Draft 2018/2020 303(d) Assessment Methods

UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
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Abbreviations

Abbreviation	Definition
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
AGRC	Automated Geographic Reference Center
ATTAINS	The Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System. This EPA maintained database is an online system for accessing information about the conditions of the Nation's surface waters.
AU	assessment unit
Ca	calcium
CFR	Code of Federal Regulations
Chl-a	chlorophyll *a*
CWA	Clean Water Act
DEQ	Utah Department of Environmental Quality
DO	dissolved oxygen
DWQ	Utah Division of Water Quality
E	expected
E. coli	Escherichia coli
EPA	U.S. Environmental Protection Agency
GIS	geographic information systems
GSL	Great Salt Lake

Abbreviation	Definition
GRAMA	Government Records Access and Management Act
HAB(s)	harmful algal bloom(s)
HH	human health
HUC	hydrologic unit
IR	integrated report
kg	kilogram
L	liter
Mg	magnesium
mg	milligram
mg/kg	milligram per kilogram
mg/l	milligram per liter
ml	milliliter
MLID	monitoring location identifier
MPN	most probable number
NHD	National Hydrologic Dataset
O	observed
O/E	observed/expected
Pc	probability of capturing
ppm	parts per million
QA	quality assurance
QA/QC	quality assurance/quality control

Abbreviation	Definition
QC	quality control
QAPP	quality assurance project plan
RIVPACS	River Invertebrate Prediction and Classification System
SAP(s)	sample analysis plan(s)
SD	standard deviation
SDD	secchi disk depth
SOP(s)	standard operating procedure(s)
T	temperature
TDS	total dissolved solids
TMDL	total maximum daily load
TP	total phosphorus
TSI	trophic state index
UAC	Utah Administrative Code
UDOH	Utah Department of Health
USGS	U.S. Geological Survey
WMU	watershed management unit
WQP	(EPA's) Water Quality Portal
WQS	water quality standard
µg/l	microgram per liter

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Introduction

THE CLEAN WATER ACT AND THE INTEGRATED REPORT

The rules and regulations of the federal Clean Water Act (CWA) require the Utah Division of Water Quality (DWQ) to report the condition or health of all Utah surface waters to the U.S. Congress every other year. The Integrated Report (IR) contains two key reporting elements defined by the CWA:

- **Statewide reporting under CWA Section 305(b):** Section 305(b) reporting summarizes the overall condition of Utah's surface waters and estimates the relative importance of key water quality concerns. These concerns can include pollutants, habitat alteration, and sources of water quality problems.
- **Water quality assessments under CWA Section 303(d):** Section 303(d) requires states to identify waters that are not attaining beneficial uses according to state water quality standards (Utah Administrative Code [UAC] R317.2.7.1). The Utah Section 303(d) List (hereafter the 303(d) List) also prioritizes the total maximum daily loads (TMDL) required for each listed waterbody and the cause of nonattainment. This list includes waters impaired as a result of nonpoint sources, point source discharges, natural sources, or a combination of sources.

In addition to Utah's 303(d) List, DWQ also identifies waterbodies that:

- have water quality problems but DWQ cannot confirm due to uncertainty regarding the nature of the data, insufficient sample size, or other factors,
- are either currently addressed by DWQ through a TMDL or other pollution-control mechanism, or
- are attaining water quality standards.

Full descriptions of these and other U.S. Environmental Protection Agency (EPA) identified waterbody assessment classifications are described and summarized in Table 1.

ASSESSMENT CATEGORIES FOR SURFACE WATERS

DWQ uses five categories defined by EPA to assess surface waters of the state (EPA, 2005). These categories are described in Table 1.

Table 1. U.S. Environmental Protection Agency categorization of assessed surface waterbodies for integrated report purposes.

EPA Assessment Category	Assessment Category Description
1	**Supporting**. All beneficial uses assigned to a waterbody are evaluated against one or more numeric criteria and each use is found to be fully attaining applicable water quality standards.
2	**No Evidence of Impairment**. Some, but not all, beneficial uses assigned to a waterbody are evaluated against one or more numeric criteria and each assessed use is found to be fully attaining applicable water quality standards.
3	Insufficient Data and/or Information. There are insufficient data and information to conclude support or nonsupport of a use. The application of this category may be applied when: (1) the dataset is smaller in size and has water quality criteria exceedances OR no water quality criteria exceedances, (2) a secondary review was applied to a waterbody that was not attaining, (3) water quality criteria and/or beneficial use support assessment methods are not yet developed (or are undergoing development or revisions) and therefore use attainment has not been determined, (4) waterbodies were assessed against water quality parameters and characteristics that require further investigations as defined in UAC R317-2, (5) assessment units (AUs) lack use designations, have improper use designations, or contain other inconsistencies in the dataset. In cases where no recent data are available, historic-listing determinations will be maintained.
4A	**TMDL-Approved**. Waterbodies that are impaired by a pollutant and have had TMDL(s) developed and approved by EPA. Where more than one pollutant is associated with the impairment of a waterbody, the waterbody and the parameters that have an approved TMDL are listed in this category. If a waterbody has other pollutants that need a TMDL, the waterbody is still listed in Category 5 with an Approved TMDL.
4B	**Pollution Control**. Consistent with 40 Code of Federal Regulations (CFR) 130.7(b) (I) (ii) and (iii), waterbodies that are not supporting designated uses are listed in this subcategory where other pollution-control requirements, such as best management practices required by local, state, or federal authority, are stringent enough to bring the waters listed in this category back into attainment in the near future with the approved pollution-control requirements in place. All waterbodies placed in this category must have a pollution control requirement plan developed and approved by EPA. Similar to Category 4A, if the waterbody has other pollutants that need a TMDL, or there is already a TMDL in place for another pollutant, the waterbody may also be listed in Categories 5 and 4A. Therefore, an AU with a pollution control in place can be listed in Categories 4B, 4A, and 5.
4C	**Non-Pollutant Impairment**. Waterbodies that are not supporting designated uses are placed in this category if the impairment is not caused by a pollutant but rather by pollution such as hydrologic modification or habitat degradation. Similar to Categories 4A and 4B, if the waterbody has other pollutants that need a TMDL, or there is an approved TMDL or pollution-control mechanism in place, the waterbody may also be listed in Categories 4A, 4B, and 5. Therefore, an AU with a pollution control in place can be listed in Categories 4C, 4B, 4A, and 5.

EPA Assessment Category	Assessment Category Description
5	**Not Supporting**. The concentration of a pollutant, or several pollutants, exceeds numeric water quality criteria, or beneficial uses are non-attaining based on violation of the narrative water quality standards. In addition, waterbodies identified as "threatened" may also be placed in this category. In the case of a "threatened" waterbody, one or more of its uses are likely to become impaired by the next IR cycle. Water quality may be exhibiting a deteriorating trend if pollution control actions are not taken. In the event that DWQ categorizes a waterbody as "threatened", documentation of a listing rationale will be provided. Both impaired and threatened waterbodies constitute Utah's formal Section 303(d) List and are prioritized for future TMDL development.
5-Alt	**TMDL Alternatives**. The 303(d) program vision promotes the identification of alternative approaches to TMDL development for impaired waters where these approaches would result in a more rapid attainment of water quality standards. Note: This category is only referred to in DWQ's "303(d) Vision Document".

UTAH'S NUMERIC CRITERIA AND BENEFICIAL USES

To determine the appropriate assessment categories for a waterbody (see Table 1), DWQ must first evaluate the impacts of measured pollutant concentrations on environmental and human health. Under UAC R317-2, Utah has developed and adopted water quality numeric criteria (chemical concentrations that should not be exceeded) to protect the water quality of surface waters and the uses these waterbodies support. As noted in UAC R317-2, the water quality criteria for a pollutant can vary depending on the beneficial use assigned to a waterbody.

To identify the use and value of a waterbody for public water supply, aquatic wildlife, recreation, agriculture, industrial, and navigational purposes, EPA and DWQ developed several beneficial use classifications (see UAC R317-2-6). Currently, DWQ designates five uses of surface waters within the state:

- Class 1. Protected for use as a raw water source for domestic water systems.
- Class 2. Protected for recreational use and aesthetics.
- Class 3. Protected for use by aquatic wildlife.
- Class 4. Protected for agricultural uses including irrigation of crops and stock watering.
- Class 5. The Great Salt Lake (GSL).

Subclassifications for several of these categories exist and are further defined in Table 2.

Table 2. Subclassifications of Utah's beneficial uses.

Beneficial Use Subclassification	Use Definition
1C*	Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water
2A	Protected for frequent primary contact recreation where there is a high likelihood of ingestion of water or a high degree of bodily contact with the water. Examples include, but are not limited to, swimming, rafting, kayaking, diving, and water skiing.
2B	Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.
3A*	Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
3B*	Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
3C*	Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.
3D*	Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
3E*	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.
4	Protected for agricultural uses including irrigation of crops and stock watering.
5A	Gilbert Bay Geographical Boundary -- All open waters at or below approximately 4,208-foot elevation south of the Union Pacific Causeway, excluding all of the Farmington Bay south of the Antelope Island Causeway and salt evaporation ponds. Beneficial Uses -- Protected for frequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.

Beneficial Use Subclassification	Use Definition
5B	Gunnison Bay Geographical Boundary -- All open waters at or below approximately 4,208-foot elevation north of the Union Pacific Causeway and west of the Promontory Mountains, excluding salt evaporation ponds. Beneficial Uses -- Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
5C	Bear River Bay Geographical Boundary -- All open waters at or below approximately 4,208-foot elevation north of the Union Pacific Causeway and east of the Promontory Mountains, excluding salt evaporation ponds. Beneficial Uses -- Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain
5D	Farmington Bay Geographical Boundary -- All open waters at or below approximately 4,208-foot elevation east of Antelope Island and south of the Antelope Island Causeway, excluding salt evaporation ponds. Beneficial Uses -- Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
5E	Transitional Waters along the Shoreline of the Great Salt Lake Geographical Boundary -- All waters below approximately 4,208-foot elevation to the current lake elevation of the open water of the Great Salt Lake receiving their source water from naturally occurring springs and streams, impounded wetlands, or facilities requiring a UPDES permit. The geographical areas of these transitional waters change corresponding to the fluctuation of open water elevation. Beneficial Uses -- Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
***Footnote: There are human health (HH) criteria associated with these beneficial uses in UAC R317-2. For uses with a HH criteria, (see Table 2.14.6 in UAC R317-2), the following use notation will be used in 303(d) data and assessment reports: HH1C, HH3A, HH3B, HH3C, and HH3D.**	

For 303(d) assessment purposes, every beneficial use with numeric criteria and credible and readily available data is assessed and reported. DWQ does not just assess and report on the most environmentally protective criterion and/or use for a parameter and waterbody. Where waterbodies are unclassified and do not have assigned beneficial uses in DWQ data records, DWQ may assign default beneficial uses as articulated in UAC R317-2-13.9, 13.10, 13.11, 13.12, and 13.13. Alternately, these undefined waterbodies may be classified as an EPA Category 3 or not reported in the IR if an Assessment Unit has not been established.

For more information on how DWQ develops, adopts, and updates the numeric criteria and beneficial uses in UAC R317-2, please refer to DWQ's Standards website.

PRIORITY AND ASSESSED PARAMETERS

To make the list of pollutants with numeric criteria in UAC R317-2 more manageable for monitoring and assessment purposes, DWQ developed a priority parameter list that is recommended for routine water quality monitoring. This priority list is a subset of the pollutants listed in UAC R317-2 and reflects the following constraints:

- Laboratory resources that limit the ability to assess all parameters in UAC R317-2.
- Significant monitoring and/or analytical costs associated with processing a sample or measuring a pollutant.
- Logistical constraints due to monitoring location and holding times for certain parameters.

As a result, water quality assessments may not report on all parameters listed in UAC R317-2. Instead, assessments reflect all parameters with adopted numeric criteria that also have readily available and credible datasets from the IR period of record.

To view DWQ's list of priority parameters, please refer to Appendix 1. Please be aware that priority parameters can change from one reporting cycle to the next if laboratory and financial constraints and monitoring priorities within a sampling area change.

Assessment Process and Time Frames

DEVELOPING THE METHODS

This document describes Utah's most up-to-date assessment methods that will be applied to Utah's current IR cycle. Although many of the methods described have been applied in past assessment cycles, other methods are new or modified from previous reporting cycles. Some of the assessment method revisions are simply intended to clarify ongoing DWQ practices. Other more substantive revisions may be based on comments that were raised during the previous IR's 303(d) Assessment Methods and draft IR public comment periods.

DWQ updates and revises the 303(d) methods when concerns are raised or when program developments are released by DWQ staff. Additional modifications or clarifications to the Assessment Methods may also be made based on feedback provided by EPA during and after a reporting cycle or from the EPA's cycle-specific 303(d) guidance memorandum.

Moving forward, all changes made to the 303(d) Assessment Methods will be reviewed and updated on even-numbered years in anticipation of developing the Draft IR and 303(d) List in the following odd-numbered year. This process allows DWQ to consider comments and suggestions on assessment methods before a formal analysis is conducted which reduces the need to rework analyses from changes in methods.

PUBLIC REVIEW OF THE METHODS PROCESS AND SCHEDULE

The development and acceptance of the Assessment Methods includes a public review process and occurs on the following schedule:

a. DWQ releases the proposed methods during an even numbered year, for a 30-day public comment period. The notice for public comments on the methods are advertised on DWQ's News and Announcements and Public Notices website, the Water Quality Assessments Program and Current Assessment Methods & Guidance websites, and DWQ's listserv.
b. DWQ compiles and responds to the comments received within the 30-day public comment period. DWQ's responses to comments are posted on the Current Assessment Methods & Guidance website.
c. If substantial revisions to the methods are adopted by DWQ based on comments received in the public comment period, DWQ has the discretion to hold a second public comment period of 30 days or less. Should DWQ proceed with a second public comment period, notifications will be advertised, at a minimum, on DWQ's News and Announcements and/or Public Notices website, the Water Quality Assessments Program and Current Assessment Methods & Guidance websites, and DWQ's listserv.
d. Following the conclusion of the public comment period(s), DWQ posts responses to comments on the Assessment Methods webpage. Any changes or additions that were made in response to public comments will be documented and issued with the draft IR and 303(d) List. If stakeholders have concerns with the final Assessment Methods released during the draft IR, the public should submit their comments during the next IR cycle when future calls for public comments on 303(d) assessment methodologies are issued.

Concerns and comments not received through the above processes may not be considered for current and future 303(d) methods updates and modifications.

CALL FOR READILY AVAILABLE DATA AND SCHEDULE

DWQ issues a request for all readily available data (i.e., the IR Call for Data) on November 1 of even-numbered years.

Existing and Readily Available Data Defined

As mandated in 40 CFR 130.7(b)(5)(i), (iii), and (iv), DWQ assembles and evaluates all existing and readily available data in determining whether a waterbody is supporting or not supporting the assigned beneficial uses and numeric criteria in UAC R317-2. For the purposes of the IR, existing and readily available data may include:

- Data and information referenced in 40 CFR 130.7(b)(5)(i), (iii), and (iv).
- Data collected by DWQ or DWQ cooperators for assessment purposes.
- Data collected for other DWQ programs, such as waste load allocations, TMDL development, watershed, and use attainability analysis.
- Readily available (Table 3) and credible data and information submitted to EPA's Water Quality Portal (WQP) or obtained by DWQ during the IR's public Call for Data.
- Additional sources of data included in the Data Types Matrix in Table 10.

Existing data that are not brought forward through one the above mechanisms or otherwise presented to DWQ in accordance with the schedule as outlined in this document and on the Water Quality Assessments Program website will not be treated as readily available for the purpose of assessment decisions during the current assessment cycle.

Existing data that are available and submitted to DWQ or obtained by DWQ during the IR data compilation process are subject to DWQ's data management and quality assurance and quality control (QA/QC) processes. Depending on resource limitations and level of effort required to ensure compatibility of the data with DWQ's dataset, some data may be excluded from formal assessment calculations, although such data may still be used as supporting evidence for assessment decisions.

Although DWQ's goal is full incorporation of all credible data into IR assessments, data submitted to or queried by DWQ during the IR Call for Data can exist in multiple formats and sometimes require significant manipulation by DWQ to harmonize and merge disparate datasets prior to incorporation into assessment. This is particularly true for newly developed or submitted datasets. As such, DWQ classifies external datasets into availability categories and recommends usage for 303(d) assessment purposes based on these categories (Table 3).

Should data not be included in the assessment process because of resource limitations or other limitations, DWQ will clearly document which dataset (or datasets) could not be included and why.

Table 3. DWQ's data availability matrix.

Data Availability	Description	Limitations	Data uses for 303(d) Assessments
Readily available	Data are incorporated into EPA's WQP database and can interface directly with DWQ's IR data processing and assessment tools Data are collected at pre-determined locations with appropriate monitoring location information linked to the waterbody and use descriptions in R217-2-13.	None	Fully incorporate into DWQ's assessment tools.
Readily available, additional processing required	Data is submitted through DWQ's data submission templates, which are provided on the Assessment's Call for Data website. All necessary metadata, including sample locations and dates, are included and incorporated into the data query process. Alternatively, data may be stored in and routinely uploaded to a queriable, regularly maintained database that is available on the web with the ability for an Open Database Connectivity to be established for DWQ. Database format is consistent and allows repeatable queries with predictable results (e.g. parameter names, location descriptions, and parameter units are consistent), making development of automated interface tools practicable.	Full incorporation into IR assessment tools requires DWQ development of interface tools for aggregating, translating, and harmonizing data to appropriate formats. In particular, sampling locations and dates, parameter names, fractions, units, analysis methods and detection limits require translation and interpretation prior to assessment.	As time and resources allow: (1) fully incorporate into IR assessment tools if interface tools have been developed, (2) screen data for exceedances without directly incorporating into IR assessment tools if interface tools are still in the development phase, or (3) manually assess data for specific sites, dates, and parameters at the request of stakeholders or data submitters.
Partially available	Data are not publically queriable and may not be publically known. Data are submitted by a collaborator or stakeholder through DWQ's call for data and may have been collected for the purposes of answering specific questions or addressing specific issues. Data are stored electronically in a series of databases, spreadsheets, or folders and are not compiled into a single file of uniform format provided by DWQ. However, data are readily interpretable and include all necessary metadata.	Incorporation into IR assessment tools requires significant DWQ resources to compile, interpret, and translate data prior to assessment.	As time and resources allow, data may be incorporated into the secondary review process by: (1) screening data for exceedances without fully incorporating into IR assessment tools if data are sufficiently compiled, or (2) manually assessing data for specific sites, dates, and parameters at the request of stakeholders or data submitters if data are not compiled and compilation is impracticable.*

Data Availability	Description	Limitations	Data uses for 303(d) Assessments
Unavailable	Data are either not currently accessible by DWQ or are not currently stored electronically in a format identified above (for example, a PDF format). Data may be electronically stored and available to DWQ, but are currently missing essential metadata such as sample locations, dates, parameter names, or parameter units. Appropriate metadata may exist elsewhere, but have not been shared with DWQ.	Data are either inaccessible or have not been received with appropriate metadata to perform an assessment. Obtaining data or essential metadata would require significant DWQ resources.	Reject from current IR assessment.*
***Footnote: Data may be more fully incorporated in future IR cycles if availability is improved.**			

DEVELOPING THE COMPONENTS OF THE DRAFT INTEGRATED REPORT AND 303(D) LIST

Following the response to public comments on the draft 303(d) Assessment Methods, and the compilation of all existing and readily available data, DWQ reviews all data and assigns a credible data "grade". All non-rejected, credible data are then assessed for the release of the following IR and associated 303(d) components.

The minimum reporting elements included in the Integrated Report and available for public review and comment are the final 303(d) Assessment Methods, 305(b) Summary, and 303(d) Assessment Results .

Final 303(d) Assessment Methods

The final version of the publicly-vetted 303(d) Assessment Methods including any changes or additions that were made in response to the assessment method public comment period(s).

305(b) Summary

At a minimum, this summary will address the following required ATTAINS reporting elements for current assessments and previous assessments where new data and information did not result in an EPA-defined categorical change:

- A unique identifier assigned to the Assessment Unit by DWQ.
- The name and location description of the Assessment Unit.
- An indicator of whether the Assessment Unit is currently active, or if the Assessment Unit identifier has been retired and is being kept for historical tracking purposes and is part of an Assessment Unit History of another Assessment Unit.
- The geographic state within which the Assessment Unit is contained.
- The waterbody type for the Assessment Unit.
- The size (and the unit of measure) for the assessed waterbody type.
- The EPA-defined assessment category for each defined and evaluated Assessment Unit.

303(d) Assessment Results

At a minimum, the following required information for populating ATTAINS will be provided for current assessments and previous assessments where new data and information did not result in an EPA-defined categorical change:

- The minimum elements discussed above in the 305(b) Summary.
- The cycle the Assessment Unit was last assessed, which can include any conclusions related to this Assessment Unit and delisting decisions (if appropriate).
- The beneficial use(s) designated to the Assessment Unit and the EPA-defined assessment categories associated with the beneficial use after assessment.
- The name of the parameter assessed, the beneficial use associated with the assessed parameter, and the EPA-defined assessment category status for the parameter and beneficial use.
- An indicator of the water quality trend representing the beneficial use or parameter assessment.
- A flag indicating whether or not the cause of the attainment status is a pollutant.
- The agency responsible for identifying the EPA-defined assessment category status for the waterbody.
- The IR cycle the Assessment Unit was first listed for a cause.
- The name of the source of the EPA-defined assessment category status, and if that source has been confirmed.
- The reason(s) and the agency responsible for identifying the delisting of a waterbody and cause.

305(b) Summary and 303(d) Assessment Metadata

For archiving purposes and to assist with the review of the IR and 303(d) List, DWQ will also provide the following *as time and resources allow*:

- The assessment method type and the assessment method context (as defined in ATTAINS).
- Geolocation information on waterbodies that were assessed.
- The date and version of UAC R317-2 that were used in the assessment cycle.
- The list of approved TMDLs that were used in the assessment cycle.
- A fact sheet summarizing the Final IR results.

Note: On January 1 of odd-numbered years, DWQ will "freeze" and establish file versions of several working files to maintain consistency and data integrity. These files include geographic information system (GIS) point files of monitoring locations, layers of AUs, beneficial uses, and water quality standards.

PUBLIC REVIEW OF THE 303(D) LIST

There will be a formal public review process for the IR and 303(d) List with the following steps:

a. Any person who has a pollution-control mechanism plan for a waterbody and would like to submit that plan for consideration and EPA approval as a Category 4B must submit that information to DWQ by July 1 of even-numbered years (Appendix 5). If approved by DWQ, this information will then be submitted to EPA for review and final approval. It should be noted, however, that successful Category 4B determinations typically take a long time to receive EPA approval and may not be received in time to be included in the current IR cycle.
b. Waters and pollutants that are considered for a potential Category 4A (approved TMDLs) must be approved by DWQ's Water Quality Board per UAC R317-1-7 and by EPA per 40 CFR 130.7 by September 30 of even-numbered years. TMDLs that are approved by DWQ and EPA after that date will be considered in future IRs.
c. After July 1 of odd-numbered years and no later than February 1 of even-numbered years, DWQ will release the proposed IR and 303(d) List for a 30-day public comment period. At a minimum, the notice for public comments on the IR will be advertised on DWQ's News and Announcements and/or Public Notices website, the Water Quality Assessments Program website, and DWQ's listserv.
d. Stakeholders who wish to submit data for listing or delisting considerations are encouraged to submit that data and information during the Assessment Program's Call for Data. However, DWQ may consider data that are submitted during the public comment period of the draft IR and 303(d) List when the commenter can show that submitted data results could result in a change to a specific waterbody assessment decision. Data that are submitted during the public comment period for the draft IR must be submitted in the format articulated in this document and on the IR Call for Data website and be of Grade A or B quality to be used in an assessment decision (see the Data Quality Matrices at the IR Call for Data website). Submitted information during the public comment period will undergo a secondary review (see Secondary Review and Appendix 3).
e. At the close of the 30-day public comment period, DWQ will compile and respond to comments that were received within the 30-day public comment period.
f. If substantial revisions to the IR and 303(d) List are adopted by DWQ on the basis of comments received in the first public comment period, DWQ may offer a second public comment period of 30 days or fewer. Should DWQ proceed with a second public comment period, notifications will be advertised, at a minimum, on DWQ's News and Announcements and/or Public Notices website, the Water Quality Assessments Program website, and DWQ's listserv.
g. No later than April 1 of even-numbered years, DWQ will submit a response to the public comments that were received during the 30-day public comment period and a final version of the IR and 303(d) List to EPA for final approval. DWQ will post a status update on the IR Program's website, letting stakeholders know that a final IR was submitted to EPA for final approval. After the submission of the IR to EPA for final approval, any concerns or rebuttals that stakeholders have with the IR will not be considered for the recently submitted IR. If stakeholders continue to

have concerns with the IR and 303(d) List, they should submit their comments during the next IR cycle.

h. EPA has 30 days to approve or disapprove the 303(d) List after receiving DWQ's formal submission letter, IR chapters, 303(d) List, categorization of non-303(d) waterbodies, public comments received and DWQ's response to them, delisting tables and justifications, list of approved TMDLs/pollution-control mechanisms, and GIS files of all assessment results. If EPA disapproves a state list, EPA has 30 days to develop a new list for the state; although historically EPA has rarely established an entire list for a state. EPA may also partially disapprove a list because some waters have been omitted, and EPA may add these waters to the state's list. If EPA's final approval of the IR takes longer than the timeframe identified above, DWQ will post updates on the IR website.

i. Any concerns and comments not received through the above processes will not be addressed in the IR.

FINALIZING THE INTEGRATED REPORT AND 303(D) LIST

Following EPA's approval, DWQ will release the following information on DWQ's Water Quality Assessments Program website:

- A final version of 303(d) Assessment Methods, including the public comments received and DWQ's response to comments.
- Final IR chapters and 303(d) Lists, including public comments received, DWQ's response to comments, all assessment information that was considered and evaluated in the finalization of the IR and 303(d) List, and a GIS file of the final assessments and 303(d) List.

In addition, EPA maintains a database of state IR results and TMDL status. If additional information not available on the Assessment Methods website is needed, DWQ may require a Government Records Access and Management Act request to be filed. These requests can be submitted at any time.

Scope of the Assessment

WATERS OF THE STATE

As defined in UAC R317-1-1, DWQ characterizes waters of the state as follows:

… all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private, which are contained within, flow through, or border upon this state or any portion thereof, except that bodies of water confined to and retained within the limits of private property, and which do not develop into or constitute a nuisance, or a public health hazard, or a menace to fish and wildlife, shall not be considered to be "waters of the state" under this definition (Section 19-5-102).

For 303(d) assessment purposes, DWQ reports on the following:

- flowing surface waters of the state,
- canals as identified in site-specific standards or named in the list of waters with designated use classifications in UAC R317-2, and
- lakes, reservoirs, and ponds.

All other waters are currently reported through other programs within DWQ. For more information on these waterbodies and their reports, please refer to DWQ's website.

WATERBODY TYPES

Utah assesses surface waters of the state at the monitoring-site level and then summarizes the site-level assessments up to a larger spatial scale (i.e., the Assessment Unit (AU) scale). To determine what sites are appropriate for assessments, the monitoring locations are categorized by considering the definitions in Table 4.

Table 4. Assessed waterbody types used for categorizing monitoring locations.

Assessed Waterbody Type	Description
Flowing surface waters of the state*	A surface body of water moving under gravity flow. Perennial, intermittent and ephemeral surface waters are included in this type. Springs and seeps are also included in this waterbody type provided they are flowing and connect, contribute, or are influencing water quality in a downstream river or stream.
Canals (general, irrigation, transport, or drainage)*	A human-made water conveyance with flowing water. Note: Canals are only assessed when identified in the site-specific numeric criteria in UAC R317-2-14 or are named in the list of waters with designated use classifications in UAC R317-2-13.
Lakes, reservoirs, and ponds*	An inland body of standing fresh or saline water that is generally too deep to permit submerged aquatic vegetation to take root across the entire body. This type may include expanded parts of a river or natural lake, a reservoir behind a dam, or a natural or excavated depression containing a waterbody without surface water inlet and/or outlet.
***Footnote: Sites associated with these waterbody types that have readily available and credible data are also subject to secondary reviews, which are described in the Secondary Review section and Appendix 3.**	

ASSESSMENT UNITS

Assessment Unit Delineation and Identification

Surface waters identified appropriate for 303(d) assessments have been delineated into discrete units called assessment units (AUs). AUs are used in identifying waters of the state that have been assessed to determine whether or not they are supporting their designated beneficial uses. Lakes, reservoirs, and ponds have been delineated as individual AUs and their size is reported in acres. Flowing surface waters of the state and canals have been delineated by specific rivers or one or more surface water reaches in subwatersheds. When using subwatersheds to delineate flowing surface water AUs, the new U.S. Geological Survey (USGS) 5th-level (10 digit) and 6th-level (12-digit) hydrologic unit codes (HUCs) for Utah are used. These HUCs allow for the aggregation of surface water reaches into individual AUs that are hydrologically based watersheds. The 5th- and 6th-level HUCs were developed by individuals representing state and federal agencies, and have been certified by the Natural Resources Conservation Service.

Additional Guidelines for Delineating Assessment Units

When delineating AUs for flowing surface waters of the state, DWQ follows the guidelines listed below with the first two guideline statements being fixed rules.

- The entire AU is within a single 8-digit USGS HUC.
- Each AU comprises reaches having identical designated beneficial use classifications. For example, for a waterbody that has beneficial uses of Class 1C, 2B, and 3A in one portion and Class 2B and 3B in another portion, this waterbody would have at least two distinct AUs because of the difference in beneficial use classifications.
- Large flowing surface waters of the state, such as the Green River, Colorado River, and portions of other large rivers (e.g., the Bear River and Weber River) were delineated into "linear" or "ribbon" AUs containing no tributaries. Where a major tributary enters these rivers or hydrological features such as dams exist, the river is further delineated into two or more AUs.
- Tributaries and headwaters were delineated primarily using the 5th- and 6th-level HUC boundaries to define the AUs.
- Additional AUs were defined by combining or splitting 5th- or 6th-level watersheds using hydrological and ecological changes such as geology, vegetation, or land use.
- Small tributaries to larger flowing surface waters that could not be incorporated into a watershed unit were combined into separate unique AUs.
- AU boundaries generally follow hydrologic units, but may also be delineated to reflect beneficial use designation changes, major tributaries or other observed hydrologic or chemical changes, administrative boundaries, such as at some U.S. Forest Service boundaries, or notable road crossings as stated in Water Quality Standards, UAC R317-2-13.

Individual AUs for flowing surface waters of the state were assigned a unique identification code for indexing. Each AU identifier begins with the prefix “UT” followed by the associated 8-digit HUC and ending in a 3-digit DWQ sequential number. Similarly, lake, reservoir, and pond AUs were identified by adding the prefix “UT-L-” to the 8-digit HUC followed by a 3-digit sequential number.

Figure 1 illustrates one example of the results of using the above guidelines to delineate and identify AUs within a major watershed. The Weber River was delineated as a linear AU from its confluence with Chalk Creek upstream to the Wanship Dam and then designated as UT16020101-017. South Fork Chalk Creek (UT16020101-011) in the Chalk Creek watershed was delineated by combining two 12-digit HUCs comprising the South Fork Chalk Creek sub-basin. The first AU (UT16020101-010) in the Chalk Creek watershed above Echo Reservoir was

delineated using the confluence of the South Fork as the upstream endpoint. This necessitated splitting the 12-digit HUC into two AUs, one for Chalk Creek below the confluence with South Fork (UT16020101-010) and another AU for Chalk Creek above the South Fork confluence and below the Huff Creek confluence to form UT16020101-012. An example of small tributary streams that could not be combined into a hydrological based AU is illustrated by the UT16020101-019 AU. These are very small tributaries, and the Weber River is not reflective of their stream order or the habitat that they flow through. Echo Reservoir (UT-L-16020101-001) and Rockport Reservoir (UT-L-16020101-002) are examples of lake or reservoir AUs.

