INTERIM METHODS FOR EVALUATING USE SUPPORT FOR GREAT SALT LAKE, UTAH POLLUTION DISCHARGE ELIMINATION SYSTEM (UPDES) PERMITS

Utah Division of Water Quality

Review Draft

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TABLE OF CONTENTS

Figures

FORWARD

This document outlines guidance to be used by Division of Water Quality staff and permittees for permitted discharges to Great Salt Lake issued in accordance with the Utah Pollution Discharge Elimination System (UDPES). The process is intended to document that that the uses (designated and existing) are protected. It is intended to assist permit writers and permittees in developing logical and consistent permits and to serve as an administrative guide towards reasonable and appropriate enforcement. This document is intended solely as guidance and, as such, cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the State. The specific procedures for whole effluent toxicity (WET) testing will be incorporated into upcoming revisions to Utah's (statewide) 1991 WET Guidance.

INTRODUCTION

In 2012, the Utah Division of Water Quality (DWQ) published the draft Great Salt Lake Water Quality Strategy (Strategy) (DWQ, 2012). The draft was revised in response to public comments and the Strategy was published in 2014 (DWQ, 2014). Core Component 1: Developing Aquatic Life Criteria for Priority Pollutants outlines the steps DWQ will take to derive numeric criteria for Great Salt Lake. Currently, only one numeric criterion is available for selenium in Gilbert Bay (Class 5A). As discussed in Component 1 of the Strategy, derivations of numeric criteria for priority pollutants are anticipated to take years under even optimistic projections of resource availability.

As discussed in the Strategy, numeric criteria are used to evaluate if existing[1] and designated uses are protected. To accomplish this evaluation, a waste load allocation[2] is performed and based on the outcome of this analysis, the DWQ permit writer determines if any of the pollutants in the effluent are present at concentrations that have "reasonable potential" to cause or contribute to an exceedance of the numeric criteria in the receiving water (EPA, 2010).

Until numeric criteria are developed, DWQ will implement this interim approach for demonstrating that the aquatic life uses of Great Salt Lake are protected for Utah Pollution Discharge Elimination System (UPDES) permits requirements.

SCOPE

The methods outlined in this guidance document are intended to be applied only to direct UDPES discharges to Great Salt Lake and upstream discharges that are not required to meet numeric criteria for the protection of aquatic life prior to discharging to Great Salt Lake. Specifically, these methods apply to discharges to Class 5 Great Salt Lake (Classes 5A, 5B, 5C, 5D, and 5E) (UAC R317-2-6). These methods also apply to discharges to Class 3E when the Class 3E water discharges to Class 5. In addition to complying with the Narrative Standards (R317-2-7.2), discharges to Class 3E waters must be protective of downstream uses and therefore, these discharges must be protective of Great Salt Lake's uses. While protection of the uses and compliance with the Narrative Standards are regulatory requirements, the specific methods described herein are guidelines but are not requirements. Alternative methods or interpretations are acceptable provided that a demonstration can be made that the aquatic life uses are protected. Nutrients are beyond the scope of this guidance.

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[1] See UAC R317-1-1, Definitions Existing Uses means those uses actually attained in a water body on or after November 28, 1975, whether or not they are included in the water quality standards (UAC R317-1-1)

[2] http://www.waterquality.utah.gov/WQM/WQlimits.htm

The recommended approach is based on UAC R317-8-4.2(4)(a)6.a. and b. that specifically addresses UPDES permitting when numeric criteria are unavailable:

> *6. Where the State has not established a water quality criterion for a specific chemical pollutant that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contributes to an excursion above a narrative criterion within an applicable State water quality standard the Director will establish effluent limits using one or more of the following options:*
>
> *a. Establish effluent limits using a calculated numeric water quality criterion for the pollutant which the Director determines will attain and maintain applicable narrative water quality criteria and will fully protect the designated use. Such a criterion may be derived using a proposed State criterion, or an explicit State policy or rule interpreting its narrative water quality criteria supplemented with other relevant information which may include: EPA's Water Quality Standards Handbook, October 1983, risk assessment data, exposure data, information about the pollutant from the Food and Drug Administration, and current EPA criteria documents:*
>
> *b. Establish effluent limits on a case-by-case basis, using EPA's water quality criteria, published under section 307(a) of the CWA, supplemented where necessary by other relevant information;*

METHODS

This document focuses on specific modifications to DWQ's UDPES permitting process for Great Salt Lake when numeric criteria are not available and is not a comprehensive guide to permitting. The following sections describe the interim procedures for use support evaluations, implementation of whole effluent toxicity (WET) testing, and mixing zones for Great Salt Lake.

Use Support Evaluations

The following presents an interim screening approach for ensuring that the Great Salt Lake's water quality supports the aquatic life uses of birds and their necessary food chain (R317-2-6). Variations to the approach described herein, or alternative approaches, may be acceptable provided they are scientifically and legally supportable. Consistent with the intent of all screening methods, conservatism should be applied as necessary to minimize the likelihood that a pollutant is improperly screened out from further consideration. Nutrients are beyond the scope of this approach.

If the data required to conduct the following evaluations are unavailable for renewing permits without changes to effluent quality or quantity[3], the permittee should identify the data gaps and formulate a plan for collecting these data. While the permittee should make every effort to complete the analyses prior to the expiration of the existing permit, permits may include compliance schedules, when appropriate, to address data gaps during the upcoming permit cycle. However, the available data and analyses at permit renewal must be sufficient to support that the effluent will not harm the uses of the receiving water.

Derivation of Screening Values

DWQ has begun compiling a species list of resident species for Great Salt Lake in support of the derivation of numeric criteria. After the Great Salt Lake species list is completed, DWQ anticipates using the EPA (1994, 2013) deletion process as part of the recalculation procedure for deriving site-specific aquatic life numeric criteria for salinities equal to or less than ocean waters. The species currently identified as being residents of Great Salt Lake suggest that the recalculation procedures will be applied to existing freshwater numeric criteria that will be supplemented with any available more recent toxicity data.

DWQ expects that Great Salt Lake will have fewer taxonomic families represented than were used to derive the national freshwater chronic criteria for protection of aquatic life. If sensitive species included in the derivation of the fresh water criteria are not present at Great Salt Lake, application of EPA's deletion procedure is expected to result in criterion less stringent than the freshwater criterion. An exception would be if avian species are more sensitive to a pollutant than the aquatic biota such as was the case with selenium and likely will be the case for pollutants that biomagnify, such as methylmercury.

For Great Salt Lake waters with salinity greater than ocean water, the criteria are anticipated to be based on Great Salt Lake-specific species toxicity testing (e.g., brine shrimp and brine flies). Great Salt Lake species would have to be more sensitive for the criteria to be more stringent than the freshwater criteria. The available toxicity data for brine shrimp and limited data for brine flies suggest that these species are relatively tolerant of metals (DWQ, 2013). Therefore, freshwater criteria are broadly appropriate as screening values for discharges to Great Salt Lake.

