide, PAHs, pesticides, PCBs, metals) **A)** 1 to 10 samples **B**) >10 samples	**A)** For any one pollutant, no more than one exceedence of the criterion. **B**) For any one pollutant, criterion exceeded in <10% of measurements.	**A)** For any one pollutant, more than one exceedence of the criterion. **B**) For any one pollutant, criterion exceeded in ≥ 10% of measurements.	

4.0 ASSESSMENT UNIT CATEGORY DETERMINATIONS FOR INTEGRATED LIST

The determination of use support using Section 3.0 and other specified protocols are combined to determine the overall WQS attainment category for each AU (USEPA 2001). The unique attainment categories for New Mexico are described as follows (see also Figure 4.1):

1. **Attaining the water quality standards 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 support a determination that the water quality criteria are attained.

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 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.

3. **No reliable data and/or information to determine if any designated or existing use is attained.** AUs are listed in this category where data to support an attainment determination for any use are not available, consistent with requirements of the assessment and listing methodology.

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

   A. **TMDL has been completed.** AUs are listed in this subcategory once all TMDL(s) have been developed and approved by USEPA 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 5A (see below) until all TMDLs for each pollutant have been completed and approved by USEPA.

   B. **Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future**. Consistent with the regulation under the Clean Water Act 130.7(b)(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 water quality standard (WQS) applicable to such waters.

   C. **Impairment is not caused by a pollutant.** AUs are listed in this subcategory if a pollutant does not cause the impairment. For example, USEPA considers flow alteration to be “pollution” vs. a “pollutant.”

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 water quality standards are not attained according to current water quality standards 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 into the following categories:

A. **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 USEPA.

B. **A review of the water quality standard will be conducted.** AUs are listed in this category when it is possible that water quality standards are not being met because one or more current designated uses are inappropriate, or if available data indicate background processes are causing criteria exceedences. After additional reviews of available data and the water quality standard are conducted, a Use Attainability Analysis (UAA) will be developed and submitted to USEPA for consideration, or the AU will be moved to Category 5A and a TMDL will be scheduled.

C. **Additional data will be collected before a TMDL is scheduled.** AUs are listed in this category if there is not enough data to determine the pollutant of concern or there is not adequate data to develop a TMDL. For example, AUs with biological impairment will be listed in this category until further research can determine the particular pollutant(s) of concern. When the pollutant(s) are determined, the AU will be moved to Category 5A and a TMDL will be scheduled. If it is determined that the current designated uses are inappropriate, it will be moved to Category 5B and a UAA will be developed. If it is determined that "pollution" is causing the impairment (vs. a "pollutant"), the AU will be moved to Category 4C. AUs that are <u>suspected</u> of being impaired due solely to natural causes, but which lack sufficient data to make this determination, will be placed in Category 5C with a note that additional information is needed.

This present reporting approach was developed in response to a recent 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, USEPA 2001, WERF 2007). With a few additions and minor changes in terminology, the information requested in the *Integrated Listing* guidance (USEPA 2001) and CALM guidance (USEPA 2002a) were previously suggested in earlier 305(b) reporting guidance (USEPA 1997). The earlier guidance formed the basis of previous SWQB assessment protocols.

Assessment information is housed in ADB v.2.1.4 (RTI 2005). This database was designed to help states implement suggestions in the *Integrated Listing* guidance (USEPA 2001, USEPA 2005, USEPA 2006a, 2009, 2011). The database is first populated with AU information, associated designated uses, comments, and any supporting documentation. Individual designated use attainment decisions (i.e., Full Support, Non Support, or Not Assessed) are then entered for each AU. ADB v.2.1.4 then automatically determines the water quality standards attainment category for each AU based on the information entered for each applicable designated use.

Section 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. New Mexico expresses this

ranking, including indicating which waters bodies are targeted for TMDL development in the next two years, in the form of a scheduled TMDL completion date per USEPA's recommendation (USEPA 2005). This information is housed in ADB v.2.1.4 and reported within the Integrated List under "TMDL Status" for all individual Category 5A waters.

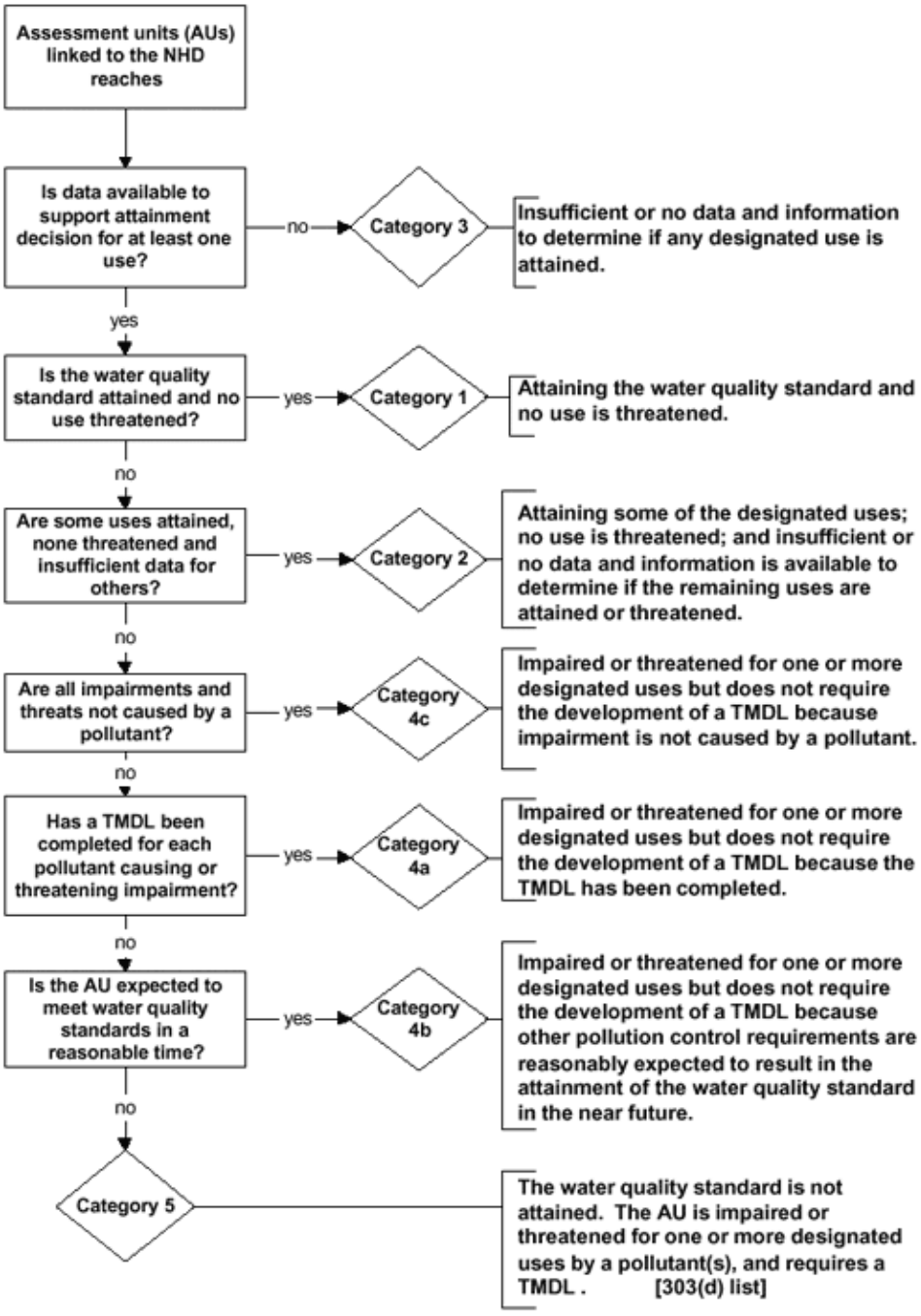


Figure 4.1. Generalized summary of logic for attainment categories (USEPA 2001). Category 5 was further expanded by New Mexico into categories 5A, 5B, and 5C.

5.0 PUBLIC PARTICIPATION

The assessment protocols are periodically revised based on new USEPA guidance, changes to the WQS, and the need to clarify various assessment procedures for staff. When the protocols are revised, a draft is first sent to USEPA Region 6 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 assessment protocol was opened for a 30-day public comment period beginning on March 22, 2011. No comments were received.

The final version of this protocol is provided to USEPA Region 6. USEPA considers the assessment protocols in its review and approval of Category 5 waters in the integrated report. The assessment protocol is also posted on the SWQB website: http://www.nmenv.state.nm.us/SWQB/.

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APPENDIX A

LIST OF COMMON ACRONYMS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 6, 2011

LIST OF COMMON ACRONYMS

4Q3	4-Day, 3-Year Low Flow
ADB	Assessment Database
AP	Assessment Protocol
AU	Assessment Unit
CALM	Consolidated Assessment and Listing Methodology
CWA	Clean Water Act
DO	Dissolved Oxygen
MAS	Monitoring and Assessment 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
NMWQCC	New Mexico Water Quality Control Commission
NPDES	National Pollutant Discharge Elimination System
PAH	Poly Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PQL	Practical Quantification Limit
QA	Quality Assurance
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	State Laboratory Division
SOPs	Standard Operating Procedures
SSC	Suspended Sediment Concentration
STORET	Storage and Retrieval System
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WET	Whole Effluent Toxicity
WQC	Water Quality Criterion
WQS	Water Quality Standard

APPENDIX B

TEMPERATURE ASSESSMENT PROTOCOL

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 6, 2011

Purpose and Applicability

This document establishes an assessment protocol for determining impairment due to excessive water temperature in streams, rivers, lakes, and reservoirs. This protocol is not applicable to ephemeral streams and wetlands because the research and implementation procedures necessary have not been investigated or developed by the Surface Water Quality Bureau (SWQB).

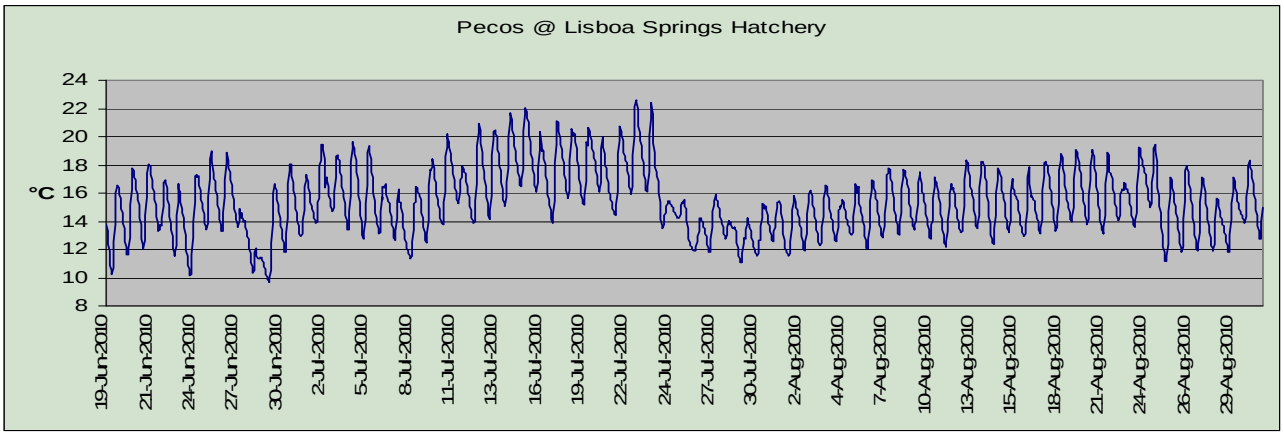
1.0 Data Collection Procedures and Considerations

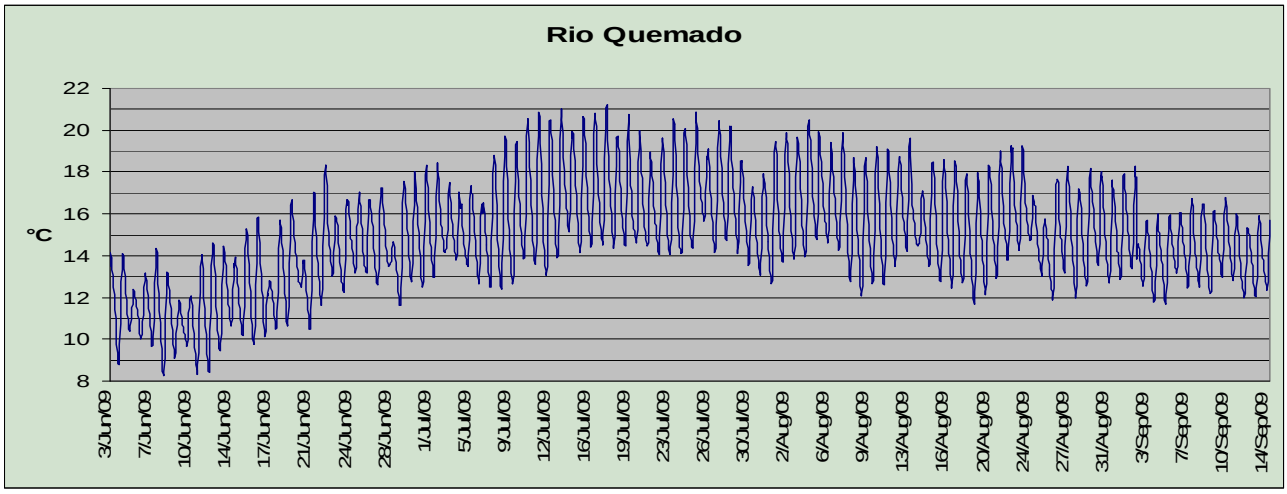
Temperature data for assessment will be collected from at least June through August for any aquatic life use when possible. Data logger (thermograph) data for rivers and streams, collected with a maximum interval of one hour, takes precedence over grab data in all cases and is preferred. The assessment tables also provide information on how to assess grab data if no thermograph data are available. Data loggers will be deployed and the data reviewed following the QA/QC guidelines specified in SWQB's Standard Operating Procedures (SOPs). This includes locating the thermograph in the shade when possible, but the primary consideration is to place the logger in a location such that it will remain submerged for the duration of the data recording period while not becoming buried in sediment or covered with debris. Data will be reviewed and periods when the record indicates that the data logger was exposed or buried will be censored and not used for assessment.

In order for a stream/river thermograph dataset to be assessable, it must include that portion of the summer season with the highest temperatures (in New Mexico, this virtually always occurs sometime from June through August). This can be discerned by plotting the data on a graph and observing a peak surrounded by periods of relatively lower temperatures. For example, if the period of record starts at some low point, rises to a high point and then descends to a low point, the data would be considered assessable (Fig 1A). If, for example, the data started at some low point, rose to a high point that indicated support, but the data set was curtailed at that point (i.e., it did not descend to another low point), the data would be considered inconclusive. If a dataset as described above (with only one low point) indicated nonsupport, it would be considered conclusive even though it did not cover the entire warm season because additional data would not change the nonsupport determination (Fig. 1B).

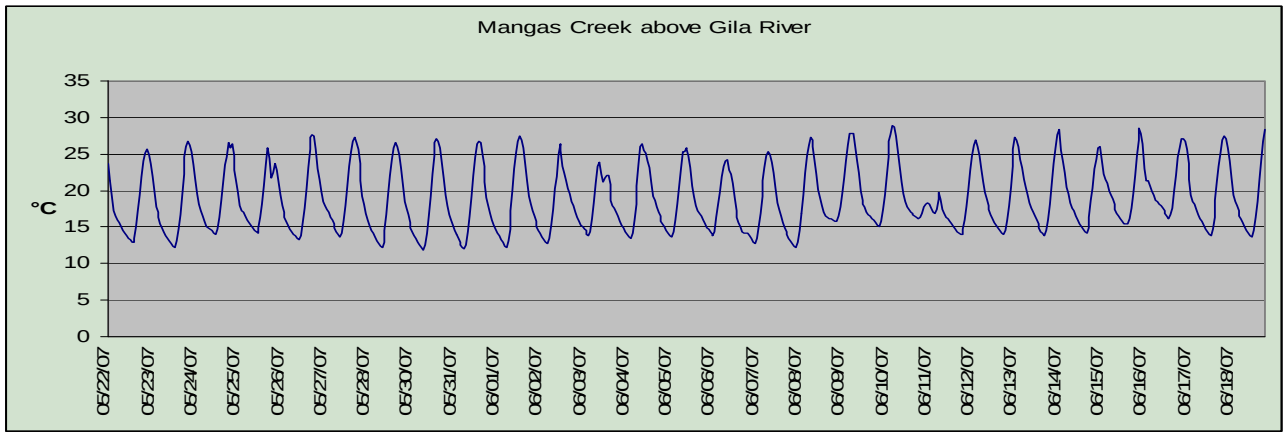
Figure 1: Discerning if a data set is assessable

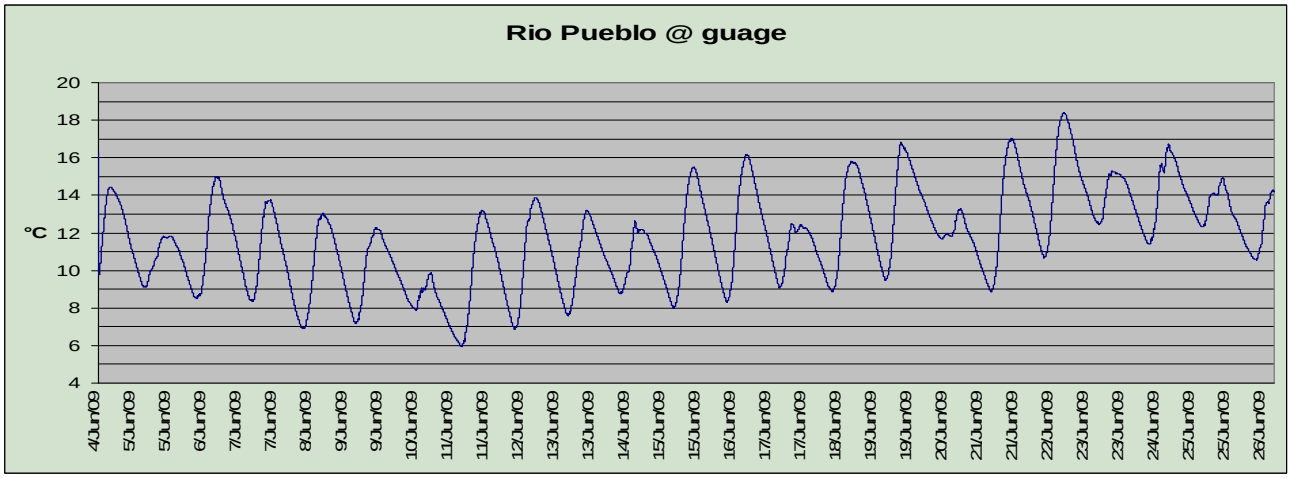
A. Examples of assessable data sets





B. Examples of data sets that are inconclusive for support determination, but conclusive for nonsupport determination





2.0 Assessment of Temperature Data to Determine Aquatic Life Use Support

The following tables provide detailed temperature assessment procedures for each of the aquatic life uses detailed in Subsection H of NMAC 20.6.4.900 (NMWQCC 2011). New Mexico has seven aquatic life uses: high quality coldwater (HQCWAL), coldwater (CWAL), marginal coldwater (MCWAL), coolwater, warmwater (WWAL), marginal warmwater (MWWAL), and limited aquatic life.