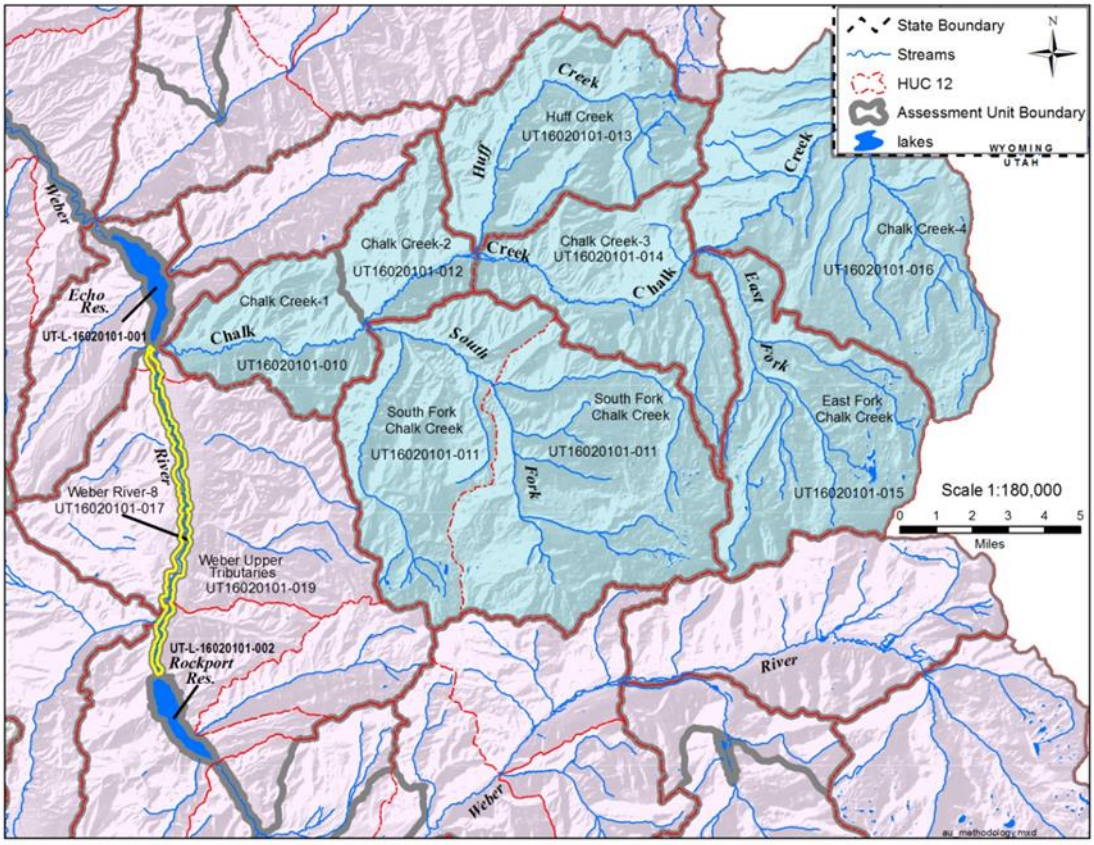

Figure 1. Utah Division of Water Quality assessment unit delineations.

Assessment Unit Datum

Digital data representing all established AUs are stored as subwatershed polygons in GIS-formatted spatial data files. These data are georeferenced as North American Datum 1983 in Universal Transverse Mercator (Zone 12 North) projection, and units are in meters. Maps depicting statewide AUs on letter-sized paper require scales at approximately 1:2,200,000. Digital maps can be shown at various scales depending on the selected zoom magnification.

AU Stream Mileage Estimation for Flowing Surface Waters and Canals

For reporting purposes, flowing surface water assessments are summarized by stream mileage in each assessment category. Stream mileage within each AU is estimated using a streams GIS layer generated by the Utah Automated Geographic Reference Center (AGRC). This layer was derived from the high resolution (1:24,000 scale) National Hydrologic Dataset (NHD). Stream mileage within an AU is estimated as the sum of the lengths of all perennial and intermittent streams and canals identified in the site-specific numeric criteria in UAC R317-2-14 or named in the list of waters with designated use classifications in UAC R317-2-13. The NHD based

layer is used only to estimate stream mileage within an AU and is not used to define individual monitoring locations as perennial or intermittent or remove monitoring locations from the assessment process on that basis.

WATERS WITHIN AND SHARED WITH OTHER STATES

Though readily available data may exist from locations near Utah's state boundaries, DWQ only assesses, for 303(d) purposes, monitoring location sites that are within the jurisdictional boundaries of the state. Assessment Units or sites on lands under tribal jurisdiction are not assessed in the IR. Assessed surface waters of the state (as defined in Table 4) that flow into Utah but originate outside of Utah's borders will be assessed using DWQ monitoring locations residing within state boundaries. Lakes, reservoirs, and ponds that overlap with other state jurisdictions (e.g., Lake Powell, Bear Lake, and Flaming Gorge) will be assessed using the monitoring locations that fall within Utah state jurisdictional boundaries.

As resources allow, DWQ will work with neighboring states on any impairments that fall close to jurisdictional boundaries in other states by notifying the neighboring state of the impairments or exceedances and available data relevant to the impairment.

Data Quality

CREDIBLE DATA DEFINED

To be considered for 303(d) water quality assessments, all readily available data and information that are submitted to the Water Quality Assessment Program or obtained during the assessment program's data compilation process must be of high quality. To ensure that data used for environmental decision making are of high quality, representative of ambient conditions, and appropriately documented, the Water Quality Assessment Program refers to the broader data quality goals outlined in the Department's DEQ Quality Management Plan, the more specific requirements for surface water monitoring in DWQ's Quality Assurance Project Plan (QAPP), and the Water Quality Assessment Program specific credible data requirements outlined in this document.

Though the Water Quality Assessment Program (the 'assessment program') may not use non-credible data (based on the requirements outlined in this document), this credible data criteria does not restrict other programs within DWQ from using data for other Division reporting analyses and actions. For example, data used for a Watershed Plan may not necessarily meet the credible data requirements for the assessment program but may meet the needs of a Watershed Plan and the Watershed Protection Program.

DWQ's assessment program defines credible data as:

- water quality samples and field measurements that are collected following the adherence and documentation of appropriate quality assurance (QA) and quality control (QC) procedures,
- environmental samples or measurements that are representative of water quality conditions at the time of sampling, and
- field sample collection, processing, and laboratory analyses that are documented and follow established protocols, procedures and methods, which are available when needed/requested.

To ensure that the data and information used by the assessment program is of high quality, the assessment program relies on documentation from project planners, sample collectors, and laboratories to assist in documenting that the data are of known quality and defensible. The following policies and documents are requested when submitting data to the assessment program.

COMPONENTS FOR CREDIBLE DATA

QAPP Guidance and Example

The assessment program requires that all assessment related decisions that use data are supported by a Quality Assurance Project Plan (QAPP). QAPPs, *"integrate all technical and quality aspects of a project, including planning, implementation, and assessment." The purpose of a QAPP is to document planning results for environmental data operations and to provide a project-specific "blueprint" for obtaining the type and quality of environmental data needed for a specific decision or use. The QA Project Plan documents how quality assurance (QA) and quality control (QC) are applied to an environmental data operation to assure that the results obtained are of the type and quality needed and expected"* (EPA, 2002).

- Environmental Protection Agency's Quality Assurance Quality Program Guidance & Requirements. EPA's requirements and guidance documents for ensuring that all environmental data is of a known quality and defensible. The Water Quality Assessment Program encourages DWQ staff and cooperators and all other parties interested in submitting high quality data to the assessment program to review QA/R-5 and QA/G-5.

- DWQ Quality Assurance Program Planning (QAPP). DWQ's document outlining the minimum Quality Assurance and Quality Control (QA/QC) requirements for environmental data generated by DWQ and its cooperators.

Sampling Analysis Plan Guidelines and Examples

Sampling Analysis Plans are the second type of documentation the assessment program requires when compiling information for assessments and other programmatic decisions. SAPs*, "are intended to assist organizations in documenting the procedural and analytical requirements for one-time, or time limited, projects involving the collection of water, soil, sediment, or other samples taken to characterize areas of potential environmental contamination. It combines the basic elements of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan"* (EPA, 2014).

- EPA's Sampling Analysis Plan Guidance & Requirements.
- DWQ's recommended Sampling Analysis Plan Requirements. Currently used by DWQ cooperators and internally at DWQ, this document contains information on what DWQ looks for in a SAP (see Appendix 2)

Standard Operating Procedures Guidelines and Examples

Standard Operating Procedures (SOPs) are documented procedures that describe in full detail the routine operations of a monitoring program. The assessment program requires SOPs as part of data submission packages to ensure consistency across sampling techniques from many disparate data sources.

- EPA's Guidance for Preparing Standard Operating Procedures (G-6). EPA's guidance on how to develop and provide the necessary documentation when generating an SOP. DWQ recommends referring to EPA's guidance if using a SOP different than DWQ's.
- DWQ Standard Operating Procedures . DWQ generates SOPs for any procedure that becomes routine, even when published methods are utilized. The use of SOPs ensures data comparability, defensibility, accuracy, and reduces bias. DWQ has published the following final SOPs, which can be found in on DWQ's QA/QC or Harmful Algal Bloom websites:

    a. Aquatic Benthic Macroinvertebrate Collection in Rivers and Stream
    b. Calibration, Maintenance, and Use of Hydrolab Multiprobes (SOP includes an example of a multi-probe calibration form).
    c. Chain-of-Custody Samples
    d. Collection and Handling of Escherichia coli (E. coli) Samples
    e. Collection and Preparation of Fish Tissue Samples for Mercury Analysis
    f. Collection of Lake Water Samples
    g. Collection of Water Chemistry Samples
    h. *Escherichia coli (E. coli)* and Total Coliform Quantification using the IDEXX Quanti-Tray/2000 System
    i. Filtering Water Column Chlorophyll-a Samples
    j. Hydrolab Data Collection in Lakes
    k. Phytoplankton collection to detect Harmful Algal Blooms
    l. Secchi Disk Depth Measurements
    m. Stream Flow Measurement

Sampling Observations and Laboratory Comments

To assist DWQ in determining data quality, the assessment program requires documentation on field conditions which may affect data quality or laboratory comments on QA/QC issues encountered during analysis. Appendix 2 includes an example of sampling observations DWQ recommends documenting in the field for grab sample collections, and the credible data matrices included in Table 5 - Table 9 describe additional sampling and laboratory observations and comments required by the assessment program.

Monitoring Location Information

To assess a waterbody against the numeric criteria assigned in UAC R317-2, DWQ must review all of the monitoring location information associated with datasets. This process involves validating the location's geospatial information in GIS, assigning beneficial uses to DWQ-validated locations, and merging monitoring locations and their associated data where locations are representative of the same waterbody or segment. Information that must be included with a monitoring location measurement is as follows:

- Monitoring Location ID (Organization's unique identifier for the sample site),
- Waterbody type description, and
- Monitoring location latitude/longitude measurements and associated metadata as defined on the Assessment Program's Call for Data website.

If, during DWQ's geospatial review of the monitoring location information, a monitoring location has insufficient or inaccurate information (e.g., it cannot be mapped or is improperly recorded by the sampler in the field), the monitoring location and its associated data will not be included in any assessment program's analyses.

CREDIBLE DATA MATRICES

Where beneficial uses can be assigned to a DWQ-validated and approved monitoring location, DWQ will then consider the scientific rigor of the sampling information and measurements associated with that site. To assess the validity of the sampling and analytical protocols associated with a sample measurement, DWQ uses a data type–specific credible-data matrix. As noted in the credible-data matrices, each credible-data matrix considers the field and laboratory QA/QC protocols, sampling and laboratory methods, analytical detection or instrumentation limits, and field observations associated with a sample measurement. Based on the level of information provided and the strength of the metadata associated with the sample measurement, DWQ assigns a grade level (A–D) to the associated sample measurement(s).

Measurements that receive an A or B grade are considered to be of high quality by DWQ and will be considered and used by DWQ in the process of assigning an EPA-derived assessment category to a waterbody (i.e., the IR's 305(b) and 303(d) assessments). Measurements that receive a C or D grade are considered by DWQ to be of lower quality and will not be used for assessment and 303(d) listing purposes. Details on the required data quality criteria for inclusion in the IR and use by the water quality assessment program are included in Table 5.

Table 5. Data validation criteria for water quality field grab sample parameters.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Sampling Analysis Plan (SAP)	Calibration Documentation	Field Documentation	Flow Data	Water Temperature Methods*	pH Methods*	Dissolved Oxygen, Percent Saturation for Calibrated Meter*	Dissolved Oxygen, Concentration Methods for Calibrated Meter*
A	Approved QAPP	SAP	Available for DWQ review if needed for all field parameters	Available for DWQ review if needed	Submitted or Available for DWQ review if needed	Checked against NIST A ≤ ± 0.1 ºC R ≤ 0.01 ºC	Calibrated pH Probe A ≤ ± 0.2 R ≤ 0.01	0-200 %Sat: A ≤ ± 1% R ≤ 0.1%	0-8 mg/L: A ≤ ± 0.01mg/L > 8mg/L: A ≤ ± 0.02 mg/L R ≤ 0.01
B	QAPP or equivalent	SAP or equivalent	Available for DWQ review if needed, for field parameters in question	Optional	Not Submitted or Unavailable for DWQ review if needed	A ≤ ± 0.5 ºC R ≤ 0.05 ºC	Calibrated pH Probe A ≤ ± 0.5 R ≤ 0.05	0-200 %Sat: A ≤ ± 2% R ≤ 0.2%	0-20 mg/L: A ≤ ± 0.1 mg/L R ≤ 0.1
C	Not Submitted	Not Submitted	Available for DWQ review if needed, for field parameters in question	Optional	Not Submitted or Unavailable for DWQ review if needed	A ≥ ± 0.5 ºC R ≥ 0.05 ºC	Any Method	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data
D	Unavailable	Unavailable	Missing or Unavailable for DWQ review if needed	Optional	Not Submitted	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data

***Footnote: A = accuracy, R = range**

Table 6. Data validation criteria for water quality high frequency dissolved oxygen data.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Sampling Analysis Plan (SAP)	Calibration and Field Documentation	Data QA/QC Information or Report	Calibration and Field Documentation	Discharge**	Specific Conductivity**	Water Temperature**	pH**	Dissolved Oxygen*, Percent Saturation for Calibrated Meter	Dissolved Oxygen*, Concentration Methods for Calibrated Meter	Turbidity**
A	Approved QAPP	Approved SAP	Mandatory-calibration record(s) (e.g., field records of calibration and/or fouling) and field survey information	Documentation describing the QA/QC process on the raw data	All pertinent deployment data (i.e., information necessary for interpreting data)	± 0.05% Full Scale (at 15°C), ± 0.1% Full Scale (maximum)	± 5 µS/cm or ± 3% of the measured value, whichever is greater	Checked against NIST A ≤ ± 0.5°C R ≤ 0.5°C	Calibrated pH electrode A ≤ ± 0.2 R ≤ 0.3	0-200%: A ≤ ± 1% R ≤ 0.1%	0-8 mg/L: A ≤ ± 0.01 mg/L > 8mg/L: A ≤ ± 0.02 mg/L R ≤ 0.01	A ≤ ± 0.5 NTU or ± 5%, whichever is greater
B	Approved QAPP or equivalent	Approved SAP or equivalent	Mandatory-calibration record(s) (e.g., field records of calibration and/or fouling) and field survey information	Documentation describing the QA/QC process on the raw data	All pertinent deployment data (i.e., information necessary for interpreting data)	± 0.05% Full Scale (at 15°C), ± 0.1% Full Scale (maximum)	± 10 µS/cm or ± 6% of the measured value, whichever is greater	Checked against NIST A ≤ ± 1.0°C R ≤ 2.0°C	Any Method A ≤ ± 0.5 R ≤ 0.5	0-200%: A ≤ ± 2% R ≤ 0.2%	0-20 mg/L: A ≤ ± 0.1 mg/L R ≤ 0.1	A ≤± 0.5 NTU or ± 5%, whichever is greater
C	Approval of project manager that Minimum Data	Approval of project manager that Minimum Data Acceptance Criteria Met	Unavailable for DWQ review if needed	Unavailable for DWQ review if needed	Unavailable for DWQ review if needed	± 0.05% Full Scale (at 15°C), ± 0.1% Full Scale (maximum)	± 10 µS/cm or ± 6% of the measured value, whichever is greater	A ≥ ± 0.5 ºC R ≥ 0.05 ºC	Any Method A ≤ ± 0.5 R ≤ 0.5	0-200%: A ≤ ± 2% R ≤ 0.2%	0-20 mg/L: A ≤ ± 0.1 mg/L R ≤ 0.1	± 0.5 NTU or ± 5%, whichever is greater
D	Acceptance Criteria	Not Submitted	Unavailable	Unavailable	Unavailable	Not Submitted	Not a calibrated meter, missing, or rejected data					
***Footnote: A = accuracy, R = range**												

*__Please note__: Raw and QA/QC data records *must be* submitted to qualify for consideration in 303(d) assessments.

**Optional data and documentation. DWQ is still developing assessment methods for high frequency temperature and pH datasets.

Table 7. Data validation criteria for water quality chemistry grab sample parameters.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Sampling Analysis Plan (SAP)	Laboratory Method	Detection Limits	Lab Certification	QC Data	Laboratory Comments	Field Documentation	Metals*	Organics*	Inorganics*
A	Approved Lab QAPP	SAP	Approved Methods	Submitted within DWQ Approved Limits	Utah Bureau of Laboratory Improvement certification, NELAC, or equivalent	Available for DWQ review if needed	Laboratory Comments Associated with Sample	Available for DWQ review if needed	Chronic: Aluminum submitted with Ca and Mg OR Lab Hardness and field pH; Cadmium, Chromium (III), Copper, Lead, Nickel, Silver, and Zinc submitted with Ca and Mg OR Lab Hardness	Pentachlorophenol submitted with field pH	Total Ammonia as N submitted with field pH or field Temperature
B	Lab QAPP or Data Quality Objectives	SAP or equivalent	Approved Methods	Submitted within DWQ Approved Limits	Utah Bureau of Laboratory Improvement certification, NELAC, or equivalent	Available for DWQ review if needed	Laboratory Comments Associated with Sample	Optional	Chronic: As above, but Aluminum submitted without Hardness or field pH will be assessed at 750 ug/l; As above, but samples submitted without Ca, Mg, or Lab Hardness **	Pentachlorophenol submitted without field pH	Total Ammonia as N submitted with field pH or field Temperature
C	Data Quality Objectives	Optional	Approved Methods	Submitted within DWQ Approved Limits	Utah Bureau of Laboratory Improvement certification, NELAC, or equivalent	Available for DWQ review if needed	Laboratory Comments Associated with Sample	Optional	Chronic: As above, but Aluminum without Hardness or field pH will not be assessed;	Pentachlorophenol submitted without field pH	Total Ammonia as N submitted with field pH or field Temperature
D	Unavailable	Optional or Unavailable	Missing or Unapproved Methods	Missing or Unapproved Limits	No certifications	Optional	No Laboratory Comments	Optional	Chronic: As above, but Aluminum without Hardness or field pH will not be assessed	Pentachlorophenol submitted without field pH	Total Ammonia as N submitted with neither field pH nor field Temperature

***Footnote: Please also refer to UAC R317-2 to confirm that all the necessary data is submitted to DWQ, so correction factors and equations may be fully calculated for 303(d) assessment purposes.**
****Footnote: Please refer to the 303(d) Assessment Methods for corrections to assessment due to missing values of hardness or pH.**

Table 8. Data validation criteria for macroinvertebrate data.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Sampling Analysis Plan (SAP)	Standard Operating Procedures (SOPs)	Field Documentation	DWQ approved taxonomy lab	Other accredited taxonomy lab
A	Approved Lab QAPP	SAP or equivalent	Available for DWQ review if needed for all field methods	Available for DWQ review if needed	Required	Required
B	Approved Lab QAPP or Data Quality Objectives	Not Submitted	Available for DWQ review if needed for all field methods	Available for DWQ review if needed	Required	Not Submitted
C	Data Quality Objectives	Not Submitted	Available for DWQ review if needed for all field methods	Available for DWQ review if needed	Not Submitted	Required
D	Unavailable	Not Submitted	Not Submitted	Not Submitted	Not Submitted	Not Submitted

Table 9. Data validation criteria for Escherichia coli (E. coli) data.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Sampling Analysis Plan (SAP)	Standard Operating Procedures (SOPs)	EPA Approved Method	Demonstration of Capability (Annual)	Data	Lab Documentation	QA/QC	Location Information
A	Approved QAPP	SAP	DWQ E. coli Sample Collection & DWQ E. coli Sample Analysis	IDEXX Colilert	Available for DWQ review	Submitted in template on time	Bench Sheet Present and Complete	Information on holding time, incubation, and expiration dates provided.	Provided
B	QAPP or equivalent	SAP or equivalent	DWQ E. coli Sample Collection & DWQ E. coli Sample Analysis	IDEXX Colilert	Available for DWQ review or acknowledgement of SOP	Submitted in template after deadline or Not submitted in template	Bench Sheet Present, incomplete, or not available	Not provided	Provided
C	Not Submitted	Not Submitted	DWQ E. coli Sample Collection & DWQ E. coli Sample Analysis	IDEXX Colilert or EasyGel	Unavailable	Submitted in template after deadline or Not submitted in template	Unavailable	Not provided	Provided
D	Unavailable	Unavailable	Missing or Unavailable	IDEXX Colilert or Easy Gel	Unavailable		Unavailable	Not provided	Not provided

Data Submission Process

TYPE OF DATA TO SUBMIT

As referenced in 40 CFR 130.7(b)(5), the assessment program considers all existing and readily available data as defined in Table 3. Both quantitative and qualitative data may be used to evaluate whether physical, chemical, and biological characteristics of a water body are sufficient to support that water bodies designated uses. However, based on the type of data submitted to or obtained by DWQ during the Assessment Program's Call for Data for generating the Integrated Report, the data may not be appropriate for assessments. As recommended in EPA's July 29, 2005, guidance (EPA, 2005), DWQ considers several quantitative and qualitative types of data described in Table 10 for water quality assessments and analyses.

Table 10. Summary of data types considered by the assessment program.

Assessment Program Data Uses	Quantitative Data	Qualitative Data	Other
305(b) and 303(d) Assessments (Grade A and B Data in credible data matrices)	(1) Assessment Parameters contained in Utah Water Quality Standards (UAC R317-2) and Safe Drinking Water Act Standards (see Appendix 1), (2) Segment-specific ambient monitoring of Analytical, Physical, and/or Biological Conditions, (3) Simple Dilution Calculations, and (4) Human Health/Consumption closures, restrictions, and/or advisories	(1) Observed Effects (e.g. fish kills), (2) Complaints and comments from the public, and (3) Human health/consumption closures, restrictions, and/or advisories	Landscape Analysis (when applicable)
Monitoring Planning and Training (Grade C and D Data in credible data matrices)	See above	See above	(1) Landscape Analysis (when applicable), (2) Technical Reports, (3) White Papers, (4) Articles from Refereed Journals, and (5) Other Scientific Publications

PERIOD OF RECORD

DWQ uses water years to define the period of record. For the 2018/2020 IR, the period of record is October 1, 2010 to September 30, 2018 (water years 2011-2018).

Data and information from the IR's period of record are considered to be most reflective of the current conditions of a waterbody. Provided the data from this record period meet the interpretive, sampling, and analytical considerations and protocols outlined in this document and on the Assessment Program's Call for Data website, DWQ will analyze and assign EPA- derived assessment categories to the assessed waterbodies from this record period (see Table 1).

Older Data and Information

DWQ will not consider data and other information older than the period of record in the current IR and 303(d) List. Instead, DWQ will encourage the data submitter to collect newer information and submit that data and information in future calls for data.

Newer Data and Information

Quantitative and qualitative data types that are considered in 303(d) assessments but are collected or represent conditions after the closing date specified in the above period of record are not considered in the current reporting cycle. DWQ does not include these newer datasets because of the time required to compile data, perform data quality checks, format data from different sources, assess, review assessments, and generate the IR and 303(d) for public comment by April 1 of even-numbered years.

DATA SUBMISSION TOOLS

To ensure the inclusion of data in DWQ's assessment process, it is important for data to be submitted in a form that are amenable to the Assessment Program's existing data-management and QA capabilities. Please refer to the Table 3 and the water quality assessment program's Call for Data website for more information on how to submit data for consideration in the IR.

Data Preparation for Conventional and Toxic Assessments for All Waters

Following the readily available and credible data reviews, DWQ compiles all high quality credible data within the period of record of concern and begins standardizing, validating, and preparing the data for assessments. To assist reviews and increase transparency to reviewers, raw data and accompanying metadata are not altered; instead, a series of database comments and flags are used. Though High Frequency Dissolved Oxygen (DO) and E. coli assessments are considered conventional assessments (see Table 11), these parameters have data preparation protocols that are unique to those datasets. Please refer to the High Frequency and E. coli assessment sections of this document for more details.

RESULTS BELOW DETECTION LIMITS

Environmental chemistry laboratories often report sample results as below their detection limit for a given analytical method. These limits are variously reported as minimum detection limit, minimum reporting limit, and/or minimum quantitation limit. DWQ first screens and flags laboratory result values that are empty and have detection limits higher than the water quality criteria in UAC R317-2. These flagged data records are not considered for the analysis. For sample results below detection, the reported result value or a value of 0.5 times the lowest reported detection limit is applied for purposes of the assessment. However, if the detection limit is above the water quality standard, the data will not be used in the assessment.

DUPLICATE AND REPLICATE RESULTS

Datasets often contain duplicate and replicate sample results due to QA/QC procedures, reporting errors, or sampling design. In these cases, a single daily value is determined by accepting the highest result for parameters with not-to-exceed criteria in UAC R317-2, or the lowest reported value for parameters with minimum criteria in UAC R317-2. All data are retained in the assessment dataset and flagged as rejected because of replicate or duplicate values.

INITIAL ASSESSMENT: MONITORING LOCATION SITE LEVEL

DWQ determines attainment or nonattainment of numeric standards by assessing credible data at the monitoring location site level against the numeric criteria in UAC R317-2. DWQ developed this protocol because individual assessments offer a more direct measure of supporting or not-supporting water quality standards in UAC R317-2.

Multiple parameter assessments at an individual monitoring location and results from multiple monitoring locations within the same AU are then summarized and combined following the procedures outlined in the Determination of Impairment: All Assessment Units section of this report.

Assessments Specific to Flowing Surface Waters of the State and Canals

CONVENTIONAL PARAMETER ASSESSMENTS

Currently, DWQ assesses five parameters within UAC R317-2 as conventional parameters and assesses them against the beneficial use–specific criteria established in UAC R317-2. Several waterbodies with conventional numeric criteria have site-specific standards articulated in self-explanatory footnotes within DWQ's surface water standards (UAC R317-2). Site-specific standards that require further clarification for 303(d) assessment purposes are noted and explained in Table 11.

Table 11. Conventional parameters and associated designated uses as identified for assessment purposes.

Parameters	Designated Use	Notes
DO*	Aquatic life	Numerous recurrence intervals are listed. 30-day averages are used for assessments based on grab samples. 30- and 7-day averages and minimums are used for assessments based on high frequency data, and early life stages are assumed present for the 7-day and minimum high frequency assessments. Some site-specific standards have been generated, which are used for assessment purposes.
Maximum temperature*	Aquatic life	Some site-specific standards have been generated, which are used for assessment purposes
pH*	Domestic, Recreation, Aquatic life	Criteria are identical across uses.
Total dissolved solids (TDS)**	Agriculture	Many site-specific standards have been generated, which are used for assessment purposes. Clarification on how three site-specific standards are used for 303(d) purposes are provided below: (1) For South Fork Spring Creek from the confluence with Pelican Pond Slough Stream to U.S. Route 89, two seasonal assessments are not performed. Instead, each sample is compared to the monthly corrected criteria in the footnote in UAC R317-2. (2) Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek. If TDS exceeds the site-specific standard, the site is not attaining site-specific criteria. If TDS is not exceeding, total sulfate is assessed. (3) Quitchupah Creek from the confluence with Ivie Creek to Utah State Route 10: If TDS exceeds the site-specific standard, it is not attaining site-specific criteria. If TDS is not exceeding, total sulfate is assessed. (4) Blue Creek and tributaries, Box Elder County, from Bear River Bay, Great Salt Lake to Blue Creek Reservoir. The only site to be assessed within this area is 4960740. (All other sites within this area description will not be assessed for TDS). Site-specific standard associated with sulfate for the following areas: (1) Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, it is not attaining. (2) Quitchupah Creek from the confluence with Ivie Creek to Utah State Route 10: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, it is not attaining.

Parameters	Designated Use	Notes
Sulfate**	Agriculture	Site-specific standard associated with sulfate for the following areas: (1) Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, it is not attaining. (2) Quitchupah Creek from the confluence with Ivie Creek to Utah State Route 10: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, it is not attaining.
***Footnote: Indicate that assessments are performed from field measurement only. **Footnote: Indicate that assessments are performed from lab measurements only.**		

Grab Sample Assessments

A minimum of 10 samples for conventional parameters are required to determine if a site is attaining or not attaining water quality standards (Figure 2). Where locations have sufficient sample sizes of 10 or more, 10% of the total samples are calculated. This 10% calculation becomes the maximum number of samples that can exceed the numeric criterion. For example, if there are 10 samples in a dataset for a site, one sample can exceed the criterion and the site still supports uses. If more than 10% of the total samples collected exceed the criterion, the site is not attaining the beneficial use and the next beneficial use is assessed. If 10% or less of the total samples collected exceed the criterion, the site is attaining its beneficial use and the next beneficial use is assessed. In the case of waterbodies with site-specific standards for TDS and sulfate, both criteria must be met or the waterbody will be listed as not supporting its agricultural use.

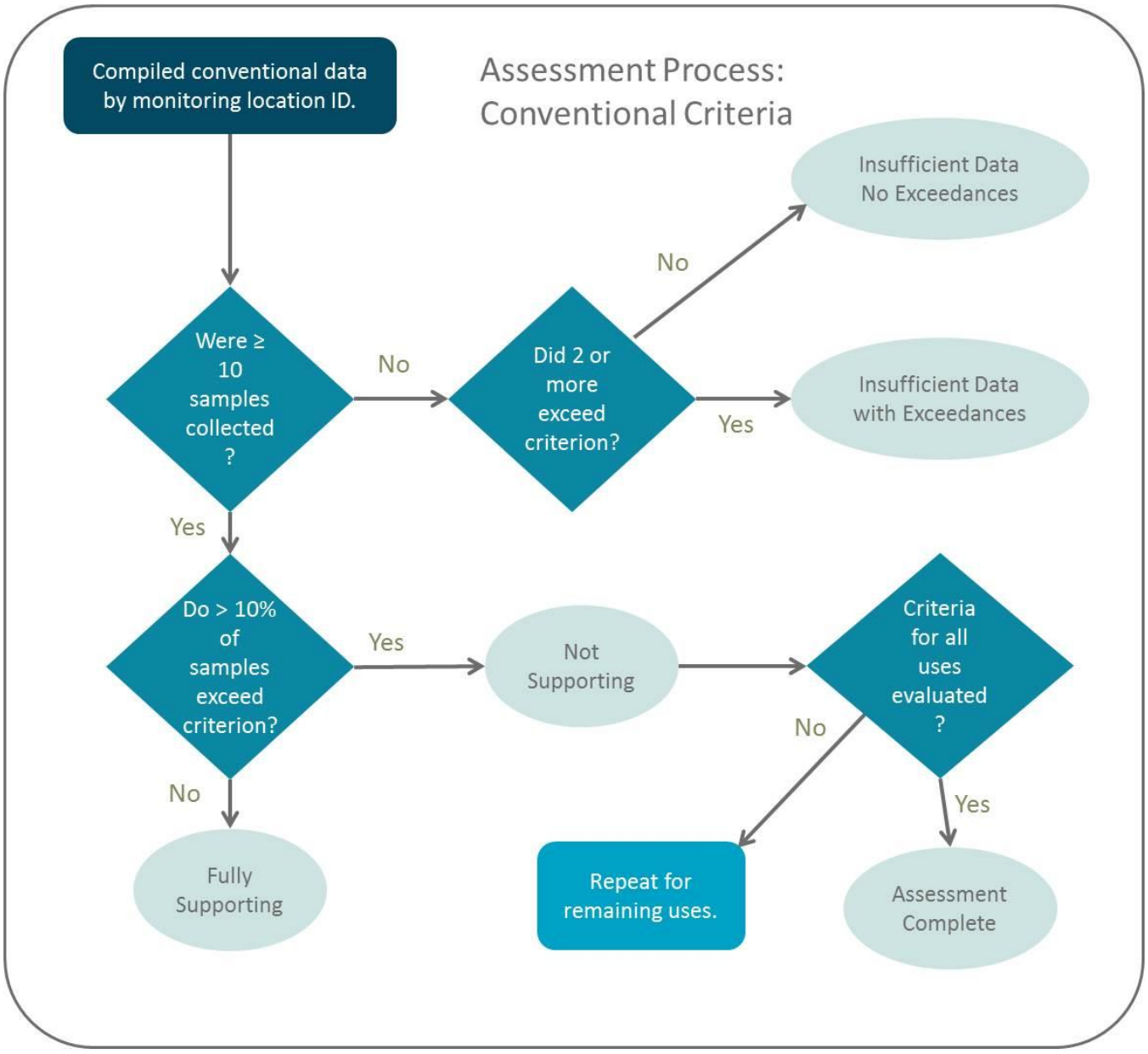

Figure 2. Overview of the assessment process for conventional parameters using grab sample data.

