UTAH'S FINAL 2016 INTEGRATED REPORT

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

2016 Final Integrated Report

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Numerous agencies and entities have contributed to the data that went into the creation of this report. These include the Bureau of Land Management, U.S. Forest Service, National Park Service, Salt Lake County, Davis County, Bureau of Reclamation, Utah State University, Central Davis Sewer District, and other members of DWQ's Cooperative Monitoring Program. Special thanks go out to the staff at the United States Geological Survey and the Utah Division of Oil, Gas and Mining for providing additional data.

Numerous agencies and entities also contributed to the development of methods that went into the creation of this document. These include:

- Colorado's Department of Public Health and Environment Washington State Department of Ecology
- Idaho's Water Quality Division's Source Water Assessment Program
- Nevada's Bureau of Water Quality Planning in the Nevada Division of Environmental Protection
- New Mexico's Surface Water Quality Bureau in the New Mexico Environment Department
- Oregon's Department of Environmental Quality
- Pennsylvania's Department of Environmental Protection Bureau of Point and Non-point source Management
- Virginia's Department of Environmental Quality
- Wisconsin's Water Division as part of the Department of Natural Resources

The previously published work by these states allowed us to develop these draft assessment methods for high frequency data and helped us define credible data requirements specific to DWQ's High-Frequency Assessment program.

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CHAPTER 1: INTRODUCTION

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ABBREVIATIONS

AU(s)	assessment unit(s)
CFR	Code of Federal Regulations
CWA	Clean Water Act
DWQ	Division of Water Quality
EPA	U.S. Environmental Protection Agency
HABs	harmful algal blooms
IR	Integrated report
MLID	monitoring location ID
NPS	nonpoint source
QA	quality assurance
TMDL(s)	total maximum daily load(s)
USGS	U.S. Geological Survey
WQSs	water quality standards

FIGURES

Introduction

The Division of Water Quality (DWQ) is pleased to issue the final 2016 Integrated Report (IR) on the condition of Utah's rivers, streams, and lakes. Included with the report is a summary of public comment received during the Public Comment Period (June 10th – September 8th, 2016). The Division received approximately 30 comment letters with over 450 unique comments. To facilitate addressing a large number of comments regarding Harmful Algal Blooms in Utah Lake and Farmington Bay, a *Joint Comment Responses* document is provided in Appendix A of the *2016 Final Integrated Report Response to Public Comments* table provided with this report.

PURPOSE OF THE INTEGRATED REPORT

The Utah Division of Water Quality (DWQ) is responsible for a variety of programs that monitor, assess, and protect the surface and ground waters of the state. Partnering with a range of public and private entities, DWQ combines its data collection efforts with the data collected by identified stakeholders to characterize the surface water quality of the state. This report is the result of that collaborative effort. The 2016 Integrated Report (IR) contains updates from previous reports (e.g., the 2012 - 2014 IR) and a comprehensive survey of the water quality of surface waters in the state from 2008 to 2014.

What makes up an IR?

The U.S. Environmental Protection Agency (EPA) asks states to integrate four components into their IRs every 2 years:

1. **A water quality inventory report, Chapters 3 and 4 of this document**
2. **An impaired waterbody list, incorporated into Chapters 3 and 4 this document**
3. **An electronic copy of the 305(b), e.g., the Assessment Database**
4. **A copy of the state's National Hydrology Dataset**

Information on the reporting requirements from EPA and the different components of the IR are also discussed in this chapter. For details on the assessment methods used for this IR, please refer to Chapter 2 Assessment Methods.

Clean Water Act 305(b) Reporting Requirements

The Federal Water Pollution Control Act—e.g., the Clean Water Act (CWA), Section 305(b)—requires states to monitor the water quality of their surface and ground waters and report on the status of these waters in a biennial report that is submitted to EPA.

As recommended by EPA in their IR Guidance Document (EPA, 2005), the following information must be included in the 305(b) report:

- A list of water quality–limited (impaired) waters still requiring total maximum daily loads (TMDLs), pollutants causing the impairment, and priority ranking for TMDL development
- A description of the methods used to develop the list

- A description of the data and information used to identify waters, including a description of the existing and readily available data and information used
- A rationale for any decision to not use any existing and readily available data and information
- Any other reasonable information requested by EPA, such as demonstrating good cause for not including a water or waters on the list

Clean Water Act 303(d) Reporting Requirements

In addition to the 305(b) report, Section 303(d) of the CWA requires states to submit a list biennially to EPA that identifies the waterbodies in that state that do not meet the state's WQSs. This list is reviewed by EPA and helps guide the state's TMDL development process to correct the specified impairment.

- As recommended by EPA in their IR Guidance Document (EPA, 2005), the following information must be included in the 303(d) report:
- A list of water quality–limited (impaired and threatened) waters still requiring TMDL(s), pollutants causing the impairment, and priority ranking for TMDL development
- A description of the methods used to develop the list
- A description of the data and information used to identify waters, including a description of the existing and readily available data and information used
- A rationale for any decision to not use any existing and readily available data and information
- Any other reasonable information requested by EPA, such as demonstrating good cause for not including a water or waters on the list

Cleaning up a State's Impaired Waters:

For waterbodies that are listed as impaired, the CWA requires a TMDL to be developed. TMDLs document the nature of the water quality impairment, determine the maximum amount of a pollutant discharge (while still meeting state standards), and identify acceptable loads from the pollutant source. EPA also recognizes alternative mechanisms that can be used to restore an impaired water including watershed based implementation plans.

Integrated Report Classified Use Categories

Utah refers to *designated uses* as the basic unit for reporting water quality and uses EPA-recommended reporting categories to classify segments of waterbodies as meeting or not meeting applicable WQS. These categories are presented in Figure 1 and are described in further detail following the figure. The specific methods used by DWQ to make any of the below conclusions are documented in detail in Chapter 2 Assessment Methods.

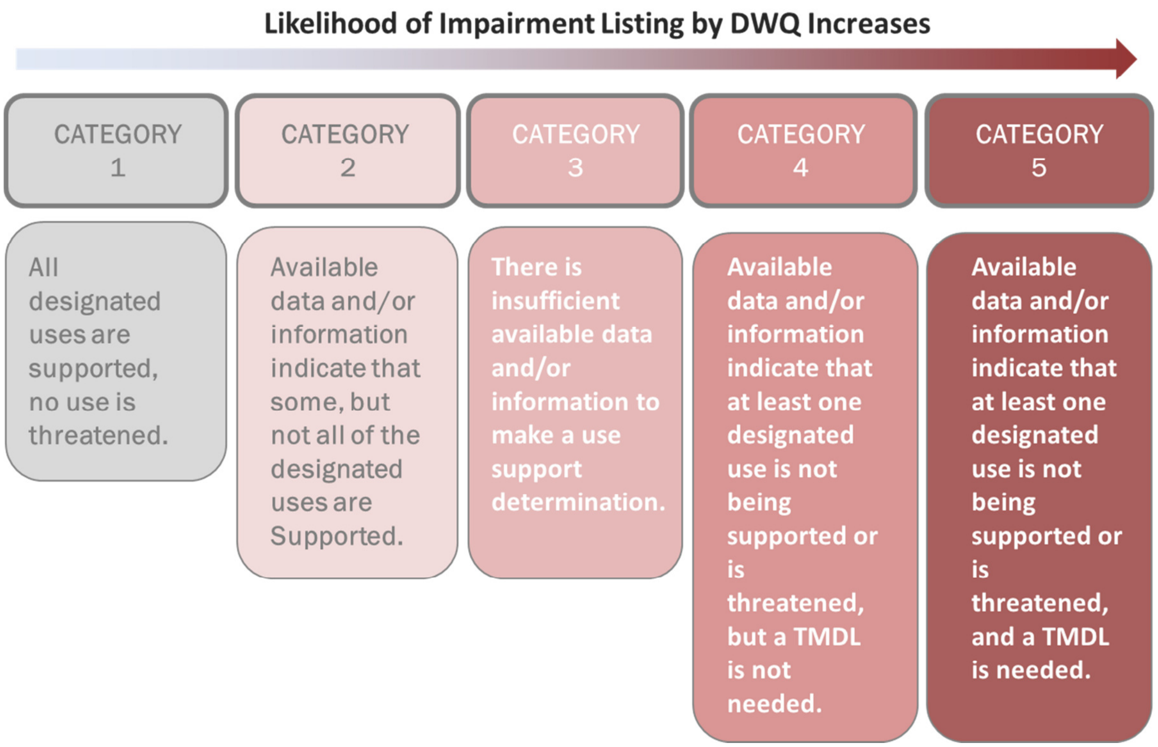

Figure 1. EPA's five-category system for classifying water quality standards for waterbodies.

Category 1: All designated uses are attained.
Assessment units (AUs) are reported as Category 1 if all beneficial uses have been assessed against one more numeric criterion ***and*** each use is found to be fully supporting all uses.

Category 2: Some of the designated uses are attained, but there are insufficient data to determine beneficial use support for the remaining designated uses.
AUs are reported as Category 2 if some but not all designated uses have been evaluated, ***yet*** those uses that have been assessed are found to be supporting designated uses.

Category 3: There are insufficient data to make a determination, or lakes and reservoirs show indication of impairment for a single monitoring cycle.
For each designated use, AUs are reported as Category 3 if some data and information are available to evaluate one or more of an AU's designated uses, ***yet*** available data are insufficient to make a conclusive assessment determination. Inconclusive decisions result from datasets that fail to meet data quality objectives that DWQ has established for making IR assessment decisions. Examples of situations where AUs are reported as Category 3 include the following: datasets with an insufficient number of samples available for analysis, situations where there were contradictory conclusions from multiple data sources, or situations where quality assurance/quality control procedures were improper or poorly documented.
By reporting an AU as Category 3, versus simply reporting the AU as not assessed, DWQ is making a commitment to prioritize future monitoring to make a final assessment determination. In part due to this intrinsic commitment to prioritize monitoring, DWQ uses six Category 3 subcategories for planning purposes, which are defined as follows at the monitoring location identification (MLID):

- **Category 3A**: MLIDs are listed in Category 3A if there are insufficient data and information to make an assessment and if the data include violations of water quality criteria. Information on Category 3A waters will be used to guide future monitoring and evaluations.

- **Category 3B**: Lakes and reservoirs that have been assessed as not supporting a beneficial use for one monitoring cycle are included in Category 3B. If a lake or reservoir is assessed as impaired for two consecutive monitoring cycles, it is listed on the 303(d) list.

- **Category 3C**: This category is currently used for Great Salt Lake (Designated Use Class 5). Assessment of this ecosystem with traditional approaches is complicated by the current lack of numeric criteria, with the exception of a selenium standard applicable to bird eggs. Also, the lake is naturally hypersaline, so traditional assessment methods are not appropriate. DWQ is working toward developing both numeric criteria and assessment methods for this ecosystem. In the interim, the IR documents the progress that was made in the most recent 2-year reporting cycle.

- **Category 3D**: Further investigations are required. For example, MLIDs with potential impairments for nutrients and biochemical oxygen demand were placed in Category 3D until such time that numeric nutrient criteria are developed.

- **Category 3E**: MLIDs are listed in Category 3E if there are insufficient data and information to make an assessment and if the data do not include violations of water quality criteria.

- **Category 3F**: MLIDs are listed in Category 3F if an assessment was not performed due to missing use information for the AU. Category 3F waters will be assigned designated uses for the 2016 IR assessment.

Category 4: Impaired for one or more designated uses, but does not require development of a TMDL. For each designated use, AUs are reported as Category 4 if water quality remains insufficient to support the designated use, yet a TMDL is not required. EPA and DWQ use three Category 4 subcategories, which are defined as follows:

- **Category 4A: TMDL has been completed for any pollutant:** AUs are listed in this subcategory when any TMDL(s) has been developed and approved by EPA, that when implemented, is expected to result in full support of the water quality standards or support the designated uses. Where more than one pollutant is associated with the impairment of an AU, the AU and the parameters that have an approved TMDL are listed in this category. If it has other pollutants that need a TMDL, it will be listed in Category 5 until all TMDLs are complete.

(North Fork, Chalk Creek)

- **Category 4B: Other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future:** Consistent with the regulation under 40 Code of Federal Regulations 130.7(b)(I) (ii) and (iii), AUs are listed in this subcategory where other pollution control requirements (e.g., best management practices required by local, state, or federal authority) are stringent enough to meet any water quality standard or support any beneficial use applicable to such waters.

- **Category 4C: The impairment is not caused by a pollutant:** AUs are listed in this subcategory if the impairment is not caused by a pollutant (e.g., habitat alteration, hydromodification).

Interpreting a WQS:

When deciding if a segment of a river or stream or a lake or reservoir should be put into a Category 1, 2, 3, 4, or 5, DWQ must consider the following factors: WQSs applied to that segment, the designated use assigned to the segment, and numeric criteria applicable to the designated use.

These factors help answer the following: *What do the monitoring data and other information tell us about whether or not this river/stream or lake is meeting WQSs?* For more information on how Utah interprets a WQS, please refer to Chapter 2 *Utah's 2016 303(d) Assessment Methods*

Category 5: The concentration of a pollutant—or several pollutants—exceeds numeric water quality criteria, or quantitative biological assessments indicate that the biological designated uses are not supported (narrative water quality standards are violated).

Waters reported as Category 5 are impaired, which means that they are not meeting their designated uses. The list of Category 5 waters is sometimes called the "303(d) list" in reference to this section of the CWA, which among other things, requires states to identify impaired waters. There are several sources of data and information that are used when making impairment decisions. First, chemical assessments evaluate designated use support for an AU by comparing pollutant concentrations against numeric criteria that have been established to protect the use. A designated use of an AU is reported as Category 5 if any of the following apply:

- The concentration of any pollutant exceeds—as defined by the methods described in this document—a numeric water quality criterion.
- Quantitative biological assessment results for streams and rivers are statistically different than the reference site conditions.
- Weight of evidence assessments for lakes and reservoirs indicate that designated uses are not being supported.

Category 5- Alt

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. The alternatives include "4C candidates," waterbodies impaired by causes that cannot be addressed by a TMDL such as hydrologic and habitat modification; waterbodies impaired by total dissolved solids that fall within the auspices of the Colorado River Basin Salinity Control Program; impaired waters that have existing TMDLs in place for related parameters and are therefore already being addressed; waterbody impairments that are the result of natural uncontrollable pollutant sources and therefore require development of site-specific standards; and impaired waters that have taken a straight-to-implementation approach through ongoing watershed implementation activities.

Utah Division of Water Quality's Tiered Monitoring Framework

To integrate the various programmatic data needs within the division, DWQ employs an adaptive approach to its annual monitoring plans, which allows for an efficient and adaptive monitoring and management program.

This tiered adaptive monitoring and management framework for DWQ allows the division to develop robust datasets in 1 year that inform the data collection and assessment decision making in subsequent years (Figure 2). In this adaptive program, monitoring continues to iteratively improve the knowledge base of management, so decision making is based on the best science available. As more information becomes available, the scientific uncertainty about the ecosystem is reduced, and initial actions and management decisions are revisited and refined (see Figure 2). During the evaluation process at DWQ, the information that is gathered provides staff with critical input on how to adjust to the next round of monitoring in the three types of monitoring and assessment efforts described below.

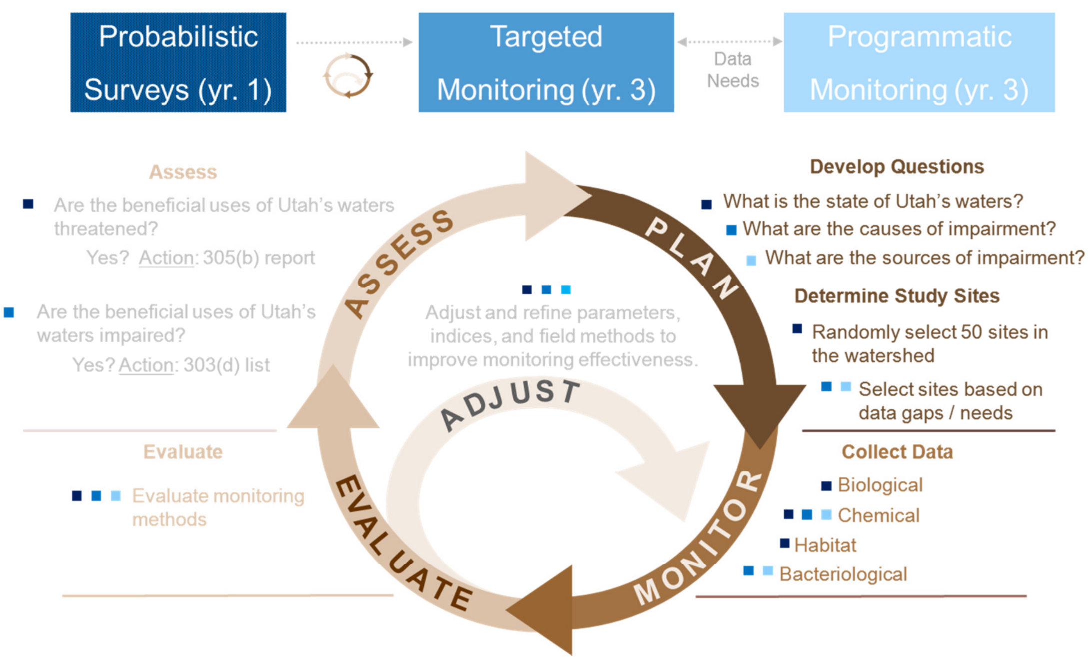

Figure 2. DWQ's adaptive monitoring approach.

- Probabilistic Surveys: Designed to meet the reporting requirements of the 305(b), probabilistic surveys assess all waters of the state by randomly selecting and monitoring different waterbodies within one of the seven major watersheds in Utah (see Figure 3 for the rotating basin schedule). The information collected from the environmental surveys is used to 1) assess the attainment of various designated uses (e.g., aquatic life and contact recreational uses) and 2) better understand the significant causes of pollution throughout Utah.
- Targeted Monitoring: Environmental surveys within this monitoring effort are performed annually to develop the 303(d) impairment status reports. Using the water quality concerns

that are highlighted during probabilistic surveys as a guide, site-specific monitoring plans during targeted monitoring efforts are used to assess the biological and chemical conditions of a specific stream (see Figure 2). These more intensive surveys allow DWQ to more fully understand the scope and extent of water quality problems in the state.

- Programmatic Monitoring: Surveys within this monitoring effort are performed annually, alongside targeted monitoring efforts. This is done to maximize division resources in the targeted watershed. During these programmatic monitoring efforts, the data needs of the division are met; these needs include TMDL development, evaluation of nonpoint source (NPS) project effectiveness, development or refinement of numeric water quality criteria, and a variety of compliance monitoring programs.

To implement the monitoring and assessment efforts described above, DWQ developed a 6-year rotating basin monitoring schedule to ensure that 1) staff has sufficient data to determine if a waterbody is impaired and 2) DWQ can work toward its goal of assessing all wadeable rivers and streams and all lakes and reservoirs in the state.

By focusing the division's monitoring efforts on a couple of river basins each year (versus the whole state), DWQ is able to concentrate its monitoring efforts on a smaller geographical area and collect more water quality samples from numerous waterbodies within a watershed management unit during a single sampling season. Using this rotating sampling structure allows DWQ staff to make more accurate assessments and informed 303(d) listing decisions by having a more robust dataset.

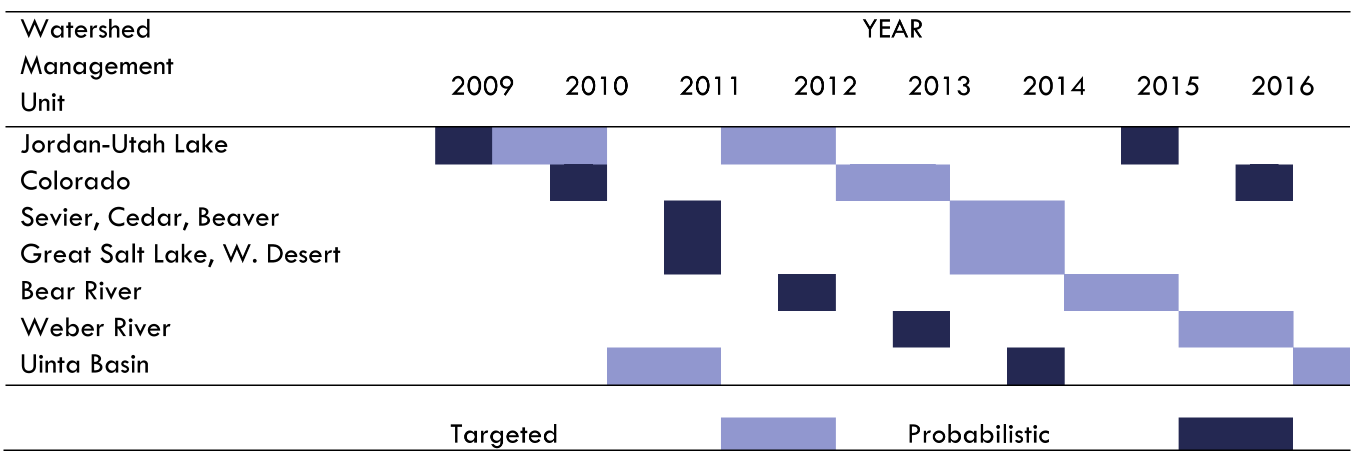

Figure 3. Summary of DWQ's 6-year rotating basin monitoring schedule.

Integrating the proposed tiered monitoring framework into current division and programmatic needs and constraints requires targeted and programmatic monitoring efforts to follow the probabilistic surveys (1–2 years later) and focus on ongoing TMDL needs around the state until the initial round of probabilistic surveys is assessed.

Assessment Summary

Figure 4 summarizes the results of the 2016 303(d) report indicating the number of AUs in each of the five categories and total stream miles and lake acreage for each.

Category	No. of Stream AUs	Stream miles	No. Lake of AUs	Lake Acres
1 (Supporting)	41 (6%)	667 (4%)	0 (0%)	0 (0%)
2 (No evidence of Impairment)	123 (16%)	2,706 (17%)	58 (41%)	57,369 (4%)
3 (Insufficient Data)	335 (44%)	4,991 (32%)	22 (15%)	1,121,274 (76%)
4 (Pollution Control in Place)	26 (3%)	742 (5%)	11 (8%)	22,324 (2%)
5 (Not Supporting)	235 (31%)	6,582 (42%)	51 (36%)	266,256 (18%)

CATEGORY 1 Supporting | CATEGORY 2 No Evidence of Impairment | CATEGORY 3 Insufficient Data | CATEGORY 4 Pollution Control in Place | CATEGORY 5 Not Supporting

Figure 4. Number of AUs assessed and stream miles in each assessment category. Category 3 lakes include four Great Salt Lake AUs comprising 1,090,361acres.

Restoring Impaired Waters: Delistings

When assessment units are removed from a 303(d) listing, EPA strongly encourages states to document why they are moved from a Category 5, 4a, 4b, and 4c to other categories. When a delisting occurs, Utah provides in the 305(b) report a list of the newly delisted site(s) and the following justification(s):

- Utah determines that the water quality standards are being met.
- There were flaws in the original listing.
- Other point source or nonpoint source controls are expected to meet water quality standards
- Impairment was due to a nonpollutant.
- EPA approves the TMDL.
- The waterbody is not in the state's jurisdiction.

Public Participation Process

As part of DWQ's ongoing commitment to work with the public to safeguard human health and protect and enhance Utah's waters, DWQ engages its stakeholders from the start. Communities and others affected by the decisions of the 305(b) and 303(d) are asked to participate in the IR process through two opportunities before DWQ submits the IR to EPA. These two opportunities are described below:

1. Publicly Submitted Data Notification

Each IR cycle, DWQ makes a formal public notification—through newspaper ads, website postings, and email list servers—requesting data and information that can be used to inform designated use assessments. Whenever possible, the aim of DWQ is to obtain all data and information with sufficient time to compile the information by April of odd years. This allows DWQ sufficient time to obtain clarification where necessary, ensuring that outside sources of information are used to the greatest extent possible for IR assessments. Following each public notice, interested stakeholders have a minimum of 30 days to submit water quality information to DWQ.

2. Public Comment on the revisions to the Assessment Methods

In preparation for the 2016 IR, DWQ implemented a process of issuing the Assessment Methods for public comment prior to performing the analysis for the IR. DWQ established a comment period for the methods in March of 2015 and received a number of comments from stakeholders. Since issuing the draft methods, DWQ has integrated those comments and made a number of refinements and changes to improve the assessment process. A complete summary of the changes can be found in the introduction of Chapter 2.

3. Public Comment on 305(b) and 303(d) Decisions

At the end of the 305(b) and 303(d) report writing process, DWQ again makes a formal public notification, requesting comments that can be used for considering the placement of AUs in the five categories. Upon receiving comments from the public, DWQ either revises the IR (based on the public's feedback) or addresses the comments in a summary. These comments or comment summaries are then submitted to EPA along with the 305(b) and 303(d) listing decisions.

CHANGES IN THE 2016 INTEGRATED REPORT

Since our last report, DWQ has improved our methods of evaluating and reporting on the status of water quality and included a number of additional data sources to enhance the coverage of our assessments statewide. This section summarizes the additions and changes to DWQ's assessments since the 2014 IR.

New Data Sources

Federal regulations (40 CFR 130.7(b)(5)) require DWQ to examine all existing and readily available data when making assessment decisions, which includes consideration of data collected by DWQ and others. DWQ has long included data collected by partnering agencies such as the US Forest Service, Bureau of Land Management, and a variety of local and state agencies. These partnerships have been developed over the years as part of DWQ's Cooperative Monitoring Program, in which participants collect samples in the field in return for an allocation of state lab resources as a way of leveraging additional data collection to mutually support program needs. In the 2016 IR assessment, in addition to our cooperator data, DWQ included data collected in rivers and streams as part of the compliance monitoring for the Division of Oil, Gas, and Mining as well as data collected by a citizen group.

While DWQ analyzed these same data sources in its 2016 assessments, several other sources of data were also included. For the first time, DWQ evaluated applicable data collected between 2008-2014 by the US Geological Survey (USGS) and compiled results from monitoring locations where data indicated impairments for inclusion in the draft 303(d) list. For each monitoring location, DWQ compiled and screened all available water quality data (as outlined in 303(d) methods). For the 2016 IR, observations from the USGS dataset that had numeric values exceeding the Utah's water quality standard for each beneficial use were used to either conclude impairment or prioritize the AU for follow-up monitoring to obtain the data necessary to make conclusive assessment decisions. Due to time and resource constraints, USGS data was only used for Category 5 (impaired) determinations. In future IR cycles, DWQ plans to fully integrate these data into its assessments for determining all applicable assessment categories.

DWQ performed an evaluation of data related to harmful algal blooms that could pose a health risk to recreational users in Farmington Bay (see Chapter 6). Extensive datasets were submitted to DWQ by two stakeholders, the Central Davis Sewer District and Utah State University, and were aggregated for the purpose of this evaluation. The data were compared to indicators of human health risks for harmful algal blooms (HABs) to provide context to the public about potential risks associated with recreating in Farmington Bay. HABs can adversely affect human health during recreational activities in and on the water. DWQ is obligated to analyze these data and report findings to the public. In Chapter 6, DWQ discusses the recreational uses of Farmington Bay, HAB indicators, and the results of the data evaluation.

In addition, DWQ obtained a significant dataset from the Jordan River/Farmington Bay Water Quality Council, which DWQ used to evaluate methods for high frequency data assessments. These include a high frequency dataset of dissolved oxygen from several sites on the Jordan Rover that were used in a pilot evaluation of proposed assessment methods for high frequency dissolved oxygen data (see Chapter 7).

DWQ also assessed a rich dataset including data from DWQ and EPA that was collected in the San Juan River following the Gold King Mine release in Colorado on August 5, 2015. Data collected by EPA in Fall 2015, during monsoonal storm events, caused DWQ to list two segments of the San Juan River as impaired for several metals.

Narrative Standard Assessment of Recreational Use Support

The occurrence of harmful algal blooms (HABs) is a growing water quality concern across the nation. In Utah, HABs usually consist of cyanobacteria (also known as blue green algae) that can produce dangerous toxins and pose a risk to human health through direct contact, inhalation or ingestion. HABs have occurred in some Utah lakes and reservoirs. In 2015, DWQ developed assessment methods that included a new HAB assessment method for recreational uses (Chapter 2) which reflects the potential for "*undesirable human health effects*" identified in the Narrative Standard and uses a cyanobacteria cell count as the indicator of HAB related impairments for recreational and drinking water uses. A full evaluation of the assessment is contained in Chapter 5.

Credible Data Review

In 2015 as part of it "Call for Data" for the 2016 IR, DWQ implemented a credible data review process. Data quality grades were assigned by the Monitoring and Reporting Section QA Officer using best professional judgment and criteria listed in the Credible Data Quality Matrix for each data type. Data quality grades were assigned generally for the dataset as a whole, acknowledging that individual results are reviewed and may be flagged or rejected during pre-assessment QC checks. For DWQ and DWQ's Cooperators, and for Western Watersheds, an additional column titled "Areas for Improvement" is populated for the use of the Monitoring and Reporting Section Manager. This column includes suggestions for ways to achieve higher data quality for future IR cycles.

Changes to Assessment Units

With the detailed assessment results provided by the 2012-14 IR, DWQ has performed an evaluation of assessment units that could be redefined to better reflect and isolate the subwatersheds that are impaired from areas meeting water quality standards. With this flexibility, DWQ hopes to improve tracking and dissemination of water quality information and assessment results and highlight areas of focus for developing TMDLs, wasteloads, and other pollution prevention strategies. A summary of the proposed Assessment Unit redefinitions is provided with this report.

303(d) Vision

In 2016, DWQ has adopted a new framework for implementing the Clean Water Act (CWA) Section 303(d) Program. The new Program Vision enhances overall efficiency of the CWA 303(d) Program, encourages focusing on priority waters, and provides States flexibility in using tools in addition to TMDLs to restore and protect water quality. With the recognition that there is not a "one size fits all" approach to restoring and protecting water resources, Utah has developed tailored strategies to implement its CWA 303(d) Program responsibilities in the context of our water quality goals.

Changes to Assessment Methods

In preparation for the 2016 IR, DWQ implemented a process of issuing the Assessment Methods for public comment prior to performing the analysis for the IR. DWQ established a comment period for the methods in March 2015 and received a number of comments from stakeholders. Since issuing the draft methods, DWQ has integrated those comments and made a number of refinements and changes to improve the assessment process. A complete summary of the changes can be found in the introduction of Chapter 2.

LITERATURE CITED

EPA. 2005. *Guidance for 2006 assessment, listing and reporting requirements pursuant to Sections 303(d) and 305(b) of the Clean Water Act*. Available at: https://www.epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf.

CHAPTER 2: 2016 303(D) ASSESSMENT METHODS

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WATER QUALITY

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EXECUTIVE SUMMARY

Changes from the March 2015 Draft 303(d) Assessment Methods

Since the development of *Utah's 303(d)Assessment Methods* for the 2016 IR which was submitted for public comment in March 2015, a number of changes and refinements have been made to the methods that are presented here as Chapter 2 of the Draft 2016 Integrated Report. In addition to editorial and formatting changes, a number of substantive changes have been made to address comments and to more accurately reflect the assessment process. UDEQ will only accept comments on these substantive changes. A responsiveness document to comments received on the original assessment methods is available on DWQ's Assessment webpage. A track change version showing all changes to the assessment methods since public notice of the draft in March 2015 is available upon request (contact Jim Harris at jameharris@utah.gov).

The following is a summary of significant changes made to the 2015 draft of the Assessment Methods:

1. Addition of a description for the 5-Alt category which reflects the revised 303(d) Vision.
2. Re-definition of Category 2 waters to better distinguish Category 2 from Category 3 definitions.
3. Clarification of public comment on the assessment methods allowing for comment on interim changes.
4. Clarification on the elements included in the 305(b) component.
5. Clarification of how DWQ will assess canals and seeps, namely "Canals, springs, and seeps will all be evaluated in the assessment results, but, with few exceptions, the results at individual monitoring locations will not be applied to the entire AU, as is the case with stream and river assessments. The exceptions include canals with specifically identified uses and site-specific standards in **UAC R317-2** or springs or seeps found to accurately represent water quality in a stream."
6. Revision of assessment unit delineation to include the process of defining, refining or establishing new assessment units.
7. Clarification of jurisdictional waters of the state excluding AUs on lands under tribal jurisdiction.
8. Addition of a provision to allow the evaluation of more recent data outside the period of record such that DWQ will reserve the discretion to integrate the newer information in the current cycle.
9. Clarification of *E. coli* assessment methods with regards to health advisories on rivers and streams.
10. Additional information on the process of integrating information regarding extreme conditions such as drought or flood that may come to light during the review of the 303(d) list and its associated datasets (see section on Representative Data).

11. Clarification of the minimum data requirements for performing *E. coli* assessments and provisions for placing sites with fewer than 5 samples in the index period in category 3 (insufficient data).

12. Description of how assessments of hardness dependent metals were evaluated in situations where hardness results are missing. Namely a default hardness of 100 milligrams per liter (mg/l) is used to evaluate the toxic results. Results were reviewed to ensure that a Category 5 (not supporting) decision was not reached using surrogate hardness values.

13. Removal of fluoride data from the assessment until a more appropriate criterion is adopted in R317.2.

14. Interpretation of the standards for Boron assessments. **UAC R317-2** does not specify sample fraction (total or dissolved) for the boron criterion. All data for boron, both total and dissolved, were included in the assessment. The intent of the boron standard was for dissolved fraction. The criterion will be updated in future triennial reviews by the Standards Program. Until it is adopted in rule, results will be reviewed to ensure that no waterbody is listed based on total boron results.

15. More detail on supplemental indicators used to confirm harmful algal bloom assessments in lakes including cyanotoxins, chlorophyll a, phycocyanin, and harmful algal bloom–related beach closures.

16. Clarification on reporting causes of impairment. EPA requires each impairment to identify a cause. Added additional language on determining cause and sources for pollutants and pollution impairments.

17. The following statement was added to the weight of evidence criteria in the lake assessment section: “The weight of evidence criteria allow DWQ to use key lines of evidence in assessing a waterbody’s support Utah’s narrative standard that would be ignored by exclusively focusing on chemical water quality parameters.”

18. Additional clarification and detail on the process for assessing waters for fish tissue consumption (see section “Beneficial Use Assessment Based on Tissue Consumption Health Advisories.”)

19. Elaboration on “Good Cause” for delisting a waterbody.

HOW TO USE THIS DOCUMENT

Utah's Clean Water Action Section 303(d) Assessment Methods provide a framework for categorizing and determining whether a waterbody or segment within a waterbody supports or does not support the assigned water quality standards and designated uses found in **Utah Administrative Code (UAC) R317-2**. However, there may be site-specific considerations not identified in the 303(d) Assessment Methods that are appropriately factored into the final listing decision.

Generally, DWQ's decision to list or not list a waterbody will be based on the stringent application of the policies and procedures outlined in the data assessment sections of this document. As is also indicated in this document, best professional judgment may be applied when appropriate. If best professional judgment or any other deviations from the methods defined in this document are implemented, DWQ tracks these deviations and provides justification and supporting documentation.

All changes and supporting information will be available to stakeholders and other interested parties for their review during the IR and 303(d) public comment periods. DWQ encourages stakeholders and other reviewers to submit their own best professional judgment and mitigating evidence using the data and information requirements outlined in this methods and the IR **Call for Data**. All DWQ and stakeholder-generated data and information will be retained by DWQ and become part of the process for final consideration and approval of the IR and 303(d) List.

CONTENTS

ABBREVIATIONS

<	less than
>	greater then
≤	less than or equal to
≥	greater than or equal to
AGRC	Automated Geographic Reference Center
AU	assessment unit
BPJ	best professional judgment
CFR	Code of Federal Regulations
CWA	Clean Water Act
DO	dissolved oxygen
DWQ	Division of Water Quality
EPA	U.S. Environmental Protection Agency
GIS	geographic information systems
GSL	Great Salt Lake
HUC	hydrologic unit
IR	Integrated report
kg	kilogram
L	liter
mg	milligram
mg/kg	milligrams per kilogram
mg/l	milligram per liter
ml	milliliter
MLID	monitoring location ID
MPN	most probable number
NHD	National Hydrologic Dataset
O/E	observed/expected
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RIVPACS	River Invertebrate Prediction and Classification System
SD	standard deviation
TDS	total dissolved solids
TMDL	total maximum daily load

TSI	trophic state index
UAC	Utah Administrative Code
USGS	U.S. Geological Survey
WMU	watershed management unit
µg/l	microgram per liter

FIGURES

TABLES

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 U.S. Congress every other year. The Integrated Report (IR) contains two key reporting elements defined by the CWA:

1. **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.
2. **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 in the IR that DWQ suspects have water quality problems but cannot confirm due to uncertainty regarding the nature of the data, insufficient sample size, or other factors. Waterbodies without sufficient information to make an assessment determination are given priority by DWQ's Water Quality Assessment Program for follow-up monitoring to determine whether the waterbody is attaining water quality standards.

Waters that are not on the 303(d) List or on the Assessment Program's priority list for follow-up monitoring 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 and state-identified waterbody assessment classifications are described in the following section.

Assessment Categories for Surface Waters

DWQ used five categories defined by EPA to assess surface waters of the state (EPA, 2005). DWQ has also developed several state-derived subcategories that are used for internal tracking and planning purposes in addition to EPA's categories. These categories and subcategories are described in Table 1.

Table 1. U.S. Environmental Protection Agency and Utah Division of Water Quality subcategorization of assessed surface waterbodies for integrated report purposes.

Category (EPA)	Subcategory (DWQ)	Category Description
1	n/a	**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	n/a	**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	3A	**Insufficient Data, Exceedances** There are insufficient data and information to conclude support or nonsupport of a use, but the smaller dataset had water quality criteria exceedances. This category is also used where a best professional judgment (BPJ) was applied to a waterbody that was not attaining. See Best Professional Judgement Section for more information. In instances where BPJ is applied, DWQ requires that confirmational data are collected before listing the waterbody as impaired in a future IR cycle. These waterbodies are prioritized for follow-up monitoring by the Assessment Program.
3	3B	**Holding Place: Not Currently Used for Assessments** Historically, this category was used for lakes and reservoirs where there were insufficient data and information to conclude support or nonsupport of a use, but the dataset had water quality criteria exceedances. Currently, lakes with insufficient data to perform assessments or, through the application of BPJ, demonstrate atypical conditions not resulting in an impairment, are placed in a 3A category.
3	3C	**Assessment Methods in Development** This category is currently used for Great Salt Lake (GSL) (Class 5). Assessment of the designated uses of this ecosystem is complicated because, with the exception of a selenium standard applicable to bird eggs, GSL lacks numeric criteria. Also, the lake is naturally hypersaline, so traditional assessment methods are not appropriate. DWQ is working toward developing both numeric criteria and assessment methods for this ecosystem as outlined in the Great Salt Lake Water Quality Strategy. In the interim, the IR documents the progress that was made in the most recent 2-year reporting cycle.

Category (EPA)	Subcategory (DWQ)	Category Description
3	3D	**Further Investigations Needed** Waterbodies that are assessed against water quality parameters and characteristics and require further investigations as defined in UAC R317-2 or are currently undergoing standards development, numeric criteria revisions, or assessment methods development. These waterbodies are prioritized for follow-up monitoring by the Monitoring and Reporting Program.
3	3E	**Insufficient Data, No Exceedances** There are insufficient data and information to make an assessment, but the smaller dataset had no water quality criteria exceedances. These waterbodies are prioritized for follow-up monitoring by the Assessment Program.
3	3F	**Not Assessed** Waterbodies not assessed because assessment units (AUs) lack use designations, have improper use designations, or contain other inconsistency in the dataset. In cases where no recent data are available, historic-listing determinations will be maintained. These waterbodies are prioritized for use designation or clarification in the next assessment cycle.
4	4A	**TMDL-Approved** Waterbodies that are impaired by a pollutant, and that 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.
4	4B	**Pollution Control** Consistent with 40 Code of Federal Regulations (CFR) 130.7(b)(l) (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.

Category (EPA)	Subcategory (DWQ)	Category Description
4	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. Historic listings of these waterbodies and causes of impairment are identified in the IR as Utah's Section 303(d) list. However, DWQ is not placing new waterbodies into this category until a listing method is developed.
5	5	**Not Supporting** The concentration of a pollutant, or several pollutants, exceeds numeric water quality criteria, or quantitative biological assessments indicate that the biological designated uses are not supported. The latter determination is based on violation of the narrative water quality standard. 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 listing rationale will be provided. These impaired waters constitute Utah's formal Section 303(d) List.
5	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. The alternatives include "4C candidates," waterbodies impaired by causes that cannot be addressed by a TMDL such as hydrologic and habitat modification; waterbodies impaired by total dissolved solids that fall within the auspices of the Colorado River Basin Salinity Control Program; impaired waters that have existing TMDLs in place for related parameters and are therefore already being addressed; waterbody impairments that are the result of natural uncontrollable pollutant sources and therefore require development of site-specific standards; and impaired waters that have taken a straight-to-implementation approach through ongoing watershed implementation activities. Note: This category is only referred to in DWQ's "303(d) Vision Document".

Note: While DWQ maintains subcategories for Category 3, due to limitations in EPA reporting requirements, all Category 3 subcategories will be reported in the report as "Category 3: Insufficient Data". However, resolution at the MLID level will be maintained in the individual data assessment reports and made available during public comment.

Utah's Numeric Criteria and Beneficial Uses

To determine the appropriate assessment categories for a waterbody (see Table 1), DWQ must first evaluate the impact of measured pollutant concentrations on environmental and human health effects. Under **UAC R317-2**, Utah has developed and adopted over 190 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 uses classifications (see **UAC R317-2-6**). Currently, DWQ uses four major classes to characterize the uses of surface waters within the state for 303(d) assessment purposes:

Class 1. Domestic water systems
Class 2. Recreational use and aesthetics
Class 3. Aquatic wildlife
Class 4. Agricultural

GSL has its own beneficial use classification (Class 5). Subclassifications also exist and are further defined in Table 2.

Table 2. Subclassifications of Utah's beneficial uses.

Beneficial Use Subclassification	Use Definition
1C*	Drinking water
2A	Primary contact recreation
2B	Secondary contact recreation
3A*	Cold water aquatic life
3B*	Warm water aquatic life
3C*	Nongame aquatic life
3D*	Wildlife
3E*	Habitat limited
4	Agriculture
5	Great Salt Lake

* There are human health (HH) criteria associated with these beneficial uses in UAC R317-2. For uses with a HH criteria associated to them (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 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 Category 3F, and prioritized for assignment of AU definitions and uses for the next IR cycle.

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 for assessment purposes, DWQ developed a priority parameter list that is used in 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 DWQ's ability to assess all parameters in **UAC R317-2**.
- Significant monitoring and/or analysis 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 against which they can be evaluated.

To view DWQ's list of priority parameters, please refer to the Parameters Currently Assessed table located on the IR **Call for Data**. 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

Existing and Readily Available Data

To determine whether a waterbody is supporting or not supporting the assigned beneficial uses and numeric criteria in UAC R317-2, DWQ must compile all existing and readily available data. As part of the initial data compilation process, DWQ will take into account and consider the following parameters:

- Data and information referenced in 40 CFR 130.7(b)(5)(i), (iii), and (iv), which define readily available data for inclusion in water quality assessments. In addition to DWQ data collected for assessment purposes, DWQ also uses the raw data collected for other DWQ programs, such as waste load allocations, TMDL development, watershed, and use attainability analysis.
- Credible data and information that are submitted to or obtained by DWQ during the IR public Call for Data from October 1 to December 31 of even-numbered years.
- Data and information that are independently collected by DWQ and its cooperators between reporting cycles.
- Quantitative data that can be downloaded from publicly available databases from federal, state, and local agencies.
- Additional sources of data included in the Data Types Matrix link on the IR Call for Data website.

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. To help ensure the inclusion of data in DWQ's assessment process, it is important for data to be submitted in a form that matches DWQ's existing data-management capabilities. Required formats and metadata submissions are provided on the IR Call for Data and will be updated October 1 of even-numbered years.

Should data not be included in the assessment process because of resource limitations or other limitations, DWQ will clearly define in the draft and final IR which dataset (or datasets) could not be included, why, and next steps DWQ will take to ensure future inclusion of these datasets and information. Updates on datasets that will be targeted by DWQ for the upcoming assessment cycle will be provided on the Water Quality Assessments Program website.

Developing the Methods

This document describes Utah's most current assessment methods that will be applied for Utah's 2016 IR. Although many of the methods described have been applied in past assessment cycles, other methods are new or modified from previous cycles. Some of the assessment method revisions are simply intended to clarify ongoing DWQ practices. Other more substantive revisions to the methods are based on concerns that were raised during the public comment periods of the 2014 303(d) Assessment Methods and draft IR and 303(d) List.

DWQ updates and revises the 303(d) methods when concerns are raised and/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 released to states on odd-numbered years.

Moving forward, all changes made to the 303(d) Assessment Methods will be reviewed and updated on odd-numbered years in anticipation of developing the IR and 303(d) List in the following even-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

The process for formal consideration and acceptance of the Assessment Methods is driven by a public review process that follows the following schedule:

1. DWQ released the proposed methods on March 11, 2015, for a 30-day public comment period. The notice for public comments on the methods was advertised in the *Salt Lake Tribune*, *Deseret News*, DWQ's **News and Announcements** and **Public Notices** website, the IR **Program Information** and **Current Assessment Methods & Guidance** website, and DWQ's listserv.
2. At the close of the public comment period on April 12, 2015, DWQ compiled and began responding to comments that were received within the 30-day public comment period.
3. If substantial revisions to the methods are adopted by DWQ based on comments received in the first 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** website, and DWQ's listserv.
4. Following the conclusion of the public comment period(s), DWQ will post responses to comments on the Assessment Methods webpage. DWQ will release a final version of the methods that will be used in the upcoming assessment cycle with the results of the draft IR.
5. In the event that DWQ changes elements of the Assessment Methods in the interim between public comment and the issuing of the subsequent IR for public comment, reviewers will have the opportunity to make comments on the Assessment Methods during the IR public comment period only on the changes that were implemented. If stakeholders continue to have concerns with the final Assessment Methods, the public should submit their comments during future calls for public comments on 303(d) assessment methodologies that support future IR cycles.

Concerns and comments not received through the above processes cannot be guaranteed inclusion in current and future 303(d) methods updates and modifications. However, in the event that additional changes or additions to the publicly vetted 303(d) Assessment Methods are made following the close of the public comment and during the current assessment process, those 303(d) method alterations will be documented and issued with the draft IR and 303(d) List for additional public comment.

Developing the Components of the Integrated Report and 303(d) List

Following the release of a final 303(d) Assessment Methods and compilation of all existing and readily available data, DWQ reviews all data and assigns a credible data "grade" as defined on the IR Call for Data website. All non-rejected, credible data are then assessed as defined in this document for the release of the following IR and associated 303(d) components.

The following minimum report elements will be included in the Integrated Report available for public review and comment. Please note that additional related program reports or chapters may be issued along with the Integrated Report.

Executive Summary

This component will include the following:

- A summary of report highlights and any deviations from the Assessment Methods contained in the IR analysis.

305(b) Summary of Lakes/Reservoirs and Rivers/Streams

At a minimum, this summary will address the following elements:

- EPA-defined assessment categories for each defined and evaluated Assessment Unit.
- Percentage of waters assessed versus not assessed.
    - Of those waters that were assessed, the percentage that are impaired versus not impaired.
    - Of those waters that were impaired, the percentage that have approved TMDLs versus those that do not have approved TMDLs.
- Percentage of impaired versus not-impaired waters by beneficial uses.
- Miles/acres and number of waterbodies that are impaired for a specific cause.
- Update on the miles/acres of causes of impairments.
- Number of approved TMDLs by pollutant and the number of causes addressed in the TMDL.

303(d) Assessment Results

At a minimum, the following information will be provided:

- 303(d) List and other EPA- and state-derived assessment categories by waterbody type. The two lists will include the following information:
    - EPA category 5 waters listed by Assessment Unit and parameter causing impairment.
    - Perrenial rivers and stream miles and lake/reservoir acreage.
    - Causes of impairment(s), if known.

  - Cycle first listed and the last cycle the waterbody and cause of impairment were assessed.
  - Impaired uses, if any.
  - TMDL priority for Category 5 waters and previous listing decisions (when new data do not result in delisting and in an update to an assessment category, or no new data existed and the assessment category from prior 303(d) listing is applied).
  - Not-supporting beneficial uses.
- Delistings by waterbody and parameter, cycle delisted, and why the waterbody and parameter were delisted.

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:

- Data reports and summaries of the assessment results by parameter.
- Data report reflecting a single categorization at the parameter, sample site location, and AU level. Also, included is information on the application of BPJ.
- 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 was used in the assessment cycle.

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.

Additional Assessment Metadata

For archiving purposes and to assist with the review of the IR, DWQ will also provide the following:

- Waters and parameters that were impaired but have an approved TMDL. DWQ will also indicate if the water and parameter moved from the previous reporting cycle's 303(d) List to a Category 4A (approved TMDL) in the current cycle vs. the water and parameter are newly impaired but are addressed in an approved TMDL and therefore move straight to a Category 4A.
- Summary list of the water and the assessment category.

Public Review of the 303(d) List

Similar to the consideration and final adoption of the 303(d) Assessment Methods, there will be a formal public review process for the IR and 303(d) List with the following steps:

1. 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 odd-numbered years (Appendix 3). 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 would likely not be received in time to be included in the current IR cycle.

2. 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.
3. After October 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 in the *Salt Lake Tribune*, *Deseret News*, DWQ's News and Announcements and/or Public Notices, Water Quality Assessments Program website, and DWQ's listserv.
4. Stakeholders who wish to submit data for listing or delistings considerations are encouraged to submit that data and information during the Assessment Program's Call for Data. However, DWQ will also consider data that are submitted during the public comment period of the draft IR and 303(d) List when the public commenter can show that their submitted data results could result in a potential 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).
5. During the 30-day public comment period for the draft IR and 303(d) List, the Assessment Program will present a summary of the draft report and 303(d) List to DWQ's Water Quality Board. Concerns raised by the board will be documented and considered part of the public comment process.
6. At the close of the 30-day public comment period, DWQ will compile and begin responding to comments that were received within the 30-day public comment period.
7. 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 grant or withhold its discretion to 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, Water Quality Assessments Program website, and DWQ's listserv.
8. 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 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 through future calls for public comments on future IRs.
9. 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.

10. Any concerns and comments not received through the above processes cannot be guaranteed for inclusion in the IR. DWQ will apply discretion with regard to evaluating and responding to comments received after the ending of the comment period.

Finalizing the 303(d) List

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

- Draft and final versions of 303(d) Assessment Methods, including the public comments received and DWQ's response to comments
- Draft and 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 surface waters of the state:

- Rivers and streams
- Springs
- Seeps
- Canals as identified in site-specific standards in UAC R317-2
- Lakes and reservoirs

All other waters, such as ground water, are 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 waters at the monitoring-site level and then summarizes the site-level assessments up to a larger spatial scale (i.e., the AU scale). Each monitoring location can only represent one waterbody type. The monitoring locations are categorized by considering the definitions in Table 3 and applying BPJ where a site may be representative of another waterbody type. For instance, a monitoring location for a spring may be representative of downstream water quality in a stream. Canals, springs, and seeps will all be evaluated in the assessment results, but, with few exceptions, the results at individual monitoring locations will not be applied to the entire AU, as is the case with stream and river assessments. The exceptions include canals with specifically identified uses and site-specific standards in UAC R317-2 or springs or seeps found to accurately represent water quality in a stream.

Table 3. Waterbody types used for categorizing monitoring locations.

Waterbody Type	Description
Rivers and streams	A body of running water moving under gravity flow in a defined channel. The channel may be entirely natural or altered by engineering practices such as straitening, dredging, and/or lining. Both perennial and intermittent rivers and streams are included in this type. Ephemeral rivers and streams are not included in this type and are not reported on in the IR.

Waterbody Type	Description
	Note: If specific samples for this waterbody type were collected under stagnant conditions, the samples and data records will be flagged and not considered in the assessment of the monitoring location because these samples are not representative of free-flowing conditions.
Springs and seeps	A body of water or location where the water table intersects the land surface, resulting in a natural flow of ground water to the surface. Perennial, intermittent, and ephemeral springs and seeps are assessed, provided they are moving under gravity flow and connect, contribute, or are influencing water quality in a downstream river or stream. *Note:* Springs and seeps assessments will be placed in category 3. If specific samples for springs or seeps were collected during conditions that do not fit the above description or were collected under stagnant conditions, the samples and data records will be flagged and not considered in the assessment of the monitoring location.
Canals (general, irrigation, transport, or drainage)	A human-made water conveyance. *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 and reservoirs	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.
Wetlands	Waterbodies that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. *Note*: Wetlands are not assessed by the 303(d) program. Utah is in the process of developing an assessment framework for wetlands.

Great Salt Lake and Associated Wetlands

DWQ is currently developing criteria and methods for the assessment of GSL as outlined in the Great Salt Lake Water Quality Strategy. In addition, DWQ is actively pursuing projects that continue to develop, test, and refine wetland condition assessment frameworks for GSL wetlands. For 2016, this waterbody will not be assessed for 303(d) reporting purposes.

Assessment Units

Assessment Unit Delineation and Identification

Streams, rivers, lakes, and reservoirs 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 if they are supporting their designated beneficial uses. Lakes and reservoirs have been delineated as individual AUs and their size is reported in acres. Rivers and streams have been delineated by specific river, river or stream reach, or several stream reaches in subwatersheds. AU size for streams is reported in total perennial stream miles. When using subwatersheds to delineate stream 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 stream 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.

Guidelines for Delineating Stream and River Assessment Units

When delineating river and stream AUs, DWQ followed the guidelines listed below with the first two guideline statements being fixed rules.

- The AU is within an 8-digit USGS HUC.
- Each river and stream AU comprises stream reaches having identical designated beneficial use classifications (i.e., a stream that has beneficial uses of Class 1C, 2B, and 3A and at another part of the stream has Class 2B and 3B). This stream would have at least two AUs because of the difference in beneficial use classifications.
- Large rivers, 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. Where a major tributary enters these rivers or hydrological features such as dams exist, the river is further delineated into two or more AUs.
- Tributary rivers and streams were delineated primarily using the 5th- and 6th-level HUCs to define the AUs.
- Additional AUs were defined by combining or splitting 5th- or 6th-level watersheds using tributary streams, stream size, and ecological changes such as geology, vegetation, or land use.
- Small tributary streams to larger streams that could not be incorporated into a watershed unit were combined into separate unique AUs.

These AUs have been georeferenced (indexed) to the National Hydrologic Dataset (NHD) using a reach-indexing tool that provides the capability of using GIS techniques to display information and data for each AU. Beneficial use classifications and assessments for individual AUs can be mapped or displayed to provide visual representation of assessment results.

Individual stream AUs were assigned a unique identification code for indexing. Each stream 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 and reservoir 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. The Weber River was delineated as a linear AU from its confluence with Chalk Creek upstream to the Wanship Dam, 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.

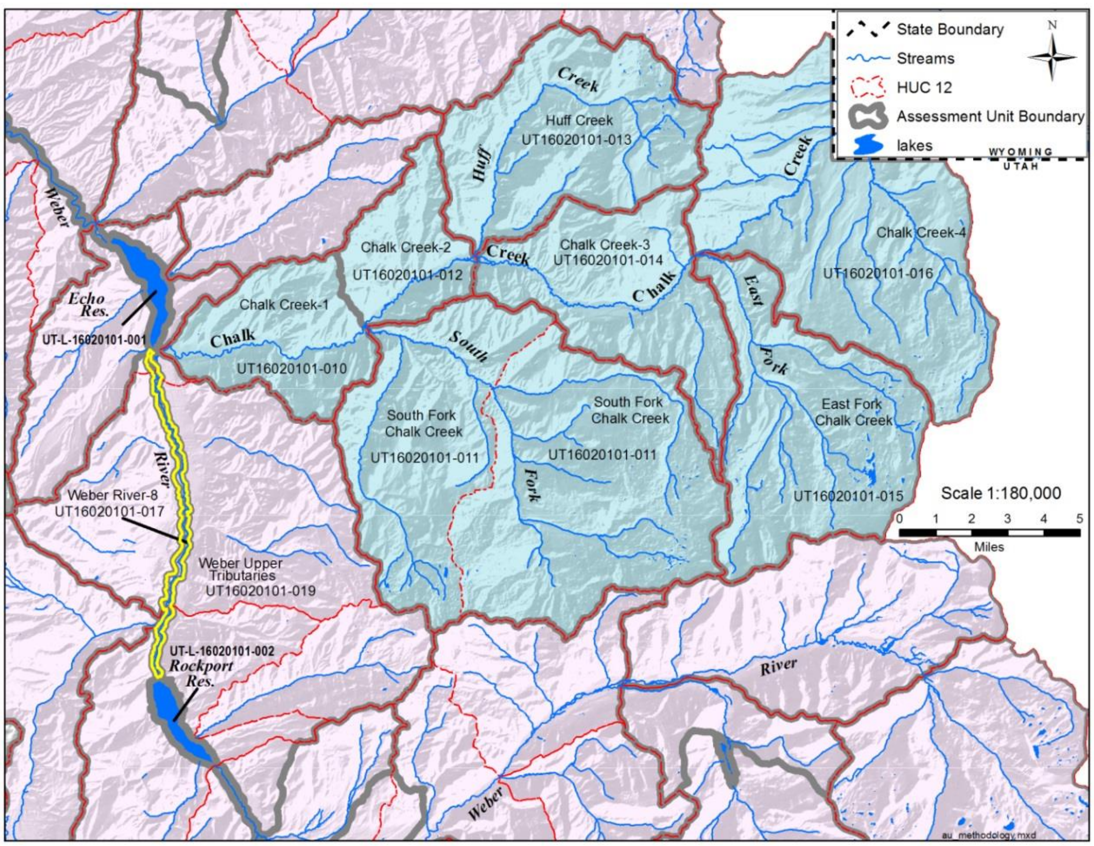


Figure 1. Utah Division of Water Quality assessment unit delineations.

Digital data representing all established AUs representing Utah's lakes and streams 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. All perennial streams or lake area represented within a defined AU receive the same beneficial use assessment category according to assessment results for each AU. Spatial statistics and assessment summaries are also available for hydrologic basins at various levels of detail.

Refining and Creating New Assessment Units

New AUs can be created based on ecological, geological, and beneficial use assessment information that provides greater resolution in identifying and delineating rivers and streams into additional AUs that provide for a more precise assessment of the state's rivers and streams. A number of considerations may be used in evaluating whether subdividing an AU is warranted to more accurately reflect its impairment status (i.e., should the whole AU be listed or just a portion?). A primary consideration is to identify which monitoring locations result in listing the AU as impaired and which are supporting uses. In the process, major hydrologic breaks within the AU are identified by viewing the HUC 12 boundaries. If impaired monitoring locations are located in both upper and lower watershed HUC 12 subwatersheds, existing AU boundaries are retained. If impaired monitoring locations are only located in lower subwatersheds but not in upper subwatersheds, the AU is suggested to be split along the HUC 12 boundary. Finally, if impaired monitoring locations are only located in upper subwatersheds but not in lower subwatersheds, the existing AU boundaries are also retained.

Stream Mileage Calculation for the DWQ 2016 Integrated Report

The following ArcGIS shapefiles were used to calculate stream miles for each AU in the DWQ 2016 IR:

The Utah Automated Geographic Reference Center (AGRC) State Geographic Information Database dataset known as "NHD streams" or Water.StreamsNHDHighRes, was derived by AGRC from the NHD. The derivation and modification process has been performed by AGRC to provide a general-purpose feature class of streams. Two fields have been added to this feature class (InUtah and IsMajor), and features have been split at the state boundary (see the **AGRC NHD Lakes, Rivers, Streams, Springs** GIS Data Layer website). These vector data are high resolution (1:24,000 scale) GIS stream features and attribute data used to represent water features across the country (see the USGS **NHD** website).

All line features within DWQ's established and geographically delineated AUs were assigned the unique AU identifier associated with that AU. The AU designation was completed by GIS overlay processing (e.g., spatial join) and by splitting line segments at AU boundaries in nearly all cases of AU boundary intersection.

Using coded NHD attributes describing waterbody characteristics, each waterbody, or segment, was defined as one of the following waterbody types: Artificial Path (allows for flow though lakes and reservoirs), Canal/Ditch, Connector, Intermittent Stream, Perennial Stream, or Pipeline (aqueduct).

Total stream mileage for each AU was obtained by the sum of the lengths of all perennial stream segments within each AU.

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 on lands under tribal jurisdiction are not assessed in the IR. Assessments Assessed surface waters of the state (as defined in Table 3) that flow into Utah but originate outside of Utah's borders will be assessed using DWQ monitoring locations residing within state boundaries. Lakes and reservoirs 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. For these larger lakes, UAC R317.2 specifies which portions of the lakes are assessed by Utah's water quality standards.

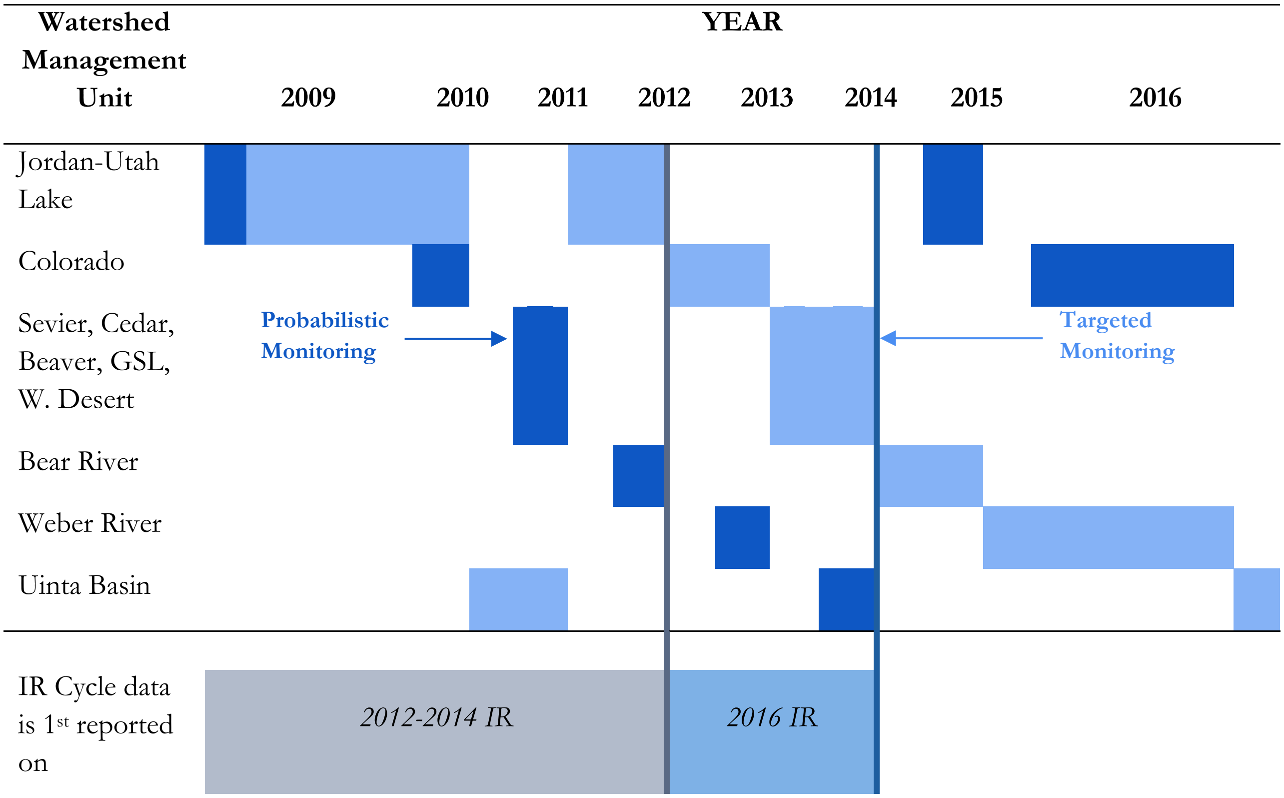
As resources allow, DWQ will work with neighboring states on any impairments that fall close to jurisdictional boundaries in other states by notifying the neighboring state of the impairments or exceedances and available data relevant to the impairment.

Monitoring and the Rotating Basin

To help coordinate and prioritize water quality monitoring and planning throughout the state, DWQ uses a "rotating basin" approach. Designed to meet the reporting requirements of the 305(b) component of the IR, DWQ begins monitoring a watershed management unit (WMU) through 50 randomly selected sites to better understand the significant causes of pollution throughout the WMU. Following the initial probabilistic-monitoring efforts within a WMU, DWQ returns to the watershed 2 years later for more intensive sampling based on the probabilistic-survey results and different programmatic needs within DWQ.

The following schedule (Table 4) sets out the relationship between the basin reviews and when assessments generated by those reviews are incorporated in the 303(d) Listing process for the first time.

Table 4. Summary of the Division of Water Quality's 6-year rotating basin monitoring schedule and the Integrated Report data reporting cycle.



Though DWQ will consider and assess any readily available data throughout the state that fall within the Assessment Program's Data Quality and Procedures outlined on the IR Call for Data website, datasets collected by DWQ will be heavily focused in the Colorado, Sevier/ Cedar/ Beaver, and Great Salt Lake/ West Desert WMUs for the 2016 cycle.

For more information on DWQ's WMUs and DWQ's rotating basin plan, please refer to DWQ's Watershed Protection and Monitoring and Reporting websites.

Credible Data: General Requirements

A key component of assessing a waterbody against numeric criteria as defined in UAC R317-2 is ensuring that the data and information from different sources are comparable, sufficient in size, representative, and of good quality. To minimize potentially flawed assessment decisions based on inaccurate data, DWQ will evaluate all chemical, physical, and biological data used in assessing waters of the state against the following interpretive, sampling, and analytical considerations and protocols.

Data Types

As referenced in 40 CFR 130.7(b)(5), DWQ will consider all existing and readily available data. However, based on the type of data submitted to or obtained by DWQ during the Assessment Program's Call for Data for generating the IR and 303(d) List, the data may not be appropriate for

303(d) assessments. As recommended in EPA's July 29, 2005, guidance (EPA, 2005), DWQ will consider several quantitative and qualitative types of data described in Table 5 for 303(d) assessments.

Table 5. Summary of data types considered in 303(d) assessment analysis work.

Quantitative Data	Qualitative Data
• Laboratory or field data for parameters contained in Utah's Water Quality Standards (UAC R317-2) and Safe Drinking Water Act Standards (UAC R309-200). • Segment-specific ambient monitoring of biological measures of health (**observed/expected** [O/E] scores).	• Observed effects (e.g., fish kills). • Complaints and comments from the public. • Human health/consumption closures, restrictions, and/or advisories.

Data types not included in Table 5 will be used by the Assessment Program but not necessarily for 303(d) evaluation purposes. To review how other data types will be used by the Assessment Program, please refer to DWQ's Assessment Program's Data Types Matrix link on the IR **Call for Data** website.

Period of Record

Quantitative and qualitative data types that are used for a 303(d) analysis are separated into two groups based on water year (see Table 5). Using DWQ's 6-year rotating basin monitoring schedule as a guide, DWQ defines the period of record for a 6-year assessment from October 1, 2008 to September 30, 2014 for the 2016 IR.

Data and information from the 6-year assessment 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- and state-derived assessment categories to the assessed waterbodies from this record period (see Table 1). DWQ will not consider information or data older than 6 years 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 **Call for Data** request (after September 30, 2014 for the 2016 IR) 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. If more recent data are submitted, DWQ will reserve the discretion to integrate the newer information in the current cycle or they will be retained and used in the subsequent assessment cycle. For more information, please refer to the General Questions section on the **Call for Data** website.