[3] These renewing permits are not required to conduct a Level II antidegradation review in accordance with R317-2-3.5.b.1.(b).

If pollutant concentrations are less than or equal to the indicators, adverse effects to Great Salt Lake biota are unlikely and the uses are likely supported. If the indicators are exceeded, additional data is required to evaluate the potential for adverse effects and the support status is uncertain.

The process by which UPDES permit limits will be derived in the interim is outlined as a series of steps in Figure 1. The steps are arranged in order of increasing effort and complexity. The steps do not have to be followed sequentially and the permittee may elect to proceed directly to the more complex steps without completing the initial steps. The final outcome must be that the discharge will not impair the designated and existing uses. Adequate documentation of the process and outcome is essential and will become part of the administrative record.

Step 1. Quantify Pollutant Concentrations. The pollutant concentrations are the maximum estimated concentration for the effluent or desired as a permit limit by the permittee (EPA, 1991). If the pollutant concentrations are based on actual discharge data, the maximums should be estimated taking into account operational variability and dissolved fraction (EPA, 1991). If water-quality-based effluent limits[4] are ultimately included in the permit, they should not be higher than the concentrations evaluated. Previous permit limits may be appropriate estimates of the maximum pollutant concentrations if supported by monitoring data.

All priority pollutants should be considered. Consistent with the existing UPDES permitting process[5], pollutants can be excluded based on knowledge of the nature of the discharge and/or treatment process or analytical data (assuming analytical detection limits are adequate).

Step 2. The pollutant concentrations are compared to the chronic criteria for Class 3 waters found in R317-2-14. Concentrations that are less than the Class 3 criteria can be concluded to be protective of Great Salt Lake's aquatic life uses. Concentrations greater than the Class 3 criteria are carried forward to Step 3. Note that the numeric criteria for Classes 3A through 3D are the same for toxics. For discharges to Great Salt Lake, the numeric criteria for Class 3D (protected for waterfowl, shore birds and other water-oriented wildlife including the necessary aquatic organisms in their food chain) can be applied as screening values based on the rationale provided earlier in this section.

[4] A water quality-based effluent limit means an effluent limitation determined on the basis of the water quality standards in UAC R317-2. Water quality-based effluent limits are commonly referred to as limits to protect the designated uses.

[5] See EPA Permit Application NPDES Forms 2A, 2C, or 2D, as appropriate, http://www.waterquality.utah.gov/UPDES/updes_f.htm

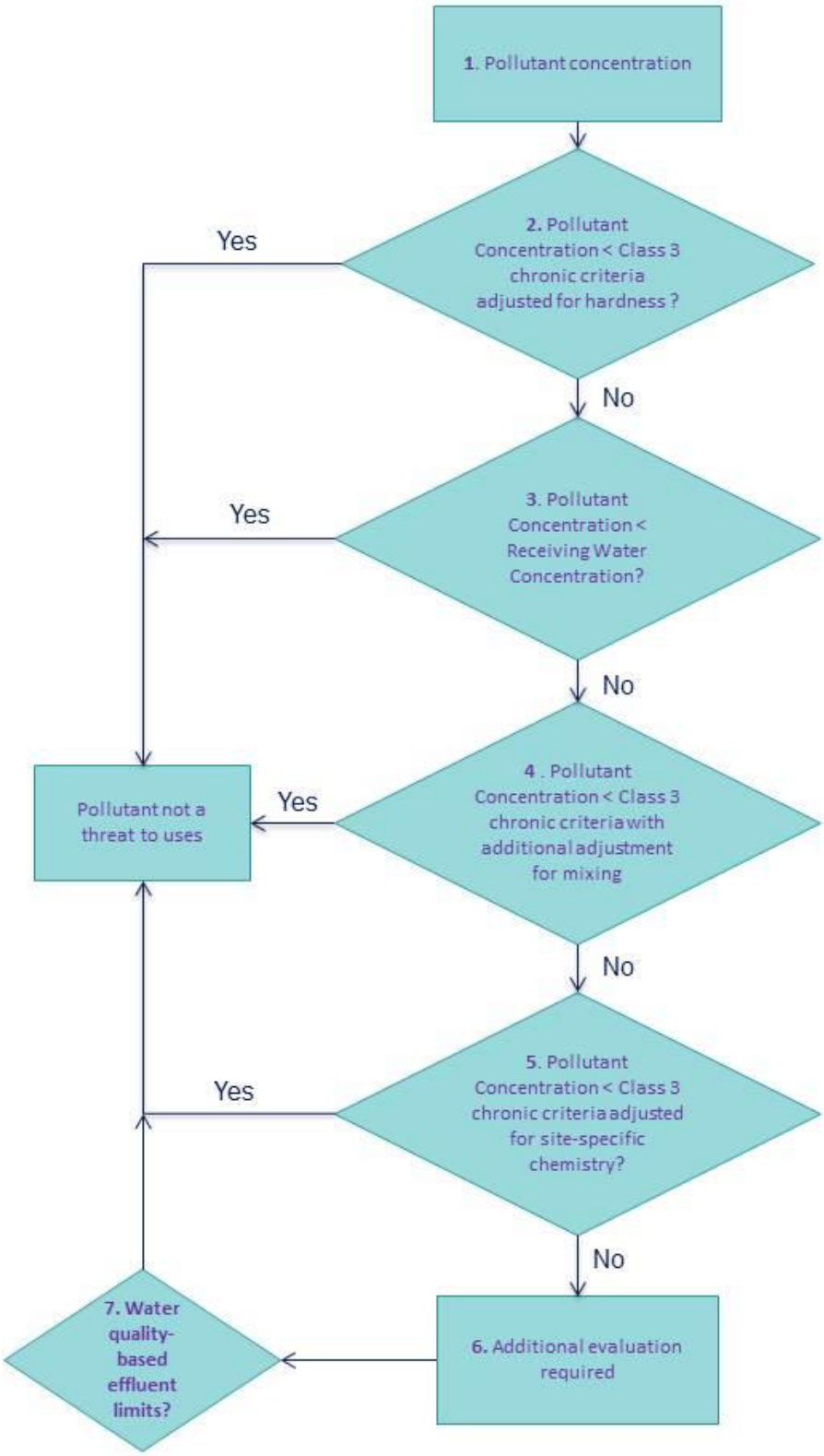

FIGURE 1 PROCESS FOR CONDUCTING USE SUPPORT EVALUATIONS FOR GREAT SALT LAKE UPDES PERMITS

Currently, DWQ does not recommend absolute temperature criteria but the effluent should not change the receiving water temperatures by more than 4° C (Class 3B requirements). Exceptions should be justified and documented in the UDPES permit fact sheet and statement of basis.

The chronic criteria should be adjusted for hardness as shown in R317-2-14 based on the hardness of the effluent and receiving water. Currently, adjustments for hardness up to 400 mg/l $CaCO_3$ are supported. Adjustments for higher hardness will be considered with adequate scientific justification.