High Frequency Assessments for Dissolved Oxygen

Data Preparation

For readily available and credible data within the period of record, DWQ will correct or remove all questionable data points (i.e., sensor drift, calibration shift, strange anomalous points, and battery issues) before data analysis and interpretation begins. These data screens are particularly important for dissolved oxygen (DO) sensors because they are subject to bio-fouling, especially in nutrient-rich water where they have the higher potential to become covered in algae growth. When bio-fouling occurs, it results in erroneous logger measurements or sensor drift.

Data sufficiency

To ensure that daily minima are captured and that daily averages can be accurately calculated, high frequency data must capture complete days. DWQ defines a complete day as a calendar day (i.e. 12:00 am – 11:59 pm) in which at least one measurement is made in each hour. For 303(d) assessment purposes DWQ considers a high frequency dataset of sufficient size for assessment when there are ≥39 complete days of contiguous data within the period of record. This ensures measurements are adequately spaced and representative of DO concentrations over the course of a day and that the 30-day, 7-day, and daily minimum criteria can all be fully assessed. If both of these conditions are not met, the data will be flagged as insufficient in size and not included in the current IR cycle.

Assessment Process

For each complete day in a dataset, a daily minimum and daily average are calculated. Moving 7 and 30 day averages are then calculated from the daily averages for each 7 or 30 day period within the dataset. These values are then compared to the applicable daily minimum, 7-day average, and 30-day average criteria to determine use impairment or support.

A site is considered to be not attaining the daily DO minimum criterion if more than 10% of the total daily minima within the period of record are below the applicable standard. For example, in a dataset containing 50 contiguous complete days, the site is considered not attaining if more than 5 daily minima are below the criterion (see Figure 3).

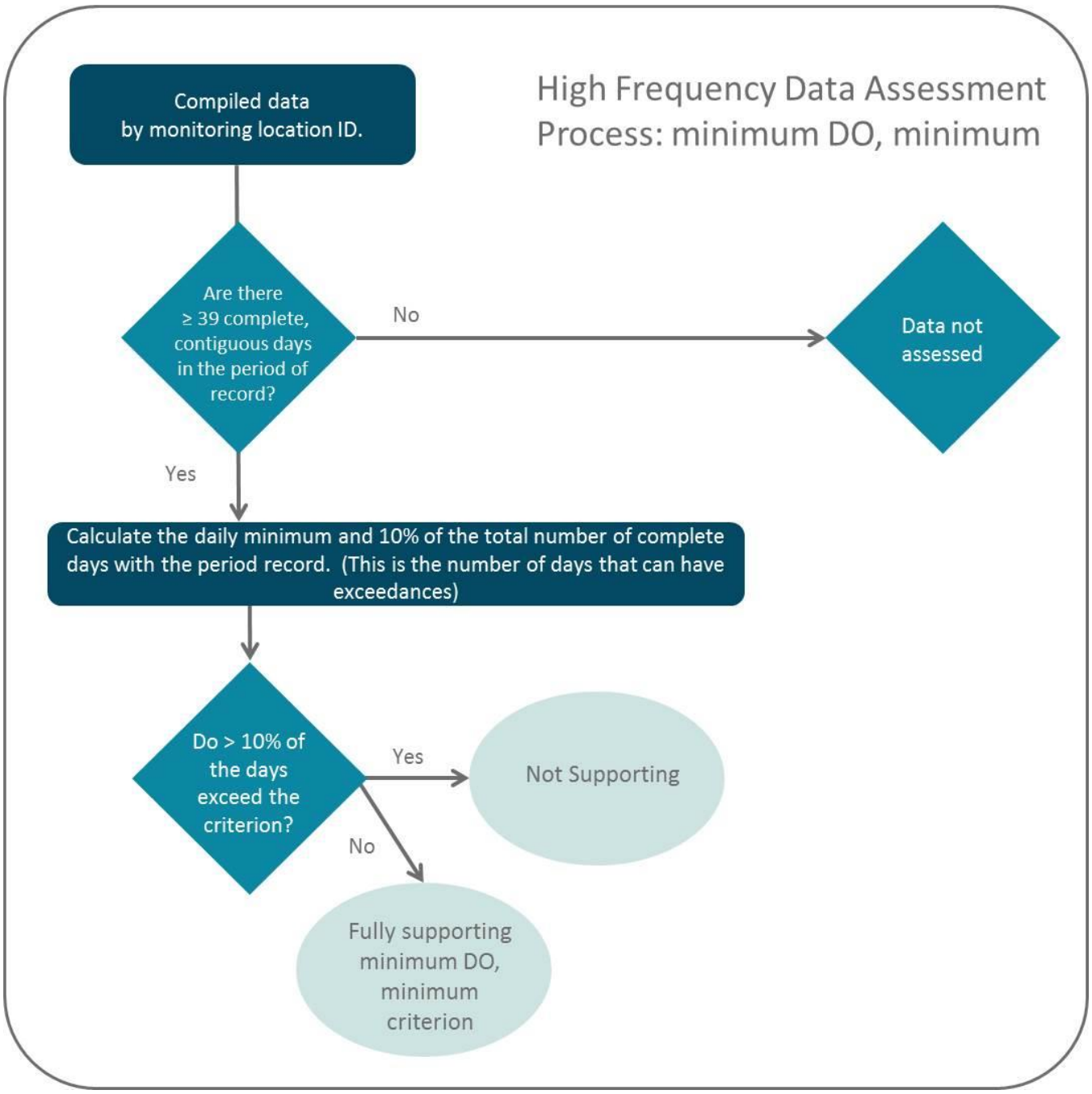

Figure 3. Overview of the assessment process for the minimum dissolved oxygen, minimum using high frequency data.

A site is considered to be not attaining the 7-day average criterion if more than 10% of the 7-day averages within the period of record are below the applicable standard. For example, in a dataset containing 50 contiguous complete days, a total of 44 unique 7-day averages are calculated. The site is considered not attaining if greater than 5 7-day averages are below the criterion (see Figure 4).

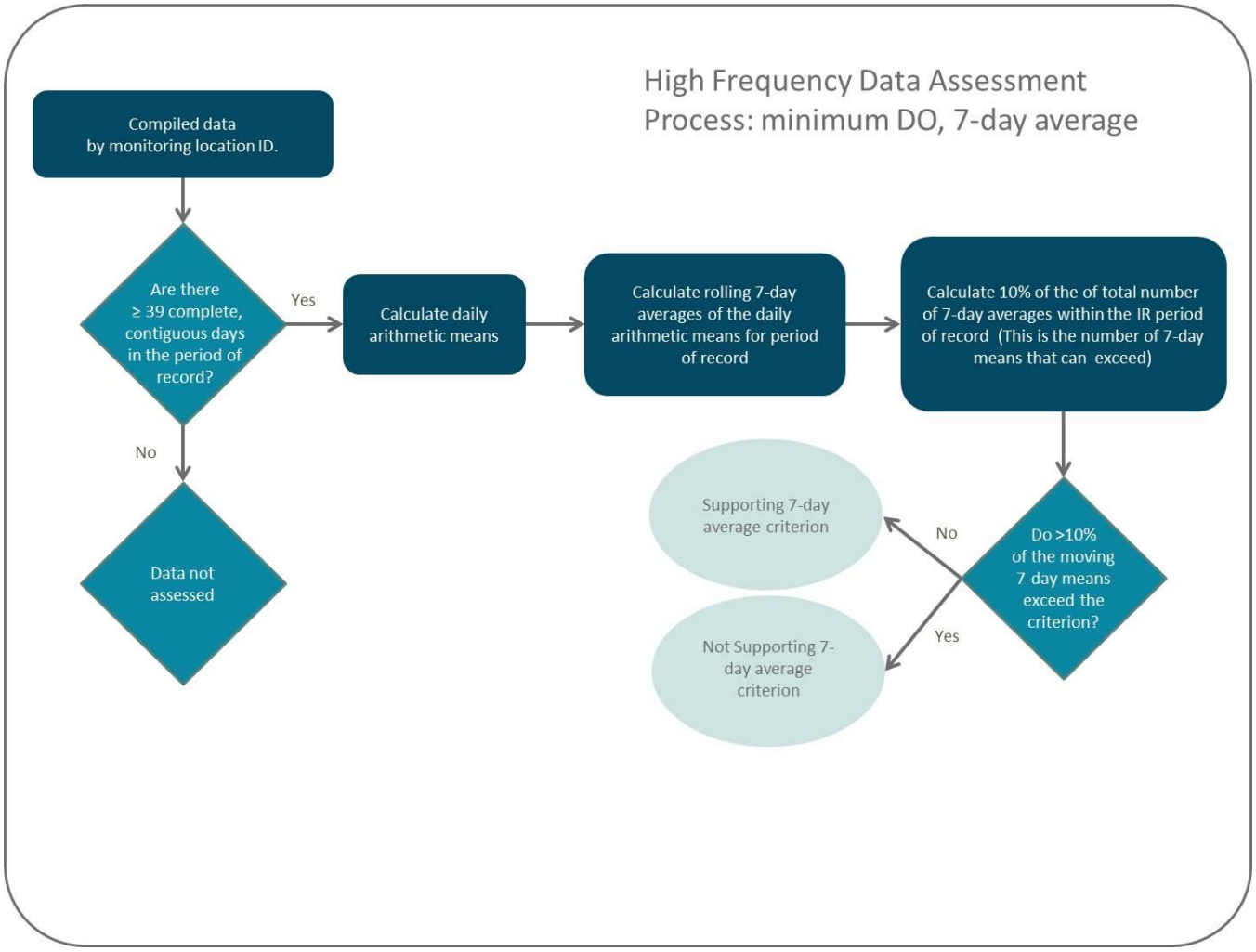

Figure 4. Overview of the assessment process for the minimum dissolved oxygen, 7-day averages using high frequency data.

A site is considered to be not attaining the 30-day average criterion if greater than 10% of the 30-day averages within the period of record are below the applicable standard. For example, in a dataset containing 50 contiguous complete days, a total of 21 unique 30-day averages are calculated. The site is considered not attaining if greater than 3 30-day averages are below the criterion (see Figure 5).

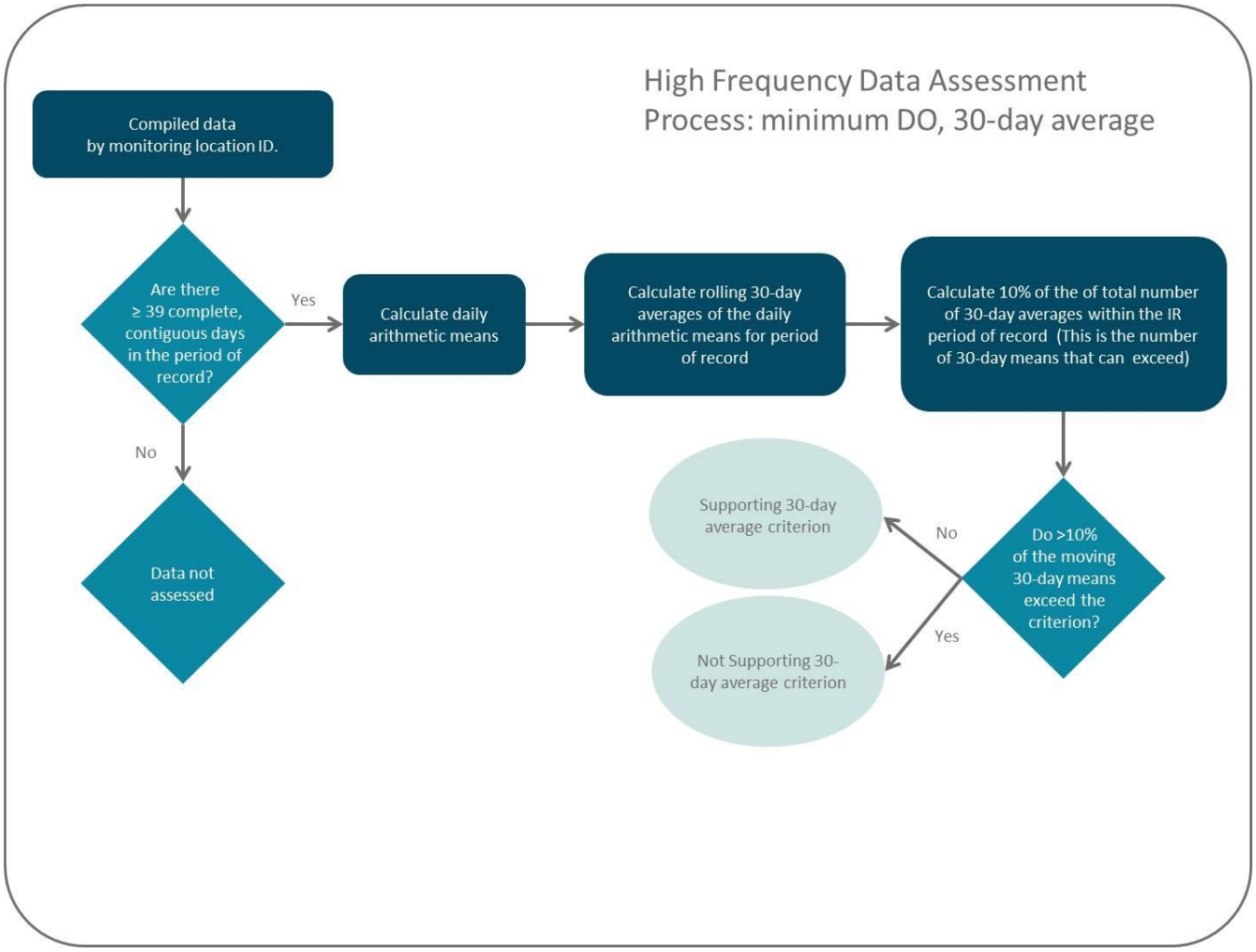

Figure 5. Overview of the assessment process for the minimum dissolved oxygen, 30-day averages using high frequency data.

A site is considered not supporting if it is not attaining either of daily minimum, 7-day average, or 30-day average criteria. A site is considered fully supporting if less than 10% violation is observed for all three criteria.

This process (Figure 3 - Figure 5) is repeated until each beneficial use has been assessed.

Analyzing Multiple DO Datasets at a Site

During the initial assessment of DO at a site, DWQ assesses grab and high frequency independently of each other. During the secondary reviews of determining impairment, DWQ reviews these assessments in context of one another. These processes are discussed in greater detail in Determinations of Impairment: All Assessment Units.

NARRATIVE STANDARDS: BIOLOGICAL ASSESSMENTS

Utah's beneficial uses for aquatic life require the protection of fish (cold water or warm water species) and the organisms on which they depend (UAC R317-2-6.3). Historically, DWQ assessed these beneficial uses using water chemistry sampling and associated standards that are protective of aquatic organisms. Now, DWQ uses an empirical model that directly assesses attainment of aquatic life uses by quantifying the integrity of

macroinvertebrate assemblages. Measuring biological communities directly has the advantage of integrating the combined effects of all pollutants, which allows a direct examination of how pollutants are interacting to affect the condition of a stream ecosystem (Karr, 1981). Moreover, because aquatic macroinvertebrates spend most of their life in aqueous environments, they are capable of integrating the effects of stressors over time, providing a measure of past and transient conditions (Karr and Dudley, 1981).

Biological assessments are often conducted by comparing the biological assemblage observed at a site with the expected biological assemblage in the absence of human-caused disturbance. Ideally, these comparisons are made using historical data to measure changes to the current biological community. However, in most cases, historical data are not available. As a result, biological conditions representing an absence of human-caused stress are typically set using reference sites as controls, or benchmarks, to establish the biological condition expected in the absence of human-caused disturbance. The biological integrity of sites can be evaluated by comparing the biological composition observed at a site against a subset of ecologically similar reference sites. Collectively, such comparisons are referred to as biological assessments.

In aquatic biological assessments, reference sites are selected to represent the best available condition for waterbodies with similar ecological, physical, and geographical characteristics (Hughes et al., 1986; Suplee et al., 2005; Western Center for Monitoring and Assessment of Freshwater Ecosystems website). When reference sites are selected for water quality programs, conditions vary regionally depending on adjacent historical land use. For example, reference sites in Utah mountains are generally more pristine than in valleys. As a result, there are more biological benchmarks in areas of the state that receive less human-made disturbance than those with more disturbances.

A numeric index is a useful tool that quantifies the biological integrity, or biological beneficial use, of stream and river segments. Data obtained from biological collections are complex, with hundreds of species found throughout Utah that vary both spatially and temporally. Similarly, the physical template on which biota depends also varies considerably across streams. A robust index of biological integrity should simultaneously account for naturally occurring physical and biological variability and summarize these conditions through a single, easily interpretable number (Hawkins, 2006; Hawkins et al., 2010).

River Invertebrate Prediction and Classification System Models

DWQ uses the River Invertebrate Prediction and Classification System (RIVPACS) model approach to quantify biological integrity (Wright, 1995). RIVPACS is a classification of freshwater sites based on macroinvertebrate fauna. It was first derived in 1977 and has subsequently been used in numerous biological assessment programs worldwide. In the early 1970s, scientists and water managers recognized a need to understand the links between the ecology of running waters and macroinvertebrate communities. This began some of the very early biological assessment work in Europe. A 4-year project was initiated to create a biological classification of unpolluted running waters in Great Britain based on the macroinvertebrate fauna (Clarke et al., 1996; Furse et al., 1984; Moss et al., 1999; Wright, 1995).

Over the past 30 years, equivalent RIVPACS models have been developed for aquatic ecosystems throughout the world, including Australia (Davies et al., 2000; Marchant and Hehir, 2002; Metzeling et al., 2002) and Indonesia (Sudaryanti et al., 2001). In the United States, scientists have developed RIVPACS models to assess the biological integrity of the country's aquatic habitats (Hawkins et al., 2000; Hawkins and Carlisle, 2001). Recently, many western states have adopted the RIVPACS model to determine beneficial uses of aquatic life in the rivers of state's such as Colorado (Paul et al., 2005), Montana (Feldman, 2006; Jessup et al., 2006), and Wyoming (Hargett et al., 2005).

To quantify biological condition, RIVPACS models compare the list of taxa (the lowest practical taxonomic resolution to which taxonomic groups are identified) that are observed (O) at a site to the list of taxa expected (E) in the absence of human-caused stress. Predictions of E are obtained empirically from reference sites that

together are assumed to encompass the range of ecological variability observed among streams in the region where the model was developed. In practice, these data are expressed as the ratio O/E, the index of biological integrity (Figure 6).

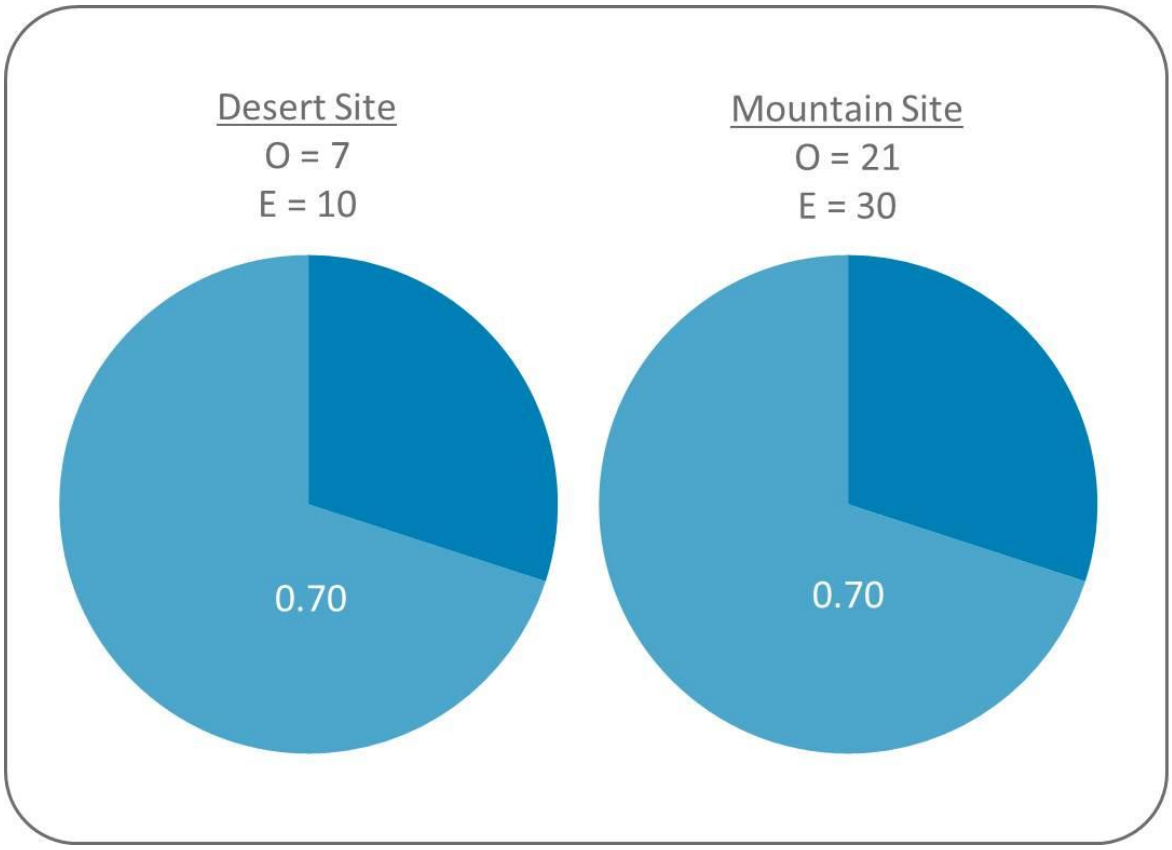

Figure 6. A hypothetical example of O/E as a standardization of biological assessments.

Interpretation of RIVPACS models requires an understanding of the O/E ratio. In practice, O/E quantifies loss of predicted taxa. However, it is not a measure of raw taxa richness because O is constrained to include only those taxa that the model predicted to occur at a site. The fact that O/E only measures losses of native taxa is an important distinction, because the stream ecological template changes in response to disturbance, and taxa richness can actually increase as conditions become more advantageous to taxa that are more tolerant of the degraded condition (Hawkins and Carlisle, 2001; Hawkins, 2006; Hawkins et al., 2010). Despite the mathematical complexities of model development, O/E is easily interpreted because it simply represents the extent to which taxa are missing as a result of human activities. For example, an O/E ratio of 0.40 implies that, on average, 60% of the taxa are missing as a result of human-caused alterations to the stream.

O/E has some very useful properties as an index of biological condition. First, it has an intuitive biological meaning. Species diversity is considered the ecological capital on which ecosystem processes depend; therefore, O/E can be easily interpreted by researchers, managers, policy-makers, and the public. Second, O/E is universally spatial, which allows direct and meaningful comparison throughout the state on a site-specific scale. This is particularly important for Utah, where streams vary considerably from high-altitude mountain environments to the arid desert regions. Third, its derivation and interpretation do not require knowledge of stressors in the region; it is simply a biological measuring tool. Finally, the value of O/E provides a quantitative measure of biological condition.

Model Construction and Performance

Construction of a RIVPACS model for Utah began in 2002, which involved developing and evaluating dozens of models. Details of model development procedures can be found elsewhere (Clarke et al., 1996; Moss et al. 1999; Wright et al., 1993; Wright 1995). Additionally, specific detailed instructions can be viewed on the Western Center for Monitoring and Assessment of Freshwater Ecosystems website and the EPA website. A brief summary is provided here to help the reader better understand Utah's model results and subsequent assessments.

Predictions of expected "E" taxa are obtained empirically from reference site collections made throughout Utah. Reference sites are those that represent the reference conditions in different biogeographical settings throughout Utah. The initial list of candidate reference sites is independently ranked by different scientists familiar with the waterbodies. Only reference sites with a consensus representing best available conditions are used in model development. Subsequent reference sites are added using scores from reference scoring metrics developed during site visits and averaging with independent rankings from field scientists.

Some of the calculations involved in obtaining the list of expected taxa are complex. A heuristic description of the steps involved in predicting "E" provides some context of the Assessment Methods. The first step in model development is to classify reference sites into groups of sites with similar taxonomic composition using a cluster analysis. Next, models are developed based on watershed descriptors such as climatic setting, soil characteristics, and stream size to generate equations that predict the probability of a new site falling within each group of reference sites. These equations account for environmental heterogeneity and ensure that when a new site is assessed, it is compared against ecologically similar reference sites. When a new site is assessed, predictions of group membership are then coupled to the distributions of taxa across groups of reference sites to estimate the probability of capturing (Pc) each taxon from the regional pool of all taxa found across all reference sites. E is then calculated as the sum of all taxa Pcs that had a greater than 50% chance of occurring at a site given the site's specific environmental characteristics. Using a Pc limit set at greater than 50% typically results in models that are more sensitive and precise, which results in a better ability to detect biological stress (Hawkins et al., 2000; Simpson and Norris, 2000; Ostermiller and Hawkins, 2004; Hawkins, 2006; Van Sickle et al., 2007, Hawkins et al., 2015; Hawkins and Yuan, 2016; Mazor et al., 2016).

The accuracy and precision of RIVPACS models depend in part on the ability of the models to discriminate among groups of biologically similar reference sites. An extensive list of 74 GIS-based watershed descriptors is evaluated for potential predictor variables in models that predict the probability of membership within biological groups for sites not used in model construction. Site-specific, GIS-based predictor variables, such as soils, meteorology, and geography, instead of field-derived descriptors, are evaluated for a couple of reasons. First, GIS-based descriptors are unlikely to be influenced by human disturbance and are therefore unlikely to bias estimates of expected conditions (Hawkins, 2004). Second, these predictors are easily obtained for any location, on a site-specific basis, that allows inclusion of additional macroinvertebrate samples collected by others. Various subsets of potential predictors are evaluated in an iterative, analytical process that explores different combinations of predictors able to explain the biological variability among reference sites. The current RIVPACS model used by DWQ includes 15 variables that resulted in the most precisely predictive model (Table 12).

Table 12. Final predictor variables used in model construction.

General Category	Description
Geography	Mean watershed elevation (meters) from National Elevation Dataset.
Geography	Minimum watershed elevation (meters) from National Elevation Dataset.
Geography	Watershed area in square kilometers.
Geography	Latitude of the sample location.
Climate	Watershed average of the mean day of year (1–365) of the first freeze derived from the PRISM data.

General Category	Description
Climate	Watershed average of the annual mean of the predicted mean monthly precipitation (millimeters) derived from the PRISM data.
Climate	Watershed average of the annual maximum of the predicted mean monthly precipitation (millimeters) derived from the PRISM data.
Climate	Watershed average of the annual mean of the predicted mean monthly air temperature derived from PRISM data.
Climate	Average of the annual mean of the predicted maximum monthly air temperature at the sample location derived from PRISM data.
Climate	Watershed average of the annual mean of the predicted maximum monthly air temperature derived from PRISM data.
Climate	Watershed average of the annual mean of the predicted minimum monthly air temperature derived from PRISM data.
Climate	Watershed average of the annual mean of the predicted mean monthly relative humidity derived from PRISM data.
Climate	Average of the annual mean of the predicted mean monthly air temperature at the sample location derived from PRISM data
Climate	Watershed maximum of mean 1961–1990 annual number of wet days.
Vegetation	Watershed maximum of mean 2000–2009 annual enhanced vegetation index.

The RIVPACS model used for the current assessments was reconstructed to accommodate broader spatial and temporal data. Models used earlier were limited to samples from streams ranging from second to fifth order and were collected during a 'fall' window of September–November. The updated model accepts data collected from first- to eighth-plus- order rivers and streams with no limitations on season of collection. In addition, new predictor variables were tested, and new and updated reference site data were included. However, to include data collected from agencies using different taxonomic laboratories, the taxon levels required adjustment, which resulted in a more coarse resolution of taxonomy. However, the resulting model was capable of scoring nearly 1,800 samples collected across the state by various agencies.

The updated model is nearly as accurate and precise as previous models. If the model was perfectly accurate and precise, the O/E score for all reference sites would equal 1. Instead, reference O/E values are typically spread in a roughly normal distribution centered on 1 (Wright, 1995). Model precision is often expressed as the standard deviation (SD) of reference O/E values with lower SDs indicating higher model precision. The RIVPACS model to be used for the current IR assessments has an SD of 0.19, which is within the range of "accepted" water quality models. The precision was likely affected by the more coarse resolution of taxonomy and the inclusion of a few large river sites as reference. The average reference O/E score for the current model is 1.00, which means that the model has high precision calculating O/E values. The accuracy of the model was evaluated by examining the distribution of reference O/E scores across environmental settings and determined that reference O/E values are not biased by stream size, elevation, or ecoregion.

Assessing Biological Use Support

DWQ does not have numeric biological criteria. However, DWQ has narrative biological criteria (UAC R317-2-7.3) that specify how quantitative model outputs are used to guide assessments. To make the narrative assessments as rigorous as possible, a systematic procedure was devised to use the RIVPACS model O/E values to determine

aquatic life beneficial use support (Figure 7). The goal of this assessment process is to characterize each AU as fully supporting or not supporting aquatic life beneficial uses.

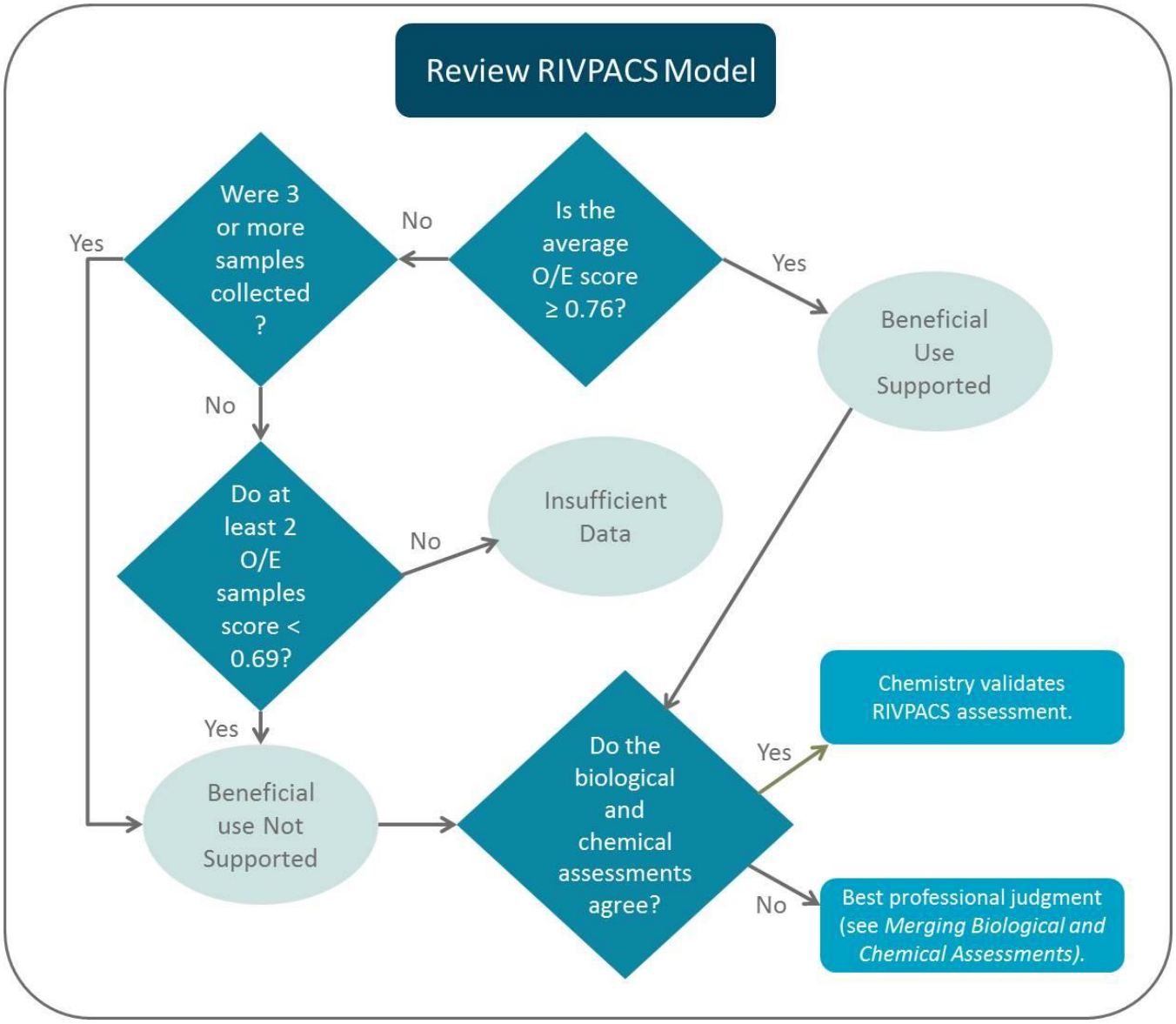

Figure 7. Decision tree for making biological assessment decisions.