General Credible Data Requirements

All biological, physical, and chemical data and information that fall within the defined period of record for an assessment cycle are evaluated against a series of sampling, analytical, and interpretive protocols. These protocols include an evaluation of sample site geospatial information, QA/QC of field and laboratory protocols, sampling and laboratory methods, analytical detection limits, field observations, and variability within a dataset. Data that meet DWQ's credible data requirements will be evaluated against the numeric criteria associated with the beneficial uses assigned to waterbodies in **UAC R317-2**. Data and information that do not meet DWQ's credible data requirements will receive a rejection flag and justification. At no point during the data evaluation or assessment process will DWQ intentionally delete or remove data from a dataset.

Monitoring Location

To assess a waterbody against the numeric criteria assigned in **UAC R317-2** , DWQ must review all of the monitoring location information associated within the 6-year 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. At a minimum, the information that must be included with a monitoring location measurement is as follows:

- MLID.
- Monitoring location name.
- Monitoring location description.
- Monitoring location waterbody type.
- Waterbody type description.
- Monitoring location latitude/longitude measurements and associated metadata as defined on the Assessment Program's **Call for Data** website.
- Monitoring location elevation measurements and associated metadata as defined on the Assessment Program's **Call for Data** website.
- State.

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 the assessment process of assigning an EPA- and state-derived assessment category (see Table 1). Stakeholders will be able to review any rejection results from this evaluation process during the draft IR and 303(d) List public comment period.

Credible Data

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 on the Assessment's **Call for Data** website, 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 assigned a grade level (A–D) to the associated sample measurement(s) (see Appendix 6 and the Data Quality Matrices at the IR Call for Data website for more information).

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- and state-derived assessment category to a waterbody (see Table 1). 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. Though DWQ does not use these lower-grade data for generating the IR and 303(d) List, the Assessment Program still considers some of the lower-quality data for different programmatic purposes such as targeted/future monitoring for 303(d) Assessment purposes.

Representative Data

To minimize potentially flawed assessment decisions that are driven by extreme events, DWQ screens all high-quality (Grade A or B) data for representativeness. For IR and 303(d) assessment purposes, examples of extreme events include the following:

- Accidental spills of toxic chemicals.
- Scouring storm flows that lead to diminished aquatic-life beneficial uses.
- 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. 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 3A), 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 3A: Isufficient Data, Exceedances**: If analyses with and without the extreme events show evidence of impairment (Category 3A).
- **Category 3A: 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 3A), 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 3A).
- **Category 5: Not supporting:** If analyses with and without the extreme events are not supporting (Category 5).

Assessed Waterbodies

Parameter Assessment under Development: Evaluation of Indicators

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 6.

Table 6. 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 3d: Further investigation needed.
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 3D until DWQ adopts new criteria. See the Addressing Nitrogen and Phosphorus section of this document.
Total phosphorus as P	2A, 2B, 3A*, 3B*	Phosphorus will be assessed in the same manner as toxic parameters, but all categorical assessments will be overwritten to Category 3D until DWQ adopts new criteria. See the Addressing Nitrogen and Phosphorus section of this document.

* Footnote 11 in UAC R317-2 is wrongly applied to this parameter and uses. The footnote that should be applied is number 10.

Note: Assessment decisions articulated in the notes section of the table will be applied to all assessed waterbodies of the state identified in Table 4.

Addressing Nitrogen and Phosphorus

DWQ is currently developing a multifaceted nutrient reduction program to address water quality problems associated with nitrogen and phosphorus pollution. One important aspect of this program is the development of assessment methods that accurately identify streams and lakes with nutrient-related problems.

Development of robust assessments to address nitrogen and phosphorus pollution is important for several reasons. There are many different nutrient responses with the potential to degrade the designated uses of aquatic ecosystems (Figure 2). Each causal path needs to be assessed to ensure that excess nutrients are not resulting in water quality impairments. Moreover, there are several physical characteristics (shading, temperature) of these systems that both reduce and exacerbate nutrient responses. Further complications arise because different deleterious responses manifest at different times of the year. Together, these complications mean that it is not easy to generalize about the concentration of nitrogen and phosphorus that must be avoided to ensure ongoing support of designated uses, nor a single, isolated ecological response that can reliably identify nutrient-related problems.

DWQ is developing comprehensive assessment methods that use multiple lines of evidence to accurately identify sites with nutrient-related problems. These assessments incorporate both historical and recently developed (e.g., Ostermiller et al. 2014) water quality indicators to accurately assess whether excess nutrients have degraded conditions to the extent that the designated uses are impaired. DWQ will seek ongoing public input on these assessment methods as they are developed and ultimately integrated into assessments in future IRs.

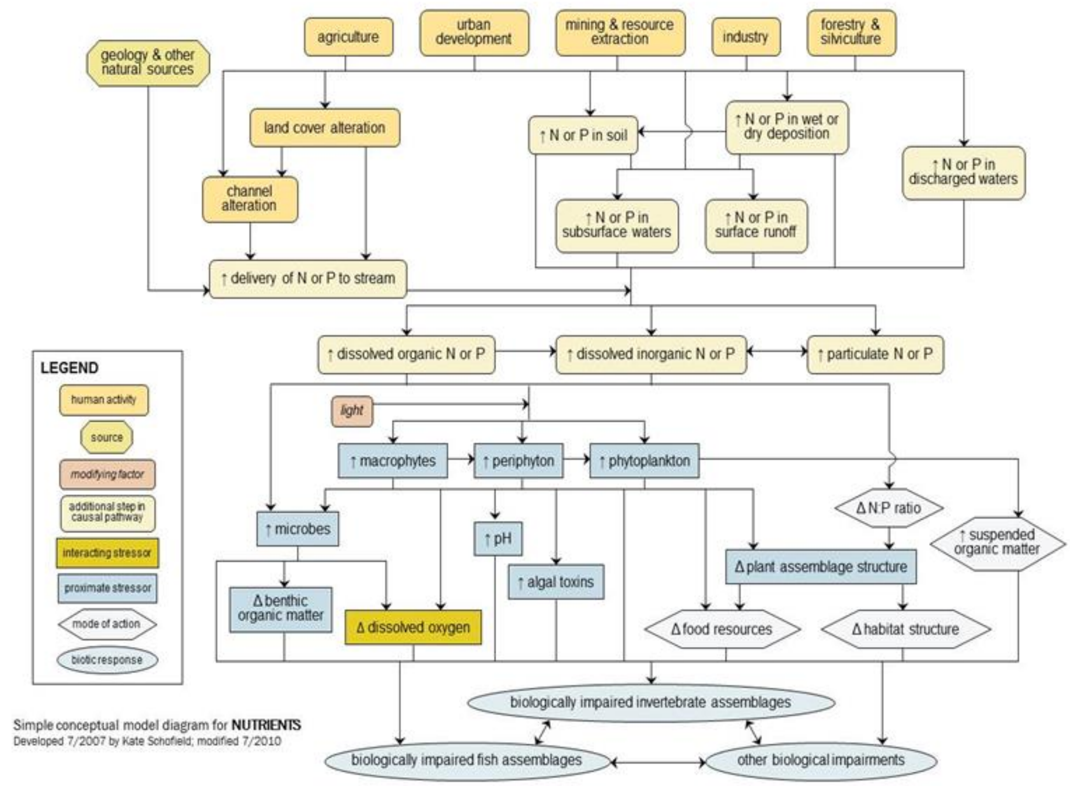


Figure 2. A conceptual model of nutrient sources and their impacts on aquatic ecosystems.

Screening Values

DWQ may also use percentage saturation of dissolved oxygen (DO) as a screening value for sites that may exhibit high daytime values above 110% saturation. As discussed in peer-reviewed literature and white papers, the collection of DO using grab sampling methods is problematic because single daytime measurements may not be indicative of nighttime minima or 7-day or 30 day averages. As algae produce DO during the day, excessively high saturation values may indicate that the stream may exhibit a corresponding drop in DO as the algae respire during the night. Therefore, the saturation data may be evaluated to guide decisions regarding assessment results and prioritizing sites for future monitoring.

ESCHERICHIA COLI ASSESSMENTS

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 is 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 in the IR.

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 follows:

- 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 there is a quantified MPN value reported from a dilution and the value reported is greater-than-detect, the quantified value will be used as the collection event for assessment purposes. Furthermore, 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 as described above, 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. The following default use classifications will be used for waters that are not designated for specific uses in UAC R317-2:

- Lakes and reservoirs not designated in **UAC R317-2** as 2A are designated as Class 2B waters by default. If a lake or reservoir is > 10 acres and not listed in UAC R317-2-13.12, the lake or reservoir is assigned by default to the classification of the stream with which they are associated.
- River and streams, springs, seeps, and canals that are unclassified and do not have assigned beneficial uses in DWQ data records will be assigned default beneficial uses as articulated in **UAC R317-2-13.9, 13.10, 13.11, and 13.13**.

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 for lakes and reservoirs is to determine if there were two *E. coli*–related beach closures or health advisories in a recreation season. Lakes and reservoirs with two or more closures or advisories are impaired, and no further assessment is conducted (Figure 3). DWQ does not currently have assessment methods for rivers and streams due to *E. coli*–related health advisories. If there were fewer than two closures or advisories for lakes, or the AU is a river or stream, the assessment process continues using *E. coli* concentrations.

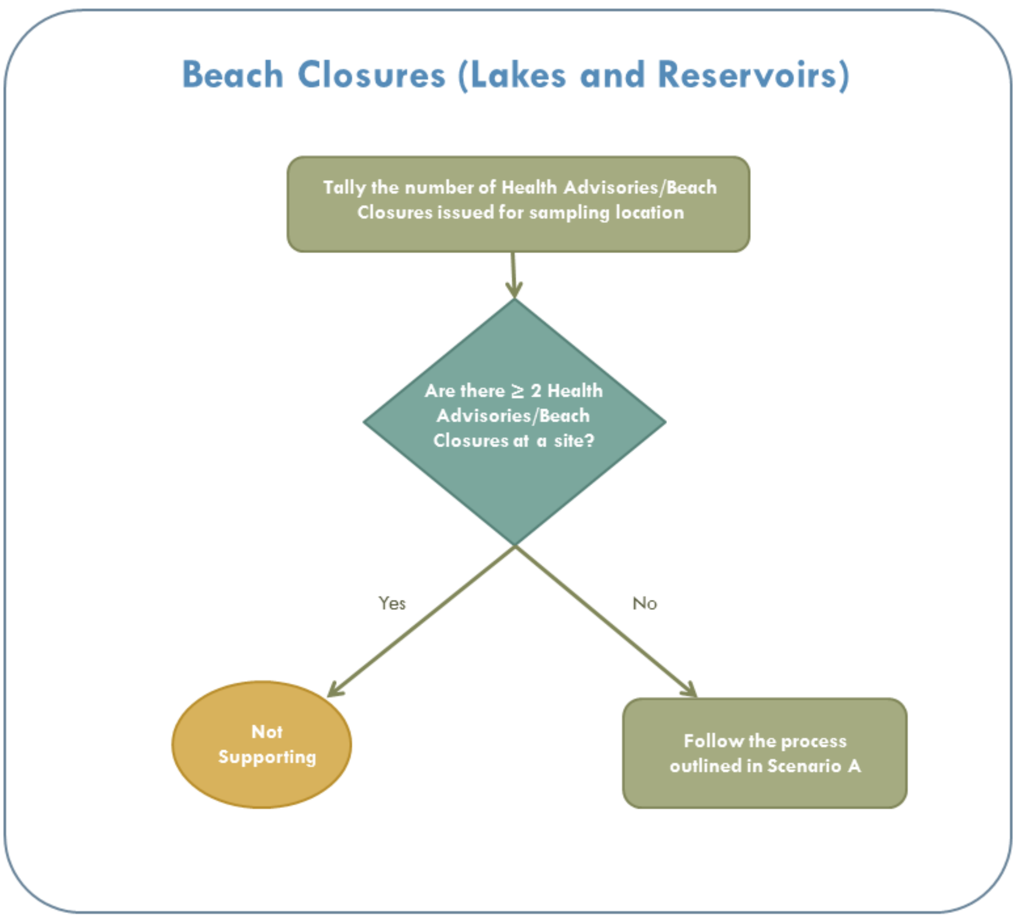


Figure 3. Lakes and reservoirs with two or more closures or advisories.

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 4).
- **Scenario B:** A 30-day geometric mean assessment (Figure 5).
- **Scenario C:** A seasonal geometric mean assessment (Figure 6).

Each monitoring location is assessed against the maximum criterion first if there are five or more samples (see Figure 4).

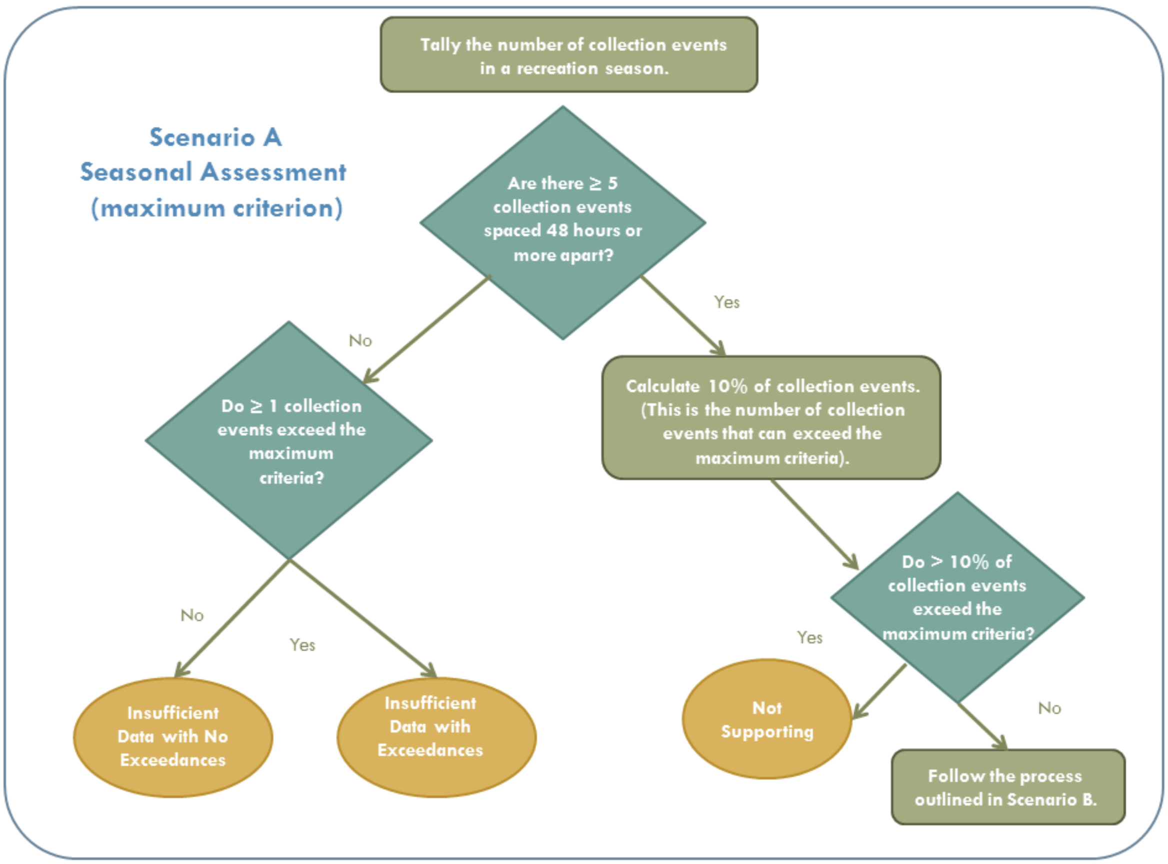


Figure 4. Scenario A: a seasonal assessment using the maximum criterion at a monitoring location.

If less than 10% of collection events exceed the maximum criterion, the site is then assessed using the 30-day geometric mean criterion (see Figure 5). 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.

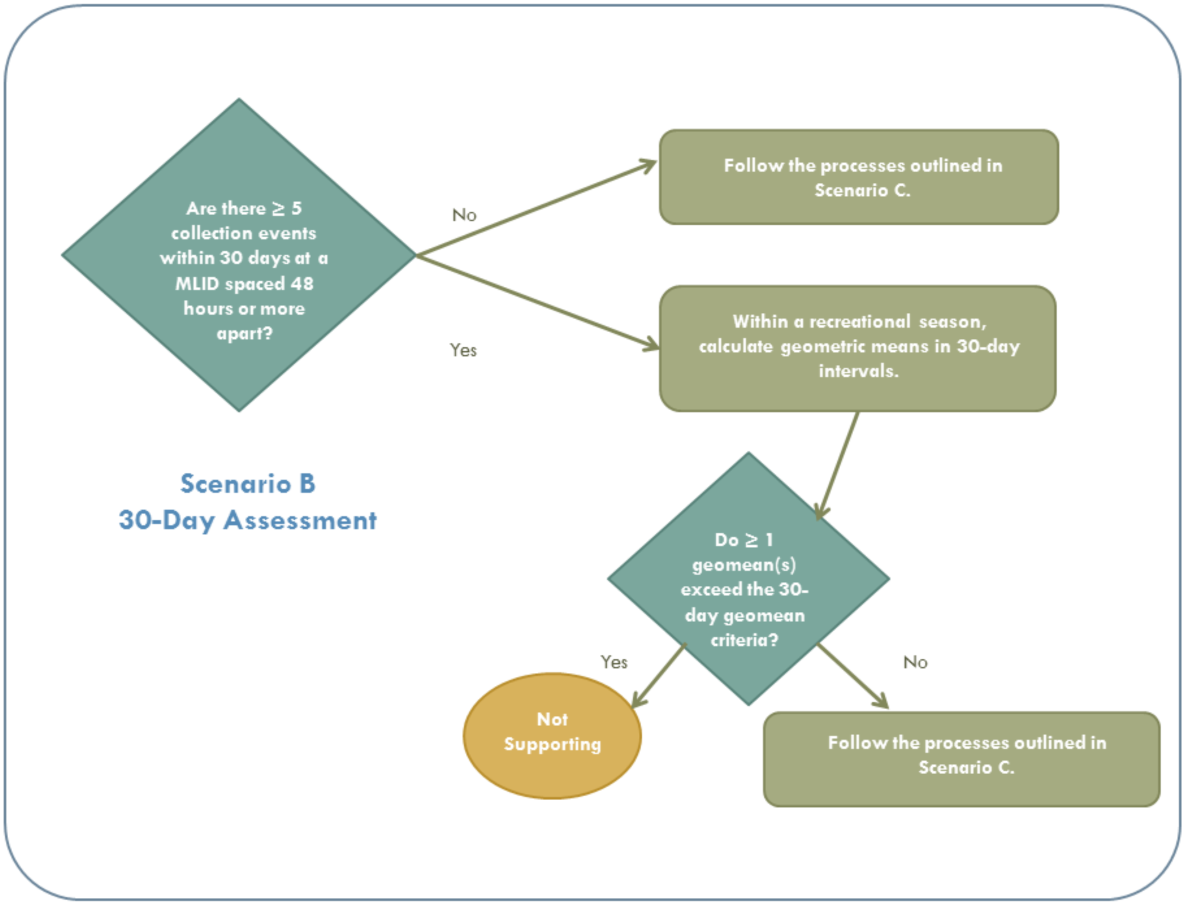


Figure 5. Scenario B: an assessment using the 30-day geometric mean for monitoring locations with five or more collection events within 30 days.

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 season (May–October). 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 6).

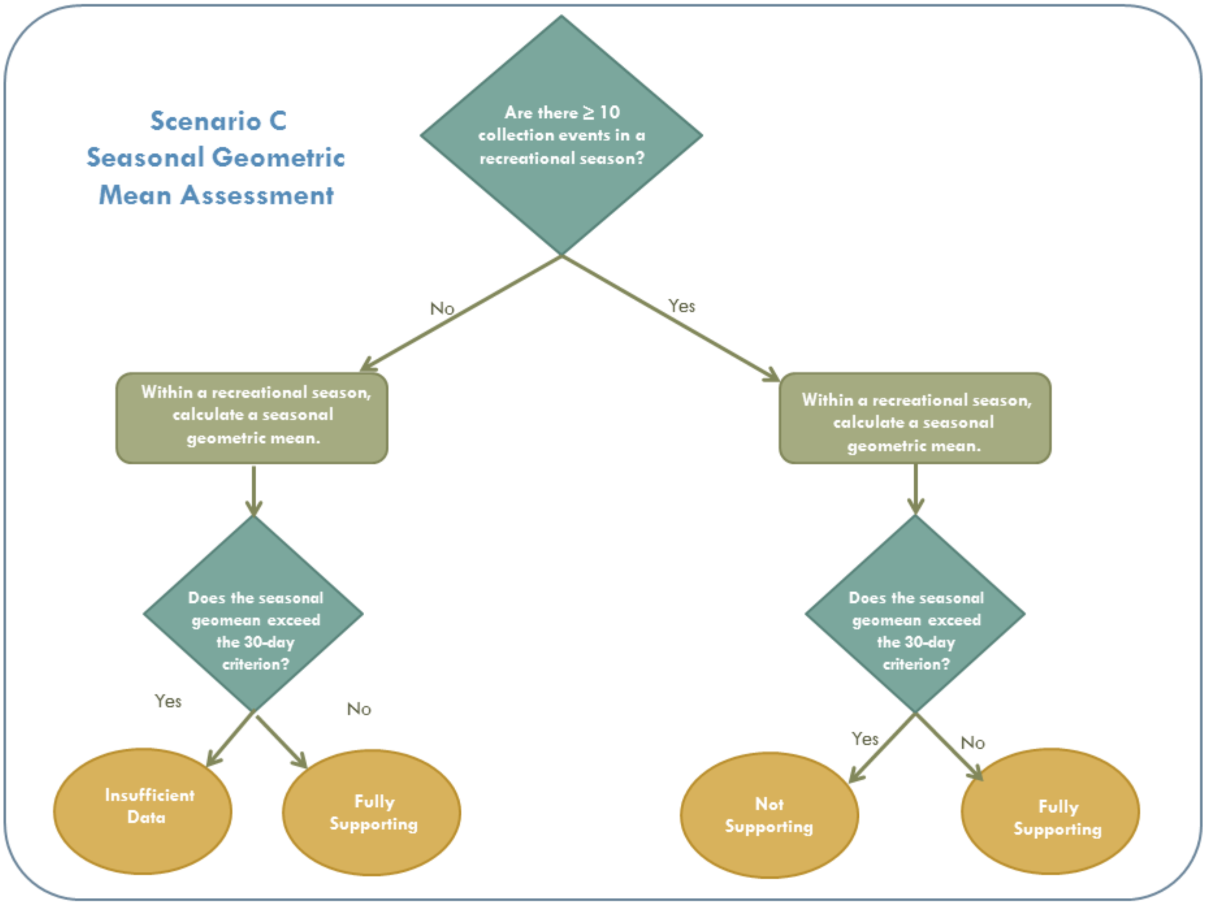


Figure 6. Scenario C: A seasonal geometric mean assessment.

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 or reservoir that 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 (May–October) geomean exceeds the 30-day geometric mean criterion (minimum of 10 collection events).

Insufficient Data or Information Assessment Considerations (Category 3A)

- Sites with four or fewer samples in all seasons evaluated will be listed as not assessed, provided impairment is not suggested by a posted health advisories or beach closure. This applies at lakes and reservoirs only.
- All Category 3A sites will be prioritized for future monitoring, especially if limited data suggest impairment.

Combinations of Category 3E, 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 has a process for merging assessment results from multiple locations within an AU (Assessment of Lakes and Reservoirs section).

Fully Supporting (Category 1 or 2)

- No evidence of impairment by any assessment approach for all recreation seasons over the most recent 6 years. 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 internal reviewers, parameter assessments at an individual monitoring location and results from multiple monitoring locations within the same AU are not summarized and combined (Assessment Unit Roll-up; Appendix 1).

ASSESSMENT OF RIVERS, STREAMS, SPRINGS, SEEPS, AND CANALS

Data Preparation

DWQ determines attainment or nonattainment of numeric standards for rivers, streams, springs, seep, and canals by assessing credible data against the numeric criteria in UAC R317-2 through the protocols outlined below. Though *E. coli* and biological assessments also are performed on rivers, streams, springs, seeps, and canals, assessment methods unique to those parameters are described in separate sections of this document.

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 that 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 one-half of the detection limit is above the water quality standard, the data will not be used in the assessment.

Duplicate and Replicate Results

Following credible data requirements and additional QA/QC checks as outlined in DWQ's *Quality Assurance Program Plan For Environmental Data Operations* (DWQ, 2014), datasets may contain duplicate and replicate sample results either due to 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

Once data records reflect the corrections described above, DWQ analyzes each beneficial use for a parameter at a single monitoring location. 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 not summarized and combined until the determination of impairment and the additional supporting information are completed by internal reviewers. See the Determination of Impairment: All Assessment Units section.

Conventional Parameters

Currently, DWQ assesses six 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 7.

Table 7. 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. 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.
E. coli	Domestic Recreation	Criteria are different for uses. Several seasonal scenarios are evaluated.
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: • 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. • 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. • 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.
Sulfate	Agriculture	Site-specific standard associated with sulfate for the following areas: • 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. • 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.

* Indicate that assessments are performed from field measurement only. Springs and seeps will not be assessed by field level measurements.

A minimum of 10 samples for conventional parameters are required to determine if a site is attaining or not attaining water quality standards (Figure 7). 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. If 10% or less of the total samples collected exceed the criterion, the site is attaining its beneficial uses. Where locations have insufficient samples to make an attaining or non-attaining determination, DWQ prioritizes the sites and parameters for future monitoring, depending on whether the dataset contains criterion exceedances. 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.

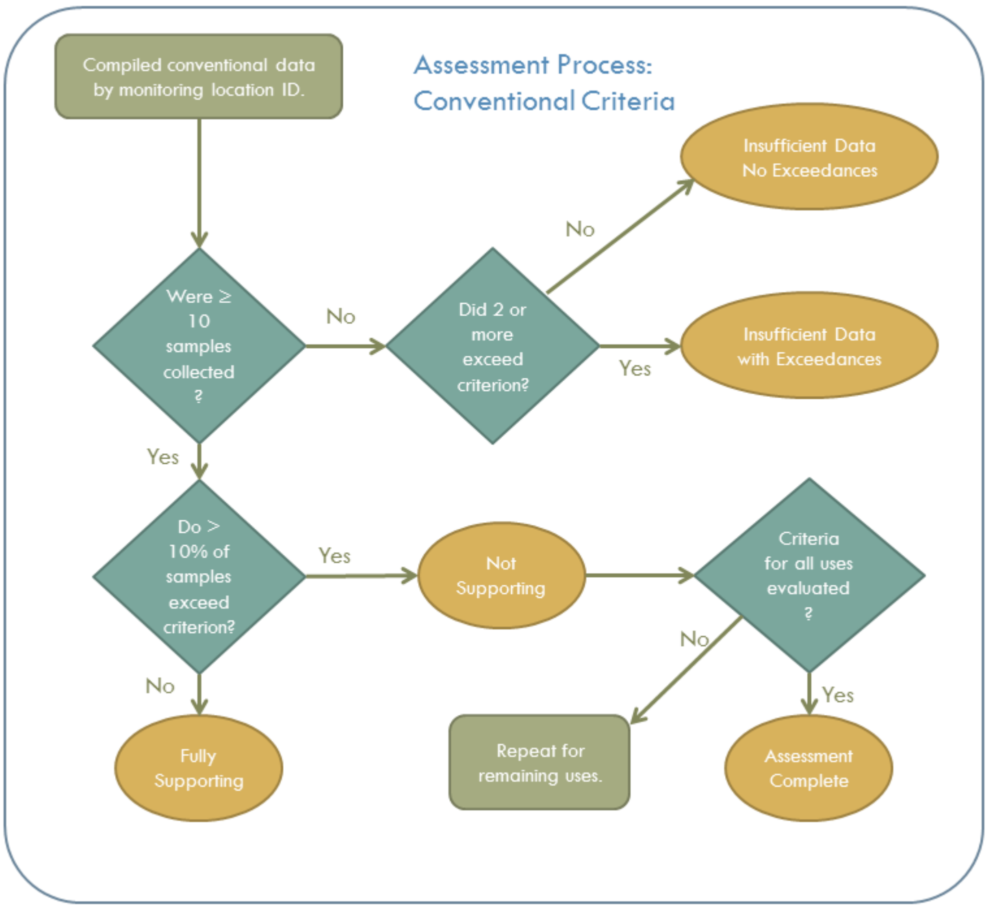


Figure 7. Overview of the assessment process for conventional parameters.

Toxic Parameters

DWQ identifies *toxics* as all parameters within UAC R317-2 that are not defined as conventional parameters (see Table 7). Assessment procedures for toxics are more conservative than conventional parameters for the following reasons:

- Many toxic substances accumulate in the tissue of aquatic organisms and become increasingly toxic with prolonged exposure to high pollutant concentrations.
- Toxic substances can biomagnify, or increase, in tissue concentration from lower to higher trophic levels.
- High concentrations of many of these substances can lead to the direct mortality of many species at various life stages.

To ensure protection of designated uses, data are compared against one or more toxic criteria, sample size requirements are smaller, and sites are considered degraded with two or more violations of a criterion.

Multiple toxic parameters can also have multiple criteria for a single beneficial use, depending on the averaging period: a lower, chronic criterion and a higher, acute criterion (UAC R317-2). For 303(d) assessment purposes, one daily measurement at each monitoring location is compared to the chronic and/or acute criteria. Currently, the acute and chronic averaging periods defined in UAC R317-2are 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. If a hardness value cannot be calculated from a measured Ca and Mg value and the laboratory did not provide a hardness value, a default hardness of 100 milligrams per liter (mg/l) is used to evaluate the toxic results. Results were reviewed to ensure that a Category 5 (not supporting) decision was not reached using surrogate hardness values.

- 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:

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

  - pH ≥ 7.0 and (calculated or laboratory reported) hardness < 50 ppm: 87 µg/l.
  - 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:

  $$((0.0577/(1+10^{7.688-pH})) + (2.487/(1+ 10^{pH-7.688}))) * MIN (2.85, 1.45*10^{0.028*(25-T)})$$

  Where $(1.45*10^{0.028*(25-T)})$ is ≤ 2.85, $(1.45*10^{0.028*(25-T)})$ is applied and if $(1.45*10^{0.028*(25-T)})$ 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.

- Fluoride:
  UAC R317-2 currently provides a range of criteria for fluoride depending on air temperature. This sliding criterion was determined to be inappropriately applied. Fluoride data were not assessed in 2016.

- Hydrogen sulfide:

  DWQ has discovered that the formula in UAC R317-2 used to convert dissolved sulfide to un-disassociated hydrogen sulfide is not correct. This formula will be updated in the future by DWQ's Standards Program. Until the equation and/or criteria are reviewed and corrected by DWQ's Standards Program and Triennial Review work group and DWQ's board, all hydrogen sulfide data will not be assessed.

Additional Standards Interpretations

- Boron:

  UAC R317-2 does not specify sample fraction (total or dissolved) for the boron criterion. All data for boron, both total and dissolved, were included in the assessment. The intent of the boron standard was for dissolved fraction. The criterion will be updated in future triennial reviews by the Standards Program. Until it is adopted in rule, results will be reviewed to ensure that no waterbody is listed based on total boron results.

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 3A or 3E categories (Figure 8).

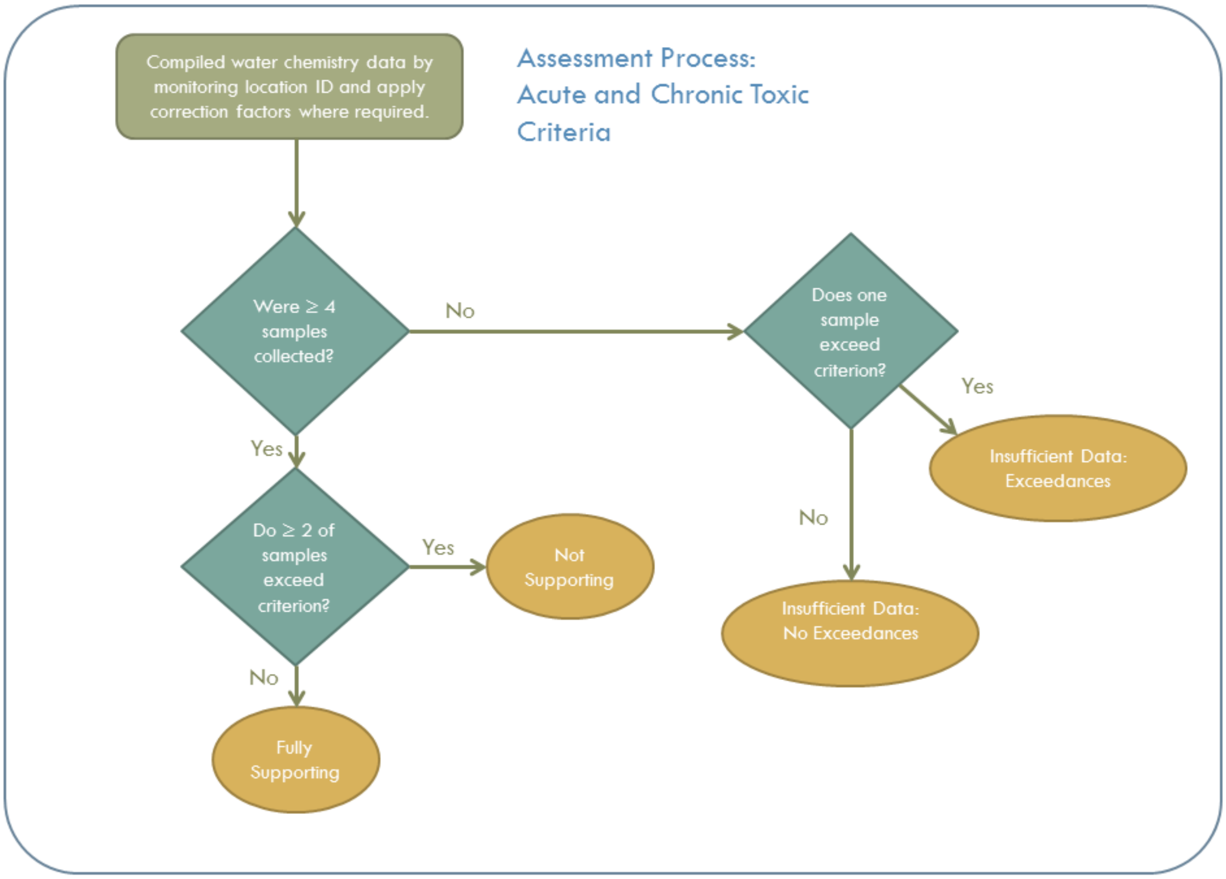


Figure 8. Overview of the assessment process for toxic parameters.

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 depend 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 9).

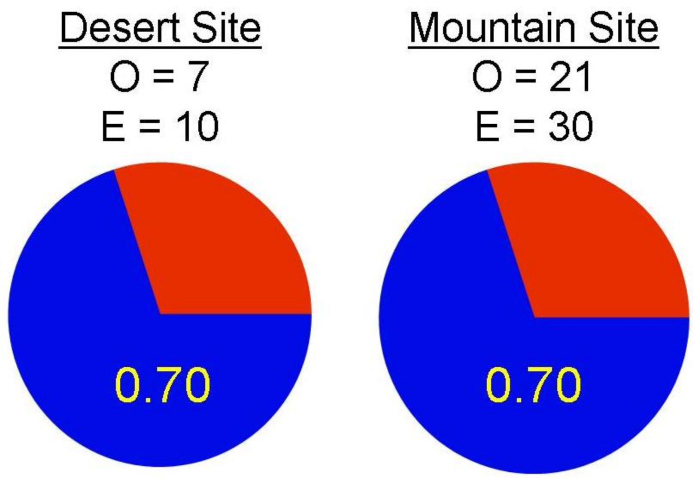


Figure 9. A hypothetical example of O/E as a standardization of biological assessments.

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.

As mentioned earlier, 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) of 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 8).

Table 8. 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.
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 2016 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 2016 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 10). The goal of this assessment process is to characterize each AU as fully supporting or not supporting aquatic life beneficial uses.

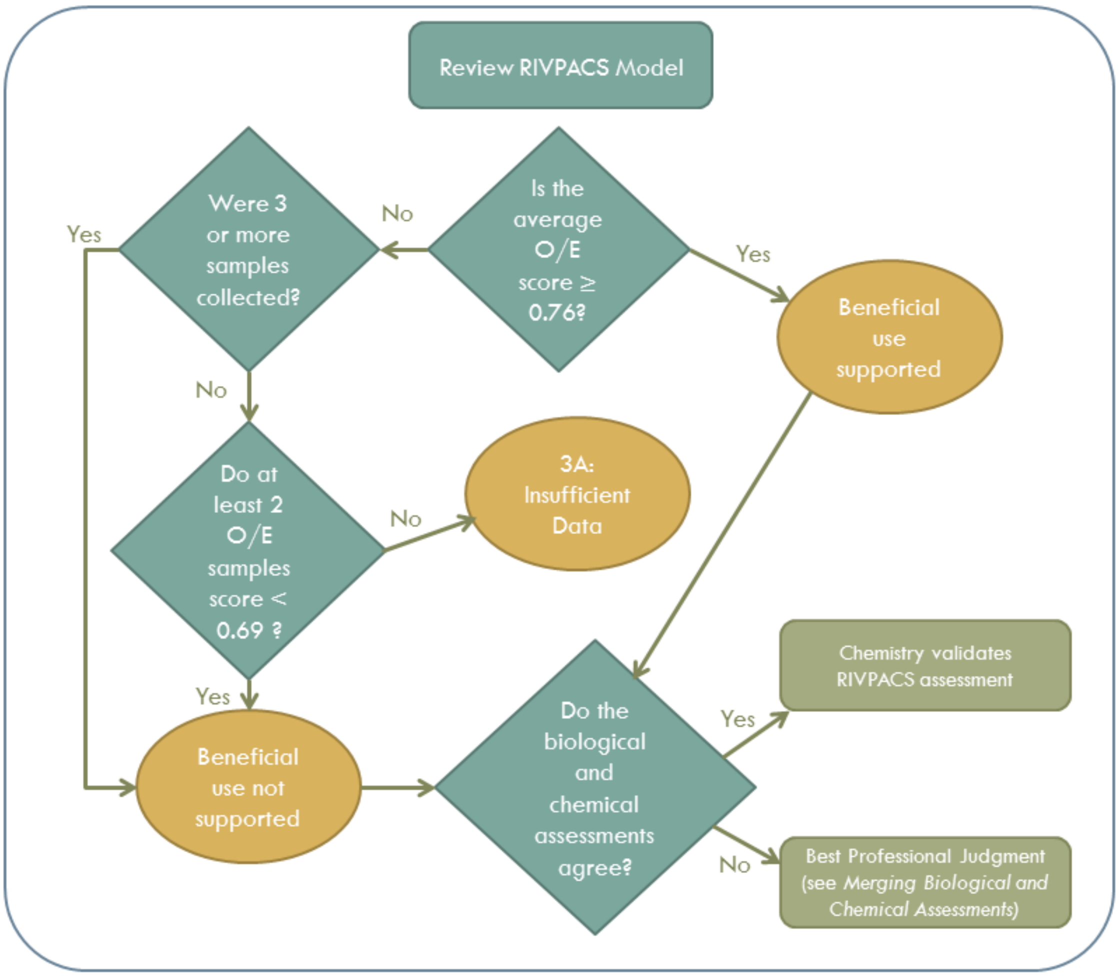


Figure 10. Decision tree for making biological assessment decisions.

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. If DWQ finds multiple sites within an AU from different environmental settings, AUs may be subdivided into smaller watershed units whenever clear boundaries can be identified (e.g., political/land use boundaries, tributary confluence). 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 9). For these assessments, the 10th and 5th percentiles of reference sites were used. Essentially, the data used for the 2016 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 6 years since the most recent year of available data (2014). 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 9. 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 5 years	Mean O/E score ≥ 0.76	Fully Supporting	Threshold based on 10th percentile of reference sites.
≥ 3 samples collected over 5 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

These errors can be costly to DWQ by increasing staff time and resources for follow-up assessments on erroneous assessments. AUs not meeting biological thresholds will be assessed as non-supporting, or they will be required for follow-up sampling if additional information is needed. 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 3A, which indicates that there are insufficient data to make an assessment. All sites listed as 3A will be given a high priority for future biological monitoring.

ASSESSMENT OF LAKES AND RESERVOIRS

Lakes and reservoirs 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). Other than GSL, each waterbody has been assigned an AU for purposes of assessment. 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 will affect how conventional water quality parameters are assessed (**UAC R317-2-14**). Therefore, each waterbody will be evaluated for thermal stratification and assessed appropriately.

Monitoring Overview

DWQ has identified 137 lakes based on size and public interest to receive consistent, programmatic monitoring. These waterbodies account for 93% of the water surface acres in Utah. Additional lakes are targeted for monitoring to ensure public health due to potential harmful algal blooms. Waters that are classified as having a high recreational use or are protected for drinking water are prioritized. DWQ transitioned to a rotating basin (n = 6) approach where monitoring is focused in a basin through sampling. Lakes within the focused basin are sampled once during the year, typically May–September. Waterbodies deemed high priority (Category 3A and 5) will be sampled more frequently per year regardless of their location. For most lakes, the change to a basin-intensive approach results in collecting a single sample every 6 years, which necessitated changes to the Assessment Methods. The 2016 assessments are based on the last 6 years of data (for instance, the 2016 data used data from 2009 to 2014). If data for this time period were unavailable, data from the previous 4 years (total of 12 years) were assessed. DWQ also participates in the National Lake Assessment (NLA) component of the National Aquatic Surveys conducted every 5 years by EPA. For these surveys, Utah adopts a state-intensification approach where 50 probability-based sites are selected within the state using the NLA design. Data that are compatible with DWQ's lake assessment methods are also used for determining beneficial use support.

Field Method Overview

For most waterbodies, data collection occurs in the deepest location of the lake. Although some waterbodies have multiple locations where data are collected, data used for assessments rely on, but are not limited to, samples collected from the location with the deepest depth. Water column profile data are collected at the surface and at every meter of the water column depth. The collection is completed when the probe is one meter above the bottom. Surface samples are collected from a depth of 0.5 meter. All water chemistry samples, except dissolved metals and algae, are collected at the surface, 1 meter above the thermocline, 1 meter below the thermocline, and near the bottom. The dissolved metals sample is collected 1 meter above the bottom at the deepest site of the waterbody. The algal sample, which is analyzed for taxonomic composition and primary production (chlorophyll *a*), is collected as a composite sample from two times the depth of the Secchi disc reading to the surface up to a maximum of 2 meters.

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, toxicants, 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 BPJ. 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.

DWQ will prioritize waterbodies that are assessed as Category 3A for subsequent monitoring so that conclusive beneficial use assessments can be made.

Tier I Assessment

Drinking Water Use Support

Assessing for Drinking Water Use support involves evaluations of *E. coli*, harmful algal blooms, pH, and metals. *E. coli* is collected at waterbodies designated for the Drinking Water Use. For further information, please review the *E. coli* Assessment section discussed earlier in this document. The evaluation process of pH and metals is the same as the requirements for Aquatic Life Uses (other than criteria thresholds), which are described below.

Harmful Algal Blooms

DWQ is actively developing a monitoring and reporting program for harmful algal blooms. In the interim, DWQ will use the recommendations by the World Health Organization to guide this assessment. These recommendations prescribe human health risks associated with aggregated cyanobacteria cell counts (Table 10). Excessive growth of cyanobacteria can lead to taste and odor problems, which increase drinking water treatments costs. In some instances, sources of drinking water may need to be temporarily excluded from the water supply until a cyanobacteria bloom subsides. Some species of cyanobacteria, particularly *Anabaena* sp., *Aphanizomenon* sp., *Microcystis* sp., and *Planktothrix* sp., can produce cyanotoxins that are harmful to people and other animals. Currently, DWQ prioritizes monitoring for harmful algal blooms in waters designated for drinking water and those waters that experience significant recreational usage, such as motor boating, water skiing, and swimming. This monitoring will be in partnership with the Utah Division of Drinking Water and Utah Division of State Parks, as resources allow. Data and assessments will be shared with the Utah Department of Health and local health departments.

Beneficial Use Supported

The beneficial use is supported if cyanobacteria cell counts are < 20,000 cells/milliliter (ml).

Beneficial Use Not Supported
The beneficial use is categorized as "Threatened" if the cyanobacteria cell count exceeds 100,000 cells/ml once for waters that have Drinking Water Use (1C) designation.
The beneficial use is not supported if the cyanobacteria cell count exceeds 100,000 cells/ml for more than one sampling event for waters that have Drinking Water Use (1C) designation.

Insufficient Data and Information
The waterbody will be categorized 3A if there is one exceedance of > 20,000 cells/ml. These waterbodies will be prioritized for further evaluation with respective public health managing partners such as the Utah Department of Health, respective drinking water agencies, and state parks departments.

Table 10. World Health Organization thresholds of human health risk associated with potential exposure to cyanotoxins.

Indicator (units)	Low Risk	Moderate Risk	High Risk
Chlorophyll *a* (µg/l)	< 10	10–50	> 50
Cyanobacteria cell counts (cells/ml)	< 20,000	20,000–100,000	> 100,000

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 that section below. The methods for assessing the remaining indicators are described below.

Escherichia coli
E. coli is collected at select waterbodies to ensure the protection of Recreational Uses. For further information, please review the *E. coli* Assessment section for further information.

Harmful Algal Blooms
A person's health can be put at risk when exposed to algal toxins through skin contact, inhalation, or ingestion. This exposure pathway exists through multiple methods of recreation in lakes such as boating, water-skiing, and swimming. DWQ is working with partner agencies to develop a monitoring, evaluation, notification, and mitigation strategy to address the public's potential exposure to these toxins.

Beneficial Use Supported
The beneficial use is supported if cyanobacteria cell counts are < 20,000 cells/ml.

Beneficial Use Not Supported
The beneficial use is not supported if the cyanobacteria cell count exceeds 100,000 cells/ml for more than one sampling event or other narrative indicators (e.g., phycocyanin, chlorophyll a, harmful algal bloom–related beach closures) suggest recreational uses are not being attained.

Insufficient Data and Information

The waterbody will be categorized 3A if there is one exceedance of 20,000 cells/mL. These waterbodies will be prioritized for further evaluation with respective public health managing partners such as the Utah Department of Health and state parks departments.

Aquatic Life Use Support

Lake monitoring routinely involves collecting pH, temperature, and DO measurements at 1-meter intervals throughout the water column, from the surface to the lake bottom. If more than one site is sampled, the profile measurements collected at the deepest location of the waterbody are used for assessment calculations, unless there is sufficient reason to use profile data from other locations on the lake. These water column measurements are compared against Utah water quality standards to assess beneficial use support (Figure 11). For waterbodies that are thermally stratified, a separate process is used to determine whether sufficient habitat is available for aquatic life (Figure 15).

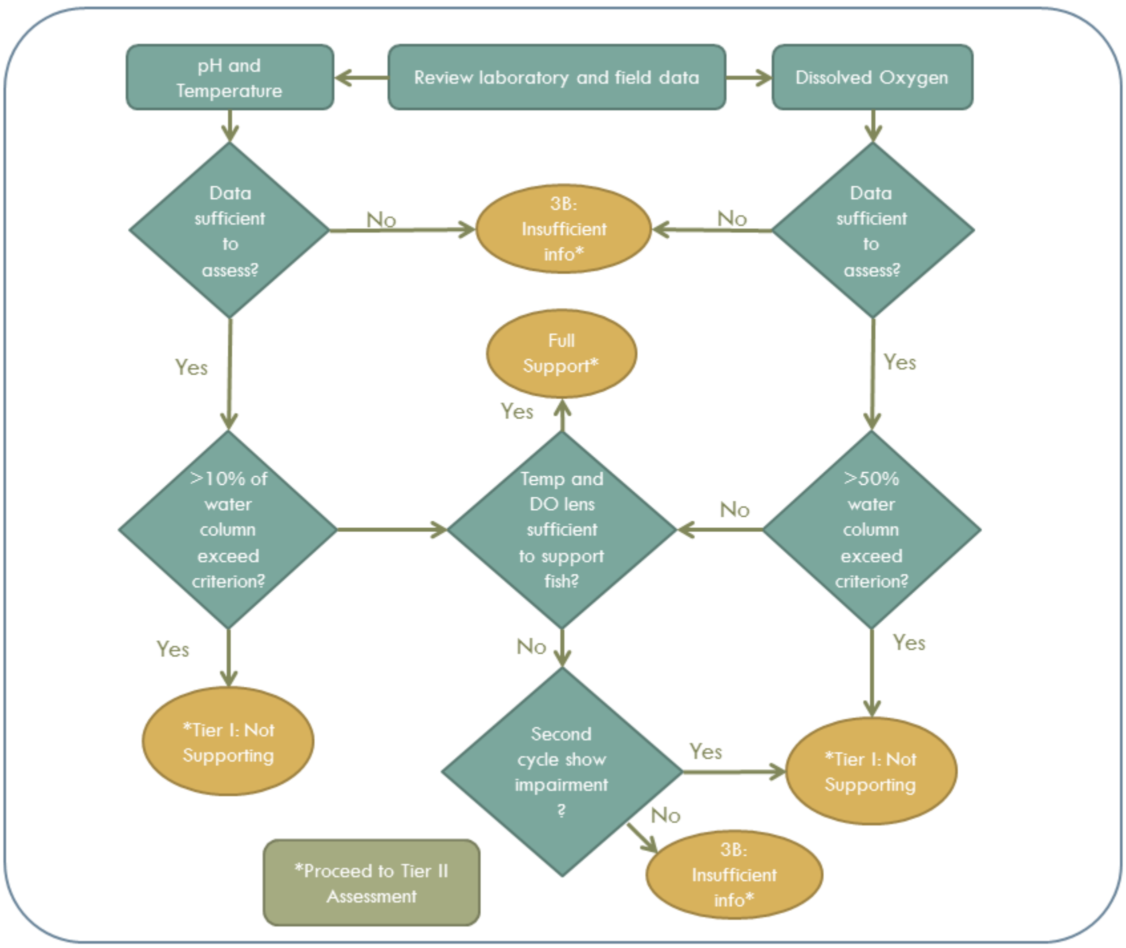


Figure 11. Process using conventional (nontoxic) parameters to assess lakes that are mixed.

For stratified waterbodies, an alternative test is used to evaluate whether aquatic life has sufficient habitat. In all cases, these assessments are followed by a second, Tier II, assessment process.

<u>pH</u>

Two pH criteria, maximum (9.0) and minimum (6.5), are used to assess support of beneficial uses:

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 12, 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 (see Figure 12, Panel B).

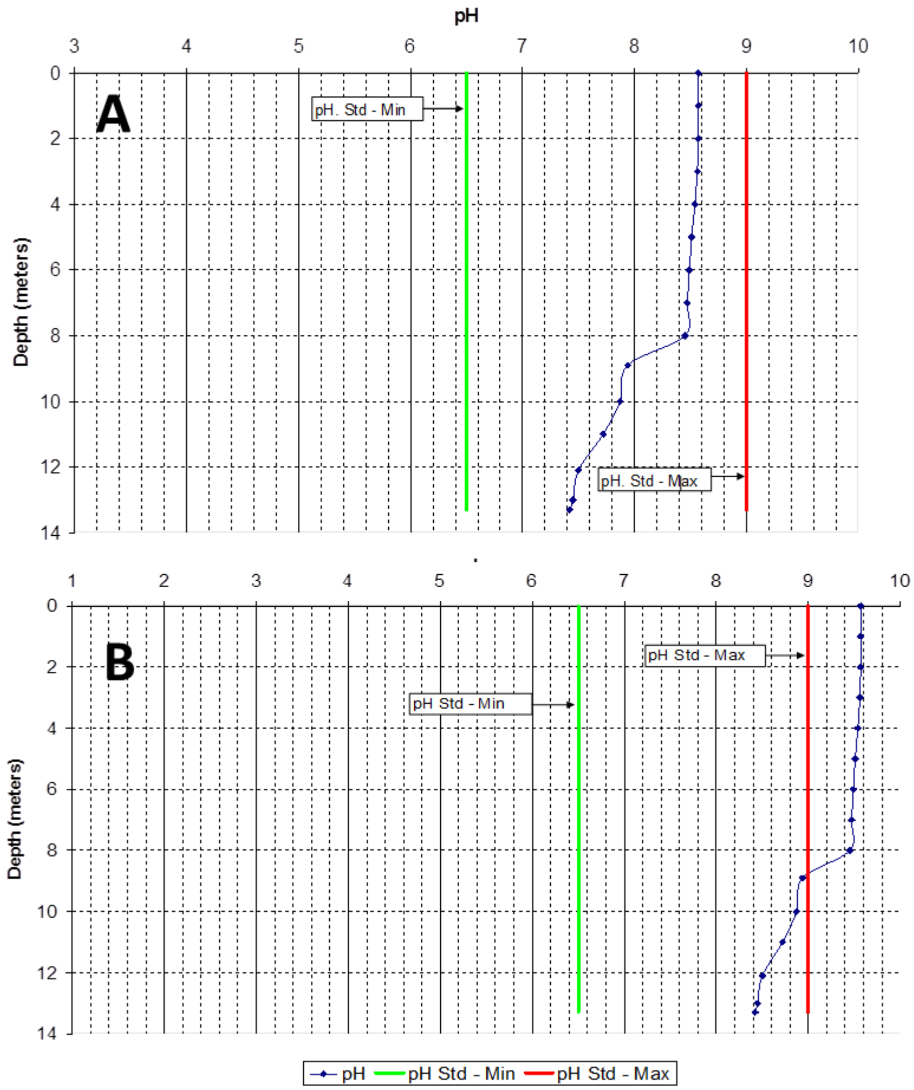


Figure 12. Plots of pH measurements (blue dots) against lake depth for a waterbody meeting (Panel A) and violating (Panel B) the pH water quality standards.

<u>Temperature</u>

The temperature assessment uses the criteria of 20 degrees Celsius for Class 3A waters and 27 degrees Celsius for Class 3B and 3C waters. The criteria used to assess the beneficial use support are based on profile data. Data collected from the deepest location of the waterbody during the critical time period (May–September) are used to calculate the percentage of violations for each sampling date. 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 waterbody is 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 13, 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 13, Panel B).

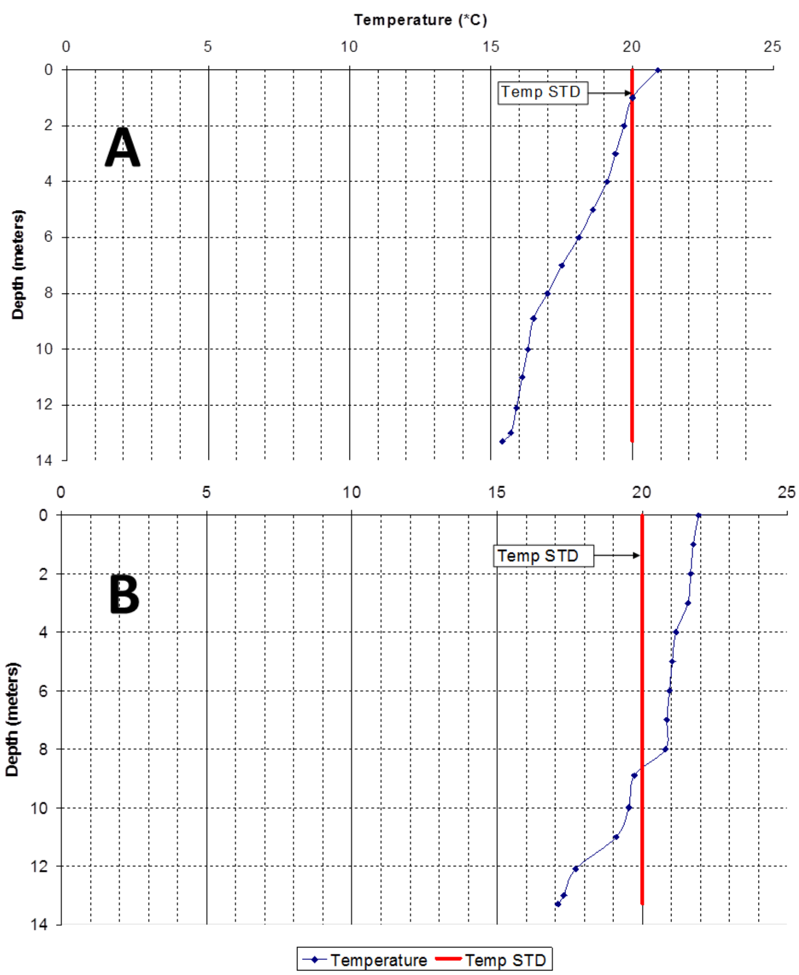


Figure 13. Plots of temperature measurements (blue dots) against lake depth for two waterbodies to provide an example of assessment procedures.

Notes: The red line illustrates a temperature criterion of 20 degrees Celsius: Class 3A beneficial use. Panel A (top) illustrates a waterbody meeting the beneficial use because less than 10% of the temperature measures are greater than the criterion, whereas Panel B (bottom) illustrates a waterbody 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 the lake profile 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 measures in deep, stratified waterbodies used in the assessment are limited to the layer above the thermocline. See the next section for further explanation of this method.

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.

Aquatic Life Use Assessment for Stratified Lakes and Reservoirs

For lakes that are thermally stratified, a separate assessment technique is needed to ensure sufficient habitat exists. If a lake profile indicates that the aquatic habitat is reduced by high temperatures or limited DO in the water column, an assessment is conducted to determine if there is sufficient habitat for aquatic life. Habitat is considered sufficient if at least 3 continuous meters of the water column are meeting the criteria for both temperature and DO. The only exception to this rule is if, after consulting with the Utah Division of Wildlife Resources, that the waterbody is meeting the requirements of a healthy fishery and is not limited due to poor water quality. For waterbodies that are subject to human-controlled operations or instances where severe drought has been documented (e.g., Palmer Drought Severity Index), water levels are taken into consideration. Water levels can change from year to year based on the spring runoff and how full the waterbody was at the end of the previous irrigation season, or how much water was needed for culinary purposes. Figure 15 provides an example of supporting and not supporting the beneficial use based on the DO and temperature data above the thermocline. The rationale for a conclusion of beneficial use support based on the existence of adequate habitat follows the decision diagram (Figure 14).

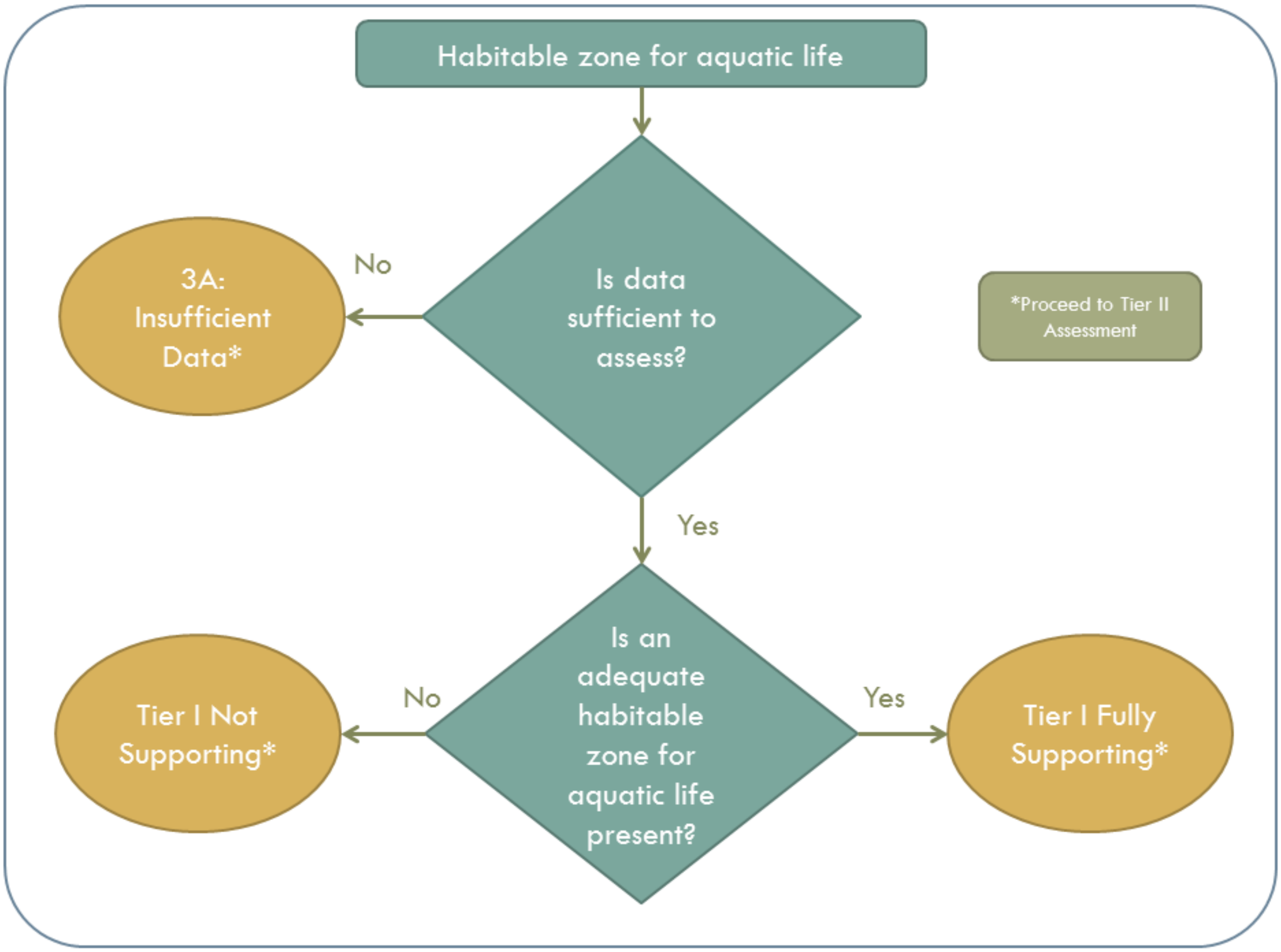


Figure 14. Beneficial use support based on the existence of adequate habitat.

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.

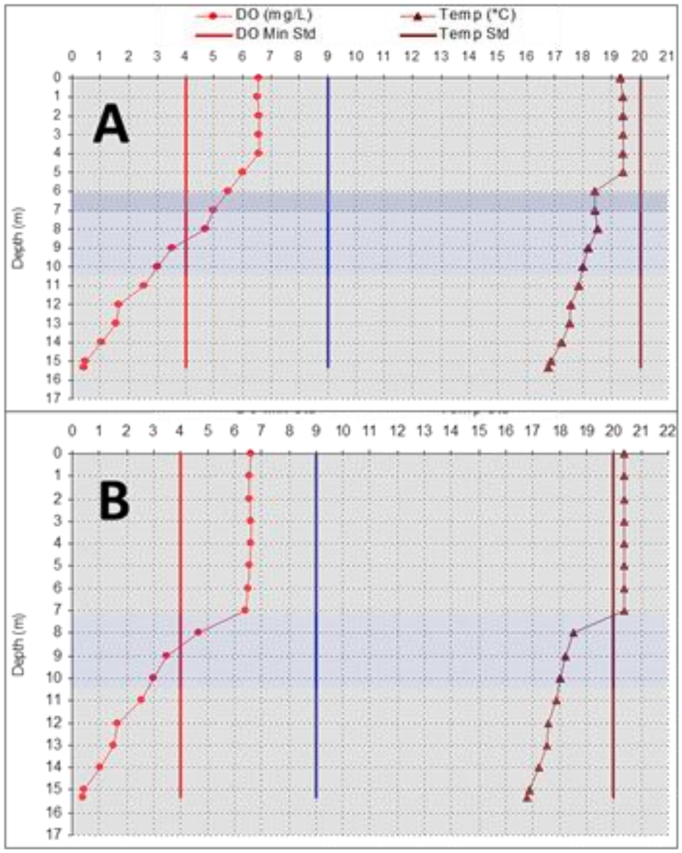


Figure 15. Concept of the habitable zone where both DO and temperature are suitable for aquatic life.

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

Toxics: Dissolved Metals

To obtain dissolved metals data, one sample is collected near the bottom at the deepest point in the waterbody. The sample is obtained here because this area generally has the highest dissolved metal concentrations.

Insufficient Data and Information

If the concentration of these pollutants exceeds the criteria, the waterbody is categorized as 3A, and DWQ will return to the site to conduct sampling the following year. In other words, because of the potentially toxic nature of these contaminants, DWQ will not wait until the next rotating basin cycle before following up on these potential water quality problems.

Beneficial Use Supported
The beneficial use is supported if there are less than two exceedances of the chronic or acute standard across consecutive reporting cycles.

Beneficial Use Not Supported

The beneficial use is not supported if the concentration exceeds the chronic or acute standard two or more times across consecutive reporting cycles.

Agricultural Use Support

Total Dissolved Solids

The TDS criterion is 1,200 mg/l unless a site-specific standard for the waterbody has been established. If TDS data are unavailable but conductivity data are available, the conductivity data are used to estimate TDS (USGS, 2006). An exceedance using conductivity as a surrogate will result in a Category 3A listing, and the waterbody will be targeted for TDS sampling.

The following rules are used to determine whether a lake is supporting its agricultural beneficial use (Figure 16):

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.

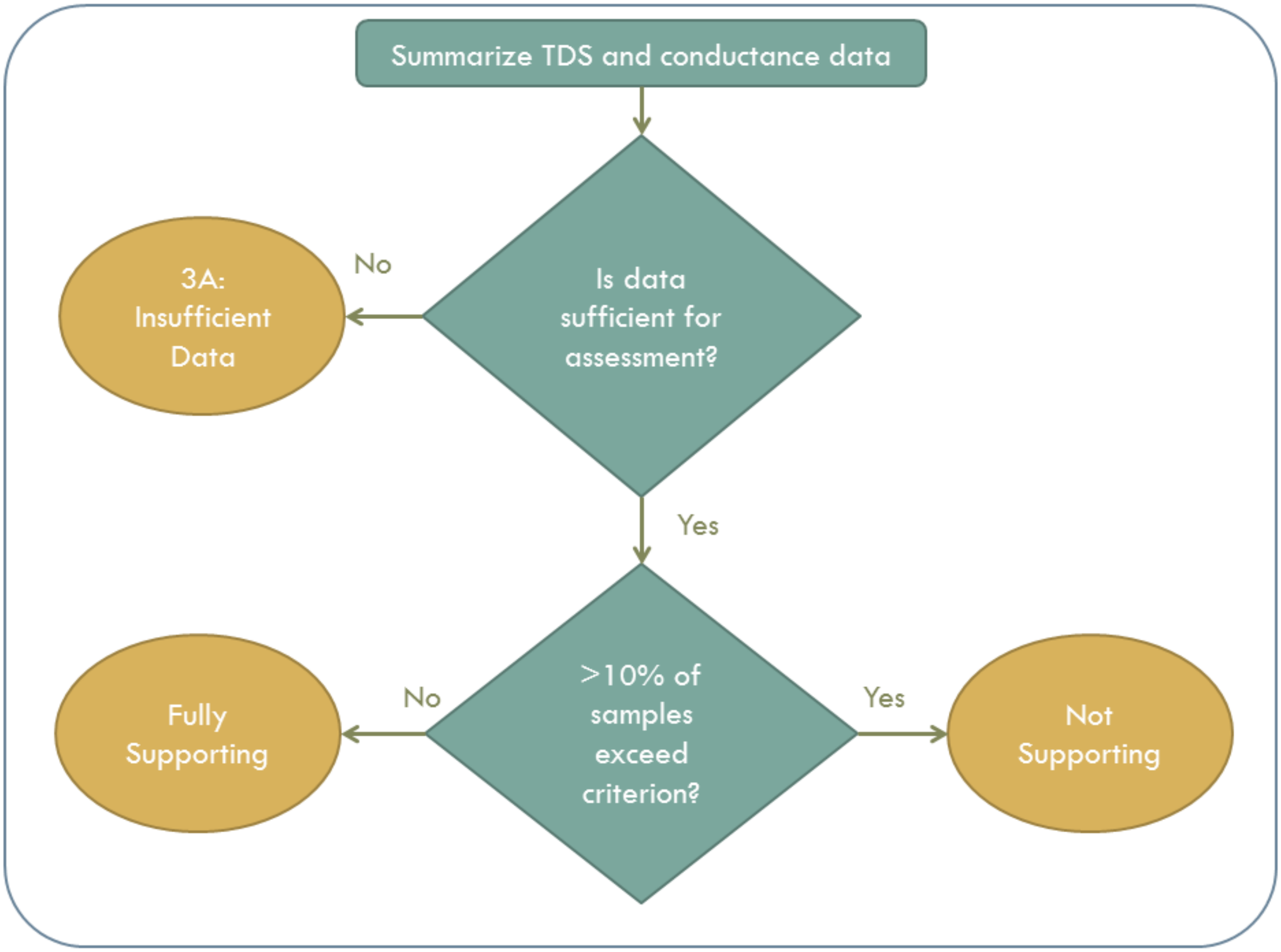


Figure 16. Assessment process to determine support of the agricultural beneficial use with TDS data.