If analytical data alone are used to exclude pollutants from further consideration, the detection limit should be less than the comparison criteria. If the detection limits are higher than the criteria, refined analytical techniques should be attempted to accurately estimate pollutant concentrations. This situation is anticipated for mercury but may also apply to other pollutants. Depending on site-specific circumstances, the additional characterization efforts may be temporary. If lower detection limits are impracticable, DWQ should be consulted for guidance.

Step 3. The pollutant effluent concentrations are compared to the receiving water concentrations before mixing. By definition, pollutant concentrations less than ambient do not degrade water quality. The receiving water concentrations must be adequately characterized to support these comparisons and collection of additional site-specific data may be necessary. The permittee should prepare a Sampling Plan for DWQ review and only collect data after receiving approval from DWQ. Comparisons should be consistent with the methods outlined in DWQ's (2012a) Waste Load Allocation procedures.

Step 4. Mixing can be considered, when consistent with the requirements of R317-2-5, for the remaining pollutants. The concentrations adjusted for mixing are compared to the chronic criteria adjusted for hardness. For POTW's in the pretreatment program, these concentrations are typically used in the derivation of local limits. Depending on the mixing assumed, comparisons may also have to be conducted for acute criteria. When a pollutant concentration is less than the criteria, these concentrations can be concluded to be protective of the use. Pollutants with concentrations greater than the criteria are carried forward to Step 5 for additional evaluation.

Step 5. In this step, the freshwater criteria may be further adjusted with site-specific water chemistry data. The EPA approved biotic ligand model (BLM), such as is available for copper and zinc, can be applied. These models require the collection of additional site-specific data to support the modeling. These investigations can be used to support development of site-specific criteria or effluent limits. For

Great Salt Lake specifically, these investigations can only be used to support the development of effluent limits because of the lack of numeric criteria. When a pollutant concentration is less than the criteria, the concentrations can be concluded to be protective of the use. Metals with conversion factors (see Table 2.14.3 in R317-2-14) can be adjusted by measuring the amount of dissolved pollutant and total pollutant to obtain a site-specific conversion factor. Details can be found in EPA's (1996) Metals Translator Guidance. Pollutants with concentrations greater than the criteria are carried forward for additional evaluation.

Step 6. The methods for evaluating the pollutants remaining after the previous screening steps are dependent on the specific pollutant and other site-specific conditions which precludes providing detailed methodologies. One option for metals and metalloids is a site-specific dissolved to total recoverable conversion factor. The default conversion factors are published in Utah's Water Quality Standards. Another option is use of a water effects ratio (using receiving water for dilution in chronic testing versus laboratory water). Water effects ratios are site-specific and determined by conducting a whole effluent toxicity (WET) test using laboratory (i.e., clean) water for dilution and comparing the toxicity to a WET test conducted using receiving water for dilution. For most discharges to Great Salt Lake, measuring water effect ratios may be impractical because of the lack of dilution water (effluent dependent) or salinity of the receiving water. Using saline receiving water for dilution in the WET test could result in an increase in observed effects that are due to salinity. However, ocean WET test organisms may be a viable alternative for situations where dilution water is available.

Any remaining pollutants that do not meet the screening benchmarks should be evaluated using methods that demonstrate that the uses will not be impaired by the pollutant. No specific guidance is available for how to conduct these evaluations but portions of EPA's *Guidance for Ecological Risk Assessment* (1996) and *Interim Process for Designing and Conducting Ecological Risk Assessments at Superfund Sites* (1997) can be adapted. These evaluations are anticipated to require specialized expertise in toxicology and risk assessment. Close coordination with DWQ is essential because of the lack of specific guidance and complexity of Great Salt Lake.

A use attainability analysis (UAA) can be conducted where the best attainable use is determined which may support that less stringent, site-specific criteria are appropriate. A UAA may also be an effective way to evaluate effluent-dependent receiving waters. Because of their complexity, UAAs may require significant resources and any changes to the uses must be adopted by rulemaking. UAAs are beyond the scope of this document. More information on UAAs can be found at http://water.epa.gov/scitech/swguidance/standards/uses/uaa/index.cfm.

Step 7. If the outcome of Step 6 is that the effluent pollutant concentrations cannot be concluded to be protective of the aquatic life uses, then the effluent pollutant concentrations must be reduced. If the outcome of Step 6 is that the effluent pollutant concentrations are protective of the uses, no further evaluation is required. Pollutants that have "reasonable potential" to cause or contribute to the exceedance of a water quality standard must have water quality-based effluent limits.

Interim Whole Effluent Toxicity (WET) Testing

This section outlines the interim policy for WET testing specific to Great Salt Lake discharges. An interim policy is needed until DWQ makes a determination regarding what WET test species are appropriate to represent the Great Salt Lake ecosystem. As with all Utah waters, the determination of whether a UPDES permit includes a requirement for WET testing is based on the policies documented in the 1991 Utah WET Implementation Guidance. If WET testing is determined to be appropriate, this interim policy changes the following procedures from the 1991 Utah WET Implementation Guidance (Figure 2) for Great Salt Lake discharges:

- Use the receiving water dilution to determine if chronic or acute WET testing will be conducted. This changes the approach from the 1991 Utah WET Implementation Guidance that required acute WET testing only.

- Base the decision for selecting the test organism(s) (freshwater or ocean species) on effluent characteristics. The use of EPA-approved test organisms is still required. The 1991 Utah WET Implementation Guidance requires the use of EPA-approved organisms but does not discuss the potential use of marine organisms.

- If chronic WET testing is conducted, the chronic results are interpreted as an indicator. That is, if no effects are observed, then no effects are predicted for Great Salt Lake organisms. If effects are observed, further investigation is necessary to interpret the results in the context of Great Salt Lake organisms. The chronic test will be conducted so that acute endpoints are also measured or an additional acute test is conducted. Consistent with 1991 Utah WET Implementation Guidance, not meeting the acute test criteria can be a basis for a reasonable potential for toxicity determination that could result in WET effluent limits in the permit.

These changes are further explained in the following paragraphs. All other procedures, such as frequency of testing, notifications, and toxicity identification evaluations, are the same for Great Salt Lake as for the rest of Utah waters. The Appendix provides recommended text for WET testing for UPDES permits discharging to Great Salt Lake.The decision to conduct acute only, or acute and chronic

WET testing is based on the receiving water dilution as determined by the mixing zone analyses. If dilution is less than 20:1, chronic WET testing is recommended in addition to acute testing. If dilution is greater than 20:1, then acute WET testing only is recommended. The 20:1 dilution ratio is consistent with the decision criterion for determining if acute or chronic WET testing for all of Utah's water with aquatic life uses, i.e., Class 3 waters, except Great Salt Lake.