Utah currently assesses watersheds based on established AUs. Although many AUs contain a single biological monitoring location, some AUs contain multiple sites. In such instances, DWQ staff examines available data to determine if multiple sites in an AU score similarly. When comparisons suggest that sites in one AU are ecologically similar, O/E scores from all sites in an AU are averaged for assessment purposes, provided that conclusions of biological condition are similar. If O/E scores differ appreciably among multiple sites in an AU, DWQ will investigate possible explanations for such discrepancies (see the Assessment Unit Re-segmentation discussion for more information on that process). Additionally, if only one site is sampled in an AU, it is examined to determine whether it is an appropriate representation of the AU.

To translate the O/E values into assessment categories, it is necessary to devise thresholds, or O/E scores that indicate whether or not a site is meeting biological beneficial uses (Table 13). For these assessments, the 10th and 5th percentiles of reference sites were used. Essentially, the data used for the current assessment calculate

the threshold based on 5th percentile at 0.69, whereas the 10th percentile is 0.76. These thresholds will provide the bounds according to sample strength. The data will be averaged across 8 years since the most recent year of available data. Multiple years are preferred for assessments because O/E scores can vary from year to year and assessments are based on average conditions. Assessments based on the average condition of three or more samples reduce the probability of making an error of biological beneficial-use support as a result of an unusual sampling event (e.g., following a flash flood, an improperly preserved sample).

Table 13. Beneficial use support determination for O/E values obtained from different sample sizes.

Sample Size	O/E Threshold	Use Determination	Comments
≥ 1 sample collected over 8 years	Mean O/E score ≥ 0.76	Fully Supporting	Threshold based on 10th percentile of reference sites.
≥ 3 samples collected over 8 years	Mean O/E score < 0.76	Not supporting	Threshold based on 10th percentile of reference sites.
< 3 samples	Mean O/E score ≥ 0.76	Fully supporting	Threshold based on 10th percentile of reference sites.
< 3 samples	Mean O/E score ≥ 0.69–≤ 0.76	Insufficient Data	Lower threshold based on 5th percentile of reference sites.
< 3 samples	2 O/E scores < 0.69	Not Supporting	Threshold based on 5th percentile of reference sites
< 3 samples	< 2 O/E scores < 0.69	Insufficient Data	Threshold based on 5th percentile of reference sites

AUs not meeting biological thresholds will be assessed as non-supporting. Assessments of more than three samples with average O/E scores of greater than or equal to 0.76 have a low probability of being misclassified as nonsupport. Alternatively, assessments with fewer than three samples with an average O/E score of less than 0.69 have a 5% probability of being misclassified as nonsupport. To ensure that one sample was not incorrectly misapplied, at least two samples with a score of 0.69 or less will be required to consider an AU not meeting the aquatic life use. Assessments with fewer than three samples that have a mean O/E score of greater than or equal to 0.69 and less than 0.76 will be placed in Category 3 (insufficient data and information with exceedances), which indicates that there are insufficient data to make an assessment. All sites listed as Category 3 with exceedances will be given a high priority for future biological monitoring.

Assessments Specific to Lakes, Reservoirs, and Ponds

ASSESSMENT OVERVIEW

Lakes, reservoirs, and ponds are defined in UAC R317-2-13.12 by county along with the designated beneficial uses for which they are protected. Waterbodies not specifically listed are assigned beneficial uses by default to the classification(s) of the tributary stream(s). In UAC R317-2-14, numeric water quality criteria for both toxic and conventional parameters are assigned for each designated use. Deeper lakes naturally stratify thermally, which affects how conventional water quality parameters are assessed (UAC R317-2-14). Therefore, each waterbody is evaluated for thermal stratification and assessed appropriately.

The assessment of Utah lakes and reservoirs consists of two tiers:

- **Tier 1**: The tier I assessment is the preliminary determination of support status for recreational use (Class 2), aquatic life (Class 3), and agricultural (Class 4) classes based on conventional parameters, such as DO, temperature, pH, toxic parameters, and E. coli. When Tier I data are not available, DWQ may rely on Tier II data to make an initial assessment. When considering Aquatic Life Use attainment within this tier, the waterbody will be classified as mixed or stratified based on the depth profile information. If it is a stratified waterbody, the evaluation of conventional parameters will follow the protocol designed to evaluate the sufficiency of aquatic life habitat. If the waterbody is mixed, it will follow the assessment protocol that evaluates the entire depth profile.
- **Tier II**: The tier II assessment looks further into the weight of evidence criteria (trophic state index [TSI], fish kills, and algal composition) using secondary reviews. The Tier I preliminary support status may be modified through an evaluation of the TSI, water quality–related fish kills, and the composition and abundance of blue-green algae. The Tier II evaluation could adjust the preliminary support status ranking if at least two of the three criteria indicate a different support status.

TIER I ASSESSMENT

Drinking Water Use Support

Drinking Water Use support is assessed by evaluations of pH, toxics, E. coli, and harmful algal blooms (HABs). For further information regarding drinking water use assessments for Toxics, E. Coli and HABs, please review the Toxics Parameter Assessments for All Waters, Escherichia Coli Assessment for All Waters, and Harmful Algal Blooms (HAB) assessment sections. The evaluation process of pH is the same as the requirements for Aquatic Life Uses, which are described in the second paragraph below.

Recreational Use Support

Assessing for Recreational Use support involves evaluations of pH, E. coli, and harmful algal blooms. The evaluation of pH is the same as the requirements for Aquatic Life Uses, which are described in the paragraph below. For further information regarding recreational use assessments for E. Coli and HABs, please review the Escherichia Coli Assessment for All Waters and Harmful Algal Blooms (HAB) assessment sections.

Aquatic Life Use Support

Lake monitoring routinely involves collecting pH, temperature, and DO measurements at approximately1-meter intervals throughout the water column, from the surface to the lake bottom (note that the measurement interval may be modified in the field depending on waterbody depth). These water column measurements are compared against Utah water quality standards to assess beneficial use support (Figure 8). For waterbodies that are

thermally stratified, a separate process is used to determine whether sufficient habitat is available for aquatic life (Figure 9).

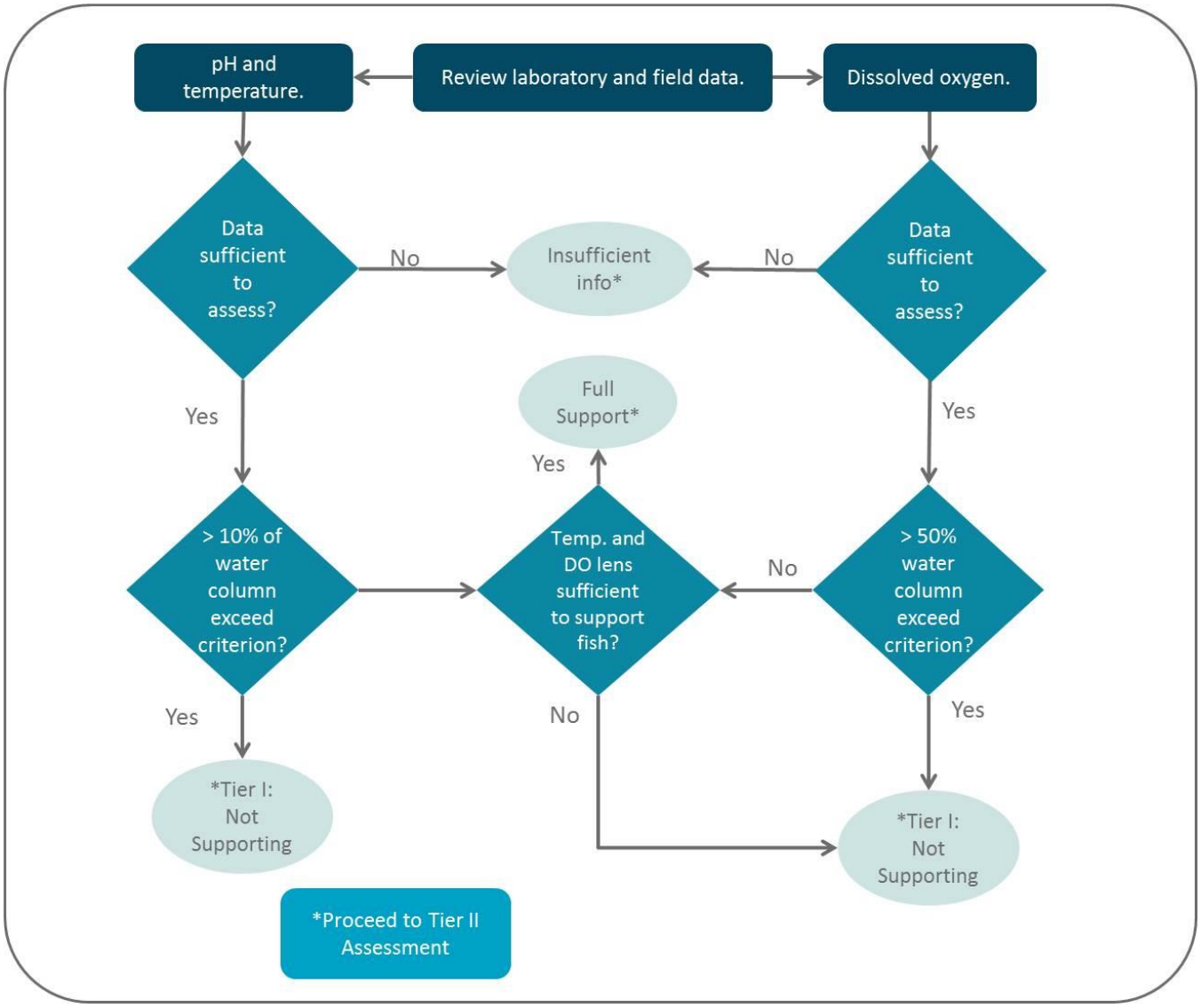

Figure 8. Process using conventional (nontoxic) parameters to assess lakes that are mixed.

Mixed Lakes and Reservoirs

pH

Beneficial Use Supported

The beneficial use is supported if the number of violations are less than or equal to 10% of the measurements (see Figure 9, Panel A).

Beneficial Use Not Supported

The beneficial use is not supported if greater than 10% of the measurements (minimum of two discrete measures outside thresholds) violate the pH criterion (Figure 9, Panel B).

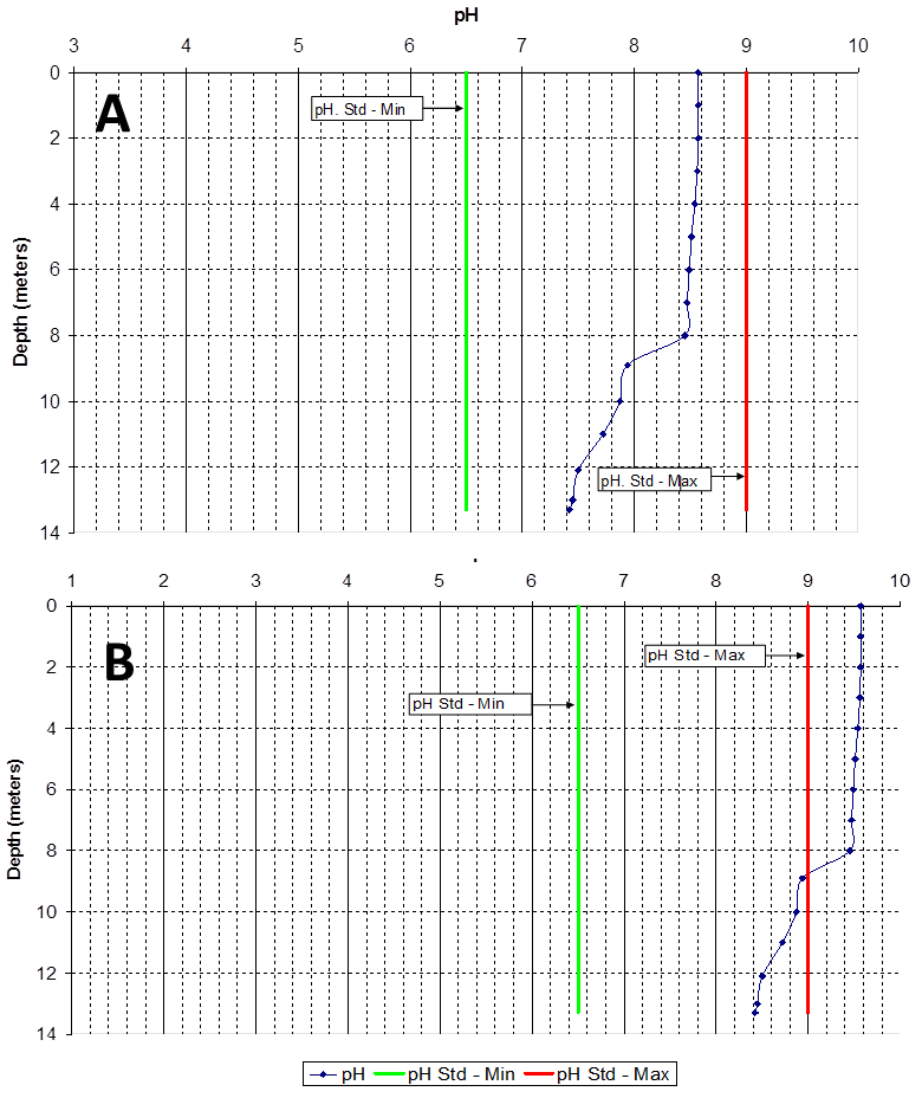

Figure 9. Plots of pH measurements (blue dots) against lake depth for a waterbody meeting (Panel A) and violating (Panel B) the pH water quality standards.

Temperature

The criteria used to assess the beneficial use support are based on profile data. If the temperature criterion is exceeded in more than 10% of the measurements with a minimum of two discrete measures exceeding criteria from any individual sampling event, the site is considered to be not supporting the aquatic life uses.

Beneficial Use Fully Supported

The beneficial use is supported if the number of violations is less than or equal to 10% of the measurements (see Figure 10, Panel A).

Beneficial Use Not Supported

The beneficial use is not supported if more than 10% of the measurements violate the temperature standard (see Figure 10, Panel B).

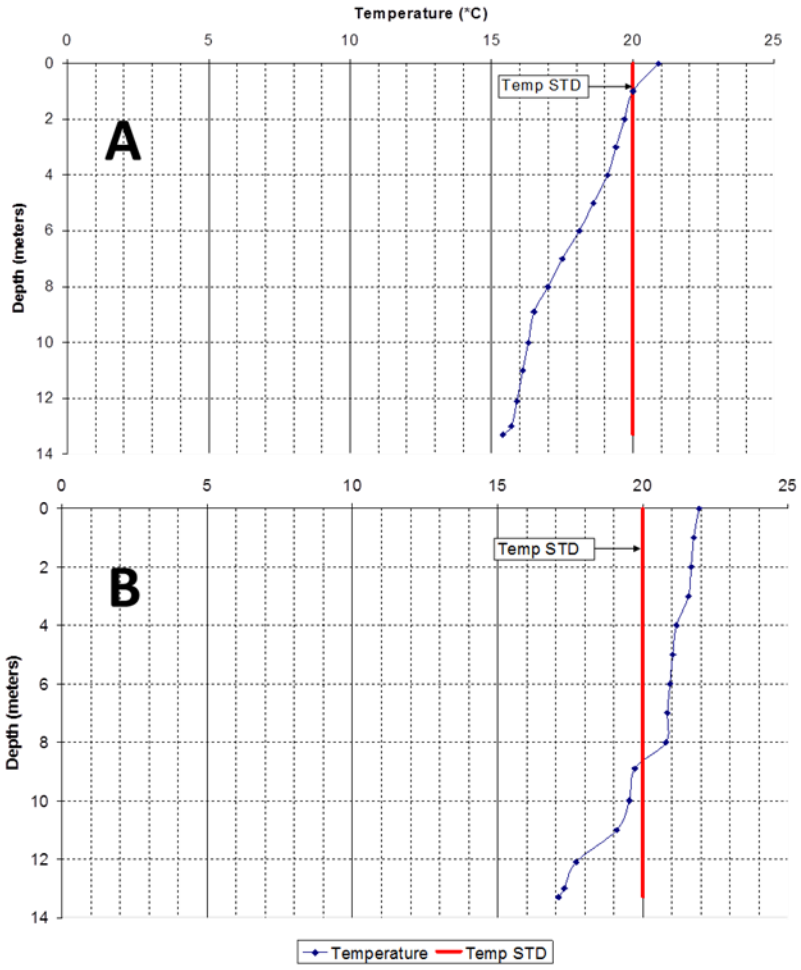

Figure 10. Plots of temperature measurements (blue dots) against lake depth for two sites to provide an example of assessment procedures. Note: The red line illustrates a temperature criterion of 20 degrees Celsius: Class 3A beneficial use. Panel A (top) illustrates a site meeting the beneficial use because less than 10% of the temperature measures are greater than the criterion, whereas Panel B (bottom) illustrates a site not meeting the beneficial use because greater than 10% of the temperature measures exceed the criterion.

Dissolved Oxygen

Like the temperature assessment, the DO assessment uses data that are gathered from profiles. The DO assessment uses the minimum criteria of 4.0 mg/l for Class 3A waters and 3.0 mg/l for Class 3B and 3C waters (UAC R317-2-14, Table 2.14.2). State standards account for anoxic or low DO conditions that may exist in the bottoms of deep waterbodies (UAC R317-2-14). For that reason, DO assessments for stratified lakes and reservoirs follow the stratified lakes and reservoirs assessment methods below:

Beneficial Use Supported

The beneficial use is supported if at least 90% of the oxygen measurements are greater than the standard.

Beneficial Use Not Supported

The beneficial use is not supported if greater than 10% of the oxygen measurements are below the DO standard during any single sampling event.

Temperature and Dissolved Oxygen: Aquatic Life Use Assessment

When sample locations demonstrate stratification, a separate assessment technique for temperature and DO is used to ensure that sufficient habitat for aquatic life exists. Habitat is considered sufficient if at least 3 continuous meters of the water column are meeting the criteria for both temperature and DO. The rationale for a conclusion of beneficial use support based on the existence of adequate habitat follows the decision diagram (Figure 11). Figure 12 provides an example of supporting and not supporting the beneficial use based on the DO and temperature data above the thermocline.

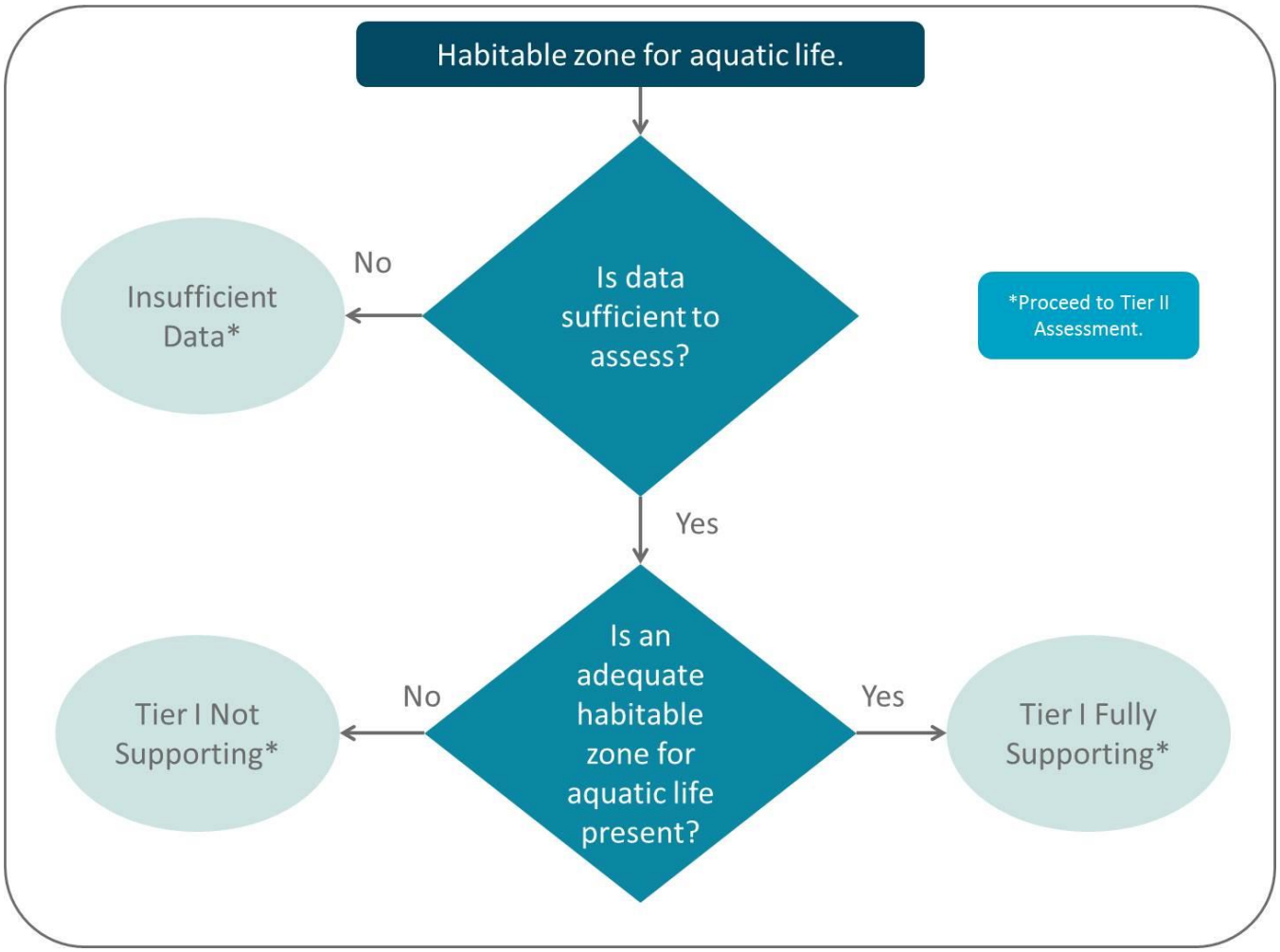

Figure 11. Beneficial use support based on the existence of adequate habitat.

Beneficial Use Supported

The beneficial use is supported if there is sufficient habitat, defined as 3 continuous meters of the water column meeting the criteria for both temperature and DO.

Beneficial Use Not Supported

The beneficial use is not supported if there is insufficient habitat for aquatic life based on DO and temperature profile.

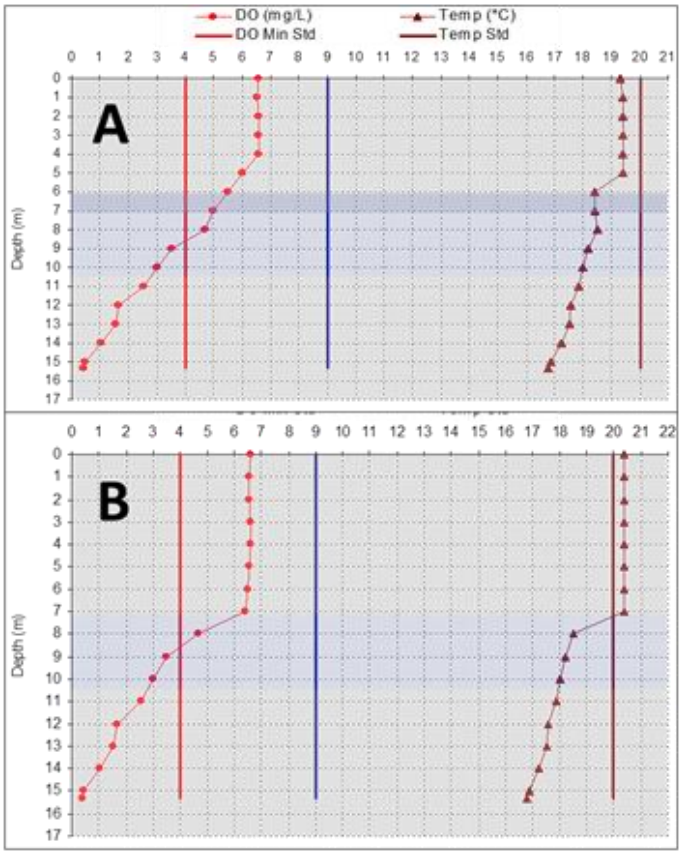

Figure 12. Concept of the habitable zone where both DO and temperature are suitable for aquatic life.

The site depicted on the top (Figure 12, Panel A) would be considered supporting because the lens where both temperature and DO provide sufficient habitat. Conversely, the site on the bottom is not meeting aquatic life uses because the habitable zone is minimal.

Total Dissolved Solids: Agricultural Use Support

The following rules are used to determine whether a lake is supporting its agricultural beneficial use (Figure 13):

Beneficial Use Supported

The beneficial use is supported if the standard is exceeded in 10% or fewer of TDS samples.

Beneficial Use Not Supported

The beneficial use is not supported if the TDS standard is exceeded in more than 10% of TDS samples.

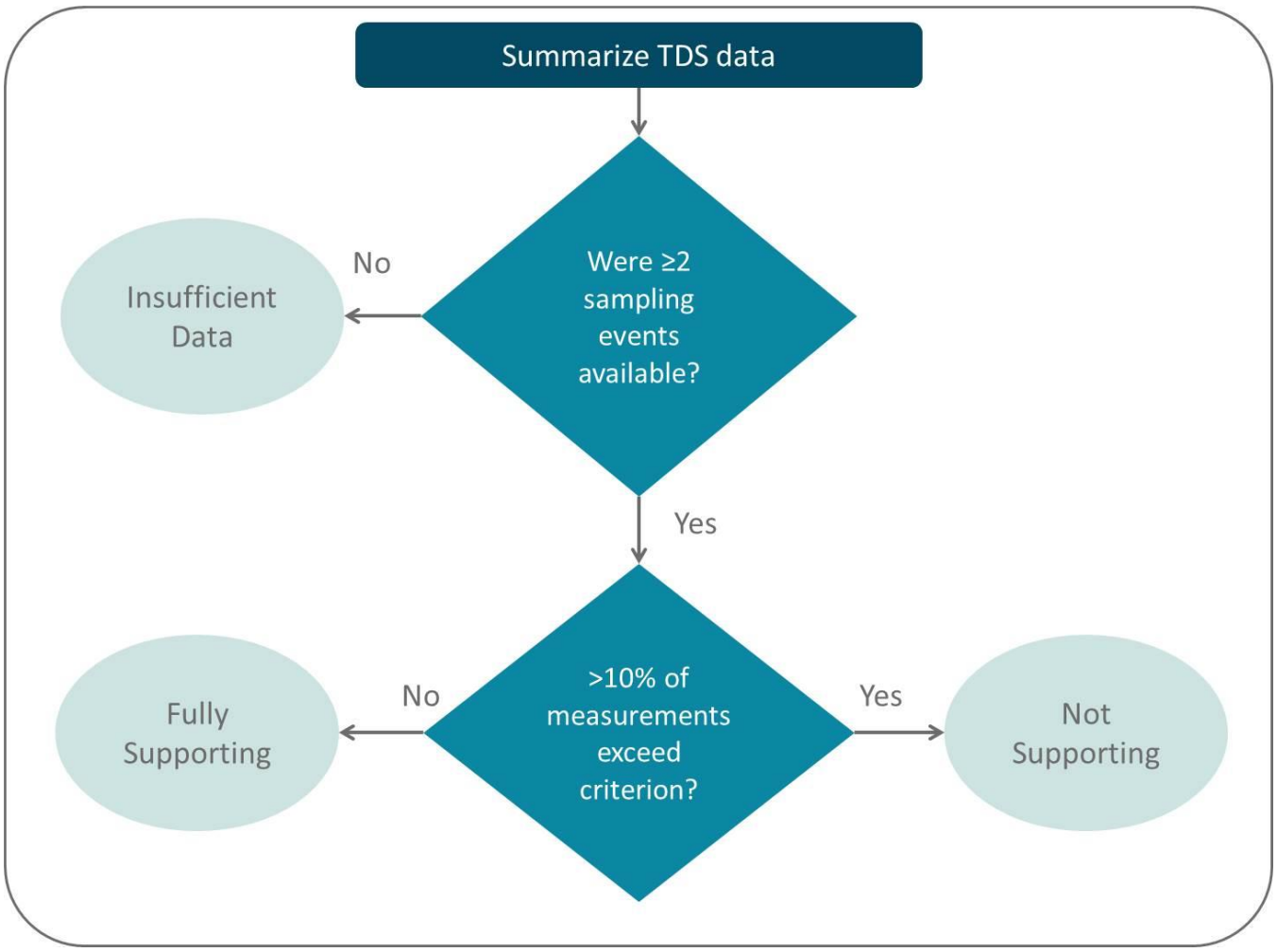

Figure 13. Assessment process to determine support of the agricultural beneficial use with TDS data.

TIER II ASSESSMENT

Weight of Evidence Criteria

The weight of evidence criteria allows DWQ to use key lines of evidence in assessing a waterbody's use support including evaluations of Utah's narrative standard.

The weight of evidence evaluation consists of three components:

- Increasing trophic state index (TSI) trend over the long term (approximately 10 years) or a TSI-Chl-a greater than 50 (see Carlson's Trophic State Index section below for more information).
- The observation of water quality–based fish kills (see the Narrative Standards for All Waters for more information) or winter DO measures not meeting the criterion when measured.
- Evaluation of phytoplankton community.

These three components are evaluated following Figure 14.