Tier II Assessment

Weight of Evidence Criteria

The weight of evidence criteria allow DWQ to use key lines of evidence in assessing a waterbody's support Utah's narrative standard that would be ignored by exclusively focusing on chemical water quality parameters.

The weight of evidence criteria consist of the following three data types. These evaluations are based on data collected by DWQ and sometimes by outside agencies that follow DWQ procedures.

- Increasing TSI trend over the long term (approximately 10 years) or a TSI-Chl-*a* greater than 50.
- Water quality–based fish kills or winter DO measures not meeting the criterion when measured.
- Evaluation of phytoplankton community.

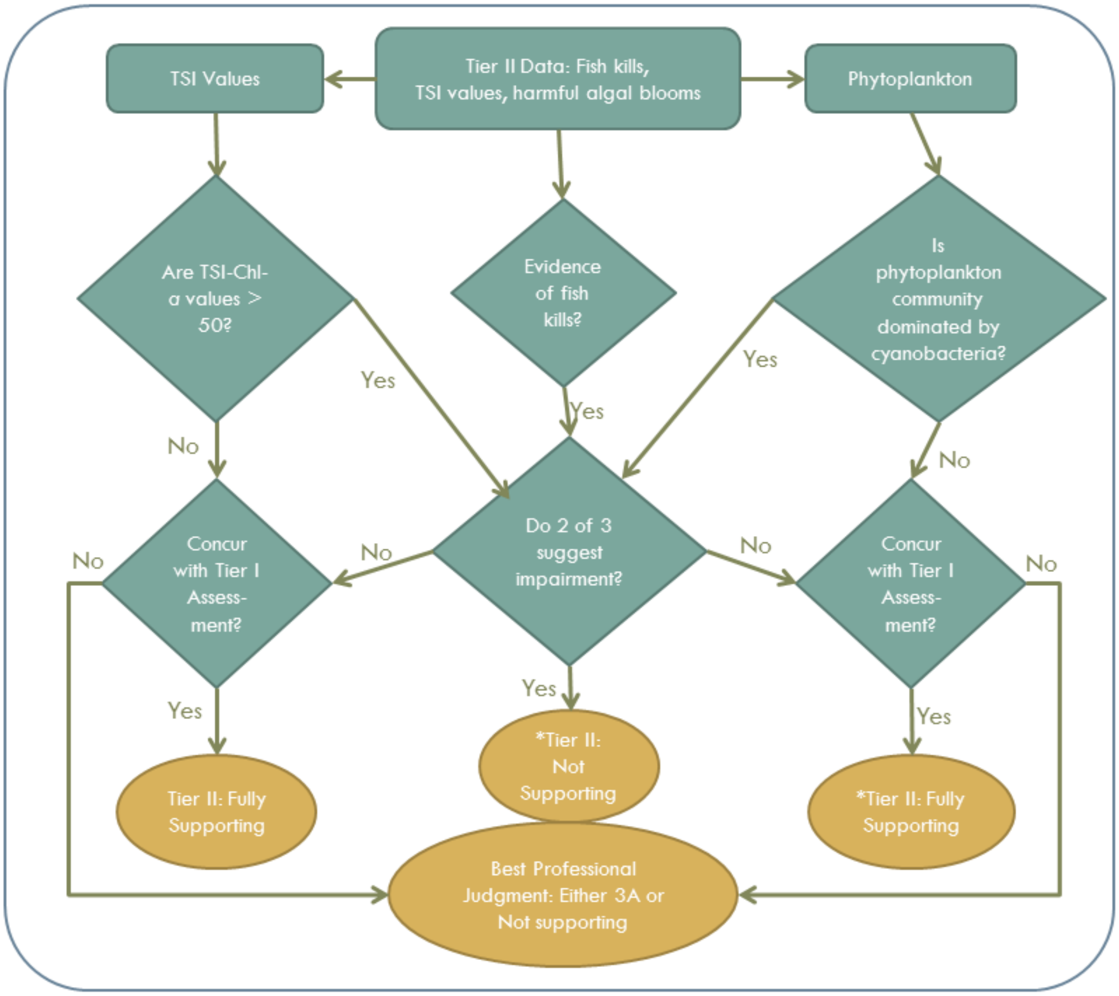


Figure 17. Tier II assessment process for lakes and reservoirs.

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 100, with increasing values indicating a more eutrophic condition, as follows (Table 11).

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

- Trophic Status Based on Secchi Disk (TSI-SD)
  TSI-SD = 60 - 14.41 ln (SD), where SD = 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 11). In each case, individual TSI values can also be used to generalize the overall trophic state of the lake as follows:

- TSI value less than 40: oligotrophic
- TSI value 40–50: mesotrophic
- TSI value 51–70: eutrophic
- TSI value greater than 70: hypereutrophic

Table 11. Conditions likely limiting production.

Relationship Between TSIs	Conditions Limiting Algae Production
TSI (Chl-a) = TSI (SD) = TSI (TP)	**Algae conditions dominate light attenuation.**
TSI (Chl-a) > TSI (SD)	**Large particulates, such as *Aphanizomenon* flakes, dominate.**
TSI (TP) = TSI (SD) > TSI (Chl-*a*)	**Nonalgal particulates or color dominate light attenuation.**
TSI (SD) = TSI (Chl-*a*) > TSI (TP)	**Phosphorus limits algal biomass (total nitrogen/total phosphorus ratio greater than 33:1).**
TSI (TP) > TSI (Chl-a) = TSI (SD)	**Zooplankton grazing, nitrogen, or some factor other than phosphorus limits algal biomass.**

TSIs are calculated independently for each indicator (i.e., Secchi disk, chlorophyll *a*, and total phosphorus) and are not averaged. The most reliable indicator of trophic status is chlorophyll *a* (TSI-Chl-*a*), followed by Secchi disk (TSI-SD), and total phosphorus (TSI-TP) (Carlson, 1977). In some lakes, the TSIs for each index are similar. For other lakes, large differences may be observed.

For this reporting cycle, the TSI (May through September) for each measure is reported. Large discrepancies between TSIs can be suggestive of specific lake conditions that may provide additional context for interpreting the TSI (Figure 18). If TSI has increased from past reporting cycles, DWQ will elevate the priority status of the waterbody for more frequent and urgent sampling. However, the weight of evidence (see Figure 18) using TSI is activated when TSI-Chl-*a* values are > 50.

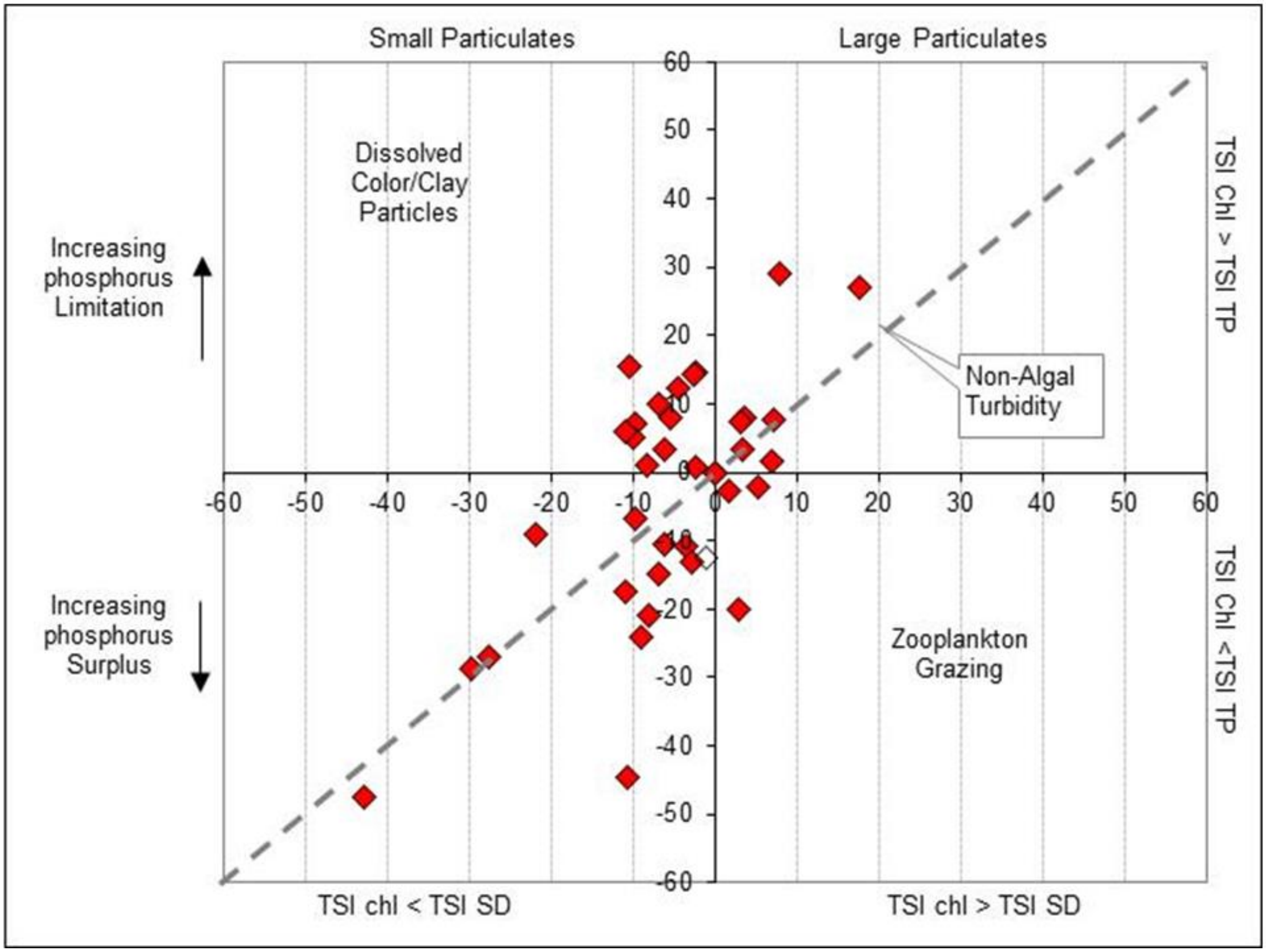


Figure 18. Plots of chlorophyll *a*, total phosphorus, and Secchi depth TSI values.

Fish Kill Observations

Fish kills can result from poor water quality, although not exclusively, and can provide an important line of evidence that a waterbody is not meeting the beneficial uses. To obtain this information, DWQ contacts regional biologists at the Utah Division of Wildlife Resources to obtain fish kill records and proposed rationale for death. However, reliable fish kill data are not available for many waterbodies due to their remoteness.

Phytoplankton Community

DWQ routinely collects phytoplankton to evaluate the composition and relative abundance of algae and cyanobacteria. These data are used to determine if a waterbody is not meeting beneficial uses due to eutrophication and whether the public are at risk of exposure to toxins secreted by cyanobacteria. Phytoplankton (algal) data are used in the Tier II assessment process because they 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, pose a potential risk to human health or aquatic life through the production of cyanotoxins, and may reflect 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). With the exception of a numeric selenium egg tissue standard for Class 5A (Gilbert Bay), no other numeric criteria are available to assess GSL. Instead, the beneficial uses of GSL are protected and assessed by the Narrative Standard (UAC R317-2-7.2). The Great Salt Lake Water Quality Strategy, finalized and endorsed by the Water Quality Board in 2014, outlines the process for the future development of numeric criteria for each of the lake's bays as well as monitoring and research.

DETERMINATION OF IMPAIRMENT: ALL ASSESSMENT UNITS

Following the initial assessment of credible data against the numeric criteria in UAC R317-2, each parameter within a waterbody is assigned a provisional EPA- and state-derived assessment category. To verify the parameter-specific assessment results and consolidate the often multiple parameter assessments into one result per waterbody, DWQ must consider the strength of 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.
- Multiple lines of evidence.
- Independent applicability.
- DWQ's narrative criterion, to make a final decision based on the overwhelming evidence.
- Several levels of BPJ.

Individual Assessment of Water Quality Standards

In determining whether or not a waterbody or segment within a waterbody is supporting or not supporting the beneficial uses assigned in UAC R317-2, DWQ first considers the individual parameter-specific assessment results that were derived from the data assessment protocols described earlier in this document. 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.

Conflicting Assessments of Water Quality Standards

Following the review of the individual water quality standard assessments, DWQ looks across the multiple parameter-specific assessment results that exist for a waterbody or segment within a waterbody and then consolidates the results into a final assessment. That is, DWQ assigns one EPA- and state-derived assessment decision category as defined in Table 1. To address the possibility of conflicting results among different types of data (e.g., biological versus conventionals, toxics versus *E.coli*), 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 19 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 3A (requiring additional study or monitoring) to better understand the seemingly conflicting lines of evidence. Specific assumptions regarding model applicability applied during the biological assessment process are discussed above. 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 3A categorization may be warranted. All evaluations of conflicting assessment decisions will be made in consultation with EPA on a case-by-case basis.

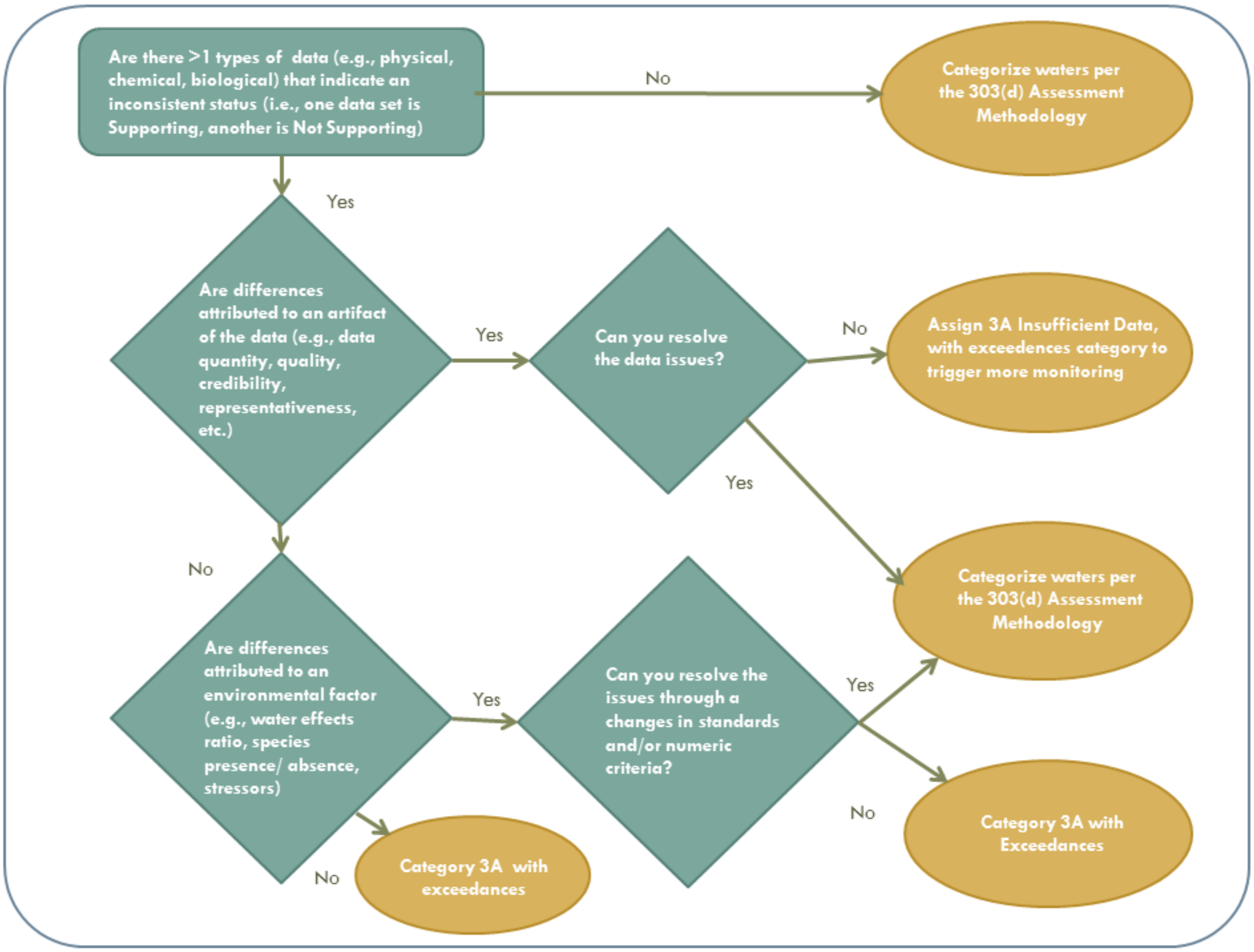


Figure 19. Overview of independent applicability process.

Note: These judgment decisions are based in part on EPA's *Consolidated Assessment and Listing Methods* guidance published in 2002.

Narrative Standards

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 an 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, 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 *E. coli* Assessment section. DWQ will also apply a cyanobacterial cell count threshold for determining impairments due to harmful algal blooms (see Assessment of Lakes and Reservoirs section).

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.

Beneficial Use Assessment Based on Tissue 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 (16 reservoir and 8 river sites).

DWQ staff develop an annual fish sampling plan. Sampling criteria currently include the following:

- Sampling when a current consumption advisory is greater than 5 years old.
- Sampling when there is no advisory but the existing data are greater than 5 years old.
- Sampling to address uncertainties from previous years' data.
- Sampling waterbodies that have no mercury data.

Regional Utah Division of Wildlife Resources staff collect fish from locations that are both identified in the sampling plan and that they will already be visiting for their own purposes. All fish are submitted to DWQ by December 1, at which time DWQ staff process samples from fillets and submit them to the EPA Region 8 Laboratory for total mercury analysis.

DWQ performs basic statistical analyses on the results, including minimum concentration, maximum concentration, mean, standard deviation, p-value, and 95% confidence intervals.

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 3A)

- 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.

Overwhelming Evidence

Following the consolidation of all of the individual assessment results and data information that exist for a waterbody or segment within a waterbody, DWQ may review individual listing decisions if there is overwhelming evidence of a waterbody or segment of a waterbody supporting or not supporting its associated beneficial uses and numeric criteria in UAC R317-2.

Where there is a lack of overwhelming evidence of a waterbody or segment within a waterbody supporting or not supporting its beneficial uses, BPJ can be used to verify a preliminary assessment. Where this is overwhelming evidence for credible data as defined earlier in this document, assessment decision are considered confirmed.

Best Professional Judgment

DWQ recognizes that BPJ from internal and external reviewers during the public comment periods may provide useful feedback on determining the strength of the quantity of data and the extent to which such data demonstrate clear and convincing evidence of a waterbody or segment of a waterbody supporting or not supporting its beneficial uses and numeric criteria. To ensure consistency in when and how BPJ is used among different professionals, DWQ will use BPJ in a select number of scenarios using a standard set of guidelines. Appendix 5 elaborates on when and how DWQ's assessment and 303(d) BPJ policy will be implemented.

Where BPJ 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.

- Where BPJ documentation for overriding a preliminary assessment decision is sufficient in strength and can be provided, the preliminary assessment decision based on the data assessment procedures outlined in this document will be overwritten. Preliminary listings for Category 5 or Category 1 and Category 2 waters could be re-assigned as Category 3A, insufficient data with exceedances or Category 3E, insufficient data with no exceedances, respectively.

For tracking and transparency to the public, DWQ will retain the original category assignment and a justification for the BPJ in the data files.

Categorization of an Assessment Unit

To summarize the water quality of a waterbody or segment of a waterbody, DWQ compiles and aggregates all credible and representative water quality data from multiple data sources and monitoring locations into one EPA- and state-derived assessment category for the AU (see Table 1). Appendix 5 elaborates on the processes and procedures DWQ goes through when rolling up the individual assessments that have undergone the reviews and considerations outlined earlier in this document into one category for each defined AU within the state. For a brief summary on how DWQ summarizes the individual assessments at a monitoring location site to an AU, see Figure 20.

Assessment of "All Tributaries" Segments

If after aggregating all of the assessments into one EPA- and state-derived assessment category for an AU, DWQ believes that there is some reason 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 above analysis will be categorized as follows:

- Whole AU is Not Supporting (Category 5)

  If all of the data from multiple tributaries within a segment indicate only (or a combination of) not supports (Category 5) and insufficient data with exceedances (Category 3A) , DWQ will recommend that 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 that only the tributaries with data indicating an impairment be listed as not supporting.

- Supporting (Category 1)
- No Evidence of Impairments (Category 2)
- Insufficient Data with Exceedances (Category 3A)
- Insufficient Data with No Exceedances (Category 3E)
- Needs Further Investigations (Category 3D)
- Not Assessed (Category 3F)

The rest of the AU will be assigned a category following procedures as outlined in Figure 20.

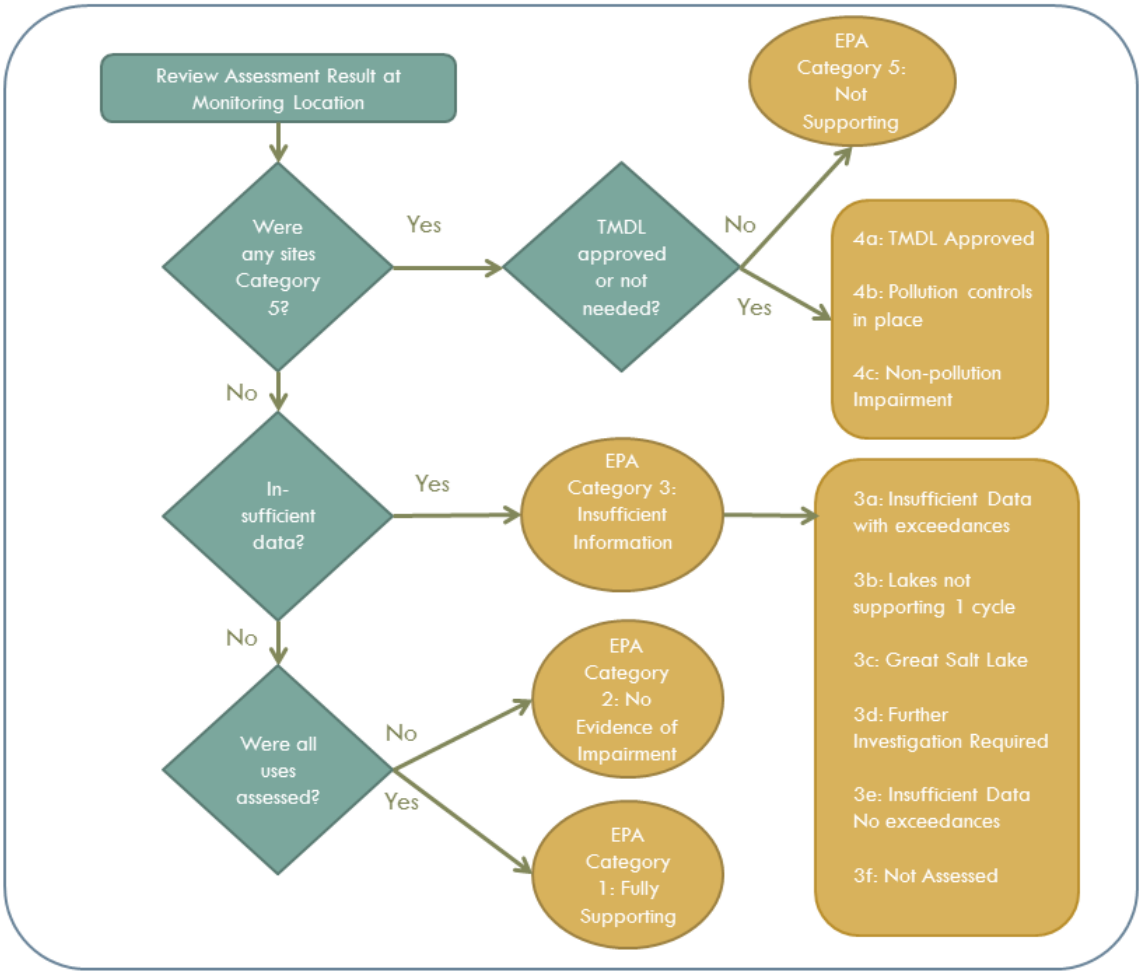


Figure 20. Process of assigning EPA categories to AUs based on results of monitoring location assessments.

IDENTIFYING CAUSES OF IMPAIRMENTS

Once an AU is assigned an EPA- and state-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 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 more detail 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 later in this document 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 later in this document.

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 and submitted for approval from the Natural Resource Committee (for implementation costs exceeding $10 million), the state legislature (for implementation costs over $100 million), and EPA. 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:

  The only impairments within the waterbody or segment within the waterbody are included in the approved TMDL.

  There are additional impairments within the waterbody or segments within the waterbody that are addressed in a Category 4B demonstration plan (described below in this document) 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.

  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:

  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 7 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:

  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:

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

  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:

  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:

  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:

  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:

  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:

  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.

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:

  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:

  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:

  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 credible data requirements posted on DWQ's Call for Data website.

- Reassessment (new data and information):

  Assessment and interpretation of older data that were 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:

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

- Analysis Errors:

  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:

  - Calculation errors in the data assessment methods outlined in the 303(d) Assessment Methods from that Assessment cycle.
  - Errors produced when reviewing credible and representative data information.
  - Mapping errors generated during the validation of monitoring location information and assigning AU designations.

  - Discrepancies between the beneficial use assignments in **UAC R317-2** and the IR geo-location information files for internal and external data.
  - Wrong identification and assessment of a waterbody type.
  - Application of the wrong numeric criteria to a beneficial use.

- New Modeling:

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

- Effluent Limitations:

  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:

  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 based on methods outlined earlier in this document. 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 3E).
- 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 3E).
- 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 3E).

- 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 3E).

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 3E).
- 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 3E).
- 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 3E).
- 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 3E).

Where assessment category assignments at the AU- and parameter-level warrant a further investigation for good cause as articulated above, 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 3) 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 (as outlined above), 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 2).

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 as defined earlier in this document 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, as described above, 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 earlier in 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 (a 6-year period of record). 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 as defined earlier in this document.
- Previous categorizations that have insufficient data with exceedances (Category 3A), require further investigations (Category 3D), have insufficient data with no exceedances (3E), are not assessed (Category 3F), show no evidence of impairment (Category 2), or are supporting (Category 1).
- Historical Category 3A waters 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. As noted earlier in this document, data older than a 12-year period of record may not be reflective of current condition, 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 no exceedances (Category 3E) to prioritize and encourage DWQ and stakeholders to collect newer information and submit that data and information in future calls for data.

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 new 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 antidegradation program, nonpoint source implementation program, and 401 water quality certification program). In response to the release of this document, DWQ will be engaging with stakeholders while updating and developing 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 statuses and developments of TMDLs.

DWQ is scheduled to release its new state-specific 303(d) vision policy and procedures in 2016 for public comment and final approval from EPA (Table 12). To minimize the potential for conflicting information between the release of the draft 2016 IR and 303(d) vision priority TMDL list and the public comment period and adoption of the DWQ 303(d) vision, DWQ will only incorporate new TMDL priority criteria once the DWQ 303(d) vision document has been through a public review. Please refer to Appendix 4 for how DWQ prioritized the future developments of TMDLs on DWQ's 303(d) List.

Table 12. Milestones for 303(d) vision prioritization process.

Milestone	Date
Presentation to Water Quality Board	1/21/15
Criteria Development and Application	
Compile all priorities and criteria developed internally.	1/15/15
Rank criteria and priorities based on DWQ needs and mission.	2/06/15

Apply criteria to 303(d) list using spreadsheet ranking tool.	2/20/15
Presentation of draft TMDL priorities to Water Quality Board.	9/24/15
Report	
Internal draft of 303(d) priorities report.	11/15/15
Evaluation of DWQ resources for high priorities (funding/feasibility).	12/01/15
Internal review.	12/15/16
Public draft report.	1/15/16
Public comment period.	1/15–2/15/16
Final draft report.	3/15/16

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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APPENDIX 1: ASSESSMENT UNIT ROLL UP

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: <u>3A: (insufficient Data)</u>

- 1,2, or 3 exceedances (with **<u>no</u>** data rejected for a use)
  - 3Aexcceds is populated with a "Y" → ParamDWQCat: 3a → ParamEPACat: 3

- 1,2, or 3 exceedances (with **<u>some</u>** data rejected for a use)
  - 3Aexcceds is populated with a "Y" → ParamDWQCat: 3a → ParamEPACat: 3

- 0 exceedances (with **<u>no</u>** data rejected for a use)
  - No Data is populated with a "Y" → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

- 0 exceedances (with **<u>some</u>** data rejected for a use)
  - No Data is populated with a "Y" → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

- All data removed for every use
  - No Data is populated with a "Y" → ParamDWQCat: 3f: No Beneficial Uses → ParamEPACat: 3

IRAnalysisAction: <u>Not Assessed</u>

- All data removed for every use (this would be populated in use_comment columns)
  - No Data is populated with a "Y" → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

IRAnalysisAction: <u>Not Assessed</u>

- **<u>IRAnalysisComment:</u>** "NonRejected data available for MLID/AU, but data available for individual use assessment was all rejected"
  - No Data is populated with a "Y" → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

IRAnalysisAction: <u>Not Assessed</u>

- **<u>IRAnalysisComment:</u>** "No Uses assigned to site"
  - No Data is populated with a "Y" → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

IRAnalysisAction: <u>Assessed By Use</u>

- **FS Only** → ParamDWQCat: 1 → ParamEPACat: 1
- **FS Only + some data rejected by use** → ParamDWQCat: ~~1~~2 → ParamEPACat:~~1~~ 2
- **Contains an NS** → ParamDWQCat: 5 → ParamEPACat: 5
- **Only combo: all data was rejected for a use** → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

- **FS Only + 3As by Use (exceedances) + some data rejected by use** → ParamDWQCat: 3a → ParamEPACat: 3
- **FS Only + 3As by Use (<u>NO</u> exceedances) + some data rejected by use** → ParamDWQCat: 2 → ParamEPACat: 2

- **FS Only + 3As by Use (exceedances) + <u>NO</u> data rejected by use** → ParamDWQCat: 3a → ParamEPACat: 3
- **FS Only + 3As by Use (<u>NO</u> exceedances) + <u>NO</u> data rejected by use** → ParamDWQCat: 2 → ParamEPACat: 2

- **3As by Use (exceedances) + some data rejected by use** → ParamDWQCat: 3a → ParamEPACat: 3
- **3As by Use (<u>NO</u> exceedances) + some data rejected by use** → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

- **3As by Use (exceedances) + <u>NO</u> data rejected by use** → ParamDWQCat: 3a → ParamEPACat: 3
- **3As by Use (<u>NO</u> exceedances) + <u>NO</u> data rejected by use** → ParamDWQCat: 3e: Not Assessed → ParamEPACat: 3

- **BOD, TP, and Nitrate (for non 1C uses)** → ParameterDWQCat: MLIDDWQCat =3d: 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.

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:
    - **Parameter_DWQCat = 5 → MLIDDWQCat = 5 **<u>AND</u>** MLIDEPACat = 5
    - Parameter_DWQCat = 3a → MLIDDWQCat =3a **<u>AND</u>** MLIDEPACat = 3
    - Parameter_DWQCat = 1 → (Cat1 Matrix Check is a match)→MLIDDWQCat =1 **<u>AND</u>** MLIDEPACat = 1
    - Parameter_DWQCat = 1 → (Cat1 Matrix Check is a **<u>NOT</u>** a match)→MLIDDWQCat =2 **<u>AND</u>** MLIDEPACat = 2
    - Parameter_DWQCat = 2 →MLIDDWQCat =2 **<u>AND</u>** MLIDEPACat = 2
    - Parameter_DWQCat = 3d →MLIDDWQCat =3d: Further Investigations Needed **<u>AND</u>** MLIDEPACat = 3
    - Parameter_DWQCat = 3e →MLIDDWQCat =3e: Not Assessed **<u>AND</u>** MLIDEPACat = 3
    - Parameter_DWQCat = 3f →MLIDDWQCat =3f: No Beneficial Uses **<u>AND</u>** 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:
  - **MLIDDWQCat = 5 → AUIDDWQCat = 5 **AND** AUIDEPACat = 5
    - AUIDDWQCat = 5 (and TMDL in Place) → AUIDDWQCat = 5 **AND** AUIDEPACat = 4a
    - AUIDDWQCat = 5 (and non-TMDL in Place) → AUIDDWQCat = 5 **AND** AUIDEPACat = 4b
  - **MLIDDWQCat = 5 → (and TMDL is in place & only parameter assessed for that AUID is being considered) → AUIDDWQCat = 4a **AND** AUIDEPACat = 4a
    - AUIDDWQCat = 5 (and non-TMDL in place) → AUIDDWQCat = 4a **AND** AUIDEPACat = 4b
  - **MLIDDWQCat = 5 → (and non-TMDL is in place & only parameter assessed for that AUID is being considered) → AUIDDWQCat = 4b **AND** AUIDEPACat = 4b
    - NOTE: for the 2014IR this should not happen. The only 4Bs we have are KL's and AD's – may happen for AD's?
  - MLIDDWQCat = 3a → AUIDDWQCat =3a **AND** AUIDEPACat = 3
  - MLIDDWQCat = 2 →AUIDDWQCat =2 **AND** AUIDEPACat = 2
  - MLIDDWQCat = 1 →AUIDDWQCat =1 **AND** AUIDEPACat = 1
  - MLIDDWQCat = 3d → AUIDDWQCat =3d: Further Investigations Needed **AND** AUIDDWQCat = 3
  - MLIDDWQCat = 3e → AUIDDWQCat =3e: Not Assessed **AND** AUIDDWQCat = 3
  - MLIDDWQCat = 3f → AUIDDWQCat =3f: No Beneficial Uses **AND** AUIDDWQCat = 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. <u>One</u> 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 2: DELISTING

1. Does the AU/AU-parameter combination warrant further investigation? (see 303(d) Assessment Methods for more details).
2. What was the AU originally impaired for?
3. What IR assessment cycle was the AU and parameter first listed?
    a. What datasets were used for that listing (e.g., the agency/sample collector)?
    b. What was the period of record? (If unknown, use the longer period of record as defined in the 303(d) Assessment Methods.)
    c. What MLIDs are in the AU?
4. For impairments listed in the previous assessment cycle, compile the data. (Query data for all MLIDs in the AU. Ignore waterbody types.)
    a. What MLID has > = 1 exceedances?
    b. 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).
    c. Where all MLIDs with exceedances are assessed in the current IR cycle:
        i. For MLIDs with impairments/exceedances and the current parameter assessment for the MLID **is not** 1, 2, or 3E –> **no delisting.**
        ii. Is the current parameter Category 1, 2, or 3E? Was there a BPJ applied to this parameter (e.g., an assessment category overwrite for the whole:
            1. Parameter?
                a. If the BPJ created a Category 1, 2, or 3E, the BPJ justification will need to be EPA-approved if it is consider to be a delisting. **Check for good cause.**
            2. MLID?
                a. If the BPJ created a Category 1, 2, or 3E, the BPJ justification will need to be EPA-approved if it is consider to be a delisting. **Check for good cause.**
            3. AU?
                a. If the BPJ created a Category 1, 2, or 3E, the BPJ justification will need to be EPA-approved if it is consider to be a delisting. **Check for good cause.**
        iii. Is the current parameter Category 1, 2, or 3E? (No BPJ 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 3E, because the exceedances are out of the period of record for assessment analysis (i.e., not a delisting).

Double check before delisting:

d. If the current Parameter Category 1, 2, or 3E – what is the oldest date in that period of record for that MLID/Parameter combo in the current Assessment cycle?
e. 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?
f. What MLID has > = 1 exceedances
g. 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.**
h. Where all MLIDs with exceedance are assessed in the current IR cycle:
    i. For MLIDs with impairments/exceedances and the current parameter assessment for the MLID **is not** 1, 2, or 3E –> **no delisting.**
    ii. Is the current parameter Category 1, 2, or 3E? Was there a BPJ applied to this parameter (e.g., an assessment category overwrite for the whole:
        1. Parameter?
            a. If the BPJ created a Category 1, 2, or 3E, the BPJ justification will need to be EPA-approved if it is consider to be a delisting. **Check for good cause.**
        2. MLID?
            a. If the BPJ created a Category 1, 2, or 3E, the BPJ justification will need to be EPA-approved if it is consider to be a delisting. **Check for good cause.**
        3. AU?
            a. If the BPJ created a Category 1, 2, or 3E, the BPJ justification will need to be EPA-approved if it is consider to be a delisting. **Check for good cause.**
    iii. Is the current parameter Category 1, 2, or 3e? (No BPJ 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 3e, because the exceedances are out of the period of record for assessment analysis.

APPENDIX 3: 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:

1) A statement of the problem causing the impairment.
2) A description of
    a. the pollution controls to be used,
    b. how these pollution controls will achieve attainment with all applicable water quality standards, and
    c. requirements under which those pollution controls will be implemented.
3) An estimate of the time needed to meet all applicable water quality standards.
4) A schedule for implementation of the necessary pollution controls.
5) A schedule for tracking progress, including a description of milestones.
6) 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 August 30, 2015, in order for DWQ to submit the plan to EPA by September 6, 2015. 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, 2015; otherwise, DWQ will continue to propose that the segment in question is included on the 2016 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,” available at http://www.epa.gov/OWOW/tmdl/2006IRG/#documents; and “Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions,” available at: http://yosemite.epa.gov/R10/WATER.NSF/TMDLs/CWA+303d+List/.

APPENDIX 4: 2014 IR 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.

DWQ is currently engaged in an effort to solicit stakeholder input into the prioritization process as part of putting the 303(d) vision into action. This effort is related but separate from the Integrated Report. Public input is critical for the success of the 303(d) vision because it will promote support for protecting and restoring water quality and define the values that best serve the public interest.

APPENDIX 5: APPLICATION OF BEST PROFESSIONAL JUDGEMENT

Best Professional Judgement Concern	**Pre-Best Professional Judgement Review Process**	**Best Professional Judgement Application**
Temporal variation within a dataset	• Insufficient sampling frequency within an assessment period of record.	Individual data records.
Bias in sampling design	• Event monitoring (review flow, weather, and spill data; narrative criteria; field observations and photographs; satellite imagery; other data types collected in same (and around the) period of concern, etc.). • Sample time of day (literature review to determine if parameter is impacted by the time of day sample is collected). • 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)].	Individual data records.
Data quality	• *Quality Assurance Program Plan For Environmental Data Operations.* • Field calibration documentation. • Laboratory method. • Standard operating procedures. • Demonstration of capability (if applicable to data type). • Discussion with sample collector.	Individual data records, and/or, parameter(s) in period of record, and/or monitoring location.
Wrongly monitored	• Measured point source (vs. main water body), review imagery of area, flow, etc. • Waterbody type DWQ does not assess (as defined in the 303(d) Methods). • Grab sample vs. composite. • Flow conditions (too low or not flowing). • Field observation that impacts quality of data.	Individual data records and/or monitoring location.

Outlier	Need more than a statistical test. Should be based on scientific or QA basis. • QA/QC field sampling blanks, duplicates/replicate. • Laboratory Analytical Batch QC. • Value is nonsensical (e.g., cannot be measured with field/laboratory method). • Refer to data quality (above).	Individual data records
Magnitude of exceedance	• Significant figures • Review narrative criteria	Individual data records
QA/QC concerns	• Holding time • Laboratory Comment • Dilutions, Spikes • Other laboratory QC Performance Checks	Individual data records
Environmental factors	• Extreme Event Captured [see definition of extreme event in 303(d) Assessment Methods]: review flow, weather, and spill data, narrative criteria, field observations and photographs, satellite imagery, other data types collected in same (and around the) period of concern, etc.).	Individual data records
Assessment unit grouping/spatial variation	• Multiple locations not grouped correctly (either should or should not have been grouped). • Assessment of All Tributary Segments (please refer to 303(d) Assessment Methods section on "All tributaries" for more information on the process). • Non-river/stream sampled in AU and is not supporting (this waterbody is still a water of the state and should be assessed. See the 303(d) Assessment Methods for more details).	Monitoring location.

Credible data	• Data type applied incorrectly. • 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	• Parameters wrongly grouped (by CAS, fraction, or methods). • Data type is laboratory measurement (when the data assessment requires a field measurement). • IR QA/QC flagged data. • Errors in standards.	Individual data records. Entire parameter assessments.

APPENDIX 6. CREDIBLE DATA – DATA QUALITY GRADE LEVEL ASSIGNMENTS

Dataset: Utah DWQ (internally-collected data) and Non-DWQ Cooperators.

Summary: Data quality can be improved upon, but most results meet the Data Validation Criteria from the Credible Data Quality Matrix for data submission and can move forward to IR-specific QC checks to determine if they can used for all assessment purposes. Overall Grade: A-

Data Type	Data Validation Criterion from Credible Data Quality Matrix	Grade Level Assigned	Justification	Areas for Future Improvement
Field Data	Quality Assurance Project Plan (QAPP)	A	DWQ's QAPP approved by DEQ Quality Assurance Council (May 2014).	Implement all components of DWQ's QAPP.
	Sampling & Analysis Plan (SAP)	B	Multiple planning documents that constitute key SAP components were approved informally for targeted runs. Some projects such as UCASE have formal SAPs.	Formalize SAP documentation and approval process and make sure all required SAP components (listed in QAPP) are completed. Lakes SAP needs to be updated.
	Calibration Documentation	A	Calibration documentation available for most field records but recalibration information typically not recorded. Individual results may be flagged or rejected if calibration documentation cannot be found.	Maintain documentation of recalibration; make sure recalibration is occurring according to SOP. Make calibration documentation more accessible and tied to results.
	Field Documentation	A	Field notes, if collected, are scanned into file and available for review.	Few field notes are being collected; find solution to simplify/automate recording field notes, especially when they apply to representativeness of sampling conditions, and make sure they get transferred into AWQMS.

	Flow Data	A	Flow data is routinely collected and final value is stored in file and available for review.	Perform second flow measurement at replicate sites. Record cross-sectional measurements, depths, velocity readings, equipment used, and any other notes related to flow measurement on a form.
	Water Temperature Methods	B	Accuracy and resolution of thermistor acceptable. However the traceable, certified thermistors have not been rechecked against NIST reference thermometer annually.	Purchase a new NIST reference thermometer and perform check of all thermistors against NIST reference thermometer annually, as required by QAPP and SOP.
	pH Methods	A	Probe is calibrated according to SOP and manufacturer's instructions. Accuracy and resolution of probe acceptable.	Perform and record recalibration when needed as required by SOP.
	Dissolved Oxygen – Percent Saturation for Calibrated Meter	A	Probe is calibrated according to SOP and manufacturer's instructions. Accuracy and resolution of probe acceptable.	Perform check of all barometers against NIST reference barometer annually, as required by QAPP and SOP. Any new equipment should have a built-in barometer.
	Dissolved Oxygen – Concentration Methods for Calibrated Meter	A	Probe is calibrated according to SOP and manufacturer's instructions. Accuracy and resolution of probe acceptable.	Perform check of all barometers against NIST reference barometer annually, as required by QAPP and SOP. Any new equipment should have a built-in barometer.

Data Type	Data Validation Criterion from Credible Data Quality Matrix	Grade Level Assigned	Justification	Areas for Future Improvement
Water Chemistry Data	Quality Assurance Project Plan (QAPP)	A	DWQ's QAPP approved by DEQ Quality Assurance Council (May 2014). All analyzing laboratories have approved QAPPs.	Implement all components of DWQ's QAPP.

	Sampling & Analysis Plan (SAP)	B	Multiple planning documents that constitute key SAP components were approved informally for targeted runs. Some projects such as UCASE have formal SAPs.	Formalize SAP documentation and approval process and make sure all required SAP components (listed in QAPP) are completed. Lakes SAP needs to be updated.
	Laboratory Method	A	All methods approved by DWQ and/or Utah Public Health Laboratory.	Obtain and review copies of method SOPs from all methods from analyzing laboratories.
	Detection Limits	B	Detection limits are approved and submitted by some labs. State Lab detection limits are approved and available but not routinely submitted (only reporting limits are submitted with all non-detect results).	Require State Lab to submit a reporting and detection limit with every result value. Work with State Lab to achieve greater sensitivity for IR analytes for which detection limit > numeric criteria.
	Lab Certification	B	State Lab is certified by EPA. Other analyzing labs are certified by Utah Public Health Laboratory or NELAC.	State Lab plans to be certified by NELAC in 2016.
	QC Samples	A	QC sample results are available for DWQ review.	Build QC sample performance review into project SAPs. Perform occasional assessment of laboratory internal/batch QC sample performance.
	Laboratory Comments	A	Analyzing laboratories submit comments with individual results when applicable. Individual results are flagged or rejected if comment indicates data quality issue. Laboratories are available for follow-up explanation on comments.	Require State Lab to provide more detail in comments, for example if comment indicates recovery limits for MS/MSD are out of range, the actual recovery percentage should be included in the comment.
	Field Documentation	A	All field documentation associated with samples submitted to laboratory is stored in file and available for review.	Few field notes are being collected; find solution to simplify/automate recording field notes, especially when they apply to representativeness of sampling conditions, and make sure they get transferred into AWQMS.

	Metals	A	Results for assessed metals are submitted with hardness values (or Ca and Mg values) as requested by sampler.	Add into SOPs/SAPs a check to make sure these conditions are including in project planning process (i.e. when a field value or important lab parameter such as hardness must accompany an analyte result for assessment).
	Organics	A	Results for pentachlorophenol are routinely submitted with field pH; individual results are flagged or rejected if this is not the case.	Add into SOPs/SAPs a check to make sure these conditions are including in project planning process (i.e. when a field value or important lab parameter must accompany an analyte result for assessment).
	Inorganics	B	Results for fluoride are not routinely collected and may not be submitted with air temperature. Results for Total Ammonia as N are routinely submitted with field pH and water temperature. When these requirements are not met, individual results are flagged or rejected.	Add into SOPs/SAPs a check to make sure these conditions are including in project planning process (i.e. when a field value or important lab parameter must accompany an analyte result for assessment).
Data Type	**Data Validation Criterion from Credible Data Quality Matrix**	**Grade Level Assigned**	**Justification**	**Areas for Future Improvement**
E. coli Data	Quality Assurance Project Plan (QAPP)	A	DWQ's QAPP approved by DEQ Quality Assurance Council (May 2014).	Implement all components of DWQ's QAPP.
	Sampling Analysis Plan (SAP)	B	Multiple planning documents that constitute key SAP components were approved informally for targeted runs. Some projects such as UCASE have formal SAPs.	Formalize SAP documentation and approval process and make sure all required SAP components (listed in QAPP) are completed. Lakes SAP needs to be updated.
	Standard Operating Procedures (SOPs)	A	Samplers follow DWQ's SOPs for E. coli Sample Collection & Analysis.	SOPs need to be revisited and possibly updated/revised.

	EPA Approved Method	A	IDEXX Colilert (USEPA-approved) used for all samples.	
	Demonstration of Capability (Annual)	A	DOC or SOP training/review signatures available and stored in file.	
	Data	A	All data submitted in template on time.	
	Field Documentation	B	All bench sheets stored in file met but QA info about materials often not recorded.	Make sure all samplers are filling out bench sheet for materials QA info.
	QA/QC	B	Holding times and incubation period routinely met but QA info about materials often not recorded.	
	Geo Information	A	Geo information is provided in form of MLID associated with each sample.	
	NIST Thermometer for Incubator	B	NIST certification has expired for the majority of traceable, certified incubator thermometers.	Purchase a new NIST reference thermometer and perform check of all incubator thermometers against NIST reference thermometer annually, as required by QAPP and SOP.
Data Type	**Data Validation Criterion from Credible Data Quality Matrix**	**Grade Level Assigned**	**Justification**	**Areas for Future Improvement**
Biological Data	Quality Assurance Project Plan (QAPP)	A	DWQ's QAPP approved by DEQ Quality Assurance Council (May 2014).	Implement all components of DWQ's QAPP.
	Sampling Analysis Plan (SAP)	A	UCASE Field Manual constitutes approved SAP.	
	Standard Operating Procedures (SOPs)	A	Samplers follow SOPs included in UCASE Field Manual.	
	Field Documentation	A	All field documentation is scanned into file and available for review.	

	DWQ approved taxonomy lab	A	All samples analyzed by approved taxonomy lab.	

Dataset: USGS

Summary: Data quality is good, results meet the Data Validation Criteria from the Credible Data Quality Matrix for data submission and can move forward to IR-specific QC checks to determine if they can used for all assessment purposes. Overall Grade: A

Data Type	Data Validation Criterion from Credible Data Quality Matrix	Grade Level Assigned	Justification
Field Data	Quality Assurance Project Plan (QAPP)	A	USGS Utah Water Science Center maintains a general QAPP. In additional an approved QAPP and SAP is required for each study as described in the USGS National Field Manual for the Collection of Water-Quality Data. The USGS National Water Quality Laboratory and other national USGS labs maintain their own QAPPs.
	Sampling & Analysis Plan (SAP)	A	
	Calibration Documentation	A	Calibration documentation is maintained and available for review as required in the USGS National Field Manual for the Collection of Water-Quality Data.
	Field Documentation	A	Calibration documentation is maintained and available for review as required in the USGS National Field Manual for the Collection of Water-Quality Data.
	Flow Data	A	Flow data is routinely collected with water samples and is accessible online in real-time and in Annual Reports.
	Water Temperature Methods	A	Accuracy and resolution of thermistor acceptable. Thermistors checked against NIST reference thermometer every 6 to 12 months, depending on the manufacturer's recommendation and as required by USGS National Field Manual for the Collection of Water-Quality Data.
	pH Methods	A	Probe is calibrated according to USGS National Field Manual for the Collection of Water-Quality Data and manufacturer's instructions. Accuracy and resolution of probe acceptable.
	Dissolved Oxygen – Percent Saturation for Calibrated Meter	A	

	Dissolved Oxygen – Concentration Methods for Calibrated Meter	A	
Data Type	**Data Validation Criterion from Credible Data Quality Matrix**	**Grade Level Assigned**	**Justification**
Water Chemistry Data	Quality Assurance Project Plan (QAPP)	A	USGS Utah Water Science Center maintains a general QAPP. In additional an approved QAPP and SAP is required for each study as described in the USGS National Field Manual for the Collection of Water-Quality Data. The USGS National Water Quality Laboratory and other national USGS labs maintain their own QAPPs.
	Sampling & Analysis Plan (SAP)	A	
	Laboratory Method	A	Most methods approved by DWQ; research methods used in some USGS studies may be flagged during IR QC checks.
	Detection Limits	A	Detection limits are approved by DWQ and submitted with results.
	Lab Certification	A	USGS National Water Quality Laboratory maintains accreditation through NELAC.
	QC Samples	A	QC sample results are available for DWQ review.
	Laboratory Comments	A	Lab comments submitted with individual results when applicable. Individual results are flagged or rejected during IR QC checks if comment indicates data quality issue.
	Field Documentation	A	Field documentation is available for DWQ review.
	Metals	A	Results for assessed metals are submitted with hardness values (or Ca and Mg values).
	Organics	A	Results for pentachlorophenol are routinely submitted with field pH; individual results are flagged or rejected if this is not the case.

	Inorganics	A	If fluoride collected, air temperature is typically also collected. Results for Total Ammonia as N are routinely submitted with field pH and water temperature. When these requirements are not met, individual results are flagged or rejected.

Dataset: Western Watersheds

Summary: Data quality can be improved upon, but most results meet the Data Validation Criteria from the Credible Data Quality Matrix for data submission and can move forward to IR-specific QC checks to determine if they can used for all assessment purposes. Overall Grade: B

Data Type	Data Validation Criterion from Credible Data Quality Matrix	Grade Level Assigned	Justification	Areas for Future Improvement
Field Data	Quality Assurance Project Plan (QAPP)	B	QAPP/SAP approved by WY DEQ (May 2010). Utah informally accepted this plan but for future submittal years.	For future submission years, DWQ would prefer WW to submit a Utah-specific QAPP/SAP. Or if WW is to have DWQ "Cooperator" status, they must submit a SAP for DWQ approval and operate under DWQ's QAPP requirements.
	Sampling & Analysis Plan (SAP)	B		
	Calibration Documentation	B	Calibration documentation available for review according to SAP.	DWQ SOPs require daily calibration of Dissolved Oxygen probes. If WW is to have DWQ "Cooperator" status, calibration documentation must be submitted quarterly with field data.
	Field Documentation	A	Field notes submitted with data.	
	Flow Data	n/a	Not submitted; not collected according to SAP.	
	Water Temperature Methods	B	Accuracy and resolution of thermistor acceptable. SAP does not indicate whether the traceable, certified thermistors have been checked against NIST reference thermometer annually.	For "A" grade, a more accurate probe must be used and traceable, certified thermistors must be rechecked against NIST reference thermometer annually, and recalibrated, if needed.
	pH Methods	B	Probe is calibrated daily according to SAP and manufacturer's instructions. Accuracy and resolution of probe acceptable.	For "A" grade, a more accurate probe must be used.

	Dissolved Oxygen – Percent Saturation for Calibrated Meter	n/a	Not submitted; not collected according to SAP.	
	Dissolved Oxygen – Concentration Methods for Calibrated Meter	B	Probe is factory-calibrated according to SAP and manufacturer's instructions. Accuracy and resolution of probe acceptable.	DWQ SOPs require daily calibration of dissolved oxygen probes used for instantaneous measurements. If WW is to have DWQ "Cooperator" status, calibration documentation must be submitted quarterly with field data.
Data Type	**Data Validation Criterion from Credible Data Quality Matrix**	**Grade Level Assigned**	**Justification**	
E. coli Data	Quality Assurance Project Plan (QAPP)	B	QAPP/SAP approved by WY DEQ (May 2010). Utah informally accepted this plan.	For future submission years, DWQ would prefer WW to submit a Utah-specific QAPP/SAP. Or if WW is to have DWQ "Cooperator" status, they must submit a SAP for DWQ approval and operate under DWQ's QAPP requirements.
	Sampling Analysis Plan (SAP)	B		
	Standard Operating Procedures (SOPs)	B	Sampler follows WY-approved E. coli-related SOPs. These have been initially determined to be equivalent to DWQ SOPs for E. coli sample collection and analysis.	For future submission years, and if WW is to have DWQ "Cooperator" status, WW should be trained on and sign they have read and follow DWQ's E. coli Program SOPs, and pass an annual DOC. This should be included in a Utah-specific SAP.
	Demonstration of Capability (Annual)	B	Sampler acknowledges review of DWQ's E. coli-related SOPs (via email confirmation) and follows WY-equivalent SOP and IDEXX instructions.	
	EPA Approved Method	A	IDEXX Colilert (USEPA-approved) used for all samples.	

	Data	B	Data submitted in template; extension provided for submission following deadline.	If WW is to have DWQ “Cooperator” status, they must submit data quarterly. This will ensure that data is provided to IR Assessment staff in a timely manner and in the proper format.
	Field Documentation	A	Bench sheet information and field notes provided with data submission.	
	QA/QC	B	SAP indicates that holding times and incubation conditions will be met and the reagents will be used before expiration.	For “A” grade, these items should be included in a filled out bench sheet and provided to DWQ with data submission.
	Geo Information	A	Provided with data submission.	If WW is to have DWQ “Cooperator” status, they must include sampling sites in approved SAP and MLIDs will be assigned prior to data collection.
	NIST Thermometer for Incubator	B	SAP indicates that incubator temperature will be checked for accuracy but does not specify if a NIST-traceable incubator thermometer will be used.	For “A” grade, DWQ SOP requires a certified internal incubator thermometer in additional to the digital display from the built-in incubator thermistor.

Dataset: DOGM

Summary: Data quality is difficult to assess because DWQ did not review actual QAPPs or SAPs, but DWQ assumes most results meet the Data Validation Criteria from the Credible Data Quality Matrix for data submission and can move forward to IR-specific QC checks to determine if they can used for all assessment purposes. In-depth IR-specific QC checks will thoroughly evaluate the quality of each result.
Overall Grade: B

Data Type	Data Validation Criterion from Credible Data Quality Matrix	Grade Level Assigned	Justification
Field Data	Quality Assurance Project Plan (QAPP)	B	DWQ assumes data collected under a QAPP and SAP as R645-301-723 requires monitoring follow "Standard Methods" which outlines Quality Assurance Plan requirements in Chapter 1020. Permit application also requires a monitoring plan (SAP). Further sampling and analysis requirements outlined in DOGM Technical Directives.
	Sampling & Analysis Plan (SAP)	B	
	Calibration Documentation	B	Calibration documentation available for DWQ's review if needed as per email communication with DOGM officials (calibration documentation and demonstration of capability required during facility inspections).
	Field Documentation	B	DWQ assumes field notes are available for DWQ review, if needed, as per typical SAP requirements.
	Flow Data	B	DWQ assumes flow data is available for DWQ review, if needed, as the rule requires it be collected.
	Water Temperature Methods	B	DWQ assumes monitoring conducted according to 40 CFR Part 136 and/or "Standard Methods for the Examination of Water and Wastewater", which ensures acceptable accuracy and resolution of thermistors.
	pH Methods	B	DWQ assumes monitoring conducted according to 40 CFR Part 136 and/or "Standard Methods for the Examination of Water and Wastewater", which ensures calibration and acceptable accuracy and resolution of pH probes.

	Dissolved Oxygen – Percent Saturation for Calibrated Meter	B	DWQ assumes monitoring conducted according to 40 CFR Part 136 and/or "Standard Methods for the Examination of Water and Wastewater", which ensures calibration and acceptable accuracy and resolution of dissolved oxygen probes.
	Dissolved Oxygen – Concentration Methods for Calibrated Meter	n/a	Not submitted or collected.
Data Type	**Data Validation Criterion from Credible Data Quality Matrix**	**Grade Level Assigned**	**Justification**
Water Chemistry Data	Quality Assurance Project Plan (QAPP)	B	DWQ assumes data collected under a QAPP and SAP as R645-301-723 requires monitoring follow "Standard Methods" which outlines Quality Assurance Plan requirements (including laboratory QAPPs) in Chapter 1020. Permit application also requires a monitoring plan (SAP). Further sampling and analysis requirements outlined in DOGM Technical Directives.
	Sampling & Analysis Plan (SAP)	B	
	Laboratory Method	A	All methods approved by DWQ and/or Utah Public Health Laboratory; any results collected with unapproved methods will be flagged/rejected during IR QC Checks.
	Detection Limits	B	Detection limits are approved by DWQ and submitted with results.
	Lab Certification	A	Analyzing labs are certified by Utah Public Health Laboratory or NELAC; any results from unapproved labs will be flagged/rejected during IR QC Checks.
	QC Samples	B	Unknown whether field QC samples are collected. Laboratory QC samples are available for DWQ review if needed.
	Laboratory Comments	B	Laboratory comments available for DWQ review, if needed, as per policy of any certified laboratory.
	Field Documentation	B	DWQ assumes field notes are available for DWQ review, if needed, as per typical SAP requirements.

	Metals	A	Results for assessed metals are submitted with hardness values or Ca and Mg values.
	Organics	n/a	Organics data not submitted.
	Inorganics	n/a	Fluoride and Total Ammonia data not submitted.

CHAPTER 3: RIVERS AND STREAM ASSESSMENTS

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WATER QUALITY

2016 Final Integrated Report

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Rivers, Streams, Springs, Seeps, and Canals 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Bear River	UT16010202-008_00	High Creek Lower	High Creek and tributaries from confluence with Cub River to USFS boundary	4A	TMDL Approved	Total Phosphorus	3A		1998	3
Bear River	UT16010203-005_00	Logan River-1	Logan River and tributaries, except Blacksmith Fork drainage, from Cutler Reservoir to Third Dam	4A	TMDL Approved	Total Phosphorus	3A		1998	41
Bear River	UT16010202-009_00	Spring Creek Lewiston	Spring Creek (Lewiston) and tributaries from confluence with Cub River to Utah-Idaho border	4A	TMDL Approved	Total Phosphorus	3B		1998	2
Bear River	UT16010201-001_00	Bear Lake West	Bear Lake west side tributaries	5	Not Supporting	OE Bioassessment	3A	Low	2016	1
Bear River	UT16010204-002_00	Bear River Lower-East	Bear River east side tributaries from Malad confluence south	5	Not Supporting	Dissolved Oxygen	3B; 3D	Low	2012	26
						Total Dissolved Solids	4	Low	2012	26
Bear River	UT16010204-003_00	Bear River-1	Bear River from Great Salt Lake to Malad River confluence	5	Not Supporting	Dissolved Oxygen	3B; 3D	Low	2014	17
						OE Bioassessment	3B	Low	2010	17
						Total Dissolved Solids	4	Low	2008	17
Bear River	UT16010204-008_00	Bear River-2	Bear River from Malad River confluence to Cutler Reservoir	5	Not Supporting	OE Bioassessment	3B	Low	2008	42
						Temperature	3B	Low	2014	42
Bear River	UT16010202-004_00	Bear River-3	Bear River from Cutler Reservoir to Idaho state line	5	Not Supporting	Sedimentation	3B; 3D	Low	1998	41
					TMDL Approved	Total Phosphorus	3B; 3D		1998	41
Bear River	UT16010101-006_00	Bear River-4	Bear River from Woodruff Creek north to Sage Creek Junction	5	Not Supporting	Temperature	3A	Low	2014	55
					TMDL Approved	Total Phosphorus	3A		2000	55
Bear River	UT16010101-007_00	Big Creek	Big Creek and tributaries from Bear River to headwaters	5	Not Supporting	E. coli	2B	Low	2014	30
						pH	3A	Low	2006	30
						Temperature	3A	Low	2010	30
						Total Dissolved Solids	4	Low	2014	30
Bear River	UT16010203-020_00	Blacksmiths Fork-1	Blacksmiths Fork and tributaries from confluence with Logan River to Left Hand Fork Blacksmiths Fork	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	12
						E. coli	2B	Low	2016	12
Bear River	UT16010202-015_00	Clay Slough		5	Not Supporting	Dissolved Oxygen	3B; 3D	Low	2012	3
						pH	2B; 4; 3B; 3D	Low	2012	3
						Total Dissolved Solids	4	Low	2012	3
Bear River	UT16010202-010_00	Cub River	Cub River from confluence with Bear River to Utah-Idaho state line	5	Not Supporting	Sedimentation	3B	Low	1998	16
					TMDL Approved	Total Phosphorus	3B		1998	16
Bear River	UT16010201-002_00	Laketown	Laketown and Big Creek and other tributaries from Bear Lake to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2012	12
						Temperature	3A	Low	2008	12

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.
** Phase II of TMDL in Progress.
***Impairment temporary: site specific TDS criterion should apply until WQS change.