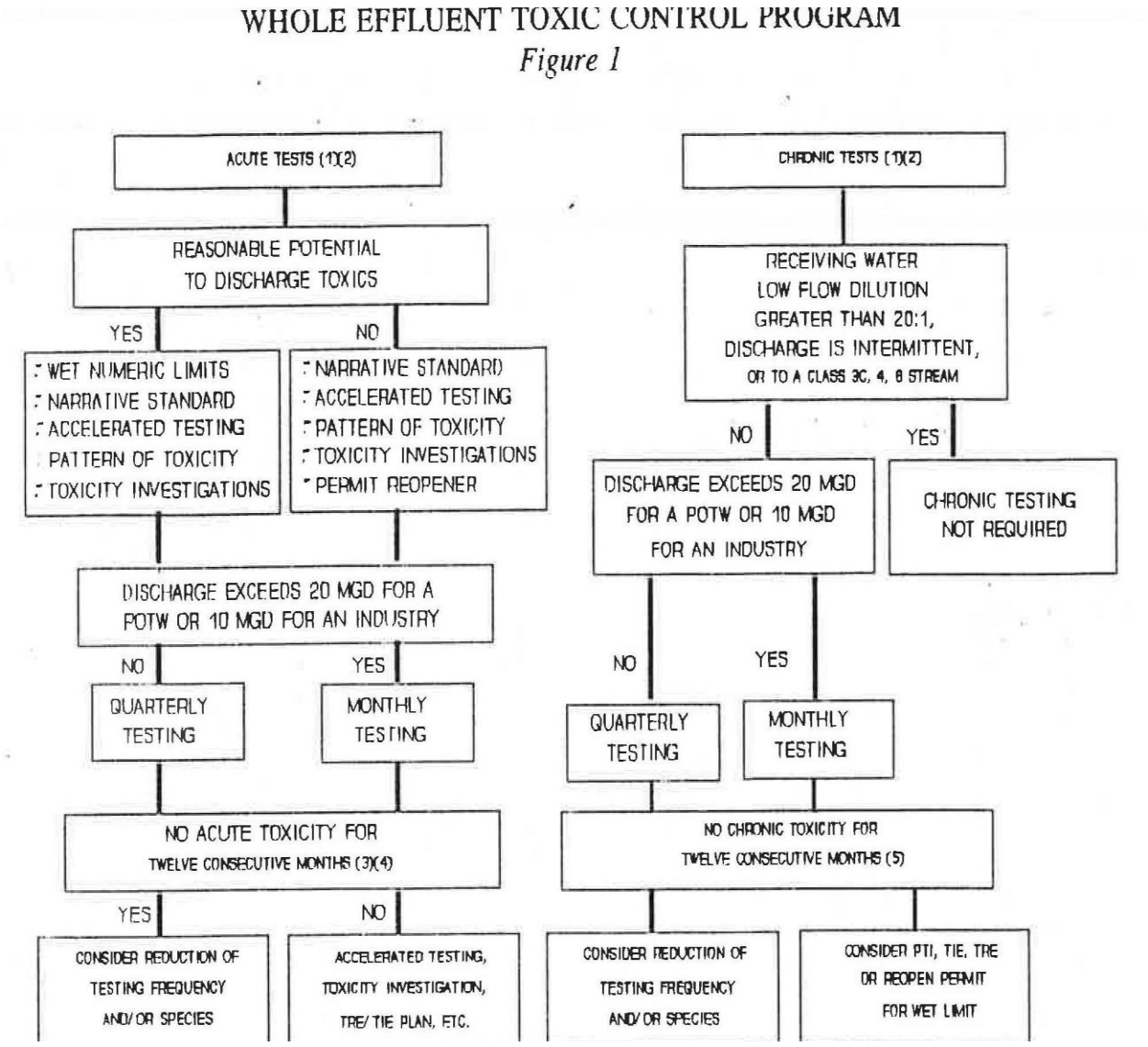

FIGURE 2 FIGURE FROM THE 1991 UTAH WHOLE EFFLUENT TOXICITY IMPLEMENTATION GUIDANCE.

The goal of evaluating dilution is to determine whether chronic or acute WET testing has the appropriate sensitivity. When chronic WET testing is conducted, the organisms are exposed to effluent diluted as calculated by the mixing zone analyses whereas acute WET testing uses 100 percent effluent. In atypical cases, acute testing may be more protective than chronic testing at dilutions less than 20:1. With appropriate documentation in the UDPES Fact Sheet/ Statement of Basis, DWQ permit writers can deviate from 20:1 to conduct the more protective of acute or chronic WET testing.

When dilution is less than 20:1, chronic testing is anticipated to be more sensitive than acute testing because of longer test duration and endpoints such as growth that can be more sensitive than survival. With the more sensitive nonlethal endpoints, the importance of using an appropriate test organism increases. Using test organisms that are not representative of the biota in the receiving waters introduces the potential for errors when interpreting the WET test results. These errors could result in decisions that are either under- or overprotective of the receiving waters. In addition, water-effects ratios (using receiving water for dilution in chronic testing versus laboratory water) cannot always be evaluated.

Until the chronic WET test organisms are concluded to represent Great Salt Lake biota, the chronic WET testing endpoints of survival[6], growth, and reproduction are not considered an absolute determinant of the potential toxicity of the effluent for Great Salt Lake but are instead interpreted as indicators. As an indicator, an absence of effects during chronic WET testing are presumed to be protective of the Great Salt Lake biota and demonstrate compliance with the Narrative Standards. If effects are observed, the conclusion is that adverse effects to Great Salt Lake biota are possible. The permittee has the option of eliminating the cause of effects observed in the WET testing or conducting additional investigations. An example of an additional investigation to evaluate the potential effects specifically for Great Salt Lake biota would be toxicity testing using Great Salt Lake biota.

The acute tests for survival demonstrate that "no toxics in toxic amounts" are being discharged. Failing acute WET test results in either an acute WET test or during the acute exposure phase of a chronic WET test could lead to a finding of reasonable potential for toxicity and WET limits in the permit. Currently, no Great Salt Lake UPDES permits have WET limits.

Figure 3 and the text following presents the interim WET testing procedures when chronic WET testing is conducted for Great Salt Lake discharges.

[6] Specifically, effects to survival observed at durations longer than an acute test. The interpretations of acute results (no dilution, acute exposure duration) from the chronic test are unchanged from the 1991 Utah WET Implementation Guidance.