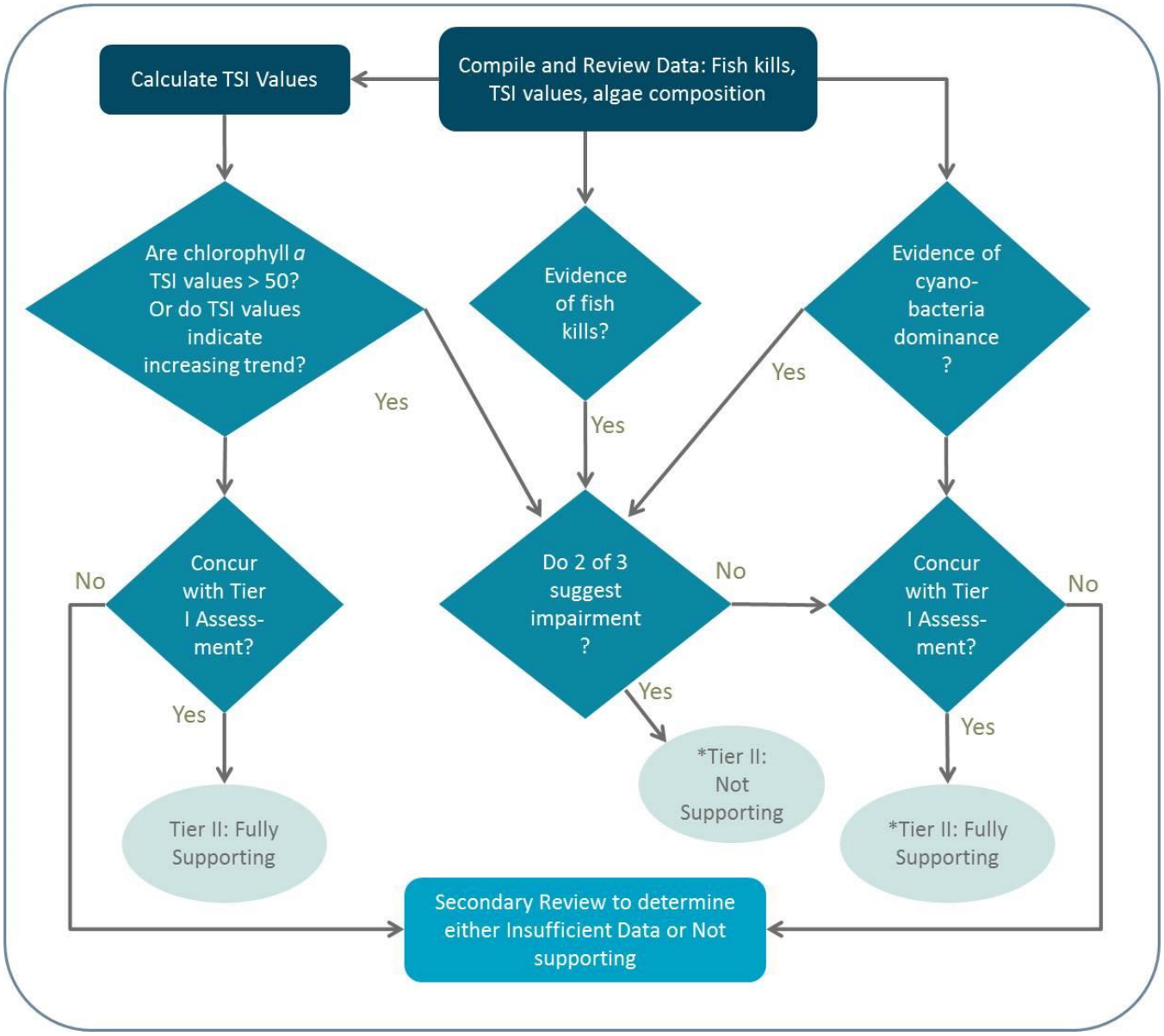

Figure 14. Tier II assessment process for lakes, reservoirs, and ponds.

Carlson's Trophic State Index

The Carlson's TSI is calculated using Secchi disk transparency, total phosphorus, and chlorophyll a. TSI value ranges from 0 to about 100, with increasing values indicating a more eutrophic condition, as follows (Table 14).

Carlson's TSI estimates are calculated using the following equations:

- Trophic Status Based on Secchi Disk (TSI-SDD): TSI-SDD = 60 - 14.41 ln (SDD), where SDD = Secchi disk transparency in meters. The abbreviation "ln" indicates the natural logarithm.
- Trophic Status Based on Total Phosphorus (TSI-TP): TSI-TP = 14.20 ln (TP) + 4.15, where TP = total phosphorus concentration in µg/l.
- Trophic Status Based on Chlorophyll a (TSI-Chl-a): TSI-Chl-a = 9.81 ln (Chl-a) + 30.60, where Chl-a = chlorophyll a concentrations in µg/l.

Once calculated, these independent TSI indicators can be used to interpret how various factors interact to influence lake production (see Table 14, **Error! Reference source not found.**).

Table 14. Relationships between TSI values and suggested interpretations (from Carlson and Havens 2005).

TSI Relationship	Suggested interpretation
TSI (Chl-a) = TSI (SDD)	Algae dominate light attenuation.
TSI (SDD) = TSI (Chl-a) ≥ TSI (TP)	Phosphorus limits algal biomass, and algae dominate light attenuation.
TSI (TP) > TSI (Chl-a) = TSI (SDD)	Some factor other than phosphorus (zooplankton grazing, nitrogen, etc.) limits algal biomass.
TSI (Chl-a) < TSI (SDD)	Small particles, not necessarily related to algae, dominate light attenuation
TSI (TP) = TSI (SDD) > TSI (Chl-a)	Non algal particulate matter dominates light attenuation. Particles contain phosphorus, but do not contain chlorophyll.
TSI (SDD) > TSI (Chl-a) = TSI (TP)	Dissolved color affects transparency but not chlorophyll or total phosphorus concentrations.
TSI (TP) > TSI (SDD) > TSI (Chl-a)	Zooplankton grazing Has reduced the number of smaller particles, leaving larger particles. Biomass has been reduced below levels predicted from total phosphorus.
TSI (Chl-a) > TSI (SDD)	Large phosphorus-containing particulates dominate.
TSI (Chl-a) = TSI (TP) >> TSI (SDD)	Large chlorophyll-containing particulates, such as Aphanizomenon flakes, dominate.

TSIs are calculated independently for each indicator (i.e., Secchi disk, chlorophyll a, and total phosphorus) and are not averaged. Chlorophyll a (TSI-Chl-a) is generally considered the most reliable indicator of trophic status, followed by Secchi disk (TSI-SDD), and total phosphorus (TSI-TP) (Carlson, 1977). In some lakes, the TSIs for each index are similar. For other lakes, significant differences may be observed. These differences can provide important insight into lake ecosystem processes and factors limiting algal growth or water clarity (Table 14, **Error! Reference source not found.**). TSI-SDD and TSI-TP are not directly used for assessment purposes, but are calculated to aid in the interpretation of a lake's trophic status and characteristics.

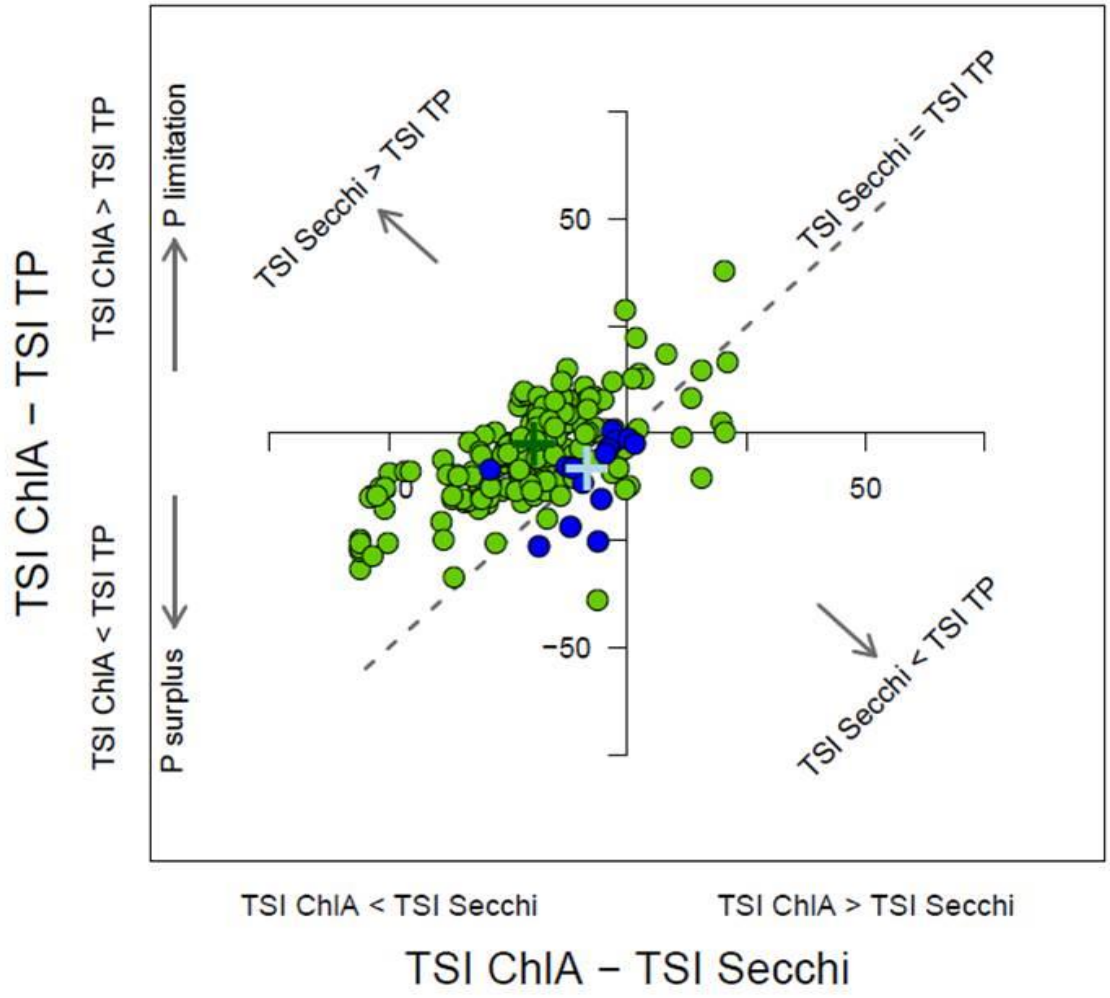

Figure 15. Graphical representation of suggested TSI difference interpretations.

Phytoplankton Community

DWQ routinely collects phytoplankton to evaluate the composition and relative abundance of algae and cyanobacteria. These data are used to identify waterbodies potentially undergoing cultural eutrophication that may negatively impact beneficial uses. Phytoplankton data are used in the Tier II assessment process because they may reflect nutrient availability and nutrient ratios. The observation that a waterbody has a diverse assemblage of diatoms or green algae relative to cyanobacteria or other potentially harmful taxa is used as a line of evidence that the waterbody is supporting its designated uses. In contrast, a phytoplankton assemblage dominated by cyanobacteria may be indicative of eutrophication, an increased potential for harmful algal blooms, and a loss of aquatic biodiversity.

GREAT SALT LAKE

GSL is assigned its own beneficial use class (Class 5) and is further divided into five subclasses (5A–5E) that represent the four main bays (Gilbert, Gunnison, Bear River, and Farmington) and transitional waters (UAC R317-2-6). The only numeric water quality criterion currently applicable to GSL is a selenium bird egg tissue criterion for Gilbert Bay (Class 5A). In addition to this criterion, the beneficial uses of GSL are protected and assessed by Utah's narrative water quality standard (UAC R317-2-7.2). The Great Salt Lake Water Quality Strategy outlines the process for monitoring and criteria development for GSL.

Gilbert Bay Bird Egg Tissue Assessment

Bird eggs are collected annually from representative locations within the Gilbert Bay AU or from Gilbert Bay adjacent transitional wetlands (UAC R317-2-6.5) during each nesting season. Selenium concentrations from eggs collected each year are assessed against the criterion in UAC R317-2-14. Gilbert Bay's beneficial use will be identified as impaired if the geometric mean of selenium concentrations from five or more eggs collected in any year exceeds the 12.5 mg/kg criterion. DWQ will identify Gilbert Bay's beneficial use as threatened and initiate preliminary TMDL studies to evaluate selenium loading sources if the geometric mean of selenium concentrations from five or more eggs collected in any year exceeds 9.8 mg/kg dry weight. If Gilbert Bay is identified as impaired for selenium, five consecutive nesting seasons meeting selenium criteria will be considered sufficient for delisting the impairment.

The Gilbert Bay selenium criterion also includes thresholds below 9.8 mg/kg that trigger management actions (Table 15). DWQ evaluates egg concentrations against these thresholds to inform management decisions, but these thresholds are not used for use attainment determinations in the IR.

Eggs are also collected as part of discharge monitoring programs for certain dischargers to GSL. Eggs collected as a part of these programs are specifically intended to characterize discharge outfall conditions and are therefore not relevant to assessing more general GSL conditions. Eggs collected under these programs are only used for evaluating discharge permits and are not used in 303(d) assessment of the GSL AUs.

Table 15. Selenium trigger levels and DWQ responses (UAC R317-2-14.2(14)).

Se concentration (mg/kg dry weight)	DWQ Response
< 5.0	Routine monitoring with sufficient intensity to determine if selenium concentrations within the Great Salt Lake ecosystem are increasing.
5.0	Increased monitoring to address data gaps, loadings, and areas of uncertainty identified from Great Salt Lake selenium studies.
6.4	Initiation of a Level II Antidegradation review by the State for all discharge permit renewals or new discharge permits to Great Salt Lake. The Level II Antidegradation review may include an analysis of loading reductions.
9.8	Declare aquatic life use as threatened. Initiate preliminary TMDL studies to evaluate selenium loading sources.
12.5	Declare aquatic life use as impaired. Formalize and implement TMDL.

Toxics Parameter Assessments for All Waters

DWQ identifies toxics as all parameters within UAC R317-2 that are not defined as conventional parameters (see Table 11 and the Lakes, Reservoirs, and Ponds Assessment section).

To ensure protection of designated uses, data are compared against one or more toxic criteria, depending on the beneficial use. For 303(d) assessment purposes, one daily measurement at each monitoring location is compared to the chronic and/or acute criteria. In lakes, DWQ targets dissolved metals sample collection to 1 meter above the bottom at the deepest site of the waterbody, as this location is the most likely to identify dissolved metal exceedances if they exist in a lake. However, where additional metals data are available for other lake locations or depths, they are also assessed following these methods. Currently, the acute and chronic averaging periods defined in UAC R317-2 are not applied for 303(d) assessment analysis because monitoring and sampling frequencies are different and more widely spaced than the acute and chronic periods typically defined in UAC R317-2.

EQUATION-BASED TOXIC PARAMETERS

A number of toxic criteria are specified as equations rather than specific values (see footnotes in UAC R317-2). The equations include variables of other chemical constituents or water properties that either reduce or magnify the extent to which a toxic is harmful to aquatic life. To properly apply the correction factor equations, it is necessary to use measured data for the variables in the equation to calculate the appropriate numeric criteria for the sample. To calculate the correct criterion for a pollutant-result value, the monitoring location site and date of sample must match between the pollutant of concern and the additional parameter(s) needed for the equation. In the case where there are missing supplemental data values to apply the equation, the following rules will be applied:

Only hardness-dependent toxics: For hardness-dependent criteria where a calcium (Ca) or magnesium (Mg) value is missing and the hardness cannot be calculated, a hardness value reported from the laboratory will be used. Data without a hardness value are removed from assessments.

- **Aluminum, chronic only**: If either a field pH or calculated or laboratory hardness is missing, the aluminum acute default value of 750 microgram per liter (µg/l) provided in Table 2.14.2 of UAC R317-2 will be applied. Otherwise, the following pH and hardness combination and numeric criteria are applied:

    a. pH ≥ 7.0 and (calculated or laboratory reported) hardness ≥ 50 parts per million (ppm): 750 µg/l.
    b. pH < 7.0 and (calculated or laboratory reported) hardness ≥ 50 ppm: 87 µg/l.
    c. pH ≥ 7.0 and (calculated or laboratory reported) hardness < 50 ppm: 87 µg/l.
    d. pH < 7.0 and (calculated or laboratory reported) hardness < 50 ppm: 87 µg/l.

- **Ammonia, chronic**: DWQ assumes fish early life stages are present at all monitoring locations and the following equation is used: ((0.0577/(1+107.688-pH)) + (2.487/(1+ 10pH-7.688))) * MIN (2.85, 1.45*100.028*(25-T)). Where (1.45*100.028*(25-T)) is ≤ 2.85, (1.45*100.028*(25-T)) is applied and if (1.45*100.028*(25-T)) is > 2.85, 2.85 is applied. However, if a field pH or temperature reading is unavailable, a correction factor cannot be made and the result value for ammonia will be removed from the assessment.
- **Ammonia, acute**: If a field pH is missing, a correction factor cannot be made, and the result value for ammonia will be removed from assessment.

ASSESSMENT PROCESS

Once chronic and acute criteria are calculated, where applicable, toxicant sampling results are compared to the criteria to determine if the monitoring location is supporting designated uses or is impaired due to exceedances of the standard. Sites with sufficient data (4 or more samples) with two or more exceedances of the acute and/or

chronic criteria will result in nonattainment of the beneficial use. For sites to be attaining beneficial uses, four or more samples will be required with one or zero samples exceeding acute or chronic criteria. In cases where there are fewer than four samples and one or zero samples are exceeding the acute or chronic criteria, sites will be placed in category 3, insufficient data (Figure 16).

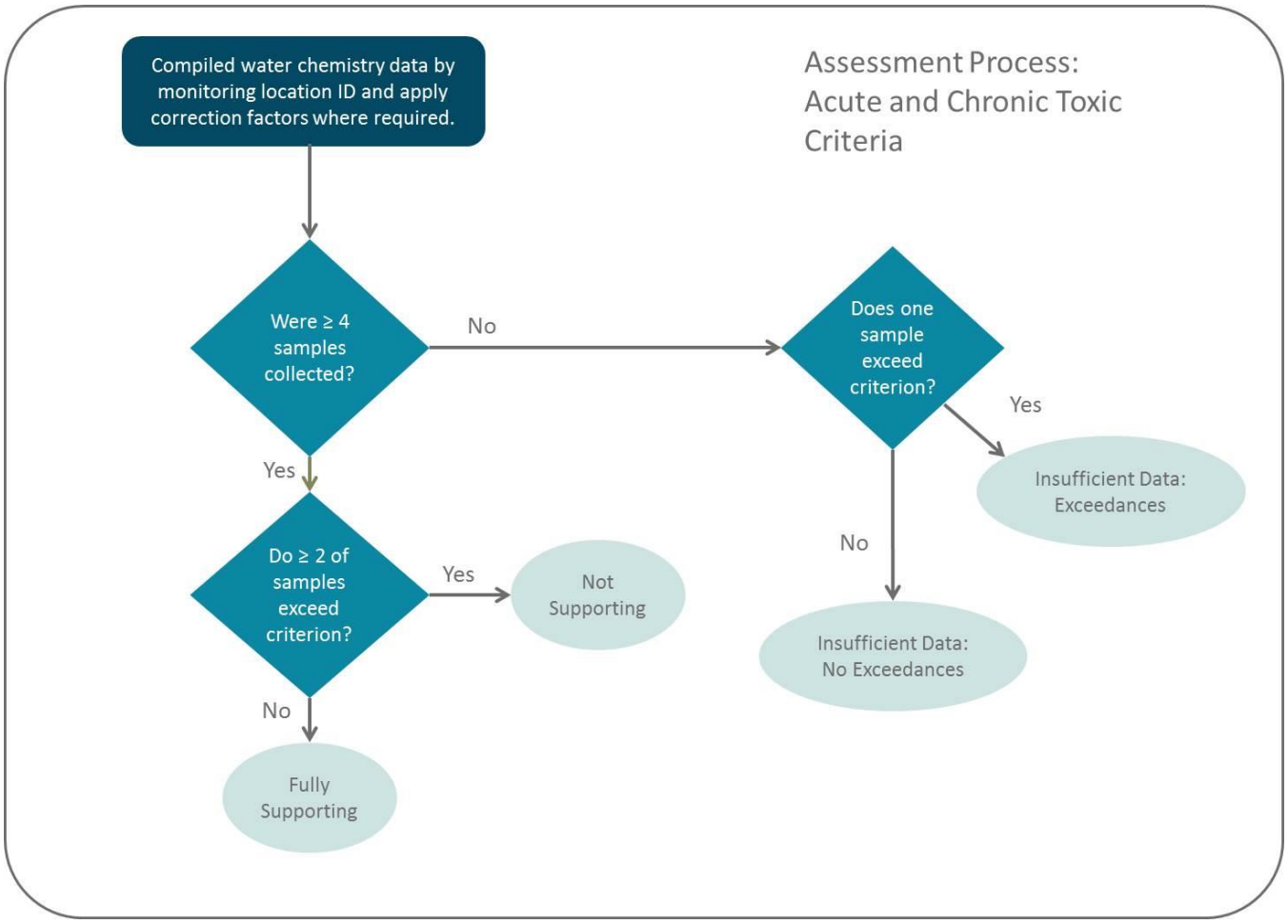

Figure 16. Overview of the assessment process for toxic parameters.

Escherichia Coli Assessment for All Waters

DATA PREPARATION

Following a credible data review and additional QA/QC checks as outlined in DWQ's Quality Assurance Program Plan for Environmental Data Operations (DWQ, 2014), DWQ compiles all credible data within the period of record of concern and makes several adjustments based on the reported limits and sampling frequencies necessary to conduct the assessment. Similar to the other QA/QC and assessment procedures outlined in this document, the raw data and accompanying metadata values in Escherichia coli (E. coli) datasets are not altered; instead, a series of database comments and flags are used.

Recreation Season

To ensure protection of recreation uses, E. coli assessments will be conducted on data collected during the recreation season from May 1 through October 31. The recreation season may be adjusted either longer or shorter based on site-specific conditions. Any site-specific adjustments made to the recreation season will be documented.

Escherichia coli Collection Events and Replicate Samples

Due to sampling design, datasets at a single monitoring location may contain replicate samples or multiple samples collected in the same day. For E. coli assessments, single daily values, or collection events, are required. DWQ defines a collection event as one of the following:

- The daily most probable number (MPN) result value.
- A geometric mean of replicates where multiple samples are collected on the same day.
- The daily MPN as a quantified value reported as being obtained from a dilution.

In cases where replicate samples were taken and there is a quantified MPN value reported from a dilution and the MPN value reported is greater-than-detect, the quantified MPN value will be used as the collection event for assessment purposes. In this scenario, MPNs reported as greater-than-detect are not used to calculate the geometric mean for the collection event.

Data Substitution for Calculating the Geometric Mean

Attainment of E. coli standards is assessed using the geometric mean of representative samples. E. coli data that are reported as less than detect (< 1) or 0 will be treated as a value of 1 to allow for the calculation of a geometric mean. Similarly, E. coli data that are reported as greater than detect (> 2,419.6) will be treated as 2,420 to allow for the calculation of the geometric mean.

Use Designation

Once the data are compiled, DWQ assesses use support for each monitoring location. All waters of the state are classified for contact recreation (Class 2), and some waters are classified as drinking water sources (Class 1C). These uses have associated specific E. coli standards that are used for determining use support. Based on the beneficial use assignments to a waterbody or segment within a waterbody, the numeric criteria within UAC R317-2 are applied to Class 2 and Class 1C uses.

Annual Recreation Season Assessment

The first step in the assessment process is to gather information regarding health advisories and/or closures issued during the recreation season. If there were two or more E. coli–related beach closures and/or health advisories in a recreation season, or if a health advisory and/or closure was issued for recreational access to a waterbody for two or more weeks, the waterbody is considered impaired and no further assessment is conducted

(Figure 17). If there were fewer than two closures or advisories, or if the closure lasted less than two weeks, the assessment process continues using E. coli concentrations.

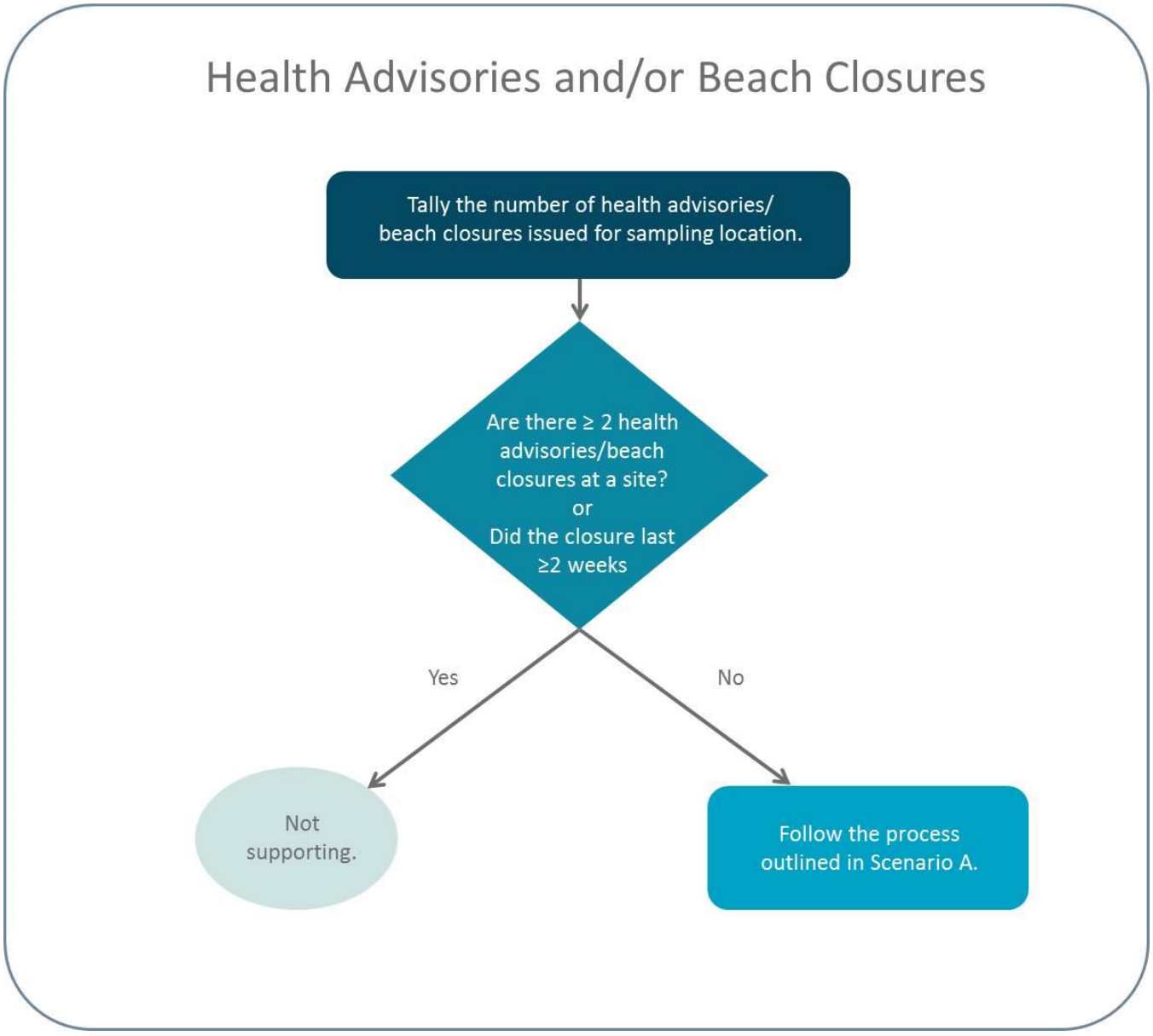

Figure 17. Considering E. coli related beach closures and/or health advisories.

To ensure protection of recreation and drinking water uses of assessed waterbodies of the state, DWQ considers three scenarios based on sampling frequency and the number of collection events at a monitoring location:

- **Scenario A**: A seasonal assessment against the maximum criterion (Figure 18).
- **Scenario B**: A 30-day geometric mean assessment (Figure 19).
- **Scenario C**: A seasonal geometric mean assessment (Figure 20).

Scenario A

Each monitoring location is assessed against the maximum criterion if there are five or more collection events (see Figure 18).

Step 1: Calculate 10% of collection events. If there are greater than or equal to 5 collection events within the recreation season, then the following calculations are performed:

- Divide the total number of collection events in the recreation season by 10 and round to the nearest whole number. This is the number of collection events that can exceed the maximum criteria. For example, if there were 6 collection events in a recreation season, then one sample can exceed the maximum criteria. If there were 15 collection events in a recreation season, then two samples can exceed the maximum criteria.

Step 2: Determine the number of times the collection event exceeded the max criteria.

- If more than 10% of the collection events exceeded the maximum criteria, the monitoring location is not supporting beneficial uses.
- If less than 10% of the collection events exceeded the maximum criteria, the site is then assessed using Scenario B and C.
- If there are less than 5 collection events in the recreation season, a tally of collection events exceeding the max criteria determines if the site is placed in the category of insufficient data with exceedances, or insufficient data without exceedances.

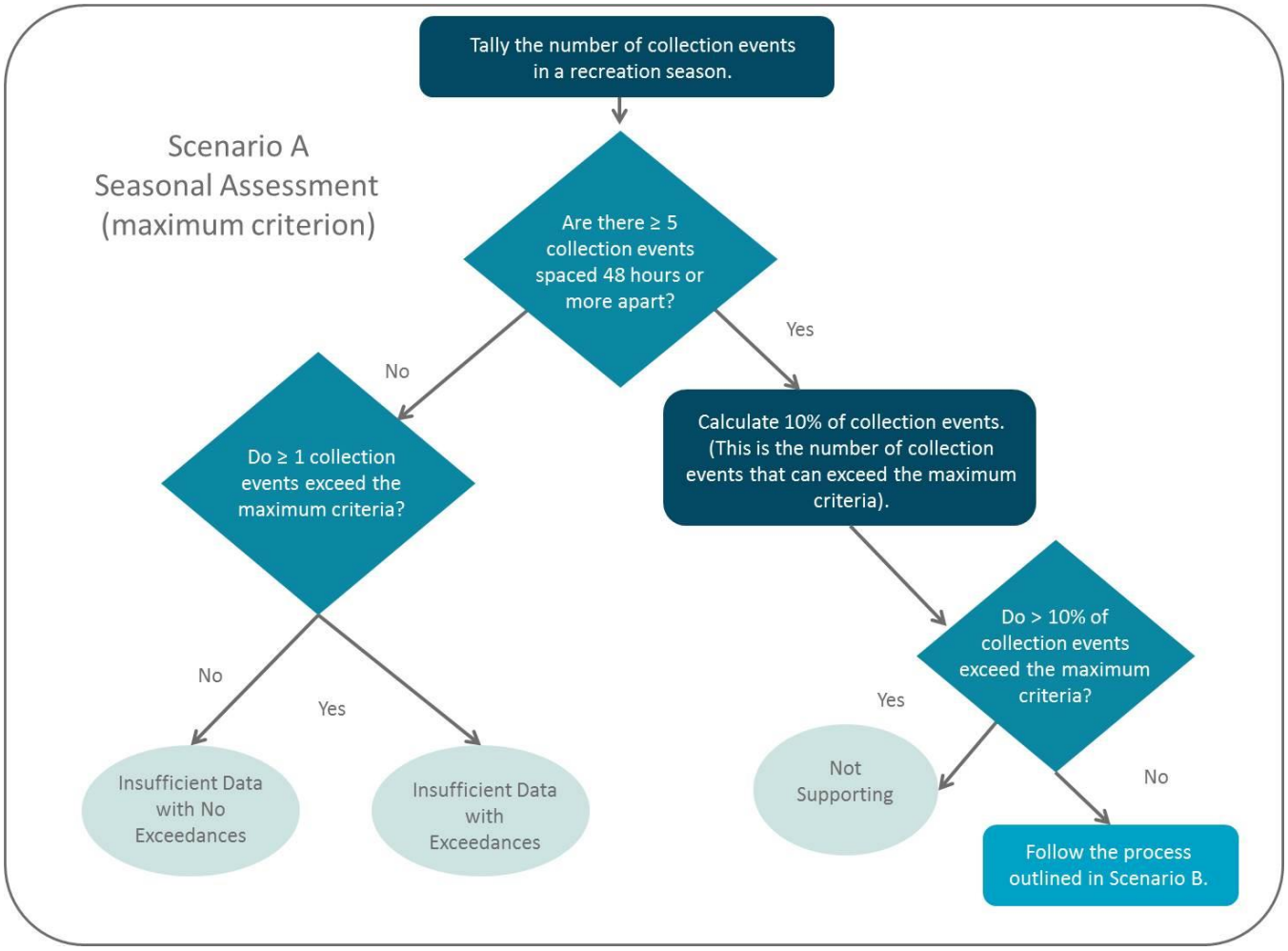

Figure 18. Scenario A: a seasonal assessment using the maximum criterion at a monitoring location.

Scenario B

If less than 10% of the collection events exceed the maximum criterion, the site is then assessed using the 30-day geometric mean criterion (see Figure 19). In order to assess against the 30-day geometric mean criterion directly, there must be a minimum of five collection events in 30 days, with at least 48 hours between collection events. This ensures that collection events are adequately spaced and are representative of ambient conditions.

Step 1: Determine if there are ≥5 collection events within a 30-day period.

- Count the number of collection events collected between each sample date (day 1) and the sample date plus 29 days (day 30).

Step 2: Determine if the collection events are representative (must have ≥5 collection events within a 30-day period).