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Bear River	UT16010203-009_00	Little Bear River-1	Little Bear River from Cutler Reservoir to Hyrum Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	28
						Temperature	3A	Low	2008	28
Bear River	UT16010202-002_00	Newton Creek	Newton Creek from confluence with Cutler Reservoir to Newton Reservoir	5	Not Supporting	Temperature	3A	Low	2008	1
					TMDL Approved	Total Phosphorus	3A		1996	1
Bear River	UT16010201-004_00	North Eden	North Eden Creek and tributaries from Bear Lake to headwaters	5	Not Supporting	Temperature	3A	Low	2010	18
Bear River	UT16010101-004_00	Sage Creek	Sage Creek and tributaries from confluence with Bear River to headwaters	5	Not Supporting	E. coli	2B	Low	2014	10
						Temperature	3A	Low	2010	10
Bear River	UT16010101-016_00	Saleratus Creek	Saleratus Creek and tributaries from confluence with Woodruff Creek to headwaters	5	Not Supporting	Temperature	3A	Low	2012	30
					TMDL Approved	Dissolved Oxygen	3A		1998	30
Bear River	UT16010101-002_00	Six Mile Creek - Bear	Sixmile Creek from reservoir to headwaters	5	Not Supporting	E. coli	2B	Low	2016	20
Bear River	UT16010203-008_00	Spring Creek-Hyrum	Spring Creek and tributaries from confluence with Little Bear River to headwaters	5	Not Supporting	OE Bioassessment	3A	Low	2008	11
						Temperature	3A	Low	2006	11
					TMDL Approved	Total Ammonia	3A; 3D		1998	11
Bear River	UT16010101-028_00	Yellow Creek	Yellow Creek and tributaries from Utah-Wyoming border to headwaters	5	Not Supporting	OE Bioassessment	3A	Low	2008	17
Bear River	UT16010204-004_00	Bear River Lower-West	Bear River west side tributaries from Malad River confluence south	3	Insufficient Data*					11
Bear River	UT16010102-001_00	Bear River North	Bear River tributaries in HUC 16010102	3	Insufficient Data*					0
Bear River	UT16010101-001_00	Bear River West	Bear River west side tributaries from Sixmile Creek north	3	Insufficient Data*					7
Bear River	UT16010204-001_00	Box Elder Creek-1	Box Elder Creek from the confluence with Black Slough to Brigham City Reservoir (the Mayor's Pond)	3	Insufficient Data*					0
Bear River	UT16010204-005_00	Box Elder Creek-2	Box Elder Creek from Brigham City Reservoir (the Mayor's Pond) to headwaters	3	Insufficient Data*					7
Bear River	UT16010202-006_00	City Creek	City Creek and tributaries and other Bear River east side tributaries south toward Summit Creek to headwaters	3	Insufficient Data*					7
Bear River	UT16010202-013_00	Clarkston Creek	Clarkston Creek and tributaries from Newton Reservoir to Utah-Idaho State Line	3	Insufficient Data*					24
Bear River	UT16010203-001_00	Cutler West	Cutler Reservoir west side tributaries	3	Insufficient Data*					3
Bear River	UT16010203-015_00	Davenport Creek	Davenport Creek and tributaries from confluence with South Fork Little Bear to headwaters	3	Insufficient Data*					37
Bear River	UT16010101-017_00	Dry Creek	Dry Creek and tributaries from confluence with Saleratus Creek to headwaters	3	Insufficient Data*					0

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Bear River	UT16010101-026_00	East Fork Bear River	East Fork Bear River and tributaries from confluence with Hayden Fork to headwaters	3	Insufficient Data*					54
Bear River	UT16010202-003_00	Hopkins Slough		3	Insufficient Data*					10
Bear River	UT16010203-011_00	Little Bear River-2	Little Bear River from Hyrum Reservoir to East Fork Little Bear confluence	3	Insufficient Data*					11
Bear River	UT16010203-007_00	Little Bear-3	Little Bear River west side tributaries from Cutler Reservoir To Hyrum Reservoir	3	Insufficient Data*					15
Bear River	UT16010203-010_00	Little Bear-4		3	Insufficient Data*					0
Bear River	UT16010101-003_00	Little Creek - Bear	Little Creek and tributaries from confluence with Bear River to headwaters	3	Insufficient Data*					8
Bear River	UT16010204-006_00	Malad River-1	Malad River from confluence with Bear River to Utah-Idaho state line	3	Insufficient Data*					61
Bear River	UT16010204-011_00	Mantua Reservoir Tributaries	Big Creek from confluence with Box Elder Creek to Mantua Reservoir	3	Insufficient Data*					2
Bear River	UT16010204-007_00	Middle Bear East	Bear River east side tributaries from Malad River confluence north to HUC boundary	3	Insufficient Data*					11
Bear River	UT16010204-009_00	Middle Bear West	Tributaries on West Side of Bear River from Malad confluence north to HUC boundary	3	Insufficient Data*					2
Bear River	UT16010204-013_00	Salt Creek-Bothwell		3	Insufficient Data*					5
Bear River	UT16010203-013_00	South Fork Little Bear	South Fork Little Bear and tributaries from confluence with Little Bear River to headwaters, except Davenport Creek	3	Insufficient Data*					21
Bear River	UT16010101-018_00	Sutton Creek	Sutton Creek and tributaries from Utah-Wyoming border to headwaters	3	Insufficient Data*					27
Bear River	UT16010101-012_00	Unnamed Creek	Unnamed tributary to Saleratus Creek	3	Insufficient Data*					0
Bear River	UT16010101-014_00	Woodruff Creek-3	Woodruff Creek Reservoir tributaries excluding Woodruff Creek	3	Insufficient Data*					0
Bear River	UT16010101-013_00	Woodruff Creek-4	Woodruff Creek and tributaries from Woodruff Creek Reservoir to headwaters	3	Insufficient Data*					42
Bear River	UT16010101-027_00	Bear River East	Bear River east side tributaries from Woodruff to near Sage Creek Junction	2	No Evidence of Impairment					1
Bear River	UT16010101-009_00	Bear River-5	Bear River from Woodruff Creek upstream to Utah-Wyoming border	2	No Evidence of Impairment					12
Bear River	UT16010101-021_00	Bear River-6	Bear River and tributaries from Utah-Wyoming border to Hayden Fork - Stillwater Fork confluence	2	No Evidence of Impairment					20
Bear River	UT16010101-010_00	Birch Creek - Bear	Birch Creek and tributaries from confluence with Woodruff Creek to headwaters	2	No Evidence of Impairment					20
Bear River	UT16010203-018_00	Black Smiths Fork-2	Blacksmith Fork and tributaries from confluence with Left Hand Fork Blacksmith Fork to headwaters	2	No Evidence of Impairment					57
Bear River	UT16010202-007_00	Cherry Creek - Bear	Cherry Creek and tributaries from confluence with Cub River to headwaters	2	No Evidence of Impairment					5
Bear River	UT16010203-014_00	East Fork Little Bear-1	East Fork Little Bear River and tributaries from confluence with Little Bear to Porcupine Reservoir	2	No Evidence of Impairment					8
Bear River	UT16010203-017_00	East Fork Little Bear-2	East Fork Little Bear River and tributaries from Porcupine Reservoir to headwaters	2	No Evidence of Impairment					31

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Bear River	UT16010202-012_00	High Creek Upper	High Creek and tributaries from U.S. Forest Service boundary to headwaters	2	No Evidence of Impairment					10
Bear River	UT16010203-019_00	Left Hand Fork Blacksmiths For	Left Hand Fork Blacksmiths Fork and tributaries from confluence with Blacksmiths Fork to headwaters	2	No Evidence of Impairment					26
Bear River	UT16010203-012_00	Little Bear River Tributaries	West side tributaries to Little Bear River above Hyrum Reservoir	2	No Evidence of Impairment					0
Bear River	UT16010203-006_00	Logan River-2	Logan River and tributaries from Third Dam to headwaters	2	No Evidence of Impairment					72
Bear River	UT16010204-010_00	Malad River-2	Malad River tributaries	2	No Evidence of Impairment					18
Bear River	UT16010101-022_00	Mill Creek	Mill Creek and tributaries from Utah-Wyoming border to headwaters	2	No Evidence of Impairment					59
Bear River	UT16010101-008_00	North Woodruff	Bear River west side tributaries between Woodruff and Big Creek	2	No Evidence of Impairment					2
Bear River	UT16010101-005_00	Otter Creek	Otter Creek and tributaries from Bear River to headwaters	2	No Evidence of Impairment					26
Bear River	UT16010203-016_00	Porcupine Creek	Porcupine Creek and tributaries from Porcupine Reservoir to headwaters	2	No Evidence of Impairment					1
Bear River	UT16010201-003_00	South Eden	South Eden Creek from Bear Lake to headwaters	2	No Evidence of Impairment					4
Bear River	UT16010202-005_00	Summit Creek Lower	Summit Creek and tributaries from confluence with Bear River to USFS boundary	2	No Evidence of Impairment					8
Bear River	UT16010203-002_00	Swift Slough	Swift Slough and tributaries from Cutler Reservoir to headwaters	2	No Evidence of Impairment					11
Bear River	UT16010202-014_00	The Slough		2	No Evidence of Impairment					3
Bear River	UT16010101-023_00	West Fork Bear River	West Fork Bear River and tributaries from confluence with Bear River to headwaters	2	No Evidence of Impairment					72
Bear River	UT16010101-011_00	Woodruff Creek-1	Woodruff Creek from mouth to Birch Creek confluence	2	No Evidence of Impairment					8
Bear River	UT16010101-015_00	Woodruff Creek-2	Woodruff Creek and tributaries from Birch Creek confluence to Woodruff Creek Reservoir	2	No Evidence of Impairment					6
Bear River	UT16010202-001_00	Worm Creek	Worm Creek from confluence with Cub River to Utah-Idaho state line	2	No Evidence of Impairment					0
Bear River	UT16010101-019_00	Yellow Creek Tributaries	Yellow Creek tributaries (e.g. Thief, Chicken, Spring Creeks) above Barker Reservoir and Yellow Creek below Barker Reservoir	2	No Evidence of Impairment					23
Bear River	UT16010101-024_00	Hayden Fork	Hayden Fork and tributaries from confluence with Stillwater Creek to headwaters	1	Supporting					18
Bear River	UT16010101-025_00	Stillwater Fork	Stillwater Fork and tributaries from confluence with Hayden Fork to headwaters	1	Supporting					35
Bear River	UT16010202-011_00	Summit Creek Upper	Summit Creek and tributaries from USFS boundary to headwaters	1	Supporting					10

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Cedar/Beaver	UT16030007-002_00	Beaver River-2	Beaver River and tributaries from Minersville Reservoir to USFS boundary	5	Not Supporting	Aluminum, Dissolved	3A	Low	2016	67
						E. coli	2B	Low	2016	67
						OE Bioassessment	3A	Low	2008	67
					TMDL Approved	Dissolved Oxygen	3A		2014	67
						Temperature	3A		1998	67
Cedar/Beaver	UT16030006-001_00	Coal Creek - C/B	Coal Creek and tributaries from Main Street in Cedar City (SR130) to headwaters	5	Not Supporting	Temperature	3A	Low	2016	45
Cedar/Beaver	UT16030006-002_00	Pinto Creek	Pinto and Little Pinto Creeks and their tributaries from Newcastle Reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	32
						Dissolved Oxygen	3A	Low	2016	32
						E. coli	2B	Low	2016	32
						Temperature	3A	Low	2014	32
Cedar/Beaver	UT16030007-001_00	Beaver River-1	Beaver River Below Minersville Reservoir	3	Insufficient Data*					8
Cedar/Beaver	UT16030007-003_00	Beaver River-3	Beaver River and tributaries from USFS boundary to headwaters	3	Insufficient Data*					180
Cedar/Beaver	UT16030006-004_00	Parowan Creek	Parowan Creek and tributaries from the south end of Main Street in Parowan to headwaters	3	Insufficient Data*					33
Cedar/Beaver	UT16030007-004_00	Pine Creek-Tushar		3	Insufficient Data*					6
Cedar/Beaver	UT16030006-008_00	Red Creek Lower (Iron Co.)	Red Creek and tributaries (Iron Co.) below Red Creek Reservoir	3	Insufficient Data*					1
Cedar/Beaver	UT16030006-006_00	Shoal Creek	Shoal Creek and tributaries from Enterprise to headwaters	3	Insufficient Data*					6
Cedar/Beaver	UT16030006-009_00	Cottonwood Canyon-Parowan Valley	Unknown	2	No Evidence of Impairment					6
Cedar/Beaver	UT16030006-005_00	Little Creek (Iron Co.)	Little Creek and tributaries from irrigation diversion at mouth to headwaters	2	No Evidence of Impairment					16
Cedar/Beaver	UT16030006-007_00	Red Creek (Iron Co.)	Tributaries of Red Creek Reservoir, Iron County	2	No Evidence of Impairment					7
Cedar/Beaver	UT16030006-003_00	Summit Creek-Iron	Summit Creek and tributaries from collection pond at 6060 feet elevation to headwaters	2	No Evidence of Impairment					15

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Colorado River Southeast	UT14030005-003_00	Colorado River-3	Colorado River from Green River confluence to Moab	4A	TMDL Approved	Selenium, Dissolved	3B		2006	62
Colorado River Southeast	UT14030005-004_00	Colorado River-4	Colorado River from Moab to HUC unit (14030005) boundary	4A	TMDL Approved	Selenium, Dissolved	3B		2006	36
Colorado River Southeast	UT14030001-005_00	Colorado River-5	Colorado River from Dolores River confluence to HUC 14010005 boundary	4A	TMDL Approved	Selenium, Dissolved	3B		2004	33
Colorado River Southeast	UT14010005-001_00	Colorado River-6	Colorado River from HUC 14010005-14030001 boundary to Colorado State Line	4A	TMDL Approved	Selenium, Dissolved	3B		2004	4
Colorado River Southeast	UT14030005-009_00	Castle Creek-1	Castle Creek and tributaries from confluence with Colorado River to Seventh-Day Adventist diversion	5	Not Supporting	OE Bioassessment	3B	Low	2008	13
Colorado River Southeast	UT14080201-011_00	Comb Wash	Comb Wash and tributaries from the confluence with San Juan River to headwaters	5	Not Supporting	Dissolved Oxygen	3B	Low	2014	7
						Selenium, Dissolved	3B	Low	2014	7
						Temperature	3B	Low	2014	7
						Total Dissolved Solids	4	Low	2014	7
Colorado River Southeast	UT14030001-001_00	Cottonwood Wash	Cottonwood Wash from Colorado River confluence to headwaters	5	Not Supporting	Temperature	3B	Low	2014	23
Colorado River Southeast	UT14080201-006_00	Cottonwood Wash-2	Cottonwood Wash from Westwater confluence to USFS boundary	5	Not Supporting	Dissolved Oxygen	3B	Low	2012	6
						Radium	1C	Low	1998	6
					TMDL Approved	Gross Alpha	1C		1998	6
Colorado River Southeast	UT14080201-007_00	Cottonwood Wash-3		5	Not Supporting	Radium	1C; 4	Low	2010	17
					TMDL Approved	Gross Alpha	1C, 4		2010	17
Colorado River Southeast	UT14030004-001_00	Dolores River	Dolores River and tributaries (except Granite Creek) from confluence with Colorado River to headwaters or Utah-Colorado state line	5	Not Supporting	Temperature	3C	Low	2014	61
						Total Dissolved Solids	4	Low	2008	61
Colorado River Southeast	UT14080201-004_00	Johnson Creek	Johnson Creek and tributaries from confluence with Recapture Creek to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	4
						Temperature	3A	Low	2010	4
Colorado River Southeast	UT14030005-001_00	Kane Spring Wash	Kane Spring Wash from confluence with Colorado River to headwaters	5	Not Supporting	Temperature	3C	Low	2014	22
						Total Dissolved Solids	4	Low	2014	22

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Colorado River Southeast	UT14030005-005_00	Mill Creek1-Moab	Mill Creek and tributaries, except Pack Creek, from the confluence with Colorado River to USFS boundary	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	29
						E. coli	1C; 2B	Low	2016	29
					TMDL Approved	Temperature	3A		1998	29
Colorado River Southeast	UT14080203-007_00	Montezuma Creek-3	Montezuma Creek from San Juan River confluence to Verdure Creek confluence within State Jurisdiction	5	Not Supporting	Selenium, Dissolved	3B	Low	2014	7
Colorado River Southeast	UT14030005-015_00	North Cottonwood Creek	North Cottowood Creek and tributaries from confluence with Indian Creek near Dugout Ranch to headwaters	5	Not Supporting	OE Bioassessment	3B	Low	2014	29
Colorado River Southeast	UT14030005-010_00	Onion Creek Lower	Onion Creek and tributaries from confluence with Colorado River to road crossing above Stinking Springs	5	Not Supporting	Selenium, Dissolved	3B	Low	2014	9
						Total Dissolved Solids	4	Low	2016	9
					TMDL Approved	Temperature	3B		1998	9
Colorado River Southeast	UT14030005-011_00	Pack Creek	Pack Creek and tributaries from the confluence with Mill Creek to USFS boundary	5	Not Supporting	E. coli	1C; 2B	Low	2016	9
						Selenium, Dissolved	3A	Low	2010	9
						Temperature	3A	Low	2006	9
						Total Dissolved Solids	4	Low	2006	9
Colorado River Southeast	UT14030005-019_00	Professor Creek		5	Not Supporting	Temperature	3B	Low	2012	0
						Total Dissolved Solids	4	Low	2012	0
Colorado River Southeast	UT14030005-007_00	Salt Wash	Salt Wash and tributaries from confluence with Colorado River to headwaters	5	Not Supporting	Total Dissolved Solids	4	Low	2016	22
Colorado River Southeast	UT14080205-001_00	San Juan River-1	San Juan River from Lake Powell to confluence with Chinle Creek within State Jurisdiction	5	Not Supporting	Aluminum, Dissolved	3B	Low	2016	88
						Copper, Dissolved	3B	Low	2016	88
						Dissolved Oxygen	3B	Low	2014	88
						Iron, Dissolved	3B	Low	2016	88
						Mercury, Dissolved	3B; HH3B	Low	2016	88
Colorado River Southeast	UT14080205-003_00	San Juan River-1 Triburaries		5	Not Supporting	Total Dissolved Solids	4	Low	2012	6

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Colorado River Southeast	UT14080201-009_00	San Juan River-2	San Juan River from the confluence with Chinle Creek to the Confluence with Montezuma Creek within State Jurisdiction	5	Not Supporting	Aluminum, Dissolved	3B	Low	2016	31
						Cadmium, Dissolved	3B	Low	2016	31
						Iron, Dissolved	3B	Low	2016	31
						Lead, Dissolved	3B	Low	2016	31
Colorado River Southeast	UT14030001-003_00	Westwater Creek	Westwater Creek and tributaries from confluence with Colorado River to headwaters	5	Not Supporting	Temperature	3B	Low	2012	18
						Total Dissolved Solids	4	Low	2012	18
Colorado River Southeast	UT14080201-008_00	Westwater Creek	Westwater Creek and tributaries from confluence with Cottonwood Wash to headwaters	5	Not Supporting	Dissolved Oxygen	3B	Low	2012	6
						Selenium, Dissolved	3B	Low	2012	6
Colorado River Southeast	UT14030001-004_00	Bitter Creek	Bitter Creek and tributaries from Colorado River to headwaters	3	Insufficient Data*					0
Colorado River Southeast	UT14080201-001_00	Butler Wash	Butler Wash and tributaries from confluence with San Juan River to headwaters	3	Insufficient Data*					8
Colorado River Southeast	UT14030005-012_00	Castle Creek-2	Castle Creek and tributaries from Seventh-Day Adventist diversion to headwaters	3	Insufficient Data*					7
Colorado River Southeast	UT14070001-003_00	Colorado River-2	Colorado River from Dirty Devil confluence to Green River confluence	3	Insufficient Data*					15
Colorado River Southeast	UT14030005-017_00	Courthouse Wash		3	Insufficient Data*					1
Colorado River Southeast	UT14030005-018_00	Courthouse Wash		3	Insufficient Data*					1
Colorado River Southeast	UT14080205-002_00	Grand Gulch		3	Insufficient Data*					0
Colorado River Southeast	UT14030004-002_00	Granite Creek - CRSE	Granite Creek and tributaries from confluence with Dolores River to Utah-Colorado state line	3	Insufficient Data*					11
Colorado River Southeast	UT14030005-014_00	Indian Creek-1	Indian Creek from confluence with North Cottonwood Creek near Dugout Ranch to northern boundary of Newspaper Rock State Park	3	Insufficient Data*					9
Colorado River Southeast	UT14030002-001_00	La Sal Creek	La Sal Creek and tributaries from Utah-Colorado state line to headwaters	3	Insufficient Data*					24
Colorado River Southeast	UT14070001-005_00	Lake Canyon		3	Insufficient Data*					0
Colorado River Southeast	UT14030001-002_00	Little Dolores River	Little Dolores River from confluence with Colorado River to Utah-Colorado state line	3	Insufficient Data*					0
Colorado River Southeast	UT14080202-001_00	McElmo Creek	McElmo Creek and tributaries from the confluence with San Juan River to Utah-Colorado state line within State Jurisdiction	3	Insufficient Data*					1

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Colorado River Southeast	UT14080201-005_00	Recapture Creek-1	Recapture Creek and tributaries from confluence with San Juan River to USFS boundary within State Jurisdiction, except Johnson Creek	3	Insufficient Data*					0
Colorado River Southeast	UT14080201-003_00	Recapture Creek-2	Recapture Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					4
Colorado River Southeast	UT14030004-003_00	Roc Creek	Roc Creek and tributaries from Utah-Colorado state line to headwaters	3	Insufficient Data*					24
Colorado River Southeast	UT14030005-016_00	Salt Creek-Canyonlands		3	Insufficient Data*					0
Colorado River Southeast	UT14080203-006_00	Spring Creek	Spring Creek and tributaries from confluence with Vega Creek to headwaters	3	Insufficient Data*					6
Colorado River Southeast	UT14030001-060_00	Undefined Waterbodies (CU 14030001)	Area of undefined waterbodies	3	Insufficient Data*					6
Colorado River Southeast	UT14030001-061_00	Undefined Waterbodies (CU 14030001)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River Southeast	UT14030001-063_00	Undefined Waterbodies (CU 14030001)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River Southeast	UT14030005-044_00	Undefined Waterbodies (CU 14030005)	Area of undefined waterbodies	3	Insufficient Data*					37
Colorado River Southeast	UT14030005-045_00	Undefined Waterbodies (CU 14030005)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River Southeast	UT14030005-046_00	Undefined Waterbodies (CU 14030005)	Area of undefined waterbodies	3	Insufficient Data*					1
Colorado River Southeast	UT14030005-052_00	Undefined Waterbodies (CU 14030005)	Area of undefined waterbodies	3	Insufficient Data*					5
Colorado River Southeast	UT14030005-058_00	Undefined Waterbodies (CU 14030005)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River Southeast	UT14080201-020_00	Undefined Waterbodies (CU 14080201)	Area of undefined Waterbodies	3	Insufficient Data*					0
Colorado River Southeast	UT14080201-030_00	Undefined Waterbodies (CU 14080201)	Area of undefined Waterbodies	3	Insufficient Data*					16
Colorado River Southeast	UT14080201-032_00	Undefined Waterbodies (CU 14080201)	Area of undefined waterbodies	3	Insufficient Data*					5
Colorado River Southeast	UT14080203-070_00	Undefined Waterbodies (CU 14080203)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River Southeast	UT14080205-014_00	Undefined Waterbodies (CU 14080205)	Area of undefined waterbodies	3	Insufficient Data*					2
Colorado River Southeast	UT14080205-015_00	Undefined Waterbodies (CU 14080205)	Area of undefined waterbodies	3	Insufficient Data*					8
Colorado River Southeast	UT14080205-016_00	Undefined Waterbodies (CU 14080205)	Area of undefined waterbodies	3	Insufficient Data*					9
Colorado River Southeast	UT14080205-017_00	Undefined Waterbodies (CU 14080205)	Area of undefined waterbodies	3	Insufficient Data*					6
Colorado River Southeast	UT14010005-002_00	Unknown tribs	Unknown tributaries from HUC boundary (14010005) to Utah-Colorado state line	3	Insufficient Data*					0
Colorado River Southeast	UT14080203-001_00	Verdure Creek-1	Verdure Creek and tributaries from confluence with Montezuma Creek to U.S.191	3	Insufficient Data*					5
Colorado River Southeast	UT14070001-004_00	White Canyon	Bowns Canyon from confluence with Lake Powell to headwaters	3	Insufficient Data*					0
Colorado River Southeast	UT14080201-002_00	Cottonwood Wash-1	Cottonwood Wash and tributaries from confluence with San Juan River to Westwater Creek confluence	2	No Evidence of Impairment					0
Colorado River Southeast	UT14030005-002_00	Indian Creek-2	Indian Creek and tributaries from Newspaper Rock State Park north boundary to headwaters	2	No Evidence of Impairment					18

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Colorado River Southeast	UT14030005-006_00	Mill Creek2-Moab	Mill Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					27
Colorado River Southeast	UT14080203-005_00	Montezuma Creek-1	Montezuma Creek and all other tributaries not defined, from U.S. 191 to headwaters	2	No Evidence of Impairment					0
Colorado River Southeast	UT14080203-003_00	Montezuma Creek-2	Montezuma Creek and tributaries from Verdure Creek confluence to U.S. 191	2	No Evidence of Impairment					12
Colorado River Southeast	UT14030001-006_00	Nash Wash	Nash Wash and tributaries from the confluence with Pinto Wash to headwaters	2	No Evidence of Impairment					6
Colorado River Southeast	UT14030005-008_00	Negro Bill	Negro Bill Creek from confluence with Colorado River to headwaters	2	No Evidence of Impairment					9
Colorado River Southeast	UT14080203-002_00	Verdure Creek-2	Verdure Creek and tributaries from U.S. 191 to headwaters	2	No Evidence of Impairment					11
Colorado River Southeast	UT14080203-008_00	North Creek	North Creek and tributaries from confluence with Montezuma Creek to headwaters	1	Supporting					5
Colorado River Southeast	UT14030005-013_00	Onion Creek Upper	Onion Creek and tributaries from road crossing above Stinking Springs to headwaters	1	Supporting					3
Colorado River Southeast	UT14080203-004_00	South Creek	South Creek and tributaries from confluence with Montezuma creek to headwaters	1	Supporting					0

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Colorado River West	UT14070003-014_00	Fremont River-4	Fremont River and tributaries from confluence with Dirty Devil to east boundary of Capitol Reef National Park, except Pleasant and Sandy Creeks	4A	TMDL Approved	Total Dissolved Solids	4		1998	82
Colorado River West	UT14060007-006_00	Gordon Creek	Gordon Creek and tributaries below 7500 feet elevation	4A	TMDL Approved	Total Dissolved Solids	4		2014	58
Colorado River West	UT14070002-008_00	Ivie Creek Lower	Ivie Creek and tributaries from confluence with Muddy River to U-10 highway crossing	4A	TMDL Approved	Total Dissolved Solids	4		2014	16
Colorado River West	UT14060007-015_00	Price River-5	Price River and tributaries from confluence with Green River to Woodside	4A	TMDL Approved	Total Dissolved Solids	4		2016	37
Colorado River West	UT14070005-002_00	Birch Creek	Birch Creek and tributaries from confluence with Escalante River to headwaters	5	Not Supporting	Temperature	3A	Low	2014	30
Colorado River West	UT14070005-007_00	Calf Creek	Calf Creek and tributaries from confluence with Escalante River to headwaters	5	Not Supporting	Temperature	3A	Low	2008	8
Colorado River West	UT14060007-008_00	Coal Creek	Coal Creek and tributaries from confluence with Price River to headwaters	5	Not Supporting	OE Bioassessment	3C	Low	2014	31
Colorado River West	UT14070007-004_00	Cottonwood Creek	Cottonwood Creek and tributaries from confluence with Paria River to headwaters	5	Not Supporting	Dissolved Oxygen	3C	Low	2014	6
Colorado River West	UT14060009-011_00	Cottonwood Creek Lower	Cottonwood Creek and tributaries from confluence with Huntington Creek to Highway 57	5	Not Supporting	pH	2B; 4; 3C	Low	2014	0
					TMDL Approved	Total Dissolved Solids	4		2014	0
Colorado River West	UT14060009-007_00	Cottonwood Creek Upper	Cottonwood Creek and tributaries from USFS boundary to headwaters and Joes Valley Reservoir	5	Not Supporting	pH	1C; 2B; 4; 3A	Low	2014	21
						Temperature	3A	Low	2014	21
						Total Dissolved Solids	4	Low	2014	21
Colorado River West	UT14070004-001_00	Dirty Devil River	Dirty Devil from confluence with Colorado River to Fremont River	5	Not Supporting	Total Dissolved Solids	4	Low	2016	69
Colorado River West	UT14070005-012_00	Escalante River Upper	Escalante River from Boulder Creek confluence to Birch Creek confluence	5	Not Supporting	OE Bioassessment	3B	Low	2008	30
						Total Dissolved Solids	4	Low	2016	30
Colorado River West	UT14070003-005_00	Fremont River-2	Fremont River and tributaries from Bicknell to Mill Meadow Reservoir near USFS boundary	5	Not Supporting	pH	1C; 2A; 4; 3A	Low	2014	41
						Temperature	3A	Low	2014	41
					TMDL Approved	Total Phosphorus	3A		1998	41

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Colorado River West	UT14070003-008_00	Fremont River-3	Fremont River and tributaries from east boundary of Capitol Reef National Park to Bicknell	5	Not Supporting	E. coli	1C; 2A	High	2014	81
						Temperature	3A	Low	2014	81
						Total Dissolved Solids	4	Low	2014	81
Colorado River West	UT14060007-013_00	Grassy Trail Creek Upper	Grassy Trail Reservoir tributaries	5	Not Supporting	Temperature	3A	Low	2014	12
Colorado River West	UT14060009-010_00	Huntington Creek-1	Huntington Creek and tributaries from confluence with Cottonwood Creek to Highway 10	5	Not Supporting	Selenium, Dissolved	3C	Low	2006	30
Colorado River West	UT14060009-004_00	Huntington creek-2	Huntington Creek and tributaries from Highway 10 crossing to USFS boundary	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	20
						pH	1C; 2B; 4; 3A	Low	2014	20
						Temperature	3A	Low	2014	20
					TMDL Approved	Total Dissolved Solids	4		2014	20
Colorado River West	UT14060009-003_00	Huntington Creek-3	Huntington Creek and tributaries from USFS boundary to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	0
						pH	1C; 2B; 4; 3A	Low	2014	0
						Temperature	3A	Low	2014	0
					TMDL Approved	Total Dissolved Solids	4		2016	0
Colorado River West	UT14070002-004_00	Ivie Creek Upper	Ivie Creek and some tributaries from U-10 crossing to headwaters	5	Not Supporting	Total Dissolved Solids	4	Low	2014	28
Colorado River West	UT14070006-004_00	Last Chance Creek	Chance Creek and tributaries from Lake Powell to headwaters	5	Not Supporting	OE Bioassessment	3B	Low	2008	16
						Total Dissolved Solids	4	Low	2014	16
Colorado River West	UT14070002-001_00	Muddy Creek Upper	Muddy Creek from U-10 crossing to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	81
						OE Bioassessment	3A	Low	2014	81
						Temperature	3A	Low	2016	81
						Total Dissolved Solids	4	Low	2014	81
Colorado River West	UT14070005-003_00	North Creek-Escalante	North Creek and tributaries from confluence with Escalante River to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	50
						Temperature	3A	Low	2014	50
Colorado River West	UT14070003-011_00	Oak Creek	Oak Creek and tributaries from east boundary of Capitol Reef National Park to headwaters	5	Not Supporting	Temperature	3A	Low	2014	30
Colorado River West	UT14070007-001_00	Paria River-1	Paria River from start of Paria River Gorge to headwaters	5	Not Supporting	Temperature	3C	Low	2008	29
						Total Dissolved Solids	4	Low	2000	29

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Colorado River West	UT14070007-002_00	Paria River-2	Paria River from Cottonwood Creek confluence to start of Paria Gorge	5	Not Supporting	Temperature	3C	Low	2014	35
						Total Dissolved Solids	4	Low	2014	35
Colorado River West	UT14070007-005_00	Paria River-3	Paria River and tributaries from Arizona-Utah state line to Cottonwood Creek confluence	5	Not Supporting	OE Bioassessment	3C	Low	2008	11
						Total Dissolved Solids	4	Low	2014	11
Colorado River West	UT14060007-017_00	Pinnacle Wash	Pinnacle Wash and tributaries from confluence with Price River to headwaters	5	Not Supporting	Selenium, Dissolved	3C	Low	2016	0
					TMDL Approved	Total Dissolved Solids	4		2016	0
Colorado River West	UT14070003-009_00	Pleasant Creek-1	Pleasant Creek and tributaries from east boundary of Capitol Reef National Park to headwaters	5	Not Supporting	Temperature	3A	Low	2016	58
Colorado River West	UT14060007-003_00	Price River-1	Price River and tributaries from Price City Water Treatment intake to Scofield Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	82
						OE Bioassessment	3A	Low	2014	82
Colorado River West	UT14060007-007_00	Price River-3	Price River and tributaries (excluding Gordon Creeka nd Pinnacle Wash) from Coal Creek confluence to Carbon Canal Diversion	5	Not Supporting	Boron, Total	4	Low	2014	18
						Selenium, Dissolved	4; 3C	Low	2014	18
						Total Ammonia	3C	Low	2014	18
					TMDL Approved	Total Dissolved Solids	4		2014	18
Colorado River West	UT14070002-007_00	Quitchipah Creek Lower	Quitchipah Creek and tributaries from confluence with Ivie Creek to U-10 crossing	5	Not Supporting	OE Bioassessment	3C	Low	2010	15
					TMDL Approved	Total Dissolved Solids***	4		2014	15
Colorado River West	UT14070002-002_00	Quitchipah Creek Upper	Quitchipah Creek from U-10 to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	30
						OE Bioassessment	3A	Low	2010	30
						Temperature	3A	Low	2014	30
Colorado River West	UT14070002-003_00	Saleratus Creek - Emery	Saleratus Creek and tributaries from U-10 crossing to headwaters	5	Not Supporting	Boron, Total	4	Low	2014	15
						Temperature	3A	Low	2016	15
						Total Dissolved Solids	4	Low	2014	15

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Colorado River West	UT14060009-014_00	San Rafael Lower	San Rafael River from confluence with Green River to Buckhorn Crossing	5	Not Supporting	OE Bioassessment	3C	Low	2010	88
					TMDL Approved	Total Dissolved Solids	4		2016	88
Colorado River West	UT14060009-013_00	San Rafael Upper	San Rafael River from Buckhorn Crossing to confluence of Huntington and Cottonwood Creeks	5	Not Supporting	OE Bioassessment	3C	Low	2008	24
Colorado River West	UT14060007-002_00	Scofield Tributaries	Scofield Reservoir tributaries	5	Not Supporting	Dissolved Oxygen	3A	Low	2016	98
Colorado River West	UT14060008-007_00	Ten Mile Canyon - Grand	Ten mile canyon and tribs from confluence with Green River to confluence with Thompson Wash	5	Not Supporting	Dissolved Oxygen	3B	Low	2014	0
						Temperature	3B	Low	2014	0
Colorado River West	UT14070003-002_00	UM Creek	UM Creek and other tributaries to Forsyth Reservoir	5	Not Supporting	Zinc, Dissolved	3A	Low	2012	28
Colorado River West	UT14070006-001_00	Wahweap Creek	Wahweap Creek and tributaries from Lake Powell to headwaters	5	Not Supporting	Selenium, Dissolved	3B	Low	2014	0
						Temperature	3B	Low	2014	0
						Total Dissolved Solids	4	Low	2014	0
Colorado River West	UT14070005-015_00	Alvey Wash Lower	Harris Wash and tributaries from confluence with Escalante River to Tenmile Spring	3	Insufficient Data*					9
Colorado River West	UT14070005-014_00	Alvey Wash Upper	Alvey Wash and tributaries from Tenmile Spring to headwaters	3	Insufficient Data*					0
Colorado River West	UT14060008-006_00	Barrier Creek		3	Insufficient Data*					1
Colorado River West	UT14070005-018_00	Boulder Creek	Boulder Creek and tributaries from confluence with Escalante River to headwaters	3	Insufficient Data*					59
Colorado River West	UT14070001-002_00	Bullfrog Creek	Bullfrog Creek and tributaries from Lake Powell to headwaters	3	Insufficient Data*					30
Colorado River West	UT14070005-017_00	Coyote Gulch	Coyote Gulch and tributaries from confluence with Escalante River to headwaters	3	Insufficient Data*					13
Colorado River West	UT14070006-005_00	Croton	Croton Canyon and tributaries from Lake Powell to headwaters	3	Insufficient Data*					2
Colorado River West	UT14060007-011_00	Desert Seep Wash	Desert Seep Wash from confluence with Price River to headwaters	3	Insufficient Data*					31
Colorado River West	UT14070004-002_00	Dirty Devil west side tributaries		3	Insufficient Data*					10
Colorado River West	UT14060009-001_00	Electric Lake Tributaries	Electric Lake tributaries	3	Insufficient Data*					17
Colorado River West	UT14070005-011_00	Escalante River Lower	Escalante River from Lake Powell to Boulder Creek confluence	3	Insufficient Data*					67
Colorado River West	UT14070005-013_00	Escalante Tributaries	Escalante River tributaries not previously defined from Boulder Creek to Birch Creek	3	Insufficient Data*					0
Colorado River West	UT14060009-012_00	Ferron Creek Lower	Ferron Creek and tributaries from confluence with San Rafael River to Millsite Reservoir	3	Insufficient Data*					26
Colorado River West	UT14060008-004_00	Floy Creek		3	Insufficient Data*					27
Colorado River West	UT14060007-012_00	Grassy Trail Creek Lower	Grassy Trail Creek and tributaries from Price River confluence to Grassy Trail Creek Reservoir	3	Insufficient Data*					3
Colorado River West	UT14060008-002_00	Green River-5	Green River from confluence with Colorado River to San Rafael confluence	3	Insufficient Data*					99

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Colorado River West	UT14070003-013_00	Henry Mountains	Henry Mountain streams in Garfield County whicih flow west and north as Fremont River tributaries	3	Insufficient Data*					31
Colorado River West	UT14060008-005_00	Horse Canyon-Canyonlands		3	Insufficient Data*					0
Colorado River West	UT14070003-001_00	Johnson Valley	Johnson Valley Reservoir tributaries	3	Insufficient Data*					18
Colorado River West	UT14070006-003_00	Lake Powell Tribs-1	Lake Powell north side tributaries between Wahweap and Warm Creek	3	Insufficient Data*					0
Colorado River West	UT14070006-008_00	Lake Powell Tribs-2	Lake Powell north side tributaries between Warm and Chance Creeks	3	Insufficient Data*					0
Colorado River West	UT14070006-006_00	Lake Powell Tribs-3	Lake Powell tributaries from Croton Canyon to HUC boundary	3	Insufficient Data*					0
Colorado River West	UT14070006-007_00	Lake Powell Tributaries-4	Lake Powell south side tributaries from Utah-Arizona state line to HUC (14070006) boundary	3	Insufficient Data*					3
Colorado River West	UT14070002-005_00	Last Chance Creek	Last Chance Creek and tributaries from Ivie Creek confluence to headwaters	3	Insufficient Data*					4
Colorado River West	UT14060009-002_00	LF Huntington Creek	Left Fork Huntington Creek and tributaries from confluence with Huntington Creek to headwaters	3	Insufficient Data*					41
Colorado River West	UT14070005-019_00	Lower Escalante River trbiutaries		3	Insufficient Data*					0
Colorado River West	UT14060009-005_00	Lowery Water	Lowery Water and tributaries from Joes Valley Reservoir to headwaters	3	Insufficient Data*					51
Colorado River West	UT14070005-005_00	Mamie Creek	Mamie Creek and tributaries from confluence with Escalante River to headwaters	3	Insufficient Data*					0
Colorado River West	UT14060007-010_00	Miller Creek	Miller Creek and tributaries below 7500 feet elevation	3	Insufficient Data*					28
Colorado River West	UT14070002-009_00	Muddy Creek Lower	Muddy Creek from confluence with Freemont River to Ivie Creek confluence	3	Insufficient Data*					85
Colorado River West	UT14070002-006_00	Muddy Creek Middle	Muddy Creek and tributaries from Ivie Creek confluence to U-10 crossing	3	Insufficient Data*					20
Colorado River West	UT14070001-006_00	Navajo Long Creek		3	Insufficient Data*					0
Colorado River West	UT14070001-093_00	North Wash	North Wash from Lake Powell to headwaters	3	Insufficient Data*					9
Colorado River West	UT14070005-004_00	Pine Creek	Pine Creek and tributaries from confluence with Escalante River to headwaters	3	Insufficient Data*					33
Colorado River West	UT14070003-006_00	Pine Creek (Wayne Co)	Pine Creek and tributaries from confluence with Fremont River to headwaters	3	Insufficient Data*					21
Colorado River West	UT14070003-010_00	Pleasant Creek-2	Pleasant Creek and tributaries from confluence with Fremont River to east boundary of Capitol Reef National Park	3	Insufficient Data*					10
Colorado River West	UT14060007-005_00	Price River-2	Price River and tributaries from Carbon Canal Diversion to Price City Water Treatment intake	3	Insufficient Data*					9
Colorado River West	UT14060007-014_00	Price River-4	Price River and tributaries (except Desert Seep Wash, Miller Creek, and Grassy Trail Creek) from Woodside to Soldier Creek confluence	3	Insufficient Data*					70
Colorado River West	UT14060007-009_00	Soldier Creek	Soldier Creek and tributaries from confluence with Price River to headwaters	3	Insufficient Data*					23
Colorado River West	UT14070001-094_00	Trachyte Creek	Trachyte Creek and tributaries from Lake Powell to headwaters	3	Insufficient Data*					8

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Colorado River West	UT14060008-032_00	Undefined Waterbodies (CU 14060008)	Area of undefined waterbodies	3	Insufficient Data*					18
Colorado River West	UT14060008-035_00	Undefined Waterbodies (CU 14060008)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14060008-109_00	Undefined Waterbodies (CU 14060008)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14060009-112_00	Undefined Waterbodies (CU 14060009)	Area of undefined waterbodies	3	Insufficient Data*					8
Colorado River West	UT14060009-113_00	Undefined Waterbodies (CU 14060009)	Area of undefined waterbodies	3	Insufficient Data*					4
Colorado River West	UT14070001-087_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					2
Colorado River West	UT14070001-088_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					20
Colorado River West	UT14070001-092_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					6
Colorado River West	UT14070001-095_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					3
Colorado River West	UT14070001-096_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					3
Colorado River West	UT14070001-097_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					2
Colorado River West	UT14070001-098_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					3
Colorado River West	UT14070001-099_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070001-100_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070001-101_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					3
Colorado River West	UT14070001-102_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070001-103_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070002-045_00	Undefined Waterbodies (CU 14070002)	Area of undefined waterbodies	3	Insufficient Data*					11
Colorado River West	UT14070002-046_00	Undefined Waterbodies (CU 14070002)	Area of undefined waterbodies	3	Insufficient Data*					1
Colorado River West	UT14070004-061_00	Undefined Waterbodies (CU 14070004)	Area of undefined waterbodies	3	Insufficient Data*					5
Colorado River West	UT14070004-062_00	Undefined Waterbodies (CU 14070004)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070001-104_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					6
Colorado River West	UT14070001-105_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					13
Colorado River West	UT14070005-078_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					23
Colorado River West	UT14070005-080_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070005-081_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					15
Colorado River West	UT14070005-082_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					19
Colorado River West	UT14070005-083_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					13
Colorado River West	UT14070005-084_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					12

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Colorado River West	UT14070005-110_00	Undefined Waterbodies (CU 14070005)	Area of undefined waterbodies	3	Insufficient Data*					0
Colorado River West	UT14070005-001_00	Upper Valley Creek	Upper Valley Creek and tributaries from confluence with Birch Creek to headwaters	3	Insufficient Data*					0
Colorado River West	UT14070006-002_00	Warm Creek	Warm Creek and tributaries from Lake Powell to headwaters	3	Insufficient Data*					2
Colorado River West	UT14060007-004_00	Willow Creek - Carbon	Willow Creek and tributaries from confluence with Price River to headwaters	3	Insufficient Data*					48
Colorado River West	UT14070005-016_00	Wolverine Creek	Wolverine Creek and tributaries from confluence with Escalante River to headwaters	3	Insufficient Data*					0
Colorado River West	UT14070005-008_00	Deer Creek (Garfield Co.)	Deer Creek and tributaries from confluence with Escalante River to headwaters	2	No Evidence of Impairment					64
Colorado River West	UT14060009-009_00	Ferron Creek Upper	Ferron Creek and tributaries from Millsite Reservoir to headwaters	2	No Evidence of Impairment					105
Colorado River West	UT14060008-001_00	Green River-4	Green River from San Rafael confluence to Price River confluence	2	No Evidence of Impairment					42
Colorado River West	UT14060008-003_00	Green River-5 Tributaries	Thompson Creek and tributaries from I-70 to headwaters	2	No Evidence of Impairment					9
Colorado River West	UT14060009-006_00	Joes Valley	Joes Valley Reservoir tributaries except Lowry Creek	2	No Evidence of Impairment					45
Colorado River West	UT14070005-006_00	Sand Creek	Sand Creek and tributaries from confluence with Escalante River to headwaters	2	No Evidence of Impairment					46
Colorado River West	UT14070003-012_00	Sandy Creek	Sandy Creek and tributaries from confluence with Fremont River to east boundary of Capitol Reef National Park	2	No Evidence of Impairment					31
Colorado River West	UT14060008-031_00	Undefined Waterbodies (CU 14060008)	Area of undefined waterbodies	2	No Evidence of Impairment					0
Colorado River West	UT14060008-034_00	Undefined Waterbodies (CU 14060008)	Area of undefined waterbodies	2	No Evidence of Impairment					0
Colorado River West	UT14070001-091_00	Undefined Waterbodies (CU 14070001)	Area of undefined waterbodies	2	No Evidence of Impairment					1
Colorado River West	UT14060007-001_00	White River-Colton	White River from confluence with Price River to headwaters	2	No Evidence of Impairment					42
Colorado River West	UT14070007-003_00	Buckskin Gulch	Buckskin Gulch and tributaries from Paria River confluence to headwaters	1	Supporting					3
Colorado River West	UT14070003-007_00	Donkey Creek	Donkey Creek and other tributaries between Pine Creek and Pleasant Creek and above USFS boundary	1	Supporting					36
Colorado River West	UT14070003-015_00	Fish Lake Tributaries	Fish Lake tributaries	1	Supporting					6
Colorado River West	UT14070003-004_00	Fremont River-1	Fremont River and tributaries from Mill Meadow Reservoir to Johnson Valley Reservoir	1	Supporting					9
Colorado River West	UT14070001-001_00	Halls Creek	Halls Creek and tributaries from Lake Powell to headwaters	1	Supporting					0
Colorado River West	UT14070005-010_00	The Gulch	The Gulch from confluence with Escalante River to headwaters	1	Supporting					44
Colorado River West	UT14070003-003_00	UM Creek Lower	UM Creek and tributaries from Mill Meadow to Forsythe Reservoir	1	Supporting					2

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Jordan River/Utah Lake	UT16020204-012_00	Emigration Creek	Emigration Creek and tributaries from stream gage at Rotary Glen Park (40 44 58.49N, 111 48 36.29W) to headwaters	4A	TMDL Approved	E. coli	2B		2008	4
Jordan River/Utah Lake	UT16020202-022_00	Thistle Creek-1	Thistle Creek from confluence with Soldier Creek to confluence with Little Clear Creek	4A	TMDL Approved	Sedimentation	3A		2008	21
Jordan River/Utah Lake	UT16020202-027_00	Beer Creek	Beer Creek and tributaries from confluence with Spring Creek to headwaters	5	Not Supporting	OE Bioassessment	3C	Low	2014	16
						Total Ammonia	3C	Low	2016	16
Jordan River/Utah Lake	UT16020202-030_00	Benjamin Slough	Benjamin Slough from confluence with Utah Lake to Beer Creek confluence	5	Not Supporting	Total Ammonia	3B	Low	2016	6
Jordan River/Utah Lake	UT16020204-019_00	Big Cottonwood Creek-1	Big Cottonwood Creek and tributaries from Jordan River to Big Cottonwood WTP	5	Not Supporting	E. coli	2B	High	2014	10
						OE Bioassessment	3A	Low	2014	10
						Temperature	3A	Low	2006	10
Jordan River/Utah Lake	UT16020204-020_00	Big Cottonwood Creek-2	Big Cottonwood Creek and tributaries from Big Cottonwood WTP to headwaters	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	Low	2014	44
						Copper, Dissolved	3A	Low	2014	44
Jordan River/Utah Lake	UT16020204-023_00	Bingham Creek	Bingham Creek and tributaries from confluence with Jordan River to headwaters	5	Not Supporting	Selenium, Dissolved	3D	Low	2014	4
						Total Dissolved Solids	4	Low	2014	4
Jordan River/Utah Lake	UT16020204-024_00	Butterfield Creek	Butterfield Creek and tributaries from confluence with Jordan River to headwaters	5	Not Supporting	E. coli	2B	High	2014	6
						Selenium, Dissolved	3D	Low	2014	6
						Total Dissolved Solids	4	Low	2014	6
Jordan River/Utah Lake	UT16020204-010_00	City Creek-2	City Creek and tributaries from filtration plant to headwaters	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	High	2010	6
Jordan River/Utah Lake	UT16020202-019_00	Clear Creek-Tucker	Clear Creek and tributaries from confluence with Soldier Creek to headwaters	5	Not Supporting	OE Bioassessment	3A	Low	2008	14
Jordan River/Utah Lake	UT16020201-003_00	Currant Creek	Current Creek from mouth of Goshen Canyon to Mona Reservoir	5	Not Supporting	Temperature	3A	Low	2002	4
Jordan River/Utah Lake	UT16020201-014_00	Currant Creek-Juab Valley		5	Not Supporting	Temperature	3A	Low	2016	21
Jordan River/Utah Lake	UT16020201-015_00	Dry Creek-Alpine		5	Not Supporting	pH	2B; 4; 3A	Low	2014	11

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Jordan River/Utah Lake	UT16020204-033_00	Emigration Creek Lower	Emigration Creek and tributaries from 1100 East (below Westminster College) to stream gage at Rotary Glen Park (40 44 58.49N, 111 48 36.29W) above Hogle Zoo	5	Not Supporting	E. coli	2B	High	2014	1
Jordan River/Utah Lake	UT16020203-026_00	Heber Valley		5	Not Supporting	Temperature	3A	Low	2014	47
Jordan River/Utah Lake	UT16020202-003_00	Hobble Creek-1	Hobble Creek from Utah Lake to confluence of Left Fork Hobble Creek and Right Fork Hobble Creek	5	Not Supporting	pH	2B; 4; 3A	Low	2016	10
Jordan River/Utah Lake	UT16020204-001_00	Jordan River-1	Jordan River from Farmington Bay upstream contiguous with the Davis County line	5	Not Supporting	Copper, Dissolved	3B; 3D	Low	2014	9
						E. coli	2B	High	2010	9
						OE Bioassessment	3B; 3D	Low	2008	9
						Total Dissolved Solids	4	Low	2016	9
					TMDL Approved	Dissolved Oxygen	3B; 3D	High**	2002	9
Jordan River/Utah Lake	UT16020204-002_00	Jordan River-2	Jordan River from Davis County line upstream to North Temple Street	5	Not Supporting	E. coli	2B	High	2006	6
						OE Bioassessment	3B	Low	2008	6
						Total Dissolved Solids	4	Low	2016	6
					TMDL Approved	Dissolved Oxygen	3B	High**	2002	6
Jordan River/Utah Lake	UT16020204-003_00	Jordan River-3	Jordan River from North Temple to 2100 South	5	Not Supporting	E. coli	2B	High	2006	3
						OE Bioassessment	3B	Low	2008	3
						Total Phosphorus	3B	Low	2008	3
					TMDL Approved	Dissolved Oxygen	3B	High**	2008	3
Jordan River/Utah Lake	UT16020204-004_00	Jordan River-4	Jordan River from 2100 South to the confluence with Little Cottonwood Creek	5	Not Supporting	E. coli	2B	High	2014	6
						OE Bioassessment	3B	Low	2010	6
						Total Dissolved Solids	4	Low	2008	6
Jordan River/Utah Lake	UT16020204-005_00	Jordan River-5	Jordan River from the confluence with Little Cottonwood Creek to 7800 South	5	Not Supporting	E. coli	2B	High	2006	4
						Temperature	3A	Low	2006	4
						Total Dissolved Solids	4	Low	2006	4
Jordan River/Utah Lake	UT16020204-006_00	Jordan River-6	Jordan River from 7800 South to Bluffdale at 14600 South	5	Not Supporting	OE Bioassessment	3A	Low	2008	13
						Selenium, Dissolved	3A	Low	2014	13
						Temperature	3A	Low	2006	13
						Total Dissolved Solids	4	Low	2006	13

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Jordan River/Utah Lake	UT16020204-007_00	Jordan River-7	Jordan River from Bluffdale at 14600 South to Narrows	5	Not Supporting	OE Bioassessment	3A	Low	2008	4
						Temperature	3A	Low	2004	4
Jordan River/Utah Lake	UT16020201-008_00	Jordan River-8	Jordan River from Narrows to Utah Lake	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	High	2014	10
						Total Dissolved Solids	4	Low	2006	10
Jordan River/Utah Lake	UT16020204-021_00	Little Cottonwood Creek-1	Little Cottonwood Creek and tributaries from Jordan River confluence to Metropolitan WTP	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	Low	2014	7
						E. coli	2B	High	2014	7
						OE Bioassessment	3A	Low	2008	7
						Temperature	3A	Low	2006	7
						Total Dissolved Solids	4	High	2006	7
Jordan River/Utah Lake	UT16020204-022_00	Little Cottonwood Creek-2	Little Cottonwood Creek and tributaries from Metropolitan WTP to headwaters	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	Low	2014	28
						Copper, Dissolved	3A	Low	2014	28
						pH	1C; 2B; 3A	Low	2014	28
					TMDL Approved	Zinc, Dissolved	3A		1998	28
Jordan River/Utah Lake	UT16020203-009_00	Main Creek-1	Main Creek and tributaries from Deer Creek Reservoir to Round Valley	5	Not Supporting	E. coli	1C; 2B	Low	2010	8
						OE Bioassessment	3A	Low	2016	8
Jordan River/Utah Lake	UT16020203-010_00	Main Creek-2	Main Creek and tributaries from Round Valley to headwaters	5	Not Supporting	E. coli	1C; 2B	Low	2016	34
Jordan River/Utah Lake	UT16020203-016_00	McHenry Creek	McHenry Creek and tributaries from Jordanelle Reservoir to headwaters	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	Low	2014	1
						Zinc, Dissolved	3A	Low	2014	1
Jordan River/Utah Lake	UT16020204-026_00	Mill Creek1-SLCity	Mill Creek from confluence with Jordan River to Interstate 15 crossing	5	Not Supporting	E. coli	2B	High	2014	1
						OE Bioassessment	3C	Low	2014	1
Jordan River/Utah Lake	UT16020204-017_00	Mill Creek2-SLCity	Mill Creek and tributaries from Interstate 15 to USFS Boundary	5	Not Supporting	E. coli	2B	High	2002	8
						OE Bioassessment	3A	Low	2010	8
Jordan River/Utah Lake	UT16020201-012_00	Mill Race Creek-1		5	Not Supporting	OE Bioassessment	3B	Low	2016	0
Jordan River/Utah Lake	UT16020204-025_00	Parleys Canyon Creek-1	Parleys Canyon Creek and tributaries from 1300 East to Mountain Dell Reservoir	5	Not Supporting	E. coli	1C; 2B	High	2010	14
						OE Bioassessment	3A	Low	2014	14
Jordan River/Utah Lake	UT16020204-013_00	Parleys Canyon Creek-2	Parleys Canyon Creek and tributaries from Mountain Dell Reservoir to headwaters	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	Low	2014	16
Jordan River/Utah Lake	UT16020201-010_00	Powell Slough	Powell Slough state waterfowl management area	5	Not Supporting	Dissolved Oxygen	3D	Low	2014	0

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Jordan River/Utah Lake	UT16020203-013_00	Provo Deer Creek	Provo Deer Creek and tributaries from confluence with Provo River to headwaters	5	Not Supporting	OE Bioassessment	3A	Low	2008	20
Jordan River/Utah Lake	UT16020203-001_00	Provo River-1	Provo River from Utah Lake to Murdock Diversion	5	Not Supporting	OE Bioassessment	3A	Low	2008	11
Jordan River/Utah Lake	UT16020203-004_00	Provo River-4	Provo River from Deer Creek Reservoir to Jordanelle Reservoir	5	Not Supporting	E. coli	1C; 2B	High	2010	17
Jordan River/Utah Lake	UT16020203-005_00	Provo River-5	Provo River from Jordanelle Reservoir to Woodland	5	Not Supporting	Aluminum, Dissolved	3A	Low	2016	12
Jordan River/Utah Lake	UT16020203-006_00	Provo River-6	Provo River and tributaries from Woodland to headwaters, except Little South Fork and Upper South Fork	5	Not Supporting	Aluminum, Dissolved	3A	High	2014	107
						Zinc, Dissolved	3A	High	2014	107
Jordan River/Utah Lake	UT16020204-035_00	Red Butte Creek Lower	Red Butte Creek and tributaries from 1100 East Street to Red Butte Reservoir	5	Not Supporting	OE Bioassessment	3A	Low	2014	2
Jordan River/Utah Lake	UT16020204-029_00	Rose Creek	Rose Creek and tributaries from confluence with Jordan River to headwaters	5	Not Supporting	E. coli	2B	High	2014	7
Jordan River/Utah Lake	UT16020201-005_00	Salt Creek-2	Salt Creek and tributaries from USFS boundary to headwaters	5	Not Supporting	pH	2B; 4; 3A	Low	2014	23
Jordan River/Utah Lake	UT16020203-014_00	Snake Creek-1	Snake Creek from confluence with Provo River to Wasatch Mountain State Park Golf Course	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	High	2006	5
Jordan River/Utah Lake	UT16020202-012_00	Soldier Creek-1	Soldier Creek from confluence with Thistle Creek to confluence of Starvation Creek	5	Not Supporting	Temperature	3A	Low	2014	25
					TMDL Approved	Sedimentation	3A		1998	25
						Total Phosphorus	3A		1998	25
Jordan River/Utah Lake	UT16020203-027_00	Spring Creek-Heber	Spring Creek and tributaries from confluence with Provo River to headwaters	5	Not Supporting	E. coli	1C; 2B	Low	2016	9
Jordan River/Utah Lake	UT16020201-009_00	Spring Creek-Lehi	Spring Creek and tributaries from Utah Lake near Lehi to headwaters	5	Not Supporting	Cadmium, Dissolved	3A; HH3A	Low	2014	5
Jordan River/Utah Lake	UT16020202-042_00	Spring Creek-Springville		5	Not Supporting	Temperature	3A	Low	2014	3
						Total Ammonia	3B; 3D	Low	2014	3
Jordan River/Utah Lake	UT16020204-034_00	State Canal	State Canal from Farmington Bay to confluence with the Jordan River	5	Not Supporting	Dissolved Oxygen	3B; 3D	Low	2014	0
						Total Ammonia	3B; 3D	Low	2016	0
						Total Dissolved Solids	4	Low	2016	0
Jordan River/Utah Lake	UT16020201-001_00	American Fork River-1	American Fork River and tributaries from Diversion at mouth of Canyon to Tibble Fork Reservoir	3	Insufficient Data*					7
Jordan River/Utah Lake	UT16020201-002_00	American Fork River-2	American Fork River and tributaries from Tibble Fork Reservoir to headwaters	3	Insufficient Data*					33
Jordan River/Utah Lake	UT16020204-028_00	Barneys Canyon Creek	Barney Canyon Creek and tributaries from mouth to headwaters	3	Insufficient Data*					0

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Jordan River/Utah Lake	UT16020204-030_00	Bells Canyon	Bells Canyon Creek and tributaries from Lower Bells Canyon Reservoir to headwaters	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020202-024_00	Bennie Creek	Bennie Creek and tributaries from confluence with Thistle Creek to headwaters	3	Insufficient Data*					5
Jordan River/Utah Lake	UT16020203-022_00	Bridal Veil Falls	Bridal Veil Falls from falls to headwaters	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020204-009_00	City Creek-1	City Creek and tributaries from Memory Park to SLC WTP	3	Insufficient Data*					4
Jordan River/Utah Lake	UT16020204-027_00	Coon Creek	Perennial portion of Coon Creek	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020202-006_00	Diamond Fork-1	Diamond Fork Creek and tributaries from confluence with Spanish Fork River to Sixth Water confluence	3	Insufficient Data*					27
Jordan River/Utah Lake	UT16020202-007_00	Diamond Fork-2	Diamond Fork Creek and tributaries from Sixth Water Creek confluence to Hawthorne Campground	3	Insufficient Data*					5
Jordan River/Utah Lake	UT16020202-008_00	Diamond Fork-3	Diamond Fork Creek and tributaries from Hawthorne Campground to headwaters	3	Insufficient Data*					27
Jordan River/Utah Lake	UT16020202-036_00	Dry Creek-2	Dry Creek and tributaries from Interstate 15 to headwaters	3	Insufficient Data*					7
Jordan River/Utah Lake	UT16020202-021_00	Indian Creek	Indian Creek and tributaries from confluence with Soldier Creek to headwaters	3	Insufficient Data*					3
Jordan River/Utah Lake	UT16020204-036_00	Lee Creek		3	Insufficient Data*					5
Jordan River/Utah Lake	UT16020203-020_00	Lost Creek and tributaries from confluence with Provo River	HUC: 16020203 (across Provo Canyon from Bridal Veil Falls)	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020202-018_00	Mill Fork	Mill Fork and tributaries from confluence with Soldier Creek to headwaters	3	Insufficient Data*					9
Jordan River/Utah Lake	UT16020202-031_00	Moark	Spanish Fork River east side tributaries from Moark Diversion to Diamond Fork confluence	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020204-014_00	Mountain Dell Creek-1	Mountain Dell Creek from Mountain Dell Reservoir to Little Dell Reservoir	3	Insufficient Data*					1
Jordan River/Utah Lake	UT16020202-025_00	Nebo Creek	Nebo Creek and tributaries from confluence with Thistle Creek to headwaters	3	Insufficient Data*					40
Jordan River/Utah Lake	UT16020204-016_00	North Canyon	North Canyon Creek and tributaries from USFS boundary to headwates.	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020203-008_00	North Fork Provo River	North Fork Provo River and tributaries from confluence with Provo River to headwaters	3	Insufficient Data*					8
Jordan River/Utah Lake	UT16020203-025_00	Provo Canyon	HUC: 16020203	3	Insufficient Data*					1
Jordan River/Utah Lake	UT16020203-023_00	Provo Lower Tributaries	HUC: 16020203	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020203-003_00	Provo River-3	Provo River from Olmstead Diversion to Deer Creek Reservoir	3	Insufficient Data*					6
Jordan River/Utah Lake	UT16020203-028_00	Provo Tributaries-Heber	Provo River west side tributaries from Deer Creek Dam to Jordanelle Dam except Snake Creek	3	Insufficient Data*					14
Jordan River/Utah Lake	UT16020203-024_00	Rock Canyon	Rock Canyon and tributaries from mouth to headwaters	3	Insufficient Data*					3

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Jordan River/Utah Lake	UT16020202-014_00	Sheep Creek	Sheep Creek and tributaries from confluence with Soldier Creek to headwaters	3	Insufficient Data*					6
Jordan River/Utah Lake	UT16020202-009_00	Sixth Water Creek	Sixth Water Creek and tributaries except Fifth Water and First Water Creeks and tributaries from confluence with Diamond Fork Creek to headwaters	3	Insufficient Data*					20
Jordan River/Utah Lake	UT16020202-033_00	Soldier Creek-3	Soldier Creek north side perennial tributaries between Tie Fork and Sheep Creek confluence	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020202-034_00	Soldier Creek-4	Soldier Creek south side tributaries from confluence with Thistle Creek to Dairy Fork confluence, excluding Lake Fork above USFS boundary	3	Insufficient Data*					4
Jordan River/Utah Lake	UT16020202-039_00	Soldier Creek-5	Soldier Creek south side tributaries between Mill Fork confluence and Clear Creek confluence	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020203-018_00	South Fork Provo	Upper South Fork Provo River and tributaries from confluence with Provo River to headwaters	3	Insufficient Data*					31
Jordan River/Utah Lake	UT16020203-007_00	South Fork Provo River	Lower South Fork Provo River and tributaries from confluence with Provo River to headwaters	3	Insufficient Data*					11
Jordan River/Utah Lake	UT16020202-001_00	Spanish Fork River-1	Spanish Fork River from Utah Lake to Moark Diversion	3	Insufficient Data*					17
Jordan River/Utah Lake	UT16020204-032_00	Surplus Canal		3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020202-010_00	Third Water Creek	Third Water Creek and tributaries from confluence with Sixth Water Creek to headwaters	3	Insufficient Data*					25
Jordan River/Utah Lake	UT16020202-037_00	Thistle Creek-3	Thistle Creek east side tributaries from confluence with Soldier Creek upstream to confluence with Little Clear Creek	3	Insufficient Data*					11
Jordan River/Utah Lake	UT16020202-038_00	Thistle Creek-4	Thistle Creek west and south side tributaries from Nebo Creek to Little Clear Creek	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020202-032_00	Thistle Creek-5	Thistle Creek tributaries between Bennie Creek and Nebo Creek confluences	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020203-029_00	Unknown	Mill Race Creek and tributaries from HUC boundary (16020203) to headwaters	3	Insufficient Data*					0
Jordan River/Utah Lake	UT16020203-021_00	Upper Falls Drainage	Upper Falls above Bridal Veil Falls	3	Insufficient Data*					1
Jordan River/Utah Lake	UT16020202-011_00	Cottonwood Creek	Cottonwood Creek and tributaries from confluence with Sixth Water Creek to headwaters	2	No Evidence of Impairment					14
Jordan River/Utah Lake	UT16020202-017_00	Dairy Fork	Dairy Fork and tributaries from confluence with Soldier Creek to headwaters	2	No Evidence of Impairment					6
Jordan River/Utah Lake	UT16020203-011_00	Daniels Creek-1	Daniels Creek and tributaries from confluence with Deer Creek Reservoir to Whiskey Springs	2	No Evidence of Impairment					11
Jordan River/Utah Lake	UT16020203-012_00	Daniels Creek-2	Daniels Creek and tributaries from Whiskey Springs to headwaters	2	No Evidence of Impairment					16
Jordan River/Utah Lake	UT16020202-004_00	Hobble Creek-2	Left Fork Hobble Creek and tributaries from confluence with Right Fork to headwaters	2	No Evidence of Impairment					25

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Jordan River/Utah Lake	UT16020202-005_00	Hobble Creek-3	Right Fork Hobble Creek and tributaries from confluence with Left Fork to headwaters	2	No Evidence of Impairment					31
Jordan River/Utah Lake	UT16020202-016_00	Lake Fork	Lake Fork and tributaries from USFS Boundary to headwaters	2	No Evidence of Impairment					30
Jordan River/Utah Lake	UT16020203-017_00	Little South Fork Provo	Little South Fork Provo River and tributaries from confluence with Provo River to headwaters	2	No Evidence of Impairment					30
Jordan River/Utah Lake	UT16020204-031_00	Little Willow Creek	Little Willow Creek and tributaries from Draper Irrigation Company diversion to headwaters	2	No Evidence of Impairment					3
Jordan River/Utah Lake	UT16020204-018_00	Mill Creek3-SLCity	Mill Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					19
Jordan River/Utah Lake	UT16020204-015_00	Mountain Dell Creek-2	Mountain Dell Creek and tributaries from to Little Dell Reservoir headwaters	2	No Evidence of Impairment					8
Jordan River/Utah Lake	UT16020202-028_00	Peteetneet Creek	Peteetneet Creek and tributaries from Maple Dell Campground to headwaters	2	No Evidence of Impairment					22
Jordan River/Utah Lake	UT16020204-011_00	Red Butte Creek Upper	Red Butte Creek and tributaries from Red Butte Reservoir to headwaters	2	No Evidence of Impairment					6
Jordan River/Utah Lake	UT16020201-004_00	Salt Creek-1	Salt Creek from mouth of Canyon to USFS boundary	2	No Evidence of Impairment					2
Jordan River/Utah Lake	UT16020202-020_00	Starvation Creek	Starvation Creek and tributaries from confluence with Soldier Creek to headwaters	2	No Evidence of Impairment					19
Jordan River/Utah Lake	UT16020201-007_00	Summit Creek-Santaquin	Summit Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					8
Jordan River/Utah Lake	UT16020202-023_00	Thistle Creek-2	Thistle Creek and tributaries from confluence with Little Clear Creek to headwaters	2	No Evidence of Impairment					21
Jordan River/Utah Lake	UT16020202-015_00	Tie Fork	Tie Fork and tributaries from confluence with Soldier Creek to headwaters	2	No Evidence of Impairment					14
Jordan River/Utah Lake	UT16020201-016_00	American Fork	American Fork and tributaries from Utah Lake to diversion at mouth of American Fork Canyon	1	Supporting					0
Jordan River/Utah Lake	UT16020201-017_00	Currant Creek-Goshen		1	Supporting					19
Jordan River/Utah Lake	UT16020202-035_00	Dry Creek-1	Dry Creek and tributaries from Utah Lake (Provo Bay) to Interstate 15	1	Supporting					3
Jordan River/Utah Lake	UT16020201-006_00	Hop Creek	Hop Creek and tributaries from confluence with Salt Creek to headwaters	1	Supporting					16
Jordan River/Utah Lake	UT16020201-013_00	Ironton Canal Lower		1	Supporting					0
Jordan River/Utah Lake	UT16020203-019_00	Lake Creek-2	Lake Creek and tributaries above Timber Creek confluence to headwaters	1	Supporting					23
Jordan River/Utah Lake	UT16020203-002_00	Provo River-2	Provo River from Murdock Diversion to Olmstead Diversion	1	Supporting					4
Jordan River/Utah Lake	UT16020203-015_00	Snake Creek-2	Snake Creek and tributaries from Wasatch Mountain State Park to headwaters	1	Supporting					17
Jordan River/Utah Lake	UT16020202-013_00	Soldier Creek-2	Soldier Creek and tributaries from Starvation Creek confluence to headwaters	1	Supporting					6
Jordan River/Utah Lake	UT16020202-002_00	Spanish Fork River-2	Spanish Fork River from Moark Diversion to Thistle Creek confluence	1	Supporting					7

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Jordan River/Utah Lake	UT16020202-026_00	Spring Creek-Payson	Spring Creek and tributaries from confluence with Beer Creek to headwaters	1	Supporting					13