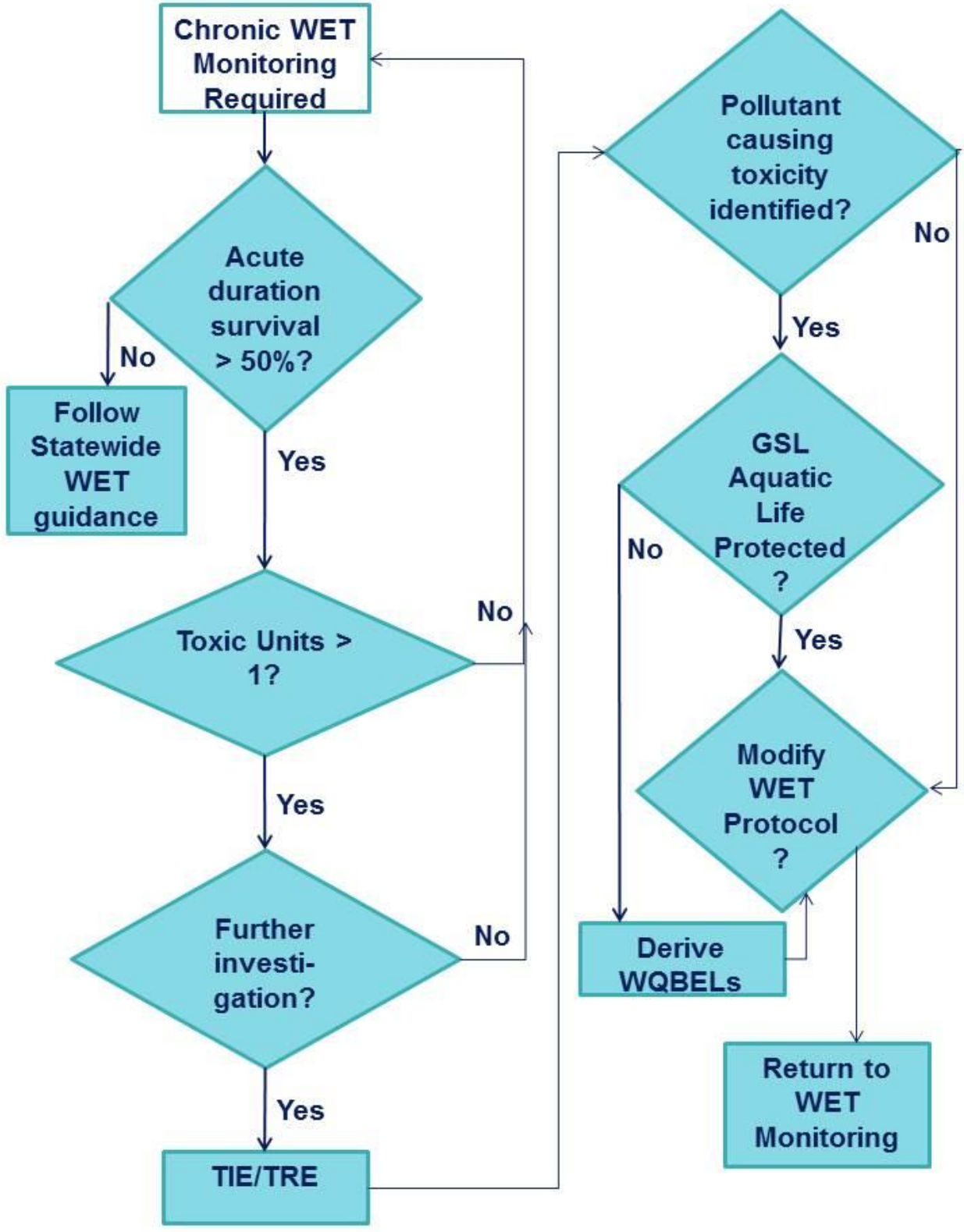

FIGURE 3 CHRONIC WHOLE EFFLUENT TOXICITY TESTING PROCEDURES SPECIFICALLY FOR GREAT SALT LAKE UPDES PERMITS

Survival > 50%. When chronic testing is required, survival must be reported for acute duration of the test. For instance, the duration of a chronic fathead minnow test is 7 days and the acute test is 2 days. Therefore, survival after day 2 will be reported. Consistent with 1991 Utah WET guidance, acute test results are considered passing if survival is 50% or greater. Acute test results and any required follow up are governed by the 1991 Utah WET guidance, or the most recent statewide guidance.

Growth or Reproduction Effect > 1 Toxic Unit (TUc)[7]. Consistent with the DWQ 1991 WET guidance, chronic WET tests have growth and reproduction endpoints in addition to survival. Results for these endpoints should be reported as toxic units (TUc). Toxic unit chronic (TUc) is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the chronic exposure period and is calculated as $100/IC_{25}$ where IC_{25} (inhibition concentration) is a point estimate of the toxicant concentration that would cause a 25% reduction in a nonlethal biological measurement of the test organism, such as reproduction or growth. Chronic effects are observed when the TUc is greater than 1 for survival, growth, or reproduction at an effluent concentration less than or equivalent to the receiving water concentration calculated in accordance with the Mixing Zone Policy, UAC R317-2-5. For these endpoints, if effects greater than 1 TUc (are observed, an additional chronic WET test is immediately conducted to determine if there is a reason for further investigation.

Further Investigation. Similar to the DWQ 1991 WET guidance, if the effects in the follow up test also are greater than 1 TU_c, this triggers further follow up in the form of a TIE/TRE (toxicity identification evaluation, toxicity reduction evaluation). If $TU_c > 1$ are not observed in the follow up test, the permittee resumes chronic WET monitoring. Only two tests with TU_cs greater than 1 are required to initiate further investigation because of the time required to conduct the tests and the potential for the receiving water's uses to be harmed during this time. The Director is immediately notified following the second test with a $TU_c > 1$ and a TIE/TRE may be required.

TIE/TRE. Consistent with the DWQ 1991 WET guidance, a toxicity identification and toxicity reduction evaluation are conducted to identify the specific cause of the observed toxicity. With Director approval, the TIE/TRE process may be modified for good cause in any manner that ensures protection of the uses in a timely fashion.

Pollutant causing effects identified? If the pollutant causing the effects cannot be identified through the TIE/TRE process, the permittee should consult DWQ to determine if modifications of the permit's

[7] See EPA (1991), Technical Support Document for Water Quality-based Toxics Control

WET monitoring requirements are appropriate. In some cases, the determination of the need for further investigation based on two tests may be a false positive or the cause of the effects is no longer present in the effluent and the permittee would resume unmodified chronic WET monitoring. In some cases, the Director may conclude that chronic WET testing is technically impractical or further chronic WET testing would not be informative. In this situation, WET testing may be terminated or changed from chronic to acute a permit modification.

If the pollutant causing the effects is identified, the pollutant may be further evaluated relative to Great Salt Lake's aquatic life uses.

Great Salt Lake aquatic life uses protected? If the concentrations of the pollutant causing the exceedance of 1 TU_c cannot be concluded to be protective of Great Salt Lake's aquatic life uses, then DWQ will derive water quality-based effluent based on protection of Great Salt Lake's aquatic life uses. The permit must be modified to implement the effluent limit. In some cases, modifications to the chronic WET monitoring requirements may also be appropriate.

Standard WET testing organisms may be more sensitive than the aquatic life community in Great Salt Lake. If data are available to provide a reasonable basis for concluding that the aquatic life uses in the receiving waters will not be impaired by the pollutants identified as having caused $TU_c > 1$, the permittee should consult DWQ to determine what modifications to the permit's WET monitoring requirements are appropriate. For instance, the salinity in the effluent may exceed the tolerance of the test organisms. Under these circumstances, continued chronic WET monitoring could result in a wasteful endless loop of tests exceeding a TU_c of 1 and TIEs/TREs without providing useful information regarding protection of Great Salt Lake aquatic life uses. Modifications to the WET testing protocol may include using a threshold other than a TU_c of 1 or cessation of WET testing.