Table 1.0 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 temperature measurement greater than 20.0°C.*	A) One or more temperature measurements greater than 23.0°C. B) One or more temperature measurements greater than 20.0°C*.	*Because lake temperature measurements are averaged over the epilimnion or the upper 1/3, the measured value is assumed be equivalent to the 4T3 value and thus this criterion is used.
•**Thermograph data**	Instantaneous (hourly) temperature does not exceed 23.0°C (or the segment-specific maximum temperature) and temperatures do not exceed 20.0°C (or the segment-specific 4T3 temperature) for four or more consecutive hours in a 24-hour cycle for more than three consecutive days (4T3).	Instantaneous (hourly) temperature exceeds 23.0°C (or the segment-specific maximum temperature) or temperatures exceed 20.0°C (or the segment-specific 4T3 temperature) for four or more consecutive hours in a 24-hour cycle for more than three consecutive days (4T3).	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.

Table 2.0 Assessing temperature data to determine CWAL Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) temperature data** **A)** Rivers or streams	A) Not assessable (cannot determine fully supporting with grab data only)	A) One or more temperature measurements greater than 24.0°C.	*Because lake temperature measurements are averaged over the epilimnion or the upper 1/3, the measured value is assumed be equivalent to the 6T3 value and thus this criterion is used.
B) Lakes or reservoirs	B) No temperature measurement greater than 20.0°C*.	B) One or more temperature measurements greater than 20.0°C*.	
•**Thermograph data**	Instantaneous (hourly) temperature does not exceed 24.0°C (or the segment-specific maximum temperature) and temperatures do not exceed 20.0°C (or the segment-specific 6T3 temperature) for six or more consecutive hours in a 24-hour cycle for more than three consecutive days (6T3).	Instantaneous (hourly) temperature exceeds 24.0°C (or the segment-specific maximum temperature) or temperatures exceed 20.0°C (or the segment-specific 6T3 temperature) for six or more consecutive hours in a 24-hour cycle for more than three consecutive days (6T3).	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.

Table 3.0 Assessing temperature data to determine MCWAL Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) temperature data** **A)** Rivers or streams	A) Not assessable (cannot determine fully supporting with grab data only)	A) One or more temperature measurements greater than 29.0°C.	*Because lake temperature measurements are averaged over the epilimnion or the upper 1/3, the measured value is assumed be equivalent to the 6T3 value and thus this criterion is used.
B) Lakes or reservoirs	B) No temperature measurement greater than 25.0°C*.	B) One or more temperature measurements greater than 25.0°C*.	
•**Thermograph data**	Instantaneous (hourly) temperature does not exceed 29.0°C (or the segment-specific maximum temperature) and temperatures do not exceed 25.0°C (or the segment-specific 6T3 temperature) for six or more consecutive hours in a 24-hour cycle for more than three consecutive days (6T3).	Instantaneous (hourly) temperature exceeds 29.0°C (or the segment-specific maximum temperature) or temperatures exceed 25.0°C (or the segment-specific 6T3 temperature) for six or more consecutive hours in a 24-hour cycle for more than three consecutive days (6T3).	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.

Table 4.0 Assessing temperature data to determine Coolwater Aquatic Life Use Support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) temperature data** **A)** Rivers or streams	A) Not assessable (cannot determine fully supporting with grab data only)	A) One or more temperature measurements greater than 29.0°C.	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.
B) Lakes or reservoirs	B) No temperature measurement greater than 29.0°C.	B) One or more temperature measurements greater than 29.0°C.	
•**Thermograph data**	Instantaneous (hourly) temperature does not exceed 29.0° C (or the segment-specific maximum temperature).	Instantaneous (hourly) temperature exceeds 29.0°C (or the segment-specific maximum temperature).	

Table 5.0 Assessing temperature data to determine WWAL or MWWAL 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 temperature measurement greater than 32.2°C.	A) One or more temperature measurements greater than 32.2°C. B) One or more temperature measurements greater than 32.2°C.	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.
•**Thermograph data**	Instantaneous (hourly) temperature does not exceed 32.2°C (or the segment-specific maximum temperature).	Instantaneous (hourly) temperature exceeds 32.2°C (or the segment-specific maximum temperature).	

References:

New Mexico Water Quality Control Commission (NMWQCC). 2011. *State of New Mexico Standards for Interstate and Intrastate Surface Waters*. 20.6.4 NMAC as amended through January 14, 2011, and approved by EPA as of April 18, 2011. Available at: http://www.nmenv.state.nm.us/swqb/Standards/.

APPENDIX C

SEDIMENTATION/SILTATION ASSESSMENT PROTOCOL FOR WADEABLE, PERENNIAL STREAMS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 6, 2011

Purpose and Applicability

This document establishes an assessment protocol for determining impairment due to excessive sedimentation/siltation (otherwise referred to as stream bottom deposits or SBD) in perennial, wadeable streams. This assessment is only conducted in wadeable perennial streams at this time because the research used to develop this assessment protocol is based upon data and information collected in perennial streams.

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 (NMWQCC 2011):

> *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.*

This assessment protocol was substantially revised for development of the 2012-2014 Integrated List. In 2008, the SWQB Sediment Workgroup was formed to review the previous sedimentation/siltation assessment protocol and recommend an approach for revision. As a result of workgroup discussions, SWQB and USEPA Region 6 contracted with Tetra Tech, Inc., to develop sediment translators or thresholds. The contractor generally followed the steps provided in USEPA's Framework for developing suspended and bedded sediment (SABS) water quality criteria (USEPA 2006). Several staff from Tetra Tech, Inc., USEPA Region 6, and SWQB worked as a team to complete this effort.

This effort included the identification of sediment characteristics that are 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 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: http://www.nmenv.state.nm.us/SWQB/. SWQB has also generated a Sedimentation/Siltation Thresholds Development Plan (NMED/SWQB 2011a) which summarizes the seven steps taken to develop recommended bedded sediment thresholds, available at the same web site. This plan also includes an abbreviated description of the previous sedimentation assessment protocol utilized during the 1998 – 2010 listing cycle as Attachment A, for historical purposes.

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:

- Lakes, reservoirs, ponds, and playas
- Large rivers (non wadeable)
- Intermittent streams
- Ephemeral streams
- Wetlands

In New Mexico, SWQB has defined "Large Rivers" as systems that cannot be monitored effectively with methods developed for wadeable streams and generally have drainage areas greater than 2,300 square miles. The systems included in this waterbody type, and consequently exempt from this protocol, are 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.

In 2002, SWQB received a grant to develop a protocol for the determination of sedimentation impairment in the San Juan and Animas Rivers. SWQB contracted with the USDA National Sedimentation Lab (NSL) to provide technical support on the project (Heins et al. 2004). 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 Ecoregion 22 as well as various river reaches in the San Juan River basin. 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 utilized to assess the San Juan and Animas Rivers for development of the 2004-2006 Integrated List, and will also be applied to subsequent data collected with comparable sampling methods to determine potential sedimentation impairment in these rivers. See NMED/SWQB 2004 for details on this approach. This document and the entire NSL report is available at: http://www.nmenv.state.nm.us/SWQB/.

1.0 Introduction/Background

Stream bottom substrate without excessive fine sediment filling the interstitial spaces provides optimum habitat for many fish and aquatic insect communities. Excessive fine sediment, or substrate fining, occurs when biologically-important habitat components such as spawning gravels and cobble surfaces are physically covered by fines (Chapman and McLeod 1987). Substrate fining results in decreased intergravel oxygen and 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 reduce the abundance of sediment intolerant taxa by reducing interstitial habitat normally available in large-particle substrate (gravel, cobbles); and 3) community composition changes as substrate particle size changes from large (gravel, cobbles) to small (sand, silt, clay) (Waters 1995).

Sediment loads that exceed a stream's sediment transport capacity often trigger changes in stream morphology (Leopold and Wolman 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 1996). These morphological changes can accelerate erosion, reduce habitat diversity (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) detectably 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 (reference or best available conditions) for that particular environmental setting. This, in itself, can be an indication that streambed substrates are impacted by human disturbance. Biotic responses to disturbed substrates can be variable, but sub-optimal biotic conditions are often associated with unbalanced sediment.

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 difficult than detecting an absolute concentration or percentage that represents a clear biological impact (Jessup et al. 2010).

2.0 Assessment Procedure

The approach utilized 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 USEPA Framework for developing SABS water quality criteria (USEPA 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 2011a and Jessup et al. 2010, respectively).

Multiple sediment indicators and their responsiveness to site disturbance and effects on benthic macroinvertebrates were analyzed. 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 & Fines (%SaFN) and log Relative Bed Stability calculated without bedrock (LRBS_NOR) -- in three site classes, Mountains, Foothills, and Xeric areas (Table 2, Figure 1). The site classes are defined by Level 3 and 4 ecoregions (Griffith et al. 2006) and distinguish sediment expectations across New Mexico. Site classes were identified through a principal components 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 2011a for additional details). Site locations near ecoregion boundaries warrant additional scrutiny. Any study site within approximately twenty kilometers of an ecoregion boundary should be compared to the definitions of the adjacent ecoregion to determine the appropriate bedded sediment site class designation for that site.

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 (Jessup et al. 2010).

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, 24, 25, 26, and 22, **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: http://www.eoearth.org/article/Ecoregions_of_New_Mexico_(EPA).

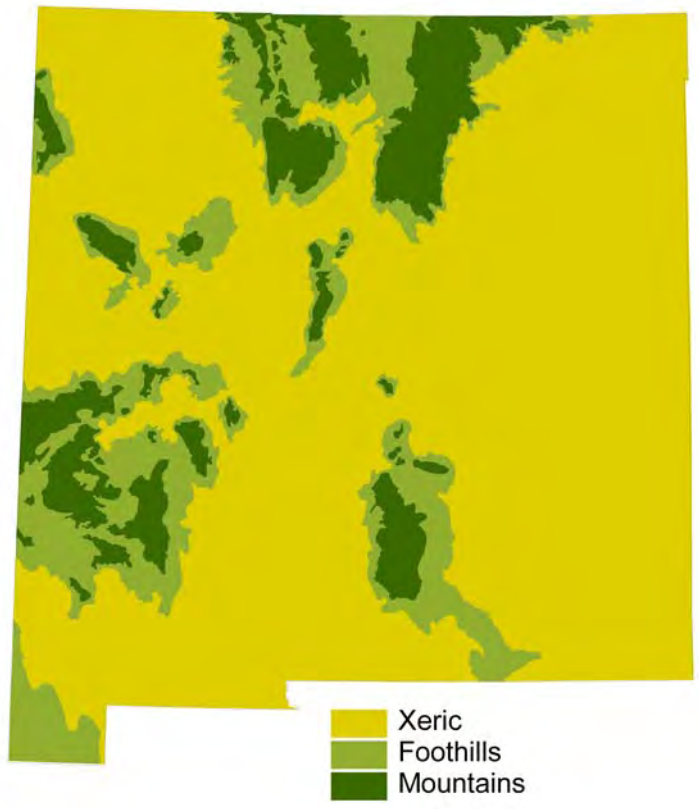


Figure 1. New Mexico Mountain, Foothills, and Xeric site class map

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 less direct indicators of required sediment conditions because the biota are affected by other environmental conditions, not just sediments (Jessup et al. 2010).

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 considers the simpler indicator of biological impairment, and then refines the assessment with the second indicator of geomorphic impairment as needed when the first level threshold is exceeded. The % SaFN sediment indicator is used in the Level One assessment because it is easily measured and related strongly with biological metrics. If the %SaFN indicates excessive fine sediment in the stream bed, a Level Two survey is performed to calculate the LRBS_NOR value in order to determine if the excessive fine sediment is expected based on geomorphic conditions. This sediment indicator is a calculation that considers site-specific hydraulic potential for moving bed sediments, so that the observed amount of fine sediments are only 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).

A two level assessment approach is justified because sediment conditions relative to the fluvial potential are better estimates 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, except for natural variability captured by site classification, are more susceptible to natural variations (Jessup et al. 2010).

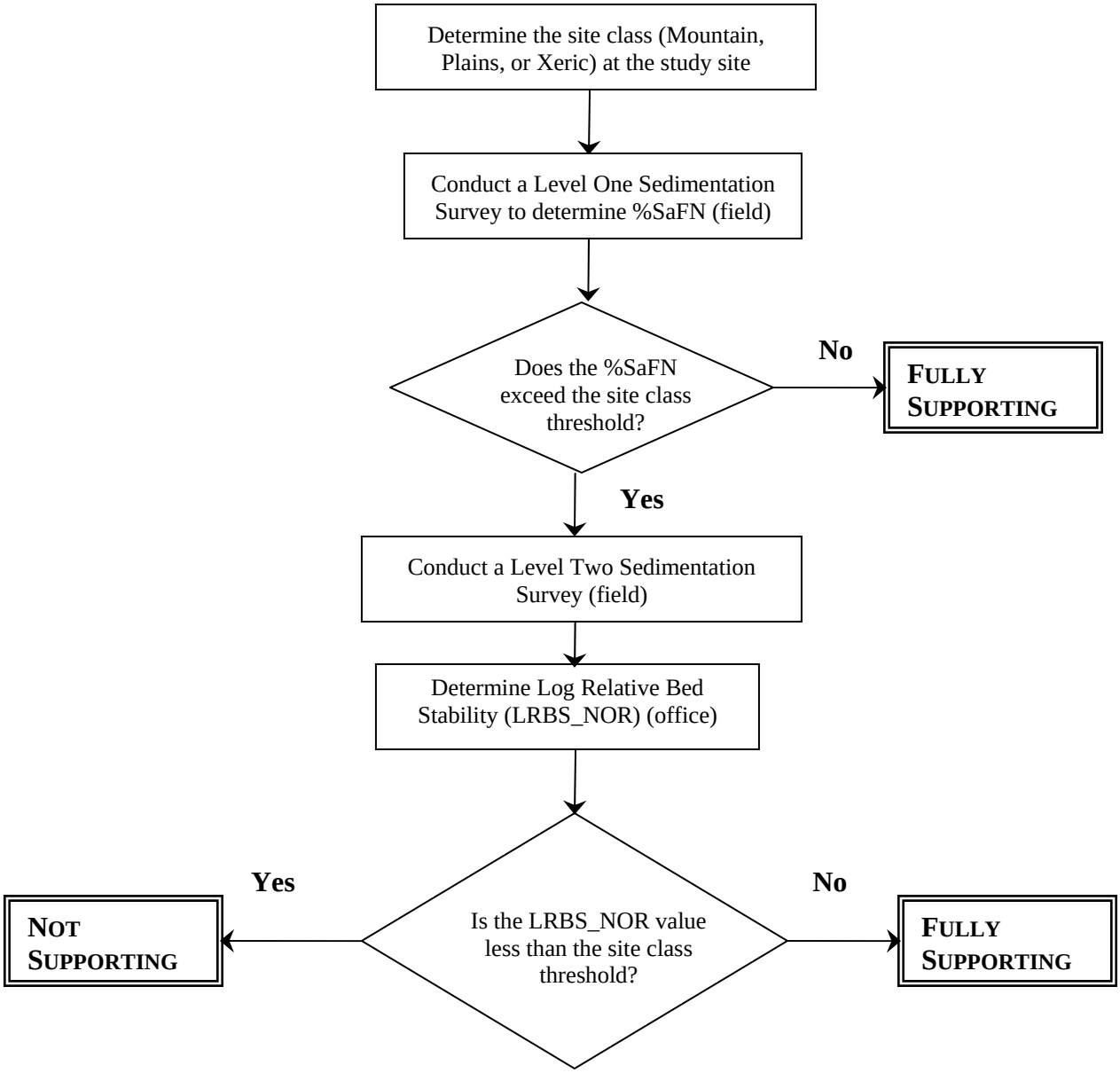


Figure 2. Generalized flowchart for determining sedimentation/siltation impairment

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 (Figure 3). For example, sites falling in the upper left quadrant represent **Non Support** (impaired) for sedimentation/siltation because they fail both the Level One and Level Two thresholds (i.e., have both high %SaFN and low LRBS values). Sites in the other three quadrants are considered **Full Support** (unimpaired). Specifically, sites that fall in the lower right quadrant are considered unimpaired because they met both Level One and Level Two thresholds. Sites in the lower left quadrant have low %SaFN (passing the Level One threshold) but low LRBS_NOR values (failing the Level Two 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 One (% SaFN) threshold, but are considered unimpaired based on the Level Two (LRBS_NOR) threshold because LRBS_NOR values greater than the threshold suggests that the higher %SaFN values may be natural and therefore expected for those sites.

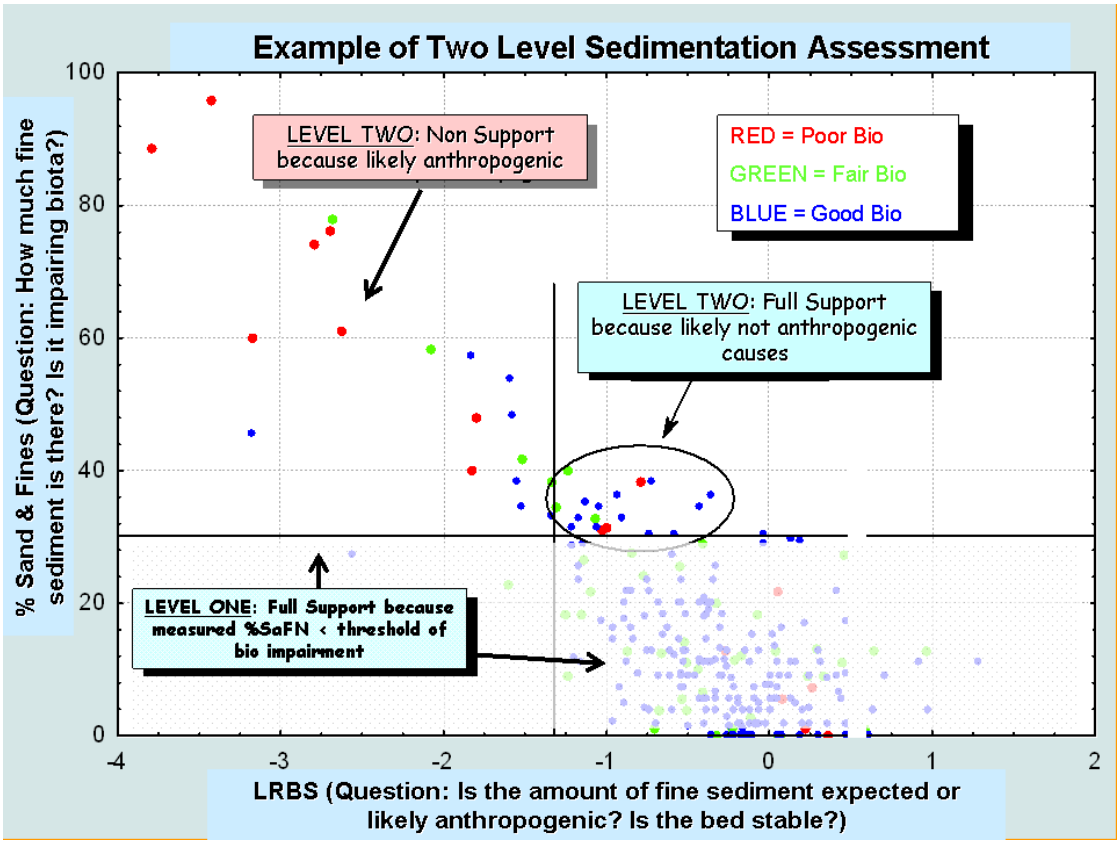


Figure 3. Graphical example of two indicator tiered assessment approach

2.1 Level One sedimentation survey and assessment

Level One sedimentation surveys are conducted during regular SWQB watershed surveys according to the procedures in SWQB's Standard Operating Procedures (SOPs) (NMED/SWQB 2011b). These surveys are completed during stable low flow conditions, preferably between August 15 and November 15. The %SaFN is calculated on-site 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 (NMWQCC 2011). In a slight deviation from 20.6.4.13 NMAC, this assessment protocol includes particles that are two mm in diameter to be conservative, and to match USEPA's definition and TetraTech's analyses (Peck et al. 2006, Jessup et al. 2010).