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Lower Colorado River	UT15010008-007_00	Ash Creek-1	Ash Creek and tributaries from confluence with La Verkin Creek to springs near Toquerville	5	Not Supporting	Temperature	3A	Low	2016	27
Lower Colorado River	UT15010003-001_00	Cottonwood Canyon	Cottonwood Canyon from Utah-Arizona state line to headwaters	5	Not Supporting	Dissolved Oxygen	3C	Low	2014	6
						Temperature	3C	Low	2014	6
Lower Colorado River	UT15010009-001_00	Fort Pearce Wash	Fort Pearce Wash and tributaries within Utah, from Virgin River confluence to headwaters, exlcuding Short Creek	5	Not Supporting	Total Dissolved Solids	4	Low	2012	0
Lower Colorado River	UT15010003-004_00	Johnson Wash-1	Johnson Wash and tributaries from Utah-Arizona state line to Skutumpah Canyon confluence	5	Not Supporting	Boron, Total	4	Low	2014	22
						Selenium, Dissolved	3C	Low	2014	22
						Total Dissolved Solids	4	Low	2008	22
Lower Colorado River	UT15010003-005_00	Johnson Wash-2	Johnson Wash and tributaries, from (including) Skutumpah Canyon to headwaters	5	Not Supporting	Copper, Dissolved	4; 3A	Low	2014	27
						Dissolved Oxygen	3A	Low	2014	27
						Lead, Dissolved	4; 3A; HH3A	Low	2014	27
						OE Bioassessment	3A	Low	2016	27
						Temperature	3A	Low	2014	27
						Total Dissolved Solids	4	Low	2014	27
						Zinc, Dissolved	3A	Low	2014	27
Lower Colorado River	UT15010003-002_00	Kanab Creek-1	Kanab Creek and tributaries from state line to the confluence with Fourmile Hollow near the White Cliffs	5	Not Supporting	Dissolved Oxygen	3C	Low	2014	18
						Total Dissolved Solids	4	Low	2008	18
Lower Colorado River	UT15010003-003_00	Kanab Creek-2	Kanab Creek and tributaries from the confluence with Fourmile Hollow near the White Cliffs to Reservoir Canyon	5	Not Supporting	Boron, Total	4	Low	2014	6
						Selenium, Dissolved	4; 3C	Low	2016	6
						Total Dissolved Solids	4	Low	2014	6
Lower Colorado River	UT15010008-010_00	La Verkin Creek	La Verkin Creek and tributaries from confluence with Virgin River to headwaters (excludes Ash Creek)	5	Not Supporting	OE Bioassessment	3B	Low	2016	48
Lower Colorado River	UT15010008-014_00	North Creek-Virgin	North Creek and tributaries from confluence with Virgin River to headwaters	5	Not Supporting	OE Bioassessment	3C	Low	2016	25
						pH	1C; 2B; 4; 3C	Low	2014	25
Lower Colorado River	UT15010008-015_00	North Fork Virgin River-1	North Fork Virgin River and tributaries from confluence with East Fork Virgin River to Kolob Creek confluence	5	Not Supporting	E. coli	1C; 2A	High	2014	47
						Temperature	3A	Low	2010	47

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Lower Colorado River	UT15010008-013_00	North Fork Virgin River-2	North Fork Virgin River and tributaries from Deep Creek confluence to headwaters	5	Not Supporting	E. coli	1C; 2A	High	2010	38
						Temperature	3A	Low	2014	38
Lower Colorado River	UT15010008-001_00	Santa Clara-1	Santa Clara River from confluence with Virgin River to Gunlock Reservoir	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2014	24
						Boron, Total	4	Low	2008	24
						Temperature	3B	Low	2008	24
					TMDL Approved	Total Dissolved Solids	4		1998	24
Lower Colorado River	UT15010008-002_00	Santa Clara-2	Santa Clara River and tributaries from Gunlock Reservoir to Baker Dam Reservoir (includes Magotsu Creek)	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	27
						Temperature	3A	Low	2008	27
Lower Colorado River	UT15010008-003_00	Santa Clara-3	Santa Clara River and tributaries from Baker Dam Reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	0
Lower Colorado River	UT15010010-001_00	Virgin River-1	Virgin River from state line to Santa Clara River confluence	5	Not Supporting	Boron, Total	4	Low	2008	14
						Temperature	3B	Low	2006	14
						Total Dissolved Solids	4	Low	2014	14
Lower Colorado River	UT15010008-004_00	Virgin River-2	Virgin River and tributaries from Santa Clara River confluence to Quail Creek diversion, excluding Quail, Ash, and La Verkin Creeks	5	Not Supporting	Boron, Total	4	Low	2008	32
						Temperature	3B	Low	2008	32
						Total Dissolved Solids	4	Low	2014	32
Lower Colorado River	UT15010008-008_00	Ash Creek-2	Ash Creek and tributaries from springs near Toquerville to Ash Creek Reservoir	3	Insufficient Data*					8
Lower Colorado River	UT15010003-006_00	Kanab Creek-3	Kanab Creek and tributaries from Reservoir Canyon to headwaters	3	Insufficient Data*					0
Lower Colorado River	UT15010008-016_00	Kolob Creek	Kolob Creek and tributaries from confluence with North Fork Virgin River to headwaters	3	Insufficient Data*					16
Lower Colorado River	UT15010009-002_00	Short Creek	Short Creek and tributaries from the Utah-Arizona border (near Hildale) to headwaters	3	Insufficient Data*					5
Lower Colorado River	UT15010008-009_00	Ash Creek-3	Ash Creek and tributaries from Ash Creek Reservoir to headwaters	2	No Evidence of Impairment					45
Lower Colorado River	UT15010010-002_00	Beaver Dam Wash	Beaver Dam Wash and tributaries from Motoqua to headwaters	2	No Evidence of Impairment					24
Lower Colorado River	UT15010008-017_00	Deep Creek	Deep Creek and tributaries from confluence with North Fork Virgin River to headwaters	2	No Evidence of Impairment					66

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Lower Colorado River	UT15010008-018_00	East Fork Virgin-1	East Fork of Virgin River and tributaries from confluence with North Fork Virgin River to Carmel Junction	2	No Evidence of Impairment					38
Lower Colorado River	UT15010008-020_00	East Fork Virgin-3	East Fork Virgin River and tributaries from Glendale to headwaters	2	No Evidence of Impairment					36
Lower Colorado River	UT15010008-006_00	Leeds Creek	Leeds Creek and tributaries from confluence with Quail Creek to headwaters	2	No Evidence of Impairment					10
Lower Colorado River	UT15010008-005_00	Quail Creek	Quail Creek and tributaries from Quail Creek Reservoir to headwaters	2	No Evidence of Impairment					3
Lower Colorado River	UT15010008-012_00	Virgin River-4	Virgin River and tributaries from North Creek confluence to Norh Fork Virgin River	2	No Evidence of Impairment					23
Lower Colorado River	UT15010008-019_00	East Fork Virgin-2	East Fork Virgin River and tributaries from Carmel Junction to Glendale	1	Supporting					26
Lower Colorado River	UT15010008-011_00	Virgin River-3	Virgin River and tributaries from Quail Creek Diversion to North Creek confluence	1	Supporting					4

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Sevier River	UT16030001-009_00	Mammoth Creek Lower	Mammoth Creek and tributaries from confluence with Sevier River to Mammoth Spring confluence	4A	TMDL Approved	Total Phosphorus	3A		2004	26
Sevier River	UT16030002-004_00	Otter Creek-2	Box Creek and tributaries from confluence with Otter Creek to headwaters	4A	Non-Pollutant	Habitat	3A		1998	24
					TMDL Approved	Dissolved Oxygen	3A		2012	24
						Sedimentation	3A		1998	24
						Total Phosphorus	3A		1998	24
Sevier River	UT16030002-003_00	Otter Creek-3	Greenwich Creek and tributaries from confluence with Otter Creek to headwaters	4A	TMDL Approved	Sedimentation	3A		1998	30
						Total Phosphorus	3A		1998	30
Sevier River	UT16030003-003_00	Salina Creek-1	Salina Creek and tributaries from confluence with Sevier River to USFS boundary	4A	TMDL Approved	Total Dissolved Solids	4		1998	5
Sevier River	UT16030004-001_00	San Pitch-1	San Pitch River and tributaries from confluence with Sevier River to tailwaters of Gunnison Reservoir (excluding all of Sixmile Creek and Twelvemile Creek above USFS boundary)	4A	TMDL Approved	Total Dissolved Solids	4		2014	20
Sevier River	UT16030003-012_00	Sevier River-17	Sevier River from Yuba Dam upstream to confluence with Salina Creek	4A	TMDL Approved	Sedimentation	3C		2000	36
						Total Dissolved Solids	4		2000	36
						Total Phosphorus	3B		2000	36
Sevier River	UT16030005-026_00	Sevier River-22	Sevier River from DMAD Reservoir upstream to U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash)	4A	TMDL Approved	Sedimentation	3C		1998	39
						Total Phosphorus	3B		1998	39
Sevier River	UT16030001-005_00	Sevier River-3	Sevier River and tributaries from Circleville Irrigation Diversion to Horse Valley Diversion	4A	TMDL Approved	Sedimentation	3C		1998	22
						Total Phosphorus	3A		1998	22
Sevier River	UT16030001-004_00	Bear Creek	Bear Creek and tributaries from confluence with Sevier River to headwaters	5	Not Supporting	Copper, Dissolved	4; 3A	Low	2014	8
						Temperature	3A	Low	2014	8
Sevier River	UT16030005-022_00	Chicken Creek-2	Chicken Creek and tributaries from confluence with Sevier River to Levan	5	Not Supporting	Temperature	3A	Low	2016	24
						Total Dissolved Solids	4	Low	1998	24

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Sevier River	UT16030003-018_00	Clear Creek-I70	Clear Creek and tributaries from confluence with Sevier River to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	120
						Temperature	3A	Low	2016	120
Sevier River	UT16030002-005_00	East Fork Sevier River-4	East Fork Sevier River and tributaries from confluence with Sevier River upstream to Antimony Creek confluence, excluding Otter Creek and tributaries	5	Not Supporting	Temperature	3A	Low	2006	27
					TMDL Approved	Total Phosphorus	3A		2000	27
Sevier River	UT16030002-009_00	East Fork Sevier-2	East Fork Sevier River and tributaries from Deer Creek confluence to Tropic Reservoir	5	Not Supporting	OE Bioassessment	3A	Low	2014	137
Sevier River	UT16030002-006_00	East Fork Sevier-3	East Fork Sevier River and tributaries from Antimony Creek confluence to Deer Creek confluence	5	Not Supporting	OE Bioassessment	3A	Low	2010	24
Sevier River	UT16030003-005_00	Lost Creek-1	Lost Creek and tributaries from confluence with Sevier River upstream approximately 6 miles	5	Not Supporting	Boron, Total	4	Low	2016	6
						Copper, Dissolved	3B	Low	2016	6
						Total Dissolved Solids	4	Low	2012	6
Sevier River	UT16030003-021_00	Manning Creek	Manning Creek and tributaries from confluence with Sevier River to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	20
Sevier River	UT16030002-002_00	Otter Creek-1	Otter Creek and tributaries from Otter Creek Reservoir to Koosharem Reservoir, except Box and Greenwich Creeks	5	Not Supporting	OE Bioassessment	3A	Low	2008	95
						pH	2B; 4; 3A	Low	2014	95
						Temperature	3A	Low	2008	95
Sevier River	UT16030002-001_00	Otter Creek-4	Otter Creek and tributaries from Koosharem Reservoir to headwaters	5	Not Supporting	E. coli	2B	Low	2016	24
						Temperature	3A	Low	2008	24
Sevier River	UT16030001-008_00	Panguitch Creek-1	Panguitch Creek and tributaries and all other tributaries to Panguitch Reservoir to headwaters	5	Not Supporting	Temperature	3A	Low	2014	26
Sevier River	UT16030003-027_00	Peterson Creek	Petersen Creek and tributaries from confluence with Sevier River to USFS boundary	5	Not Supporting	Copper, Dissolved	3B	Low	2016	8
						Total Dissolved Solids	4	Low	2016	8

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Sevier River	UT16030004-005_00	San Pitch-3	San Pitch River and tributaries from Gunnison Reservoir to U132 crossing and below USFS boundary	5	Not Supporting	E. coli	2B	Low	2016	67
						Total Ammonia	3C; 3D	Low	2016	67
					TMDL Approved	Total Dissolved Solids	4		1998	67
Sevier River	UT16030004-011_00	San Pitch-4	Silver Creek and tributaries from confluence with San Pitch to headwaters	5	Not Supporting	Total Dissolved Solids	4	Low	2014	14
Sevier River	UT16030004-009_00	San Pitch-5	San Pitch River and tributaries from U-132 to Pleasant Creek confluence, excluding Cedar Creek, Oak Creek, Pleasant Creek and Cottowood Creek	5	Not Supporting	E. coli	2B	Low	2016	71
Sevier River	UT16030001-012_00	Sevier River-1	Sevier River and tributaries from Long Canal to Mammoth Creek confluence	5	Not Supporting	Temperature	3A	Low	2008	35
Sevier River	UT16030001-007_00	Sevier River-2	Sevier River and east side tributaries from Horse Valley Bridge Diversion upstream to Long Canal	5	Not Supporting	OE Bioassessment	3A	Low	2014	53
					TMDL Approved	Sedimentation	3C		2002	53
						Total Phosphorus	3A		2002	53
Sevier River	UT16030005-025_00	Sevier River-20	Sevier River from U-132 crossing at the northern most point of the Sevier River (near Dog Valley Wash confluence) upstream to Yuba Dam	5	Not Supporting	OE Bioassessment	3B	Low	2008	37
Sevier River	UT16030005-027_00	Sevier River-24	Sevier River from Gunnison Bend Reservoir to DMAD Reservoir	5	Not Supporting	Total Dissolved Solids	4	Low	2016	17
					TMDL Approved	Sedimentation	3C		1998	17
						Total Phosphorus	3B		1998	17
Sevier River	UT16030003-017_00	Sevier River-6	Sevier River from Clear Creek confluence to HUC unit 1603003-1603001 boundary	5	Not Supporting	Temperature	3A	Low	2006	31
Sevier River	UT16030003-026_00	Sevier River-7	Sevier River east side tributaries from the Clear Creek confluence upstream to Manning Creek confluence	5	Not Supporting	pH	2B; 4; 3A	Low	2014	0
						Temperature	3A	Low	2014	0
Sevier River	UT16030004-003_00	Six Mile Creek - Sevier	Sixmile Creek and tributaries from confluence with San Pitch River to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2012	44
						Temperature	3A	Low	2012	44
Sevier River	UT16030001-014_00	Threemile Creek	Threemile Creek and other Sevier River west side tributaries from Horse Valley Diversion upstream to Long Canal, excluding Panquitch and Bear Creeks	5	Not Supporting	Temperature	3A	Low	2008	25
Sevier River	UT16030002-008_00	Antimony Creek	Antimony Creek and tributaries from confluence with Sevier River to headwaters	3	Insufficient Data*					28

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Sevier River	UT16030003-007_00	Beaver Creek-1 Sevier	Beaver Creek and other west side tributaries to Sevier River below USFS boundary from Clear Creek upstream to HUC boundary	3	Insufficient Data*					16
Sevier River	UT16030005-018_00	Chalk Creek-1	Chalk Creek and Pine Creek (Millard County) and tributaries from mouth to USFS boundary	3	Insufficient Data*					0
Sevier River	UT16030005-019_00	Chalk Creek2-Fillmore	Chalk Creek and Pine Creek (Millard County) and tributaries from USFS boundary to headwaters	3	Insufficient Data*					35
Sevier River	UT16030005-002_00	Cherry Creek	Cherry Creek and tributaries from mouth to headwaters	3	Insufficient Data*					0
Sevier River	UT16030005-011_00	Chicken Creek-3	Sevier River drainage streams south of Chicken Creek and above USFS boundary flowing towards Sevier River	3	Insufficient Data*					14
Sevier River	UT16030002-007_00	Deer Creek	Deer Creek and tributaries from confluence with East Fork Sevier River to headwaters	3	Insufficient Data*					18
Sevier River	UT16030001-010_00	Duck Creek	Duck Creek and tributaries from mouth to headwaters	3	Insufficient Data*					4
Sevier River	UT16030002-010_00	East Fork Sevier-1	East Fork Sevier River and tributaries from Tropic Reservoir to headwaters	3	Insufficient Data*					42
Sevier River	UT16030005-006_00	Fishlake National Forest-I15	Fishlake National Forest perennial streams located west of Interstate 15	3	Insufficient Data*					8
Sevier River	UT16030005-005_00	Fool Creek-1	Fool Creek and tributaries from mouth to USFS boundary	3	Insufficient Data*					0
Sevier River	UT16030005-013_00	Goose Creek-1	Goose Creek and tributaries from mouth to USFS boundary	3	Insufficient Data*					1
Sevier River	UT16030005-014_00	Goose Creek-2	Goose Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					1
Sevier River	UT16030005-001_00	Judd Creek	Judd Creek and tributaries from mouth to headwaters	3	Insufficient Data*					0
Sevier River	UT16030003-008_00	Lost Creek2-Salina	Lost Creek and tributaries from ~6 miles upstream to USFS boundary	3	Insufficient Data*					8
Sevier River	UT16030003-010_00	Lost Creek3-Salina	Lost Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					34
Sevier River	UT16030003-013_00	Monroe Creek	Sevier River east side tributaries above USFS boundary from Mill Creek-Water Creek area upstream to Durkee Creek	3	Insufficient Data*					80
Sevier River	UT16030004-006_00	Oak Creek-1	Oak Creek and Canal Creek and tributaries from Chester Ponds to USFS boundary	3	Insufficient Data*					15
Sevier River	UT16030005-004_00	Oak Creek-1	Oak Creek tributaries from mouth to USFS boundary (near Oak City)	3	Insufficient Data*					0
Sevier River	UT16030005-015_00	Pioneer Creek-1	Pioneer Creek and tributaries from mouth to USFS boundary	3	Insufficient Data*					0
Sevier River	UT16030005-016_00	Pioneer Creek-2	Pioneer Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					4
Sevier River	UT16030001-013_00	Piute	Piute Reservoir tributaries below USFS boundary and excluding Sevier River inlet	3	Insufficient Data*					3
Sevier River	UT16030001-001_00	Piute West	Piute Reservoir west side tributaries (City Creek) above USFS boundary and south of HUC boundary 16030003	3	Insufficient Data*					8
Sevier River	UT16030005-024_00	Round Valley Creek	Round Valley Creek from mouth upstream to Scipio Reservoir	3	Insufficient Data*					0
Sevier River	UT16030003-006_00	Salina Creek-2	Salina Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					158

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Sevier River	UT16030003-016_00	Sevier River-10	Sevier River east side tributaries below USFS boundary from Anabella Diversion upstream to Clear Creek confluence	3	Insufficient Data*					0
Sevier River	UT16030003-009_00	Sevier River-11	Sevier River west side tributaries from the Annabella Diversion upstream to Sevier River confluence with Clear Creek and below USFS boundary	3	Insufficient Data*					0
Sevier River	UT16030003-011_00	Sevier River-12	Sevier River west side tributaries from approximately due West of Salina Creek confluence upstream to Clear Creek confluence and above USFS boundary	3	Insufficient Data*					13
Sevier River	UT16030003-025_00	Sevier River-13	Sevier River west side tributaries from Rocky Ford Reservoir upstream to Annabella Diversion and below USFS boundary	3	Insufficient Data*					4
Sevier River	UT16030003-024_00	Sevier River-15	Sevier River form confluence with Salina Creek upstream to Rocky Ford Reservoir	3	Insufficient Data*					15
Sevier River	UT16030003-004_00	Sevier River-16	Sevier River east and west side tributaries from Salina Creek confluence to Rocky Ford Reservoir (excludes Lost Creek)	3	Insufficient Data*					1
Sevier River	UT16030003-023_00	Sevier River-18	Sevier River east side tributaries from Sevier Bridge Dam to Salina Creek confluence, excluding San Pitch River and waters above USFS boundary	3	Insufficient Data*					27
Sevier River	UT16030003-001_00	Sevier River-19	Sevier River west side tributaries from Sevier Bridge Dam to Salina Creek confluence	3	Insufficient Data*					1
Sevier River	UT16030005-007_00	Sevier River-21	Sevier River north side tributaries from DMAD Reservoir upstream to Sevier Bridge Reservoir (Yuba Dam) excluding Tanner Creek, Chicken Creek, their tributaries, and waters above USFS boundary	3	Insufficient Data*					9
Sevier River	UT16030005-017_00	Sevier River-23	Sevier River south side tributaries from Gunnison bend reservoir upstream to DMAD Reservoir	3	Insufficient Data*					2
Sevier River	UT16030005-029_00	Sevier River-26	Sevier River north side tributaries from Gunnison Bend Reservoir to DMAD Reservoir	3	Insufficient Data*					0
Sevier River	UT16030001-002_00	Sevier River-4	Sevier River and tributaries from Piute Reservoir to Circleville Irrigation Diversion, excluding East Fork Sevier River and tributaries	3	Insufficient Data*					18
Sevier River	UT16030003-022_00	Sevier River-5	Sevier River east side tributaries from Manning Creek confluence to HUC unit boundary	3	Insufficient Data*					13
Sevier River	UT16030003-015_00	Sevier River-8	Sevier River from Rocky Ford Reservoir upstream to Annabella Diversion	3	Insufficient Data*					31
Sevier River	UT16030003-019_00	Sevier River-9	Sevier River from Annabella Diversion to Clear Creek confluence	3	Insufficient Data*					12

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Sevier River	UT16030005-003_00	Tanner Creek	Tanner Creek and tributaries from mouth to headwaters	3	Insufficient Data*					0
Sevier River	UT16030003-002_00	Willow Creek - Axtell	Willow Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					16
Sevier River	UT16030005-020_00	Chicken Creek-1	Chicken Creek and tributaries from Levan to headwaters	2	No Evidence of Impairment					13
Sevier River	UT16030004-007_00	Ephraim Creek	Ephraim Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					16
Sevier River	UT16030005-012_00	Ivie Creek	Ivie Creek and tributaries from Scipio Dam to headwaters	2	No Evidence of Impairment					17
Sevier River	UT16030001-015_00	Mammoth Creek Upper	Mammoth Creek and tributaries from confluence with Mammoth Spring to headwaters	2	No Evidence of Impairment					22
Sevier River	UT16030005-023_00	Meadow Creek	Meadow Creek and tributaries from mouth to headwaters (Juab County)	2	No Evidence of Impairment					6
Sevier River	UT16030004-012_00	Oak Creek Upper	Oak Creek and tributaries from confluence with San Pitch River to headwaters (near Fairview)	2	No Evidence of Impairment					7
Sevier River	UT16030004-010_00	Oak Creek-2	Oak Creek and Canal Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					23
Sevier River	UT16030001-006_00	Panguitch Creek-2	Panguitch Creek and tributaries from confluence with Sevier River to Panguitch Reservoir	2	No Evidence of Impairment					39
Sevier River	UT16030004-008_00	Pleasant Creek	Pleasant Creek and tributaries from confluence with San Pitch River to headwaters	2	No Evidence of Impairment					58
Sevier River	UT16030003-014_00	Sevier River-14	Sevier River east side tributaries from Rocky Ford Reservoir upstream to Annabella Diversion and below USFS boundary	2	No Evidence of Impairment					9
Sevier River	UT16030004-004_00	South Creek	South Creek (Manti Creek) and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					34
Sevier River	UT16030004-002_00	Twelve Mile Creek	Twelvemile Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					72
Sevier River	UT16030001-011_00	Asay Creek	Asay Creek and tributaries from confluence with Sevier River to Headwaters	1	Supporting					47
Sevier River	UT16030003-020_00	Beaver Creek2-Piute	Beaver Creek and other west side tributaries to Sevier River above USFS boundary from Clear Creek upstream to HUC boundary	1	Supporting					56
Sevier River	UT16030005-021_00	Corn Creek	Corn Creek and tributaries from mouth to headwaters	1	Supporting					62
Sevier River	UT16030004-013_00	Cottonwood Creek-SP	Cottonwood Creek and tributaries from confluence with San Pitch River to headwaters	1	Supporting					11
Sevier River	UT16030005-028_00	Sevier River-25	Sevier River from Crafts Lake to Gunnison Bend Reservoir	1	Supporting					19
Sevier River	UT16030005-008_00	Sevier River-27	Sevier River south side tributaries from DMAD Reservoir upstream to Yuba Dam, excluding all waters above USFS boundary	1	Supporting					1

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Uinta Basin	UT14060003-003_00	Uinta River-1	Uinta River and tributaries from Duchesne River confluence upstream to Dry Gulch confluence	4A	TMDL Approved	Total Dissolved Solids	4		2016	6
Uinta Basin	UT14060003-004_00	Uinta River-2	Uinta River and tributaries from Dry Gulch confluence upstream to U.S. Highway 40	4A	TMDL Approved	Total Dissolved Solids	4		1998	7
Uinta Basin	UT14060003-005_00	Antelope Creek	Antelope Creek and tributaries from Duchesne River confluence to headwaters	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2014	34
						Boron, Total	4	Low	2008	34
						Selenium, Dissolved	3A	Low	2014	34
						Total Dissolved Solids	4	Low	1998	34
Uinta Basin	UT14060002-001_00	Ashley Creek Lower	Ashley Creek and tributaries from Green River confluence to Vernal sewage lagoons	5	Not Supporting	Selenium, Dissolved	4; 3B	Low	1992	8
						Total Dissolved Solids	4	Low	1992	8
Uinta Basin	UT14060002-007_00	Ashley Creek Upper	Ashley Creek and tributaries from Dry Fork confluence to headwaters (exclude Dry Fork)	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	71
Uinta Basin	UT14060004-005_00	Avintaquin Creek	Avintaquin Creek and tributaries from Strawberry River confluence to headwaters	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2008	52
Uinta Basin	UT14060002-006_00	Big Brush Creek	Big Brush Creek and tributaries from Red Fleet Reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	38
Uinta Basin	UT14040106-009_00	Birch Spring Draw	Birch Spring Draw and tributaries from Flaming Gorge Reservoir to headwaters	5	Not Supporting	Selenium, Dissolved	4; 3C	Low	2012	23
						Total Dissolved Solids	4	Low	2012	23
Uinta Basin	UT14050007-002_00	Bitter Creek Lower	Bitter Creek and tributaries from White River confluence to start of perennial stream (excluding Sweetwater Creek)	5	Not Supporting	Boron, Total	4	Low	2014	0
						Selenium, Dissolved	3A	Low	2014	0
						Temperature	3A	Low	2014	0
						Total Dissolved Solids	4	Low	2014	0
Uinta Basin	UT14050007-005_00	Bitter Creek Upper	Bitter Creek and tributaries from upper portion that is perennial	5	Not Supporting	Temperature	3A	Low	2014	28
						Total Dissolved Solids	4	Low	2014	28
Uinta Basin	UT14040107-001_00	Blacks Fork	Blacks Fork River and tributaries from Utah-Wyoming state line at Meeks Cabin Reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	180
						pH	2B; 4; 3A	Low	2014	180

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Uinta Basin	UT14060002-003_00	Brush Creek	Brush Creek and tributaries from confluence with Green River to Red Fleet Dam but excluding Little Brush Creek	5	Not Supporting	E. coli	2B	Low	2014	26
						Selenium, Dissolved	3B	Low	2004	26
Uinta Basin	UT14040106-014_00	Cart Creek	Cart Creek and tributaries from Flaming Gorge Reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	18
						Temperature	3A	Low	2016	18
Uinta Basin	UT14040106-010_00	Carter Creek	Carter Creek and tributaries from Flaming Gorge Reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	112
Uinta Basin	UT14060004-015_00	Currant Creek Upper	Currant Creek Reservoir tributaries	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	74
Uinta Basin	UT14060003-012_00	Deep Creek - Uinta	Deep Creek and tributaries from Uintah River confluence to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	28
Uinta Basin	UT14060001-003_00	Diamond Gulch	Diamond Gulch and tributaries from near Jones Hole Creek to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	33
Uinta Basin	UT14060003-009_00	Dry Gulch Creek	Dry Gulch Creek and tributaries from Duchesne River confluence to headwaters	5	Not Supporting	E. coli	2B	Low	2014	0
					TMDL Approved	Total Dissolved Solids	4		1998	0
Uinta Basin	UT14060003-001_00	Duchesne River-1	Duchesne River and tributaries from Green River confluence to Uinta River confluence	5	Not Supporting	E. coli	2B	Low	2014	17
					TMDL Approved	Total Dissolved Solids	4		1998	17
Uinta Basin	UT14060003-002_00	Duchesne River-2	Duchesne River and tributaries from confluence with Uinta River to Myton	5	Not Supporting	Boron, Total	4	Low	2016	31
						E. coli	2B	Low	2014	31
					TMDL Approved	Total Dissolved Solids	4		2016	31
Uinta Basin	UT14040107-005_00	East Fork Smiths Fork	East Fork Smiths Fork and tributaries from Utah-Wyoming state line to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	61
						Zinc, Dissolved	3A	Low	2014	61
Uinta Basin	UT14050007-003_00	Evacuation Creek	Evacuation Creek and tributaries from the confluence with White River to headwaters	5	Not Supporting	Boron, Total	4	Low	2014	0
						Selenium, Dissolved	3B	Low	2014	0
						Temperature	3B	Low	2014	0
						Total Dissolved Solids	4	Low	2008	0
Uinta Basin	UT14060001-004_00	Green River-2	Green River from Duchesne River confluence to Utah-Wyoming border	5	Not Supporting	Selenium, Dissolved	3B	Low	2014	100

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Uinta Basin	UT14060001-001_00	Green River-2 Tribs	Green River tributaries from Duchesne River confluence to Utah-Wyoming border, except Ashley, Brush, and Jones Hole Creeks	5	Not Supporting	E. coli	1C; 2A	Low	2014	13
Uinta Basin	UT14060004-002_00	Indian Canyon Creek	Indian Canyon Creek and tributaries from Strawberry River confluence to headwaters	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2008	48
						Boron, Total	4	Low	2008	48
						Selenium, Dissolved	3A	Low	2014	48
						Total Dissolved Solids	4	Low	1998	48
Uinta Basin	UT14060003-008_00	Lake Fork-1	Lake Fork River and tributaries from Duchesne River confluence to Pigeon Water Creek confluence	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	22
						Temperature	3A	Low	2000	22
					TMDL Approved	Total Dissolved Solids	4		2004	22
Uinta Basin	UT14060003-015_00	Lake Fork-2	Lake Fork River and tributaries from Pigeon Water Creek confluence to Yellowstone River confluence (includes Pigeon Water Creek and Yellowstone River to USFS boundary)	5	Not Supporting	Zinc, Dissolved	3A	Low	2014	34
Uinta Basin	UT14060002-005_00	Little Brush Creek Upper	Little Brush Creek and tributaries from mouth of Little Brush Creek Gorge to headwaters	5	Not Supporting	Aluminum, Dissolved	3B	Low	2014	36
Uinta Basin	UT14060002-002_00	Middle Ashley Creek	Ashley Creek and tributaries from Vernal sewage lagoons to Dry Fork confluence	5	Not Supporting	Aluminum, Dissolved	3B	Low	2014	18
						Selenium, Dissolved	3B	Low	2008	18
						Total Dissolved Solids	4	Low	2008	18
Uinta Basin	UT14040106-004_00	Middle Fork Beaver Creek	Middle Fork Beaver Creek and tributaries from Utah-Wyoming state line to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	33
Uinta Basin	UT14060003-021_00	Moon Lake Tributaries	Moon Lake tributaries	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	150
Uinta Basin	UT14060005-003_00	Ninemile	Ninemile Creek and tributaries from Green River confluence to headwaters	5	Not Supporting	Temperature	3A	High	1998	157
Uinta Basin	UT14060003-019_00	North Fork Duchesne	North Fork Duchesne River and tributaries from Duchesne River confluence to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	65

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Uinta Basin	UT14060005-002_00	Pariette Draw Creek	Pariette Draw Creek and tributaries from Green River confluence to headwaters	5	Not Supporting	Temperature	3B	Low	2014	59
Uinta Basin	UT14060005-002_00	Pariette Draw Creek	Pariette Draw Creek and tributaries from Green River confluence to headwaters	5	TMDL Approved	Boron, Total	4		1998	59
						Selenium, Dissolved	3B; 3D		1998	59
						Total Dissolved Solids	4		1998	59
Uinta Basin	UT14040106-021_00	Pot Creek	Pot Creek and tributaries from Crouse reservoir to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	26
						Dissolved Oxygen	3A	Low	2014	26
						Iron, Dissolved	3A	Low	2014	26
						Temperature	3A	Low	2014	26
Uinta Basin	UT14060005-004_00	Range Creek Upper	Range Creek and tributaries from Range Creek Pumping Station to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2016	6
Uinta Basin	UT14060003-020_00	Rock Creek Upper	Rock Creek and tributaries from USFS boundary to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	104
Uinta Basin	UT14060004-001_00	Strawberry River-1	Strawberry River from confluence with Duchesne River to Starvation Dam	5	Not Supporting	pH	1C; 2B; 4; 3A	Low	2016	7
Uinta Basin	UT14060004-010_00	Strawberry River-3	Strawberry River and tributaries, except Willow Creek and Timber Canyon, from Avintaquin Creek confluence to Strawberry Reservoir	5	Not Supporting	OE Bioassessment	3A	Low	2014	23
Uinta Basin	UT14060004-013_00	Strawberry-4	Strawberry Reservoir tributaries other than Strawberry River	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	130
						pH	1C; 2B; 4; 3A	Low	2014	130
Uinta Basin	UT14060004-011_00	Timber Canyon Creek	Timber Canyon Creek and tributaries from confluence with Strawberry River to headwaters	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2014	17
Uinta Basin	UT14060003-024_00	Uinta River-4	Uinta River and tributaries from USFS boundary to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	96
						pH	2B; 4; 3A	Low	2014	96
						Zinc, Dissolved	3A	Low	2014	96
Uinta Basin	UT14040106-003_00	West Fork Beaver Creek	West Fork Beaver Creek and tributaries from Utah-Wyoming state line to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	24
Uinta Basin	UT14060003-011_00	Whiterocks River Lower	Whiterocks River and tributaries from confluence with Uintah River to Tridell Water Treatment Plant	5	Not Supporting	Aluminum, Dissolved	3A	Low	2014	30
Uinta Basin	UT14060006-001_00	Willow Creek	Willow Creek and tributaries from Geen River confluence to Meadow Creek confluence (excluding Hill Creek)	5	Not Supporting	Boron, Total	4	Low	2014	75
Uinta Basin	UT14040106-027_00	Beaver Creek	Beaver Creek and tributaries (east of Willow Creek near 3 corners) from Colorado-Utah state line to Utah-Colorado state line	3	Insufficient Data*					2

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Uinta Basin	UT14040106-006_00	Birch Creek-tribs	Birch Creek tributaries Utah-Wyoming state line to headwaters	3	Insufficient Data*					15
Uinta Basin	UT14060004-009_00	Currant Creek Lower	Current Creek and tributaries from Red Creek confluence to Current Creek Reservoir	3	Insufficient Data*					71
Uinta Basin	UT14040106-016_00	Davenport Creek	Davenport Creek and tributaries from Green River confluence to headwaters	3	Insufficient Data*					4
Uinta Basin	UT14060002-009_00	Dry Fork Creek Upper	Dry Fork and tributaries from U.S. Forest Service boundary to headwaters	3	Insufficient Data*					48
Uinta Basin	UT14060003-017_00	Duchesne River-4	Duchesne River and tributaries from Strawberry River confluence to West Fork Duchesne River confluence, excluding Rock Creek	3	Insufficient Data*					78
Uinta Basin	UT14040106-011_00	Eagle Creek	Eagle Creek and tributaries from Flaming Gorge Reservoir to headwaters	3	Insufficient Data*					9
Uinta Basin	UT14040106-012_00	Flaming Gorge Tributaries	Flaming Gorge Reservoir tributaries not defined separately	3	Insufficient Data*					12
Uinta Basin	UT14060005-007_00	Florence Creek	Florence Creek and tributaries from Green River confluence to headwaters	3	Insufficient Data*					34
Uinta Basin	UT14040106-017_00	Goslin Creek	Goslin Creek and tributaries from Green River confluence to headwaters	3	Insufficient Data*					4
Uinta Basin	UT14060005-009_00	Green River-3	Green River from Price River confluence to Duchesne River confluence (Green River in HUC 14060005)	3	Insufficient Data*					111
Uinta Basin	UT14060005-001_00	Green River-3 Tribs	Green River tributaries from Price River to Duchesne River (HUC 14060005) not spefically defined	3	Insufficient Data*					138
Uinta Basin	UT14040106-002_00	Henrys Fork River	Henrys Fork River and tributaries from Utah-Wyoming state line to headwaters	3	Insufficient Data*					60
Uinta Basin	UT14060006-003_00	Hill Creek	Hill Creek and tributaries from Willow Creek confluence to headwaters	3	Insufficient Data*					82
Uinta Basin	UT14040106-020_00	Jackson Creek	Jackson Creek and tributaries from Green River confluence to headwaters	3	Insufficient Data*					11
Uinta Basin	UT14060001-002_00	Jones Hole Creek	Jones Hole Creek and tributaries from confluence with Green River to headwaters	3	Insufficient Data*					6
Uinta Basin	UT14060003-022_00	Lake Fork-3	Lake Fork River and tributaries from Yellowstone River confluence to Moon Lake	3	Insufficient Data*					30
Uinta Basin	UT14040106-025_00	O-Wi-Yu-Kuts Creek	O-Wi-Yu-Kuts Creek and tributaries from Willow Creek confluence to Utah-Colorado state line	3	Insufficient Data*					2
Uinta Basin	UT14060003-014_00	Pole Creek	Pole and Farm Creeks and their tributaries from their Uinta River confluence to headwaters, and Cart Hollow above USFS boundary	3	Insufficient Data*					35
Uinta Basin	UT14040106-023_00	Pot Creek Lower	Pot Creek from Utah-Colorado state line to Crouse Reservoir outlet	3	Insufficient Data*					0
Uinta Basin	UT14060005-006_00	Range Creek Lower	Range Creek and tributaries from confluence with Green River to ranch diversion	3	Insufficient Data*					9
Uinta Basin	UT14060004-007_00	Red Creek Middle	Red Creek and tributaries from Current Creek confluence to Red Creek Reservoir	3	Insufficient Data*					20
Uinta Basin	UT14060004-008_00	Red Creek Upper	Red Creek Reservoir tributaries	3	Insufficient Data*					21

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Uinta Basin	UT14060005-008_00	Rock Creek	Rock Creek from Green River confluence to headwaters	3	Insufficient Data*					28
Uinta Basin	UT14060003-016_00	Rock Creek Lower	Rock Creek and tributaries from confluence with Duchesne River to USFS boundary	3	Insufficient Data*					29
Uinta Basin	UT14040106-007_00	Sheep Creek	Sheep Creek and tributaries from Flaming Gorge Reservoir to headwaters	3	Insufficient Data*					123
Uinta Basin	UT14040106-013_00	Spring Creek	Spring Creek and tributaries from Flaming Gorge Reservoir to Utah-Wyoming state line	3	Insufficient Data*					5
Uinta Basin	UT14060004-004_00	Stawberry River-2	Strawberry River and tributaries from Starvation Reservoir to Avintaquin Creek confluence, excluding Red Creek and tributaries	3	Insufficient Data*					24
Uinta Basin	UT14050007-004_00	Sweetwater Creek	Sweetwater Creek and tributaries from Bitter Creek confluence to headwaters	3	Insufficient Data*					4
Uinta Basin	UT14040106-026_00	Tolivers Creek	Tolivers Creek from confluence with Green River to headwaters	3	Insufficient Data*					4
Uinta Basin	UT14060003-010_00	Uinta River-3	Uinta River and tributaries from U.S. Highway 40 to USFS boundary, excluding all of Whiterocks River and Farm, Pole, and Deep Creeks	3	Insufficient Data*					76
Uinta Basin	UT14060003-018_00	West Fork Duchesne	West Fork Duchesne River and tributaries from confluence with Duchesne River to headwaters	3	Insufficient Data*					90
Uinta Basin	UT14040108-001_00	West Muddy Creek	West Muddy Creek and tributaries from Utah-Wyoming state line to headwaters	3	Insufficient Data*					3
Uinta Basin	UT14050007-001_00	White River	White River from confluence with Green River to Utah-Colorado state line	3	Insufficient Data*					71
Uinta Basin	UT14060003-013_00	Whiterocks River Upper	Whiterocks River and tributaries from Tridell Water Treatment Plant to headwaters	3	Insufficient Data*					93
Uinta Basin	UT14060003-023_00	Yellowstone Upper	Yellowstone River and tributaries from USFS boundary to headwaters	3	Insufficient Data*					126
Uinta Basin	UT14060003-007_00	Zimmerman Wash	Zimmerman Wash from confluence with Lake Fork River to headwaters	3	Insufficient Data*					0
Uinta Basin	UT14040107-002_00	Archie Creek	Archie Creek and tributaries from Utah-Wyoming state line to headwaters	2	No Evidence of Impairment					4

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Uinta Basin	UT14040106-001_00	Dahlgreen Creek	Dahlgreen Creek and tributaries from Utah-Wyoming state line to headwaters	2	No Evidence of Impairment					0
Uinta Basin	UT14060003-006_00	Duchesne River-3	Duchesne River from Myton to Strawberry River confluence	2	No Evidence of Impairment					44
Uinta Basin	UT14040107-004_00	Gilbert Creek	Gilbert Creek and tributaries from Utah-Wyoming state line to headwaters	2	No Evidence of Impairment					7
Uinta Basin	UT14040106-015_00	Gorge Creek	Gorge Creek and tributaries from Green River confluence to headwaters	2	No Evidence of Impairment					8
Uinta Basin	UT14040106-019_00	Green River-1	Green River from Utah-Colorado state line to Flaming Gorge Reservoir	2	No Evidence of Impairment					30
Uinta Basin	UT14060005-005_00	Range Creek Middle	Range Creek and tributaries from ranch diversion to Range Creek Pumping Station	2	No Evidence of Impairment					27
Uinta Basin	UT14060004-006_00	Red Creek Lower	Red Creek and tributaries from Strawberry River confluence to Currant Creek Confluence	2	No Evidence of Impairment					6
Uinta Basin	UT14040106-022_00	Sears Creek	Sears Creek and tributaries from Green River confluence to headwaters	2	No Evidence of Impairment					7
Uinta Basin	UT14060004-003_00	Starvation Tributaries	Starvation Reservoir tributaries except Strawberry River	2	No Evidence of Impairment					0
Uinta Basin	UT14060004-014_00	Strawberry River Upper	Strawberry River and tributaries from Strawberry Reservoir to headwaters	2	No Evidence of Impairment					63
Uinta Basin	UT14040107-003_00	West Fork Smiths Fork	West Fork Smiths Fork and tributaries from Utah-Wyoming state line to headwaters	2	No Evidence of Impairment					19
Uinta Basin	UT14040106-024_00	Willow Creek - Daggett	Willow Creek and tributaries from confluence with Green River to headwaters (Dagget Co.)	2	No Evidence of Impairment					17
Uinta Basin	UT14060006-002_00	Willow Creek Upper	Willow Creek and tributaries from, and including, Meadow Creek confluence to headwaters	2	No Evidence of Impairment					161
Uinta Basin	UT14040106-005_00	Burnt Fork Creek	Burnt Fork Creek and tributaries from Utah-Wyoming state line to headwaters	1	Supporting					44
Uinta Basin	UT14060002-008_00	Dry Fork Creek Lower	Dry Fork and tributaries from confluence with Ashley Creek to USFS boundary	1	Supporting					7
Uinta Basin	UT14040106-008_00	Green River-1 Tribs	Green River perennial tributaries to Green River-1 (UT14040106-019) not specifially defined	1	Supporting					27
Uinta Basin	UT14060002-004_00	Little Brush Creek Lower	Little Brush Creek and tributaries from Big Brush Creek confluence to mouth of Little Brush Creek Gorge	1	Supporting					8
Uinta Basin	UT14040106-018_00	Red Creek	Red Creek and tributaries from Green River confluence to headwaters	1	Supporting					16
Uinta Basin	UT14060004-012_00	Willow Creek - Wasatch	Willow Creek and tributaries from confluence with Strawberry River to headwaters	1	Supporting					16

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Weber River	UT16020101-016_00	Chalk Creek-4	Chalk Creek and tributaries from East Fork Chalk Creek confluence to headwaters	4A	TMDL Approved	Sedimentation	3A		1998	55
						Total Phosphorus	3A		1998	55
Weber River	UT16020101-013_00	Huff Creek	Huff Creek and tributaries from confluence with Chalk Creek to headwaters	4A	TMDL Approved	Sedimentation	3A		1998	21
						Total Phosphorus	3A		1998	21
Weber River	UT16020101-011_00	South Fork Chalk Creek	South Fork Chalk Creek and tributaries from confluence with Chalk Creek to headwaters	4A	TMDL Approved	Sedimentation	3A		1998	54
						Total Phosphorus	3A		1998	54
Weber River	UT16020102-043_00	Barnard Creek	Barnard Creek and tributaries from US 89 to headwaters	5	Not Supporting	Copper, Dissolved	3A	Low	2014	2
						Dissolved Oxygen	3A	Low	2014	2
						E. coli	2B	Low	2016	2
Weber River	UT16020101-010_00	Chalk Creek1-Coalville	Chalk Creek and tributaries from confluence with Weber River to South Fork confluence	5	Not Supporting	OE Bioassessment	3A	Low	2008	8
Weber River	UT16020101-014_00	Chalk Creek3-Coalville	Chalk Creek and tributaries from Huff	5	Non-Pollutant	Habitat	3A		1998	17
					Not Supporting	pH	1C; 2B; 4; 3A	Low	2014	17
					TMDL Approved	Sedimentation	3A		1998	17
						Total Phosphorus	3A		1998	17
Weber River	UT16020102-026_00	East Canyon Creek-2	East Canyon Creek and tributaries from East Canyon Reservoir to headwaters	5	Not Supporting	OE Bioassessment	3A	Low	2008	44
						Temperature	3A	Low	2014	44
						Total Dissolved Solids	4	Low	2014	44
					TMDL Approved	Total Phosphorus	3A		1992	44
Weber River	UT16020101-015_00	East Fork Chalk Creek	East Fork Chalk Creek and tributaries from confluence with Chalk Creek to headwaters	5	Not Supporting	pH	1C; 2B; 4; 3A	Low	2012	35
Weber River	UT16020101-007_00	Echo Creek	Echo Creek and tributaries from confluence with Weber River to headwaters, excluding Sawmill Creek	5	Not Supporting	Total Dissolved Solids	4	Low	2014	45
					TMDL Approved	Sedimentation	3A		1998	45

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Weber River	UT16020102-039_00	Farmington Creek-1	Farmington Creek and tributaries from Farmington Bay to USFS boundary	5	Not Supporting	Copper, Dissolved	3B	Low	2014	0
						E. coli	2B	Low	2014	0
Weber River	UT16020102-038_00	Farmington Creek-2	Farmington Creek and tributaries from USFS boundary to headwaters	5	Not Supporting	Aluminum, Dissolved	3A	Low	2016	20
						Copper, Dissolved	3A	Low	2014	20
Weber River	UT16020102-023_00	Hardscrabble Creek	Hardscrabble Creek and tributaries from confluence with East Canyon Creek to headwaters	5	Not Supporting	Temperature	3A	Low	2012	28
Weber River	UT16020102-035_00	Holmes Creek-1	Holmes Creek and tributaries from Farmington Bay to USFS boundary	5	Not Supporting	Copper, Dissolved	3B	Low	2014	10
						E. coli	2B	Low	2014	10
Weber River	UT16020102-034_00	Holmes Creek-2	Holmes Creek and tributaries from USFS boundary to headwaters	5	Not Supporting	Copper, Dissolved	3A	Low	2016	6
Weber River	UT16020102-031_00	Kays Creek	Kays Creek and tributaries from Farmington Bay to USFS boundary	5	Not Supporting	Copper, Dissolved	3B	Low	2016	7
						E. coli	2B	Low	2014	7
Weber River	UT16020102-027_00	Kimball Creek	Kimball Creek and tributaries from East Canyon Creek confluence to headwaters, including McLeod Creek	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2014	14
						OE Bioassessment	3A	Low	2008	14
Weber River	UT16020102-009_00	Middle Fork Ogden River	Middle Fork Ogden River and tributaries from Pineview Reservoir to headwaters	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	31
Weber River	UT16020102-050_00	Mill Creek1-Davis	Mill Creek from Great Salt Lake to Mueller Park at USFS boundary	5	Not Supporting	Copper, Dissolved	3B	Low	2014	0
						Total Dissolved Solids	4	Low	2014	0
Weber River	UT16020102-049_00	Mill Creek2-Davis	Mill Creek and tributaries from Mueller Park at USFS boundary to headwaters	5	Not Supporting	Copper, Dissolved	3A	Low	2014	7
Weber River	UT16020102-044_00	Parrish Creek	Parrish and Duel Creeks and their tributaries from Davis Aqueduct to headwaters	5	Not Supporting	Copper, Dissolved	3A	Low	2014	9
Weber River	UT16020101-020_00	Silver Creek	Silver Creek and tributaries from confluence with Weber River to headwaters	5	Not Supporting	Arsenic, Dissolved	1C; HH1C	Low	2006	39
						Dissolved Oxygen	3A	Low	2014	39
						Nitrate as N, Total	1C	Low	2014	39
						OE Bioassessment	3A	Low	2008	39
						pH	1C; 2B; 4; 3A	Low	2014	39
						Total Dissolved Solids	4	Low	2010	39
					TMDL Approved	Cadmium, Dissolved	1C; 4; 3A; HH1C; HH3A		1998	39
						Zinc, Dissolved	3A		1998	39
Weber River	UT16020102-032_00	South and Middle Fork Kays Creek	Kays Creek South Fork and Middle Fork and their tributaries from USFS Boundary to headwaters	5	Not Supporting	Copper, Dissolved	3A	Low	2014	2

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Weber River	UT16020102-046_00	Stone Creek-1	Stone Creek from Great Salt Lake to USFS boundary	5	Not Supporting	Copper, Dissolved	3A	Low	2014	0
						E. coli	2B	Low	2016	0
						pH	2B; 4; 3A	Low	2016	0
						Temperature	3A	Low	2014	0
Weber River	UT16020102-045_00	Stone Creek-2	Stone Creek and tributaries from USFS boundary to headwaters	5	Not Supporting	Copper, Dissolved	3A	Low	2014	5
Weber River	UT16020102-001_00	Weber River-1	Weber River and tributaries from Great Salt Lake to Slaterville Diversion	5	Not Supporting	OE Bioassessment	3C; 3D	Low	2008	109
						Total Ammonia	3C; 3D	Low	2014	109
Weber River	UT16020102-002_00	Weber River-3	Weber River from Ogden River confluence to Cottonwood Creek confluence	5	Not Supporting	OE Bioassessment	3A	Low	2008	20
Weber River	UT16020102-022_00	Weber River-6	Weber River between East Canyon Creek confluence and Lost Creek confluence	5	Not Supporting	OE Bioassessment	3A	Low	2008	13
Weber River	UT16020101-004_00	Weber River-7	Weber River segment between confluence of Lost Creek and Echo Reservoir	5	Not Supporting	OE Bioassessment	3A	Low	2008	11
						Total Phosphorus	3A	Low	2008	11
Weber River	UT16020101-017_00	Weber River-8	Weber River from Echo Reservoir to Rockport Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	11
Weber River	UT16020102-053_00	Baer Creek-1	Baer Creek and tributaries from Farmington Bay to Interstate 15	3	Insufficient Data*					0
Weber River	UT16020102-051_00	Baer Creek-2	Baer Creek and tributaries from Interstate 15 to US 89	3	Insufficient Data*					0
Weber River	UT16020102-036_00	Baer Creek-3	Baer Creek and tributaries from US 89 to headwaters	3	Insufficient Data*					3
Weber River	UT16020102-047_00	Barton Creek	Barton Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					3
Weber River	UT16020101-029_00	Beaver Creek-1	Beaver Creek and tributaries from confluence with Weber River to Kamas	3	Insufficient Data*					16
Weber River	UT16020101-030_00	Beaver Creek2-Kamas	Beaver Creek and tributaries from Kamas to headwaters	3	Insufficient Data*					23
Weber River	UT16020102-014_00	Burch Creek-1	Burch Creek and tributaries from confluence with Weber River to Harrison Blvd	3	Insufficient Data*					3
Weber River	UT16020102-004_00	Burch Creek-2	Burch Creek and tributaries from Harrison Blvd to headwaters	3	Insufficient Data*					4
Weber River	UT16020101-012_00	Chalk Creek-2	Chalk Creek and tributaries from South Fork confluence to Huff Creek confluence	3	Insufficient Data*					6
Weber River	UT16020102-056_00	Corbett Creek	Corbett Creek and tributaries from U.S. Highway 89 to headwaters	3	Insufficient Data*					0
Weber River	UT16020102-018_00	Cottonwood Creek	Cottonwood Creek and tributaries from confluence with Weber River to headwaters	3	Insufficient Data*					8
Weber River	UT16020102-041_00	Davis Creek	Davis and Lone Pine Creeks and tributaries from US 89 to headwaters	3	Insufficient Data*					0

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** Phase II of TMDL in Progress.
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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Weber River	UT16020102-025_00	East Canyon Creek-3	East Canyon Reservoir tributaries other than East Canyon Creek	3	Insufficient Data*					3
Weber River	UT16020101-002_00	Francis Creek	Francis Creek and tributaries from Lost Creek Reservoir to headwaters	3	Insufficient Data*					8
Weber River	UT16020101-009_00	Grass Creek	Grass Creek and tributaries from confluence with Echo Reservoir to headwaters	3	Insufficient Data*					8
Weber River	UT16020101-001_00	Lost Creek1-Croydon	Lost Creek and tributaries from confluence with Weber River to Lost Creek Reservoir	3	Insufficient Data*					26
Weber River	UT16020101-003_00	Lost Creek2-Croydon	Lost Creek and tributaries from Lost Creek Reservoir to headwaters	3	Insufficient Data*					57
Weber River	UT16020102-006_00	North Fork Ogden River	North Fork Ogden River and tributaries from Pineview Reservoir to headwaters	3	Insufficient Data*					51
Weber River	UT16020102-042_00	Ricks Creek	Ricks Creek and tributaries from Interstate 15 to headwaters	3	Insufficient Data*					2
Weber River	UT16020102-052_00	Rudd Creek	Rudd Creek and tributaries from Davis Aqueduct to headwaters	3	Insufficient Data*					0
Weber River	UT16020102-037_00	Shepard Creek	Sheppard Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					0
Weber River	UT16020101-027_00	Smith Morehouse River-2	Smith Morehouse River and tributaries from Smith Morehouse Reservoir to headwaters	3	Insufficient Data*					14
Weber River	UT16020102-033_00	Snow Creek	Snow Creek and tributaries	3	Insufficient Data*					0
Weber River	UT16020102-012_00	South Fork Ogden River	South Fork Ogden River and tributaries from Causey Reservoir to headwaters	3	Insufficient Data*					38
Weber River	UT16020102-015_00	Spring Creek	Spring Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					2
Weber River	UT16020102-040_00	Steed Creek	Steed Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					0
Weber River	UT16020102-013_00	Strong Canyons Creek	Strongs Canyon Creek and tributaries from USFS boundary to headwaters	3	Insufficient Data*					1
Weber River	UT16020102-057_00	Unknown	Unknown	3	Insufficient Data*					0
Weber River	UT16020102-017_00	Weber Lower Tributaries-1	Weber River north side tributaries from Ogden River confluence to Cottonwood Creek confluence, excluding defined tributaries	3	Insufficient Data*					25
Weber River	UT16020102-016_00	Weber Lower Tributaries-2	Weber River south side tributaries from mouth of Weber Canyon to Cottonwood Creek	3	Insufficient Data*					0
Weber River	UT16020102-021_00	Weber Lower Tributaries-3	Weber River west side tributaries from Cottonwood Creek to Stoddard Diversion	3	Insufficient Data*					23
Weber River	UT16020102-019_00	Weber Lower Tributaries-4	Weber River east side tributaries from Cottonwood Creek to Stoddard Diversion	3	Insufficient Data*					3
Weber River	UT16020102-054_00	Weber Lower Tributaries-6	Weber River east side tributaries from Stoddard Diversion to East Canyon Creek	3	Insufficient Data*					0
Weber River	UT16020102-028_00	Weber Lower Tributaries-7	Weber River north side tributaries between East Canyon Creek and Lost Creek	3	Insufficient Data*					0

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Weber River	UT16020102-029_00	Weber Lower Tributaries-8	Weber River south side tributaries between East Canyon Creek and Lost Creek	3	Insufficient Data*					0
Weber River	UT16020101-028_00	Weber River-12	Weber River and tributaries from Holiday Park to headwaters	3	Insufficient Data*					28
Weber River	UT16020102-020_00	Weber River-4	Weber River from Cottonwood Creek confluence to Stoddard Diversion	3	Insufficient Data*					10
Weber River	UT16020102-048_00	Weber River-5	Weber River from Stoddard Diversion to East Canyon Creek confluence	3	Insufficient Data*					1
Weber River	UT16020101-006_00	Weber Upper Tributaries-1	Weber River east side tributaries from Lost Creek confluence to Echo Creek	3	Insufficient Data*					0
Weber River	UT16020101-018_00	Weber Upper Tributaries-2	Weber River west side tributaries between Echo Reservoir and Silver Creek confluence	3	Insufficient Data*					0
Weber River	UT16020101-019_00	Weber Upper Tributaries-3	Weber River east side tributaries between Echo Reservoir and Fort Creek confluence	3	Insufficient Data*					23
Weber River	UT16020101-021_00	Weber Upper Tributaries-4	Weber River west side tributaries between Silver Creek confluence and Beaver Creek confluence	3	Insufficient Data*					10
Weber River	UT16020101-008_00	Carruth Creek	Carruth and Lewis Canyon Creeks and tributaries from confluence with Echo Reservoir to headwaters	2	No Evidence of Impairment					8
Weber River	UT16020102-024_00	East Canyon Creek-1	East Canyon Creek from confluence with Weber River to East Canyon Dam	2	No Evidence of Impairment					26
Weber River	UT16020101-022_00	Fort Creek	Fort Creek and tributaries from confluence with Weber River to headwaters	2	No Evidence of Impairment					11
Weber River	UT16020102-003_00	Four Mile Creek	Fourmile Creek and tributaries from confluence with Weber River to headwaters	2	No Evidence of Impairment					8
Weber River	UT16020101-005_00	Main Canyon	Main Canyon Creek and other tributaries to Weber River	2	No Evidence of Impairment					13
Weber River	UT16020102-030_00	North Fork Kays Creek	North Fork Kays Creek and tributaries from USFS boundary to headwaters	2	No Evidence of Impairment					1
Weber River	UT16020101-031_00	Sawmill Creek	Sawmill Creek and tributaries from confluence with Echo Creek to headwaters	2	No Evidence of Impairment					3
Weber River	UT16020101-026_00	Smith Morehouse River-1	Smith Morehouse River from confluence with Weber River to Smith Morehouse Reservoir	2	No Evidence of Impairment					9
Weber River	UT16020102-055_00	Weber Lower Tributaries-5	Weber River west side tributaries from Stoddard Diversion to East Canyon Creek	2	No Evidence of Impairment					27
Weber River	UT16020101-024_00	Weber River-10	Weber River and tributaries from Provo Canal Diversion to Smith-Morehouse confluence	2	No Evidence of Impairment					51
Weber River	UT16020101-025_00	Weber River-11	Weber River and tributaries from Smith Morehouse confluence to Holiday Park	2	No Evidence of Impairment					39
Weber River	UT16020102-007_00	Weber River-2	Weber River from Slaterville Diversion to Ogden River confluence	2	No Evidence of Impairment					0
Weber River	UT16020101-023_00	Weber River-9	Weber River from Rockport Reservoir to Weber-Provo Canal	2	No Evidence of Impairment					26
Weber River	UT16020102-008_00	Wheeler Creek	Wheeler Creek and tributaries from confluence with Ogden River to headwaters	2	No Evidence of Impairment					14
Weber River	UT16020102-011_00	Beaver Creek-Weber	Beaver Creek and tributaries from South Fork Ogden River confluence to headwaters	1	Supporting					20

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** Phase II of TMDL in Progress.
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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
Weber River	UT16020102-005_00	Ogden River-1	Ogden River from confluence with Weber River to Pineview Reservoir	1	Supporting					10
Weber River	UT16020102-010_00	South Fork Ogden River-1	South Fork Ogden River and tributaries from Pineview Reservoir to Causey Reservoir	1	Supporting					16

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
West Desert/Columbia	UT16020309-002_00	Blue Creek		5	Not Supporting	Aluminum, Dissolved	3D	Low	2012	6
						pH	2B; 4; 3D	Low	2012	6
						Selenium, Dissolved	3D	Low	2012	6
						Total Dissolved Solids	4	Low	2012	6
West Desert/Columbia	UT16020304-002_00	Faust Creek	Faust Creek and tributaries, Tooele County	5	Not Supporting	Temperature	3A	Low	2016	14
West Desert/Columbia	UT16020304-001_00	Vernon Creek	Vernon Creek and tributaries, Tooele County	5	Not Supporting	pH	2B; 4; 3A	Low	2014	13
West Desert/Columbia	UT16020306-004_00	Basin Creek	Basin Creek and tributaries, Juab and Tooele Counties	3	Insufficient Data*					7
West Desert/Columbia	UT16020308-002_00	Bettridge Creek	Bettridge Creek and tributaries from irrigation diversion to Utah-Nevada state line	3	Insufficient Data*					2
West Desert/Columbia	UT16020308-008_00	Birch Creek	Birch Creek and tributaries from mouth to headwaters, Box Elder County	3	Insufficient Data*					9
West Desert/Columbia	UT17040210-006_00	Clear Creek-Sawtooth NF		3	Insufficient Data*					19
West Desert/Columbia	UT16020304-009_00	Clover Creek		3	Insufficient Data*					4
West Desert/Columbia	UT16020308-009_00	Cottonwood Creek	Cottonwood Creek and tributaries from mouth to headwaters, Box Elder County	3	Insufficient Data*					4
West Desert/Columbia	UT16020309-001_00	Deep Creek	Deep Creek and tributaries from Utah-Idaho state line to Rose Ranch Reservoir, Box Elder County	3	Insufficient Data*					9
West Desert/Columbia	UT16020308-001_00	Donner Creek	Donner Creek and tributaries from irrigation diversion to Utah-Nevada state line	3	Insufficient Data*					1
West Desert/Columbia	UT17040211-001_00	Goose Creek	Goose Creek and tributaries from Utah-Idaho state line to headwaters	3	Insufficient Data*					8
West Desert/Columbia	UT16020301-002_00	Hamlin Valley Wash		3	Insufficient Data*					3
West Desert/Columbia	UT17040210-005_00	Holt Creek	Holt Creek from Utah-Idaho state line to headwaters	3	Insufficient Data*					2
West Desert/Columbia	UT17040210-004_00	Johnson Creek - WD/C	Johnson Creek and tributaries from Utah-Idaho state line to headwaters	3	Insufficient Data*					23
West Desert/Columbia	UT17040210-002_00	Junction Creek	Junction Creek and tributaries from confluence with South Junction Creek to headwaters	3	Insufficient Data*					10
West Desert/Columbia	UT16020301-001_00	Lake Creek-Millard Co		3	Insufficient Data*					20
West Desert/Columbia	UT16020304-007_00	Middle Canyon	Middle Canyon Creek and tributaries, Tooele County	3	Insufficient Data*					2
West Desert/Columbia	UT16020308-010_00	Muddy Creek	Muddy Creek and tributaries from mouth to headwaters, Box Elder County	3	Insufficient Data*					7
West Desert/Columbia	UT16020304-003_00	North Willow Creek	North Willow Creek and tributaries, Tooele County	3	Insufficient Data*					4
West Desert/Columbia	UT16020304-004_00	Ophir Creek	Ophir Creek and tributaries, Tooele County	3	Insufficient Data*					10
West Desert/Columbia	UT16020308-004_00	Pine Creek	Pine Creek and tributaries, Box Elder County	3	Insufficient Data*					18

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Perennial Stream Miles
West Desert/Columbia	UT16020308-003_00	Red Butte Creek	Red Butte Creek and tributaries from confluence with Grouse Creek to headwaters	3	Insufficient Data*					11
West Desert/Columbia	UT16020304-006_00	Settlement Canyon Creek	Settlement Canyon Creek and tributaries, Tooele County	3	Insufficient Data*					1
West Desert/Columbia	UT16020304-005_00	Soldier Creek	Soldier Creek and tributaries from the Drinking Water Treatment Facility to headwaters, Tooele County	3	Insufficient Data*					7
West Desert/Columbia	UT16020304-008_00	South Willow Creek		3	Insufficient Data*					4
West Desert/Columbia	UT16020308-006_00	Straight Fork Creek	Straight Fork Creek and tributaries from Etna Reservoir to headwaters	3	Insufficient Data*					5
West Desert/Columbia	UT16020306-001_00	Trout Creek	Trout Creek and tributaries, Juab County	3	Insufficient Data*					14
West Desert/Columbia	UT16020308-005_00	Warm Creek	Warm Creek from confluence with Etna Ditch to Headwaters	3	Insufficient Data*					2
West Desert/Columbia	UT17040211-003_00	Birch Creek - WD/C	Birch Creek and tributaries from Utah-Idaho state line to headwaters	2	No Evidence of Impairment					5
West Desert/Columbia	UT16020306-005_00	Deep Creek - 1 WD/C	Deep Creek and tributaries from Rock Spring Creek to headwaters, Juab and Tooele Counties	2	No Evidence of Impairment					54
West Desert/Columbia	UT16020306-002_00	Granite Creek	Granite Creek and tributaries, Juab County	2	No Evidence of Impairment					14
West Desert/Columbia	UT16020308-007_00	Grouse Creek	Grouse Creek and tributaries from Red Butte confluence to headwaters, except Pine Creek and tributaries	2	No Evidence of Impairment					39
West Desert/Columbia	UT17040211-002_00	Pole Creek	Pole Creek and tributaries from Utah-Idaho state line to headwaters	2	No Evidence of Impairment					19
West Desert/Columbia	UT17040210-001_00	Raft River	Raft River and tributaries from Utah-Idaho state line to confluence of Junction Creek and South Junction Creek	2	No Evidence of Impairment					24
West Desert/Columbia	UT17040210-003_00	South Junction Creek	South Junction Creek and tributaries from confluence with Junction Creek to headwaters	2	No Evidence of Impairment					53
West Desert/Columbia	UT16020306-003_00	Thomas Creek	Thomas Creek and tributaries, Juab County	2	No Evidence of Impairment					12

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessed Parameter	EPA Cause ID	Cycle Delisted	EPA Justification Code	EPA Justification Name	DWQ De-listing Comment
Bear River	UT16010101-001_00	Bear River West	Bear River west side tributaries from Sixmile Creek north	Temperature	388	2016	3	Original 303(d) listing rationale was in error.	2014: 4908220 was only MLID impaired for Temp. 4908220 is a canal but should not have been assessed per 2016 IR Methodology. Canal without site specific standards.
Bear River	UT16010202-012_00	High Creek Upper	High Creek and tributaries from U.S. Forest Service boundary to headwaters	Unknown	463	2016	3	Original 303(d) listing rationale was in error.	Listing was in error. Let 2016's Period of Record data determine assessment of UT16010202-012
Colorado River Southeast	UT14030001-001_00	Cottonwood Wash	Cottonwood Wash from Colorado River confluence to headwaters	OE Bioassessment	105	2016	2	Attaining WQS with new data.	Orginal listing was driven primarily by one sample; 4 new samples were collected throughout the AU that scored "Good"
Colorado River Southeast	UT14030001-003_00	Westwater Creek	Westwater Creek and tributaries from confluence with Colorado River to headwaters	OE Bioassessment	105	2016	2	Attaining WQS with new data.	Orginal listing was driven primarily by one sample; 1 new sample was collected at the same location that scored "Good"
Colorado River Southeast	UT14030005-017_00	Courthouse Wash		Dissolved Oxygen	322	2016	3	Original 303(d) listing rationale was in error.	2014 IR: 4956990 was impaired and ID'd as a river/stream. 2016 IR: 4956990 was identified as an emperal stream/ intermitten wash. 2016 303(d) methodology states DWQ does not assess ephemeral streams.
Colorado River West	UT14060007-006_00	Gordon Creek	Gordon Creek and tributaries below 7500 feet elevation	Unknown	463	2016	3	Original 303(d) listing rationale was in error.	Listing was in error. Please refer to the 305(b) and 303(d), and Cat 4A assessments for the list of parameters not meeting water quality standards.
Colorado River West	UT14060008-003_00	Green River-5 Tributaries	Thompson Creek and tributaries from I-70 to headwaters	Dissolved Oxygen	322	2016	3	Original 303(d) listing rationale was in error.	2014: 4930110, 4930112, 4930113 all impaired for DO. (no other MLIDs were impaired for DO in UT14060008-003). 2016 IR: 4930110, 4930112, 4930113 correctly moved from UT14060008-003 to UT14060008-007. Delist UT14060008-003 for DO, list UT14060008-007 for DO. Let 2016's Period of Record data determine proper assessment of UT14060008-003
Colorado River West	UT14060008-003_00	Green River-5 Tributaries	Thompson Creek and tributaries from I-70 to headwaters	Temperature	388	2016	3	Original 303(d) listing rationale was in error.	2014: 4930113 was impaired (no other MLIDs were impaired for Temp in UT14060008-003). 2016: 4930113 was correctly moved from UT14060008-003 to UT14060008-007. Delist UT14060008-003 for Temp, list UT14060008-007 for temp. Let 2016's Period of Record data determine proper assessment of UT14060008-003.
Colorado River West	UT14070002-003_00	Saleratus Creek - Emery	Saleratus Creek and tributaries from U-10 crossing to headwaters	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	2014: 4955460 impaired. 2016: 4955460 supporting (new data). No other MLID Assessments
Colorado River West	UT14070003-005_00	Fremont River-2	Fremont River and tributaries from Bicknell to Mill Meadow Reservoir near USFS boundary	Dissolved Oxygen	322	2016	1	Attaining WQS with new data due to restoration activity.	2014 IR - AWQMS: 4955110 & 4955310 were supporting but during EPA review the AU was ID'd as a Cat 4A. The Cat 4A overwrote the supporting MLIDs. New data was collected at 495310 and MLID is supporting. 4955110 has no new data, but again before EPA Cat 4A overwrite, the MLID was supporting. New data to support delisting and was a potential missed delisting in 2012/2014 IR.
Colorado River West	UT14070003-008_00	Fremont River-3	Fremont River and tributaries from east boundary of Capitol Reef National Park to Bicknell	OE Bioassessment	105	2016	1	Attaining WQS with new data due to restoration activity.	Success achieved through TMDL and restoration
Colorado River West	UT14070003-011_00	Oak Creek	Oak Creek and tributaries from east boundary of Capitol Reef National Park to headwaters	pH	441	2016	2	Attaining WQS with new data.	2014: 4954795 was impaired (no Cat 3As). 2016: 4954795 not impaired (new data). No other MLIDs were assessed.
Colorado River West	UT14070005-001_00	Upper Valley Creek	Upper Valley Creek and tributaries from confluence with Birch Creek to headwaters	Dissolved Oxygen	322	2016	3	Original 303(d) listing rationale was in error.	2014: 4953982 impaired for DO, not supporting use is 3A. (no other MLIDs were impaired for DO in UT14070005-001). 2016IR: 4953982 moved from UT14070005-001 to UT14070005-012. the DO data for 4953980 is Cat 3. Delist UT14070005-001 for DO. Do not List UT14070005-012 for DO because the use is now 3B and the 2012/2014 data does not exceed 3B numeric criteria. Let 2016's Period of Record data determine assessment of UT14070005-001).
Colorado River West	UT14070005-001_00	Upper Valley Creek	Upper Valley Creek and tributaries from confluence with Birch Creek to headwaters	Temperature	388	2016	3	Original 303(d) listing rationale was in error.	2014: 4953982 impaired for Temp, not supporting use is 3A. (no other MLIDs were impaired for temp in UT14070005-001). 2016IR: 4953982 moved from UT14070005-001 to UT14070005-012. the temp data for 4953980 is Cat 3. Delist UT14070005-001 for Temp. Do not List UT14070005-012 for temp because the use is now 3B and the 2012/2014 data does not exceed 3B numeric criteria. Let 2016's Period of Record data determine assessment of UT14070005-001).

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Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessed Parameter	EPA Cause ID	Cycle Delisted	EPA Justification Code	EPA Justification Name	DWQ De-listing Comment
Jordan River/Utah Lake	UT16020201-011_00	Powell Slough	Lindon Hollow and tributaries from Utah Lake to Interstate 15	Dissolved Oxygen	322	2016	3	Original 303(d) listing rationale was in error.	2014: 4995210, 4995230 all impaired for DO. (no other MLIDs were impaired for DO in UT16020201-011). 2016 IR: 4995210, 4995230 correctly moved from UT16020201-011 to UT16020201-010. Delist UT16020201-011 for DO, list UT16020201-010 for DO. Let 2016's Period of Record data determine proper assessment of UT16020201-011
Jordan River/Utah Lake	UT16020202-009_00	Sixth Water Creek	Sixth Water Creek and tributaries except Fifth Water and First Water Creeks and tributaries from confluence with Diamond Fork Creek to headwaters	Dissolved Oxygen	322	2016	3	Original 303(d) listing rationale was in error.	2014: 4995700 impaired. 2016: 4995700 was assigned wrong waterbody type in 2014 -- should not have been assessed. Other MLID assessment Cat 1 (new data)
Jordan River/Utah Lake	UT16020202-009_00	Sixth Water Creek	Sixth Water Creek and tributaries except Fifth Water and First Water Creeks and tributaries from confluence with Diamond Fork Creek to headwaters	Selenium, Dissolved	372	2016	3	Original 303(d) listing rationale was in error.	2014: 4995780 was not supporting for Se. 2016 IR: 4995780 was ID'd through the public comment period that the site was representative of groundwater and not the river/stream. MLID is removed from the assessment and Se is delisted. Let 2016's Period of Record data determine assessment of UT16020202-009.
Jordan River/Utah Lake	UT16020203-003_00	Provo River-3	Provo River from Olmstead Diversion to Deer Creek Reservoir	Dissolved Oxygen	322	2016	3	Original 303(d) listing rationale was in error.	2014: 5913210 impaired. 2016: 5913210 was assigned wrong waterbody type in 2014 -- should not have been assessed. Other MLID assessment Cat 1 (new data)
Jordan River/Utah Lake	UT16020204-006_00	Jordan River-6	Jordan River from 7800 South to Bluffdale at 14600 South	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	Additional data was also provided during the public comment period.
Jordan River/Utah Lake	UT16020204-026_00	Mill Creek1-SLCity	Mill Creek from confluence with Jordan River to Interstate 15 crossing	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	2014: 4992480 was not supporting for DO. 4992505 was supporting for DO. 2016: 4992480 and 4992505 were both supporting and 4992480 had new data. Additional data was also provided during the public comment period.
Jordan River/Utah Lake	UT16020204-036_00	Lee Creek		Total Dissolved Solids	399	2016	3	Original 303(d) listing rationale was in error.	2014 IR: 4991430 was wrongly assigned a 4 use. Not other MLID were impaired for TDS. 2016 geofile error fixed. 4991430 does not have a 4 use. Wrongly assessed in 2014.
Lower Colorado River	UT15010008-001_00	Santa Clara-1	Santa Clara River from confluence with Virgin River to Gunlock Reservoir	Selenium, Dissolved	372	2016	2	Attaining WQS with new data.	2014 IR - AWQMS: 4950090 was not supporting and 4950095 had insufficient data (3 samples, and 1 exceedance). 2016 IR: 4950090 had new data and MLID was supporting. In 2012/2014 IR the MLID 4950095 was sampled three times (2/18/05, 4/6/05, 5/4/05) after an extreme watershed event. The Santa Clara River experienced massive flooding in January 2005. DWQ sampled the MLID just three times, then dropped the site and only continued with the long term monitoring location approximately 5 miles downstream at the Santa Clara above Virgin River location. That downstream location is assessed as supporting. As specified in the 303(d) 2016 Methodolgy this scenario is - Category 2: No evidence of impairment: Analyses with the extreme events are evidence of impairment (Category 3A), but the analyses without the extreme events show no evidence of impairment (Category 2).
Lower Colorado River	UT15010008-019_00	East Fork Virgin-2	East Fork Virgin River and tributaries from Carmel Junction to Glendale	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	2014: 4951550 impaired. 2016: 4951550 supporting (new data). No other MLID assessments. Also, 4951550 geofile Uses are 3C not 3A
Lower Colorado River	UT15010008-019_00	East Fork Virgin-2	East Fork Virgin River and tributaries from Carmel Junction to Glendale	Temperature	388	2016	2	Attaining WQS with new data.	2014: 4951550 was impaired (no Cat 3As). 2016: 4951550 not impaired (new data). Also, 2016 geofile has uses for 4951550 as 3C not 3A. No other MLIDs were assessed.
Sevier River	UT16030001-002_00	Sevier River-4	Sevier River and tributaries from Piute Reservoir to Circleville Irrigation Diversion, excluding East Fork Sevier River and tributaries	Temperature	388	2016	2	Attaining WQS with new data.	2010: 4949420 had exceedances 2014: 4949420 was impaired (no Cat 3As). 2016: 4949420 not impaired (new data). No other MLIDs were assessed.
Sevier River	UT16030003-005_00	Lost Creek-1	Lost Creek and tributaries from confluence with Sevier River upstream approximately 6 miles	Selenium, Dissolved	372	2016	2	Attaining WQS with new data.	2014: 4945120 was impaired (no Cat 3As). 2016: 4945120 not impaired (new data). No other MLIDs were assessed.
Sevier River	UT16030004-005_00	San Pitch-3	San Pitch River and tributaries from Gunnison Reservoir to U132 crossing and below USFS boundary	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	2014: 4946450 impaired. 2016: 4946450 supporting (new data). Other MLIDs are Cat1 (new data) and 3E
Sevier River	UT16030005-028_00	Sevier River-25	Sevier River from Crafts Lake to Gunnison Bend Reservoir	Boron, Total	123	2016	2	Attaining WQS with new data.	2014: 4941100 was impaired (no Cat 3As). 2016: 4941100 not impaired (new data). No other MLIDs were assessed.

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Rivers, Streams, Springs, Seeps, and Canals Delistings

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessed Parameter	EPA Cause ID	Cycle Delisted	EPA Justification Code	EPA Justification Name	DWQ De-listing Comment
Uinta Basin	UT14060001-001_00	Green River-2 Tribs	Green River tributaries from Duchesne River confluence to Utah-Wyoming border, except Ashley, Brush, and Jones Hole Creeks	Selenium, Dissolved	372	2016	3	Original 303(d) listing rationale was in error.	2014: 4937291 was impaired (No Cat 3As or other Se impairements). 2016: 4937291 was identified as a Groundwater and Not a River Stream. Wrongly assessed
Uinta Basin	UT14060001-001_00	Green River-2 Tribs	Green River tributaries from Duchesne River confluence to Utah-Wyoming border, except Ashley, Brush, and Jones Hole Creeks	Total Dissolved Solids	399	2016	3	Original 303(d) listing rationale was in error.	2014: 4937291 was impaired (No Cat 3As or other TDS impairements). 2016: 4937291 was identified as a Groundwater and Not a River Stream. Wrongly assessed
Uinta Basin	UT14060006-001_00	Willow Creek	Willow Creek and tributaries from Geen River confluence to Meadow Creek confluence (excluding Hill Creek)	OE Bioassessment	105	2016	2	Attaining WQS with new data.	Orginal listing was driven primarily by one sample; 1 new sample was collected within the AU that scored "Good"
Weber River	UT16020101-007_00	Echo Creek	Echo Creek and tributaries from confluence with Weber River to headwaters, excluding Sawmill Creek	OE Bioassessment	105	2016	1	Attaining WQS with new data due to restoration activity.	TMDL was implemented; additionally, new samples were evaluated
Weber River	UT16020101-012_00	Chalk Creek-2	Chalk Creek and tributaries from South Fork confluence to Huff Creek confluence	OE Bioassessment	105	2016	1	Attaining WQS with new data due to restoration activity.	New data; long history of restoration
Weber River	UT16020101-015_00	East Fork Chalk Creek	East Fork Chalk Creek and tributaries from confluence with Chalk Creek to headwaters	OE Bioassessment	105	2016	1	Attaining WQS with new data due to restoration activity.	New data; long history of restoration

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Rivers, Streams, Springs, Seeps, and Canals Assessment Unit Splits					
Watershed Management Unit	Original Assessment Unit ID	New Assessment Unit ID	New Assessment Unit Name	New Assessment Unit Description	DWQ Comment
NA	None	None	None	None	None of the proposed assessment unit (AU) splits in the Draft 2016 IR were implemented in the Final 2016 IR. The Draft 2016 IR proposed AU splits (along with any other future proposed splits) will be considered in future IRs.

CHAPTER 4: LAKE AND RESERVOIR ASSESSMENTS

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WATER QUALITY

2016 Final Integrated Report

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Bear River	UT-L-16010202-002_00	Cutler Reservoir	Cutler Reservoir	4A	TMDL Approved	Dissolved Oxygen	3B		2004	1,355
						Total Phosphorus	3B		2004	1,355
Bear River	UT-L-16010203-005_00	Hyrum Reservoir	Hyrum Reservoir	5	Not Supporting	Temperature	3A	Low	1994	445
					TMDL Approved	Dissolved Oxygen	3A		1998	445
						Total Phosphorus	3A		1998	445
Bear River	UT-L-16010204-033_00	Mantua Reservoir	Mantua Reservoir	5	Not Supporting	Temperature	3A	Low	2008	513
					TMDL Approved	Dissolved Oxygen	3A		1998	513
						pH	3A		1998	513
						Total Phosphorus	3A		1998	513
Bear River	UT-L-16010202-013_00	Newton Reservoir	Newton Reservoir	5	Not Supporting	Temperature	3A	Low	2006	146
					TMDL Approved	Dissolved Oxygen	3A		1998	146
						Total Phosphorus	3A		1998	146
Bear River	UT-L-16010203-009_00	Porcupine Reservoir	Porcupine Reservoir	5	Not Supporting	Temperature	3A	Low	2008	179
Bear River	UT-L-16010203-012_00	Tony Grove Lake	Tony Grove Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	1996	25
						pH	3A	Low	2004	25
						Temperature	3A	Low	2006	25
Bear River	UT-L-16010201-003_00	Bear Lake	Bear Lake	2	No Evidence of Impairment					35,374
Bear River	UT-L-16010101-002_00	Birch Creek	Birch Creek	2	No Evidence of Impairment					62
Bear River	UT-L-16010101-007_00	Little Creek Reservoir	Little Creek Reservoir	2	No Evidence of Impairment					67
Bear River	UT-L-16010101-030_00	Whitney Reservoir	Whitney Reservoir	2	No Evidence of Impairment					129
Bear River	UT-L-16010101-001_00	Woodruff Reservoir	Woodruff Reservoir	2	No Evidence of Impairment					92

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.
** Big East Lake is also identified as having insufficient data with exceedances in the harmful algal bloom assessment

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Cedar/Beaver	UT-L-16030007-020_00	Kents Lake	Kents Lake	4A	TMDL Approved	Dissolved Oxygen	3A		1998	39
						Total Phosphorus	3A		1998	39
Cedar/Beaver	UT-L-16030007-027_00	LaBaron Lake	LaBaron Lake	4A	TMDL Approved	Dissolved Oxygen	3A		1998	22
						Total Phosphorus	3A		2014	22
Cedar/Beaver	UT-L-16030007-028_00	Puffer Lake	Puffer Lake	4A	TMDL Approved	Dissolved Oxygen	3A		1998	58
						pH	3A		2014	58
Cedar/Beaver	UT-L-16030007-011_00	Minersville Reservoir	Minersville Reservoir	5	Not Supporting	Temperature	3A	Low	1994	1,071
					TMDL Approved	Dissolved Oxygen	3A		1998	1,071
						pH	3A		2014	1,071
						Total Phosphorus	3A		1998	1,071
Cedar/Beaver	UT-L-16030006-008_00	Newcastle Reservoir	Newcastle Reservoir	5	Not Supporting	Mercury in Fish Tissue	3A	Low	2010	159
						Temperature	3A	Low	2012	159
						Temperature	3A	Low	2012	159
					TMDL Approved	Dissolved Oxygen	3A		1996	159
						Total Phosphorus	3A		1996	159
Cedar/Beaver	UT-L-16030006-019_00	Red Creek Reservoir (Iron Co)	Red Creek Reservoir (Iron Co)	5	Not Supporting	Total Phosphorus	3A	Low	2006	59
Cedar/Beaver	UT-L-16030007-025_00	Three Creeks Reservoir	Three Creeks Reservoir	5	Not Supporting	pH	3A	Low	2006	55
Cedar/Beaver	UT-L-16030006-002_00	Upper Enterprise Reservoir	Upper Enterprise Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	2014	353
						pH	3A	Low	2016	353
						Temperature	3A	Low	2012	353
Cedar/Beaver	UT-L-16030007-024_00	Anderson Meadow Reservoir	Anderson Meadow Reservoir	2	No Evidence of Impairment					8
Cedar/Beaver	UT-L-16030006-017_00	Yankee Meadow Reservoir	Yankee Meadow Reservoir	2	No Evidence of Impairment					56

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Colorado River Southeast	UT-L-14080201-002_00	Blanding City Reservoir	Blanding City Reservoir	5	Not Supporting	Temperature	3A	Low	2012	92
Colorado River Southeast	UT-L-14070006-001_00	Lake Powell	Lake Powell	5	Not Supporting	pH	3B	Low	2016	150,027
Colorado River Southeast	UT-L-14080203-002_00	Monticello Lake	Monticello Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	2016	5
						pH	3A	Low	2006	5
Colorado River Southeast	UT-L-14080201-007_00	Recapture Reservoir	Recapture Reservoir	3	Insufficient Data*					221
Colorado River Southeast	UT-L-14030004-001_00	Dark Canyon Lake	Dark Canyon Lake	2	No Evidence of Impairment					5
Colorado River Southeast	UT-L-14030005-004_00	Kens Lake	Kens Lake	2	No Evidence of Impairment					77
Colorado River Southeast	UT-L-14080203-009_00	Lloyds Reservoir	Lloyds Reservoir	2	No Evidence of Impairment					90

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Colorado River West	UT-L-14070003-019_00	Forsyth Reservoir	Forsyth Reservoir	4A	TMDL Approved	Dissolved Oxygen	3A		1998	165
						Total Phosphorus	3A		1998	165
Colorado River West	UT-L-14070003-010_00	Johnson Valley Reservoir	Johnson Valley Reservoir	4A	TMDL Approved	Total Phosphorus	3A		1998	671
Colorado River West	UT-L-14060007-005_00	Scofield Reservoir	Scofield Reservoir	4A	TMDL Approved	Dissolved Oxygen	3A		1998	2,668
						pH	3A		2014	2,668
						Total Phosphorus	3A		1998	2,668
Colorado River West	UT-L-14070003-044_00	Lower Bowns Reservoir	Lower Bowns Reservoir	5	Not Supporting	Dissolved Oxygen	3A	High	2010	108
						pH	3A	Low	2006	108
						Temperature	3A	Low	2012	108
						Total Phosphorus	3A	High	2012	108
Colorado River West	UT-L-14060007-004_00	Lower Gooseberry Reservoir	Lower Gooseberry Reservoir	5	Not Supporting	Total Phosphorus	3A	Low	2010	64
Colorado River West	UT-L-14070003-015_00	Mill Meadow Reservoir	Mill Meadow Reservoir	5	Not Supporting	pH	3A	Low	2012	160
					TMDL Approved	Total Phosphorus	3A		1998	160
Colorado River West	UT-L-14070005-011_00	Wide Hollow Reservoir	Wide Hollow Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	2010	156
						pH	3A	Low	2008	156
						Temperature	3A	Low	2008	156
Colorado River West	UT-L-14060009-017_00	Joes Valley Reservoir	Joes Valley Reservoir	3	Insufficient Data*					1,051
Colorado River West	UT-L-14060009-024_00	Cleveland Reservoir	Cleveland Reservoir	2	No Evidence of Impairment					146
Colorado River West	UT-L-14070003-018_00	Cook Lake	Cook Lake	2	No Evidence of Impairment					10
Colorado River West	UT-L-14070003-027_00	Donkey Reservoir	Donkey Reservoir	2	No Evidence of Impairment					24
Colorado River West	UT-L-14060009-004_00	Duck Fork Reservoir	Duck Fork Reservoir	2	No Evidence of Impairment					42
Colorado River West	UT-L-14060009-025_00	Electric Lake	Electric Lake	2	No Evidence of Impairment					450
Colorado River West	UT-L-14060007-001_00	Fairview Lakes	Fairview Lakes	2	No Evidence of Impairment					104
Colorado River West	UT-L-14060009-001_00	Ferron Reservoir	Ferron Reservoir	2	No Evidence of Impairment					54
Colorado River West	UT-L-14070003-006_00	Fish Lake	Fish Lake	2	No Evidence of Impairment					2,585
Colorado River West	UT-L-14060009-034_00	Huntington Lake North	Huntington Lake North	2	No Evidence of Impairment					235
Colorado River West	UT-L-14060009-018_00	Huntington Reservoir	Huntington Reservoir	2	No Evidence of Impairment					163
Colorado River West	UT-L-14060009-023_00	Miller Flat Reservoir	Miller Flat Reservoir	2	No Evidence of Impairment					160
Colorado River West	UT-L-14060009-026_00	Millsite Reservoir	Millsite Reservoir	2	No Evidence of Impairment					367
Colorado River West	UT-L-14070005-008_00	Posy Lake	Posy Lake	2	No Evidence of Impairment					12

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Great Salt Lake only	UT-L-16020310-003_00	Bear River Bay open water north of the Union Pacific Causeway and below 4208 feet, excluding transitional wetlands below 4208 feet, National Wildlife Refuges, and State Waterfowl Management Areas	Bear River Bay open water north of the Union Pacific Causeway and below 4208 feet, excluding transitional wetlands below 4208 feet, National Wildlife Refuges, and State Waterfowl Management Areas	3	Assessment Methods in Development					67,254
Great Salt Lake only	UT-L-16020310-004_00	Farmington Bay open water south of the Antelope Island Causeway and below 4208 feet, excluding transitional wetlands below 4208 feet and State Waterfowl Management Areas	Farmington Bay open water south of the Antelope Island Causeway and below 4208 feet, excluding transitional wetlands below 4208 feet and State Waterfowl Management Areas	3	Assessment Methods in Development					77,198
Great Salt Lake only	UT-L-16020310-001_00	Gilbert Bay open water south of the Union Pacific Causeway and below 4208 feet, excluding all of Farmington Bay, transitional wetlands below 4208 feet, and State Waterfowl Management Areas	Gilbert Bay open water south of the Union Pacific Causeway and below 4208 feet, excluding all of Farmington Bay, transitional wetlands below 4208 feet, and State Waterfowl Management Areas	3	Assessment Methods in Development					559,187
Great Salt Lake only	UT-L-16020310-002_00	Gunnison Bay open water north of the Union Pacific Causeway and below 4208 feet, excluding transitional wetlands below 4208 feet and State Waterfowl Management Areas	Gunnison Bay open water north of the Union Pacific Causeway and below 4208 feet, excluding transitional wetlands below 4208 feet and State Waterfowl Management Areas	3	Assessment Methods in Development					386,723

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Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Jordan River	UT-L-16020204-024_00	Lake Mary	Lake Mary	2	No Evidence of Impairment					19
Jordan River	UT-L-16020204-026_00	Little Dell Reservoir	Little Dell Reservoir	2	No Evidence of Impairment					221

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Lower Colorado River	UT-L-15010008-001_00	Gunlock Reservoir	Gunlock Reservoir	4A	TMDL Approved	Dissolved Oxygen	3B		1998	221
						Total Phosphorus	3B		1998	221
Lower Colorado River	UT-L-15010008-008_00	Baker Dam Reservoir	Baker Dam Reservoir	5	Not Supporting	Temperature	3A	Low	1992	44
					TMDL Approved	Dissolved Oxygen	3A		1998	44
						Total Phosphorus	3A		2002	44
Lower Colorado River	UT-L-15010008-024_00	Quail Creek Reservoir	Quail Creek Reservoir	3	Insufficient Data*					588
Lower Colorado River	UT-L-15010008-018_00	Kolob Reservoir	Kolob Reservoir	2	No Evidence of Impairment					238
Lower Colorado River	UT-L-15010008-025_00	Sand Hollow Reservoir	Sand Hollow Reservoir	2	No Evidence of Impairment					1,261

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Sevier River	UT-L-16030002-011_00	Koosharem Reservoir	Koosharem Reservoir	4A	TMDL Approved	Total Phosphorus	3A		1998	341
Sevier River	UT-L-16030001-006_00	Panguitch Lake	Panguitch Lake	4A	TMDL Approved	Dissolved Oxygen	3A		2000	1,182
						Total Phosphorus	3A		2000	1,182
Sevier River	UT-L-16030002-005_00	Lower Box Creek Reservoir	Lower Box Creek Reservoir	5	Not Supporting	pH	3A	Low	2010	22
					TMDL Approved	Dissolved Oxygen	3A		2004	22
						Total Phosphorus	3A		1998	22
Sevier River	UT-L-16030003-006_00	Manning Meadow Reservoir	Manning Meadow Reservoir	5	Not Supporting	pH	3A	Low	2016	85
						Total Phosphorus	3A	Low	1994	85
Sevier River	UT-L-16030001-001_00	Navajo Lake	Navajo Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	1996	631
						pH	3A	Low	2016	631
Sevier River	UT-L-16030004-001_00	Ninemile Reservoir	Ninemile Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	1998	185
						pH	3A	Low	2008	185
						Temperature	3A	Low	2008	185
						Total Phosphorus	3A	Low	1996	185
Sevier River	UT-L-16030002-004_00	Otter Creek Reservoir	Otter Creek Reservoir	5	Not Supporting	pH	3A	Low	2006	2,493
						Temperature	3A	Low	1994	2,493
					TMDL Approved	Total Phosphorus	3A		1998	2,493
Sevier River	UT-L-16030004-005_00	Palisade Lake	Palisade Lake	5	Not Supporting	Temperature	3A	Low	1992	80
Sevier River	UT-L-16030002-007_00	Pine Lake	Pine Lake	5	Not Supporting	pH	3A	Low	2016	85
Sevier River	UT-L-16030001-011_00	Piute Reservoir	Piute Reservoir	5	Not Supporting	Temperature	3A	Low	2008	2,151
						Total Phosphorus	3A	Low	2006	2,151
Sevier River	UT-L-16030003-007_00	Sevier Bridge Reservoir (Yuba Lake)	Sevier Bridge Reservoir (Yuba Lake)	3	Insufficient Data*					8,972
Sevier River	UT-L-16030002-002_00	Tropic Reservoir	Tropic Reservoir	3	Insufficient Data*					182
Sevier River	UT-L-16030003-005_00	Barney Lake	Barney Lake	2	No Evidence of Impairment					21
Sevier River	UT-L-16030005-026_00	D.M.A.D. Reservoir	D.M.A.D. Reservoir	2	No Evidence of Impairment					773
Sevier River	UT-L-16030005-021_00	Gunnison Bend Reservoir	Gunnison Bend Reservoir	2	No Evidence of Impairment					497
Sevier River	UT-L-16030004-002_00	Gunnison Reservoir	Gunnison Reservoir	2	No Evidence of Impairment					1,257
Sevier River	UT-L-16030003-012_00	Redmond Lake	Redmond Lake	2	No Evidence of Impairment					240
Sevier River	UT-L-16030003-016_00	Rex Reservoir	Rex Reservoir	2	No Evidence of Impairment					35

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UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Uinta Basin	UT-L-14060004-001_00	Strawberry Reservoir	Strawberry Reservoir	4A	TMDL Approved	Dissolved Oxygen	3A		1998	15,602
						Total Phosphorus	3A		1998	15,602
Uinta Basin	UT-L-14060003-230_00	Big Sand Wash Reservoir	Big Sand Wash Reservoir	5	Not Supporting	Dissolved Oxygen	3A	Low	2010	386
						Temperature	3A	Low	2010	386
Uinta Basin	UT-L-14040107-004_00	Bridger Lake	Bridger Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	1996	19
						pH	3A	Low	2016	19
Uinta Basin	UT-L-14060010-002_00	Brough Reservoir	Brough Reservoir	5	Not Supporting	Temperature	3A	Low	2008	136
					TMDL Approved	Dissolved Oxygen	3A		1998	136
Uinta Basin	UT-L-14060003-293_00	Butterfly Lake	Butterfly Lake	5	Not Supporting	pH	3A	Low	2016	5
Uinta Basin	UT-L-14040106-034_00	Calder Reservoir	Calder Reservoir	5	Not Supporting	pH	3A	Low	2016	94
						Temperature	3A	Low	2010	94
						Tier II	3A	Low	2016	94
					TMDL Approved	Dissolved Oxygen	3A		1998	94
						Total Phosphorus	3A		1998	94
Uinta Basin	UT-L-14040107-006_00	China Lake	China Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	1996	27
						Temperature	3A	Low	2000	27
Uinta Basin	UT-L-14060004-004_00	Lake Canyon Lake	Lake Canyon Lake	5	Not Supporting	Arsenic, Dissolved	1C	Low	2016	29
						Boron, Total	4	Low	2016	29
						pH	3A	Low	2016	29
						Total Dissolved Solids	4	Low	2016	29
Uinta Basin	UT-L-14040107-005_00	Lyman Lake	Lyman Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	1996	35
Uinta Basin	UT-L-14040106-033_00	Matt Warner Reservoir	Matt Warner Reservoir	5	Not Supporting	Temperature	3A	Low	1996	364
					TMDL Approved	Dissolved Oxygen	3A		1998	364
						Total Phosphorus	3A		1998	364
Uinta Basin	UT-L-14060010-001_00	Pelican Lake	Pelican Lake	5	Not Supporting	pH	3B	Low	2004	1,114
						Total Phosphorus	3B	Low	2012	1,114
Uinta Basin	UT-L-14060010-008_00	Red Fleet Reservoir	Red Fleet Reservoir	5	Not Supporting	Temperature	3A	Low	2010	478
					TMDL Approved	Dissolved Oxygen	3A		1998	478
Uinta Basin	UT-L-14060010-006_00	Steinaker Reservoir	Steinaker Reservoir	5	Not Supporting	Temperature	3A	Low	2008	744
					TMDL Approved	Dissolved Oxygen	3A		1998	744
Uinta Basin	UT-L-14060010-009_00	Stewart Lake	Stewart Lake	5	Not Supporting	Selenium, Dissolved	3B	Low	2016	155
Uinta Basin	UT-L-14040106-026_00	Crouse Reservoir	Crouse Reservoir	3	Insufficient Data*					111
Uinta Basin	UT-L-14060004-007_00	Currant Creek Reservoir	Currant Creek Reservoir	3	Insufficient Data*					274
Uinta Basin	UT-L-14060010-007_00	East Park Reservoir	East Park Reservoir	3	Insufficient Data*					178
Uinta Basin	UT-L-14040106-021_00	Flaming Gorge Reservoir	Flaming Gorge Reservoir	3	Insufficient Data*					12,519
Uinta Basin	UT-L-14040106-001_00	Hoop Lake	Hoop Lake	3	Insufficient Data*					171
Uinta Basin	UT-L-14040106-032_00	Long Park Reservoir	Long Park Reservoir	3	Insufficient Data*					300
Uinta Basin	UT-L-14060003-112_00	Moon Lake	Moon Lake	3	Insufficient Data*					786
Uinta Basin	UT-L-14060010-005_00	Oaks Park Reservoir	Oaks Park Reservoir	3	Insufficient Data*					338
Uinta Basin	UT-L-14060003-297_00	Paradise Park Reservoir	Paradise Park Reservoir	3	Insufficient Data*					147
Uinta Basin	UT-L-14060004-003_00	Red Creek Reservoir	Red Creek Reservoir	3	Insufficient Data*					147
Uinta Basin	UT-L-14060004-006_00	Starvation Reservoir	Starvation Reservoir	3	Insufficient Data*					3,340
Uinta Basin	UT-L-14060010-003_00	Ashley Twin Lakes	Ashley Twin Lakes	2	No Evidence of Impairment					32
Uinta Basin	UT-L-14040106-031_00	Beaver Meadow Reservoir	Beaver Meadow Reservoir	2	No Evidence of Impairment					106
Uinta Basin	UT-L-14040106-019_00	Browne Lake	Browne Lake	2	No Evidence of Impairment					48
Uinta Basin	UT-L-14060003-012_00	Hoover Lake	Hoover Lake	2	No Evidence of Impairment					19
Uinta Basin	UT-L-14040107-003_00	Marsh Lake	Marsh Lake	2	No Evidence of Impairment					42

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.

** Big East Lake is also identified as having insufficient data with exceedances in the harmful algal bloom assessment

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Uinta Basin	UT-L-14060003-011_00	Marshall Lake	Marshall Lake	2	No Evidence of Impairment					19
Uinta Basin	UT-L-14040107-001_00	Meeks Cabin Reservoir	Meeks Cabin Reservoir	2	No Evidence of Impairment					17
Uinta Basin	UT-L-14060003-006_00	Mirror Lake	Mirror Lake	2	No Evidence of Impairment					53
Uinta Basin	UT-L-14060003-003_00	Pyramid Lake	Pyramid Lake	2	No Evidence of Impairment					15
Uinta Basin	UT-L-14060003-002_00	Scout Lake	Scout Lake	2	No Evidence of Impairment					19
Uinta Basin	UT-L-14040106-016_00	Sheep Creek Lake	Sheep Creek Lake	2	No Evidence of Impairment					81
Uinta Basin	UT-L-14040106-002_00	Spirit Lake	Spirit Lake	2	No Evidence of Impairment					42
Uinta Basin	UT-L-14040107-007_00	Stateline Reservoir	Stateline Reservoir	2	No Evidence of Impairment					274
Uinta Basin	UT-L-14060003-296_00	Upper Stillwater Reservoir	Upper Stillwater Reservoir	2	No Evidence of Impairment					301

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.
** Big East Lake is also identified as having insufficient data with exceedances in the harmful algal bloom assessment

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Utah Lake	UT-L-16020202-002_00	Big East Lake	Big East Lake	5	Not Supporting	Dissolved Oxygen	3A	Low	1996	26
						Temperature	3A	Low	2012	26
						Total Phosphorus**	3A	Low	2012	26
Utah Lake	UT-L-16020203-001_00	Deer Creek Reservoir	Deer Creek Reservoir	5	Not Supporting	Temperature	3A	Low	2006	2,560
					TMDL Approved	Dissolved Oxygen	3A		1998	2,560
Utah Lake	UT-L-16020203-003_00	Jordanelle Reservoir	Jordanelle Reservoir	5	Not Supporting	pH	3A	Low	2016	2,987
Utah Lake	UT-L-16020203-004_00	Mill Hollow Reservoir	Mill Hollow Reservoir	5	Not Supporting	pH	3A	Low	1992	18
						Total Phosphorus	3A	Low	1992	18
Utah Lake	UT-L-16020201-004_02	Provo Bay portion of Utah Lake	Provo Bay portion of Utah Lake	5	Not Supporting	PCB in Fish Tissue	3B	Low	2010	3,609
						pH	3B	Low	2016	3,609
						Total Ammonia	3B	Low	2016	3,609
						Total Phosphorus	3B	Low	1994	3,609
Utah Lake	UT-L-16020202-001_00	Salem Lake	Salem Lake	5	Not Supporting	E. coli	2A	Low	2016	19
Utah Lake	UT-L-16020201-004_01	Utah Lake other than Provo Bay	Utah Lake other than Provo Bay	5	Not Supporting	Harmful algal blooms	2B	Low	2016	87,929
						PCB in Fish Tissue	3B	Low	2010	87,929
						Total Dissolved Solids	4	Low	2006	87,929
						Total Phosphorus	3B	Low	1994	87,929
Utah Lake	UT-L-16020201-001_00	Mona Reservoir	Mona Reservoir	3	Insufficient Data*					1,561
Utah Lake	UT-L-16020201-006_00	Silver Lake Flat Reservoir	Silver Lake Flat Reservoir	2	No Evidence of Impairment					33
Utah Lake	UT-L-16020201-005_00	Tibble Fork Reservoir	Tibble Fork Reservoir	2	No Evidence of Impairment					11
Utah Lake	UT-L-16020203-002_00	Trial Lake	Trial Lake	2	No Evidence of Impairment					62
Utah Lake	UT-L-16020203-006_00	Wall Lake	Wall Lake	2	No Evidence of Impairment					72
Utah Lake	UT-L-16020203-005_00	Washington Lake	Washington Lake	2	No Evidence of Impairment					107

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.
** Big East Lake is also identified as having insufficient data with exceedances in the harmful algal bloom assessment

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
Weber River	UT-L-16020102-020_00	East Canyon Reservoir	East Canyon Reservoir	5	Not Supporting	Temperature	3A	Low	2012	639
					TMDL Approved	Dissolved Oxygen	3A		1998	639
						Total Phosphorus	3A		1988	639
Weber River	UT-L-16020101-001_00	Echo Reservoir	Echo Reservoir	5	Not Supporting	Temperature	3A	Low	2012	1,336
					TMDL Approved	Dissolved Oxygen	3A		1996	1,336
						Total Phosphorus	3A		1994	1,336
Weber River	UT-L-16020102-014_00	Pineview Reservoir	Pineview Reservoir	5	Not Supporting	Temperature	3A	Low	1994	3,008
					TMDL Approved	Dissolved Oxygen	3A		1998	3,008
						Total Phosphorus	3A		1998	3,008
Weber River	UT-L-16020101-002_00	Rockport Reservoir	Rockport Reservoir	5	Not Supporting	Temperature	3A	Low	2012	1,055
					TMDL Approved	Dissolved Oxygen	3A		2006	1,055
Weber River	UT-L-16020102-021_00	Causey Reservoir	Causey Reservoir	2	No Evidence of Impairment					126
Weber River	UT-L-16020101-003_00	Lost Creek Reservoir	Lost Creek Reservoir	2	No Evidence of Impairment					369
Weber River	UT-L-16020101-005_00	Smith and Morehouse Reservoir	Smith and Morehouse Reservoir	2	No Evidence of Impairment					207
Weber River	UT-L-16020102-004_00	Willard Bay Reservoir	Willard Bay Reservoir	2	No Evidence of Impairment					10,103

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.
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Final 2016 Integrated Report: Lakes and Reservoirs 305(b) and 303(d)

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessment Unit Category	Category Description	Impaired Parameter	Impaired Beneficial Uses	Total Maximun Daily Load Development Priority	IR Cycle First Listed	Lake Acres
West Desert / Columbia	UT-L-16020304-003_00	Stansbury Lake	Stansbury Lake	5	Not Supporting	Total Dissolved Solids	4	Low	2016	91
West Desert / Columbia	UT-L-16020304-004_00	Settlement Canyon Reservoir	Settlement Canyon Reservoir	3	Insufficient Data*					26
West Desert / Columbia	UT-L-16020304-005_00	Grantsville Reservoir	Grantsville Reservoir	2	No Evidence of Impairment					95
West Desert / Columbia	UT-L-16020304-002_00	Rush Lake	Rush Lake	2	No Evidence of Impairment					242

* Please refer to the 2012/2014 and 2016 IR data files for the sub-category 3 details.
** Big East Lake is also identified as having insufficient data with exceedances in the harmful algal bloom assessment

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY

Final 2016 Integrated Report: Lakes and Reservoirs Delistings

Watershed Management Unit	Assessment Unit ID	Assessment Unit Name	Assessment Unit Description	Assessed Parameter	EPA Cause ID	Cycle Delisted	EPA Justification Code	EPA Justification Name	DWQ De-listing Comment
Cedar/Beaver	UT-L-16030006-017_00	Yankee Meadow Reservoir	Yankee Meadow Reservoir	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	
Colorado River Southeast	UT-L-14080201-007_00	Recapture Reservoir	Recapture Reservoir	Cause Unknown	Cause Unknown	2016	4	Attaining WQS due to change in assessment methodology.	Listing was in error. Let 2016's Period of Record data and applicable assessment methods determine assessment of UT-L-14080201-007_00.
Colorado River West	UT-L-14060007-004_00	Lower Gooseberry Reservoir	Lower Gooseberry Reservoir	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	
Colorado River West	UT-L-14060007-004_00	Lower Gooseberry Reservoir	Lower Gooseberry Reservoir	pH	441	2016	2	Attaining WQS with new data.	
Sevier River	UT-L-16030003-006_00	Manning Meadow Reservoir	Manning Meadow Reservoir	Dissolved Oxygen	322	2016	4	Attaining WQS due to change in assessment methodology.	
Uinta Basin	UT-L-14040107-003_00	Marsh Lake	Marsh Lake	Cause Unknown	Cause Unknown	2016	4	Attaining WQS due to change in assessment methodology.	Listing was in error. Let 2016's Period of Record data and applicable assessment methods determine assessment of UT-L-14040107-003_00.
Uinta Basin	UT-L-14040106-016_00	Sheep Creek Lake	Sheep Creek Lake	pH	441	2016	2	Attaining WQS with new data.	
Uinta Basin	UT-L-14060004-006_00	Starvation Reservoir	Starvation Reservoir	Dissolved Oxygen	322	2016	2	Attaining WQS with new data.	
Uinta Basin	UT-L-14060004-006_00	Starvation Reservoir	Starvation Reservoir	Temperature	388	2016	2	Attaining WQS with new data.	
Utah Lake	UT-L-16020201-004_02	Provo Bay portion of Utah Lake	Provo Bay portion of Utah Lake	Total Dissolved Solids	399	2016	2	Attaining WQS with new data.	

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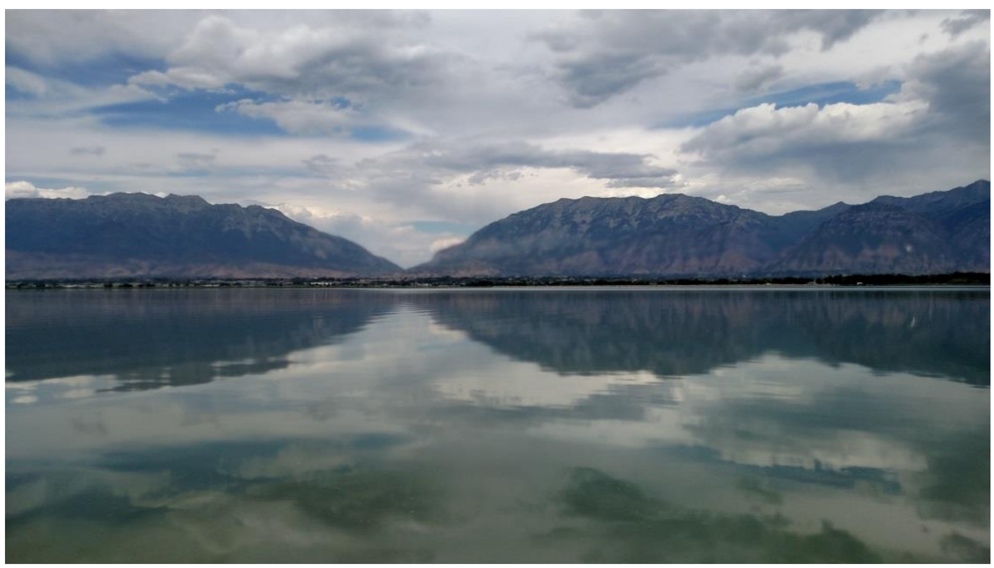
Final 2016 Integrated Report: Lakes and Reservoirs Assessment Unit Splits					
Watershed Management Unit	**Original Assessment Unit ID**	**New Assessment Unit ID**	**New Assessment Unit Name**	**New Assessment Unit Description**	**DWQ Comment**
Utah Lake	UT-L-16020201-004_00	UT-L-16020201-004_01	Utah Lake other than Provo Bay	Utah Lake other than Provo Bay	
Utah Lake	UT-L-16020201-004_00	UT-L-16020201-004_02	Provo Bay portion of Utah Lake	Provo Bay portion of Utah Lake	

CHAPTER 5: NARRATIVE STANDARD ASSESSMENT OF RECREATIONAL USE SUPPORT IN LAKES AND RESERVOIRS AND APPLICATION TO UTAH LAKE



UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

2016 Final Integrated Report

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CONTENTS

ABBREVIATIONS

<	less than
>	greater then
AU	assessment unit
cell(s)/mL	cell(s) per milliliter
CFR	Code of Federal Regulations
DO	dissolved oxygen
DWQ	Division of Water Quality
EPA	U.S. Environmental Protection Agency
HAB(s)	harmful algal bloom(s)
IR	Integrated report
km2	square kilometer
mg/L	milligram per liter
TMDL	total maximum daily load
UAC	Utah Administrative Code
UDWQ	Utah Division of Water Quality
WHO	World Health Organization
µg/l	microgram per liter

FIGURES

TABLES

INTRODUCTION

UDWQ's criteria and assessment methods for recreational uses are designed to reduce risks to human health from exposure to potentially harmful water quality conditions while engaged in recreational activities. UDWQ uses parameters such as pH, E. coli bacteria concentrations, and the occurrence of harmful algal blooms (HABs) to assess recreational support. The occurrence of HABs is a growing water quality concern across the nation. In Utah, HABs usually consist of cyanobacteria (also known as blue green algae) that can produce dangerous toxins and pose a risk to human health through direct contact, inhalation or ingestion. HABs have occurred in some Utah lakes and reservoirs. However, until now, limited data and assessment methods have hindered UDWQ's ability to assess recreational use support in these waterbodies. In 2015, UDWQ developed assessment methods that included a new HAB assessment methodology for recreational uses (Chapter 2). The assessment methods were public noticed in March 2015 and adopted for the *2016 Integrated Report* as Chapter 2. This methodology reflects the potential for "*undesirable human health effects*" identified in the Narrative Standard and uses a cyanobacteria cell count exceeding 100,000 cells/mL as the indicator of HAB related impairments for recreational and drinking water uses.

Currently, few lakes or reservoirs have existing or readily available data collected during algal bloom events. One exception to this lack of HAB data is Utah Lake where several HAB targeted samples were collected through a series of HAB events in October 2014. Only one other lake, Big East Lake, had data collected during an HAB event available to assess for HABs. One sample exceeded the 100,000 cells/mL threshold in Big East Lake and is has been placed in category 3A (insufficient data with a single recorded exceedance of the HAB indicator) for the 2016 *Integrated Report*[1]. Farmington Bay, Great Salt Lake, also has a robust dataset related to HABs. This data is presented in Chapter 6 and was not assessed for 303(d) purposes in the 2016 *Integrated Report* because assessment methods are still in development for the Great Salt Lake. UDWQ's new HAB program has begun to collect more robust data for HAB assessment from waters around the state such that assessments of a wider group of waters will be possible in the 2018 *Integrated Report*.

Utah's Narrative Water Quality Standard

Utah's Narrative Water Quality Standard (R317-2-7.2) protects water quality from pollutants for which numeric criteria are not appropriate or have not yet been adopted. It states that,

> "*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 or taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in*

[1] Note: Big East Lake is listed overall as impaired (Category 5) in Chapter 4 for dissolved oxygen, temperature, and total phosphorus. This impairment overwrites the 3A assessment for harmful algal blooms.

accordance with standard procedures; or determined by biological assessments in Subsection R317-2-7.3."

The Narrative Standard is applicable to all of Utah's waters. Freshwater lakes are assessed under the narrative standard using the HAB assessment method and the Tier II lakes assessment methods (Chapter 2). The Narrative Standard is broadly applicable to multiple beneficial uses including recreational uses and aquatic life. UDWQ's HAB assessment method reflects the potential for "*undesirable human health effects*" identified in the Narrative Standard.

Harmful algal bloom indicators for recreational use attainment

UDWQ's HAB assessment method is based on an exceedance of 100,000 cyanobacteria cells per milliliter (cells/mL), an established indicator of human health risk. The assessment methods identify two exceedances of this indicator as a recreational use impairment. While cyanobacteria cell counts are the primary indicator for assessment purposes, two supplemental indicators are also used as confirmation of the primary indicator: cyanotoxin concentrations exceeding 20 ug/L and algal growth measured as chlorophyll a concentrations exceeding 50 ug/L (Figure 1). The World Health Organization has defined thresholds for all three indicators that are associated with a low, moderate, high, and very high relative probability of human health effects in recreational waters (Table 1). Exposure routes that may result in negative human health effects from HABs and cyanotoxins include dermal contact, inhalation, or ingestion of cyanobacteria or associated cyanotoxins. Additional literature supporting these thresholds and references of thresholds used in other states are provided in the sections that follow.

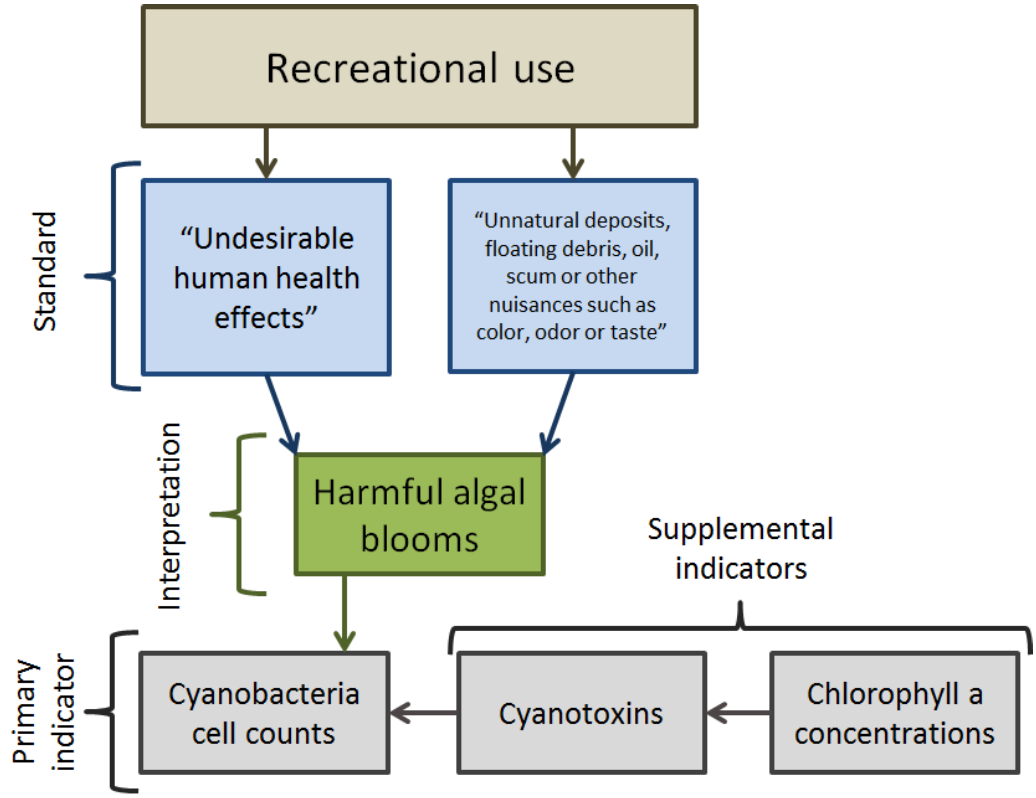

Figure 1. Conceptual diagram of UDWQ's recreational use assessment for HABs under the Narrative standard.

Utah protects water quality for both frequent and infrequent primary contact recreational beneficial uses. Frequent contact recreation includes activities such as swimming or waterskiing where dermal contact, inhalation, and ingestion are all potential exposure routes. Infrequent contact recreation includes activities such as wading or boating where occasional dermal contact or inhalation is the most likely exposure routes. In addition, domestic animals accompanying recreationists may experience higher levels of exposure to HABs than humans, particularly in waters where people generally don't swim.

Table 1. WHO recommended thresholds of human health risk for cyanobacteria, microcystin-LR, and chlorophyll a.

Health Effects Threshold	Cyanobacteria (cells/mL)	Microcystin-LR (µg/L)	Chlorophyll-a (µg/L)
Low	< 20,000	<10	<10
Moderate	20,000-100,000	10-20	10-50
High	100,000-10,000,000	20-2,000	50-5,000
Very High	> 10,000,000	>2,000	>5,000

Primary indicator: Cyanobacteria cell concentrations

The 100,000 cell/mL cyanobacteria indicator is a well-supported indicator of human health risk and negative impacts on recreational uses in a waterbody. The World Health Organization (WHO) first identified 100,000 cells/mL as a threshold representing high human health risk in 1999. WHO identifies possible health effects including potential acute poisoning, long-term illness, skin irritation, and gastrointestinal illness associated with exposure to cyanobacteria at these levels. Review of the studies underlying the WHO recommendations as well as additional research provides further evidence of the link between cyanobacteria and human health issues. Prominent studies on the human health effects of recreation exposure to cyanobacteria consistently identify human health issues such as gastrointestinal distress, headaches and earaches, skin or eye irritation, and temporary respiratory illness occurring at cyanobacteria cell counts at or below 100,000 cells/mL (Pilotto et al. 1997, Stewart et al. 2006, Levesque et al. 2014, Lin et al. 2016). For example, Pilotto et al. 1997 identify a significantly higher occurrence of these types of symptoms at a threshold of only 5,000 cells/mL. Levesque et al. 2014 identified increased gastrointestinal illness associated with limited contact activities such as fishing and boating at cyanobacteria cell counts exceeding 20,000 cells/mL, demonstrating that even limited recreational contact with water containing greater than 100,000 cells/mL of cyanobacteria may result in adverse health effects for recreational users. Stewart et al. 2006 and Lin et al. 2016 also both identify similar negative human health effects associated with recreational contact to cyanobacteria cell counts at or below 100,000 cells/mL. Importantly, the negative health effects observed in several of these studies (Pilotto et al. 1997, Stewart et al. 2006, Lin et al. 2015) were not necessarily associated with cyanotoxin concentrations, suggesting cyanotoxin concentrations alone are not sufficient for determining health risk associated with HABs. The 100,000 cell/mL cyanobacteria cell count indicator used in this assessment is a benchmark that represents a clear potential risk for human health issues.

Utah's use of the 100,000 cells/mL threshold for recreational use assessments is also consistent with those of other states. Wisconsin assesses recreational use support using a 100,000 cell/mL cyanobacteria threshold (WDNR 2015), and New Hampshire uses a threshold of 70,000 cells/mL to assess waters as impaired for cyanobacteria scum (NHDES 2015). Arizona also identifies mean blue green algae counts greater than 20,000 cells/mL in conjunction with elevated chlorophyll *a* as a violation of the state's Narrative Nutrient Criteria for Lakes and Reservoirs (AZDEQ 2009). At least 12 other states including Indiana, Kentucky, Oklahoma, Wisconsin, Kansas, Arizona, Connecticut, Massachusetts, Rhode Island, Idaho, Oregon, and Virginia have identified cyanobacteria or toxigenic algae taxa cell counts at or below 100,000 cells/mL as an appropriate benchmark for issuing public health watches or warnings or closing recreational areas. No other states that have adopted recreational guidelines for cyanobacteria have established a higher benchmark as indicative of human health risks. In addition, other countries including Canada, New Zealand, and several European countries have also issued human health guidelines for recreational waters based on the WHO cyanobacteria cell count indicators (Chorus 2012).

Supplemental indicator: Cyanotoxin concentration indicators

For recreational waters, WHO identifies microcystin-LR concentrations greater than 20 µg/L as a human health risk. The WHO guideline for microcystin in recreational waters is based on a tolerable daily intake calculated from a microcystin exposure study (Fawell et al. 1994) and the expected incidental consumption of water of a 60 kilogram adult. However, several states and countries have set lower thresholds for human health advisories based on studies that have identified lower values for microcystin toxicity based on expected recreational exposure of small children. Microcystin concentrations are used in Utah's HAB assessment as confirmatory evidence of toxin producing algae that pose a human health risk to recreational uses.

Supplemental indicator: Chlorophyll *a* concentration indicators

For recreational waters, WHO also recommends 50 ug/L of chlorophyll *a* as a threshold indicative of human health risk. The chlorophyll *a* indicator is only used as a supporting indicator in the IR, and assessment decisions have not been based solely on the chlorophyll *a* threshold. The chlorophyll *a* indicator as used in the IR is not intended to assess whether individual HAB events have occurred in a waterbody. Instead, this indicator is intended to provide supporting information regarding the overall productivity of a waterbody and its underlying potential for HABs. Several scientific studies identify a pattern of increasing cyanobacterial dominance (as either density or biovolume) with increasing chlorophyll *a* concentrations in lakes and reservoirs (e.g. Downing et al. 2001, Rogalus and Watzin 2007). Similarly, the likelihood of occurrence of cyanotoxins has also been shown to increase with elevated chlorophyll *a* concentrations (WHO 2003, Rogalus and Watzin 2007, Lindon and Heiskary 2009, Yuan et al. 2014). This pattern of a positive relationship between cyanotoxins and chlorophyll *a* concentrations is consistent both within single lakes as demonstrated by Rogalus and Watzin (2007) in Lake Champlain and across lakes at a national scale as demonstrated by Yuan et al. 2014 using the EPA's National Lakes Assessment dataset. Chlorophyll *a* data from open water samples are used in Utah's assessment to provide context and supplemental information regarding the probability and extent of HAB occurrences.

HARMFUL ALGAL BLOOM ASSESSMENT FOR UTAH LAKE

Utah Lake is a shallow, generally well-mixed lake with relatively large surface area (about 380 km^2). It is currently protected for the designated beneficial uses of infrequent primary contact recreation (2B), warm water fish (3B), waterfowl and shore birds (3D), and agricultural uses including irrigation and stock watering (4) (UAC 317-2-13.5). However, Utah Lake is currently being used for recreational activities that are better characterized as frequent primary contact recreation (2A) and this constitutes an existing use of Utah Lake. The aquatic wildlife uses in Utah Lake were previously listed as impaired due to total phosphorus concentrations (1994) and polychlorinated biphenyls in fish tissue (2010), and the agricultural uses were listed as impaired due to total dissolved solids concentrations (2006). Due to water quality differences between Provo Bay and the rest of Utah Lake, DWQ has split Provo Bay into a separate assessment unit and it is assessed separately.

Recreational Uses in Utah Lake

Utah Lake is an important recreational resource for the State of Utah. Popular activities include fishing, boating, water skiing, swimming, and wading. Developed recreational facilities include Utah Lake State Park, American Fork Boat Harbor, Lindon Marina and Boat Harbor, Vineyard Beach, Pelican Bay Marina, and Lincoln Beach Park and Marina. There are numerous other points of access for recreational use surrounding the lake identified on the Utah Division of Wildlife Resources' website at http://wildlife.utah.gov/walkinaccess/ .

Recreational use on Utah Lake is high. According to Utah Lake State Parks' visitation data (UDNR 2016) the average number of visitors to this facility since 2006 is 253,599 per year. In addition, the Utah Lake Commission is actively working to increase public access and recreational opportunities on Utah Lake including the development of new recreation facilities (Utah Lake Commission 2009). As the population in Utah County grows, the number of people recreating on Utah Lake is expected to increase.

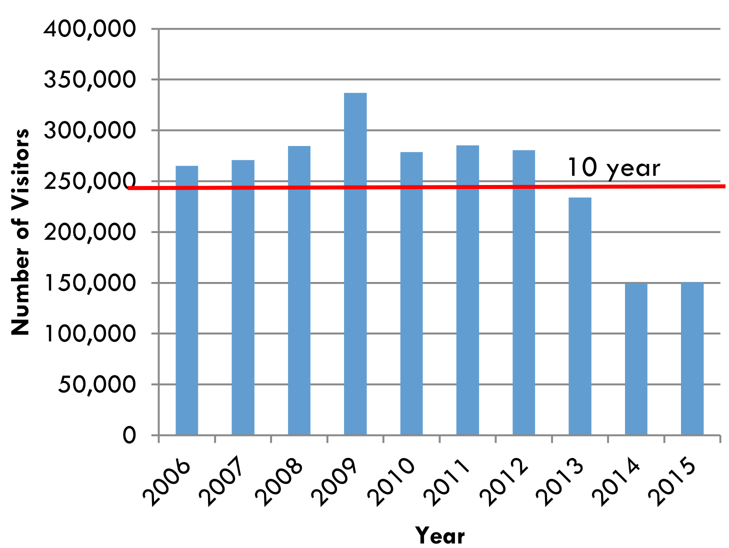

Figure 2. Number of visitors to Utah Lake State Park from 2006 to 2015 (UDNR, 2016)

Relevant Data

UDWQ collected two types of water quality samples in Utah Lake that are used in this analysis: (1) targeted HAB samples and (2) routine open water monitoring samples. The targeted HAB samples were collected at times and locations when observed potential HABs occurred in fall 2014. HAB-targeted samples are essential for assessing water quality that is protective of potential human health in locations where recreational contact with HABs is most likely, including marinas, inlets, and shorelines. These samples were collected to obtain cyanobacteria cell counts and cyanotoxin quantification and are the primary sample type assessed in this chapter. Given the sporadic nature of HAB occurrences, infrequent and routine water quality samples collected from open water monitoring locations are unlikely to detect HABs in most water bodies. Open water chlorophyll *a* samples are used to characterize the potential frequency and extent of HAB occurrence in Utah Lake.

A total of 18 HAB-targeted phytoplankton and cyanotoxin samples were collected in several locations throughout the lake during October 2014 when suspected HABs were observed. An additional three cyanotoxin samples were collected in the Jordan River immediately below the outlet from Utah Lake during and after the October 2014 bloom.

UDWQ also collected over 150 open water samples at eight monitoring locations in Utah Lake during the 2016 IR cycle (May-November, 2008-2014, Figure 3). These samples include full water chemistry analyses, but only the chlorophyll *a* data were used as a supporting indicator in this HAB assessment. An additional 45 phytoplankton samples were also collected during routine monitoring events but none of them exceeded the 100,000 cells/mL threshold and they are not indicative of HAB events.

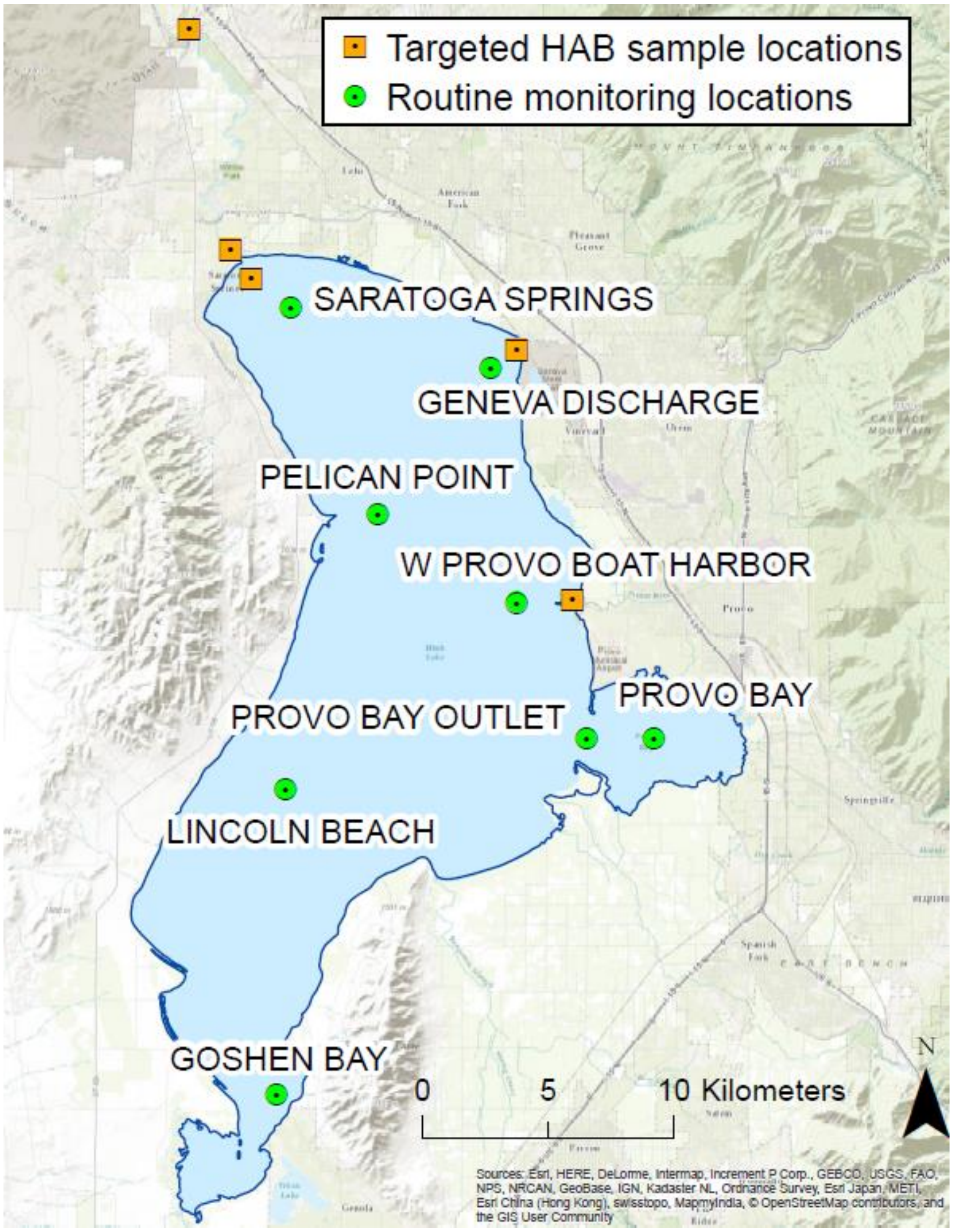

Figure 3. Map of UDWQ monitoring locations in Utah Lake and Jordan River. Routine water quality and profile monitoring locations as green circles. Targeted HAB and cyanotoxin samples as orange squares.

Exceedances of Primary Indicator: Cyanobacteria cell counts

Phytoplankton assemblage monitoring by UDWQ and partners during October, 2014 identified five exceedances of the cyanobacteria cell count indicator of 100,000 cells/mL at three locations on two separate days (Figure 4). These samples were collected in Lindon Harbor, Utah Lake State Park Harbor, and near the lake outlet. Two of these samples exceeded 200,000 cells/mL of cyanobacteria and one exceeded 750,000 cells/mL. Samples collected in Provo Bay did not exceed the 100,000 cell/mL indicator.