Substantive changes to the WET requirements in the UPDES permit include public notice requirements and that the rationale for all changes be documented as part of the modification process.

Mixing Zones

According to EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD) (EPA, 1991), "a mixing zone is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient waterbody. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented." Water quality criteria may be exceeded within the mixing zone but the criteria must be met at the boundary. Given the unique environment of Great Salt Lake, with its shallow water depth and high salinity levels, special considerations are required for determining the allowable mixing zone and the dilution of discharges at the mixing zone boundary.

The elevation of the open waters of the Great Salt Lake varies with the climatic cycle and seasonally. The area between approximately 4,208 feet and the Great Salt Lake open waters are considered Great Salt Lake transitional waters, which contain brackish fringe wetlands. Freshwater standards apply above approximately 4,208 feet, which by UAC is considered outside the Great Salt Lake.

The mixing zone rule in Utah Administrative Code (UAC R317-2-5) specifies the maximum dimensions of the mixing zone, including discharges to lakes and reservoirs. The rule does not specify the allowable mixing zone for discharges to wetlands although EPA Region 8 (1995) policy is no mixing zones for wetlands. For discharges to fringe wetlands within the Class 5E Transitional Waters of Great Salt Lake, based on the assumption that the wetland will not have standing water during critical dry periods, no mixing zones are allowed[8]. In the case where Transitional Waters have standing water even during critical dry periods, the maximum allowable mixing zone for discharges to lakes and reservoirs will apply.

R317-2-5. Mixing Zones is as follows:

A mixing zone is a limited portion of a body of water, contiguous to a discharge, where dilution is in progress but has not yet resulted in concentrations which will meet certain standards for all pollutants. At no time, however, shall concentrations within the mixing zone be allowed which are acutely lethal as determined by bioassay or other approved procedure. Mixing zones may be delineated for the purpose of guiding sample collection procedures and to determine permitted effluent limits. The size of the chronic mixing zone in rivers and streams shall not to exceed 2500 feet and the size of an acute mixing zone shall not exceed 50% of stream width nor have a residency time of greater than 15 minutes. Streams

[8] Also see EPA Region VIII Mixing Zones and Dilution Policy (1995)

with a flow equal to or less than twice the flow of a point source discharge may be considered to be totally mixed. The size of the chronic mixing zone in lakes and reservoirs shall not exceed 200 feet and the size of an acute mixing zone shall not exceed 35 feet. Domestic wastewater effluents discharged to mixing zones shall meet effluent requirements specified in R317-1-3.

5.1 Individual Mixing Zones. Individual mixing zones may be further limited or disallowed in consideration of the following factors in the area affected by the discharge:

a. Bioaccumulation in fish tissues or wildlife,

b. Biologically important areas such as fish spawning/nursery areas or segments with occurrences of federally listed threatened or endangered species,

c.Potential human exposure to pollutants resulting from drinking water or recreational activities,

d. Attraction of aquatic life to the effluent plume, where toxicity to the aquatic life is occurring,

e. Toxicity of the substance discharged,

f. Zone of passage for migrating fish or other species (including access to tributaries), or

g. Accumulative effects of multiple discharges and mixing zones.

The mixing zone rule applies to discharges to the open waters of the Great Salt Lake. Unless the rule is modified, the size of the chronic mixing zone to the open waters of the Great Salt Lake shall not exceed 200 feet and the size of an acute mixing zone shall not exceed 35 feet.

Mixing Analyses

This section summarizes the methods for conducting mixing analyses for discharges to Great Salt Lake.

For discharges to freshwater lakes and reservoirs, the lake level is assumed to be at the Ordinary High Water Mark (OHWM). Due to the long term fluctuation of the Great Salt Lake water surface elevation over multiple years, the OHWM may not occur during a given permit period. For the purposes of the mixing analysis, the average lake elevation over the previous five years will be assumed.

Fresher-water discharges to the Great Salt Lake are buoyant, dispersing in a thin layer over the denser, more saline lake water. In addition, due to the shallow lake depth, there can be boundary effects associated with the lake bottom and the shoreline. Also due to the shallow lake depth, the mixing can be highly dependent on wind shear and water current. Due to these considerations, only more sophisticated mixing zone models are appropriate to simulate the discharge plume. The following tools are acceptable for evaluating the mixing zone dilution.

CORMIX[9]: EPA supported model that simulates near field concentrations of water quality constituents (Jirka et al. 1996). CORMIX is applicable to more complex discharges, including multiple pipes and diffusers, boundary interactions, and buoyant plumes and is appropriate for discharges to Great Salt Lake. The CORMIX methodology contains systems to model single-port, multiport diffuser discharges and surface discharge sources. Effluents considered may be conservative, non-conservative, heated, brine discharges, or contain suspended sediments.

Visual Plumes (VP): EPA supported model that simulates single and merging submerged aquatic plumes in arbitrarily stratified ambient flow and buoyant surface discharges (Frick et al. 2003). VP includes four different methods for simulating near-field plume behavior that may be run consecutively and compared graphically to help verify their performance. The Brooks equations are retained to simulate far-field behavior. In addition, DOS PLUMES may be selected as one of the models, giving full access to its capabilities. Note that the distribution version of this model (Version 1.0) is not supported beyond Windows XP.

3-D Hydrodynamic Models: Though more resource intensive to build and calibrate than CORMIX, three-dimensional hydrodynamic models, such as CE-QUAL-ICM or EFDC, are appropriate for simulating the effluent plume.

Tracer Studies: An allowable alternative to utilizing modeling tools for the mixing analysis is to conduct a tracer study to evaluate the mixing zone and estimate dilution. Note the logistics of conducting the tracer study will be made more complicated due to the presence of a thin buoyant freshwater layer over the denser brine layer. The concentration of the tracer will need to be measured at sufficient depths to adequately characterize vertical mixing within the water column.

[9] See http://water.epa.gov/scitech/datait/models/ for more information

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APPENDIX A: RECOMMENDED UPDES PERMIT TEXT

Chronic WET test results are interpreted as an indicator of toxicity for Great Salt Lake. These investigations may include the testing of Great Salt Lake-specific species. Since these are not EPA-approved test organisms, specific test methods would have to be developed to test these organisms and close coordination with DWQ is essential to assure the acceptability of the test results.

The following is recommended permit language. Yellow highlighting indicates where information specific to the individual permit should be added by the permit writer.

PART I, C. Specific Limitations and Self-Monitoring Requirements

C. Specific Limitations and Self-Monitoring Requirements.

1. Effective immediately, and lasting through the life of this permit, there shall be no acute toxicity in Outfall 003 as defined in *Part VIII*, and determined by test procedures described in *Part I. C.3.a & b* of this permit.