- Count the number of collection events collected between each sample day (day 0) and the sample date plus 2 days (day 3).
- If there are two collection events within this period, only one sample will be considered representative.

Step 3: Calculate the 30-day geometric mean.

- If there are ≥5 representative samples in a 30-day period, then all collection events will be used to calculate the 30-day geometric mean.
- If ≥1 30-day geometric mean exceeds the 30-day criteria, the site is not supporting beneficial uses. If there are not representative data for Scenario B, or if the 30-day geometric mean did not exceed the 30-day criteria, the site is assessed using Scenario C.

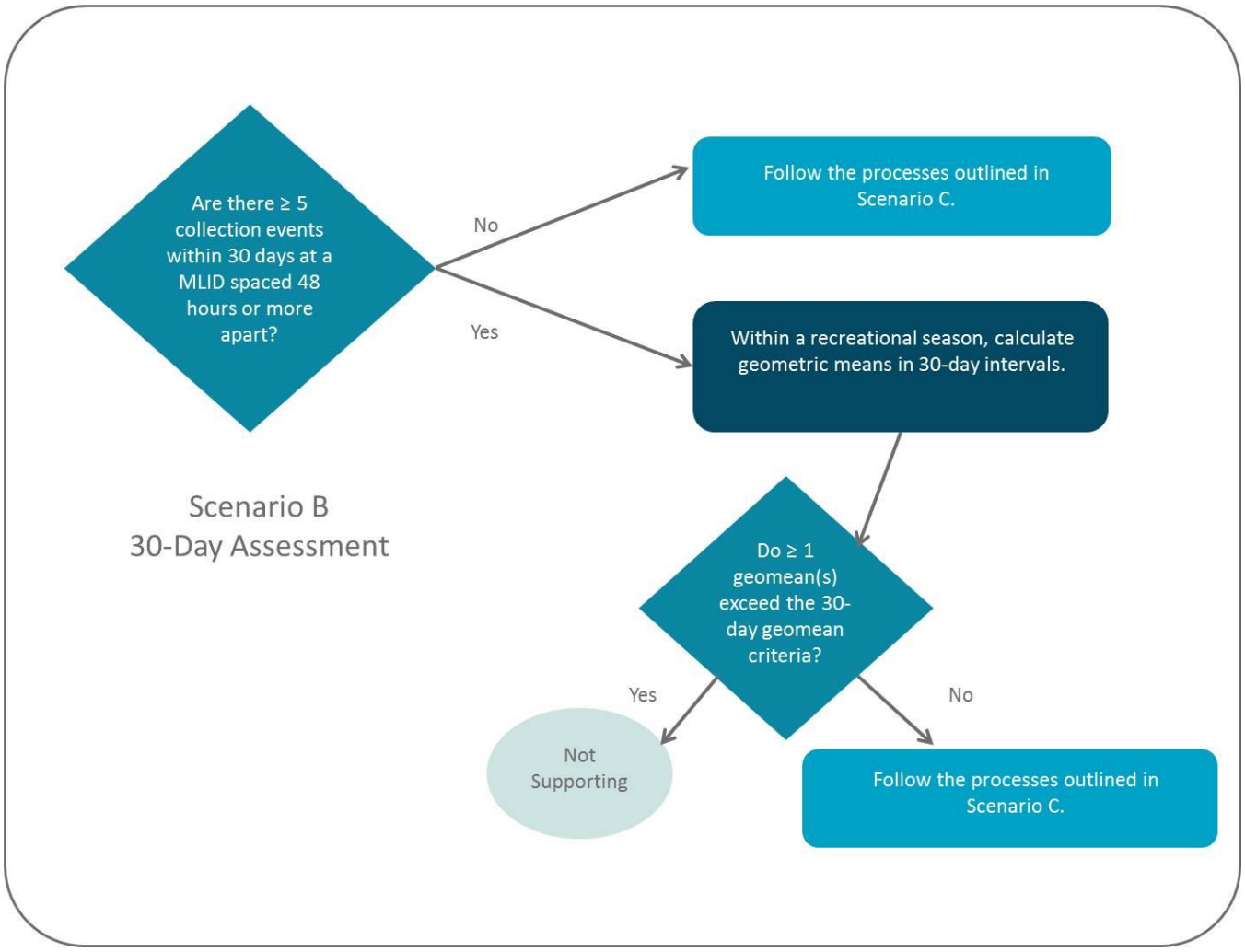

Figure 19. Scenario B: an assessment using the 30-day geometric mean for monitoring locations with five or more collection events within 30 days.

Scenario C

If adequate (at least five samples) and/or representative data spaced by at least 48 hours are not available to assess against the 30-day geometric mean, DWQ will assess E. coli data for the recreation season provided there are at least five collection events during the defined recreational season. Exceedances of the geometric mean criterion will result in the site being classified either as impaired (minimum of 10 collection events in a recreation season) or as insufficient data (sample size is more than five but fewer than 10) (see Figure 20).

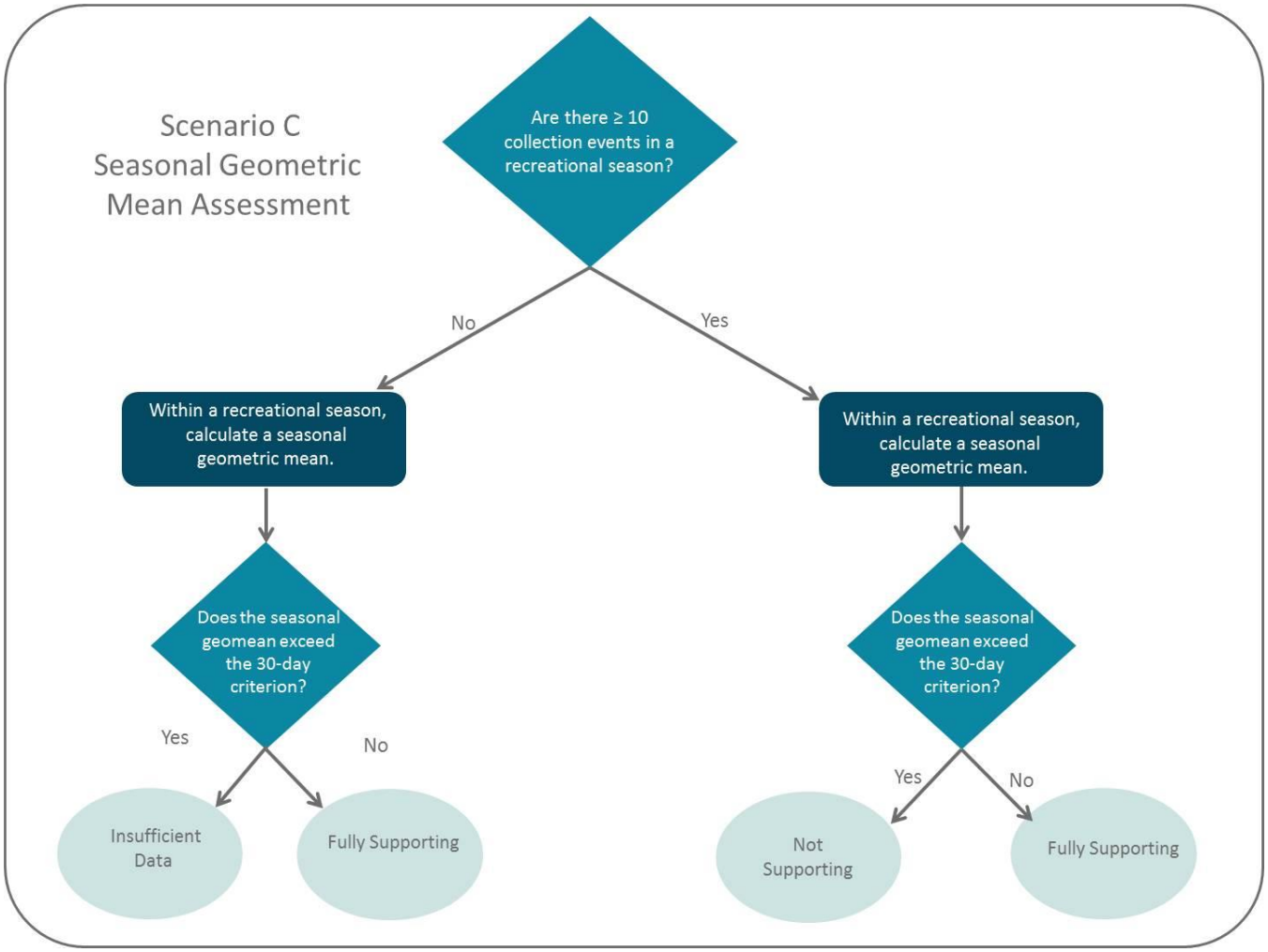

Figure 20. Scenario C: A seasonal geometric mean assessment.

Summarizing Assessment Results

When determining the attainment of a monitoring location with assessment results across multiple years, the following rules are applied (in the following order):

Not Supporting (Category 5)

A waterbody is considered to be impaired (not meeting its designated uses) if any of the following conditions exist:

- A lake, reservoir, or pond has two or more posted health advisories or beach closures during any recreation season.
- Any monitoring location where E. coli concentrations from 10% or more of the collection events exceed the maximum criterion.
- Any monitoring location where the 30-day geometric mean exceeds the 30-day geometric mean criterion (minimum five collection events with at least 48 hours between collection events).
- Any monitoring location where the recreational season geomean exceeds the 30-day geometric mean criterion (minimum of 10 collection events).

Insufficient Data or Information Assessment Considerations (Category 3, with exceedances)

- Sites with four or fewer samples in all seasons evaluated will be listed as insufficient data, provided impairment is not suggested by a posted health advisories or beach closures.

Combinations of Category 3 (with no exceedances), 2, and/or 1

- When making a final attainment decision of a site after all recreation season assessments are complete, DWQ uses the approach that if there is no evidence of impairment at a site by any of the assessment approaches over the period of record of concern, the assessment analysis from the most recent year outweighs the results from previous years. (DWQ's process for merging assessment results from multiple locations within an AU is discussed in more detail in Determinations of Impairment: All Assessment Units).

Supporting (Category 1 or 2)

- No evidence of impairment by any assessment approach for all recreation seasons over period of records. A fully supporting determination can be made with a minimum of five collection events during the recreational season.

Combining E. coli with Other Parameter Assessment Results

Until the determination of impairment and the review of additional supporting information are completed by reviewers, parameter assessments at an individual monitoring location and results from multiple monitoring locations within the same AU are not summarized and combined (see Determination of Impairment for more details).

Pollutions Indicator Assessments for All Waters

Several parameters in UAC R317-2 have footnotes indicating that further investigations should be conducted to develop more information when levels are exceeded. Parameters and beneficial-use combinations with these footnotes are noted in Table 16.

Table 16. Assessment decision for parameters and beneficial use classes.

Parameter Name	Beneficial Uses Classes	Special Assessment Notes
Biochemical oxygen demand	2A, 2B, 4, 3A, 3B, 3C, 3D	Where exceedances occur, these AUs will be Category 3.
Gross alpha	3A, 3B, 3C, 3D	This parameter will be assessed as a toxicant and appropriately categorized based on results of the assessment.
Gross beta	3A, 3B, 3C, 3D	This parameter will be assessed as a toxicant and appropriately categorized on the basis of results of the assessment.
Nitrate as N	1C, 2A, 2B, 3A, 3B, 3C	Nitrate as N in assessed waterbodies of the state with a 1C beneficial use is considered an inorganic toxicant and will be assessed as so (UAC R317-2). The parameter will be assessed as a toxicant, but all categorical assessments for aquatic life uses (Class 3) will be overwritten to Category 3. (Exceptions to this policy are noted in the Delisting section of this document). For updates on the Division's multifaceted nutrient reduction program to address water quality problems associated with nitrogen and phosphorus pollution, please refer to DWQ's website.
Total phosphorus as P	2A, 2B, 3A, 3B	Phosphorus will be assessed in the same manner as toxic parameters, but all categorical assessments for aquatic life uses (Class 3) will be overwritten to Category 3. (Exceptions to this policy are noted in the Delisting section of this document). For updates on the Division's multifaceted nutrient reduction program to address water quality problems associated with nitrogen and phosphorus pollution, please refer to DWQ's website.
Note: Assessment decisions articulated in the special assessment notes column will be applied to all assessed waterbodies of the state identified in Table 4.		

Narrative Standards for All Waters

In addition to the numeric criteria used to perform water quality assessments, Utah's water quality standards contain provisions for the application of narrative criteria to protect uses. The narrative criteria state the following:

It shall be unlawful, and a violation of these rules, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor to taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentration or combinations of substance which produce undesirable human health effect, as determined by bioassay or other tests performed in accordance with standard procedures; or determined by biological assessments in (UAC) Subsection R317-2-7.3.

Under circumstances where evidence exists that human-caused actions have produced any of these undesirable outcomes in a waterbody, DWQ will apply the narrative criteria to protect human health and aquatic life. Examples where the Narrative Standards may be used to make an impairment determination include drinking-water closures, fish kills, Harmful Algal Blooms (HABs), beach closures (for swimming), and health advisories for the consumption of fish. The assessment of E. coli data and associated beach closures to protect human health is an additional weight of evidence for defining the impairment of recreational uses and is addressed in more detail earlier in this document in the Escherichia Coli Assessment for All Waters section. DWQ will also apply a cyanobacterial cell count threshold for determining impairments due to harmful algal blooms.

DRINKING WATER CLOSURES

If the Utah Division of Drinking Water or a local municipality issues an advisory or closure for a surface drinking water source, DWQ will assess the site as impaired for 1C uses, unless data show that the problem has been solved.

FISH KILLS

DWQ requests information on reported fish kills from the Utah Division of Wildlife Resources and other stakeholders. These data are used in concert with water quality data to make final assessment decisions. For example, sites that would generally not be assessed due to small sample sizes may be listed as impaired if fish kills have also been observed in the waterbody.

HARMFUL ALGAL BLOOMS (HAB)

In fresh waters, HABs are typically composed of cyanobacteria; a phylum of photosynthetic bacteria sometimes called blue-green algae. Exposure to cyanobacteria or cyanotoxins through skin contact, inhalation, or ingestion can have negative impacts on the health of people and animals. Epidemiological studies have linked cyanobacteria exposure to negative health impacts in humans including respiratory inflammation, gastrointestinal distress, vomiting, headaches and ear aches, and skin irritations (e.g. Pilotto et al., 1997, Stewart et al., 2006, Levesque et al. 2014, Lin et al., 2016). In addition, some species of cyanobacteria such as *Dolichospermum sp., Aphanizomenon sp., Nodularia sp., Microcystis sp., and Planktothrix sp.*, can produce cyanotoxins that can produce liver, kidney, or neurological damage in humans and animals.

The goal of DWQ's HAB assessment method is to identify waterbodies that experience HAB events that impair class 2 recreational uses. Potential impacts of HABs on aquatic life uses are currently addressed through eutrophication-related aspects of general lakes, reservoirs, ponds, flowing surface waters or the State, and canal assessment methods (e.g. dissolved oxygen, pH, and lake Tier II assessments). However, HAB specific assessment methods may consider direct impacts on aquatic life (e.g., toxic effects of cyanobacteria or cyanotoxins on wildlife) in the future as more information becomes available.

Though the Narrative Standard speaks to a broad range of undesirable conditions, the potential for negative human or animal health effects and the formation of algal scums are the primary considerations in DWQ's HAB assessment methods.

DWQ's HAB assessment methods rely on three independent indicators to determine beneficial use support: cyanobacteria cell counts, cyanotoxin concentrations, and waterbody access or use limitations. In some circumstances, additional supporting indicators such as chlorophyll a concentrations or reports of human or animal health effects may also be considered in determining beneficial use support or impairment. For example, longer-term chlorophyll a concentration data in a waterbody can help estimate the frequency and potential of HAB occurrences in a waterbody which allows an assessment to differentiate an anomalous HAB in an otherwise low productivity waterbody from high productivity waterbodies where HABs are likely to occur more frequently.

DWQ's HAB assessment methods apply to waterbodies with frequent primary contact recreational uses, including those currently designated with 2A uses and those where existing frequent primary contact recreational uses have been documented. Waterbodies currently designated with a class 2B use where existing frequent primary contact usage has been documented will be considered for a classification change to 2A. DWQ is currently evaluating the applicability of existing HAB assessment benchmarks for infrequent primary contact recreational uses.

DWQ collects samples during HAB events for use in recreational use assessments using DWQ's HAB Standard Operating Procedures (SOP, DWQ 2016). These samples are most representative of recreational uses and potential recreational exposure to HABs. Samples collected outside the HAB SOP can be used to identify impairment of recreational uses in some cases, but because they may not adequately represent recreational uses, are not used to determine full support. Multiple exposure pathways to cyanobacteria and cyanotoxins exist through recreational activities such as swimming, wading, boating, or water-skiing. DWQ's assessment methods rely on EPA's draft recommended criteria for microcystin and cylindrospermopsin (EPA 2016) and guidelines recommended by Utah Department of Health for anatoxin-a (UDOH 2016, Table 17). These thresholds are subject to revision following finalization of EPA's draft criteria or continued development by DWQ and other agencies. Thresholds for additional cyanotoxins may continue to be added to the assessment methods as they become available.

Table 17. Cyanotoxin thresholds used for recreational use assessments.

Recreational Cyanotoxin Guidelines (µg/L)		Source
Microcystin	4	EPA 2016
Cylindrospermopsin	8	EPA 2016
Anatoxin-a	20	UDOH 2016

Beneficial Use Supported

The beneficial use is fully supported if, over the period of record:

- Cyanobacteria cell counts have not exceeded 20,000 cells/mL, AND
- Cyanotoxin concentrations have not been identified above recreational use thresholds (Table 17), AND
- A warning, danger, or closure has not been issued for recreational access to a waterbody.

Beneficial Use Not Supported

The beneficial use is not supported if, in representative samples for recreational uses, in two or more years in the period of record:

- The cyanobacteria cell count exceeded 100,000 cells/mL in two or more weeks (i.e. in samples collected 7 or more days apart), OR

- Cyanotoxin concentrations above recreational guidelines (Table 17) have been reported for two or more weeks (i.e. in samples collected 7 or more days apart), OR
- A warning, danger, or closure has been issued for recreational access to a waterbody for two or more weeks.

Insufficient Data and Information with Exceedances (IR Category 3)

The waterbody will be categorized 3 if:

- For less than two weeks, or only in one year: the cyanobacteria cell count exceeded 20,000 cells/mL, cyanotoxin concentrations exceeded recreational use thresholds (Table 17), or a warning, danger, or closure has been issued for recreational use for less than 2 weeks. These waterbodies will be prioritized for further sampling and evaluation.

FISH TISSUE ASSESSMENTS AND CONSUMPTION HEALTH ADVISORIES

DWQ has collected fish tissue samples for mercury analysis in waterbodies throughout the state since 2000. Since that time, consumption advisories have been issued for 24 waterbodies.

DWQ currently uses the EPA-published ambient water quality criterion for methylmercury for the protection of people who eat fish and shellfish. This criterion is 0.3 milligram (mg) methylmercury per kilogram (kg) fish tissue wet weight. If all fish (small and large) of the same species at a monitoring location have a mean mercury concentration of > 0.3 mg/kg, additional statistical tests are used to determine if a consumption advisory is necessary. If the mean is < 0.3 mg/kg, no advisory is issued. In several instances, size class advisories have been issued when it is apparent that only the larger size class exceeds the safe consumption criterion.

For locations with a mean mercury concentration of > 0.3 mg/kg, the p-value is considered. The p-value refers to the probability of obtaining a result equal to or greater than those that were measured at that location. DWQ uses a p-value of 0.05 to be 95% certain an advisory is not unnecessarily issued. Therefore, if a species has a mean of > 0.3 mg/kg and a p-value < 0.05, then a consumption advisory is issued. If a species has a mean of > 0.3 mg/kg but a p-value of > 0.05, then an advisory is not issued. The consumption advisories are based on long-term consumption; therefore, the mean is the most appropriate and commonly used parameter to estimate exposure.

In an effort to control for false negatives, DWQ calculates 95% confidence limits of the mean mercury concentration. If the upper confidence limit is above 0.3 mg/kg, that site is targeted for additional sampling.

When an advisory is warranted, DWQ sends the data to the Utah Department of Health toxicologist who uses the mean mercury concentration to calculate the actual consumption recommendations. Those calculations are based on the following:

- Average Adult Weight: 70 kg (154 pounds) | Average Adult Meal Size: 227 grams (8 ounces)/meal
- Average Child Weight: 16 kg (35 pounds) | Average Child Meal Size: 113 grams (4 ounces)/meal

Consumption amounts are calculated for three target populations: Pregnant Women and Children < 6, Women of Child Bearing Age and Children 6–16, and Adult Women Past Child Bearing Age and Men >16.

Mercury Assessment Process

The current approach for making assessments of aquatic life use support for mercury is different than the consumption advisory process. The assessment is based on the U.S. Food and Drug Administration recommended value of 1.0 mg/kg. The U.S. Food and Drug Administration set the consumption concentration at 1.0 mg/kg, which correlates to the water column mercury concentration of 0.012 µg/l in previous studies by EPA

(EPA, 1985). Utah's water quality standard for mercury is 0.012 µg/l as a 4-day average. Therefore, the corresponding fish tissue concentration of 1.0 mg/kg is used for assessment.

Beneficial Use Supported (Category 1)

- No fish consumption advisories for mercury are in place.
- Mean fish tissue mercury concentration for all individuals of the same species at a location is less than 0.3 mg/kg and p-value is < 0.5.

Insufficient Data with Exceedances (Category 3)

- Fish consumption advisories for mercury are in place, but the mean fish tissue mercury concentration for all individuals of the same species at a location is less than or equal to 1.0 mg/kg.

Beneficial Use Not Supported (Category 5)

- Fish consumption advisory for mercury is in place.
- Mean fish tissue mercury concentration is greater than 1.0 mg/kg.

For additional information and the most up-to-date list of consumption advisories, please visit fishadvisories.utah.gov.

Determinations of Impairment: All Assessment Units

Following the initial assessment of credible data against the numeric criteria in UAC R317-2, each use and parameter within a waterbody is assigned a provisional EPA-derived assessment category. To verify the use and parameter-specific assessment results and consolidate the often multiple parameter assessments into one result per waterbody, DWQ must consider the quantity of data and the extent to which such data demonstrate clear and convincing evidence of supporting or not supporting the beneficial uses assigned to the waterbody in UAC R317-2. In determining the strength of whether or not a waterbody is supporting or not supporting its beneficial uses, DWQ considers the following information:

- Individual assessment of water quality standards at a single site.
- Independent applicability.
- Multiple lines of evidence and several levels of secondary reviews.

INDIVIDUAL ASSESSMENT OF WATER QUALITY STANDARDS

In determining whether or not a waterbody is supporting or not supporting the beneficial uses assigned in UAC R317-2, DWQ first considers the individual use and parameter-specific assessment results from the monitoring location level data. Each use and parameter assessed for the waterbody is assigned a provisional EPA-derived assessment category. Unless noted in the waterbody-specific data assessment protocols, the assessment policies outlined in this document provide a direct and quantifiable method and documentation of data supporting or not supporting DWQ's water quality standards versus data and information that are developed using surrogate parameters or indicators. Because individual assessments at a single monitoring location site offer a more direct measure of supporting or not supporting water quality standards in UAC R317-2, DWQ places a greater weight on individual assessment decisions that follow the data assessment protocols in this document.

Following the review of the individual water quality standard assessments for a beneficial use, DWQ looks across the multiple parameter-specific assessment results that exist for a location and consolidates the results into a preliminary assessment at the individual site level. That is, DWQ assigns one EPA-derived assessment decision category as defined in Table 1 to each monitoring location.

CONFLICTING ASSESSMENTS OF WATER QUALITY STANDARDS

To address the possibility of conflicting results among different types of data (e.g., biological versus conventionals, toxics versus E.coli) at the site- and AU-level, DWQ applies the policy of independent applicability and goes through a series of considerations to determine if the discrepancies are because of:

- differences in data quality, or
- environmental factors such as the application of the water effects ratio, development of site specific criteria, revision to numeric criteria in UAC R317-2, or conducting a use attainability analysis.

Figure 21 elaborates on DWQ's use of the independent applicability policy.

In cases where concerns about the quality of independent datasets cannot be rectified through an evaluation and documentation of the QA/QC issues that resulted in accepting one dataset and the resulting assessment result, sites with conflicting assessment results may be listed as Category 3 (insufficient data and information) to better understand the seemingly conflicting lines of evidence. Specific assumptions regarding model applicability applied during the biological assessment process are discussed in the Biological Assessment section. Similarly, if the application of water effects ratio, justifiable site-specific criteria change, or change in beneficial uses based on a use attainability analysis cannot rectify the difference in the assessment results, then a Category 3 may be

warranted. All evaluations of conflicting assessment decisions will be made in consultation with EPA on a case-by-case basis.

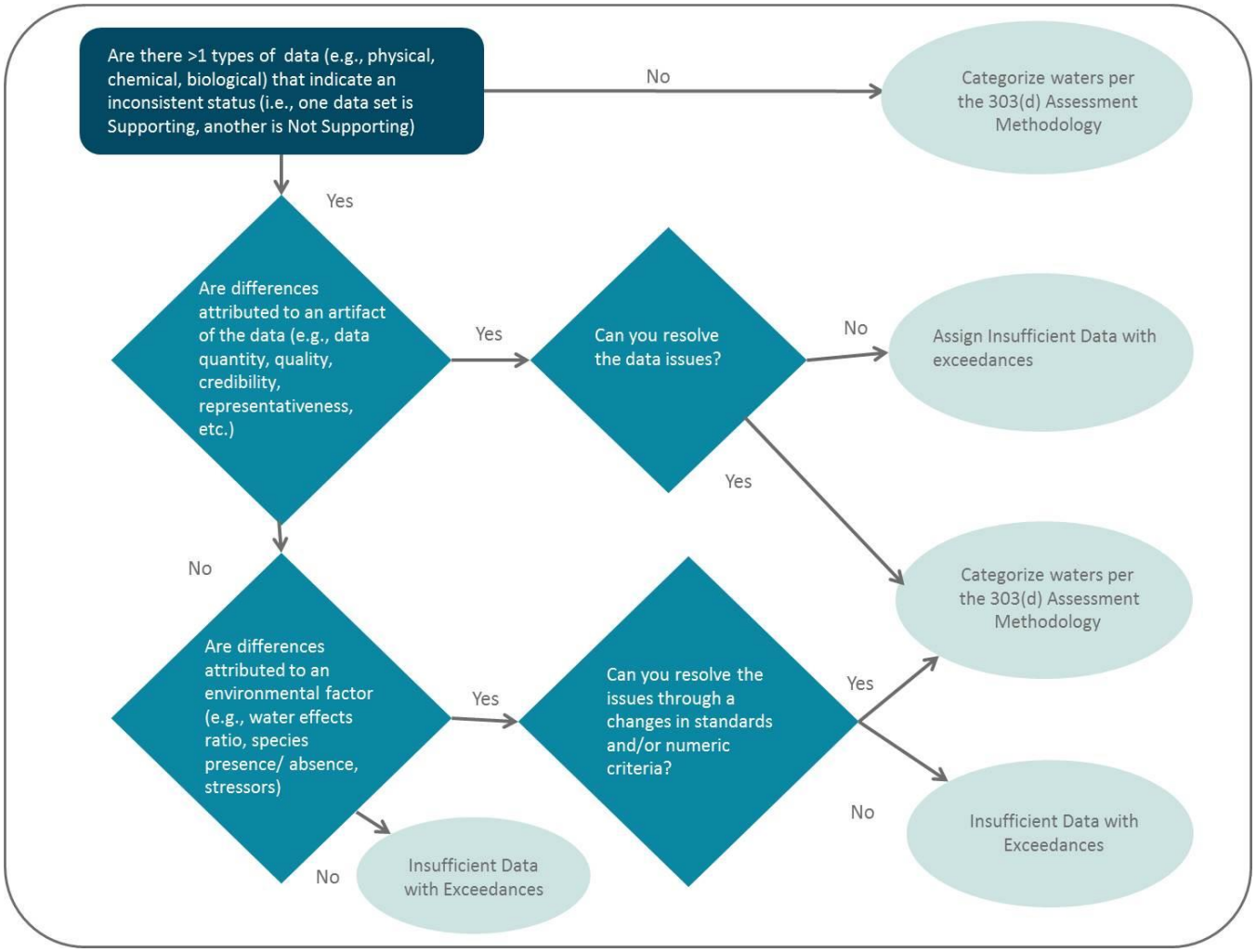

Figure 21. Overview of independent applicability process. Note: These judgment decisions are based in part on EPA's Consolidated Assessment and Listing Methods guidance published in 2002.

AGGREGATION OF SITE-SPECIFIC ASSESSMENTS TO ASSESSMENT UNIT CATEGORIES

For reporting purposes, DWQ aggregates all site-specific water quality assessments within an AU to a single assessment category for that AU as described in Table 1. A flow chart describing this process is presented in Figure 22 (see Appendix 4 for additional detail).

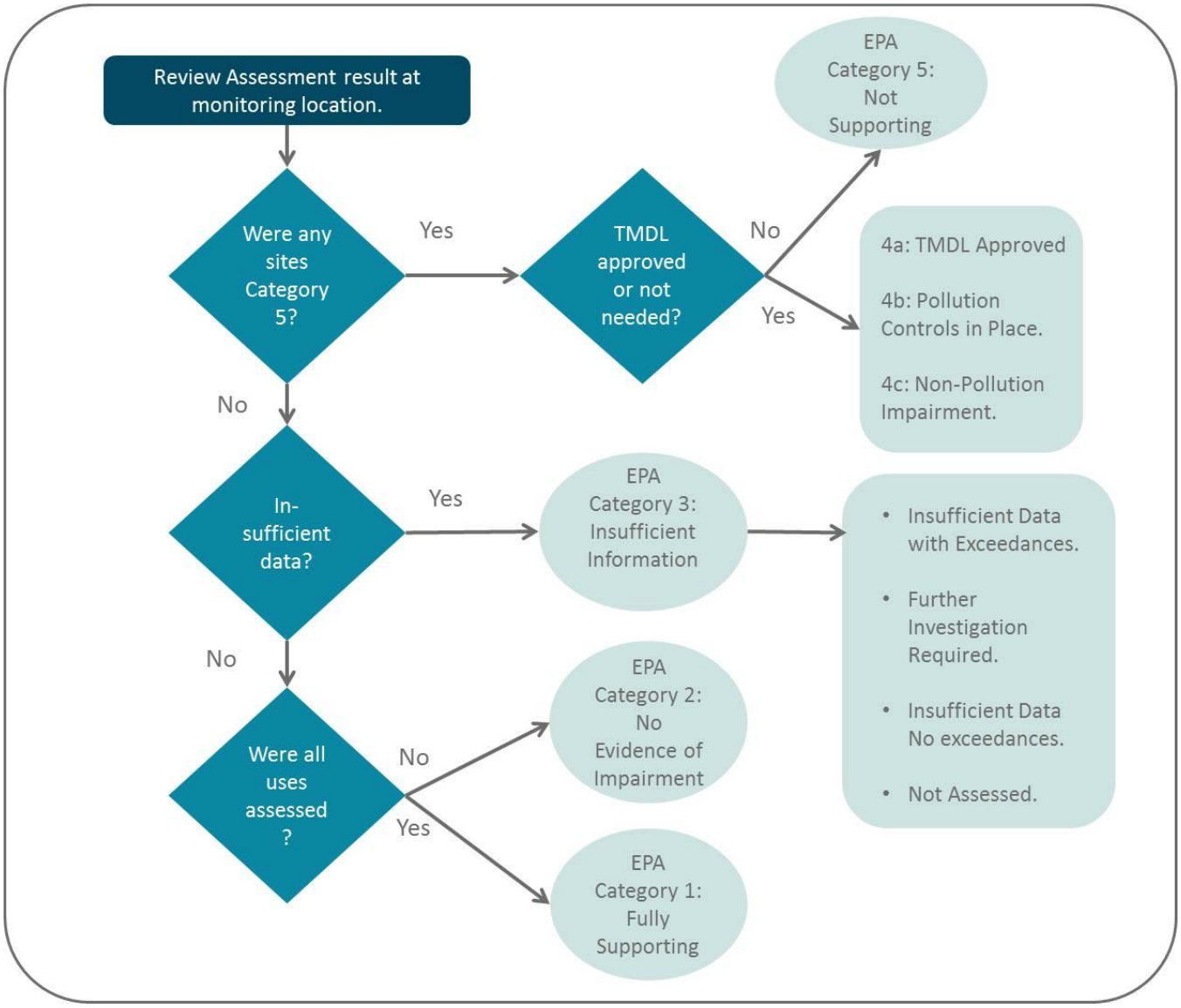

Figure 22. Process of assigning EPA categories to AUs based on results of monitoring location assessments.

SECONDARY REVIEW

Following the consolidation of all of the individual assessment results and the assignment of preliminary assessment category(s) for an AU, DWQ conducts a secondary review of listing determinations. The secondary review process allows the application of site/waterbody specific knowledge and additional data quality controls to evaluate the extent to which data used in the preliminary assessment demonstrates clear and convincing evidence of supporting or not supporting the beneficial uses assigned to the waterbody in UAC R317-2. In addition to the internal secondary review process, DWQ recognizes that input from reviewers during public comment periods may also provide key information regarding the data used in listing decisions. To ensure consistency in its use among different professionals, the secondary process will be applied in a select number of scenarios using a standard set of guidelines as outlined in Appendix 3.

If as a result of the secondary review, documentation can be provided of evidence sufficient in strength to modify the basis and result of the preliminary assessment, the preliminary assessment decision based on the data

assessment procedures outlined in this document will be overwritten. For example, preliminary listings for Category 5 or Category 1 and Category 2 waters could be re-assigned as Category 3, insufficient data and information.

Where documentation for overriding a preliminary assessment decision is insufficient in strength, vague, or cannot be provided, the preliminary assessment decision based on the data assessment procedures outlined in this document will carry forward.

For tracking and transparency to the public, DWQ will document the original category assignment and a justification for the secondary review.

Assessment Unit Re-segmentation

In cases where site-specific assessments within a single AU conflict, DWQ may determine that it is appropriate to re-segment (i.e. "split") an existing AU polygon into two or more new AUs rather than aggregate those conflicting assessments into a single AU scale category. In particular, AUs where water quality criterion exceedances are clearly isolated to a relatively small, hydrologically distinct portion of the larger AU may be re-segmented to more accurately reflect that variation in water quality. For example, a large AU with an impairment isolated to a single tributary may be re-segmented into two AUs: one for the impaired tributary and another for the rest of the existing AU. Assessment categories for both AUs are then determined following standard aggregation (Figure 22 and the delisting procedures discussed in the Delistings section. This results in a higher resolution and overall more accurate assessment. DWQ does not consider it appropriate to re-segment an AU when exceedances are observed in multiple locations throughout an AU or where impaired sites are not hydrologically distinct from unimpaired portions of the AU.

If after aggregating all of the assessments into one EPA-derived assessment category for an AU, DWQ determines that the supporting or not supporting assessment result decision is not representative of the entire AU, DWQ will investigate further to determine whether the supporting or not supporting decision is widespread or limited to individual portions of the waterbody, such as specific tributaries or reaches. Results from the analysis will be categorized as follows:

- **Whole AU is Not Supporting (Category 5)**: If data from multiple sites or tributaries within an AU indicate multiple (or a combination of) not supports (Category 5) and insufficient data with exceedances (Category 3), DWQ will recommend that the AU not be re-segmented and the entire AU be listed as not supporting.
- **Only Not Supporting Tributaries are listed as Not Supporting (Category 5)**: If data from one or more tributaries indicate a combination of any of the following, DWQ may recommend the AU be re-segmented into two AUs and that only the tributaries with data indicating impairment are listed as not supporting.
- **Insufficient Data with Exceedances (Category 3)**
- **No Evidence of Impairments (Category 2)**
- **Supporting (Category 1)**
- **Needs Further Investigations (Category 3)**
- **Insufficient Data with No Exceedances (Category 3)**
- **Not Assessed (Category 3)**

The rest of the AU will be assigned a category following procedures as outlined in Figure 22.

Identifying Causes of Impairments

Once an AU is assigned an EPA-derived assessment category that is representative of conditions with the AU, DWQ will determine if the impairment or impairments are driven by pollutants, pollution, unknown, or natural causes (see Table 1). DWQ will identify causes of impairment defined by a pollutant that has specific numeric water quality criteria identified in UAC R317-2. Pollution is a generalized term for causes of water quality impairment that can include multiple pollutants and other factors such as the absence or lack of water, riparian vegetation, and other modifications that affect a waterbody's ability to support aquatic habitat and other designated uses. With the exception of naturally occurring causes, only one cause will be applied to a not-supporting waterbody and parameter. Procedures on how DWQ identifies the cause of impairments are described in the section below.

POLLUTANTS

Using the CWA's definition of a pollutant as a guide, DWQ defines pollutant-driven impairments (Category 5) as those resulting from the following:

… dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under Atomic Energy Act of 1954, as amended), heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. (UAC R317-2)

Notwithstanding the federal definition cited above, DWQ will also identify certain radiological constituents that are regulated under the state's Water Quality Control Act. For the purpose of the 303(d) List, causes for impairments due to toxic parameters will be identified as the parameter for which there is an impairment. In the case of conventional parameters such as DO, temperature, pH, and biological scores, the cause will be assigned as the parameter that was assessed until such time as a TMDL or pollution prevention plan identifies an alternative cause of the impairment.

Once an impairment for a waterbody or segment within a waterbody is identified as pollutant-driven, DWQ will list the waterbody and the not-supporting parameter(s) as impaired for that pollutant (cadmium, iron, etc.). Waterbodies that are not supporting their beneficial uses due to pollutant impairments require future development of a TMDL or application of a TMDL alternative. Information on DWQ's process of prioritizing and developing a TMDL, and TMDL alternatives, is described in section 303(d) Vision and TMDL Priority Development and on DWQ's website.

POLLUTION

Where DWQ can identify that an impairment was not driven by a pollutant, DWQ may consider if the not-supporting assessment was driven solely by pollution versus a pollutant or by an unknown cause. Using the CWA's definition of pollution as a guide, DWQ will go through an evaluation to determine if an impairment resulted from "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water." Waterbodies with not-supporting parameters that are driven solely by pollution problems do not require the future development of a TMDL and are candidates for a non-pollutant impairment (4C) assessment category. Details on DWQ's process for using EPA's 4C assessment category are described in section Category 4C.

UNKNOWN SOURCES

For the purpose of the IR, sources of pollution contributing to an impairment will be reported in the 303(d) list to EPA as "unknown" until such time as a TMDL or special study identifies the sources and any additional causes of impairment.

NATURAL CONDITIONS

In cases where DWQ or a stakeholder can demonstrate that the natural conditions of the waterbody or segment within a waterbody are the key factor for an impairment(s), DWQ will still retain the not-supporting assessment decision. However, DWQ's response to such exceedances differs unless a site-specific standard has been promulgated. Site-specific standards require documentation that demonstrates the extent to which the violations were due to natural conditions. Once this documentation is developed, the proposed changes to standards will be developed. For more information on the review and approval process for developing standards and numeric criteria surrounding exceedances caused by naturally occurring conditions, please review DWQ's Standards website.

Revising the 303(d) List and Other Categorical Assessments

Upon validating the strength and extent of the impairments within a waterbody or segment within a waterbody, DWQ will include newly proposed and previously listed not supporting (Category 5) waterbodies on the updated 303(d) List unless the waterbody or waterbody segment(s) is currently included in the IR's TMDL-approved (Category 4A), pollution control (Category 4B), non-pollutant impairment (Category 4C), or delisting lists. Details on how and when DWQ will not apply or carry an impaired listing (not supporting, Category 5) forward on DWQ's 303(d) List are described below.

CATEGORY 4A

The first alternative DWQ has available for not listing or removing an impaired waterbody or segment within a waterbody on the state's 303(d) List is to calculate the maximum amount of a pollutant that a waterbody can receive while still meeting the state's water quality standards. This calculation and analysis work must be formalized in a TMDL and go through a thorough internal and external review process. This calculation and analysis work must be formalized in a TMDL that is provided to the public for review and comment, submitted to the Utah Water Quality Board for approval, provided to the Legislative Natural Resources, Agriculture, and Environment Interim Committee for review if implementation costs exceed $10 million or the full State Legislature for approval if implementation costs exceed $100 million, and ultimately to EPA for their approval. Information on DWQ's process for developing and implementing a TMDL can be found on DWQ's Watershed Management Program website and EPA's TMDL 303(d) website. Where DWQ has documentation of a DWQ Water Quality Board- and EPA-approved TMDL for an impaired parameter within a not-supporting waterbody or segment within a waterbody, DWQ will override a current or previous not supporting Category 5 listing decision at the AU level as follows:

- **Whole AU Category 4A, TMDL-approved if**:

    a. The only impairments within the waterbody or segment within the waterbody are included in the approved TMDL.
    b. There are additional impairments within the waterbody or segments within the waterbody that are addressed in a Category 4B demonstration plan (described in section Category 4B and Appendix 5) and are not included in the approved TMDL. If the parameters included in the approved Category 4B demonstration plan are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters have an approved Category 4B demonstration plan in place.
    c. There are additional impairments within the waterbody or segments within the waterbody that are pollution-driven (Category 4C) and not included in the approved TMDL. If the pollution-driven parameters are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters are pollution- versus pollutant-driven.

- **Whole AU Category 5, Not Supporting if:**

    d. There are any additional pollutant impairments within the waterbody or segments within the waterbody that are not included in the approved TMDL. If the parameters included in the approved TMDL are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters have an approved TMDL in place.

CATEGORY 4B

DWQ's second alternative to not listing or removing an impaired waterbody or segment within a waterbody on the state's 303(d) List is to develop a plan that ensures upon implementation that the waterbody will meet state water quality standards within a reasonable time period and through state- and EPA-approved pollution-control mechanisms. Similar to a TMDL, a Category 4B demonstration plan must go through a robust internal and

external review process. For example, once DWQ or a stakeholder develops a plan for consideration, DWQ will present the plan to DWQ's Water Quality Board and submit the board-approved plan to EPA for final approval. More information on the Category 4B demonstration plan process can be found in Appendix 5 and in EPA's Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act and Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions.

Where DWQ has documentation of an EPA-approved Category 4B demonstration plan for an impaired parameter within a not-supporting waterbody or segment within a waterbody, DWQ will override a current (or previous) not-supporting Category 5 listing decision at the AU level as follows:

- **Whole AU Category 4A, TMDL-approved if:**

    a. There are any additional impairments within the waterbody or segments within the waterbody that are addressed in an approved TMDL (Category 4A) and are not included in the approved Category 4B demonstration plan. If the parameters included in the approved Category 4B demonstration plan are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters have an approved Category 4B demonstration plan in place.

- **Whole AU Category 4B, Pollution Control if:**

    b. The only impairments within the waterbody or segment within the waterbody are included in the approved Category 4B demonstration plan.
    c. There are additional impairments within the waterbody or segments within the waterbody that are pollution-driven (Category 4C) and are not included in the approved Category 4B demonstration plan. If the pollution-driven parameter impairments are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters are pollution- rather than pollutant-driven.

- **Whole AU Category 5, Not Supporting if:**

    d. There are any additional pollutant impairments within the waterbody or segments within the waterbody that are not included in the approved Category 4B demonstration plan. If the parameters included in the approved Category 4B demonstration plan are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters have an approved Category 4B demonstration plan in place.

CATEGORY 4C

The third alternative for not listing or removing an impaired waterbody or segment within a waterbody on the state's 303(d) List is to demonstrate that the parameter-specific impairment (or impairments) is driven by pollution and not by a pollutant or pollutant that causes pollution. Unlike a TMDL or Category 4B demonstration plan, the analysis works to determine if the cause of impairment is driven by pollution and does not require formal approval from DWQ's Water Quality Board or EPA. Pollution analysis work is instead reviewed internally by DWQ and by stakeholders during the public comment period of the draft IR and 303(d) List.

For the draft IR and 303(d) List, DWQ will temporarily assume "approval" of any pollution-driven analysis work and supersede a current or previous not supporting Category 5 listing decision at the AU level as follows:

- **Whole AU Category 4A, TMDL-approved if:**

    a. All impairments within the waterbody or segments within the waterbody are addressed in an approved TMDL (Category 4A). For pollution-driven impairments that are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters are pollution- rather than pollutant-driven.

- **Whole AU Category 4B, Pollution Control if:**

    b. All impairments within the waterbody or segments within the waterbody that are addressed in an approved Category 4B demonstration plan. For pollution-driven impairments that are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters are pollution-driven.

- **Whole AU Category 4C, Non-Pollutant Impairment if:**

    c. The only impairments within the waterbody or segment within the waterbody are included in the approved Category 4B demonstration plan.

- **Whole AU Category 5, Not Supporting if:**

    d. There are any additional pollutant impairments within the waterbody or segments within the waterbody. The pollution-driven impairments that are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters are pollution-driven.
    e. DWQ will provide to stakeholders during the public comment period of the draft IR and 303(d) List documentation as to why the impaired parameter within the waterbody or segment within the waterbody is pollution- and not pollutant-driven and will not require the future development of a TMDL.

DELISTINGS

The fourth and final alternative DWQ has at its disposal is to demonstrate good cause to stakeholders and EPA that the previously impaired parameter and waterbody or segment within a waterbody are now meeting water quality standards in UAC R317-2. Good cause occurs when DWQ can demonstrate one or more of the following categories and scenarios:

- **Improvements in Watershed Conditions:**

    a. Because of the implementation of nonpoint source projects and/or revised effluent limits, the waterbody has improved such that post-implementation data indicate that the impairment has been resolved. This assessment may be based on additional data, beyond that which is typically used in assessments, including before and after project implementation monitoring. In some cases, demonstration of improvement may be based on a different time period for data collection that corresponds with known watershed improvements.

- **Changes to Water Quality Standards:**

    b. Adoption of revised water quality standards and/or uses such that the water is now in attainment of the revised standards and/or uses.

- **Changes to the 303(d) Assessment Methods:**

    c. Development of a new listing method consistent with the state water quality standards and classifications and federal listing requirements. This includes all information contained in this document and posted on DWQ's Call for Data website.

- **Reassessment (new data and information):**

    d. Assessment and interpretation of older data that was not originally included in the previous assessment and/or more recent or more accurate data that demonstrate that the applicable classified uses and numeric and narrative standards are being met.

- **Geo-location Information Error:**

e. Inappropriate listing of a water that is located within Indian lands as defined in 18 United States Code 1151.

- **Analysis Errors:**

f. Flaws in the original analysis of data and information that led to the waterbody-pollutant combination being incorrectly listed. Such flaws may include the following: (1) Calculation errors in the data assessment methods outlined in the 303(d) Assessment Methods from that Assessment cycle, (2) errors produced when reviewing credible and representative data information, (3) mapping errors generated during the validation of monitoring location information and assigning AU designations, (4) discrepancies between the beneficial use assignments in UAC R317-2 and the IR geo-location information files for internal and external data, (5), wrong identification and assessment of a waterbody type, and (6) application of the wrong numeric criteria to a beneficial use.

- **New Modeling:**

g. Results of more sophisticated water quality modeling that demonstrate that the applicable classified uses and numeric and narrative standards are being met.

- **Effluent Limitations:**

h. Demonstration pursuant to 40 CFR 130.7(b)(1)(ii) that there are effluent limitations required by state or local authorities that are more stringent than technology-based effluent limitations, required by the CWA, and that these more stringent effluent limitations will result in attainment of classified uses and numeric and narrative standards for the pollutant causing the impairment.

- **Other:**

i. There is other relevant information that supports the decision not to include the segment on the Section 303(d) List.

In order to first justify a delisting of an AU for a given parameter based on new data, the dataset must be of sufficient quantity and quality to make an assessment. There are two mechanisms for justifying a delisting based on assessment results:

- Delisting an AU for all parameters.
- Delisting individual parameters for an AU.

To demonstrate good cause, DWQ will compare the previous IR cycle's final assessment categories and 303(d) List to the current IR's assessment categories and 303(d) List. Where differences in categorical assignments exist, DWQ will only further investigate the following scenarios for good cause:

- The AU/waterbody or segment within the waterbody was previously not supporting (Category 5) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- The AU/waterbody or segment within the waterbody was previously not supporting but had an approved TMDL (Category 4A) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- The AU/waterbody or segment within the waterbody was previously not supporting but had an approved Category 4B demonstration plan and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- The AU/waterbody or segment within the waterbody was previously not supporting but had pollution-driven impairment (Category 4C) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).

Note: The next set of scenarios describes the methods that apply to delisting individual parameters rather than entire AUs.

- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting (Category 5) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting but had an approved TMDL (Category 4A) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting but had an approved Category 4B demonstration plan and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting but had pollution-driven impairment (Category 4C) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).

Where assessment category assignments at the AU- and parameter-level warrant a further investigation for good cause, DWQ will reevaluate the data from the following:

- The period of record from when the AU and/or parameter was first listed.
- The period of record in the current assessment cycle.
- The data that were collected between when the AU and/or parameter were first listed and the period of record considered in the current assessment cycle.

As part of the demonstration of good cause process, DWQ will review the data from all assessed sample locations (as defined in Table 4) in the three above scenarios to confirm whether or not there were exceedances at the sample sites. Where exceedances occur, DWQ must demonstrate that the exceedances no longer exist, no longer are of concern, or that water quality has improved. If a sample site had exceedances (and newer data do not exist), DWQ will provide documentation and a justification as to why the site was not re-sampled and/or whether water quality conditions have improved. If documentation cannot be provided, the AU and parameter will not be delisted, and the previous categorical assignment will carry forward.

Delisting Categorical Pollutant Causes

In the case of TMDLs or special studies which identify parameters contributing to a cause of impairment, but are not the original cause for listing on the 303(d) list, there may be good cause justification for delisting the categorical cause if the original impaired parameter is no longer impaired and a linkage of the additional causes can be documented in a TMDL or other study. For instance, in some circumstances DWQ has identified phosphorus as a contributing cause of impairment to an existing dissolved oxygen listing and subsequently made a categorical listing for phosphorus as a cause on subsequent 303(d) lists. Since DWQ does not have assessment methods for phosphorus, a delisting based on process outlined here is not feasible. Therefore, if the assessment results for the original DO listing can justify a delisting, any additional parameters associated with that cause may also be delisted with proper documentation of a direct linkage.

Appendix 6 elaborates on the process DWQ will follow when evaluating good cause at the AU-level, and also describes, in more detail, the process DWQ will go through when evaluating good cause at the parameter-level. For EPA review and approval, DWQ applies several delisting codes (also included in Appendix 6).

If a waterbody or parameter is shown to have good cause for not being listed or removed as an impaired waterbody or segment within a waterbody on the state's 303(d) List, DWQ will state the good cause and provide a more detailed description of the good cause. Details of the good-cause evaluation process such as the data-analysis work will not be posted online during the draft public comment period or after the final approval and

publication of the final IR and 303(d) List. DWQ will, however, summarize the data analysis work in the description of the good cause. The analyses will be available to the public upon request through Utah's Government Records Access and Management Act (GRAMA) requirements.

PREVIOUS CATEGORICAL LISTINGS

303(d) Listings

Without the proper documentation to support changing a previous not-supporting (Category 5) listing decision to a TMDL-approved (Category 4A), pollution control (Category 4B), non-pollutant impairment (Category 4C), or delisting (demonstration of good cause), DWQ must continue to list all previous impairments. At a minimum, this includes carrying forward all waterbodies or segments within a waterbody that were previously not supporting (Category 5), indicating the cause of impairment, listing the beneficial use (or uses) that is failing to meet water quality standards, providing the priority of developing a TMDL, and indicating the assessment cycle the waterbody or segment within the waterbody were first listed.

Non-303(d) Categorical Listings

Where DWQ has the proper documentation to support changing a previous not supporting (Category 5) listing decision to a TMDL-approved (Category 4A), pollution control (Category 4B), non-pollutant impairment (Category 4C), or delisting (demonstration of good cause), DWQ will do so as outlined by the policies and procedure described throughout this document.

DWQ will also carry forward all previous categorizations of waterbodies or segments within a waterbody if the waterbody does not have any credible or representative data from the period of record of the current assessment cycle . This includes carrying forward the following:

- Previous TMDL-approved (Category 4A), pollution control (Category 4B), and non-pollutant impairment (Category 4C) categorizations that do not demonstrate good cause.
- Previous categorizations that have insufficient data with exceedances (Category 3), require further investigations (Category 3), have insufficient data with no exceedances (Category 3), are not assessed (Category 3), show no evidence of impairment (Category 2), or are supporting (Category 1).
- Historical Category 3 waters that had insufficient data with exceedances will remain in that category unless there is new data for assessment.

Waterbodies or segments within a waterbody that are supporting or show no evidence of impairment (Categories 1 and 2, respectively) may carry forward for six consecutive assessment (or two rotating basin) cycles. On the seventh consecutive assessment cycle, DWQ will not continue to carry forward a supporting or no evidence of impairment categorization for waterbodies or segment within a waterbody that do not have any new data collected in the last 12 years. Data older than the period of record may not be reflective of current conditions, and will not be used for assessment purposes unless there is information or a rationale with supporting documentation that shows the data are reflective of current conditions.

If there is evidence that the data are reflective of current conditions, the previous supporting (Category 1) or no evidence of impairment (Category 2) categorization will carry forward for one more assessment cycle (the current one) and be re-evaluated in the next cycle. If there is no or not enough supporting evidence that the data are reflective of current conditions, DWQ will not carry forward the supporting or no evidence of impairment categorization for a seventh consecutive assessment cycle. Instead, DWQ will change the categorization to insufficient data with no exceedances (Category 3).

303(d) Vision and TMDL Priority Development

For waterbodies or segments within a waterbody that are impaired by a pollutant, DWQ must ensure that TMDLs will be developed following the final release of the current IR and 303(d) List. Recognizing that all TMDLs cannot be completed at once and that certain risks may be greater than others, the CWA Section 303(d) allows states to prioritize impaired waterbodies or segments within a waterbody on the Section 303(d) List for the future development of TMDLs.

To help guide states on how to best prioritize and demonstrate progress on addressing the water quality concerns highlighted and reported on in the IR and 303(d) List, EPA announced on December 5, 2013, a collaborative framework for implementing the CWA Section 303(d) Program with states (See A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program). This document outlines a framework on how states can focus their resources to support the development of TMDLs and other water quality improvement programs (such as the anti-degradation program, nonpoint source implementation program, and 401 water quality certification program). In response to the release of this document, DWQ engaged with stakeholders and developed new policies and procedures for the following IR and 303(d) reporting-specific elements:

- Assigning TMDL priorities to impaired waterbodies and segments within waterbodies on DWQ's 303(d) List.
- Performing cost–benefit analyses that estimate the environmental, economic, and social costs and benefits, and time needed to achieve the objectives of the CWA and state water quality standards.
- Tracking the status and development of TMDLs.

Please refer to Appendix 7 for how DWQ prioritized the future developments of TMDLs on DWQ's 303(d) List.

Revision Requests between Cycles

Barring unforeseen circumstances, DWQ will only propose to revise the IR and 303(d) List during the regularly scheduled reviews, which are currently biennially and on even-numbered years. Interested persons may petition DWQ at any time to request a revision to the IR and 303(d) List, whether it is an addition or deletion to the final 303(d) List. However, such revisions may only be considered if failing to either add a segment to the list or delete a segment from the list before the next scheduled review will result in a substantial hardship to the party or parties requesting the revision(s). If such hardship is shown, DWQ will take the potential revision under strong consideration and begin a dialogue with the interested party or parties and EPA.

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PRIORITY PARAMETERS

DWQ Parameter Name	DWQ Parameter Fraction	Recommended CAS Number	Parameters impacted by New/ Revised Assessment Methodology	DWQ Parameters Routinely Measured for Assessment Purposes	Required Additional Parameter Submissions for Complete Assessment Purposes	Additional Submission Considerations for QAQC
Fish Mercury		n/a				
Flow	n/a	Field Measurement		X		
pH	n/a	Field Measurement		X		
Secchi Depth	n/a	Field Measurement		X	for Lake Samples only	
Temperature, Air	n/a	Field Measurement			Accompanying Fluoride, Dissolved for Fluoride Assessment	
Temperature, Water	n/a	Field Measurement		X		
Total Dissolved Gases	Total	Field Measurement				
Bromate	Total	15541-45-4				
Chlorine (Total Residual)	Total	Field Measurement				
Chlorite	Total	14998-27-7				
Cyanide	Dissolved	57-12-5				(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Cyanide	Total	57-12-5				
Fluoride	Total	16984-48-8			Accompanying Air Temperature measurement	
Hardness	Dissolved	Calculated		X		
Hydrogen Sulfide	Total	7783-06-4			Accompanying Field pH Measurement	
Sulfate	Total	14808-79-8			Accompanying Total Dissolved Solids measurements for Site-specific locations located on Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek, and Quitchupah Creek from confluence with Ivie Creek to U-10	
Total Dissolved Solids	Total	n/a		X		
BOD	Total	n/a				
Chlorophyll a	Total	n/a		X	for Lake Samples only; Accompanying Secchi Depth	
Chlorophyll a, uncorrected for pheophytin	Total	n/a		X	for Lake Samples only; Accompanying Secchi Depth	
Dissolved Oxygen (% Sat)	n/a	Field Measurement				Recommend submitting Water Temperature
Dissolved Oxygen (Concentration)	n/a	Field Measurement	X - High frequency data assessments	X	Please refer to the credible data requirements and DWQ's Call for Data Website.	Please refer to the credible data requirements and DWQ's Call for Data Website.
Aluminum	Dissolved	7429-90-5		X	Accompanying Field pH Measurement AND Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Antimony	Total	7440-36-0				
Arsenic	Dissolved	7440-38-2		X		Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Arsenic (Trivalent)	Dissolved	7440-38-2		O - DWQ unable to routinely measure this parameter due to analytical constraints		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Asbestos	Total	1332-21-4				
Barium	Dissolved	7440-39-3		X		Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Beryllium	Dissolved	7440-41-7		X		Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Boron	Total	7440-42-8		X		
Cadmium	Dissolved	7440-43-9		X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Calcium	Dissolved	7440-70-2		X	Accompanying Magnesium, Dissolved for Hardness calculation	Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Chromium	Dissolved	7440-47-3		X		Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Chromium (Hexavalent)	Dissolved	18540-29-9		O - DWQ unable to routinely measure this parameter due to analytical constraints		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Chromium Trivalent	Dissolved	16065-83-1		O - DWQ unable to routinely measure this parameter due to analytical constraints	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Copper	Dissolved	7440-50-8		X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Iron	Dissolved	7439-89-6		X		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Lead	Dissolved	7439-92-1		X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Magnesium	Dissolved	7439-95-4		X	Accompanying Calcium, Dissolved for Hardness calculation	Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Mercury	Dissolved	7439-97-6		X		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Nickel	Dissolved	7440-02-0		X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Selenium	Dissolved	7782-49-2		X		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.

DWQ Parameter Name	DWQ Parameter Fraction	Recommended CAS Number	Parameters impacted by New/ Revised Assessment Methodology	DWQ Parameters Routinely Measured for Assessment Purposes	Required Additional Parameter Submissions for Complete Assessment Purposes	Additional Submission Considerations for QAQC
Silver	Dissolved	7440-22-4		X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
Thallium	Total	7440-28-0				
Uranium	Total	7440-61-1				
Zinc	Dissolved	7440-66-6		X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the **Total** fraction result value is also submitted in the data package for QAQC purposes.
E. coli	n/a	n/a		X		
Beach Closures		n/a				
Drinking Water Closures		n/a				
Fish Kills		n/a				
Harmful Algal Blooms: Cyanobacteria cell density		n/a		X	for Lake Samples only	
Harmful Algal Blooms: Cyanobacteria taxanomic composition (i.e., phytoplankton)		n/a		X		
Harmful Algal Blooms: Cyanobacteria toxin concentrations		n/a		X		
Nitrate as N	Total and/ or Dissolved	14797-55-8		X		
Total Ammonia as N	Total	7664-41-7		X	Accompanying Field pH AND Field Water Temperature Measurement	
Total Phosphorus as P	Total	7723-14-0		X		
1,1,1-Trichloroethane	Total	71-55-6				
1,1,2,2-Tetrachloroethane	Total	79-34-5				
1,1,2-Trichloroethane	Total	79-00-5				
1,1-Dichloroethane	Total	75-34-3				
1,1-Dichloroethylene	Total	75-35-4				
1,2 -Trans-Dichloroethylene	Total	156-60-5				
1,2,4-Trichlorobenzene	Total	120-82-1				
1,2-Dichlorobenzene	Total	95-50-1				
1,2-Dichloroethane	Total	107-06-2				
1,2-Dichloropropane	Total	78-87-5				
1,2-Diphenylhydrazine	Total	122-66-7				
1,3-Dichlorobenzene	Total	541-73-1				
1,3-Dichloropropene	Total	542-75-6				
1,4-Dichlorobenzene	Total	106-46-7				
2,4,5-TP	Total	93-72-1				
2,4,6-Trichlorophenol	Total	88-06-2				
2,4-D	Total	94-75-7				
2,4-Dichlorophenol	Total	120-83-2				
2,4-Dimethylphenol	Total	105-67-9				
2,4-Dinitrophenol	Total	51-28-5				
2,4-Dinitrotoluene	Total	121-14-2				
2,6-Dinitrotoluene	Total	606-20-2				
2-Chloroethyl vinyl Ether	Total	110-75-8				
2-Chloronaphthalene	Total	91-58-7				
2-Chlorophenol	Total	95-57-8				
2-Methyl-4,6-Dinitrophenol	Total	534-52-1				
2-Nitrophenol	Total	88-75-5				
3,3'-Dichlorobenzidine	Total	91-94-1				
3-Methyl-4-Chlorophenol	Total	59-50-7				
4,4-DDD	Total	72-54-8				
4,4-DDE	Total	72-55-9				
4,4'-DDT	Total	50-29-3				
4-Bromophenyl Phenyl Ether	Total	101-55-3				
4-Chlorophenyl Phenyl Ether	Total	7005-72-3				
4-Nitrophenol	Total	100-02-7				
Acenaphthene	Total	83-32-9				
Acenaphthylene	Total	208-96-8				
Acrolein	Total	107-02-8				
Acrylonitrile	Total	107-13-1				
Alachlor	Total	15972-60-8				
Aldrin	Total	309-00-2				
alpha-BHC	Total	319-84-6				
alpha-Endosulfan	Total	959-98-8				
Anthracene	Total	120-12-7				
Atrazine	Total	1912-24-9				
Benzene	Total	71-43-2				
Benzidine	Total	92-87-5				
Benzo(a)Anthracene	Total	56-55-3				
Benzo(a)Pyrene	Total	50-32-8				
Benzo(b)Fluoranthene	Total	205-99-2				
Benzo(ghi)Perylene	Total	191-24-2				

DWQ Parameter Name	DWQ Parameter Fraction	Recommended CAS Number	Parameters impacted by New/ Revised Assessment Methodology	DWQ Parameters Routinely Measured for Assessment Purposes	Required Additional Parameter Submissions for Complete Assessment Purposes	Additional Submission Considerations for QAQC
Benzo(k)Fluoranthene	Total	207-08-9				
beta-BHC	Total	319-85-7				
beta-Endosulfan	Total	33213-65-9				
Bis(2-Chloroethoxy)Methane	Total	111-91-1				
Bis(2-Chloroethyl)Ether	Total	111-44-4				
Bis(2-Chloroisopropyl)Ether	Total	39638-32-9				
Bis(2-Ethylhexyl)Phthalate	Total	117-81-7				
Bromoform	Total	75-25-2				
Butylbenzyl Phthalate	Total	85-68-7				
Carbofuran	Total	1563-66-2				
Carbon Tetrachloride	Total	56-23-5				
Chlordane	Total	57-74-9				
Chlorobenzene	Total	108-90-7				
Chlorodibromomethane	Total	124-48-1				
Chloroethane	Total	75-00-3				
Chloroform	Total	67-66-3				
Chlorpyrifos	Total	2921-88-2				
Chrysene	Total	218-01-9				
Dalapon	Total	75-99-0				
Di(2-ethylhexl)adipate	Total	103-23-1				
Diazinon	Total	333-41-5				
Dibenzo(a,h)Anthracene	Total	53-70-3				
Dibromochloropropane	Total	96-12-8				
Dichlorobromomethane	Total	75-27-4				
Dichloroethylene (cis-1,2)	Total	156-59-2				
Dieldrin	Total	60-57-1				
Diethyl Phthalate	Total	84-66-2				
Dimethyl Phthalate	Total	131-11-3				
Di-n-Butyl Phthalate	Total	84-74-2				
Di-n-Octyl Phthalate	Total	117-84-0				
Dinoseb	Total	88-85-7				
Dioxin	Total	1746-01-6				
Diquat	Total	85-00-7				
Endosulfan Sulfate	Total	1031-07-8				
Endothall	Total	145-73-3				
Endrin	Total	72-20-8				
Endrin Aldehyde	Total	7421-93-4				
Ethylbenzene	Total	100-41-4				
Ethylene Dibromide	Total	106-93-4				
Fluoranthene	Total	206-44-0				
Fluorene	Total	86-73-7				
gamma-BHC (Lindane)	Total	58-89-9				
Glyphosate	Total	1071-83-6				
Haloacetic acids	Total	n/a				
Heptachlor	Total	76-44-8				
Heptachlor epoxide	Total	1024-57-3				
Hexachlorobenzene	Total	118-74-1				
Hexachlorobutadine	Total	87-68-3				
Hexachlorocyclohexane (Lindane)	Total	58-89-9				
Hexachlorocyclopentadiene	Total	77-47-4				
Hexachloroethane	Total	67-72-1				
Ideno 1,2,3-cdPyrene	Total	193-39-5				
Isophorone	Total	78-59-1				
Methoxychlor	Total	72-43-5				
Methyl Bromide	Total	74-83-9				
Methyl Chloride	Total	74-87-3				
Methylene Chloride	Total	75-09-2				
Mirex	Total	2385-85-5				
Naphthalene	Total	91-20-3				
Nitrobenzene	Total	98-95-3				
N-Nitrosodimethylamine	Total	62-75-9				
N-Nitrosodi-n-Propylamine	Total	621-64-7				
N-Nitrosodiphenylamine	Total	86-30-6				
Nonylphenol	Total	84852-15-3				
Oxamyl (vydate)	Total	23135-22-0				
Parathion	Total	56-38-2				
PCB's	Total	1336-36-3				
Pentachlorophenol	Total	87-86-5			Accompanying Field pH Measurement	
Phenanthrene	Total	85-01-8				
Phenol	Total	108-95-2				
Picloram	Total	1918-02-1				
Polychlorinated Biphenyls	Total	1336-36-3				
Pyrene	Total	129-00-0				

DWQ Parameter Name	DWQ Parameter Fraction	Recommended CAS Number	Parameters impacted by New/ Revised Assessment Methodology	DWQ Parameters Routinely Measured for Assessment Purposes	Required Additional Parameter Submissions for Complete Assessment Purposes	Additional Submission Considerations for QAQC
Simazine	Total	122-34-9				
Styrene	Total	100-42-5				
Tetrachloroethylene	Total	127-18-4				
Toluene	Total	108-88-3				
Toxaphene	Total	8001-35-2				
Trichloroethylene	Total	79-01-6				
Vinyl Chloride	Total	75-01-4				
Xylenes	Total	1330-20-7				
Tributyltin	Dissolved	n/a				Please refer to appropriate method for QC requirements and to ensure that method sensitivity is sufficient to accurately quantify constituent concentration from natural waters
Gross Alpha	Total	12587-46-1				
Gross Beta (Combined)	Total	12587-47-2				
Radium 226	Total	13982-63-3				
Radium 228	Total	15262-20-1				
Strontium 90	Total	10098-97-2				
Tritium	Total	10028-17-8				
NOTE: This list and accompanying information may not be complete. Please check UAC R317-2 for the most current list of parameters and the 303(d) Methods for additional information on what parameters are assessed, readily available, and credible.						

Appendix 2

DATA QUALITY GUIDELINE EXAMPLES

DWQ Sampling Analysis Plan Requirements

Revision 1.1 July 6, 2016

Utah Division of Water Quality

Checklist of Essential Elements for Sampling and Analysis Plans (SAPs)

Monitoring Project/Program:_____

Preparer(s):_____

Reviewer(s):_____

Date Submitted for Review:_____

Date of Review:_____

Parent QAPP or Equivalent Document:_____

Instructions for Preparers:

As required by DWQ's Quality Assurance Program Plan for Monitoring Programs (DWQ QAPP), ***any monitoring activity*** conducted or overseen by DWQ ***must*** have a SAP, excluding one-time response actions (such as a spill) or compliance sampling. The SAP must be reviewed and revised for each field season/monitoring year. SAPs are approved and kept on file by the Monitoring Section QA Staff and must be distributed to everyone involved with a monitoring project. Use the template and checklist below to help create your SAP. The SAP should contain or reference all the elements in this checklist but need not have the same format. Rather than extensive text, include as much information as possible in the form of tables, which are easier to refer to in the field.

The SAP should be a usable, stand-alone document that can be taken into the field by Monitors. Therefore, if you choose to use an element directly from the DWQ QAPP that needs to be viewable when reading the SAP, copy and paste it into the SAP rather than just referencing the QAPP so that Monitors do not have to read through both documents while in the field. The Monitoring- and Data and Information-Section's QA Staff are available to assist you in preparing your SAP and you may view other DWQ SAP examples on the Monitoring Council Webpage at http://www.waterquality.utah.gov/Monitoring/Council.

Definitions and Acronyms:

DPM- Designated Project Manager. As defined by DEQ's Quality Management Plan (QMP), the DPM is the staff member responsible for a specific project and has immediate managerial or technical control of that project. The DPM is responsible for specifying the quality of the data required for each project and initiating corrective actions when quality control is not being met. The DPM may also be a program manager. The DPM is responsible for designing monitoring strategies, setting project-specific data quality objectives (DQOs), and developing project-specific SAPs. DPMs are responsible for making sure all personnel involved with the project are briefed and/or trained on the procedures to be used. Roles of DPMs are further discussed throughout the DWQ QAPP.

IR – Integrated Report

Introduction and Background Information (This can be brief if it references some previous documentation or the IR or SMP, etc.)

- Site history
- Regulatory framework
- Summary of previous investigations
- Location/characteristics of any known pollution sources at the site or in the area
- Site location map showing area at a broad scale

Objectives and Design of the Investigation (This should be very specific to the project and should be a result of discussions between DPM, data users, stakeholders, science panel, etc.)

- Specific objectives of this study (describe how they support broader program goals/objectives or regulatory framework)
- Provide the study design (i.e. spatial/temporal limits, sample characteristics, the smallest population, area, volume, or time frame for which decisions will be made).
- Discuss representative sampling conditions and instructions for field personnel if they encounter non-representative sampling conditions
- Describe parameters of concern (narrative – must conform to list(s) in sections 4 and 6)
- Number, location, and frequency of samples and quality control samples
- Sampling Site Locations
- Rationale for site selection
- Site map(s) showing sampling locations and “control” sites and any other pertinent features such as land use, etc. within the sampling area

Special Precautions and Safety Plan

- Detailed itemization of any specific safety concerns
- Reference an applicable safety plan
- Any additional safety training required for project
- Document that field personnel comply with your Invasive Species Plan and SOPs to prevent spread of invasive species

Field Sampling Methods and Documentation

- Any special training needed beyond those discussed in DWQ QAPP, and where training documentation will be kept
- Include a table listing each field instrument to be used (equipment, describe operation or indicate where operation manual is kept for field event, include calibration procedures, if any)
- Include a table listing each sampling method to be used (sampling equipment if needed, cite method in SAP, attach applicable SOPs)
- For any sampling equipment used, describe operation or indicate where operation manual is kept for field event, include decontamination procedures, if any, attach applicable SOPs
- If not found in SOPs, include equipment lists, sampling trip organizing checklists,
- List corrective actions for problems that may occur in the field
- Discuss what field documentation is required, and how field records shall be generated and stored

Laboratory Sample Handling Procedures

- Describe sample containers, preservatives, holding times
- Describe field documentation (COC) and sample labeling procedures
- Describe shipping plan for sample transport to laboratory

Analytical Methods and Laboratory Documentation

- Chemical – list parameter, cite preparation method and analytical method, list required sensitivity or detection limits
- Biological – cite method or desired taxonomic level and organism target count, etc.
- Required reporting procedures (e.g. hardcopy, electronic deliverables) and turn-around times
- Be sure DWQ has obtained QA documentation for each laboratory used (check with Monitoring Section QA Staff), reference this information and any new/research analytical methods being used (obtain these protocols if available from lab)
- List the required data package contents from the analyzing laboratories [or reference a service contract or Memorandum of Understanding (MOU)]

Project Quality Control Requirements

- Table of QC limits for field instruments (operation range, accuracy, and precision)
- Table listing each Data Quality Indicator (precision, accuracy, bias, etc.), how it will be measured, and the performance criteria against which it will be evaluated (use the table in the DWQ QAPP and adapt it to this project if needed): (1) analytical (internal to lab) QC limits for chemical analyses (acceptable precision, accuracy, and negative control – lab method blank, (2) field sample QC limits for chemical analyses [Acceptable precision (field duplicates) and negative control (field or trip blanks)], and (3) QC limits for biological analysis [Acceptable precision (% diff in enumeration, 5 taxonomic difference)]
- QC limits, schedule, and descriptions of planned field/lab audits/assessments
- Data quality assurance review procedures: (1) describe system of data qualification, (2) describe measure of completeness relative to planned design, and (3) corrective actions for non-conformance

Data Analysis, Record Keeping, and Reporting Requirements

- Data interpretation approach (include means to temper decision-making if limited completeness of design occurs)
- Describe project record keeping procedures and archive (hardcopies, electronic data)
- Describe how and when DPM wishes to be notified of available laboratory/field results
- Describe expected content and format of final project report and who will receive original/copies.

Schedule and Budget

- Table or figure showing project schedule with key project milestones
- List funding sources for project and include anticipated equipment, consumables, personnel purchases/costs
- Sample costs/lab resources per fee schedule

Project Team and Responsibilities

- Identify project team responsibilities and personnel
- Identify sampling personnel
- Identify subcontractors (e.g. chemical and biological labs)

References (Include references to DWQ-prepared documents)

Appendices and Attachments (Include SOPs, Chain of Custody forms, Field Forms, Sample Labels, etc.)

Example Field Observation Form for Grab Samples

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Version 2.0
Monitoring Location ID: _____
Monitoring Location Name: _____
Monitoring Location Description: _____

Sample Date: _____
Sample Time: _____

Check the water color desciption that best fits the sampling location:
□ Brown/Gray (turbid) □ Black □ Clear □ Stained (tea-look) □ Green □ Other (describe) _____

Indicate the level of coverage of *Didymosphenia geminata* (didymo) in reach
□ Absent (0%) □ Sparse (<10%) □ Moderate (10-75%) □ Heavy (>75%)

<-- Example of didymo.
Photo fromhttp://www.wvdnr.gov/fishing/didymo.shtm

Indicate the level of coverage of Filmentous algae in reach
□ Absent (0%) □ Sparse (<10%) □ Moderate (10-75%) □ Heavy (>75%)

<-- Example of filamentous algae
Photo from http://www.dep.wv.gov/WWE/Programs/
/wqs/Pages/FilamentousAlgaeinWestVirginia.aspx

(Lake sampling) Is there blue green algae? □ Y □ N

<-- Example of blue green algae
Photo courtesy of Utah County Health Dept

Is there an Algal Mat? ☐ Y ☐ N **Fish kill?:** ☐ Y ☐ N **Number of Fish Observed:** _____ **Type of Fish:** _____

Does the underside of the rock look black AND have a straong sulfur/ rotten eggs smell? ☐ Y ☐ N **Sheen present?:** ☐ Y ☐ N **Odor at the site?:** ☐ Y ☐ N

Anthropogenic disturbances present at site that may affect sample results? ☐ Y ☐ N

If yes to any above, explain here: _____

Were any photos take from the site visit? ☐ Y ☐ N

Circle all weather codes that apply
1 Windy
2 Dust
3 Rain in the last 24/48 hrs
4 Rain (presently
5 Runoff (indicate if you are sampling/ trying to capture runoff)

Circle all flow codes that apply
1 Standing Water (no flow BUT measurement/ sample taken
2 Measurement/ sample taken from backwater
3 Swift and deep
4 Shallow/trickle
5 Ice Present: evidence of flow beneath surface
6 Ice Present: unsure if flowing beneath surface

Circle all field condition codes that apply
1 Fire (evidence of)
2 Landslide/ Mudslide (evidence of)
3 Flooding (evidence of)
4 Presently Flooding/ Water Rising
5 Livestock (present)
6 Livestock (not present but evidence of)
7 Beaver Dam (sample taken upstream)
8 Beaver Dam (sample taken downstream)
9 Dam (sample taken downstream of resevoir tailrace)

FIELD COMMENTS: _____

Other comments/concerns/issues: _____

Appendix 3

APPLICATION OF SECONDARY REVIEW PROCESS

Data Concern	Secondary Review Process	Data Application
Temporal variation within a dataset	Insufficient sampling frequency within an assessment period of record.	Individual data records.
Bias in sampling design	(1) Event monitoring (review flow, weather, and spill/response/incident data; narrative criteria; field observations and photographs; satellite imagery; other data types collected in same (and around the) period of concern, etc.), (2) sample time of day (literature review to determine if parameter is impacted by the time of day sample is collected), (3) sampling a specific season (unless approved by DWQ in a SAP or is data-type specific (e.g., E. coli sampling during the rec. season)], (4) and locational bias.	Individual data records.
Data quality	(1) Quality Assurance Program Plan For Environmental Data Operations, (2) field calibration documentation, (3) laboratory methods, (4) standard operating procedures, (5) demonstration of capability (if applicable to data type), and (6) discussion with sample collector.	Individual data records, and/or, parameter(s) in period of record, and/or monitoring location.
Wrongly monitored	(1) Measured point source (vs. main water body), review imagery of area, flow, etc., (2) waterbody type DWQ does not assess, (3) grab sample vs. composite, (4) flow conditions (too low or not flowing), and (5) field observation that impacts quality of data.	Individual data records and/or monitoring location.
Outlier	(1) Need more than a statistical test. Should be based on scientific or QA basis, (2) QA/QC field sampling blanks, duplicates/replicate, (3) laboratory Analytical Batch QC, (4) value is nonsensical (e.g., cannot be measured with field/laboratory method), and (5) refer to data quality (above).	Individual data records
Magnitude of exceedance	(1) Significant figures and (2) review narrative criteria	Individual data records
QA/QC concerns	(1) Holding time, (2) laboratory comment, (3) dilutions, spikes, and (4) other laboratory QC Performance Checks	Individual data records
Assessment unit grouping/spatial variation	(1) Multiple locations not grouped correctly (either should or should not have been grouped), (2) AUs where water quality criterion exceedances are clearly isolated to a relatively small, hydrologically distinct portion of the larger AU and may need to be re-segmented to more accurately reflect that variation in water quality (please refer to 303(d) Assessment Methods section on “Assessment Unit Re-segmentation” for more information on the process), and (3) a surface water (e.g., a spring or seep) was sampled in the AU and was assessed but additional information indicates that the surface water may not have been flowing or did not connect, contribute, or influence downstream water quality.	Monitoring location.

Data Concern	Secondary Review Process	Data Application
Credible data	(1) Data type applied incorrectly and (2) data type not considered. (Data type must meet credible and representative data requirements in 303(d) Assessment Methods and if included in the assessment analysis would result in a change in the categorization of the waterbody and parameter.	Individual data records and/or parameter(s) in period of record, monitoring location.
Other	(1) Parameters wrongly grouped (by CAS, fraction, or methods), (2) data type is laboratory measurement (when the data assessment requires a field measurement), (3) IR QA/QC flagged data, and (4) errors in standards.	Individual data records. Entire parameter assessments.
Conflicting DO assessments between grab and high frequency data	Scenario: Two types of data available at the site(s) (i.e., grab or high frequency data) do not have the same preliminary assessment result. Reviews to consider: (1) sampling period captured, (2) duration of conditions below criterion, (3) frequency of recurrent low DO events, (4) magnitude of exceedance, (5) spatial extent of low DO, and (6) diel flux of DO.	Individual data records. Entire parameter assessments.
Representativeness and Environmental Factors*	Examples of extreme events include the following: (1) accidental spills of toxic chemicals, (2) scouring storm flows that lead to diminished aquatic-life beneficial uses, and (3) extreme drought conditions. Given the scope of these assessments, it is not always possible to identify where such circumstances may be influencing a specific sample, but DWQ will consider any evidence presented that a sample is not representative of ambient conditions. Examples of such a review may include reviewing flow, weather, spill data, narrative criteria, field observations and photographs, satellite imagery, other data types collected in the same (and around the) period of concern, etc..	Individual data records

Data Concern	Secondary Review Process	Data Application
*Footnote: Where these conditions are present in a dataset, DWQ will run the analysis without the extreme events/data record and will apply and document an appropriate assessment result for the waterbody using the methods outlined below. Category 1: Supporting: If analyses with and without the extreme events are supporting (Category 1). Category 2: No evidence of impairment: If analyses with the extreme events are supporting (Category 1), but the analyses without the extreme events show no evidence of impairment (Category 2). Category 2: No evidence of impairment: If analyses with and without the extreme events do not indicate evidence of impairment (Category 2). Category 2: No evidence of impairment: If analyses with the extreme events are evidence of impairment (Category 3 with exceedances), but the analyses without the extreme events show no evidence of impairment (Category 2). Category 2: No evidence of impairment: If analyses with the extreme events are not supporting (Category 5), but the analyses without the extreme events show no evidence of impairment (Category 2). Category 3: Insufficient Data, Exceedances: If analyses with and without the extreme events show evidence of impairment (Category 3). Category 3: Insufficient Data, Exceedances: If analyses with the extreme events are not supporting (Category 5), but the analyses without the extreme events are supporting (Category 1). Category 5: Not supporting: If analyses with the extreme events are evidence of impairment (Category 3), but the analyses without the extreme events are not supporting (Category 5). Category 5: Not supporting: If analyses with the extreme events are not supporting (Category 5), but the analyses without the extreme events show evidence of impairment (Category 3). Category 5: Not supporting: If analyses with and without the extreme events are not supporting (Category 5).		

Appendix 4

SUMMARIZING ASSESSMENTS FROM SITE- TO ASSESSMENT UNIT-LEVEL

Going from a multiple beneficial uses assessments for a parameter (i.e., a Parameter Summary Report) to 1 Parameter Category per Monitoring Location ID (MLID)*.

IRAnalysisAction: 3: (insufficient Data with exceedances)

- 1,2, or 3 exceedances (with no data rejected for a use). ParamCat: 3 insufficient data with exceedances → ParamEPACat: 3
- 1,2, or 3 exceedances (with some data rejected for a use). ParamCat: 3 insufficient data with exceedances → ParamEPACat: 3
- 0 exceedances (with no data rejected for a use). ParamCat: 3 insufficient data with no exceedances → ParamEPACat: 3
- 0 exceedances (with some data rejected for a use). ParamCat: 3 insufficient data with no exceedances → ParamEPACat: 3
- All data removed for every use. ParamCat: 3 insufficient data because not assessed → ParamEPACat: 3

IRAnalysisAction: Not Assessed

- All data removed for every use. ParamCat: 3 insufficient data because not assessed → ParamEPACat: 3

IRAnalysisAction: Not Assessed

- IRAnalysisComment: "NonRejected data available for MLID/AU, but data available for individual use assessment was all rejected". ParamCat: 3 insufficient data because not assessed →ParamEPACat: 3

IRAnalysisAction: Not Assessed

- IRAnalysisComment: "No Uses assigned to site". ParamCat: 3 insufficient data because not assessed →ParamEPACat: 3

IRAnalysisAction: Assessed By Use

- FS Only →ParamEPACat: 1
- FS Only + some data rejected by use →ParamEPACat: 2
- Contains an NS →ParamEPACat: 5
- Only combo: all data was rejected for a use →ParamEPACat: 3, insufficient data because not assessed
- FS Only + exceedances by Use + some data rejected by use →ParamCat: 3 insufficient data with exceedances →ParamEPACat: 3
- FS Only + no exceedances by Use + some data rejected by use →ParamEPACat: 2
- FS Only + exceedances by Use + NO data rejected by use →ParamCat: 3 insufficient data with exceedances →ParamEPACat: 3
- FS Only + no exceedances by Use + NO data rejected by use →ParamEPACat: 2
- Exceedances by Use + some data rejected by use →3 insufficient data with exceedances →ParamEPACat: 3
- No exceedances by Use + some data rejected by use →3 insufficient data with no exceedances →ParamEPACat: 3
- Exceedances by Use + NO data rejected by use →3 insufficient data with exceedances →ParamEPACat: 3

- No exceedances by Use (NO exceedances) + NO data rejected by use →3 insufficient data with no exceedances →ParamEPACat: 3
- BOD, TP**, and Nitrate (for non 1C uses) →ParameterCat: MLIDCat =3 Further Investigations →ParamEPACat: 3

*Note: after this rollup there will be multiple parameter assessment categories for 1 MILD. For example, MLID "X" will have 1 Iron, 1 Copper, 1 Temperature, 1 Dissolved Oxygen, etc.

**Exceptions to this are discussed in Table 16.

Going from many Parameter Categories within an MLID to 1 Category for the MLID take MLID_Param Cats and Group them by MLID. Then assign the MLID category by the following logic:

- **ParameterCat = 5 →MLIDCat = 5 AND MLIDEPACat = 5
- ParameterCat = 3 with exceedances →MLIDCat =3 with exceedances AND MLIDEPACat = 3
- ParameterCat = 1 → (Cat1 Matrix Check is a match) →MLIDCat =1 AND MLIDEPACat = 1
- ParameterCat = 1 → (Cat1 Matrix Check is a NOT a match) → MLIDCat =2 AND MLIDEPACat = 2
- ParameterCat = 2 →MLIDCat =2 AND MLIDEPACat = 2
- ParameterCat = 3 further investigations needed →MLIDCat =3 further Investigations Needed AND MLIDCat = 3
- ParameterCat = 3 no exceedances →MLIDCat =3 no exceedance AND MLIDEPACat = 3
- ParameterCat = 3 not assessed →MLIDCat =3 no assessed AND MLIDEPACat = 3

** Should be able to see a concatenation of the uses for a parameter that created a 5 category (needs validation too)

Going from many MLID Categories within an Assessment Unit (AU) to 1 Category for the AU take MLID Cats and Group them by AUID. Then assign the AUID category by the following logic:

- **MLIDCat = 5 →AUIDCat = 5 AND AUIDEPACat = 5
- AUIDCat = 5 (and TMDL in Place) →AUIDCat = 5 AND AUIDEPACat = 4a
- AUIDCat = 5 (and non-TMDL in Place) →AUIDCat = 5 AND AUIDCat = 4b
- **MLIDCat = 5 → (and TMDL is in place & only parameter assessed for that AUID is being considered) →AUIDCat = 4a AND AUIDEPACat = 4a
- AUIDCat = 5 (and non-TMDL in place) →AUIDCat = 4a AND AUIDEPACat = 4b
- **MLIDCat = 5 → (and non-TMDL is in place & only parameter assessed for that AUID is being considered) →AUIDCat = 4b AND AUIDCat = 4b
- MLIDCat = 3 with exceedances →AUIDCat =3 with exceedances AND AUIDEPACat = 3
- MLIDCat = 2 →AUIDCat =2 AND AUIDEPACat = 2
- MLIDCat = 1 →AUIDCat =1 AND AUIDEPACat = 1
- MLIDCat = 3 further investigations needed →AUIDCat =3 further investigations needed AND AUIDCat = 3
- MLIDCat = 3 no exceedances →AUIDCat =3 no exceedances AND AUIDCat = 3
- MLIDCat = 3 not assessed →AUIDCat =3 not assessed AND AUIDCat = 3

** Should be able to see a concatenation of the uses for a parameter that created a 5 category (needs validation too)

Extra Checks: Biological assessments only assess 3A, 3B, 3C, or 3D beneficial uses. For an AU to be Category 1, all assigned beneficial uses must be assessed. Query AUs with biological assessments in them and confirm

that the AU assessment category follows the roll up process described in this document. *One* example is only if a biological assessment is performed for an AU and the AU is Category 1 (should be changed to a Category 2).

Appendix 5

4B SUBMISSION POLICIES AND PROCEDURES

Process for Determining Category 4B Classification

An alternative to listing an impaired segment on the state's 303(d) List is an approved Category 4B demonstration plan. A Category 4B demonstration plan, when implemented, must ensure attainment with all applicable water quality standards through agreed-upon pollution-control mechanisms within a reasonable time period. These pollution-control mechanisms can include approved compliance schedules for capital improvements or plans enforceable under other environmental statutes (such as Comprehensive Environmental Response, Compensation, and Liability Act) and their associated regulations. A Category 4B demonstration can be used for segments impaired by point sources and/or nonpoint sources. Both DWQ and EPA must accept a Category 4B demonstration plan for the affected segment to be placed in Category 4B. In the event that the Category 4B demonstration plan is not accepted, the segment at issue will be included on the 303(d) List, Category 5.

Generally speaking, the following factors will be considered necessary for Category 4B demonstration plan acceptance: 1) appropriate voluntary, regulatory, or legal authority to implement the proposed control mechanisms (through permits, grants, compliance orders for Utah Pollutant Discharge Elimination System permits, etc.); 2) existing commitments by the proponent(s) to implement the controls; 3) adequate funding; and 4) other relevant factors appropriate to the segment.

The following evidence must be provided as a rationale for a Category 4B demonstration plan:

A statement of the problem causing the impairment.

A description of:

- the pollution controls to be used,
- how these pollution controls will achieve attainment with all applicable water quality standards, and
- requirements under which those pollution controls will be implemented.

An estimate of the time needed to meet all applicable water quality standards.

A schedule for implementation of the necessary pollution controls.

A schedule for tracking progress, including a description of milestones.

A commitment from the demonstration plan proponent to revise the implementation strategy and pollution controls if progress toward meeting all applicable water quality standards is not shown.

Timing for Proposal Submittal and Acceptance by DWQ and EPA

- Category 4B demonstration plans should be submitted to DWQ by *July 1 of even numbered years*, in order for DWQ to submit the plan to EPA by *September 1 of even numbered years*. Parties are encouraged to work with DWQ before this date as states are the entity required to submit these plans to EPA.
- Acceptance from EPA must be obtained by *October 31 of even numbered years*; otherwise, DWQ will *continue to* propose that the segment in question is included on the *current cycle's* 303(d) List.
- If EPA and DWQ accept the Category 4B plan, DWQ will notify the Utah Water Quality Board and the public through proposed statement of basis and purpose language in its proposal that a Category 4B demonstration plan is accepted and is appropriate for this segment.

EPA has several documents that contain additional information on Category 4B demonstration requirements, including: "2006 Integrated Report Guidance"; and "Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions".

Appendix 6

GUIDELINES

Does the AU/AU-parameter combination warrant further investigation? (see 303(d) Assessment Methods for more details).

What was the AU originally impaired for?

What IR assessment cycle was the AU and parameter first listed?

- What datasets were used for that listing (e.g., the agency/sample collector)?
- What was the period of record? (If unknown, use the longer period of record
- What MLIDs are in the AU?

For impairments listed in the previous assessment cycle, compile the data. (Query data for all MLIDs in the AU. Ignore waterbody types.)

- What MLID has > = 1 exceedances?
- For MLIDs with impairments/exceedances and not assessed in the current IR cycle: why did DWQ (or someone else) not resample? (Provide documentation as to why resampling was not done and why (by not re-sampling) the site should meet water quality standards. Please refer to the good cause descriptions in the 303(d) methods. Check for good cause. If it is a reason other than good cause, the documentation will need to be EPA-approved).
- Where all MLIDs with exceedances are assessed in the current IR cycle: (1) For MLIDs with impairments/exceedances and the current parameter assessment for the MLID is not 1, 2, or 3 no exceedances –> no delisting or (2) is the current parameter Category 1, 2, or 3 no exceedances? Was there a secondary review applied to this parameter (e.g., an assessment category overwrite for the whole:

    a. Parameter? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is consider to be a delisting. Check for good cause.
    b. MLID? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is consider to be a delisting. Check for good cause.
    c. AU? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is consider to be a delisting. Check for good cause.

- (3) Is the current parameter Category 1, 2, or 3 no exceedances? (No secondary review applied to this parameter) → Check for good cause.

Note: Need to confirm that if no new data are collected, the new assessment analysis is not a Category 1,2, or 3 no exceedances, because the exceedances are out of the period of record for assessment analysis (i.e., not a delisting).

Double check before delisting:

- If the current Parameter Category 1, 2, or 3 no exceedances – what is the oldest date in that period of record for that MLID/Parameter combo in the current Assessment cycle?
- For every MLID in the AU (Ignore waterbody types), compile all data for that parameter between the max date from the cycle the parameter was first listed and the oldest date in that period of record for that MLID/Parameter combo in the current Assessment cycle?
- What MLID has > = 1 exceedances

- For MLIDs with impairments/exceedances and not assessed in the current IR cycle: why did DWQ (or someone else) not resample? (Provide documentation as to why resampling was not done and why (by not re-sampling) the site should meet water quality standards. Please refer to the good cause descriptions in the 303(d) methods. If it is a reason other than good cause, the documentation will need to be EPA-approved). Check for good cause.
- Where all MLIDs with exceedance are assessed in the current IR cycle: (1) for MLIDs with impairments/exceedances and the current parameter assessment for the MLID is not 1, 2, or 3 no exceedances –> no delisting or (2) is the current parameter Category 1, 2, or 3 no exceedances? Was there a secondary review applied to this parameter (e.g., an assessment category overwrite for the whole:

    d. Parameter? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is consider to be a delisting. Check for good cause.
    e. MLID? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is consider to be a delisting. Check for good cause.
    f. AU? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is consider to be a delisting. Check for good cause.

- (3) Is the current parameter Category 1, 2, or 3 no exceedances? (No secondary review applied to this parameter) →Check for good cause

Note: Need to confirm that if no new data are collected, the new assessment analysis is not a Category 1,2, or 3 no exceedances, because the exceedances are out of the period of record for assessment analysis.

EPA DELISTING CODES

Delisting Reason Code	Comment
TMDL Approved or established by EPA (4a)	Not meeting water quality standards (WQS) but removed from 303(d) List
Other pollution control requirements (4b)	Not meeting water quality standards (WQS) but removed from 303(d) List
Not caused by a pollutant (4c)	Not meeting water quality standards (WQS) but removed from 303(d) List
Data and/or information lacking to determine WQ status; original basis for listing was incorrect	Delisting
WQS no longer applicable	Delisting
Listed water not in state's jurisdiction	Delisting
Water determined to not be a water of the state	Delisting
Applicable WQS attained, according to new assessment method	WQS Attainment
Applicable WQS attained, due to change in WQS	WQS Attainment
Applicable WQS attained, due to restoration activities	WQS Attainment
Applicable WQS attained; original basis for listing was incorrect	WQS Attainment
Applicable WQS attained; reason for recovery unspecified	WQS Attainment
Applicable WQS attained; threatened water no longer threatened	WQS Attainment
Applicable WQS attained; based on new data	WQS Attainment
Refinement of terminology of listing cause	Refinement

Appendix 7

TMDL PRIORITIZATION PROCESS

The Clean Water Act (CWA) requires total maximum daily loads (TMDLs) be developed for all impaired waterbodies on the 303(d) List. Recognizing the many limitations in data, time, and staff resources to accomplish this, the CWA also requires states to prioritize where they will dedicate resources toward TMDL development. However, defining an impaired waterbody as high priority does not necessarily mean that a TMDL will be developed before lower priority segments. For some high-priority TMDLs, the development may take considerably longer due to data collection, stakeholder involvement, and other factors.

The Utah Division of Water Quality (DWQ) prioritizes impairments to human and ecological health. These priorities translate into the protection and restoration of waters designated for culinary, recreational, and aquatic wildlife uses. Considerations for TMDL prioritization in Utah also include the level of partner agency and stakeholder involvement and potential for restoration as defined by the Recovery Potential Screening tool. Other factors considered in setting TMDL priorities include programmatic needs such as permitting and addressing watershed-wide water quality issues.