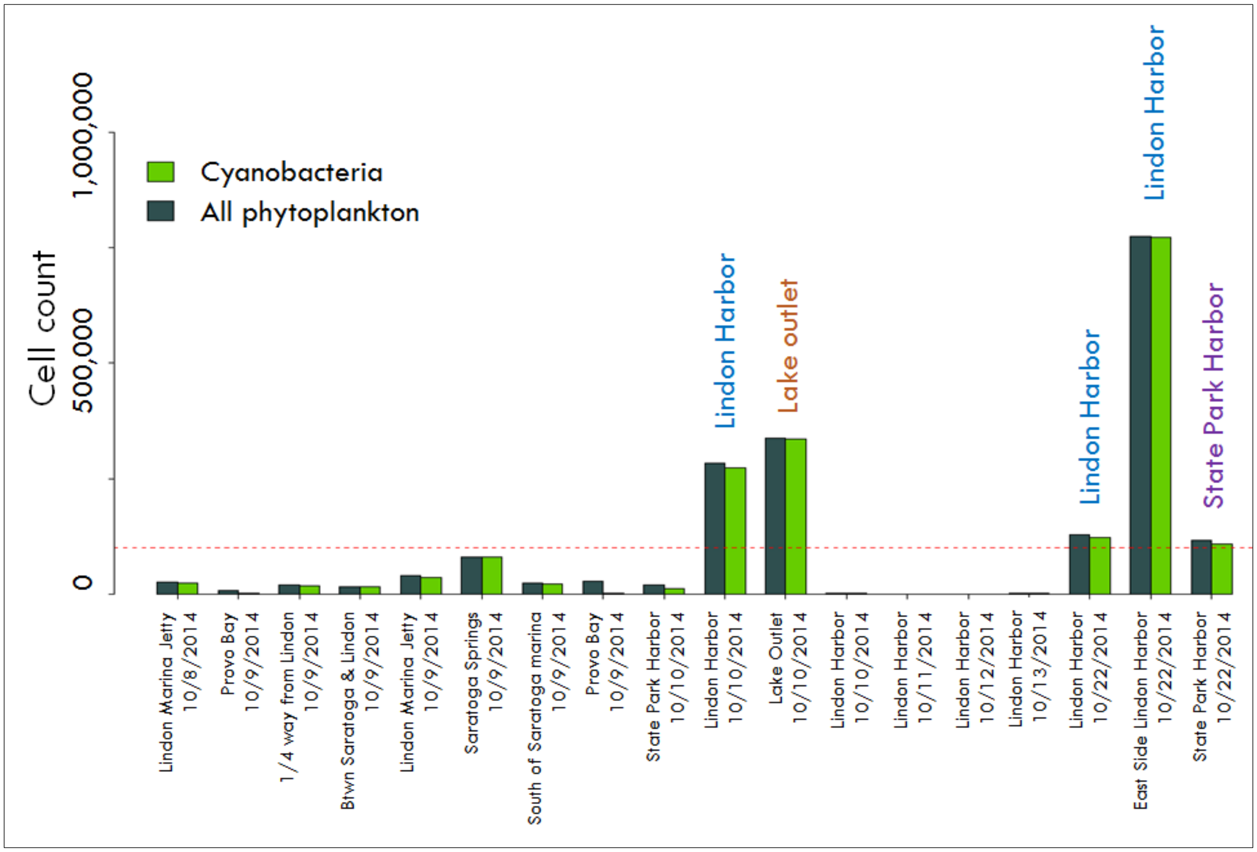

Figure 4 . Harmful algal bloom events in Utah Lake during October, 2014. Total phytoplankton counts for each sample are drawn in dark green with cyanobacteria counts beside in light green. The 100,000 cell/mL indicator is identified by a red dashed line.

Figure 5. Photographs of the HAB events and targeted sample collections in Utah Lake, October 2014.

Exceedances of supplemental indicators

Cyanotoxin concentrations in Utah Lake

Three cyanotoxins (microcystin, anatoxin-a, and cylindrospermopsin) were detected in Utah Lake during the October 2014 algal bloom. One sample collected on October 10, 2014 along the Lindon Marina shoreline, identified a microcystin-LR concentration of 730 µg/L, greatly exceeding the WHO health risk indicator of 20 µg/L. This sample was collected from a targeted location along the shoreline as recommended by Utah's HAB guidance to assess the highest risk of exposure at a point of potential recreational contact (Figure 5, bottom photos). A second sample collected north of the Lindon Marina jetty on October 6, 2014 showed a microcystin-LR concentration of 11.2 µg/L (Table 2).

Table 2. Microcystin samples collected on Utah Lake and the Jordan River during October 2014. ND = non-detect.

Waterbody	Location	Date	Microcystin (µg/L)
Utah Lake	Lindon Marina Interior	10/6/2014	4.50
Utah Lake	Lindon Marina N of Jetty	10/6/2014	11.20
Utah Lake	Lindon Boat Harbor	10/8/2014	0.18
Utah Lake	State Park Harbor	10/8/2014	0.30
Utah Lake	Outlet to Jordan River	10/8/2014	0.21
Jordan River	Utah Lake outlet	10/8/2014	0.19
Jordan River	Narrows Pump Station	10/8/2014	0.20
Utah Lake	Lindon Boat Harbor/Marina	10/10/2014	0.80
Utah Lake	State Park Harbor	10/10/2014	ND
Utah Lake	Outlet to Jordan River	10/10/2014	0.23
Utah Lake	Target (Lindon Harbor Shoreline)	10/10/2014	730
Jordan River	Utah Lake Outlet	10/10/2014	0.17
Jordan River	Narrows Pump Station	10/10/2014	1.39

Chlorophyll *a* concentrations

Chlorophyll *a* concentrations measured during routine lake monitoring demonstrate consistently high algal growth in Utah Lake throughout the entire 2016 *Integrated Report* data period (2008-2014), identifying a recurring risk for HAB occurrence. Throughout the main body of Utah Lake, the chlorophyll *a* indicator for human health risk (50 µg/L) was exceeded in 19 out of 154 samples (12%) from 2008 through 2014 (Table 3). Exceedances were observed at all routine monitoring locations except Pelican Point. In Provo Bay, the chlorophyll *a* indicator was exceeded in 14 of 19 samples (74%).

Table 3. Chlorophyll *a* sample size and exceedances of the 50 µg/L chlorophyll *a* threshold by monitoring location.

Monitoring Location	Sample size	Exceedances
Geneva Discharge	23	3
Pelican Point	23	0
W Provo Boat Harbor	20	6
Lincoln Beach	23	1
Saratoga Springs	23	1
Goshen Bay	20	6
Provo Bay Outlet	22	2
Provo Bay	19	14
Total	173	33

Other issues related to HAB occurrences in Utah Lake

There are several other issues related to the occurrence of HABs in Utah Lake that are not captured by the HAB assessment methodology but may be important to Utah Lake stakeholders. These include the potential for HABs to trigger public health advisories for recreational areas, negative effects on the health of domestic animals including pets, and impacts to downstream uses of the Jordan River.

Utah Lake recreational use advisories

The HAB events in October 2014 caused the Utah County Health Department to issue a public health advisory for recreational areas including Lindon Marina. In addition, the following summer of 2015, observed algal blooms again triggered public health advisories. Based on visual observations, local health department officials strongly suspected a cyanobacteria bloom. Subsequent phytoplankton monitoring did not identify exceedances of the 100,000 cell/mL cyanobacteria threshold, but photographs and personal communication from the sampling events suggest that the bloom was largely dissipated by the time of sample collection, and may have missed a HAB occurrence (Figure 6). Although there is uncertainty in identifying this event as a HAB, it did result in a public health advisory for recreational uses in Lindon Harbor (8/20/2015).

Figure 6. Photographs of the 2015 algal blooms that triggered a recreational advisory at Utah Lake.

Utah Lake dog deaths

Dogs and other animals can be especially susceptible to the harmful health effects of cyanotoxins while swimming and playing in water with HABs. They tend to ingest larger quantities of scum while swimming and when grooming, by licking the scum off their fur. Two dog deaths were potentially linked to algal toxins during the October 2014 HAB events in Utah Lake. UDWQ recognizes the uncertainty associated with diagnosing the causes of these deaths and directly linking them to algal toxins, and initial reports for the first reported death did not identify a conclusive cause of death. However, veterinarian investigations into the second reported death did conclude ingestion of cyanobacteria or cyanotoxins to be the cause of death. This finding was based on the dog's symptoms including rapid breathing, the veterinarian's past experience dealing with cyanotoxin poisonings in another state, and clear signs of exposure to cyanobacteria including the presence of cyanobacteria on the dog's nose. Despite the lack of confirmation that cyanobacteria poisoning was the cause of the death for the dog that died on October 5, 2014, UDWQ and Utah Department of Health scientists still suspect cyanobacteria as the sole or a contributing cause of death for both dogs. Both dogs died within hours of being in the water where toxin-producing cyanobacteria were present. The symptoms exhibited were consistent with cyanotoxin poisoning, specifically neurotoxins. Even though cyanobacteria were not detected in the dog's stomach during necropsy, the dog's owner reported that the dog was drinking the water where "algae" had accumulated and vomited bright green "algae." Cyanotoxins were not detected in the tissues of the necropsied dog, but the analytical methods that were used only identify a limited number of the known cyanotoxins, and additional unidentified toxins are suspected to exist.

Negative results from the toxin analyses are not uncommon in dog deaths attributed to cyanotoxin poisonings. Other causes not related to cyanobacteria are plausible as the cause of one or both of the deaths, but these were judged to be less likely given the weight of environmental evidence and that two dogs died within 24 hours of one another after ingesting Utah Lake water.

Cyanotoxins in Jordan River below Utah Lake outlet

Four samples taken in the Jordan River downstream from Utah Lake identified levels of microcystin-LR above detection limits during the October 2014 algal bloom. This section of the Jordan River is protected as a class 1C drinking water source (UAC R317-2.6). UDWQ will monitor for cyanotoxins at this site during future HAB blooms to ensure there is no threat to drinking water uses. The Jordan River is also protected as class 4 for agricultural uses. Numerous diversions from the Jordan River are used for stock watering and as secondary sources of water for residential properties in the south Salt Lake Valley. These data demonstrate the potential for negative impacts on downstream uses from HAB occurrences in Utah Lake.

Summary

Five unique exceedances of the primary HAB indicator for human health risk (100,000 cyanobacteria cells/mL) occurred at three locations in Utah Lake on two separate days in October 2014 (Table 4). Of these blooms, UDWQ measured cyanotoxin microcystin concentrations that pose a threat to human health. In addition, open water chlorophyll *a* concentrations from 2008-2014 exceeded the human health risk threshold of 50 µg/L representing 19% of total samples collected and demonstrating a risk for HAB occurrence (Table 4). Together, these indicators identify an impairment of the recreational use under the Narrative Standards in Utah Lake for the occurrence of HABs. Exceedances of the primary cyanobacteria indicator were not detected in Provo Bay, and recreational use in Provo Bay has therefore not been identified as impaired for HAB occurrences. However, chlorophyll *a* samples in Provo Bay do identify consistently high algal growth.

Table 4. Number and percent of exceedances in Utah Lake for all three indicators at human health risk thresholds as defined by WHO.

	HAB-targeted/harbor samples		Open water samples
Parameter	Cyanobacteria	Microcystin	Chlorophyll a
Threshold	(100,000 cells/mL)	(20 µg/L)	(50 µg/L)
Sample size	18	12	173
Exceedances	5	1	33
Percent exceedance	28	8.3	19

FREQUENTLY ASKED QUESTIONS

Aren't cyanobacteria naturally occurring in Utah Lake?

Cyanobacteria are among the oldest known photosynthetic organisms and their persistence over the last 3.5 billion years has allowed these organisms to evolve into a diverse group of organisms that are well adapted to a variety of conditions (Pearl and Huisman 2009). They occur naturally in both freshwater and marine waters, and in conditions that range from hot springs to the arctic. The diversity and tolerance of these organisms allows then to take advantage of alterations to aquatic ecosystems, which may explain the increasing dominance of the organism in aquatic ecosystems worldwide (Taranu et al. 2015).

Although cyanobacteria are naturally present in many temperate waters, including Utah Lake, the concentrations of cyanobacteria in large blooms in Utah Lake appear to have increased. These blooms are a concern especially when they involve species that are known to produce toxins, because exposure during these blooms is more likely to result in detrimental health effects (Pilotto et al. 1997). It is not the presence of these species that resulted in the impairment decision for these waters, but the magnitude of blooms and presence of toxins.

Paleolimnology investigations have been conducted on Utah Lake (Macharia 2012; Bolland 1974) that describe a general increase in algal production following European settlement. Data from these investigations suggest that Utah Lake has become increasingly eutrophic over time. Macharia (2012) was primarily interested in the effects of land use patterns, so the Utah Lake study emphasized indicators of sediment and pollen characteristics over temporal patterns in lake algae. This investigation demonstrated an increase in sediment nutrient concentrations corresponding to increasing population growth. Reductions in the carbon:nitrogen ratio were also observed in Utah Lake indicating an increase in algal productivity over time. This observation was bolstered with increases in the isotope ^{13}C, which suggests an increasing importance of algal organic matter over other carbon sources. Using a similar coring technique to that in Macharia (2012), Bolland (1974) analyzed changes in diatom assemblage over time in Utah Lake cores. This study found that pre-settlement diatoms in the lake reflected a greater representation of oligo/meso-trophic diatom taxa and benthic taxa. This means that historic conditions were very likely less turbid and typified by lower nutrient conditions.

How does the relative importance of natural and human-caused algal blooms play into impairment decisions?

UDWQ, under delegated federal Clean Water Act authority, is required to report any observed water quality problems to EPA on a biennial basis, including "*those water quality standards established under section 303 of the Act, including numeric criteria, narrative criteria, waterbody uses and antidegradation requirements*" (40 CFR §130.7(b)(3)). Reporting observed violations in water quality standards means that initial impairment listings are often made in situations where there is uncertainty about the cause, source or extent of the impairment. The decision to list a water body as impaired is only the first step in a series of steps aimed at addressing the problem. Additional investigations are required before remediation plans can be proposed and implemented. In this case, the investigations will need to include a better characterization of algal blooms in Utah Lake, including the relative importance of natural and human-caused sources, and linkages with aquatic life uses.

Is the very high microcystin concentration recorded at Lindon Harbor on October 10, 2014 representative of bloom conditions and risk?

Phytoplankton and cyanotoxin samples taken during the HAB events in Utah Lake included both composite water column samples from relatively open water and targeted surface scum samples located at recreational access points. Taking both types of samples helps quantify both the spatial extent and overall human health risk of a HAB event. Utah's HAB sampling guidance recommends sampling areas of a waterbody where algae cells tend to accumulate and where recreationists are most likely to contact harmful algae including along shorelines and within protected areas such as harbors. A targeted sample collected along the Lindon Harbor Shoreline on October 10, 2014 resulted in cyanobacteria cell counts exceeding 750,000 cells/mL and a microcystin concentration of 730 µg/L (Figure 5, bottom). This type of sample helps to quantify the total human health risk of HAB events.

Doesn't Utah require two IR cycles to make a listing decision?

UDWQ's assessment methods for lakes and reservoirs previously required two IR cycles of equivalent support status to change the use support designation. These methods were developed when monitoring data was collected every other year for each lake (e.g., see **DWQ 2008 Assessment Methods**). When UDWQ began monitoring using a rotating basin approach, commenters questioned whether the two consecutive monitoring cycle requirement was appropriate because instead of a lake being sampled every other year, a lake would be sampled every six years (see response to comments for both the **2008** and **2010** *Integrated Reports*). UDWQ determined that the two consecutive cycle methodology could not be supported if the consecutive cycles were six years apart under the rotating basin monitoring approach. An impairment could go undetected for up to 13 years if for instance, a lake was newly impaired the year following the last monitoring, it would be five years to the next monitoring, another six years until the second monitoring, and two years until that data would be assessed in the *Integrated Report*. Therefore, the assessment methods were revised and two consecutive monitoring cycles are no longer required. This change ensures that lakes with impaired water quality are identified and a plan for resolving the impairment is implemented as soon as practical.

Why use the 100,000 cells/mL cyanobacteria threshold?

UDWQ's use of the 100,000 cell/mL cyanobacteria threshold for HAB assessment seeks an appropriate balance between the high priority of protecting human health and the uncertainty inherent in the assessment process. Given the human health risks associated with HABs and cyanotoxins, a significant level of caution is appropriate. Although the presence of cyanotoxins is the clearest sign of immediate health risk, toxins can be formed, degraded, and dissipated rapidly. In addition, current tests for cyanotoxin concentrations only account for a subset of potentially occurring toxins. This means that the presence of cyanotoxins can serve as confirmation of human health risk, but the absence of cyanotoxins is not necessarily indicative of safe recreational waters. Therefore, the presence of cyanobacteria in concentrations sufficient to produce toxins is a more reliable indicator of overall human health risk than the concentrations of cyanotoxins themselves. In addition, several scientific studies demonstrate risks to human health at cyanobacteria concentrations at or below100,000 cells/mL. Finally, UDWQ is confident in the use of this threshold and the findings in this chapter for several reasons including:

- The occurrence of toxin producing cyanobacteria was confirmed through taxonomic identifications.
- Concentrations of cyanotoxins exceeded thresholds for human health risk which confirms the risk indicated by the cyanobacteria cell counts.
- The high frequency and magnitude of exceedances of the cyanobacteria cell count indicator reduces the uncertainty in assessing the recreational uses as impaired. In Utah Lake, two samples more than doubled the 100,000 cell/mL threshold, and one sample produced cell counts over 750,000 cells/mL, more than seven times the threshold.

How can you be sure that there is a health risk when not all cyanobacteria produce toxins?

The presence of high concentrations of cyanobacteria indicate that environmental conditions are favorable for both toxin and non-toxin producing cyanobacteria. The number and types of cyanobacteria can rapidly change due to causes that are not currently well understood. High concentrations of cyanobacteria are not a definitive indicator of the presence of a health risk but they do indicate a high potential for health risks (WHO 2003). This potential increases with increasing concentrations of cyanobacteria, if the cyanobacteria are known to be toxin producing, and if toxins are actually detected. These risks are potentially serious and a proactive response is warranted to protect human health.

What are the implications of potential HAB listings for other UDWQ initiatives?

The identification of recreational use impairment for the occurrence of HABs will not alter existing timelines for studying the effects of nutrients on Utah Lake.

The following initiatives and timelines will remain on track:

- Implementation of Utah's Technology Based Phosphorus Effluent Limit rule (UAC R317-1-3.3) requiring all mechanical publically owned treatment works to meet a phosphorus effluent limit of 1 mg/L by January 1, 2020.
- Phase 1 of the Utah Lake Water Quality Study that includes beneficial use assessments for aquatic life; additional monitoring; and a refined load analysis.
- No immediate changes to existing permits that discharge nitrogen and phosphorus to the Lake. Such changes would only be required if nutrients are identified as the cause of the impairment and after a TMDL is developed.

New initiatives to follow the 2016 assessment will include:

- Evaluation of additional indicators to determine if any are appropriate for inclusion as formal assessment methods used to interpret the Narrative Standard in future *Integrated Reports*.
- Increased monitoring of harmful algal blooms and nuisance algal growth in popular recreational waters and drinking water sources across Utah.
- Additional research on Utah Lake to determine the causes of harmful algal blooms.

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CHAPTER 6: EVALUATION OF HARMFUL ALGAL BLOOM DATA IN FARMINGTON BAY, GREAT SALT LAKE

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

2016 Final Integrated Report

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CONTENTS

ABBREVIATIONS

<	less than
>	greater then
cell(s)/mL	cell(s) per mililiter
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
HAB(s)	harmful algal bloom(s)
IR	Integrated report
mL	milliliter
UAC	Utah Administrative Code
UDWQ	Utah Division of Water Quality
WHO	World Health Organization
µg/l	microgram per liter

FIGURES

TABLES

INTRODUCTION

The Utah Division of Water Quality (UDWQ) performed an evaluation of data related to harmful algal blooms that could pose a health risk to recreational users in Farmington Bay. Extensive datasets were submitted to UDWQ by two stakeholders, the Central Davis Sewer District and Utah State University, and were aggregated for the purpose of this evaluation. The data were compared to indicators of human health risks for harmful algal blooms (HABs) to provide context to the public about potential risks associated with recreating in Farmington Bay. HABs can adversely affect human health during recreational activities in and on the water. UDWQ is obligated to analyze these data and report findings to the public. In this chapter, UDWQ discusses the recreational uses of Farmington Bay, HAB indicators, and the results of the data evaluation.

When developing the 2016 IR assessment methods, UDWQ did not anticipate having new data that could be used to perform a beneficial use assessment in Farmington Bay or Great Salt Lake and therefore deferred any 303(d) listing decisions until further methods were developed and data collected. The HAB assessment methods adopted in 2015, and applied to freshwater lakes in the 2016 Integrated Report, combined with the recently available data for HABs in Farmington Bay represents a significant step forward in UDWQ's ability to assess recreational uses in Farmington Bay. UDWQ intends to assess recreational use support in Farmington Bay using Utah's Narrative Standard in the 2018 Integrated Report. For the 2016 IR, Farmington Bay remains in Category 3C - assessment methods in development. This chapter constitutes a status update on the monitoring, management, and progress UDWQ has made towards developing an assessment methods for Great Salt Lake.

Recreational Uses in Farmington Bay

Like other portions of Great Salt Lake, Farmington Bay has a single beneficial use classification that includes protections for both recreational and aquatic wildlife beneficial uses. These uses are, "Infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain," (UAC R317-2-6).

Recreational uses in Farmington Bay are known to include activities such as air boating, kayaking, canoeing, hunting, and bird watching. Air boating is a popular recreational use of Farmington Bay. R. Jefre Hicks, secretary and treasurer of the Utah Airboat Association, estimates that as many as 50 air boat trips occur per weekend from mid-September through December and 30 airboat trips per weekend in January and February (personal communication between Jodi Gardberg and R. Jefre Hicks, March 31, 2016). During the weekdays, there are usually 3 to 8 airboats per day on Farmington Bay. Some users estimate that they air boat on Farmington Bay as much as 20-50 times annually (2016 IR comment letter E). While air boating, recreationists are exposed through dermal contact with the waterbody and potential inhalation from water spray. Much of the western shoreline of Farmington Bay is formed by Antelope Island State Park, one of the most popular Great Salt Lake tourism and recreation destinations. The Antelope Island Causeway that runs along the north end of Farmington Bay, serves as the first introduction many tourists have to Great Salt Lake. One of the primary access points to the waters of Great Salt Lake, Antelope Island Marina, is located on Gilbert Bay right outside the outlet from Farmington Bay and when water levels of Great Salt Lake are higher, the marina is accessible to boaters for airboating, kayaking, paddle boarding, and canoeing.

Available data

Two external groups submitted extensive datasets and summary reports of data collected along transects of Farmington Bay spanning the summer seasons of 2012 – 2014 (Marden et al. 2015, McCulley et al. 2015, Marden et al. unpublished data). In all, these data include 31 transects distributed across the summer months with samples collected at up to nine sites per transect. For additional details on sampling location and timing, see the cited reports. Data from both groups passed the credible data check process outlined in the IR assessment methods (Chapter 2), and were aggregated into a single dataset for analyses.

Harmful Algal Bloom Indicators

UDWQ compared data to indicators of human health risks for HABs to provide context to the public about potential risks associated with recreating in Farmington Bay. The indicators used are the same as those used for the formal harmful algal bloom assessment of Utah Lake (see Chapter 5). The applicability of these indicators for Farmington Bay will be further evaluated in *Utah's Assessment Methods for the 2018 Integrated Report*.

The World Health Organization (WHO) has established three types of human health based indicators for HABs: cyanobacteria cell counts, cyanotoxin concentrations, and algae growth measured as chlorophyll *a* concentrations (WHO 2003; Table 1). Exposure routes that may result in adverse human health effects from HABs and cyanotoxins can occur through dermal contact, inhalation, or ingestion of cyanobacteria or associated cyanotoxins. Utah protects Farmington Bay for infrequent primary contact recreational beneficial uses (UAC 317-2.6) that includes activities such as wading or boating where occasional dermal contact and inhalation are the most likely exposure routes.

UDWQ evaluated the Farmington Bay datasets using three indicators: 1) number of cyanobacteria cells per milliliter (cells/mL), an indicator of a health risk from HABS; 2) cyanotoxin concentrations; and 3) algal concentrations measured as chlorophyll *a*. Additional literature supporting these thresholds as well as references of thresholds used in other states are provided in the sections that follow and in Chapter 5.

Table 1. WHO recommended thresholds of human health risk for cyanobacteria, microcystin-LR, and chlorophyll *a*.

Health Effects Threshold	Cyanobacteria (cells/mL)	Microcystin-LR (µg/L)	Chlorophyll-a (µg/L)
Low	< 20,000	<10	<10
Moderate	20,000-100,000	10-20	10-50
High	100,000-10,000,000	20-2,000	50-5,000
Very High	> 10,000,000	>2,000	>5,000

Cyanobacteria Cell Counts

The 100,000 cell/mL cyanobacteria indicator is a well-supported indicator of human health risk and adverse impacts on recreational uses in a waterbody. WHO first identified 100,000 cells/mL as a threshold representing high human health risk in 1999. WHO identifies health risks including acute poisoning, long-term illness, skin irritation, and gastrointestinal illness associated with exposure to cyanobacteria at these levels. The cell count threshold is not taxon-specific, but rather represents an expected risk of HAB exposure based on overall cyanobacteria occurrence. Review of the studies underlying the WHO recommendations as well as other research literature strengthens the association between cyanobacteria and human health issues. Prominent studies on the human health effects of recreational exposure to cyanobacteria consistently report human health issues such as gastrointestinal distress, headaches and earaches, skin or eye irritation, and temporary respiratory illness occurring at cyanobacteria cell counts at or below 100,000 cells/mL (Pilotto et al. 1997, Stewart et al. 2006, Levesque et al. 2014, Lin et al. 2016). For example, Pilotto et al. 1997 identify a significantly higher occurrence of these types of symptoms at a threshold of only 5,000 cells/mL. Levesque et al. 2014 identified increased gastrointestinal illness associated with limited contact activities such as fishing and boating at cyanobacteria cell counts exceeding 20,000 cells/mL, demonstrating that even limited contact with water containing greater than 100,000 cells/mL of cyanobacteria could result in adverse health effects for recreational users. Stewart et al. 2006 and Lin et al. 2016 also both identify similar adverse human health effects associated with recreational contact to cyanobacteria cell counts at or below 100,000 cells/mL. Importantly, the adverse health effects observed in several of these studies (Pilotto et al. 1997, Stewart et al. 2006, Lin et al. 2015) were not necessarily associated with cyanotoxin concentrations, suggesting cyanotoxin concentrations alone are not sufficient for determining health risk associated with HABs.

Cyanotoxin Concentration Indicators

For recreational waters, WHO identifies microcystin-LR concentrations greater than 20 µg/L as a human health risk. The WHO guideline for microcystin in recreational waters is based on a tolerable daily intake calculated from a microcystin exposure study (Fawell et al. 1994) and the expected incidental consumption of water of a 60 kilogram adult. However, several states and countries have set lower thresholds for human health advisories based on studies that have identified lower values for microcystin toxicity or based on expected recreational exposures for small children.

Data and reports for Farmington Bay identify extensive occurrence of HABs which are often dominated by the toxin producing cyanobacteria, *Nodularia* (Marden et al. 2015, McCulley et al. 2015), an algal species common to brackish waters such as Farmington Bay. Nodularia can produce the cyanotoxin nodularin. Although nodularin-specific benchmarks are not yet available, nodularin is similar to microcystin-LR with respect to chemical structures, modes of toxicity, experimental lethal dose values, and potential for bioaccumulation of both toxins (Karjalainen et al. 2008, Pearson et al. 2010, Rinehart et al. 1988, Sipia et al. 2006, USEPA 2015, Yoshizawa et al. 1990, Chen et al. 2013). The WHO Guidelines for Safe Recreational Water Environments place the lethal dose of 50% for mice for microcystin-LR at 60 µg/kg and for nodularin at 30-50 µg/kg (WHO 2003, Table 8.1). Both toxins have similar modes of action and can result in liver hemorrhaging, tissue damage, and liver failure (Pearson et al. 2010). Although nodularin mortality in humans is rare or undocumented, it has been documented in dogs (e.g. Edler et al. 1985, Harding et al. 1995, Nehring and Stefan 1993). Another potentially harmful cyanobacteria, *Pseudanabaena*, occurs in Farmington Bay in very high numbers (>12 million cells/mL). *Pseudanabaena* is relatively understudied, but toxin production has been identified within the genus (Oudra et al. 2002, Teneva et al. 2009), and the genus has been associated with adverse biological effects in bioassays on mice (Oudra et al. 2002, Rangel et al. 2014) and cladocerans (Olvera-

Ramirez et al. 2010). One study that included the species of *Pseudanabaena* known to occur in Farmington Bay, *P. catenata*, identified adverse health effects of the cyanobacteria on *Artemia* that were not associated with known cyanotoxins (Mohamed and Al-Shehri 2015), suggesting this species may produce other potentially harmful substances that have not yet been fully described in the scientific literature.

Chlorophyll *a* Concentration Indicators

As with the cyanotoxin concentration indicators, WHO has established recommended thresholds for chlorophyll *a* concentrations that are associated with adverse human health effects. WHO identifies chlorophyll *a* concentrations greater than 50 µg/L as a potential human health risk. The chlorophyll *a* indicator is only used as a supporting indicator in the IR, and assessment decisions have not been based solely on the chlorophyll *a* threshold. The chlorophyll *a* indicator as used in the IR is not intended to assess whether individual HAB events have occurred in a waterbody. Instead, this indicator is intended to provide supporting information regarding the overall productivity of a waterbody and its underlying potential for HABs. Although high chlorophyll *a* levels do not necessarily indicate an immediate human health risk, they may be indicative of the potential for frequent and intense HAB events and associated health impacts from recreational contact. For example, several scientific studies identify a pattern of increasing cyanobacterial dominance (as either density or biovolume) with increasing chlorophyll *a* concentrations in lakes and reservoirs (e.g. Downing et al. 2001, Rogalus and Watzin 2007). Similarly, the likelihood of occurrence of cyanotoxins has also been shown to increase with elevated chlorophyll *a* concentrations (WHO 2003, Rogalus and Watzin 2007, Lindon and Heiskary 2009, Yuan et al. 2014). This pattern of a positive relationship between cyanotoxins and chlorophyll *a* concentrations has been identified both within a single lake as demonstrated by Rogalus and Watzin (2007) in Lake Champlain and across lakes at a national scale as demonstrated by Yuan et al. 2014 using the EPA's National Lakes Assessment dataset.

RESULTS AND DISCUSSION

Cyanobacteria Cell Counts

Concentrations of cyanobacteria over 100,000 cells/mL occurred frequently in Farmington Bay in 2013 and 2014 (Figure 1). Of 68 available phytoplankton samples, 53% exceeded the 100,000 cell/mL HAB benchmark, and 15% exceeded 1,000,000 cyanaboacteria cells/mL. Cell counts of Nodularia alone exceeded 100,000 cells/mL in 35% of samples. Exceedances of the 100,000 cell/mL cyanobacteria cell count occur frequently from April through September. A single exceedance was observed during October.

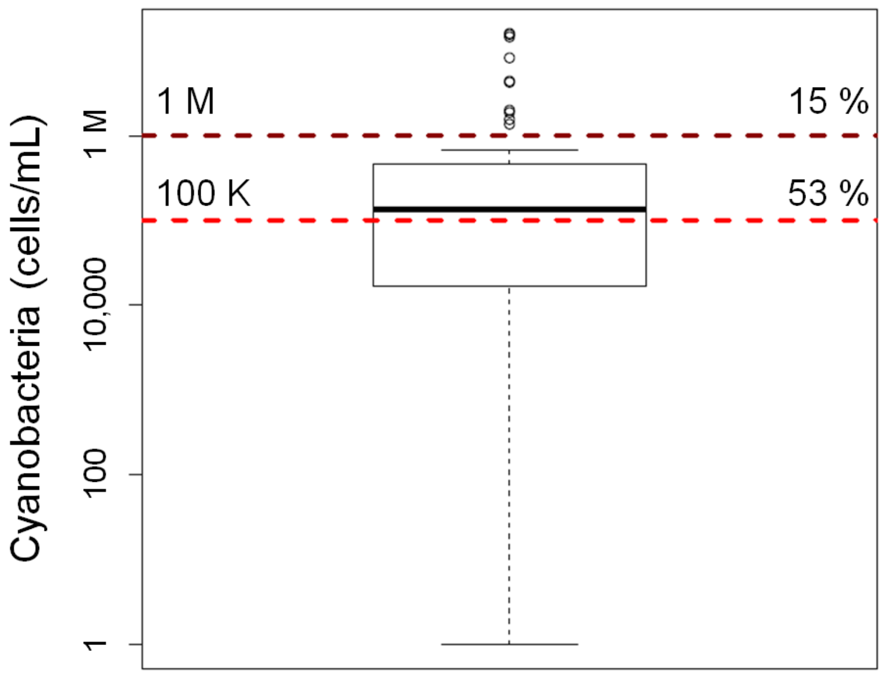

Figure 1. Cyanobacteria concentrations for all samples from the aggregated stakeholder datasets (n=68). The 100,000 cell/mL recreational use HAB indicator is identified by the dashed red line. 1 million cells/mL is shown as a dark red dashed line.

Cyanotoxin Concentrations

Nodularia blooms in Farmington Bay have been associated with significant concentrations of the cyanotoxin, nodularin. Nodularin concentrations were positively related to Nodularia cell counts with a significant increase in toxin concentrations occurring at the HAB indicator of 100,000 cells/mL (Marden et al. 2015, Figure 2). Nodularin concentrations averaged 15 µg/L and exceeded 20 µg/L in 25% of samples. Spatially, nodularin concentrations peaked in the mid-portion of the bay then dissipated towards the outlet culvert to Gilbert Bay (Figure 3). Detectable concentrations of Nodularin were exported from Farmington Bay to Gilbert Bay where the higher salinity usually prevents Nodularia growth.

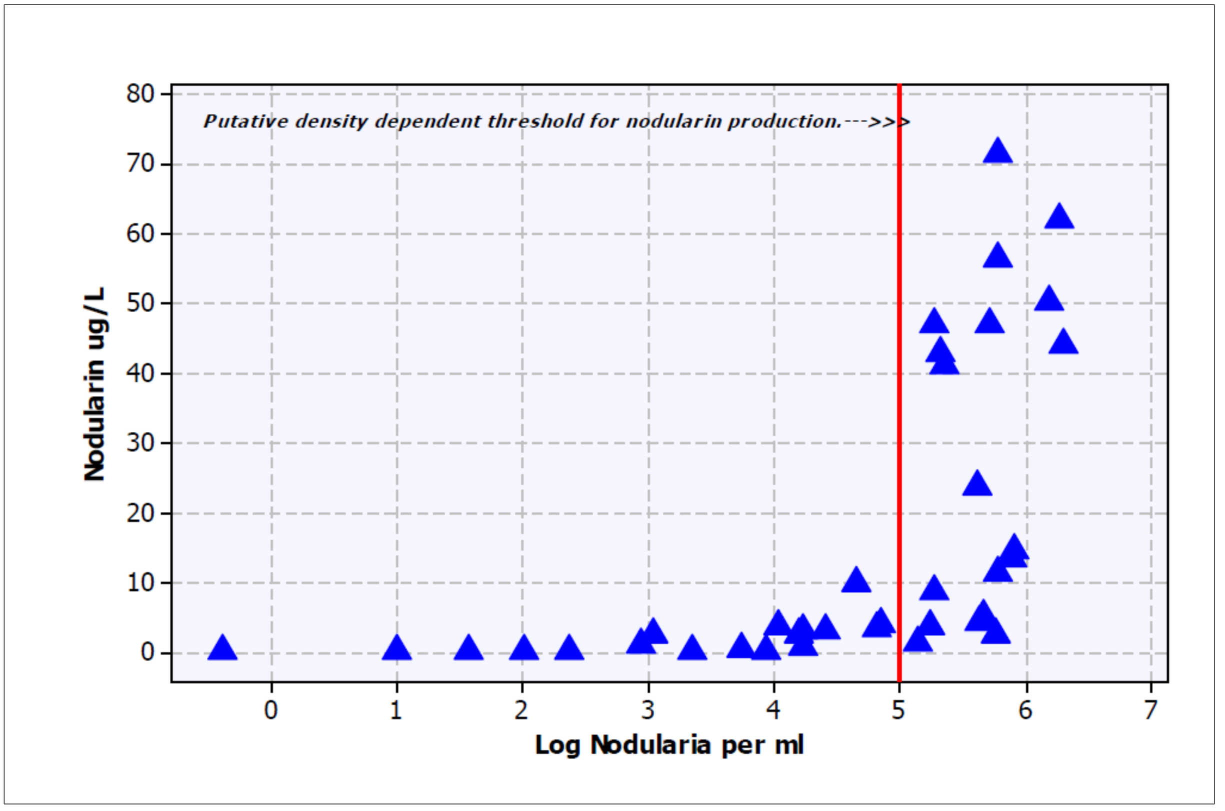

Figure 2. The relationship between Nodularia cell concentrations (x-axis) and concentrations of the cyanotoxin Nodularin (y-axis) in Farmington Bay showing a significant increase in Nodularin concentrations at 100,000 cells/mL of Nodularia. Figure from Marden et al. 2015.

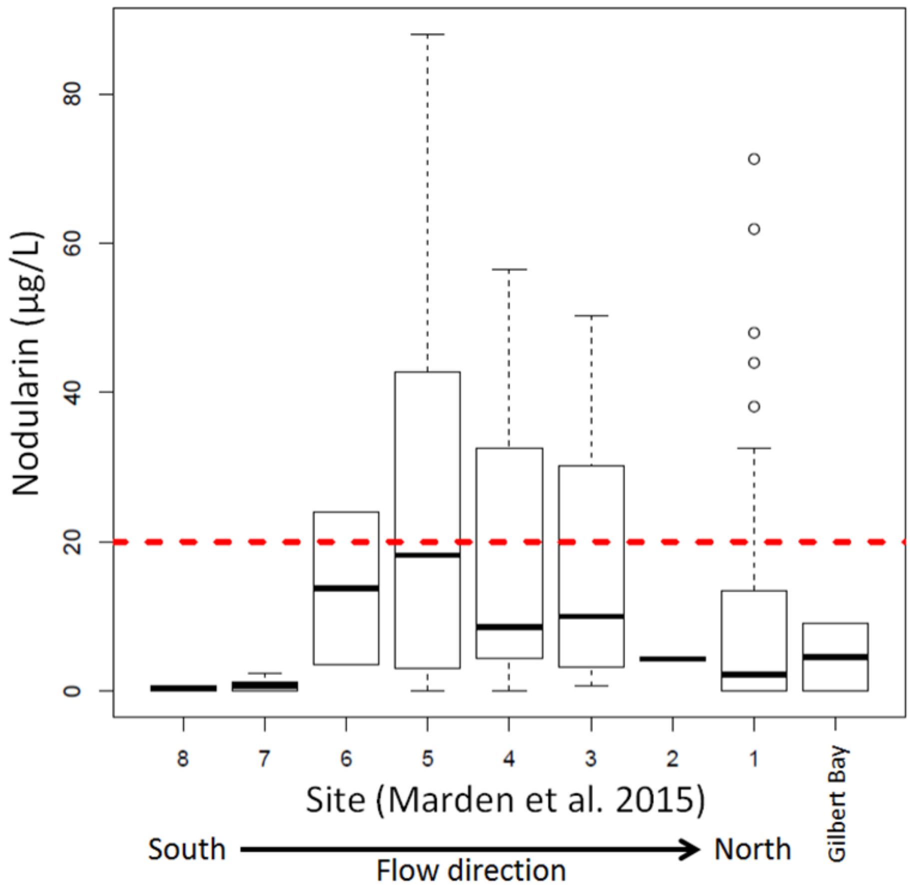

Figure 3. Nodularin concentrations in Farmington Bay by location replotted from Marden et al. 2015. The human health risk level for microcystin-LR (20 µg/L) is plotted as a dashed red line.

Chlorophyll *a* Concentrations

Chlorophyll *a* concentrations consistently exceeded the human health risk indicator of 50 µg/L. Chlorophyll *a* concentrations in Farmington Bay averaged nearly 100 µg/L (Figure 4), and exceeded the human health risk indicator of 50 µg/L in 59% of samples. This is indicative of extremely high algal growth in the water column, and a consistent potential for HAB occurrence.

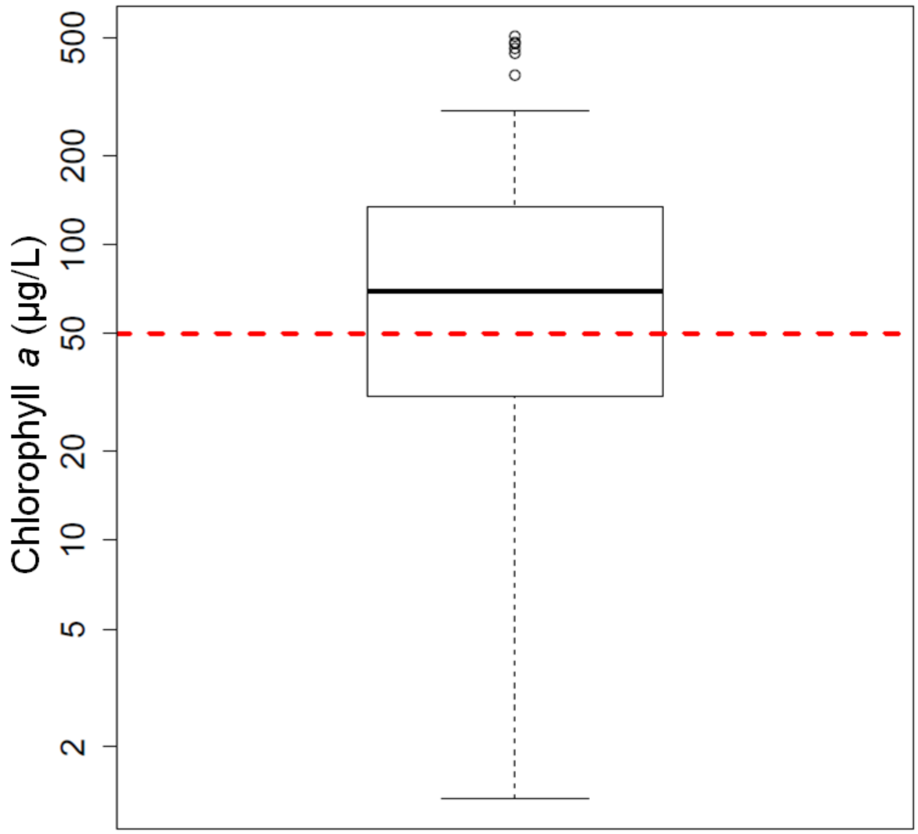

Figure 4. Chlorophyll *a* concentrations in Farmington Bay. The WHO indicator for human health risk (50 µg/L) is identified by the dashed red line.

SUMMARY

Data from Farmington Bay show frequent and extensive HABs (Table 2). Phytoplankton samples in Farmington Bay exceeded 100,000 cyanobacteria cells/mL in over 50% of samples. In addition, the cyanotoxin and chlorophyll *a* indicators also frequently exceeded thresholds for human health risk. Farmington Bay will remain in category 3C - assessment methods in development for the 2016 IR. UDWQ intends to assess recreational uses for Farmington Bay in the 2018 Integrated Report. Frequent exceedances of the indicators do identify a potential human health risk for recreational users of Farmington Bay. UDWQ is committed to human health protection and maintaining safe and enjoyable recreational experiences on Utah's waters. UDWQ will work with the Davis County Health Department to manage the public health risks posed by HABs in Farmington Bay while continuing to collect additional data and develop appropriate assessment methodologies.

Table 2. Number and percent of exceedances in Farmington Bay for all three indicators at human health risk thresholds as defined by WHO. Thresholds for microcystin-LR are used for Nodularin benchmarks.

Parameter	Cyanobacteria	Nodularin	Chlorophyll *a*
Threshold	100,000 cells/mL	20 µg/L	50 µg/L
Number of samples	68	105	159
Exceedances	36	27	94
Percent exceedance	53	26	59

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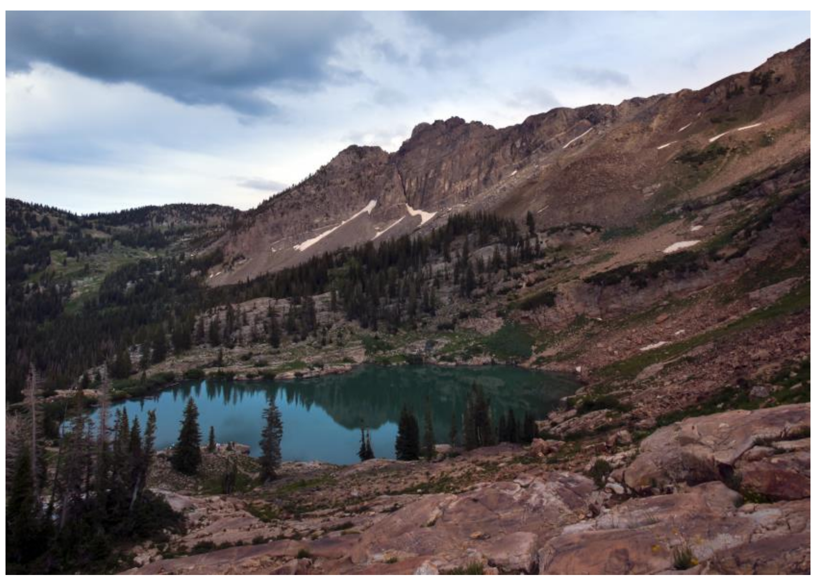
CHAPTER 7: UTAH'S DRAFT ASSESSMENT METHODS FOR HIGH FREQUENCY DATA AND PILOT APPLICATION FOR THE JORDAN RIVER



UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

2016 Final Integrated Report

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ACRONYMS

AU	Assessment Unit
CWA	Clean Water Act
DO	Dissolved Oxygen
DWQ	Utah Division of Water Quality
EPA	U.S. Environmental Protection Agency
IR	Integrated Report
MLID	Monitoring Location ID
QA/QC	Quality Assurance/Quality Control
POR	Period-of-record
POTW	Publicly Owned Treatment Works
WQS	Water Quality Standard

Contents

INTRODUCTION

Utah's Draft Assessment Methods and for High Frequency Data provide a framework for determining whether a waterbody or segment within a waterbody supports or does not support the Dissolved Oxygen (DO) criteria that were establish to protect the applicable aquatic life designated uses found in **UAC R317-2**. These water quality criteria include several different averaging periods that prescribe the magnitude and the duration of low levels of DO that should not be exceeded to maintain support groups of biota that vary in their relative susceptibility to low DO conditions. The assessment methods include several summary statisitics to facilitate the use of high frequency data to assess ambient conditions against both acute and chronic criteria.

The draft assessments methods are intended to be as closely aligned with Utah's existing water quality criteria, and the underlyng rationale used to support these criteria (EPA 1986), as possible. The methods also attempt to encapsulate the underlying rationale behind these criteria and the current scientific evidence with respect to the various ways that low DO conditions can degrade the health of stream biota. DWQ welcomes input on the draft assessment methods and recommendations for other approaches that could be used to interpret high frequency DO data in a way that improves the accuracy and interpretation of DO assessments. DWQ will evaluate and incorporate suggestions that are received, as appropriate, into revised assessment methods that will be used to make impairment decisions in subsequent *Integrated Reports*.

Background

DWQ's current assessment methods for field parameters (e.g., DO, temperature, pH) are based on data obtained from discrete water quality measurements (e.g., grab samples) during routine water quality sampling activities. While ongoing assessments based on discrete water chemistry collections enable DWQ to identify and address many water quality concerns, DWQ also acknowledges that there are important water quality parameters where instantaneous measurements are often insufficient. For instance, discrete samples are difficult to interpret for parameters that exhibit strong diel variation, such as dissolved oxygen, which can result in either over- or under-protection of water quality, depending on the time of day when the samples were collected.

Recent technological advances make obtaining high-frequency data (i.e., data collected on intervals of 1 minute to 1 hour to several hours) for field parameters more affordable and therefore more readily available. In many cases, these data provide more ecologically meaningful water quality information, particularly for temporally variable water quality parameters (i.e., dissolved oxygen concentration and saturation, specific conductance, pH, temperature, and turbidity) (EPA 1986). For example, high frequency data are more likely to reveal patterns of daily, weekly, monthly, or seasonal variation. Similarly, high frequency data can be used to more accurately quantify important water quality summary statisitics such as maxima (or minima) that are equally important determinants of threats to biological assemblages. In an assessment context, high frequency characterizations of water quality more closely mirror the duration and frequency components of water quality standards, which should lead to a reduction of both false positive and false negative impairment decisions.

While high frequency data offer numerous advantages, there are several unique challenges with their analysis and interpretation. For instance, the large data sets generated by such monitoring can be a challenge to manage, apply Quality Assurance/Quality Control (QA/QC) procedures to, and ultimately to interpret. For example, drift (systematic bias) sometimes occurs during long-term deployment of high frequency data collection instruments and methods are required for identifying and addressing suspect data.

Care must also be taken to ensure that summary statistics generated from these data sets quantify conditions that are consistent with the studies or investigations that were originally used to support water quality criteria. Together, the unique characteristics of these data mean that alternative assessment procedures are required.

Dissolved Oxygen

Of all the field-measured parameters, Dissolved Oxygen (DO) offers an opportunity to improve existing assessment methods based on high frequency data readings. DO often exhibits pronounced diel variation, particularly in highly productive environments where problems with low DO are most likely to occur. Utah's acute water quality criteria for DO are expressed as absolute minima, which are unlikely to be captured by grab sample data because these conditions are least likely to occur in the daytime when most water quality samples are collected.

Longer periods of low DO conditions can also lead to chronic effects on stream biota such as reductions in abundance or growth rates. Like many states, Utah's water quality standards protect against chronically low DO conditions with longer, 7-day or 30-day, averaging periods (Table 1). Periodic grab samples of DO make the direct calculation these averaging periods impossible. Even among streams where chronic conditions have been previously identified, the lack of long-term, high frequency data precludes identification of longer term (e.g., seasonal or year-to-year) temporal trends in DO conditions which could help identify appropriate mitigation efforts.

Table 1: Dissolved Oxygen (DO) standards for the State of Utah and site specific DO standards for the Jordan River, Utah.

Site specific criteria for DO for the *Jordan River*				
Time of year	**May-July**	**August-April**		
30 Day Average (mg/L)	5.5	5.5		
7 Day Average (mg/L)	5.5	NA		
Minimum daily (mg/L)	4.5	4		
DO criteria for the *State of Utah*				
Designated waterbody type	**3A**	**3B**	**3C**	**3D**
30 Day Average (mg/L)	6.5	5.5	5.0	5.0
7 Day Average (mg/L)	9.5/5.0*	6.0/4.0*	NA	NA
Minimum daily (mg/L)	8.0/4.0*	5.0/3.0*	3.0	3.0

Note: As per R317.2.1.1(b), up to 10% of representative samples may exceed the minimum criterion for dissolved oxygen.
* Early life stages present / all other life stages present. Early life stages assumed present unless demonstrated otherwise.

ANALYSIS AND INTERPRETATION OF HIGH FREQUENCY DISSOLVED OXYGEN DATA

If high frequency data are to be used to make water quality assessment decisions, it is necessary to summarize the data in a way that allows direct interpretation of the magnitude, duration and frequency components of water quality standards. The selection of appropriate summary statistics should also align with the scientific basis behind DO criteria, as described in the EPA guidance that provided their underlying rationale. This section describes how DWQ proposes summarizing and assessing high frequency DO data, and the underlying rationale behind the draft assessment methods.

Quality Assurance: Screening Raw DO Data

DWQ has developed a detailed QA/QC process for high frequency monitoring data. First, data sets are graded into several discrete categories based on the relative rigour of collection methods (see Chapter 7 Appendix 1). High frequency data sets that receive data quality grades of an A or B will be considered suitable for formal assessment purposes. Next, qualifying data sets are screened for data anomalies such as data drift or other instrument errors following the procedures and recommendations of the US Geologic Survey (Wagner et al. 2006). All questionable data points are removed prior to analysis and interpretation. These data quality screens are particularly important for DO sensors because they are subject to bio-fouling, especially in nutrient-rich waters where they have a higher potential to become covered with algae growth. When bio-fouling occurs, it results in erroneous logger measurements, or sensor drift.

Assessing DO with High Frequency Data: Draft Methods

Utah's DO criteria are largely based on USEPA's guidance "Ambient Water Quality Criteria for Dissolved Oxygen" (USEPA, 1986). When drafted, this guidance document compiled existing scientific literature and made several recommendations for appropriate DO criteria based on the following assumptions:

- Chronic criteria (7-day and 30-day moving averages) are needed to minimize the extent to which low DO threatens the condition of fish populations (e.g., density, growth rates)
- Acute (1-day minimum) criteria are intended to protect against the lethal effects of low DO
- More strigent criteria are required for protection of early life stages
- Together chronic and acute criteria are intrinsically protective of biota other than fish
- Warm water fish assemblages are more tolerant to low DO than cold water fish assemblages

With these assumptions in mind, DWQ identified several summary statistics that can be calculated from high frequency data and used to evaluate the acute and chronic effects of low DO to biological designated uses. These statistics were then divided into two classes: Primary Statistics and Secondary Statistics. Primary statistics are measure with direct linkages to Utah's water quality standards, which are used to evaluate both acute and chronic DO impairments. Supplemental statistics are measures that are intended to provide insight into the nature and extent of any DO impairments that are identified.

Primary Statistics: Assessing Acute and Chronic DO Impairments

These draft assessmenrt methods use summary statistics that can be most directly linked to Utah's DO criteria (UAR R317-2) to make impairment decisions (Table 1). These primary statistics include considerations for whether or not sensitive life stages are present, as well as alternative measures for acute and chronic DO conditions. Table 2. Summary of primary statistics

Primary statistics
7-day moving mean
30-day moving mean
Single day (24 hour) minimum
Frequency of minimum exceedance

CONSIDERATION FOR SENSITIVE LIFE STAGES

As discussed earlier, water quality standards include dual criteria for both acute and chronic 7-day average criteria depending on whether early life stages are present. This difference can complicate interpretation of chronic DO criteria, because data that documents the presence or absence of sensitive life stages is often unavailable. In such circumstances, the more conservative criterion will be applied for assessment purposes (i.e., assume that sensitive life stages are present unless data exist to demonstrate that they are not). This is consistent with the application of early life stage assumptions in other DWQ programs, such as wasteload analyses. If an impairment decision hinges on this conservative assumption (i.e., the site would not be considered impaired if sensitive life stages are not present), then DWQ will conduct further investigations on the fish assemblage in the assessment unit and modify the assessment decision if appropriate.

DO MINIMA STATISTICS AS INDICATORS OF ACUTE IMPAIRMENTS

DO minima criteria are intended to protect resident biota against lethal (acute) effects of low levels of DO (USEPA 1985, 1986). Consistent with this guidance, Utah's water quality criteria includes daily minima DO criteria to protect aquatic life against acutely low DO. This is expressed in Utah's water quality criteria using the averaging period "*not less than at any time*". Again consistent with EPA guidance, DWQ interprets any single reading lower than the applicable DO minima as a WQS violation; however, biota do not generally respond to very short intervals of low DO, so interpreting a criterion violation of short duration as an impairment may be be overly conservative. As a result, and per 317.2, up to 10% of all acute criteria were allowed to be exceeded without DWQ inferring an impairment .

Two acute DO minima summary statistics were calculated:

1) The percentage of total measurements that exceed the criterion versus the total number of measurements in the Index Period and the Period-of-Record respectively and the,
2) the percentage of days in which the minimum was exceeded

DO AVERAGE STATISTICS (7-DAY AND 30-DAY) AS INDICATORS OF CHRONIC IMPAIRMENTS

Chronic DO water quality concerns are evaluated with long-term (7-day and 30-day) averages. When calculating longer-term averages from high frequency data, one important consideration is the recording frequency of individual observations. Currently, there is no standard recording frequency for the collection of high frequency DO concentrations. The instruments that collect these data can generally be set at any user-defined interval. These differences among data sets create problems with the consistent analysis and interpretation of high frequency data. This is especially true if data from different sources are combined—as required for 303(d) assessment programs by CWA regulations. The interval between DO readings can alter the ecological interpretation of low DO conditions, which could potentially lead to differing impairment conclusions. For instance, longer intervals may be more consistent with DWQ's ongoing use of instantaneous DO measurements, whereas higher frequency data (i.e., 1, 5, 15 minutes rather than 2 hour) more accurately quantifies the temporally dynamic variation in DO concentrations. Ideally, datasets should be generated in hourly (or less) intervals.

Utah's DO water quality criteria also include protection against chronic problems resulting from extended periods of low DO conditions. The criteria specify an averaging period of 7- and 30-days (Table 1). DWQ proposes that these calculations should mirror those originally used to derive Utah's DO criteria (EPA 1985, 1986). Specifically, DWQ first calculated the daily mean DO from all of a single days measurements. Next, DWQ used these daily averages to calculate a moving average over both 7-day and 30-day intervals to facilitate interpretation of the data against the chronic DO criterion.

ACUTE ASSESSMENT PROCEDURES

The draft assessment methods (Figure 1) uses high frequency DO measurements to assess the frequency of excursions below the DO minima criteria based on the duration of these violations within a day and also the total number of days where DO minima criteria violations were observed. For this assessment draft, the total number of days where the minima criterion was exceeded at least once was tabulated. Also, the sum total of all observed excursions below the minima criterion is compared against the total number of observations within the Period-of-Record and Index Periods. Any site, and associated assessment unit, where acute criteria are exceeded for >10% of *days* over the Period-of-Record and/or the Index Period will be considered impaired (Figure 1). Additionally any site where acute criteria exceed >10% of *observations* over the Period-of-Record and/or the Index Period will result in the site being considered impaired. Chronic and acute criteria will be evaluated independently.

CHRONIC ASSESSMENT PROCEDURES

Chronic DO criteria are intended to protect against conditions that may alter the health, condition or productivity of aquatic biota (EPA 1985, 1986). Consistent with EPA guidance, the duration of exposure to low DO conditions is dependent upon whether sensitive life stages—most commonly fish fry—are present. If sensitive life stages are present, then the more stringent 7-day criterion is required, otherwise the less stringent 7-day criterion is applied for other life stages (see Table 1).

Where data of sufficient duration are available, DWQ will assess the chronic DO criteria with both the 7-day and 30-day averaging periods using moving average summary statistics. These calulations are made by first calculating the daily arithmetic mean of DO observations. Next, these daily means are averaged over both 7- and 30-days, moving from one day to the next over the POR. Consistent with the rationale that EPA used to support the DO recommendations (EPA 1986), these calculations allow DWQ to evaluate not just the total number of violations of the DO chronic criteria, but also the persistence of any observed excursions. Also, comparisons between these averaging periods will allow DWQ to evaluate whether or not chronic DO impairments hinge on the presence or absence of sensitive life stages. If neither the acute nor chronic assessments result in an impairment decision, then the site would be considered to be fully-supporting its aquatic life uses with respect to dissolved oxygen.

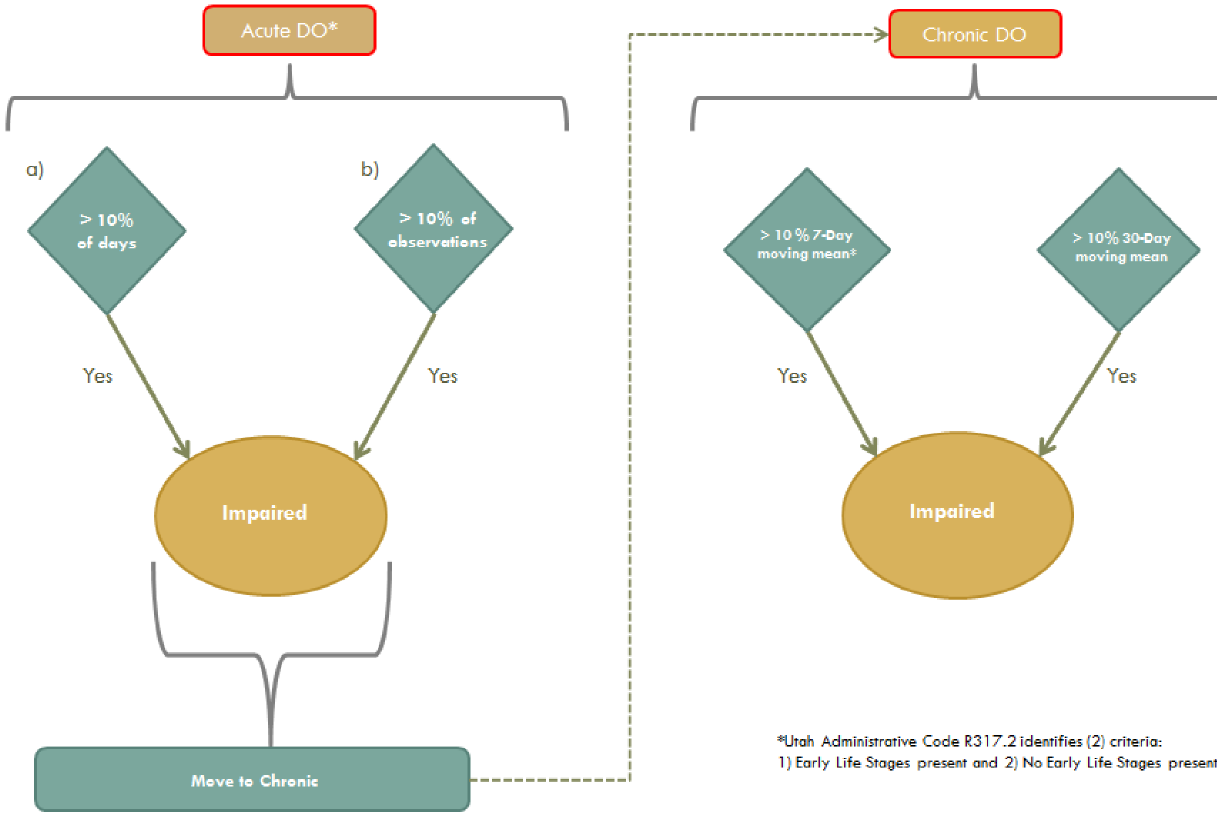


Figure 1: Assessment methods for high-frequency dissolved oxygen (DO) measurements.

Secondary Statistics: Better Interpretations of DO Water Quality Concerns

DWQ's draft assessment methods also incorporate several secondary statistics as supplemental water quality indicators (Table 3). These supplemental statistics are not intended to identify water quality impairments, but to provide supporting information to better understand the nature and extent of any DO imparments that are ultimately identified. For instance, supplemental summary statistics can be used to better link DO observations to independent scientific investigations on the effects of low DO conditions on aquatic biota.

Since USEPA's guidance was initially drafted, scientists have continued to explore the specific mechanisms that can cause low levels of DO and have deleterious effects on fish and other aquatic biota (see WSDE, 2002 for an extensive review). These investigations highlight several secondary statistics that may be used to help summarize and interpret low DO events (Table 3). DWQ calculated several of these measures as secondary statistics to help better understand any DO impairment that are ultimately identified (Table 3). For instance, long durations of low DO concentrations, particularly acutely low concentrations, can be particularly stressful to biota, which makes the duration of low DO event ecologically meaningful). Another example is the diel flux of DO. Large differences between the daily maximum and minimum DO concentrations are stressful to stream biota. Temporal patterns of these fluxes can also be used to understand changes in relative rates of Gross Primary Production and Ecossytem Respiration, which has the potential to provide insights into the underlying causes—and potential solutions to—low DO concentrations.

Table 3. Summary of secondary statistics

Secondary Statistics
Duration of DO conditions below criterion
Frequency of recurrent low DO events
Spatial extent of low DO
Diel flux of DO

JORDAN RIVER PILOT STUDY: AN APPLICATION OF DRAFT ASSESSMENT METHODS

To illustrate the draft assessment methods for high frequency data, DWQ conducted a pilot investigation on dissolved oxygen (DO) data in the lower Jordan River, Utah. The Jordan River is a relatively short river, approximately 51 miles long, originating at Utah Lake and flowing north to terminate in wetlands that eventually discharge to the Great Salt Lake. The topography within the Jordan River watershed contributes to a very complex precipitation pattern with great variability in amounts and timing of flows. Although Utah Lake is the single largest source of flows to the Jordan River, much of this water is diverted within a few miles for agricultural and municipal use. Other tributaries flow into the Jordan River from both east and west, but these, too, are subject to a complex network of diversions, return flows from canals, stormwater discharge, and exchange agreements between culinary and agricultural users. The lower Jordan River begins downstream of the largest diversion, the Surplus Canal, which redirects up to 90 percent of the flow from the Jordan River directly to the Great Salt Lake to protect neighborhoods and developments from flooding.

Designated beneficial uses for the various segments of the Jordan River include domestic uses (with prior treatment), secondary contact recreation (boating, wading, fishing, etc.), cold and warm water fisheries, other wildlife that depend on an aquatic environment (waterfowl, shorebirds, and the aquatic organisms in their food chains), and agricultural irrigation. These uses are protected by a variety of water quality standards, but every segment of the Jordan River has been found to be non-supporting of one or more beneficial uses (i.e., impaired) due to exceeding one or more of these water quality standards. With respect to DO, only the lower Jordan River downstream of the Surplus Canal (north of 2100 South in Salt Lake City) is listed as impaired.

The decision to pilot the draft methods with a water body that is already listed for DO was intentional. DWQ does not intend to use the draft high frequency DO methods to make new impairment decisions until they are fully vetted with stakeholders. Instead these assessment results are intended to highlight areas where the draft assessment methods can potentially be improved and to provide conformational support for the existing DO listings.

Methods

DO data for this pilot application of the draft high frequency assessment methods were obtained from data sondes (YSI EX01) that were deployed and are maintained by the Jordan River, Farmington Bay Water Quality Monitoring Council (JRFBWMC) at (5) sites along the lower Jordan River, from upstream to downstream: 3300 South (MLID # 4992880), 2100 South and 1100 West (MLID #4992320), 800 South above drain outfall (MLID #4992050), 300 North (MLID #4991900) and Cudahy Lane above the South

Davis POTW (MLID # 4991820) (Figure 2). At each of these locations sondes recorded DO concentrations in 15-minute intervals. While these data collection efforts are ongoing, data from 2014 were used for this pilot investigation because this was the most complete data set available at the beginning of this investigation.

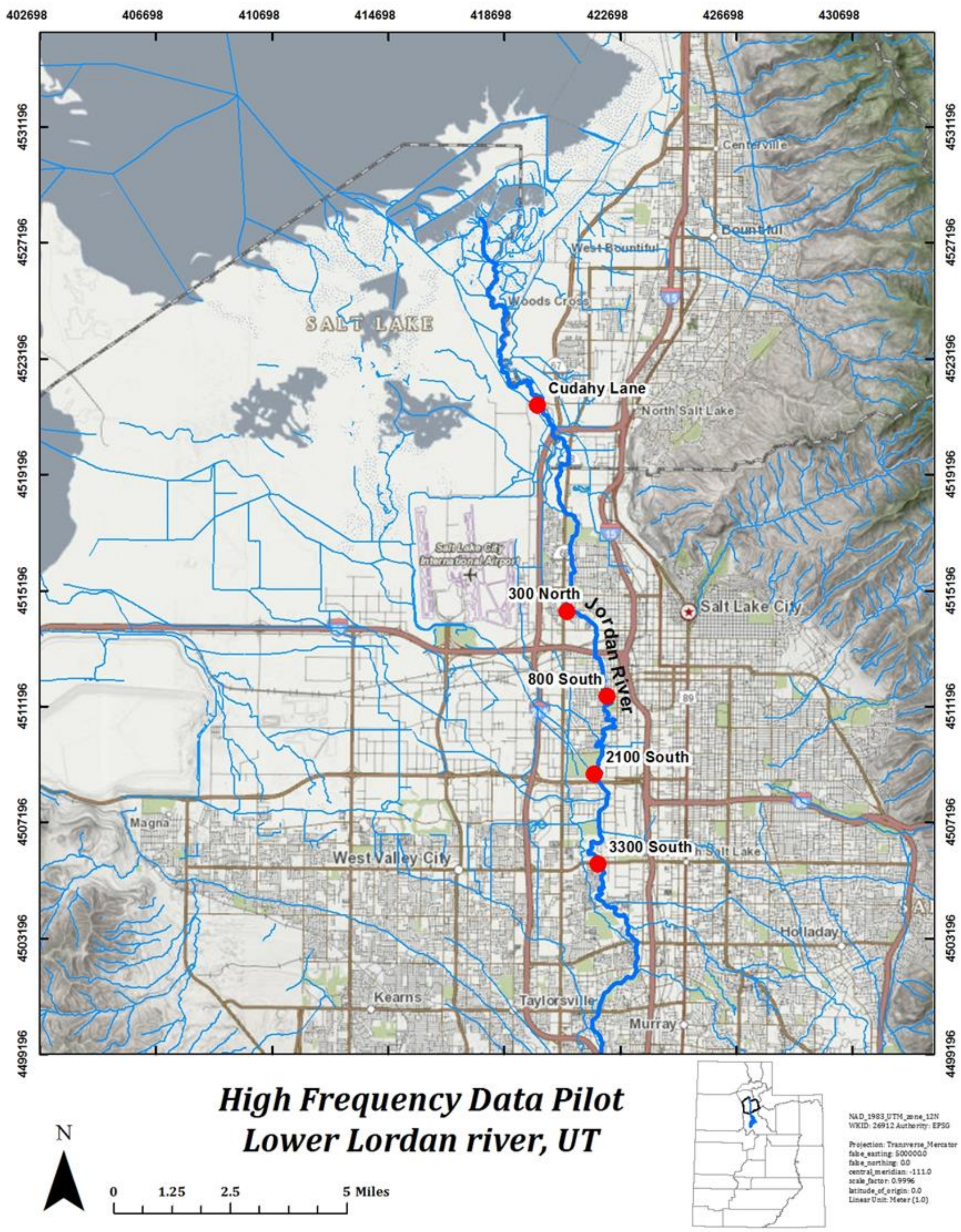


Figure 2: Locations of high-frequency sites along the lower Jordan River, Utah.

DO data from each location were screened with existing credible quality control procedures. Specifically, a database was used to plot the raw data to facilitate identification of anomalous data. Data that was deemed erroneous either via known issues with the logging device, sensor issues, or where no data was recorded by the logger were removed from data analysis. Using a simple database, the raw data (dissolved oxygen and battery voltage) was plotted and examined. In many instances where the DO measurements seemed erroneous (e.g., 0 or 25mg/L) there was an associated issue with battery voltage (i.e., 0 or 236) which resulted in sensor malfunction. Similarly, at several different sites the DO would remain at the same concentration from days to months. Any questionable DO observations that were identified were not used in the analysis. In all cases careful best professional judgement (BPJ) was used to aggregate and retain the clean data for subsequent analysis.

All summary statistics were calculated from all credible data that were not eliminated in the QA/QC process. Data were analyzed independently for the two periods (i.e., May through July and August through April) defined in the site-specific standards for the Jordan River (Table 1). All summary statistics were then plotted for each monitoring location. In total, three figures were generated for each monitoring location to summarize different DO characteristics: 1) a daily minimum DO and duration of exceedances of acute criteria, 2) 7- and 30-day moving mean, and 3) DO daily maximum and minimum and diel variation. Once generated, these plots were used to conduct pilot assessments for each monitoring location to illustrate the draft assessment process.

Results

QA/QC of the Jordan River DO Records

The QA/QC process was successful in the identification and removal of suspect/erroneous data. For instance, there were several instances where one or two consecutive observations differed greatly from the overall trend immediately prior to or following the observations. There were also several circumstances where observations were not recorded creating gaps in an otherwise continuous data record. Using DWQ's Data Quality Matrix for High Frequency Data (see Chapter 7, Appendix 1.) The data for this pilot project would be a "C" on an A through D scale. The data had no definable verification or calibration reports which would indicate periods of sensor drift or the like. As a result, DWQ was unable to address instrument drift associated with bio-fouling or calibration drift. There are QAQC methods to account for drift but the data used in this pilot project does not include any data verification or calibration records that could be used to correct drift in the dataset. Consequently, the data used as part of this pilot project is considered *provisional*. Typically, the lack of independent measures that could be used to QC sensor data would be sufficient to disqualify a high frequency dataset from use in making 303(d) impairment decisions. However, given that this is a pilot investigation and conducted on a stream segment that is already listed for DO, DWQ opted to proceed with the analysis.

Site-Specific Characterization of DO on the Lower Jordan River

This section summarizes the pilot high frequency data analysis using draft assessment methods for sites along the lower Jordan River, from upstream to downstream.

3300 SOUTH MONITORING LOCATION

Following the draft assessment methods, there was no evidence of of a DO impairment at the most upstream location on the lower Jordan River. With respect to potential acute DO concerns, the absolute minimum DO observed at this location was 3.78 mg-DO/L, which does exceed the minimum criterion of 4.5 mg-DO/L (Figure 3). However, this only occurred once for one hour in duration, which means that the site would not be considered impaired according to the acute criteria assessment rules. In addition, no violation of either the 7-day or 30-day moving averages occurred (Figure 4), which means that chronic DO violations were not observed, irrespective of whether or not early life stages are present at this site.

With respect to supplemental statistics, the average diel variation at this site was the greatest of all sites (4.09 mg-DO/L/day) (Figure 5). The large diel variation may be stressful to biota, though this is not overly concerning, given that acute and chronic criteria were met. Of note was an extended period of relatively high variation in late winter. Given that low DO observations were not made over the same period, this suggests that there may be a peak in primary production immediately prior to spring runoff. The daily minima indicator also reveal a pattern of relatively low DO conditions in late July (Figure 3).

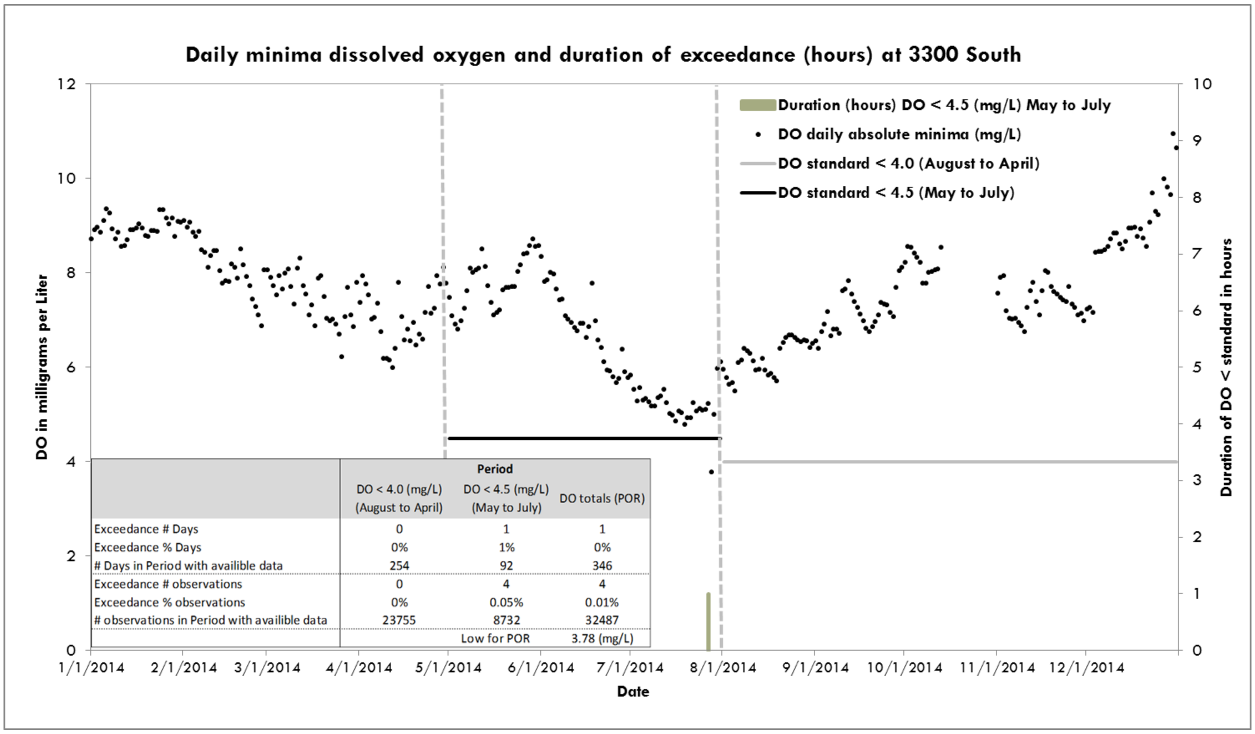


Figure 3: The daily minima represents the lowest measured value of each day and is used as a primary statistic for 3300 South.

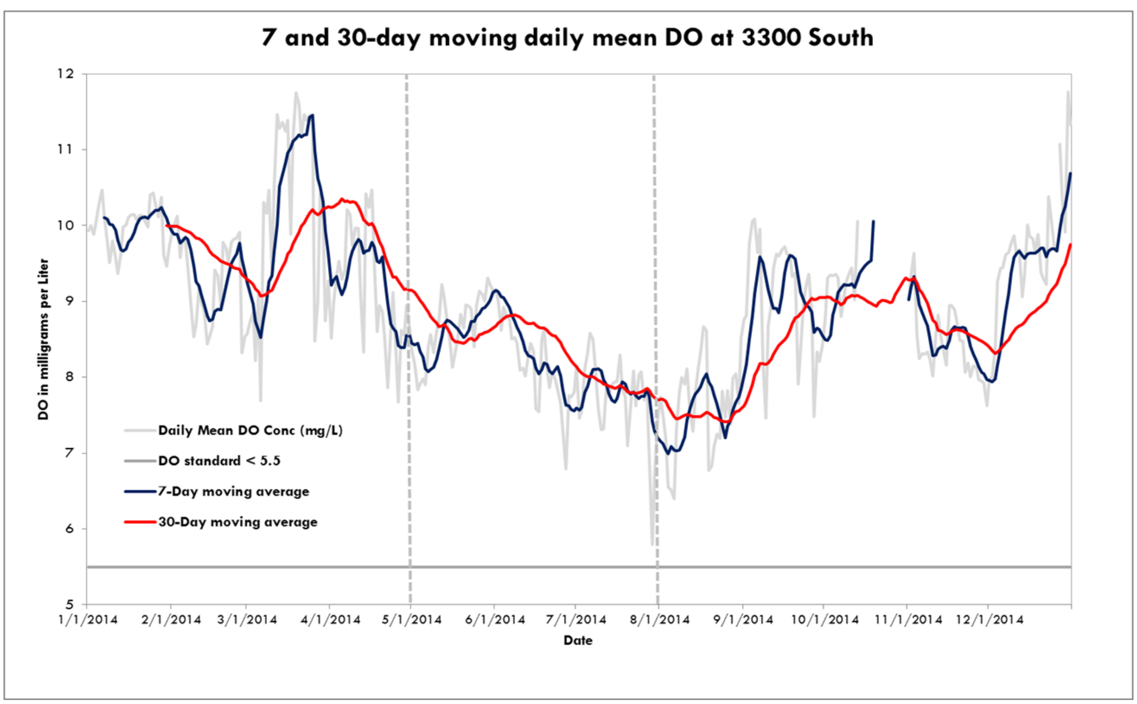


Figure 4: The 7- and 30-day moving daily mean dissolved oxygen from 3300 South. The gray horizontal line denotes the water quality standard of 5.5 (mg/L) for the entire year for the 7- and 30-day moving daily mean.

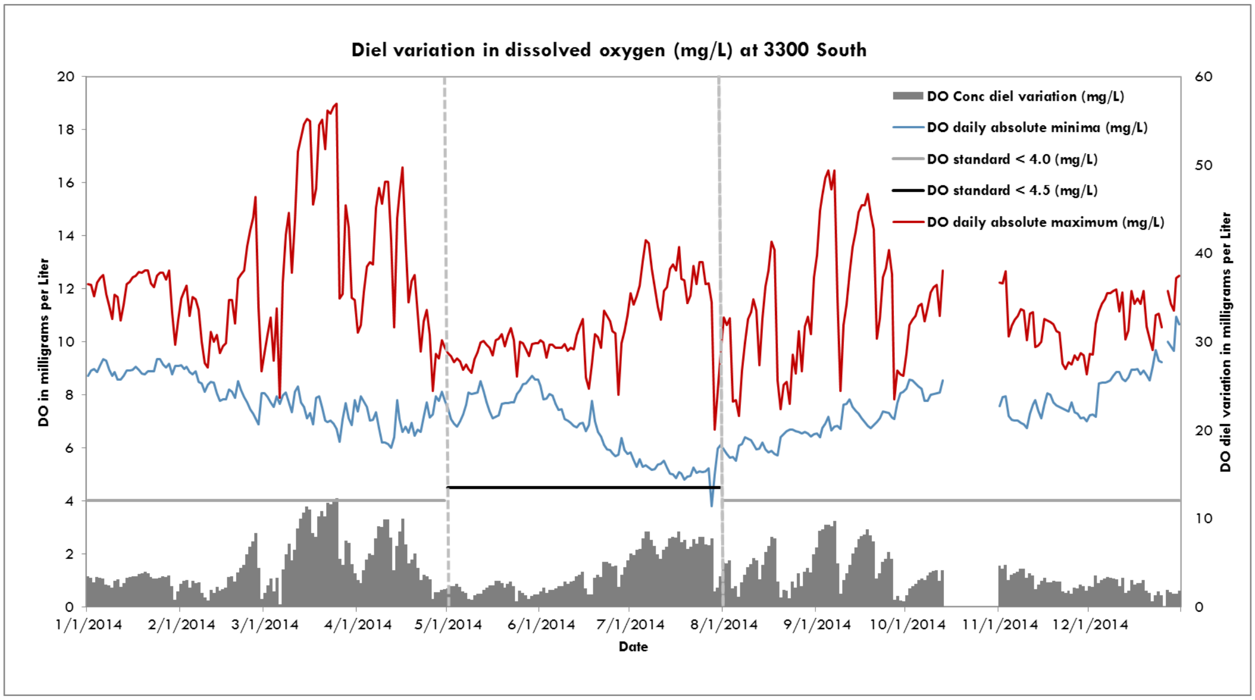
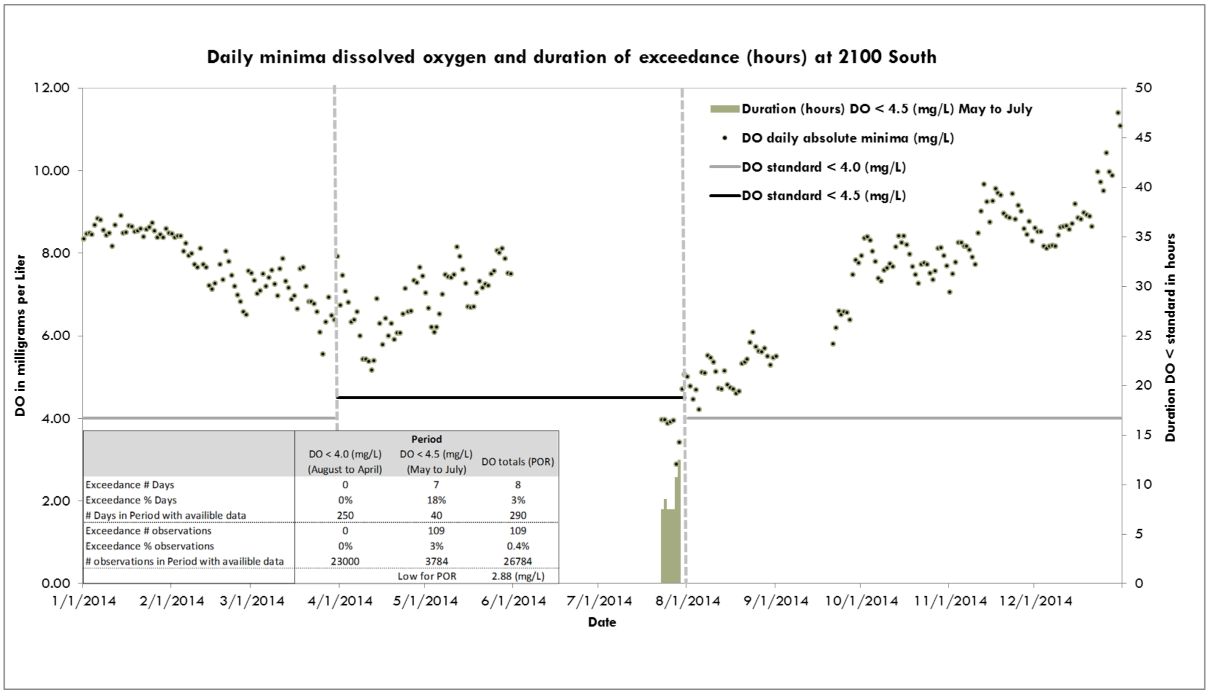


Figure 5: Temporal trends in dissloved oxygen and the diel variation (mg/L) at 3300 South. The water quality standards for the Jordan River for dissloved oxygen (mg/L) are dennoted by the gray and black lines and are 4.0 (mg/L) and 4.5(mg/L) with respect to the times of the year.

2100 SOUTH MONITORING LOCATION

The 2100 South monitoring location exhibited mixed results with respect to the draft acute DO impairment decision rules. The daily DO minima criterion was only exceeded 3% or 8 days in the Period of Record which fails to meet the draft impairment threshold of 10% (Figure 6). The available data suggest that these instantaneous minima violations may have been confined to a single incident in late July. However, this interpretation is complicated by the fact that DO data at this location were not recorded for several weeks immediately preceding this incident due to suspected equipment failure. Interpretation of the chronic DO criteria is similarly complicated by missing data during the peak growing season. Nevertheless, among data that were recorded, violations of the chronic DO criteria were not observed for the 7-day and 30-day moving averages (Figure 7).

Daily DO diel variation was generally much lower at this location than it was at the next location upstream (3300 South) (Figure8). Similar to the 3300 S location upstream, high variation values were observed in late winter, although the magnitude of diel variation in DO was not as pronounced. The daily minima is also difficult to interpret due to missing data, but those observations that were recorded suggest that late summer may also be a period of particular interest at this monitoring location (Figure 6).



	Period DO < 4.0 (mg/L) (August to April)	DO < 4.5 (mg/L) (May to July)	DO totals (POR)
Exceedance # Days	0	7	8
Exceedance % Days	0%	18%	3%
# Days in Period with availible data	250	40	290
Exceedance # observations	0	109	109
Exceedance % observations	0%	3%	0.4%
# observations in Period with availible data	23000	3784	26784
		Low for POR	2.88 (mg/L)

Figure 6: The daily minima represents the lowest measured value of each day of the period-of-record and for the time being will be used as supplemental data for 2100 South. Additionally the inserted table reflects seasonal exceedences in days, the percentage of exceedances in relation to the total days in the period-of-record as well as the number of observations that are exceeding the standard and the percentage as compared to the total observations.

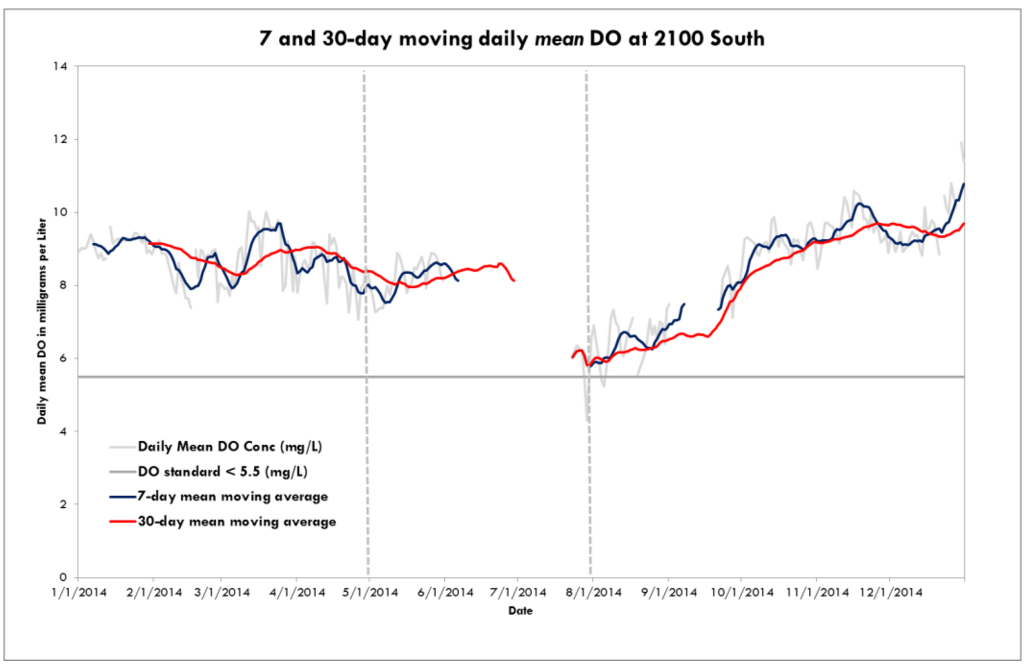


Figure 7: The 7- and 30-day moving daily mean dissolved oxygen from 2100 South. The gray horizontal line denotes the water quality standard of 5.5(mg/L) for the entire year for the 7- and 30-day moving daily mean.

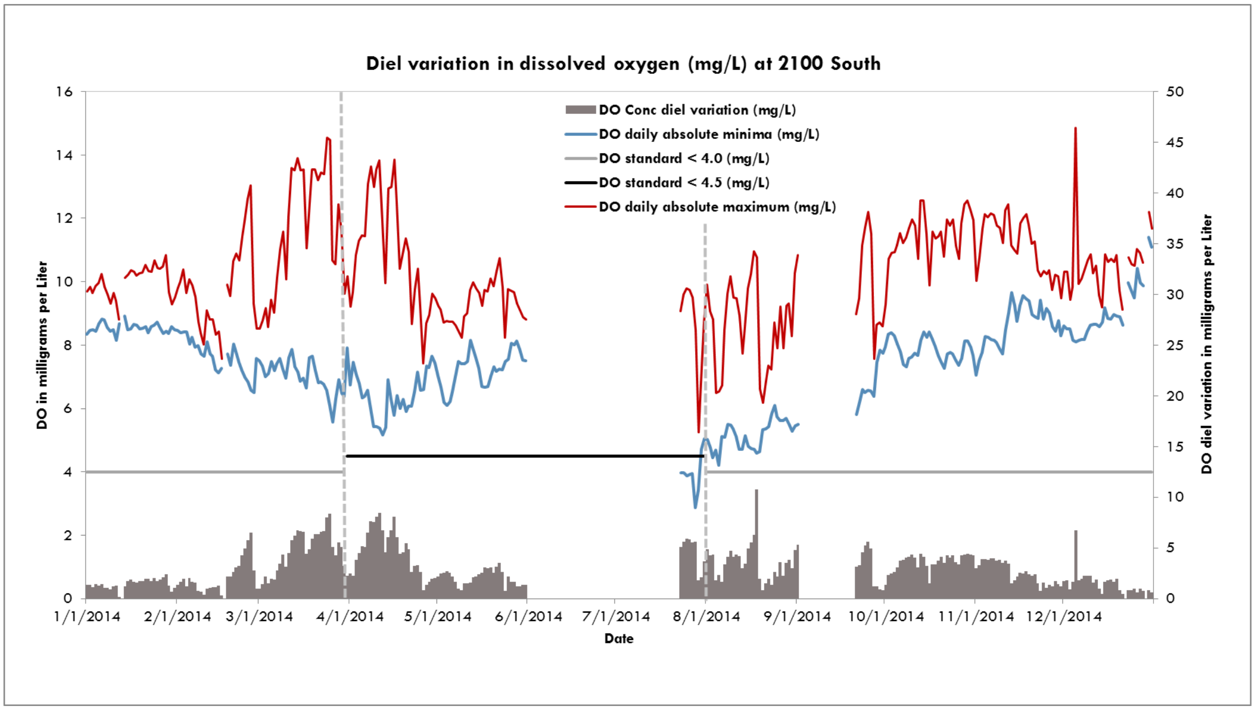


Figure 8: The dissloved oxygen(DO) daily minima and the diel variation in hours that the measured DO is below the water quality standard in hours per day at 2100 South. The water quality standards for the Jordan River for dissloved oxygen (mg/L) are dennoted by the gray and black lines and are 4.0(mg/L) and 4.5(mg/L) with respect to the times of the year.

800 SOUTH MONITORING LOCATION

Data from the 800 South monitoring location are also complicated by missing summertime data, however those data that were recorded indicate an impairment based on the draft assessment methods. The absolute minimum DO observed at this location was 1.64 mg-DO/L, which is less than ½ of the instantaneous minima criterion (Figure 9). The acute criteria were violated on 8 days in the Index Period and 22 days in the period from August to April. In total there were 30 days or 42% of the POR where DO was lower than the site specific standards. More concerning with repect to potentially deleterious affects on aquatic biota, the longest single continuous recorded period of acutely low DO conditions was 39 hours. Daily moving average calculations among the recorded data reveal violations of both 7-day and 30-day chronic criteria with 45% and 46% of observations exceeding the criteria respectively (Figure 10).

As intended, the draft supplemental statistics highlight several interesting patterns in the temporal DO conditions at this location. Unlike the locations upstream, the daily variation in DO was relatively small and did not exhibit any obvious patterns among seasons (Figure 11). The daily minima violations suggest a much longer period of potential concern than either of the upstream locations with a cumulative duration for the Period of Record when the DO was less than the standard for 233.5 hours (Figure 9).

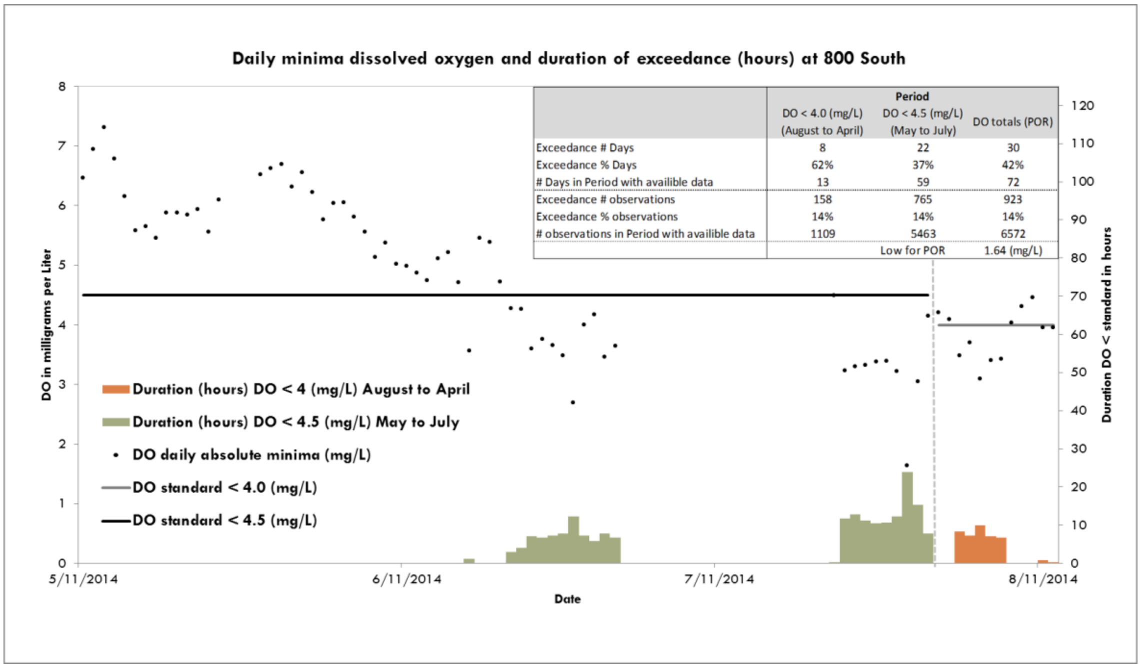


Figure 9: The daily minima represents the lowest measured value of each day of the period-of-record and for the time being will be used as supplemental data for 800 South. Additionally the inserted table reflects seasonal exceedences in days, the percentage of exceedances in relation to the total days in the period-of-record as well as the number of observations that are exceeding the standard and the percentage as compared to the total observations.

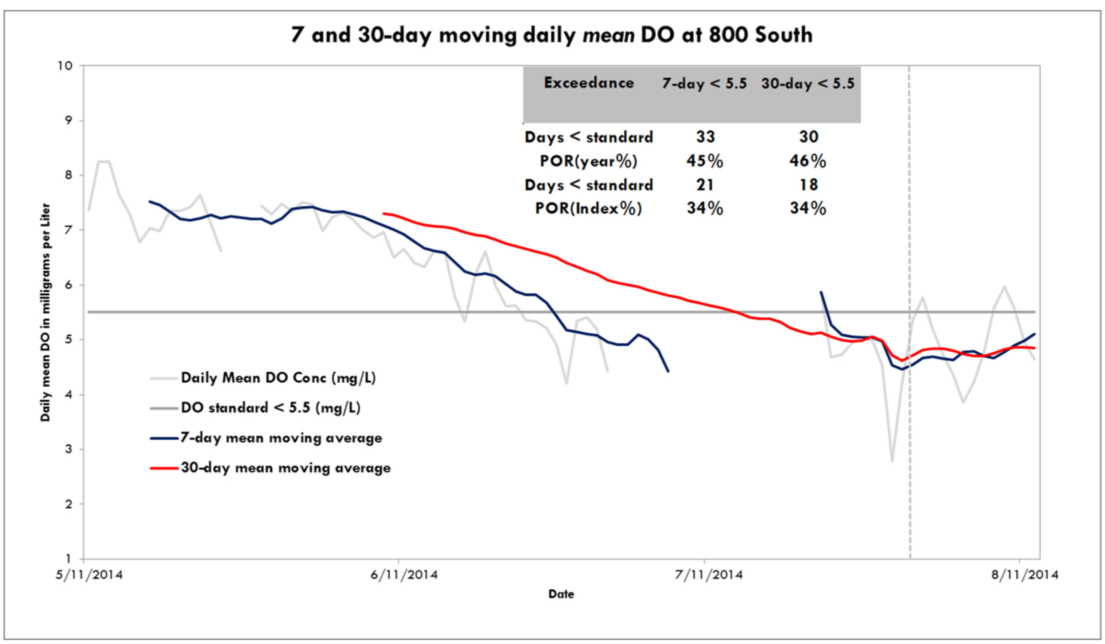


Figure 10: The 7- and 30-day moving daily mean dissolved oxygen from 800 South. The gray horizontal line denotes the water quality standard of 5.5(mg/L) for the entire year for the 7- and 30-day moving daily mean.

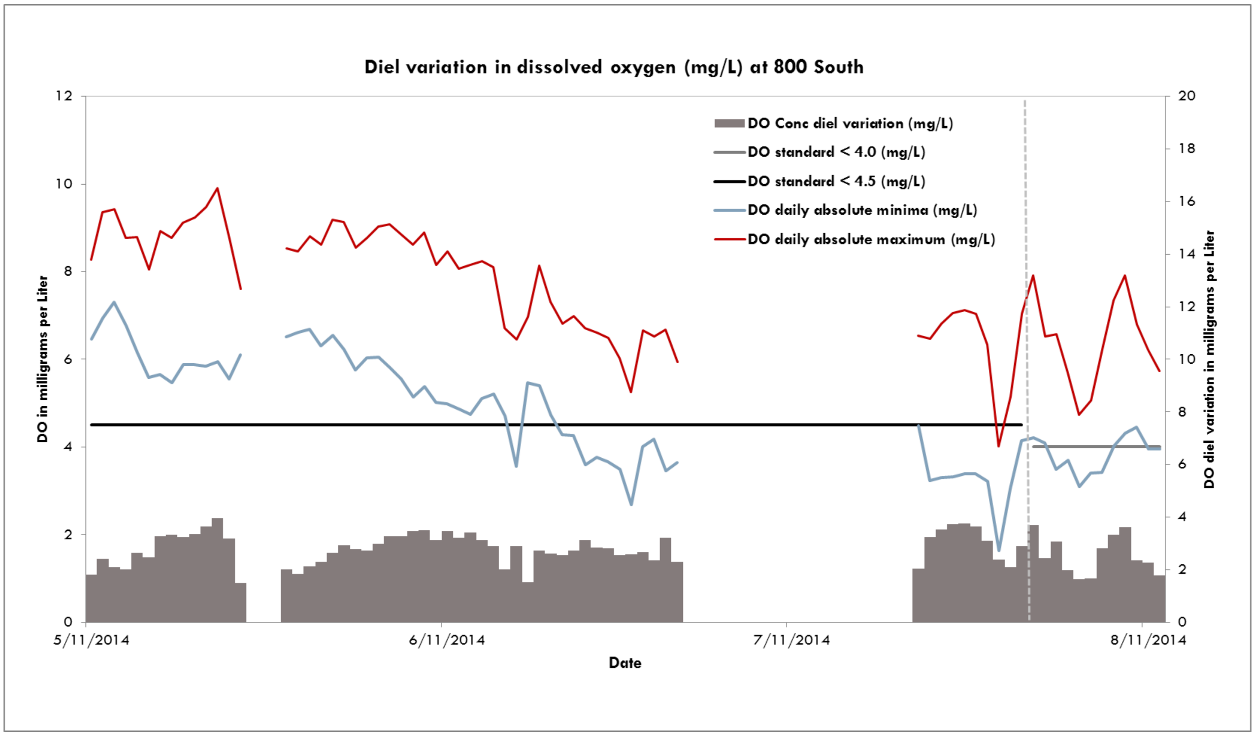


Figure 11: The dissloved oxygen(DO) daily minima and the diel variation in hours that the measured DO is below the water quality standard in hours per day at 800 South. The water quality standards for the Jordan River for dissloved oxygen (mg/L) are dennoted by the gray and black lines and are 4.0(mg/L) and 4.5(mg/L) with respect to the times of the year.

300 NORTH MONITORING LOCATION

The next monitoring location downstream, at 300 North, has a record that encompasses much of the August through April period and nearly all of the Index or May through July period. The acute criterion was violated 14% or 38 days over the Period-of-Record which included extended periods of prolonged daily periods of acutely low DO (Figure 12). On one occasion, DO remained below the minima criterion for 21 hours.

The draft chronic criteria assessment rules suggest concerns with persistently low DO at this location. The 7-day and 30-day chronic criteria were exceeded on ~20% of days over the POR (Figure 13). Given that chronic criteria are ultimately intended to be protective against deleterious consequences resulting from long periods of exposure to low DO, long periods of exposure are particularly concerning with respect to threats to aquatic life designated uses.

The supplemental statistics illustrate several interesting trends in DO concentration at this location. Similar to the 800 South location, the daily diel variation measurements continue to be less pronounced than the two most upstream locations, without any distinct seasonal patterns (Figure 14). The daily minima data indicate a fairly long period where low DO is of concern (July-late August) (Figure 12), which is consistent with the general trends observed in the chronic criteria analysis discussed above. DO peaks, absolute minimum, and average concentrations were all higher than observations at the 800 South location.

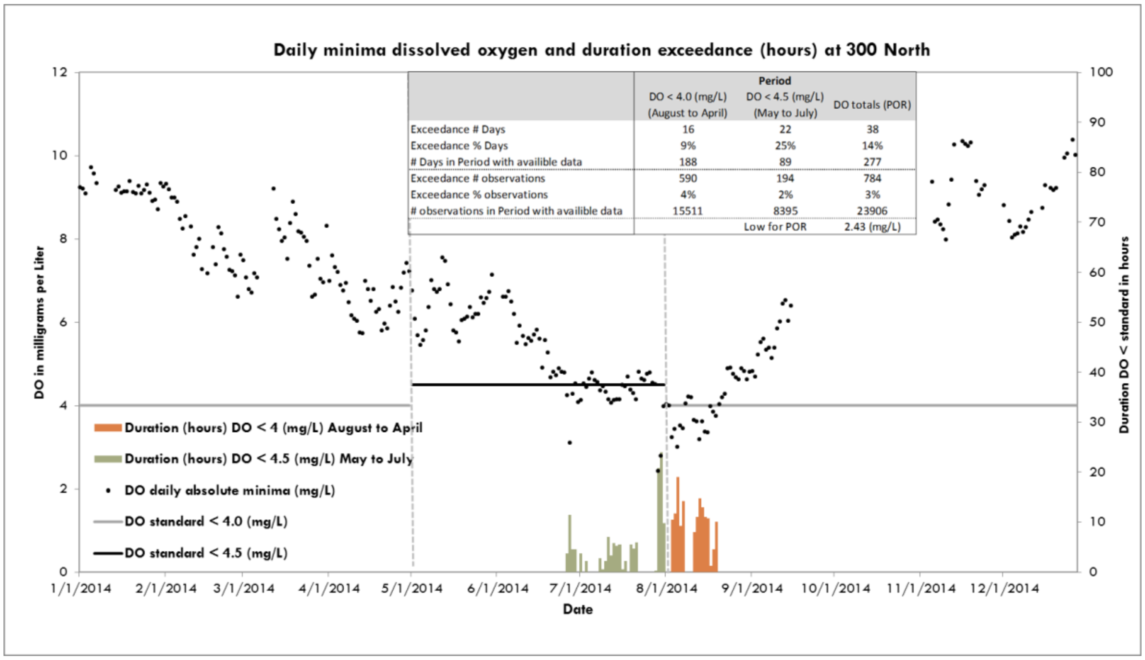


Figure 12: The daily minima represents the lowest measured value of each day of the period-of-record and for the time being will be used as supplemental data for 300 North. Additionally the inserted table reflects seasonal exceedences in days, the percentage of exceedances in relation to the total days in the period-of-record as well as the number of observations that are exceeding the standard and the percentage as compared to the total observations.

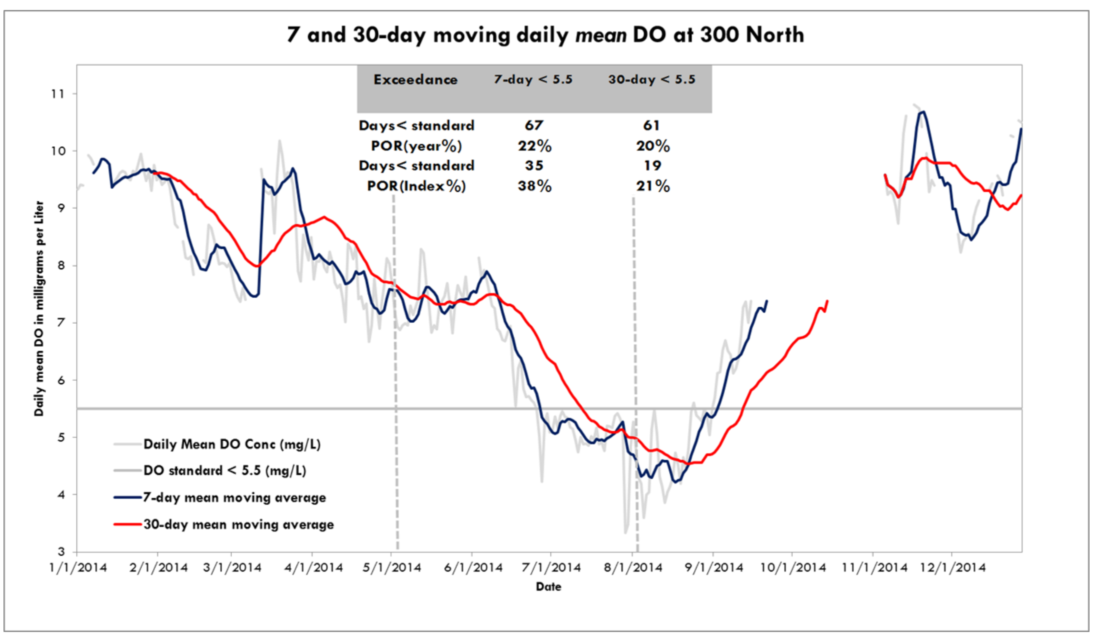


Figure 13: The 7- and 30-day moving daily mean dissolved oxygen from 300 North. The gray horizontal line denotes the water quality standard of 5.5(mg/L) for the entire year for the 7- and 30-day moving daily mean.

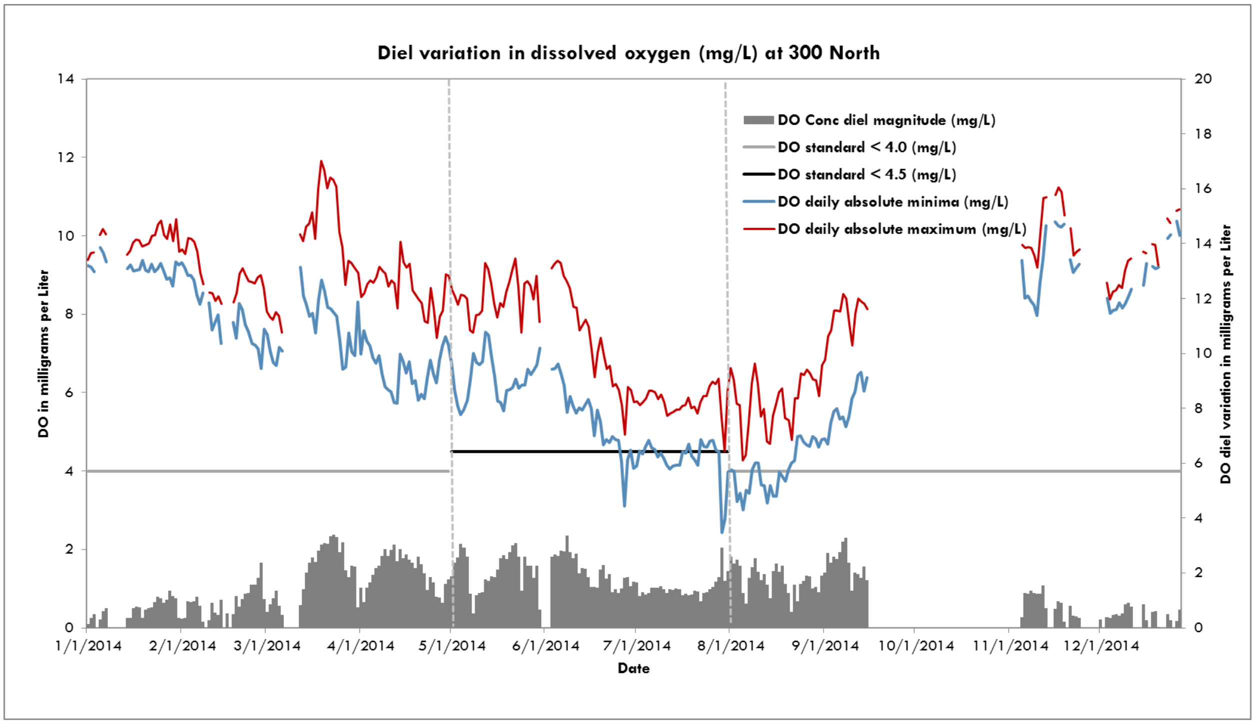


Figure 14: The dissloved oxygen(DO) daily minima and the diel variation in hours that the measured DO is below the water quality standard in hours per day at 300 North. The water quality standards for the Jordan River for dissloved oxygen (mg/L) are dennoted by the gray and black lines and are 4.0(mg/L) and 4.5(mg/L) with respect to the times of the year.

CUDAHY LANE MONITORING LOCATION

Cudahy Lane is the site furthest downstream and had the most pronounced issues with low DO of all of the sites evaluated in this pilot investigation. Both of the draft decision rules with respect to the acute criteria were violated. With respect to within day water quality standard violations, there were several extended periods where DO fell below the minimum criterion for over 20 hours per day (Figure 15). Among day violations were also frequent: DO fell below the acute criterion on 38 days, 32% of all days over the POR. As might be expected given the acute violations, this site also revealed fairly extensive chronic violations. Over the POR the 7-day moving day average was exceeded 46% of the time and the 30-day moving average was exceeded 49% of the time (Figure 16).

Both DO diel variation and the daily minima exhibited similar trends to those observed at the sites immediately upstream. Daily DO variation remained relatively small, without any obvious seasonal pattern (Figure 17). Similarly, the moving 7-day absolute minima plot suggests that the potential for low DO exists throughout the growing season (Figure 15).

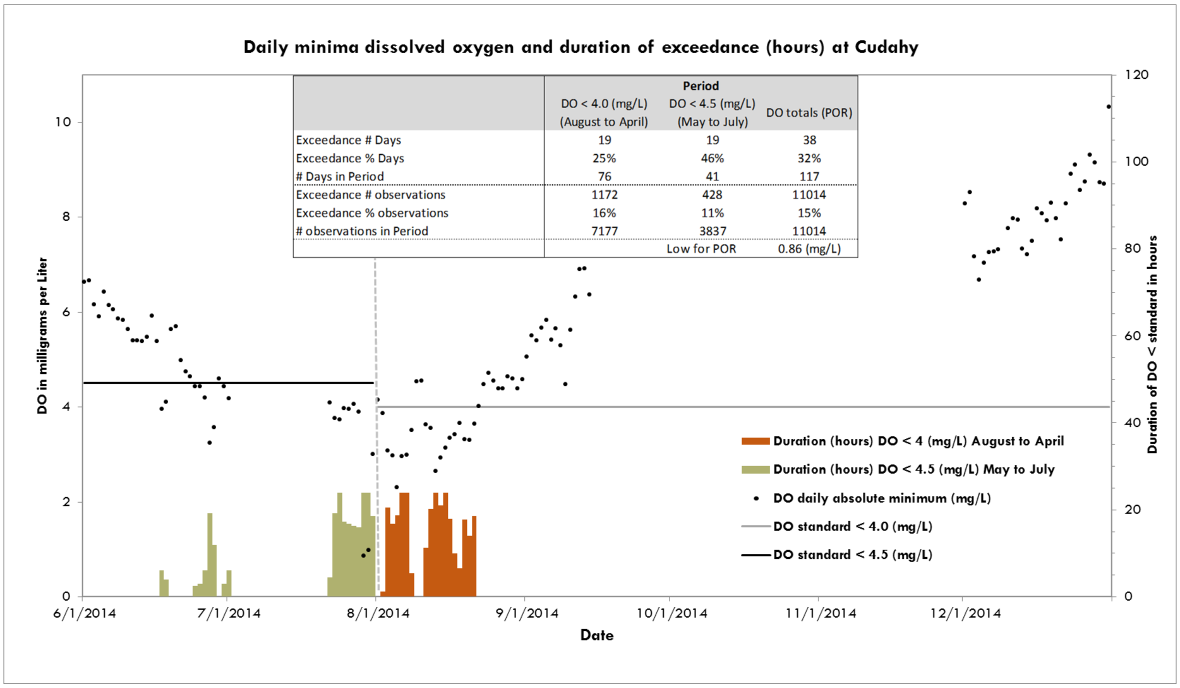


Figure 15: The daily minima represents the lowest measured value of each day of the period-of-record and for the time being will be used as supplemental data for Cudahy. Additionally the inserted table reflects seasonal exceedences in days, the percentage of exceedances in relation to the total days in the period-of-record as well as the number of observations that are exceeding the standard and the percentage as compared to the total observations.

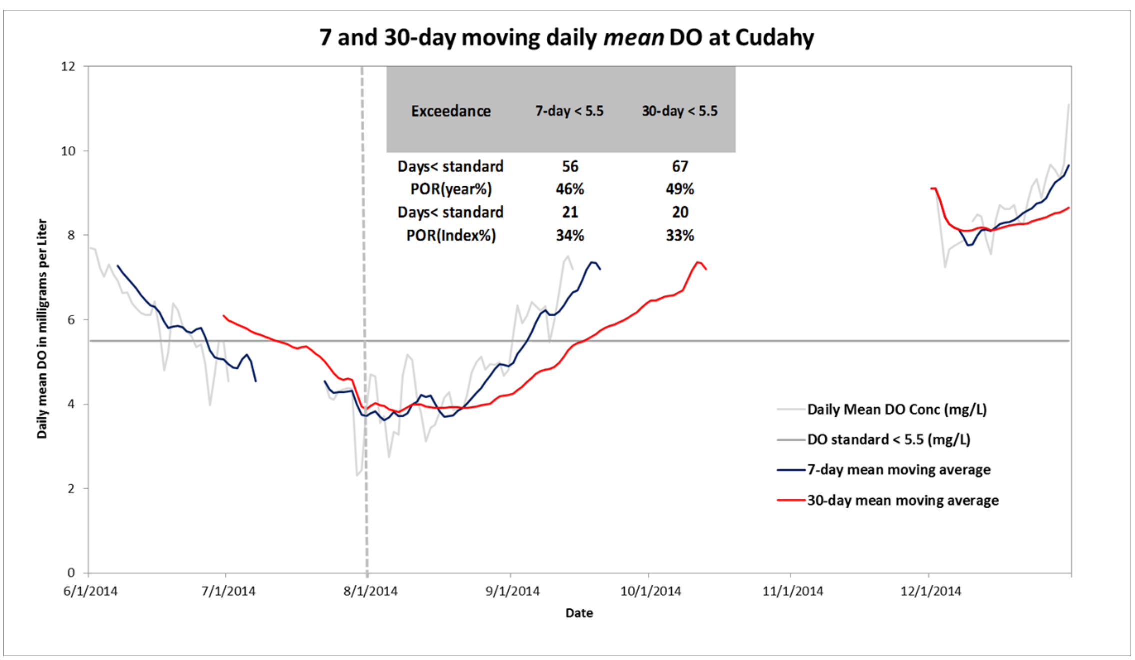


Figure 16: The 7- and 30-day moving daily mean dissolved oxygen from Cudahy Lane. The gray horizontal line denotes the water quality standard of 5.5(mg/L) for the entire year for the 7- and 30-day moving daily mean.

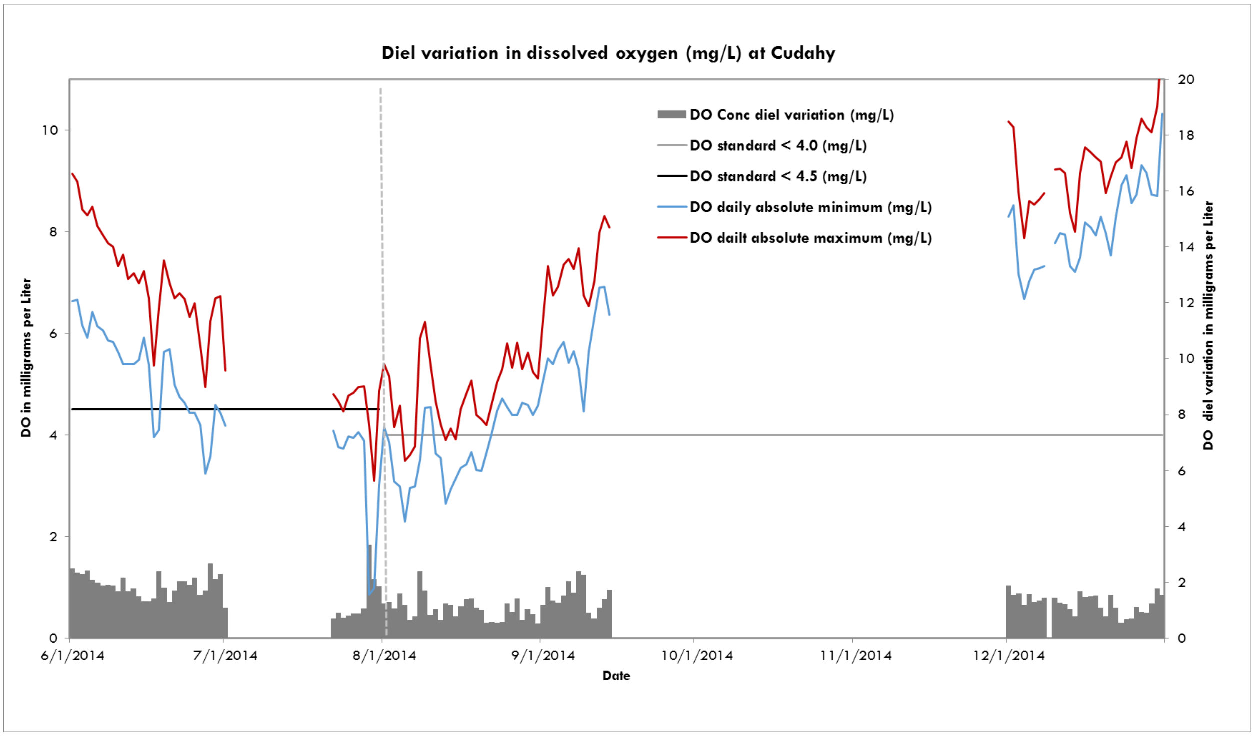


Figure 17: The dissloved oxygen(DO) daily minima and the diel variation in hours that the measured DO is below the water quality standard in hours per day at Cudahy Lane. The water quality standards for the Jordan River for dissloved oxygen (mg/L) are dennoted by the gray and black lines and are 4.0 mg/L and 4.5 mg/L with respect to the times of the year.

Site DO Trends

A comparison of all summary statistics reveals a fairly distinct trend of increasing problems with low DO from upstream to downstream monitoring locations (Table 4). For example, DO only fell below the minima criterion at the site furthest upstream (3300 South) for 1 hour or 4 observations, whereas violations of this criterion occurred on over 38 days (32% of POR) at the site furthest downstream. The frequency of DO violations shows a similar trend (Figure 18). Acute criterion violations were first observed at the 2100 South location, but these excursions only lasted ~62 hours or 14% of observations. In contrast, the minima criterion was exceeded for ~538 hours or13.5% of all observations at Cudahy Lane.

Table 4. Site-specific statistics for 2014 dissolved oxygen data for the Jordan River.

Site specific statistics viewed longitudinally for Jordan River High-Frequency Pilot for 2014					
Statistic	***Site***				
Acute Criteria	***3300 South***	***2100 South***	***800 South***	***300 North***	***Cudahy***
DO daily minima exceedance versus POR(days)	1/346	8/290	30/72	38/277	38/117
% daily minima exceedance in POR	<1	3%	42%	14%	32%
Daily absolute ***minimum*** *exceedence for* DO < 4 (mg/L) (August to April) (Days)	0	1	8	16	19
Daily absolute ***minimum*** *exceedence for* DO < 4.5 (mg/L) (May to July) (Days)	1	7	22	22	19
Maximum consecutive ***duration*** in hours < standard for both 4 or 4.5 mg/L	1	13	39	21	78
Number of DO observations exceeding standard of < 4 (mg/L) versus ***total*** obs. (August to April)	0/23755	0/23000	158/1109	590/15511	1172/7177
Number of DO observations exceeding standard of < 4.5 (mg/L) versus ***total*** obs. (May to July)	1/8732	109/3784	765/5463	194/8395	428/3837
Percentage of DO observations exceeding standard of < 4 (mg/L) (August to April)	0	0	14%	4%	16%
Percentage of DO observations exceeding standard of < 4.5 (mg/L) (May to July)	<1%	3%	14%	2%	11%
Chronic Criteria					
7-day moving *mean* exceedance in POR(days)	0	0	33	67	56
% 7-day moving *mean* exceedance in POR			45%	22%	46%
30-day moving *mean* exceedance in POR(days)	0	0	30	61	67
% 30-day moving *mean* exceedance in POR			46%	19%	49%
Supplemental Data					
Mean DO (mg/L) for POR	8.91	8.56	6.05	7.39	6.11
Instantaneous absolute minimum DO (mg/L) for POR	3.78	2.88	1.64	2.43	0.86
Duration daily minima (hours) < standard for POR	1	62	233.5	285.25	538.25
Mean DO diel variation (mg/L/day) for POR	4.09	2.99	2.77	1.58	1.41

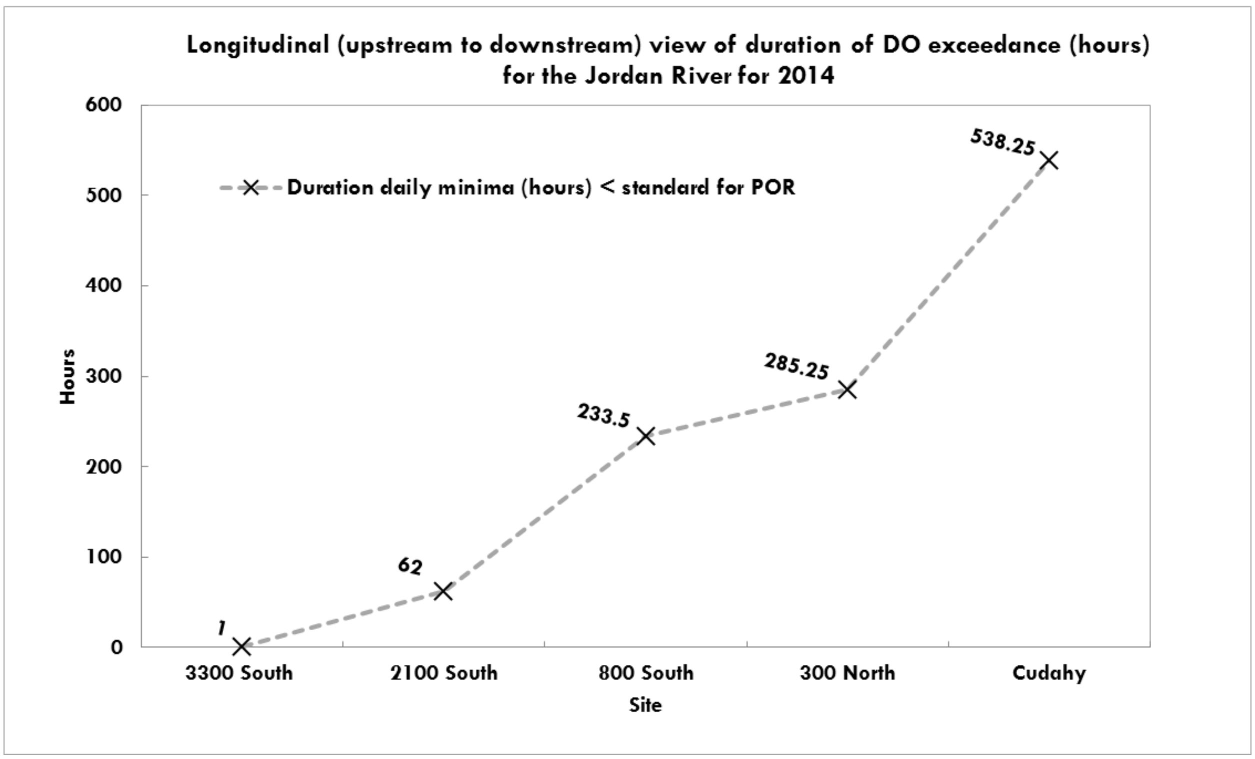


Figure 18: Longitudinal view of exceedances in hours and days of measured dissolved oxygen data from 3300 South to downstream at Cudhy Lane.

DISCUSSION

The draft assessment methods described in this chapter provide a framework for future DO high frequency data assessments. The summary statistics used for the analysis are straightforward and provide measures of averaging periods and duration that closely align with the language in Utah's water quality standards. Similarly, these analyses demonstrate that high frequency data provide an ecologically accurate description of temporally dynamic water quality parameters like DO. High frequency DO datasets provide a sufficient frequency of observations to draft assessment methods that are consistent with the averging periods defined in Utah's DO criteria. Moreover, the summary statistics derived from these data were consistent with the interpretation of temporal DO dynamics which provide the basis of EPA's DO criteria recommendations. While the assessment procedures were drafted to be broadly applicable statewide, they also proved compatible to the site-specific DO criteria on the Jordan River.

Evidence from the Jordan River pilot largely corroborates other data supporting the existing DO impairment for this stream segment. The Jordan River pilot also demonstrates advantages of using high frequency data to characterize DO conditions. For instance, several important seasonal patterns were revealed that would have been unlikely to manifest with instantaneous DO measurements.

Ongoing Considerations

In proposing and evaluating these draft assessment methods several issues were raised that will ultimately need to be resolved before the methods are finalized and implemented state-wide.

INDEX PERIOD

The Jordan River pilot investigation used index periods that were previously established for the Jordan River. However, it is not currently clear whether this is an appropriate index period to apply elsewhere. Whatever form the final assessment methods take, DWQ does not consider it appropriate to incorporate data collected in winter months when calculating the percent of water quality excursions as this "stacks the deck" against identification of conditions that can potentially degrade aquatic life. However, the Jordan River pilot also demonstrates the value in understanding year-round DO dynamics.

LONGER-TERM TEMPORAL VARIATION

This pilot investigation highlights the importance of understanding the temporal variation of DO. However, year-to-year differences may be equally important. It may not always be possible to obtain multiple years of high frequency data when making impairment decisions. Nevertheless, it is important to acknowledge the value of long-term monitoring stations such as those maintained by the JRFBWQMC. These permanent stations will ultimately allow DWQ to conduct similar analyses to better understand the long-term dynamic of DO on the Jordan River.

DRAFT SUPPLEMENTAL SUMMARY STATISTICS

Given that high frequency data sets are rich with information, DWQ proposes that several additional summary statistics be calculated to help better interpret DO conditions. Daily DO variation (absolute difference between the daily maximum(i.e., peak) and minimum(i.e., trough) DO concentration) is a potentially meaningful metric because high variation in daily DO is a demonstrated sources of stress to stream biota. Consistent with the recommendations of Washington's Department of Ecology (2002), DWQ proposes that a diel variation of > 3 mg-DO/L/day be used as a screening level to identify sites where daily variation is of potential concern. Screening levels will only be used in identifying potential sites for future monitoring and will not be used for assessment purposes in the IR. DWQ also proposes calculating a moving 7-day average of daily minima since this metric may help identify long-term trends in low DO conditions and index periods where DO issues may be of particular concern. Finally, DWQ proposes that the duration of DO water quality criteria violations be tabulated, both within a day (number of hours below the criterion) and among days to describe the duration and recurrence of low DO events.

Conclusions

This pilot investigation provides a useful "real world" example of how the draft assessment methods would be used to make impairment decisions with high frequency DO data. The summary of data from 2014 confirmst the existing dissolved oxygen impairments in the lower Jordan Rive (Assessment Units Jordan River-1, Jordan River-2, and Jordan River-3). These analyses were successful in highlighting several details that will need to be considered as DWQ adopts the draft assessment methods. These analyses will also provide an empirical basis for ongoing discussions with stakeholders on how to make these final assessment procedures both scientifically defensible and consistent with state and federal regulations.

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APPENDIX 1.

Utah Division of Water Quality
Water Quality Assessment
Version 1.0 December 16, 2014

Data Quality Matrix for Continuous Data

Data Quality Grade Level	Assessment Program Data Uses	Quality Assurance Project Plan (QAPP)	Sampling Analysis Plan (SAP)	Calibration and Field Documentation*	Metadata**	$Discharge_a$***	SpC_a	Water $Temperature_a$	pH_a	$Dissolved\ Oxygen_a$****		Turbidity
										%Saturation for Calibrated Meter	Concentration Methods for Calibrated Meter	
A	**Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments)**	Approved QAPP	Approved SAP	Mandatory- calibration record(s) (e.g., 1-point, 2-point, and/or multi-point field records of calibration and/or fouling) and field survey information	Approved information of pertinent data associated with deployment (i.e., all of the associated metadata necessary for interpreting the 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	Thermometer Accuracy checked with NIST standards A ≤ ± 0.5°C R ≤ ± 0.5°C	Calibrated pH electrode A ≤ ± 0.2 S.U. R ≤ ± 0.3 S.U.	0-200% mg/L: A ≤ ± 1% R≤0.1%	0-8 mg/L: A ≤ ± 0.01mg/L > 8mg/L: A ≤ ± 0.02 mg/L R≤0.01	± 0.5 NTU or ± 5%, whichever is greater
B	**Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments) with professional judgment**	Approved QAPP	Approved SAP	Mandatory- calibration record(s) (e.g., 1-point, 2-point, and/or multi-point field records of calibration and/or fouling) and field survey information	Approved information of pertinent data associated with deployment (i.e., all of the associated metadata necessary for interpreting the 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	Thermometer Accuracy checked with NIST standards A ≤ ± 1.0°C R ≤ ± 2.0°C	Any Method A ≤ ± 0.5 S.U. R ≤ ± 0.5 S.U.	0-200% mg/L: 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

C	**Not to used for 303(d) and 305(b) assessments Based on project manager judgment, the data may be Voided with a DQL of D.**	Approval of project manager that Minimum Data Acceptance Criteria Met	Approval of project manager that Minimum Data Acceptance Criteria Met	Mandatory-calibration records (e.g., 1-point, 2-point, and/or multi-point field records of drift from bio-fouling, etc.) and field survey information**	Approved information of pertinent data associated with deployment-all of the associated metadata necessary for interpreting the 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	A ≥ ± 0.5 ºC R ≥ 0.05 ºC	Any Method A ≤ ± 0.5 S.U. R ≤ ± 0.5 S.U.	0-200% mg/L: 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	**Not used by the Assessment Program**	Not Submitted	Not Submitted	Missing or Unavailable for DWQ review if needed	Missing or Unavailable for DWQ review if needed	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	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data

a- Resolution and accuracy as reported by Hydrolab, In-Situ, and YSI

Notes

QA definitions of Data Quality Levels:

A – Data of known quality; meets QC limits established in a DEQ approved QAPP.

B – Data of known but lesser quality; Data may not meet established QC but is within marginal acceptance criteria; or data value may be accurate, however controls used to measure Data Quality Objective (DQO) elements failed (e.g., batch failed to meet blank QC limit); the data is generally usable for most situations or in supporting other, higher quality data. (Equivalent to the "J" (estimated) qualifier used by EPA).

Note: Statistics for turbidity and conductivity are concentration-dependent; thus low-concentration B level data may be considered acceptable for all uses.

C – Data of unacceptable quality; generally due to QC failures but may be related to other known information about the sample. Data should not be used for quantitative purposes but may have qualitative use. (Equivalent to the "R" (rejected) validation qualifier used by EPA)

D –Data of unknown quality; Insufficient QA/QC or other information available to make determination. Data could be acceptable; however, no evidence is available to prove either way. Data is provided for Educational Use Only.

Data Quality Level Grading Criteria:

A = Accuracy as determined by comparison with standards, e.g., during equipment calibration or pre- and post-deployment checks
R = Resolution as determined by replicate measurements, e.g., during field duplicates, field audits, or split samples

*** Calibration and Field Documentation**

- Submitted ancillary data **must** include "raw" data. This includes the data that was initially downloaded from the deployed device (e.g., power settings, barometric pressure, battery status, memory status to name a few). The raw data has not been aggregated, disaggregated, and/or manipulated in any manner.

**** Metadata minimum requirements:**

- Station name including- Location description and picture of monitor in waterbody
- Geo-location(i.e., Lat./Lon., elevation)
- Date and time of measurements (i.e., deployment start/end, calibration, etc…)
- Frequency of measurements(i.e., 1, 10, 15, 30 60 minutes)
- Manufacturer and name field meter(s) and monitor

- Name(s) of data collector(s)
- Lot numbers and expiration dates of standard solutions-if applicable
- Monitor values, field meter values, and corresponding time for pre-cleaned, cleaned, calibration checks, calibrations/recalibrations, and final readings
- If system has a large-cross-section then survey data(locations of points, measured values, and corresponding times), and monitor values before and after the cross-section survey
- Measured flow or gage-height data
- Comments on site conditions, sensor condition, and any other pertinent observations
- Battery voltage of monitor at departure and if the batteries were replaced
- Notes on sensor/monitor changes or replacements, and other comments that facilitate processing/analysis of the record

***** Discharge**

- Flow measurement(s) including; date, time and Q
- Stage/Discharge relation(s) if completed at time of submittal
- Any notes that will facilitate analysis
- A linear relation on the least squares analysis in the stage/discharge relation (i.e., R^2) equal to or above 0.70

****** Dissolved Oxygen**

- Calibration data pre- and post-deployment
- Calibration data pre- and post-maintenance during deployment for bio-fouling and other mechanisms of drift in associated data