2. Effective immediately and lasting the duration of this permit, the permittee is authorized to discharge from Outfall 003. Such discharges shall be limited and monitored by the permittee as specified below:

Parameter	Effluent Limitations a/			
	Maximum Monthly Avg	Maximum Weekly Avg	Daily Minimum	Daily Maximum
Total Flow, MGD				
BOD_5, mg/L BOD_5 Min. % Removal				
TSS, mg/L TSS Min. % Removal				
E.Coli, No./100mL				

WET, Acute Biomonitoring	NA	NA	NA	Pass at 100 % effluent
pH, Standard Units				

NA – Not Applicable

Self-Monitoring and Reporting Requirements a/			
Parameter	Frequency	Sample Type	Units
Total Flow b/ c/			
BOD_5, Influent d/ Effluent			
TSS, Influent d/ Effluent			
E. Coli			
TRC			
WET, Acute Biomonitoring	SPECIFY	Composite or Grab	Pass/Fail
WET, Chronic Monitoring	SPECIFY	Composite or Grab	TU_c
pH			

a/ See Definitions, *Part VIII*, for definition of terms.

b/ Flow measurements of influent/effluent volume shall be made in such a manner that the permittee can affirmatively demonstrate that representative values are being obtained.

c/ If the rate of discharge is controlled, the rate and duration of discharge shall be reported.

d/ In addition to monitoring the final discharge, influent samples shall be taken and analyzed for this constituent at the same frequency as required for this constituent in the discharge.

3. Acute Whole Effluent Toxicity (WET) Testing.

a. *Whole Effluent Testing – Acute Toxicity*. Starting on the effective date of this permit, the permittee shall conduct FREQUENCY acute static replacement toxicity tests on a composite or grab sample of the final effluent. The sample shall be collected at outfall ###. If chronic WET tests are also required, the

results for survival from the acute duration portion of the chronic WET test for the same test species may be substituted for an actual acute WET test.

The monitoring frequency for acute tests shall be FREQUENCY unless a sample is found to be acutely toxic during a routine test. If that occurs, the monitoring frequency shall become weekly (See *Part I.C.3.b, Accelerated Testing*). Samples shall be collected on a two day progression; i.e., if the first sample is on a Monday, during the next sampling period, the sampling shall begin on a Wednesday, etc.

The replacement static acute toxicity tests shall be conducted in general accordance with the procedures set out in the latest revision of *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 5th Edition, (EPA 821/R/02/012), October 2002,* as per *40 CFR 136.3(a) TABLE 1A-LIST OF APPROVED BIOLOGICAL METHODS.* SPECIFY TEST ORGANISMS, e.g., The permittee shall alternate on a quarterly basis the 48-hour static replacement toxicity test using Ceriodaphnia dubia and the acute 96-hour static replacement toxicity test using Pimephales promelas (fathead minnow). A CO_2 atmosphere may be used (in conjunction with an unmodified test) in order to account for artificial pH drift, as previously demonstrated to and authorized by the Director.

Acute toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentration (LC_{50}). Mortality in the control must simultaneously be 10 percent or less for the results to be considered valid. If more than 10 percent control mortality occurs, the test shall be repeated until satisfactory control mortality is achieved.

If the permit contains a total residual chlorine limitation greater than 0.20 mg/L, the permittee may request from the Director approval to de-chlorinate the sample, or collect the sample prior to chlorination.

Quarterly test results shall be reported along with the Discharge Monitoring Report (DMR) submitted for the end of the reporting calendar quarter (e.g., biomonitoring results for the calendar quarter ending March 31 shall be reported with the DMR due April 28, with the remaining biomonitoring reports submitted with DMRs due each July 28, October 28, and January 28). All test results shall be reported along with the DMR submitted for that reporting period. The format for the report shall be consistent with the latest revision of the *Region VIII Guidance for Acute Whole Effluent Reporting* and shall include all chemical and physical data as specified.

If the results for a minimum of ten consecutive tests indicate no acute toxicity, the permittee may request a reduction in testing frequency and/or reduction to one species. The Director may approve, partially approve, or deny the request

based on results and other available information. If approval is given, the modification will take place without a public notice.

b. *Accelerated Testing*. When acute toxicity is indicated during routine biomonitoring as specified in this permit, the permittee shall notify the Director in writing within five (5) days after becoming aware of the test result. The permittee shall perform an accelerated schedule of biomonitoring to establish whether a pattern of toxicity exists. Accelerated testing will begin within seven (7) days after the permittee becomes aware of the test result. Accelerated testing shall be conducted as specified under *Part I.C.3.c, Pattern of Toxicity*. If the accelerated testing demonstrates no pattern of toxicity, routine monitoring shall be resumed.

c. *Pattern of Toxicity*. A pattern of toxicity is defined by the results of a series of up to five (5) biomonitoring tests pursuant to the accelerated testing requirements using 100 percent effluent on the single species found to be more sensitive, once every week for up to five (5) consecutive weeks.

   If two (2) consecutive tests (not including the scheduled quarterly or monthly test which triggered the search for a pattern of toxicity) do not result in acute toxicity, no further accelerated testing will be required and no pattern of toxicity will be found to exist. The permittee will provide written verification to the Director within five (5) days, and resume routine monitoring.

   A pattern of toxicity is established if one of the following occurs:

   (1) If two (2) consecutive test results (not including the scheduled quarterly or monthly test, which triggered the search for a pattern of toxicity) indicate acute toxicity, this constitutes an established pattern of toxicity.

   (2) If consecutive tests continue to yield differing results each time, the permittee will be required to conduct up to a maximum of five (5) acute tests (not including the scheduled quarterly or monthly test which triggered the search for a pattern of toxicity). If three out of five test results indicate acute toxicity, this will constitute an established pattern of toxicity.

d. *Preliminary Toxicity Investigation*.

   (1) When a pattern of toxicity is detected the permittee will notify the Director in writing within five (5) days and begin an evaluation of the possible causes of the toxicity. The permittee will have fifteen (15) working days from demonstration of the pattern to complete a Preliminary Toxicity Investigation (PTI) and submit a written report of the results to the Director. The PTI may include, but is not limited to, additional chemical and biological monitoring, examination of

pretreatment program records, examination of discharge monitoring reports, a thorough review of the testing protocol, evaluation of treatment processes and chemical use, inspection of material storage and transfer areas to determine if a spill may have occurred, and similar procedures.

(2) If the PTI identifies a probable toxicant and/or a probable source of toxicity the permittee shall submit, as part of its final results written notification of that effect to the Director. Within thirty (30) days of completing the PTI the permittee shall submit for approval a control program to control effluent toxicity and shall proceed to implement such a plan within seven (7) days following approval. The control program, as submitted to or revised by the Director, may be incorporated into the permit.

(3) If no probable explanation for toxicity is identified in the PTI, the permittee shall notify the Director as part of its final report, along with a schedule for conducting a Phase I Toxicity Reduction Evaluation (TRE) (See *Part I.C.3.e, Toxicity Reduction Evaluation*).