If the measured %SaFN is less than the applicable site class threshold in Table 3, the sediment survey is complete and the assessment unit is considered to be **Full Support** with respect to New Mexico's narrative sedimentation/siltation standard found at NMAC 20.6.4.13 (NMWQCC 2011). Sand is a common substrate in the Xeric sites. Therefore, a potential alternative indicator of sedimentation stress is % fines (defined by USEPA as particles ≤ 0.06 mm) as determined via the Level One survey. This threshold was considered and rejected because the distribution of % fines are similar for reference and stressed sites in the Xeric areas and the biological change-point was not corroborated by the percentiles in the TetraTech analysis (Jessup et al. 2010).

Table 3. % Sand & Fines (Level One) thresholds based on biological responses and reference distributions

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

If the measured %SaFN is greater than the applicable site class threshold in Table 3, the assessment is inconclusive and a Level Two sedimentation survey is conducted according to the procedures in SWQB's SOPs (NMED/SWQB 2011b).

2.2 Level Two sedimentation survey and assessment

Data from the Level Two sedimentation survey are used to calculate log relative bed stability without bedrock (LRBS_NOR). The LRBS indicator was developed by USEPA researchers as a tool to predict the expected substrate size distribution for streams (Peck et al. 2006). It has proven to be a sensitive and meaningful indicator in other studies (Jessup 2009, Kaufmann et al. 2009). Because fluvial site 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. This indicator incorporates stream channel, shape, slope, flow, and sediment supply. In essence, the LRBS calculation is used to determine the stream power based on channel measurements 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 particle size should trend towards the expected particle size (i.e., the size the stream is capable of moving as bedload at bankfull). Thus, LRBS values near zero indicate a stable stream bed, whereas increasingly negative values indicate excess fine sediment. For example, a LRBS value of -1 means that the measured geometric mean bedded sediment particle size is ten times (10X) finer than the expected particle size moving during bankfull flow events. A calculated LRBS of -2 means that the observed particle size is 100X finer than the expected particle size moving during bankfull flow events, whereas values less than -3 indicate that the bed substrate may be moving even during low flow events.

LRBS calculated without bedrock or hardpan components (termed LRBS_NOR) was selected by TetraTech to be a better threshold than LRBS calculated with bedrock. 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 (Jessup et al. 2010). Table 4 contains the LRBS_NOR threshold values by site class.

Table 4. LRBS_NOR (Level Two) thresholds based on biological responses and reference distributions

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

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 NMAC 20.6.4.13 (NMWQCC 2011). If the calculated LRBS_NOR is less than or equal to the applicable site class threshold, the assessment unit is considered **Non Support**.

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APPENDIX D

NUTRIENT ASSESSMENT PROTOCOL FOR WADEABLE, PERENNIAL STREAMS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

May 31, 2011
Revision One

Purpose and Applicability

This document establishes an assessment protocol for determining nutrient impairment status of wadeable, perennial streams. While a few streams have segment specific numeric criteria for total phosphorus, New Mexico currently has no general numeric criteria for nutrients. The narrative criterion in *State of New Mexico Standards for Interstate and Intrastate Surface Waters* found at 20.6.4.13 NMAC states (NMWQCC 2011):

> *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.*

This protocol will be used to determine if a stream reach (i.e., assessment unit) is meeting the narrative criterion. If an assessment unit is determined to be impaired, it will be added to the Integrated Clean Water Act §303(d)/§305(b) List of Assessed Waters (Integrated List) as impaired. This assessment protocol was substantially re-organized for development of the 2012-2014 Integrated List. This protocol is a dynamic document that will be refined as more data are collected, enabling more precise classification of streams and definition of relationships between nutrient concentrations, indicators, and impairment in New Mexico streams.

Additional information on nutrient threshold development is available on SWQB's website at: http://www.nmenv.state.nm.us/swqb/Nutrients/.

This protocol is not applicable to the following water body types because the necessary research and implementation procedures have not yet been developed:

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

In New Mexico, SWQB has defined "Large Rivers" as systems that cannot be monitored effectively with methods developed for wadeable streams and generally have drainage areas greater than 2,300 square miles. The systems included in this waterbody type, and consequently exempt from this protocol, are 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.

1.0 Introduction/Background

Plant 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 or surface plankton scums). Unfortunately, the magnitude of nutrient concentration that constitutes "excess" is difficult to determine. Nutrient concentrations vary widely and interact with many biological and physical variables. Nutrient pollution results in a continuum of undesirable effects, from very minor to major impairments, depending on numerous factors. For example, nutrient concentrations that would not cause a problem in rapidly flowing waters in forested areas with a canopy over the waterbody can create major blooms in lower gradient waterbodies with no forest canopy. In this type of setting, prolonged sunlight and low flow velocity provide optimal conditions for photosynthesis and minimal dispersion of algae.

Nutrient pollution can be described as excess amounts of nitrogen and phosphorus and the associated 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. The variables referred to in this document are measurable water quality parameters that can be used to evaluate the degree of eutrophication in perennial, wadeable streams. Eutrophication is the process by which a body of water becomes enriched with nutrients that stimulate the growth of aquatic plant life which reduces the amount of dissolved oxygen, causing the death of other organisms such as fish. Eutrophication is a natural, slow-aging process for a water body, but human activity greatly speeds up the process (Art 1993).

2.0 Assessment Procedure

This protocol uses a two-tiered approach to nutrient assessment. The two levels of assessment are used in sequential order to determine if there is excessive nutrient enrichment. If a Level I assessment indicates potential nutrient enrichment, a Level II assessment will be used to test this finding and provide more quantitative indicators. Level I is a screening level assessment that is observational with limited measurements. It is based on a review of available data, including on-site observations from the Level I Nutrient Survey and in-stream measurements. Level II is based on quantitative measurements of select indicators. If these measurements exceed the numeric nutrient threshold values, indicate excessive primary production (i.e., large D.O. and pH fluctuation and/or high chlorophyll *a* concentration), and/or demonstrate an unhealthy biological community, the reach is considered to be impaired.

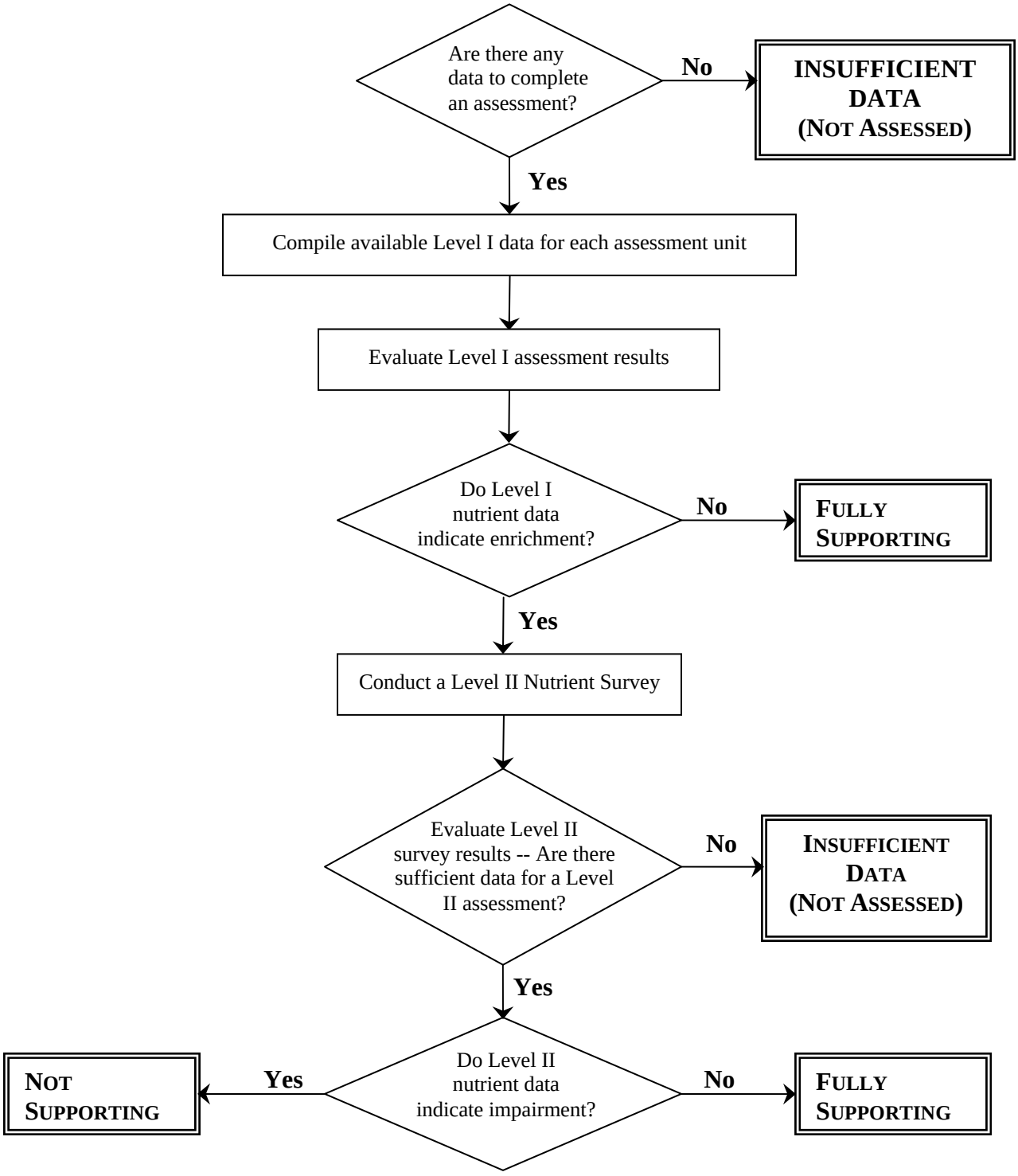

Figure 1: Generalized flowchart for determining nutrient impairment

2.1 Level I Nutrient Assessment

NOTE: If the assessment unit was previously listed for nutrients, a Level II assessment must be performed and therefore the Level I assessment does not need to be conducted.

Level I Nutrient Surveys generate data for the Level I assessments and will be conducted during regular SWQB watershed survey runs. The survey should include at least one evaluation from summer, prior to the nutrient and benthic macroinvertebrate index period (August 15 – November 15). The Level I assessments will be performed prior to the biological index period to utilize as much water quality survey data as possible and leave enough time to conduct the Level II Nutrient Survey at those sites where the Level I Assessment indicates the need. The assessment will be conducted for each site in an AU. The following parameters are used in the Level I assessment:

1. **Algae Coverage:**
   The Level I assessment uses a visual estimate of the percent algal coverage as a qualitative indicator of algal biomass . Coverages of greater than 50% in any season should be checked on the **Level I Nutrient Assessment Form** (all assessment forms are contained in Appendix H of NMED/SWQB 2011).

2. **Periphyton Abundance:**
   The thickness of periphyton growth can be an important indicator of algal biomass problems (USEPA 2000). Periphyton ratings of >2 (i.e., periphyton thickness of >1 mm) during any season should be checked on the assessment form.

3. **Anaerobic conditions:**
   Anaerobic conditions can be indicative of excessive plant growth and decay. If an anoxic layer was found under rocks and/or in depositional areas during any season, this indicator should be checked on the assessment form.

4. **Dissolved Oxygen (D.O.) and pH:**
   High rates of primary production can cause D.O. supersaturation and high pH during the day. Note on the assessment form if any D.O. saturation readings are above 120%. Additionally, note on the form if any pH values are above the appropriate aquatic life criterion (i.e., pH > 8.8 for high quality cold and coldwater uses or pH > 9.0 for marginal cold, cool, warm, and marginal warmwater uses).

5. **Total Nitrogen (TN) and Total Phosphorus (TP) Concentrations:**
   Print out and attach the Nutrient Report from the SWQB water quality database. Use the data in the report to determine if any TN or TP concentrations are above the applicable ecoregion-aquatic life use threshold values (**Table 1**). Note on the assessment form if any TN and/or TP concentrations exceeded the threshold values. Record the exceedence ratios for TN and TP in the notes section on the form. The exceedence ratio is number of times that the TN or TP concentration is above the threshold value divided by the total number of results from that site.

Table 1. NMED's nutrient thresholds for wadeable, perennial streams (mg/L)

	21- Southern Rockies		20/22- AZ/NM Plateau**		23- AZ/NM Mountains		24/79- Chihuahuan Desert**	25/26- Southwestern Tablelands		
ALU* →	CW	T/WW (volcanic***)	CW	T/WW	CW	T/WW	T/WW	CW	T	WW
TN	0.25	0.25	0.28	0.48	0.25	0.29	0.53	0.25	0.38	0.45
TP	0.02	0.02 (0.05)	0.04	0.09	0.02	0.05	0.04	0.02	0.03	0.03

NOTES: * ALU = designated aquatic life use of the assessment unit
CW – streams with only coldwater uses (high quality coldwater or coldwater)
T – transitional streams with marginal coldwater, coolwater, or both cold and warmwater uses
WW – streams with only warmwater uses (warmwater or marginal warmwater)

** Because of the limited area and number of sites in the Madrean Archipelago (79) and Colorado Plateau (20) ecoregions, these data where grouped with the most similar ecoregions; the Madrean Archipelago with the Chihahuan Desert and the Colorado Plateau with the Arizona/New Mexico Plateau. The Western High Plains (25) had no stream data as the only surface waters are playas, therefore this protocol does not apply to this ecoregion.

*** The volcanic threshold is applicable to Level IV ecoregions 21g and 21h as well as 21j in the Jemez Mountains

ANALYSIS AND INTERPRETATION:

Record appropriate data on a **Level I Nutrient Assessment Form**. If one or none of the above variables indicate enrichment, the assessment unit is considered to be Fully Supporting with respect to New Mexico's narrative nutrient standard. If **two or more Level I** indicators are present, a Level II Nutrient Survey and Assessment should be conducted because attainment status is uncertain. The causal variables, TN and TP are treated as one observation, thus if one or both exceed the established threshold it will only count as one observation. If there are more than one site in the AU and the results of the Level I assessment are not in agreement, the AU as currently defined may not represent homogeneous water quality. In this case, a Level II assessment may need to be conducted at both sites and the AU breaks should be examined and may be split appropriately.

2.2 Level II Nutrient Assessment

A Level II Assessment is conducted if the Level I Assessment indicates potential nutrient impairment or the assessment unit was previously impaired for nutrients. The Level II Assessment uses data that are collected during a Level II Nutrient Survey and/or water quality survey. The assessment will be conducted for each site in an AU where the full suite of parameters were monitored.

The Level II Assessment is based on quantitative measures of both stressor and response variables (USEPA 2010) and may use either a reference or threshold approach (USEPA 2000). For most streams, indicators will be compared to thresholds values derived from water quality standards, SWQB analyses, or published literature. If, however, the assessor feels that these thresholds are not appropriate for the class of stream being assessed, a reference site approach can be used. A suitable reference reach will be surveyed and indicators from the study reach will be compared to those of the reference reach rather than the established thresholds. This is to account for streams that may have naturally high productivity because of regional geology, flow regime, or other natural causes. The following parameters are used in the Level II assessment:

1. **<u>Large D.O. and pH Data Sets:</u>**
   Algal biomass above nuisance levels often produces large diel fluctuations in dissolved oxygen (D.O.) and pH (**Figure 2**), therefore D.O. concentration, percent local D.O. saturation, and pH are all used as indicators of nuisance levels of algal biomass. To complete a Level II nutrient assessment, D.O. and pH data should be collected using multi-parameter, continuous recording devices (sondes) to observe diel fluctuations, as opposed to the "snapshot" that grab data provide.

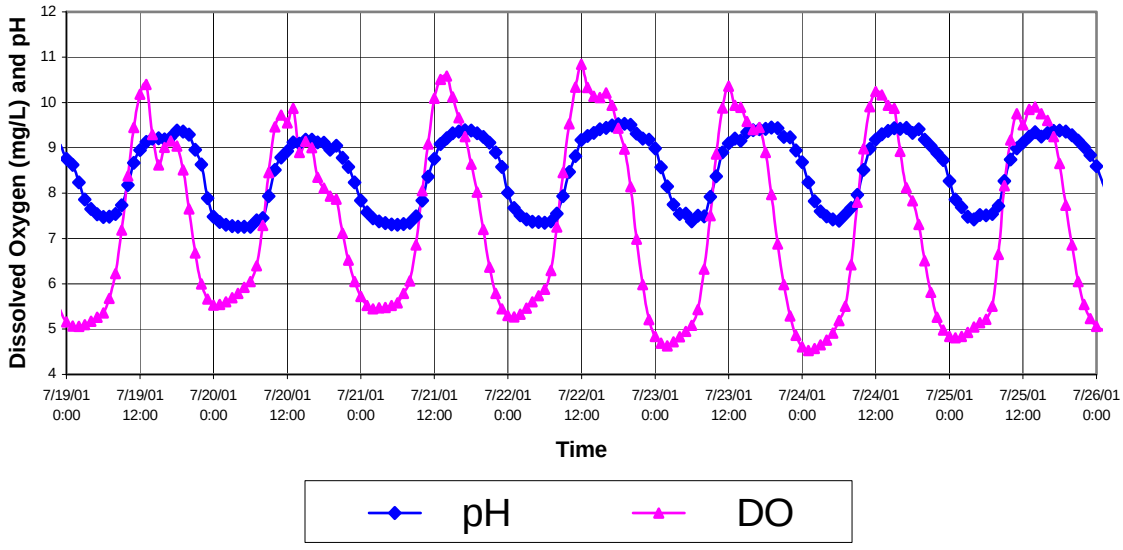

Figure 2. Diel patterns in dissolved oxygen and pH in East Fork Jemez River below La Jara Creek (July 18 - 26, 2001)

Nutrient Level II Assessments of D.O. and pH are made with large sonde data sets as well as grab sample data. SWQB typically deploys sondes set to record hourly readings of D.O., pH, specific conductance, temperature, and turbidity for multiple days. The large data set assessment procedures detailed in the *Dissolved Oxygen Assessment Protocol* and the *pH Assessment Protocol* are used to assess D.O. and pH data from a sonde when there are a minimum of three days (72 hours) of hourly sonde data available (Appendices E and F in NMED/SWQB 2011). If this amount of sonde data is not available, the methods detailed below and in **Table 2** are applied for assessment. Based on these assessments, note on the **Level II Nutrient Assessment Form** whether or not the designated use is being supported (all assessment forms are contained in Appendix H of NMED/SWQB 2011).

The magnitude of diel D.O. fluctuations is also examined. Fluctuations in D.O. data that exceed 3 mg/L can be indicative of excessive algal activity. Low D.O. values that do not have diel fluctuations typically indicate groundwater input. If the data indicate that a D.O. exceedence is due to groundwater input, the large sonde dataset will not be used as the D.O. response variable. Also, note the occurrence and character of the influencing variables (e.g., streamflow, large accumulations of organic matter, recent scouring flows, etc.) and, if applicable, take these factors into consideration in the assessment of the D.O. and pH data.

2. <u>D.O. and pH Grab Data:</u>

Field data from the water quality and nutrient surveys should also be used to calculate exceedence ratios for pH, D.O. concentration, and local D.O. percent saturation. D.O. concentration and pH criteria are based on designated uses of an assessment unit, as indicated in section 20.6.4.900 of the *State of New Mexico Standards for Interstate and Intrastate Surface Waters* (NMWQCC 2011) (**Table 3**). If an assessment unit has both warmwater and coldwater uses, the more stringent criterion should be applied to be protective of all uses. **Table 2** explains how to interpret D.O. and pH grab data to assess use support. Record the exceedence ratios on the assessment form and note if D.O. and/or pH are causes of concern. .

If the data from large sonde data sets and the grab samples are <u>not</u> in agreement (i.e., do not both indicate impairment or full support), data from large sonde data sets will be given more weight in the final assessment when:

1) the sonde data are representative of usual stream conditions (e.g. near normal flows, at least six weeks since last scouring flow, with probes remaining in flowing water) during the general period of peak productivity (approximately July – Sept), **and**
2) the grab sample data set consists of less than four measurements **or** the exceedence ratio is less than 50%.

Note the occurrence and character of the influencing variables (e.g., streamflow, substrate, recent scouring flows, etc.) on the assessment form. If applicable, take these factors into consideration in the assessment of the D.O. and pH data (**Figure 3**). For example, considerable algal growth may have been noted when > 120% grab D.O. measurements were taken, but high flows can remove enough of the growth before the sonde deployment that the large data set assessment indicates supporting.

Table 2. Interpreting D.O. and pH grab data to assess use support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING**	NOTES
•D.O. concentration and pH			
A) 1 to 10 samples	**A**) No more than one exceedence of the appropriate criterion*.	**A**) More than one exceedence of the appropriate criterion*.	The index period for Nutrient Level II Surveys is August – November.
B) >10 samples	**B**) Criterion* exceeded in < 10% of measurements.	**B**) Criterion* exceeded in ≥ 10% of measurements.	
•Local D.O. % saturation			
A) 1 to 10 samples	**A**) No more than one measurement greater than 120%.	**A**) More than one measurement greater than 120%.	The index period for Nutrient Level II Surveys is August – November.
B) >10 samples	**B**) Threshold (120%) exceeded in < 25% of measurements.	**B**) Threshold (120%) exceeded in ≥ 25% of measurements.	

Notes:

* Criteria for dissolved oxygen concentration and pH are based on designated uses and presented in Table 3.

** If D.O. and/or pH are assessed as "not supporting" they are considered causes of concern and the appropriate box should be checked on the Level II Nutrient Assessment Form.

Table 3. Criteria for dissolved oxygen concentration and pH

Designated Use	Dissolved Oxygen	pH
High Quality Coldwater Aquatic Life	6.0 mg/L	6.6 – 8.8
Coldwater Aquatic Life	6.0 mg/L	6.6 – 8.8
Marginal Coldwater Aquatic Life	6.0 mg/L	6.6 – 9.0
Coolwater Aquatic Life	5.0 mg/L	6.6 – 9.0
Warmwater Aquatic Life	5.0 mg/L	6.6 – 9.0
Marginal Warmwater Aquatic Life	5.0 mg/L	6.6 – 9.0

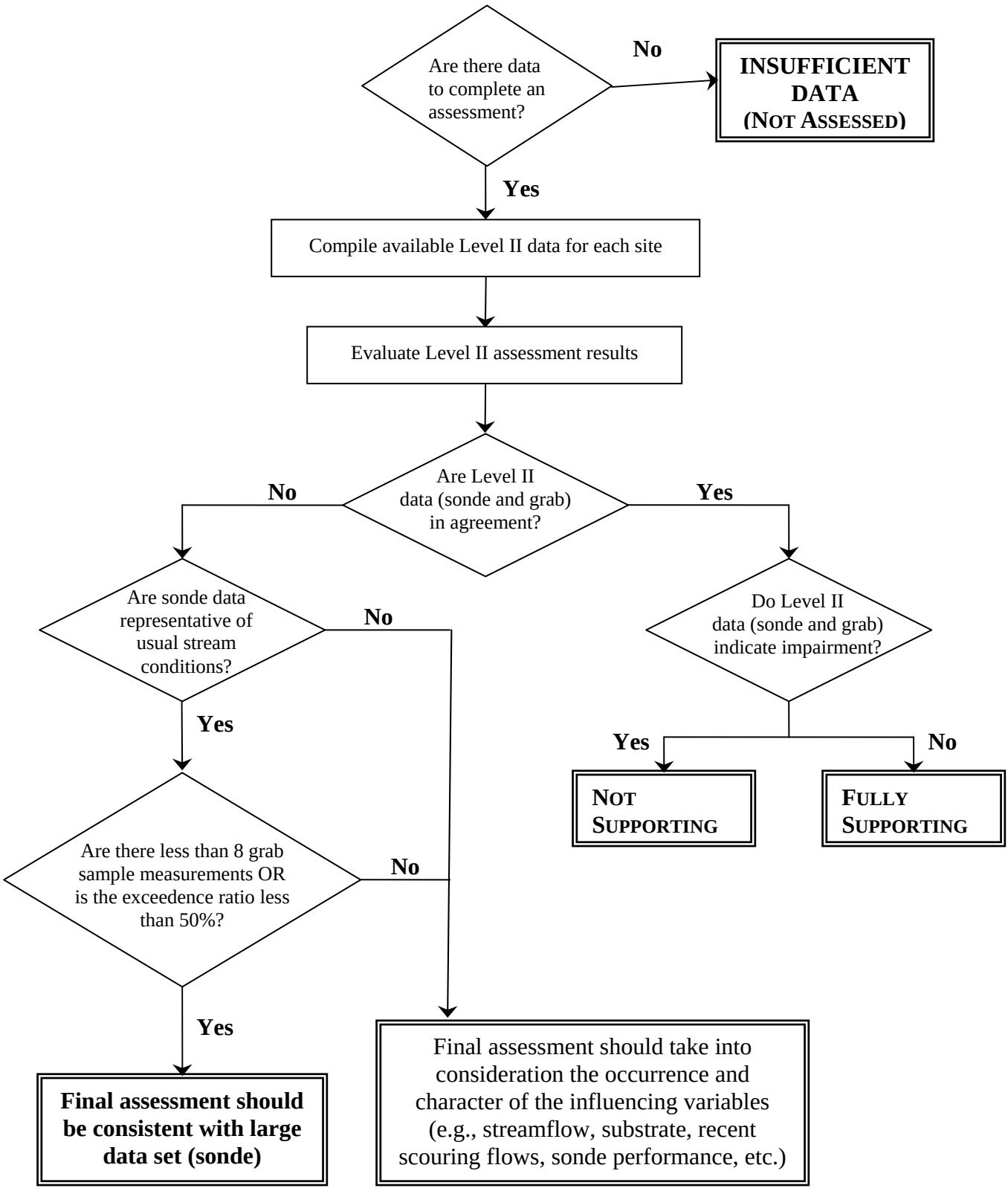

Figure 3. Generalized flowchart for Level II dissolved oxygen and pH assessments

3. Total Nitrogen (TN) and Total Phosphorus (TP) Concentrations:

Print out and attach the Nutrient Report from the SWQB water quality database. Use the data in the report to calculate the exceedence ratios for TN and TP. The exceedence ratio is the number of times that the TN or TP concentration is above the nutrient threshold values (**Table 1**) divided by the total number of samples from that site. **Table 4** explains how to interpret TN and TP data to assess use support. Record the exceedence ratios for TN and TP on the assessment form. Note on the form if total nitrogen and/or total phosphorus are causes of concern.

Table 4. Interpreting nutrient data to assess use support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING**	NOTES
•**Nutrients** (total nitrogen and total phosphorus)			
A) 1 to 10 samples	**A**) No more than one exceedence of the appropriate threshold value*.	**A**) More than one exceedence of the appropriate threshold value*.	The index period for Nutrient Level II Surveys is August – November.
B) >10 samples	**B**) Threshold value* exceeded in < 10% of measurements.	**B**) Threshold value* exceeded in ≥ 10% of measurements.	

Notes:

* Threshold values for total nitrogen and total phosphorus are found in Table 1.

** If TN or TP are assessed as "not supporting" they are considered causes of concern and the appropriate box should be checked on the Level II Nutrient Assessment Form.

4. Algal Sampling:

In streams, benthic algae production and biomass are the most useful parameters in monitoring changes in water quality (USEPA 1991). Chlorophyll *a* concentration is used as a surrogate for algal biomass and is generally the most appropriate variable to monitor (USEPA 2000). Record the chlorophyll *a* concentration (in $\mu g/cm^2$) on the assessment form and note the occurrence and character of the influencing variables (e.g., streamflow, substrate, recent scouring flows, etc.). If applicable, take these factors into consideration in the assessment of the chlorophyll *a* data. **Table 5** explains how to interpret chlorophyll *a* data to assess use support. The 90^{th} to the 99^{th} percentile range of ecoregional threshold values are shown in the **Table 6**. If the chlorophyll-a concentration falls within the range of values in Table 6, then the final interpretation should take into

consideration the **other response variables** and the occurrence and character of other influencing variables (e.g., geology, groundwater upwelling, substrate, shading, etc.). For example, algal growth appears to be limited by shading of the streambed or lack of stable substrate on which to grow. Note on the assessment form if chlorophyll *a* is a cause of concern.

Table 5. Interpreting chlorophyll *a* data to assess use support

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING ** (CATEGORY 5C)	NOT SUPPORTING ** (CATEGORY 5A)
•**Algal Biomass** (chlorophyll *a*)*	Chl-*a* concentration is less than the lower limit of the applicable threshold range.	Chl-*a* concentration falls within the applicable threshold range and none of the other response variables exceed their thresholds.***	1) Chl-*a* concentration is greater than the upper limit of the applicable threshold range, or 2) Chl-*a* concentration falls within the applicable threshold range but other factors appear to be limiting the potential for excessive algal growth.

Notes:

* The index period for chlorophyll *a* sampling is August – November. Threshold ranges for chlorophyll *a* are found in Table 6.

** If chlorophyll *a* are assessed as "not supporting" they are considered causes of concern and the appropriate box should be checked on the Level II Nutrient Assessment Form.

*** The AU will be listed under "5C – Additional information needed before scheduling TMDL development." The listing will be changed to Not Supporting (Category 5A) if a second Level II nutrient survey within a 5-year period confirms value within the applicable threshold range.

Table 6. Chlorophyll *a* Level III Ecoregional Threshold Values in µg/cm^2

21-Southern Rockies	20/22-AZ/NM Plateau	23-AZ/NM Mountains	24/79-Chihuahuan Desert	25/26-SW Tablelands
3.9 – 5.5	7.4 – 7.8	5.8 – 11.0	16.5 – 17.5	8.2 – 14.0

Note: Since the number of samples used to calculate the thresholds is relatively small for each ecoregion, the 90th to 99th percentile range is used for threshold values.

ANALYSIS AND INTERPRETATION:

Record appropriate data, threshold values, and exceedence ratios on page one of the **Level II Nutrient Assessment Form.** Compare each indicator to the associated threshold value. Make a note of those indicators that exceed the threshold value on page two of the form. . An assessment unit (AU) is **Fully Supporting** with respect to New Mexico's narrative nutrient standard if (1) one or none of the variables exceed their threshold value, or (2) both total nitrogen and total phosphorus exceed their threshold values, but there was no indication of a biological response to elevated nutrients (i.e., the response variables did not exceed their threshold values). In this instance a review of the ecoregional thresholds may be warranted. An AU is **Not Supporting** if *at least* one causal variable and one response variable exceed their thresholds. If there is more than one site in the AU where the full suite of parameters were monitored and the results of the Level II assessments are not in agreement, the AU as currently defined may not represent homogeneous water quality. In this case, the AU should be examined to determine if a split is appropriate.

EXCEPTIONS:

- If the study reach is believed to have naturally high productivity because of geology, flow regime, or other natural factors, assessment for nutrient impairment may be conducted using a reference site approach and the **Level II Nutrient Assessment Form (Reference Site Approach)**. Identify an appropriate reference reach for the study area and conduct a Level II Nutrient Survey of the reference reach near the same time that the study reach is surveyed. Whenever possible, select an existing survey site as a reference, as existing sites will have associated water quality data. Compare each indicator from the two sites, including algal biomass, chemical and physical parameters, and benthic macroinvertebrate community composition, if available and appropriate. Use statistical tests to determine significant differences when feasible. When the number of samples from each site is sufficient ($n > 4$), the rank-sum test (a.k.a. Wilcox or Mann-Whitney test) will be used to test if there is a high probability that the study site is different from the reference site. If $n \leq 4$, best professional judgment will be used to determine if the parameters are different at the sites (see notes on the form for general guidelines). If indicators from the sites are in the same range, the assessment unit is considered to be Fully Supporting with respect to New Mexico's narrative nutrient standard. If, however, **two or more** indicators are substantially different from the reference site the assessment unit will be determined to be not supporting due to nutrient enrichment.

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APPENDIX E

DISSOLVED OXYGEN ASSESSMENT PROTOCOL

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 6, 2011

1.0 Introduction/Background

Most of the information available concerning the oxygen requirement for aquatic life is based on salmonids, although a substantial number of studies also involve warmwater fish species. According to available literature, salmonids and other coldwater species are generally more sensitive to low levels of dissolved oxygen than warmwater species, and early life stages (embryos and larvae) of all species have higher dissolved oxygen requirements than their respective adult stages. Although few data are available on the effects of reduced dissolved oxygen on benthic macroinvertebrates, "historical consensus states that, if all life stages of fish are protected, the invertebrate communities, although not necessarily unchanged, should be adequately protected" (USEPA, 1986).

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 dissolved oxygen content that at least approaches 100% saturation[1]. Oxygen content may fall substantially below 100% saturation during the night when respiration and oxidation of decaying organic matter exceed production from photosynthesis (Deas and Orlob, 1999). This type of situation is particularly pronounced in systems with excessive nutrient enrichment and resulting algal and plant growth.

Currently, New Mexico's criteria for dissolved oxygen are expressed only as mass per volume (mg/L). However, in certain circumstances, such as high altitude, where atmospheric pressure is comparatively low, or high temperatures that reduce oxygen solubility, criteria may be physically impossible to attain. For this reason, this assessment protocol proposes a combined assessment of both dissolved oxygen concentration (i.e., mg/L) and percent saturation, as this integrates several factors that influence the amount of oxygen that water can contain.

2.0 Assessment Procedure

New Mexico dissolved oxygen criteria found in 20.6.4.900 NMAC are based on the aquatic life use designation (Table 1) (NMWQCC 2011). There is one set of segment specific dissolved oxygen criteria found at 20.6.4.113 NMAC.

Table 1. New Mexico's dissolved oxygen 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

SWQB typically deploys continuous recording devices (sondes) for seven days set to record hourly dissolved oxygen, pH, specific conductance, temperature, and turbidity values. Ideally, dissolved

[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).

oxygen data should be collected using sondes in order to observe diel fluctuations, as opposed to the "snapshot" that grab data provide. However, in some cases, grab sample data will be all that are available. In those cases, grab samples should be taken as near to sunrise as possible to ensure that the lowest concentration for a given day is recorded. Areas where excessive aquatic plant growth is evident should be prioritized for sonde deployment because diel fluctuations in dissolved oxygen concentrations will likely be greater due to variation in photosynthetic activity.

Table 2 provides dissolved oxygen targets for each of the following aquatic life uses detailed in Subsection H of NMAC 20.6.4.900 (NMWQCC 2011): high quality coldwater (HQCWAL), coldwater (CWAL), marginal coldwater (MCWAL), coolwater, warmwater (WWAL), and marginal warmwater (MWWAL). Consideration is given to the percent saturation in that if the value is above 90, the excursion below the water quality criterion is not of sufficient magnitude to consider the criterion to not be met for assessment purposes.

Table 2. Dissolved oxygen concurrent minimums

Aquatic Life Use	Concurrent Minimum
High Quality Coldwater Coldwater Marginal Coldwater	6.0 mg/L; 90% saturation
Coolwater Warmwater Marginal Warmwater	5.0 mg/L; 90% saturation

When assessing data for the concurrent minimum, only simultaneous data are considered. In other words, both the concentration and saturation values must fail to meet minimum values at the same time for an exceedence to occur.

Data from a deployment of a minimum of three days (72 hours) with a data collection frequency interval of no more than one hour are required to assess with the large data set assessment method in Table 3. If this amount of sonde dissolved oxygen data is not available, the instantaneous grab method is used to determine attainment.

Table 3. Determination of aquatic life use support using dissolved oxygen data

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) dissolved oxygen data** **A)** Rivers or streams **B**) Lakes or reservoirs	**A)** Not assessable (cannot determine fully supporting with grab data only) **B)** Concurrent minimum values are simultaneously not met in <10% of measurements.	**A)** or **B)** Concurrent minimum values are simultaneously not met in ≥ 10% of measurements, or 2 or more measurements if 10 or fewer data points are available.	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.
•**Continuously recorded (sonde) dissolved oxygen data**	Concurrent minimum values are simultaneously not met for <u>less than four</u> consecutive hours.	Concurrent minimum values are simultaneously not met for <u>four or more</u> consecutive hours.	When single excursions substantially below minimum values occur; when such excursions occur during a critical life cycle period, such as during spawn periods for coldwater fish species; or when severe events lead to fish kills (or other serious water quality impairment), best professional judgment and other available data will be used to determine aquatic life use support status.

3.0 Additional Thresholds under Consideration

When the percent saturation drops too low, the resulting reduction of the oxygen tension gradient across the gill epithelium of a fish decreases the ease of oxygen diffusion from the water into the blood, with deleterious physiological effects (Davis, 1975). For this reason, New Mexico is also investigating the potential need for minimum percent saturation thresholds that are independent of oxygen concentration. Percent saturation threshold in Table 4 were derived by averaging the oxygen levels at which many (>20) freshwater cold, cool, and warm water fish species begin to show signs of hypoxic stress, and applying a margin of safety (approximately one standard deviation) above that level (Davis, 1975). Apparently, oxygen supersaturation has no negative impact on fish (Wiebe and McGavock, 1932), thus only the application of minimum saturation levels is being evaluated.

Also, interstitial dissolved oxygen concentration may be substantially lower than that of the adjacent water column. In order to be protective of fish embryos and larvae that develop in the interstitial environment (e.g., salmonids), dissolved oxygen criteria and saturation thresholds during early life

stages need to be higher than criteria for other life stages. Early life stage values would apply to data that are collected during the time period when early life stages are likely to occur in a given water body. For HCWAL and CWAL, the period of applicability for these thresholds are defined as November 1 through July 31 for elevations at or above 2,750 m (~9000 ft) and November 1 through June 30 for elevations below 2,750 m (Table 4). Early life stage values do not apply to the MCWAL, as this designated use is intended to protect cold season use of warm waters.

Table 4. Local percent saturation thresholds and life stage considerations

	HQCWAL, CWAL, MCWAL		**COOLWATER, WWAL, MWWAL**
	Early life stages^ (1 Nov - 31 Jul at ≥ 2750 m; 1 Nov - 30 Jun at < 2750 m)	**Other life stages**	**All life stages**
Concurrent Minimum	8.0 mg/L; 95% saturation	6.0 mg/L; 90% saturation	5.0 mg/L; 90% saturation
Local percent saturation minimum	**85%**	**75%**	**75%**

NOTES: ^ = Early life stage values do not apply to the marginal coldwater aquatic life use because this designated use is intended to protect cold season use of warm waters.

In addition to the aquatic life use support determinations made with Table 2 above, New Mexico will also evaluate data using the local percent saturation values and life stage considerations in Table 5 below during assessment of DO data. If these conditions occur, an AU Comment will be added to indicate that percent saturation is a potential concern in the particular water body.

Table 5. Additional dissolved oxygen thresholds under consideration

TYPE OF DATA	CONCERN THRESHOLD
•**Instantaneous (grab) dissolved oxygen data**	Concurrent minimum values based on early life stages are simultaneously not met in ≥10% of measurements, or 2 or more measurements if 10 or fewer data points are available **or** Minimum saturation value is below 85% (coldwater early life stages) or 75% (coldwater other life stages and warmwater all life stages) in ≥ 10% of measurements.
•**Continuously recorded (sonde) dissolved oxygen data**	Concurrent minimum values based on early life stages are simultaneously not met for four or more consecutive hours, **or** Minimum saturation value is below 85% (coldwater early life stages) or 75% (coldwater other life stages; coolwater and warmwater all life stages) for four or more consecutive hours.

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APPENDIX F

pH ASSESSMENT PROTOCOL

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 6, 2011

1.0 Introduction

The pH of a solution is a measure of its hydrogen ion concentration and is calculated as the inverse log of the hydrogen ion concentration ($pH = -\log_{10}[H^+]$). 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 system regulating pH in natural waters is the carbonate system, composed of carbon dioxide (CO_2), carbonic acid (H_2CO_3), bicarbonate ion (HCO_3), and carbonate ion (CO_3).

There is no absolute pH range outside of which there are detrimental effects to freshwater aquatic life. Rather, gradual deterioration occurs as pH values move away 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) can be substantially affected by pH changes within this range (USEPA, 1986). At pH values above 9.0, fish have difficulty excreting ammonia across the gill epithelium, but they are generally able to survive pH values up to 9.5 for 2-3 days (McKean and Nagpal, 1991). Benthic macroinvertebrates may be more sensitive to lower pH values than fish. A pH range from 6.5 to 9.0 appears to adequately protect both fish and benthic macroinvertebrates (USEPA, 1986).

In New Mexico, typical pH values in surface waters that are largely unaffected by anthropogenic disturbance vary approximately from 7.5 to 8.7. Some streams, depending on local geology, have documented natural background pH values as low as 3.0 (e.g., Sulphur Creek in the Jemez River watershed), but this is atypical on a statewide basis.

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 growth, pH values above 9.0 may occur during the daylight hours. During the night, when photosynthesis does not occur, the pH value drops. The result is a diel fluctuation of pH values that lags a few hours behind the diel fluctuation observed in dissolved oxygen concentrations. For this reason, it is best to use continuous recording devices (sondes) to record pH values where excessive aquatic plant growth is evident. If this is not possible, grab samples should be taken at the end of the day when pH values will be at their highest.

If exceedences of water quality criteria are to be detected, the use of grab samples for recording pH in areas of excessive aquatic plant growth poses a logistical problem when viewed with the need to also detect exceedences of the dissolved oxygen criterion. Dissolved oxygen is at its lowest (i.e., most likely to exceed criteria) in the early morning in areas of excessive aquatic plant growth. This is in contrast to the diel pattern of pH values, which are most likely to exceed criteria late in the day. This dilemma underscores the need to use sondes for collecting these kinds of data.

2.0 Assessment Procedure

New Mexico pH criteria found in 20.6.4.900 NMAC (Table 1) are based on the aquatic life use designation with only two segment specific pH criteria (20.6.4.108 and 20.6.4.124 NMAC) (NMWQCC 2011).

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

SWQB typically deploys sondes for seven days set to record hourly dissolved oxygen, pH, specific conductance, temperature, and turbidity values. Data from a deployment of a minimum of three days (72 hours) with a data collection frequency interval of no more than one hour are required to assess with the large dataset assessment method in Table 2. If this amount of sonde pH data is not available, the instantaneous grab method is used to determine attainment.

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

TYPE OF DATA	FULLY SUPPORTING	NOT SUPPORTING	NOTES
•**Instantaneous (grab) pH data**		**A)** or **B)**	
A) Rivers or streams	A) Not assessable (cannot determine fully supporting with grab data only)	**Any one** of the following is met: 1) pH is outside the range of the criterion for the water body in question in ≥ 10% of measurements, or 2 or more measurements if 10 or fewer data points are available, 2) pH exceeds 9.5 at any time.	See 20.6.4.14 NMAC Subsection C Paragraph (3) for additional information regarding lake sampling.
B) Lakes or reservoirs	B) **All** of the following must be met: 1) pH is outside the range of the criterion for the water body in question in <10% of measurements, 2) pH does not exceed 9.5 at any time.		
•**Continuously recorded (sonde) pH data**	**All** of the following must be met: 1) pH is outside the range of the criterion for the water body in question in <10% of measurements, 2) pH exceeds the upper criterion for less than 24 consecutive hours, and 3) pH does not exceed 9.5 at any time.	**Any one** of the following is met: 1) pH is outside the range of the criterion for the water body in question in ≥ 10% of measurements, 2) pH exceeds the upper criterion for 24 or more consecutive hours, or 3) pH exceeds 9.5 at any time.	Assessments shall be based upon floating 24-hour periods; data from partial 24-hour periods shall not be included in assessments in order to avoid skewing the percentage of exceedences. The only exception is an instantaneous reading that exceeds 0.5 units above the upper limit of the criterion within the partial day data. When single excursions substantially outside the criteria occur; when such excursions occur during critical life cycle period, such as during spawn periods for coldwater fish species; or when severe events lead to fish kills (or other serious water quality impairment), best professional judgment and other available data will be used to determine aquatic life use support status.

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APPENDIX G

TURBIDITY ASSESSMENT PROTOCOL FOR COOLWATER OR COLDWATER PERENNIAL STREAMS AND RIVERS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 6, 2011

Purpose and Applicability

This document establishes an assessment protocol for determining impairment due to excessive turbidity in coldwater and coolwater perennial streams and rivers. 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 currently found at 20.6.4.13J NMAC (NMWQCC 2011):

> ***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.*

Exclusions

This protocol is currently 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, ponds, and playas
- Intermittent streams
- Ephemeral streams
- Wetlands
- Stream segments with a warmwater or marginal warmwater aquatic life designated use per the current version of 20.6.4. NMAC

1.0 Introduction/Background

The approach described below relies on the use of biotranslators to derive numeric thresholds from the 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 well defined endpoint is usually determined 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 influence turbidity assessment, this protocol will consider 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 were also considered.

The *State of New Mexico Standards for Interstate and Intrastate Surface Waters* 20.6.4.7 define several aquatic life uses, including High Quality Coldwater, Coldwater, Marginal Coldwater, Coolwater, Warmwater, and Marginal Warmwater (NMWQCC 2011). For each type of aquatic life use, 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.

1.1 Coldwater Aquatic Life (including High Quality Coldwater Aquatic Life)

The most representative fish to use in determining the appropriate turbidity thresholds for stream segments assigned these aquatic life uses are salmonids. The majority of studies on turbidity in 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 NTUs, reactive distance is halved, and passive feeding is replaced with an active feeding. This turbidity level, if maintained for a sufficiently duration, results in impaired growth (Berg and Northcote, 1985; Sweka and Hartman, 2001a; Newcombe, 2003). This suggests a long duration threshold of < 10 NTUs is appropriate for waters with these aquatic life uses. Further support for a threshold in this neighborhood come from 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 NTUs. No physical effects of sediment were found on macroinvertebrates, indicating the observed reductions in densities were due to reduced food production as a result of reduced light transmission.

1.2 Marginal Coldwater Aquatic Life

Brown trout, though a non-native species, are widespread throughout New Mexico and are considered a representative marginal coldwater species. Reduced feeding was observed in brown trout at 7.5 NTUs (Bachman, 1984) indicating that growth would be impaired at lower turbidity levels.

1.3 Coolwater Aquatic Life

Smallmouth Bass can be considered representative of coolwater aquatic life species. Changes in prey selection, which influence growth and reproduction in fish, were demonstrated to occur between 0 and 5 NTUs (Carter et al., 2009). This suggests that the turbidity threshold for coolwater aquatic life habitat should be the same or slightly lower than for coldwater aquatic life uses.

1.4 Warmwater Aquatic Life (including Marginal Warmwater Aquatic Life)

Bluegill typically occupy warmwater aquatic life habitat and are native to New Mexico. Bluegill feeding activity was reduced approximately 20% at 60 NTUs relative to clear water conditions (Gardner, 1981). A second representative fish of warmwater aquatic life habitat 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 NTUs and possibly higher. Conversely, other native New Mexican warm water 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 NTUs, and prey consumption was enhanced in Arkansas River shiner as turbidity increased from 0-2,000 NTUs (Bonner and Wilde, 2002).

The limited availability of data for 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 for warmwater aquatic life designations. As more studies on the effects of turbidity on warmwater fish are published, assessment of turbidity in water quality segments with warmwater and marginal warmwater designated uses may become possible.

2.0 Turbidity Thresholds for Perennial Streams with Exclusively Coldwater or Coolwater Designated Aquatic Life Uses

Newcombe (2003) used the information cited in the above studies, excluding warmwater fish, as part of a larger dataset to develop a severity of ill effects (SEV) index that describes the combined effects of turbidity levels and duration of exposure on clear water fishes. The “clearwater fishes” used in the study are those found in High Quality Coldwater Aquatic Life, Coldwater Aquatic Life, Marginal Coldwater Aquatic Life, and Coolwater Aquatic Life water quality segments. As such, the SEV index is applicable to only these designated uses, and 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.

For purposes of applying the SEV index to develop thresholds for turbidity assessment, a value of 3.5 was selected which corresponds to the boundary between conditions that produce changes in feeding and those that reduce growth rate and habitat size. A graph of the relationship between turbidity and duration for a severity index of 3.5 (Figure 1) shows a power relationship between these variables (Equation 1).

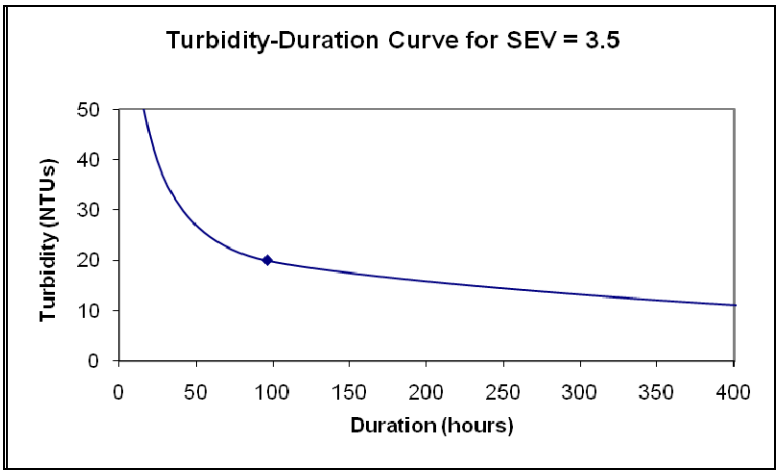

Figure 1. Relationship between turbidity and length of exposure for a severity of ill effects (SEV) index of 3.5, based on Newcombe (2003)

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

$$x = 37382y^{-1.9887} \quad \text{or} \quad y = 199.2x^{-0.5028}$$

where x = duration in hours and y = NTUs.

Solving Equation 1 for various NTUs and durations gives a range of turbidity thresholds for clear water fishes (Table 1). If the turbidity threshold (y) is exceeded consecutively for more than the allowable duration (x), the water body is considered to have exceeded that particular turbidity threshold. Impairment thresholds were determined with a minimum duration (x) of 72 hours (three days) and a minimum turbidity threshold (y) of 7 NTUs.

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*	3
20	96	4
18	120	5
16	144	6
15	168	7
11	336	14
7	720**	30

NOTES:
* Turbidity levels above this duration will certainly 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.
**Thresholds for duration longer than this result in turbidity values lower than supported by the literature review presented in section 1.0.

3.0 Assessment Procedure

The first step is to collate available grab and sonde turbidity data (Figure 1). SWQB collects grab (instantaneous) turbidity measurements roughly once a month during water quality surveys. SWQB typically deploys sondes for three to seven days set to record at least hourly dissolved oxygen, pH, specific conductance, temperature, and turbidity values. Only valid datasets as determined via application of SWQB's standard operating procedures (SOPs) and quality assurance project plan (QAPP) are used for assessment purposes (NMED/SWQB 2011a, 2011b).

Sonde data

If at least 72 hours (3 days) of sonde data are available, the sonde data are evaluated to determine impairment status. The data are evaluated against impairment thresholds in Table 1 and attainment status is determined per Table 2 (see also Figure 1). If less than 72 hours of data are available, the data will only be evaluated to determine priority for subsequent sonde deployment. In other words, an impairment determination for turbidity using sonde data are only made if three days (72 hours) of continuous sonde data are available. To evaluate a sonde dataset with sufficient data against the impairment thresholds, the maximum value for the entire sonde dataset is first determined. This value is then compared to the threshold associated with the closest duration listed in Table 1 by rounding up. For example, if there are 3.5 days of sonde data available, round up to the 4-day threshold in Table 1. If this impairment threshold is not exceeded, the assessment conclusion is Full Support.

If this impairment threshold is exceeded, the sonde data are then scanned for consecutive intervals of elevated turbidity (i.e., turbidity values greater than the impairment threshold determined in the above paragraph). If any are found, a turbidity value is chosen that is just below the lowest measured value from the interval under consideration and Equation 1 is used to determine the allowable duration. If the consecutive turbidity readings last for a period exceeding the calculated allowable duration, the threshold has been exceeded and the conclusion is Non Support. Below are three examples. See also Figure 1:

> **Example 1**: The maximum value for a 7-day sonde deployment at a particular water quality station is 10.6 NTU. The impairment threshold of 15 NTU was not exceeded, as well as none of the shorter-duration thresholds in Table 1 because these thresholds are all greater than 15 NTUs. Therefore, the impairment conclusion is Full Support.
>
> **Example 2**: The maximum value for a 6-day sonde deployment at different water quality station is 36.0 NTU. This exceeds the 6-day threshold of 16 NTU, so the sonde data were then scanned for consecutive intervals of elevated turbidity greater than 16 NTU. An interval with turbidity values from 30.5 to 36.0 NTUs was found that lasted for 48 hours. Therefore, 30 NTUs was plugged into Equation 1 to determine the allowable duration of 43 hours. The consecutive elevated turbidity readings lasted 48 hours, which exceeded the calculated allowable duration, so the impairment conclusion is Non Support.
>
> **Example 3**: The scenario is the same as Example 2 above, but the elevated period only lasted for 12 hours. This does not exceed the calculated allowed duration of 43 hours, so the impairment conclusion is Full Support.

Grab data

If less than 72 hours of sonde data are available, grab data may be evaluated to determine either Fully Supporting or to prioritize future sonde deployments. Only grab data collected during non-flood flows (i.e., generally under snowmelt or baseflow conditions) will be used. 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 either a corresponding flow condition rating of 2 or 3 as recorded on the SWQB Field Sampling Form or by analysis of available quantitative flow data. If there are at least four data points collected that are at least 21-days apart, and all values are below the minimum impairment threshold of 7 NTU, the assessment unit (i.e., stream reach) will be determined to be Fully Supporting for turbidity. If one or more data points exceed 7 NTU, the assessment unit will be prioritized for sonde deployment.

Table 2. Assessing turbidity data to determine Coldwater or Coolwater Aquatic Life Use Support

TYPE OF DATA	FULL SUPPORT	NON SUPPORT	NOTES
If sonde data are available			
STEP 1: Sonde Data			
A) ≥ 72 hours (3 days) of data	**A)** No sonde data exceed impairment thresholds in Table 1 (Equation 1).	**A**) One or more data exceed impairment thresholds in Table 1 (Equation 1).	* If there are not enough sonde data to assess, move on to **Step 2**. If available sonde data exceed any impairment threshold(s), site will be prioritized for future minimum three-day (72 hour) sonde deployment.
B) < 72 hours (3 days) of data	**B)** Not Assessed*	**B**) Not Assessed*	
If <72 hours of sonde data			
STEP 2: Grab Data			
C) ≥ 4 samples and data ≥ 21-days apart	**C)** No measurements greater than 7 NTU.	**C)** Not Assessed**	** If available grab data exceed 7 NTU, site will be prioritized for future minimum three-day (72 hour) sonde deployment.
D) < 4 samples or data < 21-days apart	**D)** Not Assessed**	**D)** Not Assessed**	

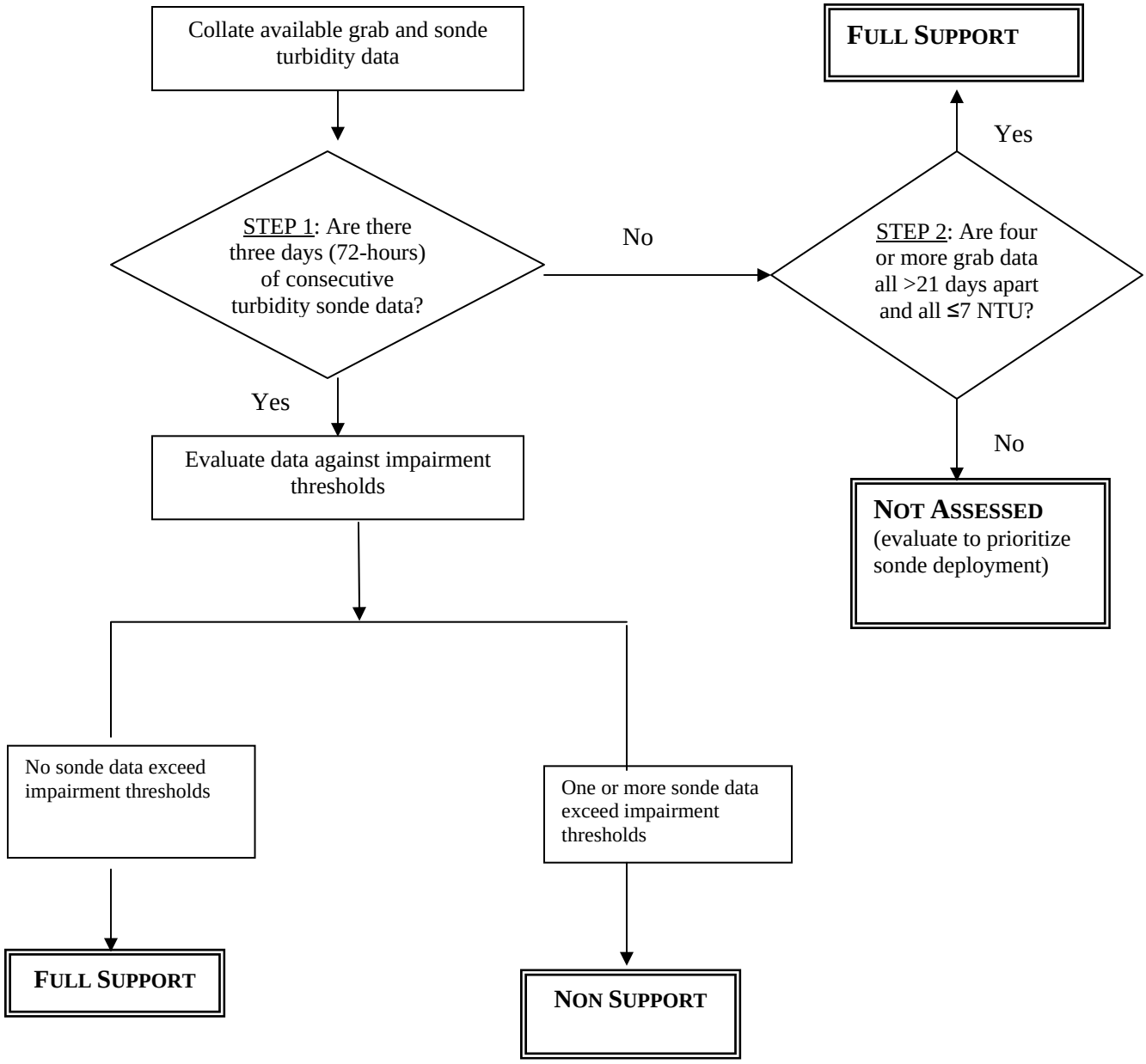

Figure 1 Generalized flowchart for determining turbidity attainment status

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APPENDIX H

DATA ASSESSMENT PROCEDURE AND FORMS

NEW MEXICO ENVIRONMENT DEPARTMENT
SURFACE WATER QUALITY BUREAU

MAY 31, 2011
REVISION ONE

Introduction:

Assessments of data from watershed surveys or other monitoring projects to determine designated use attainment status on an assessment unit basis are performed by the assigned assessor after available and applicable data have been verified and validated in accordance with the most recent version of the Quality Assurance Project Plan (QAPP). Completed assessments are verified to ensure they are complete and accurate. During verification of assessments, it is assumed that all relevant data have been compiled and that the data validation process or any other QA procedures were correctly performed.

This outline is to be used in conjunction with the *Procedures of Assessing Standards Attainment for the State of New Mexico CWA §303(d) /§305(b) Integrated Report* (Assessment Protocols), and is intended to detail the general steps that occur during the assessment process for each of the main categories of data. This outline will be updated and expanded as new and revised assessment protocols are developed and implemented.

I. Assessment Procedures Common to All Data Types:

A. Data Collation

1. Ensure that all chemical/physical and E. coli field and lab grab data from the survey have been validated and verified per the most recent version of the Quality Assurance Project Plan (QAPP) – found at http://www.nmenv.state.nm.us/swqb/QAPP/index.html -- and have been marked as such in NMEDAS (SWQB's in-house water quality database). Ensure all other data to be assessed have also been validated and verified per the most recent QAPP. Generate spreadsheet(s) of applicable and available assessment data.
2. Search for any readily available sources of outside data (such as recent water quality from active USGS stream gages [http://waterdata.usgs.gov/nwis], USFS data, EPA National Survey data [http://www.epa.gov/owow/streamsurvey/web_data.html], etc.) to incorporate into the assessment as appropriate. If there are any USGS water quality stations in any assessment units in the study, download available data since the last SWQB survey from NWIS: http://waterdata.usgs.gov/nwis. Contact current USGS cooperative agreement contact (ask MAS Program Manager for current contact info) to acquire any provisional water quality data from the recent year which they expect to be finalized by the projected date of the final integrated list in progress. Ask SWQB WPS watershed lead if he/she is aware of any other entities collecting water quality data in the study area. Ask MAS staff if they are aware of any other entities collecting water quality data in the study area.
3. Determine whether data qualities of these additional data sources are sufficient to incorporate into assessments. (NOTE: USGS data downloaded from NWIS are assumed to meet SWQB data quality requirements; level of QA/QC of USGS provisional data however must be determined). All data submissions from outside sources will be reviewed by the SWQB QA Officer to ensure the suitability of the QA/QC procedures under which the data were collected. Specifically, submitted documentation associated with the dataset will be reviewed to determine: (1) if there is documentation of QA/QC procedures that, at a minimum, meet the QA/QC requirements described in the SWQB's most recent QAPP; and (2) if there is reasonable evidence or assurance that these procedures were followed.

4. If outside data are of adequate quality for assessment, collate into assessment spreadsheet and merge with SWQB data in the spreadsheet, including a Data Source column. If the data are not of adequate quality, document why and keep in assessment folder.

B. Assessment

1. Download the latest version of the Assessment Protocols – found at http://www.nmenv.state.nm.us/swqb/protocols/index.html. If in doubt, consult with Assessment Coordinator.
2. Download latest version of the EPA-approved WQS (20.6.4 NMAC) – found at. http://www.nmenv.state.nm.us/swqb/Standards/. If in doubt, consult with Standards Coordinator.
3. Start an electronic Administrative Record folder (i.e., assessment packet) for your assessments by creating a directory on your hard drive to house all assessment documentation (Ex: Jemez 2005 Assessments -- to include MSExcel data spreadsheets, assessment forms, etc.)
4. Follow below assessment procedures by Data Type (see below sections).
5. Complete and print the *Assessor's Worksheet* (Attachment H-2).
6. Submit signed hardcopy of completed *Assessor's Worksheet*, and electronic copies of completed assessment forms and all supporting information (i.e., the electronic Administrative Record folder from step B1) to the Assessment Coordinator. Specifically, submit the following electronic files:
    - All completed Assessment Forms
    - Any supporting data spreadsheets used during the assessment procedure
    - Any supporting data called for on the Assessment Form

C. Assessment verification

1. Retrieve assessment packet (as described in B3) for all data types from the Assessment Coordinator.
2. Ensure available data were accurately assessed in accordance with the most recent EPA-approved WQ standards and associated Assessment Protocols.
3. Verify that the forms were filled out correctly by verifying correct WQS reference, correct assignment of stations to assessment units, and checking all calculations and impairment conclusions. If everything is correct, initial and date the "Verified by/on:_____" line on the top of each assessment form.
4. If discrepancies arise or assessments were not properly performed, discuss any proposed changes to the assessment with the original assessor, document the discussion, and revise assessment forms as necessary, and then initial and date the "Verified by/on:_____" line on the top of the assessment forms.
5. Complete and print the *Assessment Verification Worksheet* (Attachment H-3).
6. Submit signed hardcopy of the *Assessment Verification Worksheet*, and electronic copies of the sample tracking spreadsheet, completed assessment forms and all supporting information (i.e., the final electronic Administrative Record) to Assessment Coordinator for inclusion on the upcoming draft Integrated List and eventual filing in the Administrative Record.

II. Specific Assessment Steps by Data Type

A. Chemical/Physical and E. coli Grab Data

1. Export all field and lab data from NMEDAS using the report functions. Collate with any available outside data determine to be of sufficient data quality following the procedures above in Section I.A.
2. Fill out the *Summary Chemical/Physical and E. coli Assessment Form* for available and applicable chemical/physical and bacteriological grab data (Attachment H-1 of this document and electronically located in MAS Core Documents) for each assessment unit.
3. Determine exceedence ratios for all applicable criteria based on applicable tables in the most recent version of the Assessment Protocols.

    a. Hardness-dependent metals: When all metals results are below the quantification limit, there is no need to calculate the hardness-dependent metals criteria, and the Exceedence Ratio field on the Summary Chemical/Physical and E. Coli Assessment Form should be filled in with "BLW QL" for "below quantification limit." When there are metals results above the quantification limit, a screening level using the lowest measured hardness value in the data set to calculate hardness-dependent criteria may first be employed to determine the potential for any exceedences in the data set. If any measured values are above the associated criteria determined in this way, the assessor must calculate appropriate hardness-dependent metals criteria for the sampling event(s) using concurrently-collected hardness and the formulas in 20.6.4.900 NMAC (see the hardness-dependent calculator spreadsheet in \SWQB Public\MAS Core Documents). If concurrently-collected hardness data are not available, the lowest available hardness value within a seven-day period of the sample collection date may be used with a note in the Comments section of the appropriate Assessment Form explaining why concurrently-collected data were not used. If no hardness data (or adequate data to calculate hardness) are available within a seven-day period of the sample collection date, it is permissible to use conservative hardness estimates determined by qualified natural resources agencies or entities as appropriate for that water body. This deviation must be noted on the appropriate Assessment Form. Generate a spreadsheet that details the station, date/time, hardness, hardness-dependent criteria, and sample result. This spreadsheet must be included as part of the electronic record.

    b. pH, temperature, and fish life stage dependent ammonia: When all ammonia results are below the quantification limit, there is no need to determine the pH, temperature, and life stage -dependent ammonia criteria, and the Exceedence Ratio field on the Summary Chemical/Physical and E. Coli Assessment Form should be filled in with "BLW QL" for "below quantification limit." When there are ammonia results above the quantification limit, determine the appropriate ammonia criteria for the sampling event(s) using Tables K through M of 20.6.4.900 NMAC, and the notes in Table 3.4 of the main assessment protocol. Generate a spreadsheet that details the station, date/time, pH, temperature, appropriate criteria, and sample result. This spreadsheet must be included as part of the electronic record.

    c. Nitrate as N vs. Nitrite+Nitrate in 20.6.4.900 NMAC: Because data are generally reported from the State Laboratory Division (SLD) as Nitrite+Nitrate (N), and nitrite is generally negligible, the Nitrite+Nitrate (N) results can assessed against the Domestic Water Supply criterion of 10 mg/L expressed as "Nitrate as N" in 20.6.4.900 NMAC.

4. Include comments and notes regarding extraordinary field conditions that may have influenced results, Data Validation flags, the need for AU splits, questionable designated uses, etc., in the Comments section of the summary form.
5. Individual out individual assessment forms as indicated below. These individual forms are extremely important because they constitute the primary record for both new listings and de-listings.

Chronic aquatic life (AL) use assessments

- Fill out an *Individual Chemical/ Physical Data (chronic AL use) Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents) by assessment unit for any chronic ALU parameter a) with 2 or more exceedence(s) of the applicable criteria, or b) previously listed as "Non Support" on the most recent CWA 303(d)/305(b) Integrated List.
- As needed, determine whether or not there were hydrologically stable conditions at the time of data collection (STEP 3 on the form) using the procedure discussed in Section 3.1.2.1 of the Main Assessment Protocol.
- Include comments and notes regarding field conditions that may have influenced results, etc., in the Comments section of this form.

All non-chronic AL use or E. coli assessments

- Fill out an *Individual Chemical/ Physical Data (except chronic AL use) or E.coli Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents) by assessment unit for any non-chronic ALU parameter or E. coli data a) with 1 or more exceedence(s) of the applicable Domestic Water Supply criteria, 2) with 2 or more exceedence(s) of the applicable non-chronic AL criteria, or c) previously listed as "Non Support" on the most recent CWA 303(d)/305(b) Integrated List.
- Include comments and notes regarding field conditions that may have influenced results, etc., in the Comments section of this form.

B. Ambient Toxicological Data

NOTE: The data utilized for these assessments are downloaded from EPA's toxicological program. It is therefore assumed that these data are thoroughly validated and verified before EPA uploads them to this site.

1. Download the most recent New Mexico toxicological data at http://www.epa.gov/earth1r6/6wq/ecopro/watershd/monitrng/toxnet/nm.pdf. This website collates all EPA toxicological tests performed in New Mexico for SWQB and EPA Region 6 over the years in one place.
2. Determine use attainment status based on the applicable table in the most recent version of the Assessment Protocol.
3. Fill out *Ambient Toxicity Monitoring Assessment Form* (Attachment H-1 and MAS Core Documents) for each assessment unit for which there are data. Include comments and notes regarding field conditions that may have influenced results, etc., in the Comments section of this form.

C. Benthic Macroinvertebrate Data

1. Determine Level IV ecoregion. Site locations near ecoregion boundaries warrant additional scrutiny. Any study site within approximately twenty kilometers of an ecoregion boundary should be compared to the definitions of the adjacent ecoregion to determine the appropriate approach (M-SCI or RBP comparison).

2. If study site is in Level III Ecoregion 21 or 23, determine M-SCI score using the reports in NMEDAS.
3. If study site is not in Level III Ecoregion 21 or 23, determine RBP Bio Score for both the study site and reference site using the reports in NMEDAS.
4. Fill out *Benthic Macroinvertebrate Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents) by station according to the most recent version of the Main Assessment Protocol. Include comments and notes regarding extraordinary field conditions that may have influenced results, etc., in the Comments section of this form.
5. If there is more than one station in the AU, repeat all steps above and fill out new form(s). Follow the procedures detailed in the "Multiple stations in one assessment unit" section in the Main Assessment Protocol.

D. Sedimentation/Siltation Data

1. Collate all data necessary to determine impairment due to excessive sedimentation as detailed in the most recent version of the Sedimentation/Siltation (Stream Bottom Deposits) Protocol for Wadeable Perennial Streams**,** Appendix C of the Assessment Protocol.
2. Determine Level IV ecoregion. Site locations near ecoregion boundaries warrant additional scrutiny. Any study site within approximately twenty kilometers of an ecoregion boundary should be compared to the definitions of the adjacent ecoregion to determine the appropriate bedded sediment site class designation for that site.
3. Fill out *Sedimentation/Siltation (Stream Bottom Deposit) Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents) by station according to the protocol. Include comments and notes regarding extraordinary field conditions that may have influenced results, etc., in the Comments section of this form.
4. If there is more than one station in the AU, repeat all steps above and fill out new form(s). Follow the procedures detailed in the "Multiple stations in one assessment unit" section in the Main Assessment Protocol.

E. Nutrient Data

1. Collate all data necessary to apply the weight-of-evidence approach detailed in the most recent version of the Nutrient Assessment Protocol for Wadeable Perennial Streams, Appendix D of the Assessment Protocol.
2. Fill out *Level II Nutrient Assessment Form,* (Attachment H-1 and MAS Core Documents) as necessary according to the protocol (NOTE: *Level I Nutrient Assessment Forms* are completed before August to indicate where Level II is needed – see Appendix

D for details). Include comments and notes regarding extraordinary field conditions that may have influenced results, etc., in the Comments section of this form.

3. If there is more than one station in the AU, repeat all steps above and fill out new form(s). Follow the procedures detailed in the "Multiple stations in one assessment unit" section in the Main Assessment Protocol.

F. Large Data Sets

Thermograph data:

1. Locate and collate available thermograph MS Excel files in \SWQB PUBLIC\Gary S Public\. Collate with any available outside data determine to be of sufficient data quality following the procedures above in Section I.A.
2. Determine the aquatic life use (ALU) of the water body being assessed (see 20.6.4 NMAC).
3. Use the "Conditional Formatting" option or other MS Excel functions to assess the data using the most recent Temperature Assessment Protocol **(A**ppendix B of the Assessment Protocol.
4. Fill out *Temperature Data Logger (Thermograph) Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents). Include comments and notes regarding extraordinary field conditions that may have influenced results, Data Validation flags, the need for AU splits, questionable designated uses, etc., in the Comments section of this form.
5. If there is more than one station in the AU, repeat all steps above and fill out new form(s). Follow the procedures detailed in the "Multiple stations in one assessment unit" section in the Main Assessment Protocol.

Sonde data:

1. Locate available sonde MS Excel files in \SWQB PUBLIC\Gary S Public\. Collate with any available outside data determine to be of sufficient data quality following the procedures above in Section I.A.
2. Assess data using the most recent Dissolved Oxygen and pH Assessment Protocols**,** **(**Appendices E and F, respectively, of the Assessment Protocol).
3. Fill out the *pH and Dissolved Oxygen Sonde Data Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents). Include comments and notes regarding extraordinary field conditions that may have influenced results, Data Validation flags, the need for AU splits, questionable designated uses, etc., in the Comments section of this form.
4. If there is more than one station in the AU, repeat all steps above and fill out new form(s). Follow the procedures detailed in the "Multiple stations in one assessment unit" section in the Main Assessment Protocol.
5. Provide copies of complete assessment forms to the nutrient assessors for use in the nutrient assessments.

G. Turbidity assessments

1. Export all available turbidity data from the WQ dbase using the "Export Data" functions. Collate with any available outside data determine to be of sufficient data quality following the procedures above in Section I.A.

2. Assess data using the most recent Turbidity Assessment Protocol**,** Appendix G of the Assessment Protocol.
3. Fill out *Turbidity Assessment Form* (Attachment H-1 of this document and electronically located in MAS Core Documents). Include comments and notes regarding extraordinary field conditions that may have influenced results, Data Validation flags, the need for AU splits, questionable designated uses, etc., in the Comments section of this form.
4. If there is more than one station in the AU, repeat all steps above and fill out new form(s). Follow the procedures detailed in the "Multiple stations in one assessment unit" section in the Main Assessment Protocol.

Attachment H-1: Assessment Forms

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Summary Chemical/Physical and E.coli Assessment Form

Study Year|Study Name: _____

1. Name of assessment unit (stream reach) in NMEDAS or 303d/305b list: _____
2. Segment number from NM WQ standards: _____
3. All designated uses (and known existing) from NM WQ standards: _____
4. Current IR Category from most recent Integrated List _____ Causes of Impairment (if any)_____
5. Sites used for assessment: _____
6. Evaluation of data compared to applicable uses, expressed as a ratio of exceedences / total number of samples (**Bold** the use(s) and associated criteria being assessed. When the lowest applicable criterion is exceeded and multiple criteria apply, must also document the exceedence ratio for the next lowest applicable criterion until there are "0 / #"). If all hardness-dependent metals are below the QL, insert "ALL BLW QL" in the "Exceedence Ratio(s)" column:

KEY: DWS = domestic water supply, **IRR** = irrigation, **LW** = livestock watering, **WH** = wildlife habitat, **AL** = aquatic life, **HH** = human health, **DL ABV WQS** = Detection limit greater than WQS, **NA** = not applicable, **BLW QL** = below quantification limit, **NO DATA =** no data available, **a** = hardness-dependent criterion (see attached spreadsheet), **P** = persistent toxic pollutant

METALS:

Pollutants	Designated Use(s) [1],[2]	Numeric Criteria (µg/L unless otherwise noted)	Exceedence Ratio(s)[3]
Aluminum, dissolved	IRR	5000	
Aluminum, total recoverable	AL chronic[4] | AL acute[4]	**a | a**	
Antimony, dissolved (**P**)	DWS | HH	6 | 640	
Arsenic, dissolved (**P**)	HH | DWS | IRR | AL chronic | LW | AL acute	9.0 | 10 | 100 | 150 | 200 | 340	
Barium, dissolved	DWS	2000	
Beryllium, dissolved	DWS	4	
Boron, dissolved	IRR | LW	750 | 5000	
Cadmium, dissolved	AL chronic[4] | AL acute[4] | DWS | IRR | LW |	**a | a** | 5 | 10 | 50	
Chromium, dissolved	DWS | IRR | LW	100 | 100 | 1000	
Cobalt, dissolved	IRR | LW	50 | 1000	
Copper, dissolved	AL chronic[4] | AL acute[4] | IRR | LW | DWS	**a | a** | 200 | 500 |1300	
Lead, dissolved	AL chronic[4] | DWS | LW | AL acute[4] | IRR	**a** | 15 | 100 | **a** | 5000	
Manganese, dissolved	AL chronic[4] | AL acute[4]	**a | a**	
Mercury, total	WH | DWS | LW	0.77 | 2 | 10	
Mercury, dissolved	AL chronic | AL acute	0.77 | 1.4	
Molybdenum, dissolved	IRR	1000	
Nickel, dissolved (**P**)	AL chronic[4] | AL acute[4] | DWS | HH	**a | a** | 700 | 4600	
Selenium, dissolved (**P**)	DWS | LW | IRR[5] | HH	50 | 50 | _____ mg/L | 4200	
Selenium, total recoverable	WH | AL chronic | AL acute	5.0 | 5.0 | 20	
Silver, dissolved	AL acute[4]	**a**	
Thallium, dissolved (**P**)	HH | DWS | HH	0.47 | 2	
Uranium, dissolved	DWS	30	
Vanadium, dissolved	IRR | LW	100 | 100	
Zinc, dissolved (**P**)	AL chronic[4] | AL acute[4] | IRR | DWS | LW | HH	**a | a** | 2000 | 10500 | 25000 | 26000	

[1] Per 20.6.4.11 Subsection G NMAC, human health-organism only criteria listed in 20.6.4.900 Subsection J NMAC shall apply to any waters with aquatic life use. For waters with **limited aquatic life use**, only the persistent (**P**) human health criteria apply unless otherwise adopted on a segment-specific basis.

[2] Per 20.6.4.900 Subsection H(7), chronic AL criteria do not apply to **limited aquatic life** unless adopted on a segment-specific basis.

[3] See Main AP for protocols by designated use.. In general, two exceedences result in **Non Support**., Must also complete Individual Assessment Forms if **Non Support** or **previously listed**

[4] Hardness-dependent criteria calculated using equations (see 20.6.4.900 Subsection I NMAC). Attach spreadsheet for any results above the quantification limit

[5] Applicable criterion depends on presence of sulfate (see 20.6.4.900 Subsection C NMAC – note units are in **mg/L**).

OTHER:

Pollutant	Designated Use(s)	Numeric Criteria	Exceedence Ratio(s)
Ammonia, total	Based on life stages, pH, and temperature (see 20.6.4.900 Subsection L NMAC and Table 3.4 of main Assessment Protocol)	See attached spreadsheet for any applicable criteria for any results above the quantification limit	_____
Cyanide, total recoverable	AL chronic | WH | AL acute | HH | DWS	5.2 | 5.2 | 22.0 | 140 | 200 µg/L	_____
E. coli	Primary or Secondary Contact	_____ cfu/100mL	_____
Nitrite + nitrate	DWS* | LW	10 | 132 mg/L	_____
Temperature (grab)	_____	Celsius	
pH (grab)	_____		
DO (grab)	_____	mg/L	
_____	_____	_____	_____
_____	_____	_____	_____

RADIONUCLIDES:

Pollutant	Designated Use(s)	Numeric Criteria	Exceedence Ratio(s)
Adjusted gross alpha	DWS | LW	15 | 15 pCi/L	_____
Radium 226 +228	DWS | LW	5 | 30.0 pCi/L	_____
_____	_____	_____ pCi/L	_____
_____	_____	_____ pCi/L	_____

8260 ORGANICS (Volatiles) – Assess any pollutants with results above the quantification limit.

Pollutant	Designated Use(s)	Numeric Criteria	Exceedence Ratio(s)
_____	_____	_____ µg/L	_____
_____	_____	_____ µg/L	_____

8270 ORGANICS (Semi-volatiles) -- Assess any pollutants with results above the quantification limit.

Pollutant	Designated Use(s)	Numeric Criteria	Exceedence Ratio(s)
_____	_____	_____ µg/L	_____
_____	_____	_____ µg/L	_____

8081 PESTICIDES (Organochlorines) -- Assess any pollutants with results above the quantification limit.

Pollutant	Designated Use(s)	Numeric Criteria	Exceedence Ratio(s)
_____	_____	_____ µg/L	_____
_____	_____	_____ µg/L	_____

Additional comments about the assessments: _____

Revised 25 January 2011 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Individual Chemical/ Physical Data (*chronic AL use*)

Study Year/Study Name: _____

1. Name of assessment unit (AU) in the SWQB WQ database or 303d/305b list: _____
2. Station Name(s): _____
3. Segment number from NM WQ standards: _____
4. Parameter [a]: _____
5. Chronic aquatic life criterion: _____
6. Evaluation of data:

STEP 1a: For a given site, are there 2 or more sample results available within a 4-day period?
☐ No – Use the grab sample result and Table 3.4 in Assessment Protocol to assess against chronic aquatic life criteria
☐ Yes – Use the arithmetic mean and Table 3.4 in Assessment Protocol to assess against chronic aquatic life criteria [b]

STEP 1b: Complete table with data expressed as the number of exceedences/number of samples:

Data Source	Snowmelt (Mar – May)	Summer/Fall Baseflow (Jun - Oct)	Winter Baseflow (Sept - Nov)	Storm Event [c]	Exceedence Ratio (# exceedences/#samples)
SWQB Station: _____	_____	_____	_____	_____	_____
SWQB Station: _____	_____	_____	_____	_____	_____
Outside data source: _____	_____	_____	_____	_____	_____
Outside data source: _____	_____	_____	_____	_____	_____
AU Totals	_____	_____	_____	_____	_____

STEP 2: Are there two or more exceedences of the WQS? [d]
☐ No – List as **Full Support**
☐ Yes – Complete STEP 4

STEP 3: Were data for the two or more exceedences collected during hydrologically stable conditions?
☐ No – Remove data from periods of unstable conditions and reassess against chronic aquatic life criteria
☐ Yes – List as **Non Support**

7. Are there multiple stations in the AU?

☐ No – complete number 8

☐ Yes – are the use support designations for individual stations in agreement?

☐ Yes – complete number 8

☐ No – examine AU breaks and reassess, or provide comments below

8. What is the use support designation according to the SWQB Assessment Protocol:

☐ **Full support**

☐ **Not supported**

☐ **Not Assessed (n=1[e])**

Additional comments about the assessment [f]:

--***Attach raw and averaged data used to make impairment determination.*** *Any data lab or SWQB qualifier codes must be included.*

a. *If parameter is **Adjusted Gross Alpha**, include documentation regarding how the data were adjusted.*

b. *If a given sample is j-flagged use the j-flagged value; if it is below detection limit use ½ the DL.*

c. *Do not include samples from storm events in assessment of chronic aquatic life criteria*

d. *Assessment of Domestic Water Supply is possible with n=1.*

e. *Note especially any single exceedence of a criterion*

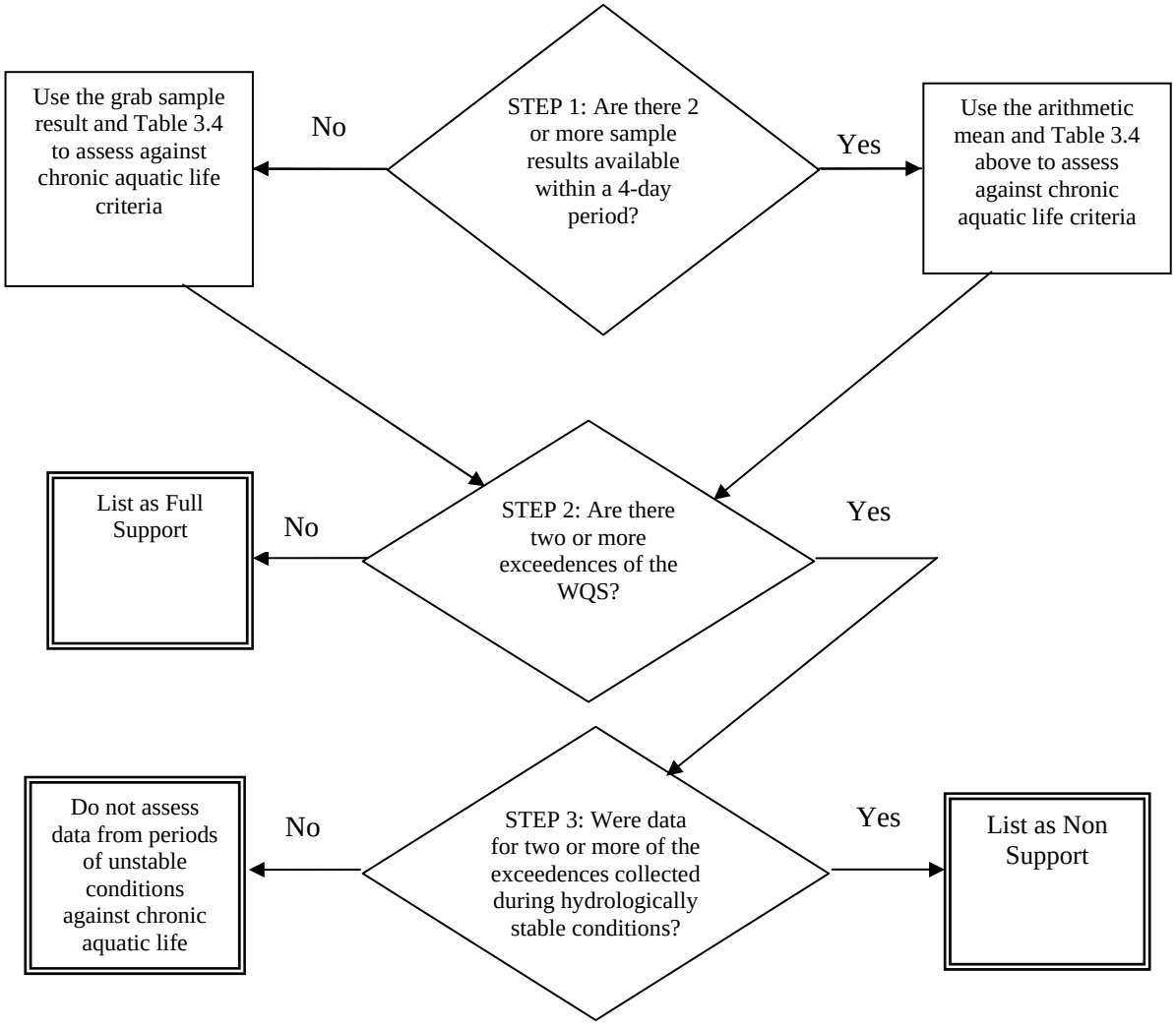

Figure 3.1 *(*from Main AP*).* Decision process for assessing against chronic aquatic life criteria

Revised 8 March 2011 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Individual Chemical/ Physical Data (*except chronic AL use*) or E.coli Assessment Form

Study Year/Study Name: _____

1. Name of assessment unit (AU) in the SWQB WQ database or 303d/305b list: _____
2. Station Name(s): _____
3. Segment number from NM WQ standards: _____
4. Parameter*: _____
5. Designated use(s) and associated criteria: _____
6. Evaluation of data, expressed as the number of exceedences/number of samples:

Data Source	Spring (Mar – May)	Summer (Jun - Aug)	Fall (Sept - Nov)	Winter (Dec - Feb)	Exceedence Ratio (# exceedences/#samples)
SWQB Station: _____	_____	_____	_____	_____	_____
SWQB Station: _____	_____	_____	_____	_____	_____
Outside data source: _____	_____	_____	_____	_____	_____
Outside data source: _____	_____	_____	_____	_____	_____
AU Totals	_____	_____	_____	_____	_____

9. Are there multiple stations in the AU?
   - ☐ No – complete number 8
   - ☐ Yes - are the use support designations for individual stations in agreement?
     - ☐ Yes – complete number 8
     - ☐ No – examine AU breaks and reassess, or provide comments below

10. What is the use support designation according to the SWQB Assessment Protocol:
    - ☐ **Full support**
    - ☐ **Not supported**
    - ☐ **Not Assessed (n = 1**)**

Additional comments about the assessment***:

_____

--**Attach data used to make impairment determination.** Any data qualifier codes from either the lab or SWQB must be included.

* If parameter is Adjusted Gross Alpha, include documentation regarding how the data were adjusted.

** Assessment of Domestic Water Supply is possible with n=1.

*** Note especially any single exceedence of a criterion

Revised 8 March 2011 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Ambient Toxicity Monitoring Assessment Form

Study Year/Study Name: _____

1. Name of assessment unit (stream reach) in the SWQB WQ database or 303d/305b list: _____
2. List all ambient water toxicity monitoring test with significant differences compared to control:

Station(s) used in assessment	Date of test	Acute or chronic[a] test?	Number of tests with significant difference
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

2. Are there multiple stations in the AU?

☐ No – complete number 3

☐ Yes - are the use support designations for individual stations in agreement?

☐ Yes – complete number 3

☐ No – examine AU breaks and reassess, or provide comments below

3. What is the use support designation according to the SWQB Assessment Protocol:

☐ **Full support**

☐ **Not supported**

Additional comments about the assessment:

_____

[a]Chronic test durations are 7 days, while acute tests are 4 days according to USEPA Region 6.
-- Attached printout of data related to this from http://www.epa.gov/earth1r6/6wq/ecopro/watershd/monitrng/toxnet/nm.pdf

Revised 19 June 2009 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Temperature Data Logger (Thermograph) Assessment Form

Year/Watershed:

Assessment Unit:

Station name: **Station ID:**

Lat: N **Lon:** W

Thermograph file name:

WQS segment: 20.6.4. **Aquatic Life use:**

First data point: Date/Time

Last data point: Date/Time

Recording interval: 1 hr. **Data points:** n =

Criterion: **°C** **Segment specific?** ☐ no ☐ yes

Maximum recorded: °C **Exceedences of criterion:** n =

High Quality Cold: Any excursion > 23°C or above segment specific criterion? ☐ no ☐ yes

Cold: Any excursion > 24°C or above segment specific criterion? ☐ no ☐ yes

Marginal Cold or Cool: Any excursion > 29°C or above segment specific criterion? ☐ no ☐ yes

Warm or Marginal Warm: Any excursion above criterion? ☐ no ☐ yes

High Quality Cold: 20.0°C exceeded ≥ 4 consecutive hours for > 3 consecutive days? ☐ no ☐ yes

Cold: 20.0°C exceeded ≥ 6 consecutive hours for > 3 consecutive days? ☐ no ☐ yes

Marginal Cold: 25.0°C exceeded ≥ 6 consecutive hours for > 3 consecutive days? ☐ no ☐ yes

Use support designation: ☐ **Supporting** ☐ **Non-supporting** ☐ **Inconclusive (see comments)**

Comments:

Revised 07 Dec 2010 (GS)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

pH and Dissolved Oxygen Sonde Data Assessment Form

Year/Watershed: _____

Assessment Unit: _____

Station name: _____

Station ID: _____

Lat: N _____ **Lon:** W _____ **Elevation:** ____ m

WQS segment: 20.6.4. ___ **Designated use:** _____

Sonde data file name: _____

First data point: Date/Time

Last data point: Date/Time

Recording interval: 1 hr. **Data points:** n = _____ **Sampling duration:** _____ hrs

---

pH Assessment

Criterion range: ☐ 6.6 – 8.8 ☐ 6.6 – 9.0 ☐ Other (specify)

Minimum recorded: _____ **Maximum recorded:** _____

Number of data points outside criterion: ___ **% data points outside criterion:** ____

Maximum contiguous duration outside criterion: ___ hours

Use support designation: ☐ **Supporting** ☐ **Non-supporting** ☐ **Inconclusive (see comments)**

Dissolved Oxygen Assessment

Applicable value: ☐ coldwater 6.0 mg/L; 90%

☐ coolwater/warmwater 5.0 mg/L; 90%

Concurrent minimum: _____ mg/L; _____ % saturation Exceedences: n = ___ ; ____ %

Percent saturation instantaneous minimum: _____*

Combined values exceeded for ≥ 4 hours contiguously? ☐ no ☐ yes

Minimum % saturation exceeded for ≥ 4 hours contiguously? ☐ no ☐ yes*

Use support designation: ☐ **Supporting** ☐ **Non-supporting** ☐ **Inconclusive (see comments)**

Information pertinent to nutrient assessment:

Below DO concentration minimum? ☐ no ☐ yes If yes, maximum contiguous duration: ___ hours

> 120% saturation? ☐ no ☐ yes If yes, maximum contiguous duration: ___ hours

< 75% saturation? ☐ no ☐ yes* If yes, maximum contiguous duration: ___ hours

Comments: *Add AU Comment to note AU of concern.

Revised 15 March 2011 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Benthic Macroinvertebrate Assessment Form

Study Name / Year:
Assessment Unit:
Site Location:
Site ID:
Level IV Ecoregion:

If ecoregion 21 or 23, determine M-SCI:

M-SCI Bio Score at Station: __

If not ecoregion 21 or 23, determine Rapid Bioassessment Protocol (RBP) Score as a % of Reference:

Reference Site ID/ Location: _____

Reference Site →	Watershed Area: _____	Elevation: _____	Ecoregion: __	RBP Bio Score:__
Study Site →	Watershed Area: _____	Elevation: _____	Ecoregion: __	RBP Bio Score:__

RBP Bio Score as a % of Ref: __

Notes on reference sites or changes to approach based on proximity to ecoregion boundary: _____
What is the use support designation according to the SWQB Assessment Protocol:

Impaired (Non Support) RBP Score < 79% of ref [1] M-SCI < 56.7 [2]	**Non-impaired (Full Support)** RBP Score > 84% of ref [1] M-SCI > 56.7 [2]
☐ Non-Support (IR Category 5C)[3]	☐ Full Support

[1] RBP Index score based on Plafkin et al. (1989). The 5% gap allows for some best professional judgment.

[2] M-SCI and Score based on Jacobi et al. (2006).

[3] The specific reason for the biological impairment is unknown, so label as Category 5C on the Integrated §303(d)/305(b) list to indicate that further study is needed.

Comments : _____

*Attach benthic macroinvertebrate metric report from NMEDAS.

25 April 2011 LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Sedimentation/Siltation Assessment Form

Study Name / Year:
Assessment Unit:
Site Location:
Site ID:
Level IV Ecoregion:

STEP 1: Determine site class based on Level IV ecoregion (note reasons for any deviations):

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, 24, 25, 26, and 22, **except** 22a, 22b, 22f

STEP 2: Determine % Sand & Fines (≤2.0 mm in diameter) from Level One sedimentation survey: %

STEP 3: Does the % Sand & Fines (%SaFN) exceed the site class threshold?

Site Class	Level One: % Sand & Fines Threshold
Mountain	< 20% Sand & Fines
Foothill	< 37% Sand & Fines
Xeric	< 74% Sand & Fines

☐ No – Assessment complete. List as **Full Support.**

☐ Yes – Go on to STEP 4.

STEP 4: Determine LRBS_NOR value from Level Two sedimentation survey: units

STEP 5: Is the LRBS_NOR value less than the site class threshold?

Site Class	Level Two: LRBS_NOR Threshold
Mountain	> -1.1
Foothill	> -1.3
Xeric	> -2.5

☐ No – Assessment complete. List as **Full Support.**

☐ Yes – Assessment complete. List as **Non Support.**

Comments:_____

**Attach custom habitat report from SWQB database*

Revised 6 May 2011 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Level I Nutrient Assessment Form

Assessment Unit:
Site Location:
Ecoregion:
Designated Aquatic Life Use:

A stream is Fully Supporting with respect to New Mexico's narrative nutrient standard if none or one of the indicators are present. If **two or more** of the indicators are present and indicated as causes of concern, a Level II Nutrient Survey and Assessment should be conducted.

Check all indicators that were present during the Level I Surveys in one or more seasons.

CAUSAL VARIABLES

☐ **Total Nitrogen (TN)** and/or **Total Phosphorus (TP)** are causes of concern
- o (☐) one or more TN grab samples exceed appropriate threshold value (**Table 1**).
- o (☐) one or more TP grab samples exceed appropriate threshold value (**Table 1**).

Table 1. Nutrient threshold values based on ecoregion and aquatic life use (in mg/L)

	Ecoregion 21-Southern Rockies		20/22-AZ/NM Plateau		23-AZ/NM Mountains		24/79-Chihuahuan Desert	26-Southwestern Tablelands		
ALU →	CW	T/WW (volcanic)	CW	T/WW	CW	T/WW	T/WW	CW	T	WW
TN	0.25	0.25	0.28	0.48	0.25	0.29	0.53	0.25	0.38	0.45
TP	0.02	0.02 (0.05)	0.04	0.09	0.02	0.05	0.04	0.02	0.03	0.03

RESPONSE VARIABLES

☐ **Dissolved oxygen saturation** is a cause of concern
- o (☐) one or more D.O. percent saturation (local) measurements are greater than 120%

☐ **pH** values are a cause of concern
- o (☐) one or more pH measurements are greater than the appropriate aquatic life criterion
  - pH greater than 8.8 for High Quality Cold and Coldwater
  - pH greater than 9.0 for Marginal Cold, Cool, Warm, and Marginal Warmwater

☐ **Algae** coverage is a cause of concern
- o (☐) Percent algal cover is greater than 50% during any season

☐ **Periphyton** growth is a cause of concern
- o (☐) Periphyton on coarse substrate has a rating of >2 (>1 mm thick) during any season

☐ **Anoxia** is a cause of concern
- o (☐) Anoxic layer ("rotten egg" smell and black color) was present under rocks and/or in depositional areas.

Level I Assessment (Check One):

☐ **Fully Supporting**
☐ Two or more indicators present – **Level II Survey and Assessment required**
☐ Insufficient Data (add NOTES below)

NOTES:

**Attach nutrient report from SWQB database*

Revised 12 January 2011 (sjj)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Level II Nutrient Assessment Form

Assessment Unit:
Site Location:
Ecoregion:
Designated Aquatic Life Use:

D.O. and pH: Use the sonde procedures in the *pH Assessment Protocol* and the *Dissolved Oxygen Assessment Protocol* to assess pH and D.O. if a minimum of three days (72 hours) of hourly sonde data are available. Also use grab sample data to calculate exceedence ratios for pH, local D.O. percent saturation, and D.O. concentration.

Large Data Sets (Sonde Data)	**Grab Samples**
Assessment of dissolved oxygen data:	D.O. % saturation exceedence ratio: _____
☐ Fully Supporting ☐ Not supporting	Applicable D.O. criterion (20.6.4.900 NMAC): _____
Assessment of pH data:	D.O. minimum exceedence ratio: _____
☐ Fully Supporting ☐ Not supporting	Applicable pH criterion (20.6.4.900 NMAC): _____
DO fluctuations > 3mg/L: ☐ Yes ☐ No	pH **(**maximum) exceedence ratio: _____
Notes: _____	

Nutrient Concentrations: attach updated nutrient report from SWQB database and calculate the exceedence ratios.

Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
Ecoregion/ALU Threshold (**Table 1**): _____	Ecoregion/ALU Threshold (**Table 1**): _____
Exceedence Ratio: _____	Exceedence Ratio: _____
Notes: _____	

Table 1. Nutrient thresholds based on ecoregion and aquatic life use (in mg/L)

	Ecoregion 21-Southern Rockies		**20/22-AZ/NM Plateau**		**23-AZ/NM Mountains**		**24/79-Chihuahuan Desert**	**25/26-Southwestern Tablelands**		
ALU →	CW	T/WW (volcanic*)	CW	T/WW	CW	T/WW	T/WW	CW	T	WW
TN	0.25	0.25	0.28	0.48	0.25	0.29	0.53	0.25	0.38	0.45
TP	0.02	0.02 (0.05*)	0.04	0.09	0.02	0.05	0.04	0.02	0.03	0.03

* The volcanic threshold is applicable to Level IV ecoregions 21g and 21h as well as 21j in the Jemez Mountains

Algal Sampling:

Ecoregion chlorophyll *a* threshold range in μg/cm^2 (**Table 2**): _____
Chlorophyll *a* (μg/cm^2): _____
Notes: _____

Table 2. Chlorophyll *a* threshold range based on ecoregion (in μg/cm^2)

21-Southern Rockies	**20/22-AZ/NM Plateau**	**23-AZ/NM Mountains**	**24/79-Chihuahuan Desert**	**25/26-SW Tablelands**
3.9 – 5.5	7.4 – 7.8	5.8 – 11.0	16.5 – 17.5	8.2 – 14.0

Note: The 90th to 99th percentile range is used for evaluation. If the chlorophyll-*a* concentration falls within the range of values in Table 2 and this parameter is a decisive factor in the impairment conclusion, the AU will be listed under "5C – Additional information needed before scheduling TMDL development." A second Level II nutrient survey will be performed to confirm the determination. If chlorophyll-*a* concentration again falls within the range, the AU will be moved to category "5A – Schedule TMDL development" to be conservative.

Sonde data are recommended to complete a Level II assessment. An assessment unit (AU) is **Fully Supporting** with respect to New Mexico's narrative nutrient standard if (1) one or none of the following indicators exceed their threshold value, or (2) both total nitrogen and total phosphorus exceed their threshold values, but there was no indication of a biological response to elevated nutrients (i.e., the response variables did not exceed their threshold values). An AU is **Not Supporting** if *at least* one causal variable and one response variable exceed their thresholds. **Check all indicators that exceeded their respective threshold values.**

CAUSAL VARIABLES:

☐ **Total Nitrogen** concentrations exceed threshold value in ≥10% of measurements, or 2 or more measurements exceed threshold value if 10 or fewer data points are available.

☐ **Total Phosphorus** concentrations exceed threshold value in ≥10% of measurements, or 2 or more measurements exceed threshold value if 10 or fewer data points are available.

RESPONSE VARIABLES:

☐ **Dissolved Oxygen** threshold is exceeded
- (☐) determined to be **not supporting** using the sonde procedures in the *Dissolved Oxygen Assessment Protocol.*
- (☐) ≥25% of grab samples exceed the D.O. percent saturation (local) threshold value of 120%.
- (☐) grab samples exceed applicable D.O aquatic life use criterion in 20.6.4.900 NMAC in ≥10% of measurements, or 2 or more measurements exceed applicable criterion if 10 or fewer data points are available.

☐ **pH** threshold is exceeded
- (☐) determined to be **not supporting** using the sonde procedures in the *pH Assessment Protocol.*
- (☐) grab samples exceed applicable pH aquatic life use criterion in 20.6.4.900 NMAC in ≥10% of measurements, or 2 or more measurements exceed applicable criterion if 10 or fewer data points are available.

☐ **Chlorophyll *a*** ($\mu g/cm^2$) threshold is exceeded.
- (☐) Chlorophyll-*a* concentration is greater than the upper limit of the applicable threshold range (**Category 5A**).
- (☐) Chlorophyll-*a* concentration falls within the applicable threshold range (**Category 5C**. If second Level II survey in 5-year period still falls in the range, move to Category 5A to be conservative).

Assessment conclusion:

☐ Fully supporting
☐ Not supporting
- (☐) Category 5A – Schedule TMDL development
- (☐) Category 5C – Additional information needed before scheduling TMDL development (see also Table 2 notes)

☐ Not Assessed (Insufficient Data to make assessment conclusion -- add COMMENTS)

COMMENTS: _____

**Attach nutrient report from SWQB database*

Revised 31 May 2011 (SL/LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Level II Nutrient Assessment Form (using Reference Site Approach)

Assessment Unit:
Site Location(s):
Reference Site:
Ecoregion:
Desiganted Aquatic Life Use:

If the study reach is believed to have naturally high productivity because of geology, flow regime, or other natural factors, a reference site approach may be used. An Assessment Unit will be determined to be **not supporting** if **two or more** of the following indicators of the study site are notably different from those of the reference site. If the number of samples from each site is sufficient (n is > 4), then the rank-sum test (a.k.a. Wilcox or Mann-Whitney test) will be used to test if there is a high (>75%) probability that the study site is different than the reference site. If the number of measurements is ≤ 4, then best professional judgment utilizing the general guidelines in the table from the "NOTES" section below will be used to determine if the parameters are different at the sites.

Indicator	Reference Site	Study Site
D.O. saturation exceedence ratio*	_____	_____
pH exceedence ratio*	_____	_____
DO concentration exceedence ratio*	_____	_____
Total nitrogen exceedence ratio	_____	_____
Total phosphorus exceedence ratio	_____	_____
Chlorophyll *a* concentration	_____	_____
Algal Bioassay algal production	_____	_____

* the exceedence ratio for large data sets refers to the number of days with exceedences divided by the number of full days that the sonde was deployed, not the number of data points. Use grab sample data if multiple day sonde data are not available for both sites.

Check One:	☐ **Fully supporting**	☐ **Not supporting**
Notes:_____		

NOTES: Put NA (not available) in boxes for parameters that were not collected. Complete and attach a Level II Nutrient (Office) Assessment Worksheet for the reference site as well as the study site.

The table below provides general guidelines of what constitutes a "difference" between the reference and study site for parameters with < 5 measurements.

Indicator	Reference Site	Study Site
D.O. saturation exceedence ratio	_____	> 1 exceedence more than reference
pH exceedence ratio	_____	> 1 exceedence more than reference
DO concentration exceedence ratio	_____	> 1 exceedence more than reference
Total nitrogen exceedence ratio*	_____	> 1 exceedence more than reference*
Total phosphorus exceedence ratio*	_____	> 1 exceedence more than reference*
Chlorophyll *a* concentration	_____	≥20% difference
Algal Bioassay algal production	_____	≥ 1 classification higher than reference

* Also consider how much greater the concentrations are at the study site and how close the concentrations of TP, TKN, and Nitrate-Nitrite are to the detection limit (d.l.). If one or both of concentrations are < 2 times d.l., then a value of 4 times the reference site concentration would be considered "different". If the concentrations are > 2 times the d.l. then a value 2 times the reference concentration would be considered "different".

Comments:_____

Revised 10 January 2011 (LG)

Page of Assessor: _____ Date of Assessment: _____

Date of Assessment Protocol used: _____ Date of WQS used: _____ Verified by/on: _____

Turbidity Assessment Form

Study Year/Study Name: _____
Name of assessment unit (AU) in the SWQB WQ database or 303d/305b list: _____
Station Name/ID: _____
Segment number from NM WQ standards: _____
Aquatic life use: ☐ coldwater -- _____ ☐ coolwater ☐ warmwater ***(=NOT ASSESSED***)

STEP 1: For a give site, are there ≥ 72 hours (three days) of sonde data available?
☐ No – Skip to **STEP 2**.
☐ Yes – Does the maximum value for the entire dataset exceed the corresponding turbidity impairment threshold for the corresponding number of days of available data in Table 1? (if partial days available, round up)

Table 1. Turbidity impairment thresholds and durations

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

☐ No – List as **Full Support** **MAX VALUE (NTU):** _____ n(entire data set): _____hours
☐ Yes – Scan sonde data to record all periods of elevated turbidity (i.e., turbidity values greater than the threshold determined in the above step), the range of values in these periods, and the corresponding allowable duration using Equation 1.

Interval start and end date / time for period of elevated turbidity	Number of hours in the period (rounded up)	Range of elevated turbidity values in period (NTUs)	Minimum value (NTU) in range rounded down to nearest integer (y)	Allowable duration in hours (x) determine using Equation 1	**Does the number of hours in the period exceed the allowable duration?**

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

$$x = 37382y^{-1.9887}$$

where x = duration in hours and y = NTUs.

Does the number of hours in any period of elevated turbidity exceed the corresponding calculated allowable during in the above table?

☐ No – List as **Full Support**
☐ Yes – List as **Non Support**

STEP 2: ***This step is only necessary if < 72 hours (three days) of sonde data***

Are there ≥ 4 grab data taken ≥ 21 days apart that are all < 7 NTU?

☐ No – List as **Not Assessed***
☐ Yes – List as **Full Support**

What is the use support designation according to the SWQB Assessment Protocol and the above procedure:

☐ **Full Support**

☐ **Non Support**

☐ **Not Assessed ***

* If any available sonde or grab data exceeds any impairment threshold(s), note below in "Comment" section so site can be prioritized for future minimum three day (72 hour) sonde deployment.

Comments:

--**Attach data used to make impairment determination.**

19 April 2011 (LG)

Attachment H-2: Assessor's Worksheet

Assessor's Worksheet

Study Name: _____ **Year:_____**

Assessor:_____ **Date of assessment completion: _____**

Specific data type covered by this worksheet (mark all that apply):

☐ **Chem/Physical** ☐ **Ambient Tox** ☐ **Bio/Hab** ☐ **Large Data Set** ☐ **Nutrient** ☐ **Turbidity**

Step 1: Data collation and verification/validation

Were all applicable data verification and validation steps completed for the SWQB data identified above in accordance with the procedures described in the most recent SWQB QAPP?

☐ Yes Date of QAPP used: _____ Date V/V completed (see NMEDAS Comment field): _____
☐ No **STOP** -- DATA VERIFICATION AND VALIDATION MUST BE COMPLETED PRIOR TO ASSESSMENT.
☐ N/A Why? _____

Were all readily-available data, quality data identified and collated prior to assessment of data (example – USGS data)?

☐ Yes

Were these outside data checked for quality? All data submissions from outside sources must be reviewed by the SWQB QA Officer to ensure the suitability of the QA/QC procedures under which the data were collected. Specifically, submitted documentation associated with the dataset must be reviewed to determine: (1) if there is documentation of QA/QC procedures that, at a minimum, meet the QA/QC requirements described in the SWQB's most recent QAPP; and (2) if there is reasonable evidence or assurance that these procedures were followed.

☐ Yes
☐ No **STOP** -- DATA VERIFICATION AND VALIDATION MUST BE COMPLETED PRIOR TO ASSESSMENT.

☐ No **STOP** -- READILY-AVAILABLE QUALITY DATA MUST BE COLLATED PRIOR TO ASSESSMENT.

Step 2: Completion of assessment per data type

Are all data identified above assessed according to applicable instructions in most recent Assessment Protocol as assessed against the most recent WQS for each Assessment Unit in the study?

☐ Yes Date of Assessment Protocol(s) used: _____ Date of WQS used: _____
☐ No Explain why (data not available for all AUs, etc.): _____

Are applicable forms completely filled out?

☐ Yes ☐ No If not, explain why: _____

Are required data detailed at bottom of assessment forms attached and/or provided electronically?

☐ Yes ☐ No If not, explain why: _____

Step 3: Completeness of forms (fill out relevant subsection for data type(s) circled in intro)

A. Chemical/Physical Data –

Did you fill out the Summary Chemical/Physical Assessment Form for each AU for which there are available data?

☐ Yes ☐ No

Did you fill out separate Individual Chemical/Physical (chronic AL use) Assessment Forms for any parameter with 2 or more exceedences of the applicable chronic AL criterion?
☐ Yes ☐ No ☐N/A -- Chronic AL do not apply because Limited AL is the designated use

Did you fill out separate Individual Chemical/Physical (non-chronic AL use) Assessment Forms for data regarding any existing WQ impairment listing from the most recent Integrated Clean Water Act §303d/§305b list?
☐ Yes ☐ No ☐N/A (no previous impairment listings)

Did you fill out separate Individual Chemical/Physical Assessment Forms for any new WQ impairment determinations?
☐ Yes No ☐N/A (no new impairment listings)

B. Biological/Habitat Data–
Did you fill out the Sedimentation/Siltation Assessment Form for each perennial, wadeable stream AU for which there are available data?
☐ Yes ☐ No

Did you fill out the Benthic Macroinvertebrate Assessment Form for each perennial, wadeable stream AU for which there are available data?
☐ Yes ☐ No

C. Large Data Sets (Thermograph and Sonde)–
Did you fill out the Temperature Data Logger (Thermograph) Assessment Form for each AU for which there are available data?
☐ Yes ☐ No

Did you fill out the pH and Dissolved Oxygen Sonde Data Assessment Form for each AU for which there are available data?
☐ Yes ☐ No

D. Nutrient Assessment Set Data --
Did you fill out Level I Nutrient Assessment Forms for each AU perennial, wadeable stream AU for which there are available data?
☐ Yes ☐ No

Did you fill out the applicable Level II Nutrient Assessment Worksheet for each AU for which there are available data?
☐ Yes ☐ No

E. Turbidity Data–
Did you fill out the Sedimentation/Siltation Assessment Form for each coolwater or coldwater perennial stream or river AU for which there are available data?
☐ Yes ☐ No

- -

COMPLETION OF ASSESSMENT PROCESS

After the above steps have been completed, save and print the worksheet, attach all assessments and applicable supplemental information, sign below, and give the electronic Administrative Record (via your public directory) and worksheet to the Assessment Coordinator.

I acknowledge that the assessment process for the above data type has been completed in accordance with the most recent EPA-approved WQ standards (20.6.4 NMAC) and the most recent Assessment Protocols.

_____ _____
Assessor's Signature Date

Attachment H-3: Assessment Verification Worksheet

Assessment Verification Worksheet

Study Name: _____ **Year:_____**

Assessor:_____ **Date of assessment completion: _____**

Assessment verifier:_____ **Date of assessment verification:_____**

Specific data type covered by this worksheet (check all that apply):

☐ **Chem/Physical** ☐ **Ambient Tox** ☐ **Bio/Hab** ☐ **Large Data Set** ☐ **Nutrient** ☐ **Turbidity**

NOTE: During verification of assessments, it is assumed that all relevant data have been compiled and that the data validation process or any other QA procedures were correctly performed.

Step 1: Verify most recent WQS and Assessment Protocols were utilized

Were the most recent EPA-approved applicable WQS used for these assessments?
☐ Yes ☐ No Date of WQS used: _____

Were the most recent SWQB Assessment Protocols used for these assessments?
☐ Yes ☐ No Date of Assessment Protocol(s) used: _____

If no to either of these, data assessments must be re-done if the changes to either the applicable WQS or Assessment Protocols would result in different impairment conclusions based on application of the same data. Discuss with Assessor and Assessment Coordinator.

Step 2: Verify correct application of assessment protocols

Are all data identified above correctly assessed according to instructions in most recent Assessment Protocol?
☐ Yes ☐ No

If not, were appropriate corrections made on the applicable Assessment Form?
☐ Yes ☐ No

Were these corrections discussed with the original data assessor?
☐ Yes ☐ No

Step 3: Verify completeness of forms

Are applicable forms completely filled out?
☐ Yes ☐ No If not, discuss deficiencies with original data assessor.

Are required data detailed at bottom of assessment forms attached and/or provided electronically?
☐ Yes ☐ No If not, acquire from original data assessor.

A. Chemical/Physical Data –

Are there separate Summary Chemical/Physical Assessment Forms for <u>each</u> AU for which there are available data?
☐ Yes ☐ No

Are there separate Individual Chemical/Physical (chronic AL use) Assessment Forms for any parameter with 2 or more exceedences of the applicable chronic AL criterion?
☐ Yes ☐ No ☐ N/A -- Chronic AL do not apply because Limited AL is the designated use

Are there separate Individual Chemical/Physical (non-chronic AL use) Assessment Forms for data regarding any <u>existing</u> WQ impairment listing from the most recent Integrated Clean Water Act §303d/§305b list?
☐ Yes ☐ No ☐ N/A (no existing impairment listings)

Are there separate Individual Chemical/Physical Assessment Forms assessment forms for any new WQ impairment listings?
☐ Yes ☐ No ☐ N/A (no new impairment listings)

B. Biological/Habitat Data–
Are there separate Sedimentation/Siltation Assessment Forms for each perennial, wadeable stream AU where there are available data? ☐ Yes ☐ No

Are there separate Benthic Macroinvertebrate Assessment Form for each perennial, wadeable stream AU for which there are available data?
☐ Yes ☐ No

Was the M-SCI only used for sites in ecoregions 21 or 23? ☐ Yes ☐ No If not, discuss with benthic macroinvertebrate subject matter expert.

When using the RBPs, are site characteristics (such as watershed area, elevation, and ecoregion) comparable between reference and study site? ☐ Yes ☐ No If not, discuss with benthic macroinvertebrate subject matter expert.

C. Large Data Sets (Thermograph and Sonde)–
Are there separate Temperature Data Logger (Thermograph) Assessment Forms for each AU for which there are available data?
☐ Yes ☐ No

Are there separate pH and Dissolved Oxygen Sonde Data Assessment Forms for each AU for which there are available data?
☐ Yes ☐ No

D. Nutrient Assessment Set Data --
Are there separate Level I Nutrient Assessment Forms for each perennial, wadeable stream AU for which there are available data?
☐ Yes ☐ No

Are there separate applicable Level II Nutrient Assessment Worksheet for each AU for which there are available data?
☐ Yes ☐ No

E. Turbidity Data–
Are there separate Turbidity Assessment Form for each coolwater or coldwater perennial stream or river AU for which there are available data?
☐ Yes ☐ No

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COMPLETION OF ASSESSMENT VERIFICATION PROCESS

After the above steps have been completed, save and print the worksheet, attach all assessments and applicable supplemental information, sign below, and give the electronic Administrative Record (via your public directory) and worksheet to the Assessment Coordinator.

I acknowledge that the assessment verification process for the above data type has been completed.

_____ _____
Assessment Verification Signature Date