(4) If toxicity spontaneously disappears during the PTI, the permittee shall submit written notification to that effect to the Director as part of the reporting requirements of *Part I.C.3.a* of this section.

e. *Toxicity Reduction Evaluation (TRE).* If toxicity is detected during the life of this permit and it is determined by the Director that a TRE is necessary, the permittee shall be so notified and shall initiate a TRE immediately thereafter. The purpose of the TRE will be to establish the cause of toxicity, locate the source(s) of the toxicity, and control or provide treatment for the toxicity.

A TRE may include but is not limited to one, all, or a combination of the following:

(1) Phase I – Toxicity Characterization

(2) Phase II – Toxicity Identification Procedures

(3) Phase III – Toxicity Control Procedures

(4) Any other appropriate procedures for toxicity source elimination and control.

If the TRE establishes that the toxicity cannot be immediately eliminated, the permittee shall submit a proposed compliance plan to the Director. The plan shall include the proposed approach to control toxicity and a proposed compliance schedule for achieving control. If the approach and

schedule are acceptable to the Director, this permit may be reopened and modified.

If the TRE shows that the toxicity is caused by a toxicant(s) that may be controlled with specific numerical limitations, the permittee may:

(a) Submit an alternative control program for compliance with the numerical requirements.

(b) If necessary, provide a modified biomonitoring protocol, which compensates for the pollutant(s) being controlled numerically.

If acceptable to the Director, this permit may be reopened and modified to incorporate any additional numerical limitations, a modified compliance schedule if judged necessary by the Director, and/or a modified biomonitoring protocol.

Failure to conduct an adequate TRE, or failure to submit a plan or program as described above, or the submittal of a plan or program judged inadequate by the Director, shall be considered a violation of this permit.

4. Chronic Whole Effluent Toxicity (WET) Testing.

a. Chronic WET tests are considered an indicator for Class 5 waters (Great Salt Lake) because of uncertainties regarding the representativeness of the standard test species for Great Salt Lake. The results of the acute duration portion of a chronic test are implemented as specified in Condition C.3. As an indicator, the chronic test results can demonstrate compliance with portions of the Narrative Standards (R317-2-7.2). However, the chronic WET test results alone do not demonstrate noncompliance with the Narrative Standards. As indicators, the chronic WET test results alone are not used for determining reasonable potential for toxicity or noncompliance with the permit.

b. *Whole Effluent Testing – Chronic Toxicity*. Starting DATE, the permittee shall FREQUENCY, conduct chronic short-term toxicity tests on a composite or grab sample of the final effluent. The sample shall be collected at LOCATION.

The monitoring frequency shall be FREQUENCY. Samples shall be collected on a SPECIFY SAMPLE COLLECTION PROTOCOL. If TUc >1 (toxic unit, chronic) is observed, the test shall be repeated in less than four weeks from the date the initial sample was taken. The need for any additional samples, and/or a Toxicity Reduction Evaluation (TRE), see *Part I.C.3.e*, shall

be determined by the Director. If the second test result is a $TU_c \leq 1$, routine monitoring shall be resumed.

The chronic WET tests shall be conducted in general accordance with the procedures set out in the latest revision of *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms, 4th Edition, (EPA 821/R-02-13), October 2002* as per 40 CFR 136.3(a) *TABLE 1A-LIST OF APPROVED BIOLOGICAL METHODS*. Test species shall consist of SPECIFY STANDARD TEST SPECIES. A CO_2 atmosphere may be used (in conjunction with an unmodified test) in order to account for artificial pH drift.

Toxic unit chronic (TU_c) is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the chronic exposure period and is calculated as $100/IC_{25}$. A $TU_c = 1$ is the inhibition concentration of toxicant that would cause a 25% reduction in survival, growth, or reproduction. Chronic effects are observed when the TU_c is greater than 1 for survival, growth, or reproduction at an effluent concentration less than or equivalent to the receiving water concentration calculated in accordance with the Mixing Zone Policy, UAC R317-2-5. If any of the acceptable control performance criteria are not met, the test shall be considered invalid.

Quarterly test results shall be reported along with the Discharge Monitoring Report (DMR) submitted for the end of the reporting calendar quarter (e.g., biomonitoring results for the calendar quarter ending March 31 shall be reported with the DMR due April 28, with the remaining biomonitoring reports submitted with DMRs due each July 28, October 28, and January 28). All test results shall be reported along with the DMR submitted for that reporting period. The format for the report shall be consistent with the latest revision of the *Region VIII Guidance for Chronic Whole Effluent Reporting* and shall include all the chemical and physical testing as specified.

If the results for a minimum of ten consecutive tests indicate no chronic effects, the permittee may request a reduction in testing frequency. The Director may approve, partially approve, or deny the request based on results and other available information. If approval is given, the modification will take place without a public notice.

c. *Toxicity Reduction Evaluation (TRE).* If effects are detected during the life of this permit and it is determined by the Director that a TRE is necessary, the permittee shall be so notified and shall initiate a TRE immediately thereafter. The purpose of the TRE will be to establish the cause of effects, locate the source(s), and control or provide treatment for the effects.

A TRE may include but is not limited to one, all, or a combination of the following:

(1) Phase I – Toxicity Characterization

(2) Phase II – Toxicity Identification Procedures

(3) Phase III – Toxicity Control Procedures

(4) Any other appropriate procedures for toxicity source elimination and control.

If the TRE establishes that the toxicity cannot be immediately eliminated, the permittee shall submit a proposed compliance plan to the Director. The plan shall include the proposed approach to control toxicity and a proposed compliance schedule for achieving control. If the approach and schedule are acceptable to the Director, this permit may be reopened and modified.

If the TRE shows that the effect is caused by a pollutant(s) that may be controlled with specific numerical limitations, the permittee may:

(a) Submit an alternative control program for compliance with the numerical requirements.

(b) If necessary, provide a modified biomonitoring protocol, which compensates for the pollutant(s) being controlled numerically.

(c) Submit an analysis that demonstrates that the observed effects in the WET testing are not indicative of a threat to the uses Great Salt Lake.

If acceptable to the Director, this permit may be reopened and modified to incorporate any additional numerical limitations, a modified compliance schedule if judged necessary by the Director, and/or a modified biomonitoring protocol including cessation of WET testing.

Failure to conduct an adequate TRE, or failure to submit a plan or program as described above, or the submittal of a plan or program judged inadequate by the Director, shall be considered a violation of this permit.

D. Reporting of Wastewater Monitoring Results. Monitoring results obtained during the previous quarter shall be summarized for each quarter and reported on a Discharge Monitoring Report Form (EPA No. 3320-1) or by NetDMR, post-marked or entered into NetDMR no later than the 28th day of the month following the completed reporting period. The first report is due on DATE. If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports including whole effluent toxicity (WET) test reports required herein, shall be signed and certified in accordance with the requirements of *Signatory Requirements (see Part VII.G*), and submitted by NetDMR, or hard copy to the Division of Water Quality at the following address: