Missouri
Department of
Natural Resources

Proposed 2016 Listing Methodology Document
PUBLIC COMMENTS

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Missouri Department of Natural Resources
Water Protection Program
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EPA Comments to MoDNR on 2014 Draft 303(d) List

Bruce Perkins, Region 7 Integrated Reporting Coordinator
December 16, 2013

In the assessment of causes like dissolved oxygen and pH; the binomial is only applicable when there are 30 or fewer samples according to the 2014 listing methodology. There are instances in the proposed delistings where this methodology is not followed. These include the North Fork Cuivre River (WBID 0170) and Williams Creek (WBID 3594). There are some water bodies where the binomial is used with greater than 30 samples but that there are less than 30 samples in the last three years and an application of the binomial shows the water body is meeting water quality standards for the last three years. These include Burris Fork (WBID 0968), Coldwater Creek (WBID 1706), Dardenne Creek (WBID 0221), Dardenne Creek (WBID 0222), Dark Creek (WBID 0690), Grand Glaize Creek (WBID 2184), Maline Creek (WBID 1709), Tributary to Big Otter Creek (WBID 1225) and Watkins Creek (WBID 1708).

Hays Creek (WBID 0097) and Dry Fork (WBID 3178) Using watershed size to assess biological samples is allowed in the MO water quality standards [MO 10 CSR 20-7.031(4) (R)] where the size is not significantly different than reference streams in the same ecoregion. For these two streams the statistical significance was not calculated to show that reference streams in the same ecoregion were significantly larger. Additionally, for Hays Creek the state used control streams instead of reference streams identified in Table I as directed by the state's water quality standards.

Urban stream sampling by the U.S. EPA Region 7 environmental services division has identified streams which should be listed for toxic bottom sediments according to the state's methodology. These include Brush Creek (Jackson County, unclassified tributary to Blue River, USGS Reach Code 10300101000565 and 10300101000566) for numerous PAH compounds (These findings are consistent with USGS studies performed in the earlier portions of the 2000's), Blue River (WBID 0419 and 0418), Line Creek (WBID 3575), Shoal Creek (WBID 0397) and East Fork Shoal Creek (WBID 0398) for cadmium, Wilsons Creek (WBID 2375) for lead and numerous PAH compounds, North Branch Wilsons Creek (WBID 3745) for zinc, Jordan Creek (WBID 3374) for numerous PAH compounds and Jones Branch (unclassified tributary to Pearson Creek, USGS Reach Code 11010002001683) for lead. This data is available in the EPA on-line data management program STORET. Data for Brush, Line, Shoal and East Fork Shoal creeks for the years 2010 and 2011 were not successfully uploaded to STORET and are included with this comment for consideration. The data is also available on the web site KCWaters.org.

The TMDL for Wilsons, Jordan and Pearson creeks has been withdrawn so these waters again need a TMDL and should be relisted.

For Troublesome Creek (WBID 0074) the habitat is stated as not being acceptable for the bioassessment to yield acceptable results. In this case one reason stated for poor habitat is sediment. Sediment is itself a pollutant and if sediment is preventing the stream biota from meeting full compliance, it would seem that the water body segment should be 303(d) listed for sediment.

The TMDL used to delist Whetstone Creek (WBID 1505U) was not approved for the upstream unclassified segment. The TMDL does not target a loading capacity which would result in meeting water quality standards. Further information on this can be obtained from the final EPA action on the 2012 Missouri 303(d) List where this water body was added back to the list.

The TMDL proposed to delist Chat Creek (WBID 3168) for cadmium was only approved for zinc. As such this water body should remain listed for cadmium.

Fox Creek (WBID 1842), is the unknown listing from 2012 being replaced with the aquatic macroinvertebrate bioassessment new to the 2014 listing cycle?

Dardenne Cr (WBID 0221) does the Aquatic Macroinvertebrate bioassessment replace the unknown cause from 2012?

Koen Creek (WBID 2171), the data collected in 1995 was discounted because of questions about its quality. As the data was collected under the EPA REMAP program according to the EPA QAPP for data collection it should be considered valid if that program's requirements meet the state's methodologies. As such, if there is no additional data to change the assessment done for the 2012 list and this water should remain listed as impaired.

For Coldwater Creek (WBID 1706) all available data was not assessed. The chloride concentration on 2/21/2012 was 274 mg/L which exceeds the chronic water quality criterion. This data is available from the state's web data search site (http://www.dnr.mo.gov/mocwis_public/wqa/waterbodySearch.do) With the sample taken on 1/5/2010 identified in the assessment spreadsheet for this water body, there were greater than one exceedance of the chronic chloride criterion in the last three years.

The *E. coli* data used to delist the North Fork Cuivre River (WBID 0170) was collected in a different segment of the stream below the confluence with Indian Creek (WBID 0171). As such this shows North Fork Cuivre River (WBID 0158) is not impaired but does not provide good cause that the upstream segment is not impaired.

For Turkey Creek (WBID 3282) the assessment sheet indicates impairment for lead in water not sediment. Additionally, this water body was listed as impaired for lead in water for 2012.

Peruque Creek (WBID 0217 and 0218) The delisting of inorganic sediment is not accompanied by any data files that show the inorganic sediment is no longer exceeding the narrative translator. MDNR water quality data search does not indicate that any new sediment samples have been collected since the 2012 list. Additionally, there is no fish assessment data provided on the review web site for the new listed impairment for these two segments.

Center Creek (WBID 3203) The impairment for zinc is covered by a TMDL.

Little Beaver Creek (WBID 1529) Is the sediment impairment being used as a pollutant for the macroinvertebrate community impairment. Should it be listed for both?

Salt River (WBID 0103) No DO data in assessment sheet for this site.

Shibboleth Branch has an EPA approved TMDL for lead and zinc in sediment and need not be listed in category 5 (303(d)) but category 4a (TMDL).

Is there an available site where WBIDs and the water body are identified and geolocated up to date with this proposed list?

Comments on the Draft 2016 Listing Methodology

In the 2016 methodology the state proposes to modify the bioassessment procedure to apply a different narrative translation to headwater streams from other wadeable streams. Using watershed size to assess biological samples is allowed in the Missouri water quality standards [MO 10 CSR 20-7.031(4) (R)] where the size is significantly different than reference streams in the same ecoregion. For these two streams the statistical significance was not calculated to show that reference streams in the same ecoregion were significantly larger. Additionally, the state proposes to use control streams instead of reference streams identified in Table I as directed by the state's water quality standards. Missouri's bioassessment procedure for fish is limited to stream orders of 3-5; presumably because this type of statistical significance process was integrated into the assessment methodology. The proposed demarcation is that a stream is "significantly smaller" than reference streams. There is no procedure outlined to identify such significance nor do the state's water quality standards make a reference to using control streams. The state's reference streams are outlined in Table I in the state's water quality standards. If a watershed size cutoff statistical methodology is defined for significantly smaller streams, then the public can meaningfully comment of the state's assessment of a water body's biological condition. Meaningful public comment is difficult to obtain if the methods used by the state to determine the results of bioassessment are not identified.

Has monitoring of raw water from drinking water reservoirs been discontinued or is it no longer being used for assessment?

Is the RAM monitoring program by MDC integrated into the DNR bioassessment web site? Is it available for stakeholder review?

In the discussion of toxic chemicals in Table 1.1 there is an exclusion for fish kills due to natural causes. Is there information to indicate that natural toxic chemicals are released at a frequency of more than once every three years on average?

In Table 1.1 the compliance column for dissolved oxygen references a footnote which states that the data is only used for wide scale 305(b) assessments and not 303(d) listing. If that reference is a typographical error and instead should reference footnote 10, then that footnote should not apply to dissolved oxygen either. If samples taken during a critical period of the year, for example high temperature low flow summer samples, and all of the samples show an excursion of the state's water quality standards, that data should not be averaged out over an annual period. An aquatic life use is not being met if there is a seasonal period where no life can exist in the assessment unit.

There is a reliance on appropriate or representative control streams for many assessments. There is no guidance on how the characteristics of such a control stream are determined. As there are many reference streams listed in the state water quality standards should there be an emphasis to shift from those reference streams to control streams. For small streams bioassessment targets see the first listing methodology comment above.

In relation to footnote 16 in Table 1.2, there are only two Mississippi Alluvial Plains reference streams identified in the state's water quality standards; these are Main Ditch and Maple Slough Ditch. This is to cover three Ecological Drainage Units. Because of the limited number of reference streams it is even more important that a method for choosing appropriate control streams is outlined in the state's listing methodology where the use of control streams is allowed in the state's water quality standards.

Table B-1 methods use a two-sided test for bottom deposits. Since the goal is to determine if the deposits are too high not just different from the control site, the test should be single-sided.

Table B-1 redefines how the binomial probability will be assessed for greater than 30 samples but there is no note or comment that this is being changed from the commission approved 2014 methodology. In later discussion in that appendix this change is identified in comment D42. The previous methodology, and the deleted text here, states that the use of a binomial is “difficult for larger sample sizes.” How has the state’s reconsideration of this difficulty led to the removal of the sample size mediated analysis?

For toxic sediments in Table B-1 the sample mean is identified as the assessment number. If this is the mean at a site it is appropriate. However, if it is the mean of multiple sites along a segment it could result in one site, of many sampled, being toxic but being averaged out by cleaner sites above and/or below that site. This could result in a portion of a segment being undeniably impaired but the segment not being listed. To alleviate this, the table should identify the site mean rather than the sample mean to eliminate any confusion.

Rielly, Trish

From: Perkins, Bruce <Perkins.Bruce@epa.gov>
Sent: Wednesday, December 18, 2013 9:45 AM
To: Rielly, Trish
Subject: RE: EPA comments on the proposed 2014 303(d) list and 2016 listing methodology
Attachments: 2016-lmd-proposed (Bob's comments) (2).pdf

Trish,

I also had Bob Angelo, the regional standards coordinator for Missouri, look over the methodology. He went through it with a fine-toothed comb and has many comments. I am forwarding you his mark-up of the methodology. His comments include some that are more programmatic suggestions also and may not influence your document per se.

You have a good holiday season also,
Bruce

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From: Rielly, Trish [mailto:trish.rielly@dnr.mo.gov]
Sent: Wednesday, December 18, 2013 9:33 AM
To: Perkins, Bruce
Cc: Rielly, Trish
Subject: RE: EPA comments on the proposed 2014 303(d) list and 2016 listing methodology

Hi Bruce, I just wanted to let you know I received your comments.

We will review and respond as needed/necessary.

Have a good week, and Holiday!!

Trish Rielly| Water Quality Monitoring and Assessment Unit | 1101 Riverside Drive, Jefferson City, Missouri |Phone: 573-526-5297 |E.mail: trish.rielly@dnr.mo.gov | Water Protection Program URL: http://dnr.mo.gov/env/wpp/wp-index.html

The Department of Natural Resources envisions a Missouri where people live and work in harmony with our natural and cultural resources; make decisions that result in a quality environment and a place where we can prosper today and in the future.

From: Perkins, Bruce [mailto:Perkins.Bruce@epa.gov]
Sent: Monday, December 16, 2013 10:07 AM
To: Rielly, Trish
Subject: EPA comments on the proposed 2014 303(d) list and 2016 listing methodology

Trish,

Here are some comments on the list and methodology. I have also attached a data file with EPA's urban waters sediment data in the Kansas City area. It was not all on the STORET site due to an oversight when uploading the data. The data I mention for sediment in the Springfield area was collected for our ongoing data collection for TMDL development. The data was sent to the TMDL section at the state but if they have not shared it with you I can also send you a copy.

If you have any questions or want further explanations just let me know.

Bruce

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Methodology for the Development

of the

2016 Section 303(d) List in Missouri

Comment [D1]: Updated date

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program

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Methodology for the Development of the 2016 Section 303(d) List

Table of Contents

I. Citation and Requirements 2
A. Citation of Section of Clean Water Act..... 2
B. U.S. EPA Guidance..... 2
Placement of Waters within the Five 305(b) Report Categories..... 3

II. Methodology Document..... 6
A. Procedures and Methods Used to Collect Water Quality Data..... 6
B. Identification of All Existing and Readily Available Water Quality Data Sources..... 10
C. Data Quality Considerations..... 13
D. How Water Quality Data is Evaluated to Determine Whether or Not Waters are Impaired..... 15
E. 303(d) Listing Considerations..... 22

List of Appendices

Appendix A: Excerpts from EPA Guidance on Statistical Approaches..... 24
Appendix B: Statistical Considerations..... 27
Appendix C: Examples of Statistical Procedures..... 33
Appendix D: The Meaning of the Sediment Quotient and How to Calculate It..... 34

Tables

Table 1.1: Methods for Assessing Compliance with Water Quality Standards: Numeric Criteria..... 16
Table 1.2: Methods for Assessing Compliance with Water Quality Standards: Narrative Criteria..... 19
Table B-1: Description of Analytical Tools for Determining if Waters are Impaired..... 27
Table B-2 Description of Analytical Tools for Determine When Waters are No Longer Impaired..... 30
Table B-3: Effects of Type 1 Error Rates and Sample Size on Type 2 Error Rates..... 32

Proposed

I. Citation and Requirements

A. Citation of Section of Clean Water Act

This document is required by revisions of rules under the Federal Clean Water Act, Section 303(d), 40 CFR 130.7, and the timetable for presenting the finished document to the United States Environmental Protection Agency (EPA) and the public is given in Part 130.10. Section 303(d) requires states to list certain impaired waters and the rules require that states describe how this list will be constructed. Missouri fulfills reporting requirements under Section 303(d), 305(b) and 314 of the Clean Water Act by the submission to EPA of an integrated report at the time the 303(d) is approved by the Missouri Clean Water Commission. In years when no integrated report is submitted, the Department of Natural Resources (Department) submits a copy of its statewide water quality assessment database to EPA.

B. EPA Guidance

In July 2003, EPA issued new guidance entitled "Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act". This guidance gave further recommendations about listing of 303(d) and other waters. In July 2005, EPA published an amended version entitled "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act." (Appendix A & B). In October 2006, EPA issued a memorandum entitled "Information Concerning 2008 Clean Water Act Sections 303(d), 305(b) and 314 Integrated Reporting and Listing Decisions." This memorandum serves as EPA's guidance for the 2008 reporting cycle and beyond. In subsequent years, EPA has provided additional guidance, but only limited new supplemental information has been provided since the 2008 cycle. Additional information can be found at EPA's website: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/guidance.cfm

Comment [D2]: Inserted reference and made minor updates wording in the sentences following and added EPA web link

The Department is responsible for administration of the Federal Clean Water Act in Missouri. EPA regulations require that the Department describe the methodology used to develop the state's 303(d) List. Biennially, the methodology is reviewed and revised as necessary, and made available to the public for review and comment. In accordance with the guidance, the Department provides EPA with a document summarizing all comments received and the Department responses to significant comments. EPA's guidance recommends that the Department provide: (1) a description of the methodology used to develop the Section 303(d) List; (2) a description of the data and information used to identify (impaired and threatened) waters, including a description of the existing and readily available data and information used; and (3) a rationale for any decision for not using any existing and readily available data and information. The guidance also notes that "prior to submission of its Integrated Report, each state should provide the public with the opportunity to review and comment on the methodology." The guidelines further recommend that the methodology document include information on how interstate or international disagreements concerning the list are resolved.

Comment [D3]: Updated this sentence

Placement of Waters within the Five Categories in the 2006[1] EPA Assessment, Listing and Reporting Guidance

The guidance issued by EPA in 2006 recommends that all waters of the state be placed in one of five categories.

Comment [D4]: Updated the year and added EPA web link to footnote

Category 1

All designated beneficial uses are fully maintained. Data or other information supporting full beneficial use attainment for all designated beneficial uses must be consistent with the state's listing methodology document. The Department will place a water in Category 1 if the following conditions are met:

- The water has physical and chemical data (at a minimum, water temperature, pH, dissolved oxygen, ammonia, total cobalt, total copper for streams, and total nitrogen, total phosphorus and secchi depth for lakes) and biological water quality data (at a minimum, *E. coli* or fecal coliform bacteria) that indicates attainment with water quality standards.
- The level of mercury in fish fillets or plugs used for human consumption does not exceed fish tissue guidelines of 0.3 mg/kg or less. Only samples of higher trophic level species (largemouth, smallmouth and Kentucky Spotted bass, sauger, walleye, northern pike, trout, striped bass, white bass, flathead catfish and blue catfish) will be used.
- The water is not rated as "threatened".

Comment [D5]: Removed fish eggs

Category 2

One or more designated beneficial uses are fully attained but at least one designated beneficial use has inadequate data or information to make a use attainment decision consistent with the state's listing methodology document. The Department will place a water in Category 2 if at least one of the following conditions are met:

- There is inadequate data for water temperature, pH, dissolved oxygen, ammonia, total cobalt or total copper in streams to assess attainment with water quality standards or inadequate total nitrogen, total phosphorus or secchi data in lakes.
- There is inadequate *E. coli* or fecal coliform bacteria data to assess attainment with the whole body contact recreational use.
- There is insufficient fish fillet tissue, or plug data available for mercury to assess attainment with the fish consumption use.

Category 2 waters will be placed in one of two sub-categories.

[1] http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2005_08_11_tmdl_2006IRG_report_2006irg-sec5.pdf

Proposed

Category 2A: Waters will be placed in this category if available data, using best professional judgement, suggests compliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards (10 CSR 20-7.031) or other quantitative thresholds for determining use attainment.

Category 2B: Waters will be placed in this category if the available data, using best professional judgment, suggests noncompliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards, or other quantitative thresholds for determining use attainment, and this data is insufficient to support a statistical test or to qualify as representative data. Category 2B waters will be given high priority for additional water quality monitoring.

Comment [D6]: Added hyperlink to CSR

Category 3

Water quality data are not adequate to assess any of the designated beneficial uses consistent with the LMD. The Department will place a water in Category 3 if data are insufficient to support a statistical test or to qualify as representative data to assess any of the designated beneficial uses. Category 3 waters will be placed in one of two sub-categories.

Category 3A. Waters will be placed in this category if available data, using best professional judgement, suggests compliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards (10 CSR 20-7.031) or other quantitative thresholds for determining use attainment.

Category 3B. Waters will be placed in this category if the available data, using best professional judgement, suggests noncompliance with numeric water quality criteria of Tables A or B in Missouri's Water Quality Standards or other quantitative thresholds for determining use attainment. Category 3B waters will be given high priority for additional water quality monitoring.

Category 4

State Water Quality Standards or other criteria, as per the requirements of Table 1 of this document, are not attained, but a Total Maximum Daily Load study is not required. Category 4 waters will be placed in one of three sub-categories.

Category 4A. EPA has approved a Total Maximum Daily Load study that addresses the impairment. The Department will place a water in Category 4A if both the following conditions are met:

- Any portion of the water is rated as being in non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document due to one or more discrete pollutants or discrete properties of the water[2], and

[2] A discrete pollutant or a discrete property of water is defined here as a specific chemical or other attribute of the water (such as temperature, dissolved oxygen or pH) that causes beneficial use impairment and that can be measured quantitatively.

Proposed

- EPA has approved a Total Maximum Daily Load for all pollutants that are causing non-attainment.

Category 4B. Water pollution controls required by a local, state or federal authority, are expected to correct the impairment in a reasonable period of time. The Department will place a water in Category 4B if **both** of the following conditions are met:

- Any portion of the water is rated as being in non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document due to one or more discrete pollutants or discrete properties of water[2], and
- A water quality based permit that addresses the pollutant(s) causing the designated use impairment has been issued and compliance with the permit limits will eliminate the impairment; or other pollution control requirements have been made that are expected to adequately address the pollutant(s) causing the impairment. This may include implemented voluntary watershed control plans as noted in EPA's guidance document.

Category 4C. Any portion of the water is rated as being in non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document, and a discrete pollutant(s) or other discrete property of the water[2] does not cause the impairment. Discrete pollutants may include specific chemical elements (e.g., lead, zinc), chemical compounds (e.g., ammonia, dieldrin, atrazine) or one of the following quantifiable physical, biological or bacteriological conditions: water temperature, percent of gas saturation, amount of dissolved oxygen, pH, deposited sediment, toxicity or counts of fecal coliform or *E. coli* bacteria.

Category 5

At least one discrete pollutant has caused non-attainment with state Water Quality Standards or other criteria as explained in Table 1 of this document, and the water does not meet the qualifications for listing as either Categories 4A or 4B. Category 5 waters are those that are candidates for the state's 303(d) List[3].

If a designated use is not supported and the segment is impaired or threatened, the fact that a specific pollutant is not known does not provide a basis for excluding a segment from Category 5. These segments must be listed as Category 5 unless the state can demonstrate that no discrete pollutant or pollutants causes or contributes to the impairment. Pollutants causing the impairment will be identified before a TMDL study is written. The TMDL must be written within the time period allowed for TMDL development in EPA guidelines.

Threatened Waters

When a water that would otherwise be in Categories 1, 2, or 3 has a time trend analysis for one or more discrete water quality pollutants that indicates the water is currently maintaining all

[3] The proposed state 303(d) List is determined by the Missouri Clean Water Commission and the final list is determined by the U.S. Environmental Protection Agency.

beneficial uses but will not continue to meet these uses before the next listing cycle, it will be considered a "threatened water." A threatened water will be treated as an impaired water and placed in the appropriate Category (4A, 4B, or 5).

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II. The Methodology Document

A. Procedures and Methods Used to Collect Water Quality Data

Department Monitoring

The major purposes of the Department's water quality monitoring program are:

- to characterize background or reference water quality conditions;
- to better understand daily, flow event and seasonal water quality variations and their underlying processes;
- to characterize aquatic biological communities;
- to assess time trends in water quality;
- to characterize local and regional impacts of point and nonpoint source discharges on water quality;
- to check for compliance with Water Quality Standards or wastewater permit limits;
- to support development of strategies, including Total Maximum Daily Loads, to return impaired waters to compliance with Water Quality Standards. All of these objectives are statewide in scope.

Coordination with Other Monitoring Efforts in Missouri

To maximize efficiency, the Department routinely coordinates its monitoring activities to avoid overlap with other agencies, and to provide and receive interagency input on monitoring study design. Data from other sources is used for meeting the same objectives as Department sponsored monitoring. The agencies most often involved are the U.S. Geological Survey, the U.S. Army Corps of Engineers, EPA, the Missouri Department of Conservation, and the Missouri Department of Health and Senior Services. The Department also tracks the monitoring efforts of the National Park Service, the U.S. Forest Service, several of the state's larger cities, the states of Oklahoma, Arkansas, Kansas, Iowa and Illinois, and graduate level research conducted at universities within Missouri. For those wastewater discharges where the Department has required instream water quality monitoring, the Department may also use monitoring data acquired by wastewater dischargers as a condition of discharge permits issued by the department. In 1995, the Department also began using data collected by volunteers that have passed Quality Assurance/Quality Control tests.

Existing Monitoring Networks and Programs

The following list is a description of the kinds of water quality monitoring activities presently occurring in Missouri.

1. Fixed Station Network

   A. Objective: To better characterize background or reference water quality conditions, to better understand daily, flow event, and seasonal water quality variations and their

Proposed

underlying processes, to assess time trends and to check for compliance with Water Quality Standards.

B. Design Methodology: Sites were chosen based on one of the following criteria:

- Site is believed to have water quality representative of many neighboring streams of similar size due to similarity in watershed geology, hydrology and land use, and the absence of any impact from a significant point or discrete nonpoint water pollution source.
- Site is downstream of a significant point source or discrete nonpoint source area.

C. Number of Sites, Sampling Methods, Sampling Frequency, and Parameters:

- Department/U.S. Geological Survey cooperative network: 70 sites statewide, horizontally and vertically integrated grab sampled, six to 12 times per year. Samples are analyzed for major ions, nutrients, temperature, pH, dissolved oxygen, specific conductance and flow on all visits, two to four times annually for suspended solids and heavy metals, and for pesticides six times annually at six sites.
- Department/University of Missouri-Columbia's lake monitoring network. This program has monitored about 249 lakes since 1989. About 75 lakes are monitored each year. Each lake is usually sampled four times during the summer and about 12 are monitored spring through fall for nutrients, chlorophyll, turbidity and suspended solids.
- Department routine monitoring of finished public drinking water supplies for bacteria and trace contaminants.
- Routine bacterial monitoring (typically weekly during the recreational season) of swimming beaches at Missouri's state parks during the recreational season by the Department's Division of State Parks.
- Monitoring of sediment quality by the Department at approximately 10 discretionary sites annually. All sites are monitored for several heavy metals and organic contaminants.

Comment [D7]: Updated information to reflect current monitoring efforts

Comment [D8]: Replaced "summer" with "recreational season"

Comment [D9]: Removed pore water analysis for ammonia and microtox toxicity

2. Special Water Quality Studies

A. Objective: Special water quality studies are used to characterize the water quality impacts from a specific pollutant source area.

B. Design Methodology: These studies are designed to determine the contaminants of concern based on previous water quality studies, effluent sampling and/or Missouri State Operating Permit applications. These studies employ multiple sampling stations downstream and upstream (if appropriate). If contaminants of concern have significant seasonal or daily variation, season of the year and time of day variation must be accounted for in the sampling design.

C. Number of Sites, Sampling Methods, Sampling Frequency and Parameters: The

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Department conducts or contracts 10 to15 special studies annually, as funding allows. Each study has multiple sampling sites. Number of sites, sampling frequency and parameters all vary greatly depending on the study. Intensive studies would also require multiple samples per site over a relatively short time frame.

3. Toxics Monitoring Program

The fixed station network and many of the Department's intensive studies monitor for toxic chemicals. In addition, major municipal and industrial dischargers must monitor for toxicity in their effluents as a condition of their Missouri State Operating Permit.

4. Biological Monitoring Program

A. Objectives: The objectives of this program are to develop numeric criteria describing "reference" aquatic macroinvertebrate and fish communities in Missouri's streams, to implement these criteria within state Water Quality Standards and to continue a statewide fish and aquatic invertebrate monitoring program.

B. Design Methodology: Development of biocriteria for invertebrates and fish involves identification of reference streams in each of Missouri's 17 ecological drainage units. It also includes intensive sampling of invertebrate and fish communities to quantify temporal and spatial variation in reference streams within ecoregions and variation between ecoregions, and the sampling of chemically and physically impaired streams to test sensitivity of various community metrics to differences in stream quality.

C. Number of Sites, Sampling Methods, Sampling Frequency and Parameters: The Department has conducted biological sampling of aquatic invertebrates for many years. Since 1991, this program has consisted of standardized monitoring of approximately 55 sites twice annually. The Missouri Department of Conservation presently has a statewide fish and aquatic invertebrate monitoring program, the Resource Assessment and Monitoring Program, designed to assess and monitor the health of Missouri's stream resources. This program samples a minimum of 450 random and 30 reference sites every five years.

5. Fish Tissue Monitoring Program

A. Objective: Fish tissue monitoring can address two separate objectives. These are: (1) the assessment of ecological health or the health of aquatic biota (usually accomplished by monitoring whole fish samples); and (2) the assessment of human health risk based on the level of contamination of fish plugs, fillets.

Comment [D10]: Added plugs, and removed fish eggs. The collection of fish eggs is conducted on occasion, but routinely. Mention of fish egg monitoring is retained in section C below.

B. Design Methodology: Fish tissue monitoring sites were chosen based on one of the following criteria:

- Site is believed to have water and sediment quality representative of many neighboring streams or lakes of similar size due to similarity in geology, hydrology and land use, and the absence of a known impact from a significant point source

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or discrete nonpoint water pollution source.

- Site is downstream of a significant point source or discrete nonpoint source area.
- Site has shown fish tissue contamination in the past.

C. Number of Sites, Sampling Methods, Sampling Frequency and Parameters:

The Department and EPA have a cooperative fish tissue monitoring program that collects whole fish composite samples[4] at approximately12 fixed sites. Each site is sampled once every two years. The preferred species for these sites are either carp or redhorse sucker.

The Department, EPA and the Missouri Department of Conservation also sample 40 to 50 discretionary sites annually for two fish fillet composite samples or plug samples (mercury only) from fish of similar size and species. One sample is of a top carnivore such as largemouth bass, smallmouth bass, walleye or sauger. The other sample is for a species of a lower trophic level such as catfish, carp or sucker. This program occasionally samples fish eggs for certain fish species at selected locations. Both of these monitoring programs analyze for several chlorinated hydrocarbon insecticides, PCBs, lead, cadmium, mercury, and fat content.

Comment [D11]: Added

6. Volunteer Monitoring Program

Comment [D12]: Updated information to reflect current efforts

Two major volunteer monitoring programs are now generating water quality data in Missouri. The first is the Lakes of Missouri Volunteer Program. This cooperative program consists of persons from the Department, the University of Missouri-Columbia and volunteers that monitor approximately 137 sites on 66 lakes, including Lake Taneycomo, Table Rock Lake and several lakes in the Kansas City area. Data from this program is used by the university as part of a long-term study on the limnology of midwestern reservoirs.

The second program involves volunteers who monitor water quality of streams throughout Missouri. The Volunteer Water Quality Monitoring Program is a subprogram of the Missouri Stream Team Program, a cooperative project sponsored by the Department, the Missouri Department of Conservation and the Conservation Federation of Missouri. By the end of 2012 over 5,000 citizen volunteers had attended at least one training workshop. After the introductory class, many proceed on to at least one more class of higher level training: Levels 1, 2, 3 and 4. Each level of training is a prerequisite for the next higher level, as is appropriate data submission. Data generated by Levels 2, 3, and 4 and the new Cooperative Site Investigation Program volunteers represent increasingly higher quality assurance. Of those completing an introductory course, about 35 percent proceed to Levels 1 and 2. One hundred-two volunteers have reached Level 3 and six volunteers have reached Level 4. The Cooperative Site Investigation Program uses trained volunteers to collect samples and transport them to laboratories approved by the Department. Volunteers and Department staff work together to develop a monitoring plan. Currently there are 25 volunteers qualified to work in the Cooperative Site Investigation Program. All Level 2, 3, and 4 volunteers as well as all CSI

Comment [D13]: Added last two sentences

[4] A composite sample is one in which several individual fish are combined to produce one sample.

trained volunteers are required to attend a validation session every 3 years to insure, equipment, reagents and methods meet our standards. To date 70 individuals have attended a validation at least once.

Laboratory Analytical Support

Laboratories used:

- Department/U.S. Geological Survey Cooperative Fixed Station Network: U.S. Geological Survey Lab, Denver, Colorado
- Intensive Surveys: Varies, many are done by the Department's Environmental Services Program
- Toxicity Testing of Effluents: Many commercial laboratories
- Biological Criteria for Aquatic Invertebrates: Department's Environmental Services Program and University of Missouri-Columbia
- Fish Tissue: EPA Region VII Laboratory, Kansas City, Kansas and miscellaneous contract laboratories (Missouri Department of Conservation
- Missouri State Operating Permit: Self-monitoring or commercial laboratorie
- Department's Public Drinking Water Monitoring: Department's Environmental Services Program and commercial laboratories
- Other water quality studies: Many commercial laboratories

Comment [D14]:

Removed Department's Public Drinking Water Reservoir Network – no longer conducting

B. Identification of All Existing and Readily Available Water Quality Data Sources:

The following data sources are used by the Department to aid in the compilation of the state's 305(b) Report. Where quality assurance programs are deemed acceptable, these sources would also be used to develop the state's Section 303(d) List. These sources presently include but are not limited to:

1. Fixed station water quality and sediment data collected and analyzed by the Department's Environmental Services Program personnel.
2. Fixed station water quality data collected by the U.S. Geological Survey under contractual agreements with the Department.
3. Fixed station water quality data collected by the U.S. Geological Survey under contractual agreements to agencies or organizations other than the Department.
4. Fixed station water quality, sediment quality and aquatic biological information collected by the U.S. Geological Survey under their National Stream Quality Accounting Network and the National Water Quality Assessment Monitoring Programs.
5. Fixed station raw water quality data collected by the Kansas City Water Services Department, the St. Louis City Water Company, the Missouri American Water Company (formerly St. Louis County Water Company), Springfield City Utilities and

Proposed

Springfield's Department of Public Works.

6. Fixed station water quality data collected by the U.S. Army Corps of Engineers. The Kansas City, St. Louis and Little Rock Corps Districts have monitoring programs for Corps-operated reservoirs in Missouri.

7. Fixed station water quality data collected by the Arkansas Department of Environmental Quality, the Kansas Department of Health and Environment, the Iowa Department of Natural Resources, and the Illinois Environmental Protection Agency.

8. Fixed station water quality monitoring by corporations.

9. Annual fish tissue monitoring programs by the Environmental Protection Agency/Department Regional Ambient Fish Tissue Monitoring Program and the Missouri Department of Conservation.

10. Special water quality surveys conducted by the Department. Most of these surveys are focused on the water quality impacts of specific point source wastewater discharges. Some surveys are of well-delimited nonpoint sources such as abandoned mined lands. These surveys often include physical habitat evaluation and monitoring of aquatic invertebrates as well as water chemistry monitoring.

11. Special water quality surveys conducted by U.S. Geological Survey, including but not limited to:

    a) Geology, hydrology and water quality of various hazardous waste sites,

    b) Geology, hydrology and water quality of various abandoned mining areas,

    c) Hydrology and water quality of urban nonpoint source runoff in St. Louis, Kansas City and Springfield, Missouri, and

    d) Bacterial and nutrient contamination of streams in southern Missouri.

12. Special water quality studies by other agencies such as the Missouri Department of Conservation, the U.S. Public Health Service, and the Missouri Department of Health and Senior Services.

13. Monitoring of fish occurrence and distribution by the Missouri Department of Conservation.

14. Fish Kill and Water Pollution Investigations Reports published by the Missouri Department of Conservation.

15. Selected graduate research projects pertaining to water quality and/or aquatic biology.

16. Water quality, sediment and aquatic biological data collected by the Department, the Environmental Protection Agency or their contractors at hazardous waste sites in Missouri.

17. Self-monitoring of receiving streams by cities, sewer districts and industries, or contractors on their behalf, for those discharges that require this kind of monitoring. This monitoring includes chemical and sometimes toxicity monitoring of some of the larger wastewater discharges, particularly those that discharge to smaller streams and have the greatest potential to affect instream water quality.

Comment [D15]: Previously the LMD repeated this statement in bullet number 24. That duplication was removed.

Proposed

18. Compliance monitoring of receiving waters by the Department and EPA. This can include chemical and toxicity monitoring.

19. Bacterial monitoring of streams and lakes by county health departments, community lake associations and other organizations using acceptable analytical methods.

20. Other monitoring activities done under a quality assurance project plan approved by the Department.

21. Fixed station water quality and aquatic invertebrate monitoring by volunteers who have successfully completed the Volunteer Water Quality Monitoring Program Level 2 workshop. Data collected by volunteers who have successfully completed a training Level 2 workshop is considered to be Data Code One. Data generated from Volunteer Training Levels 2, 3 and 4 are considered "screening" level data and can be useful in providing an indication of a water quality problem. For this reason, the data is eligible for use in distinguishing between waters in Categories 2A and 2B or Categories 3A and 3B. Most of this data is not used to place waters in main Categories (1, 2, 3, 4 and 5) because analytical procedures do not use EPA or Standard Methods approved methods. Data from volunteers who have not yet completed a Level 2 training workshop do not have sufficient quality assurance to be used for any assessment purposes. Data generated by volunteers while participating in the Department's Cooperative Site Investigation Program (Section II C1) or other volunteer data that otherwise meets the quality assurance outlined in Section II C2 can be used in the Section 303(d) assessment process.

    The following data sources (22-25) can **not** be used to rate a water as impaired (Categories 4A, 4B, 4C or 5); however, these data sources may be used to direct additional monitoring that would allow a water quality assessment for Section 303(d) listing purposes.

22. Fish Management Basin Plans published by the Missouri Department of Conservation.

23. Fish Consumption Advisories published annually by the Missouri Department of Health and Senior Services. Note: the department may use data from data source No. 9 (as listed above) to list individual waters as impaired due to contaminated fish tissue.

Comment [D16]: Previously the LMD repeated this statement in bullet number 25. That duplication was removed.

Comment [D17]: Added

The Department will review all data of acceptable quality that is submitted to the Department prior to the end of the first public notice of the draft 303(d) list. The Department reserves the right to review and use data of acceptable quality submitted after this date if the data results in a change to the assessment status of the water.

C. Data Quality Considerations

1. DNR Quality Assurance/Quality Control Program

    The Department and EPA Region VII have completed a Quality Management Plan. All

Proposed

environmental data generated directly by the Department, or through contracts funded by the Department, or EPA require a Quality Assurance Project Plan. The agency or organization responsible for collection and/or analysis of the environmental sampling must write and adhere to a Quality Assurance Project Plan approved through the Department's Quality Management Plan. Any environmental data generated by a monitoring plan with a Department approved Quality Assurance Project Plan is considered suitable for use in the 303(d) assessment process. This includes data generated by volunteers participating in the department's Cooperative Site Investigation Program. Under this program, the Department's Environmental Services Program will audit selected non-profit (governmental and university) laboratories. Laboratories that pass this audit will be approved for the Cooperative Site Investigation Program. Individual volunteers that collect samples and deliver them to an approved laboratory must first successfully complete Department training in proper collection and handling of samples. The kind of information that should allow the department to make a judgment on the acceptability of a quality assurance program are: (1) a description of the training, and work experience of the persons involved in the program, (2) a description of the field meters used and maintenance and calibration procedures used, (3) a description of sample collection and handling procedures and (4) a description of all analytical methods used for samples taken to a laboratory for analysis.

2. Other Quality Assurance/Quality Control Programs

Data generated in the absence of a Department-approved Quality Assurance Project Plan may be used to determine the 303(d) status of a waterbody if the Department determines that the data is scientifically defensible after making a review of the quality assurance procedures used by the data generator. This review would include: (1) names of all persons involved in the monitoring program, their duties and a description of training and work related experience, (2) all written procedures, Standard Operating Procedures, or Quality Assurance Project Plans pertaining to this monitoring effort, (3) a description of all field methods used, brand names and model numbers of any equipment and a description of calibration and maintenance procedures, and (4) a description of laboratory analytical methods. This review must also include an audit by the Department's Environmental Services Program.

3. Other Data Quality Considerations

3.1 Data Age. For assessing present conditions, more recent data is preferable; however, older data can be used to assess present conditions if the data remains representative of present conditions.

If the department uses data to make a 303(d) List decision that predates the date the list is initially developed by more than seven years, the Department will provide a written justification for the use of such data.

A second consideration is the age of the data relative to significant events that may have an effect on water quality. Data collected prior to the initiation, closure or significant

PROPOSED

change in a wastewater discharge, or prior to a large spill event or the reclamation of a mining or hazardous waste site, for example, may not be representative of present conditions. Such data would not be used to assess present conditions even if it was less than seven years old. Such "pre-event" data can be used to determine changes in water quality before and after the event or to show water quality time trends.

3.2 Data Type, Amount and Information Content. EPA recommends establishing a series of data codes, and rating data quality by the kind and amount of data present at a particular location (EPA 1997[5]). The codes are single digit numbers from one to four, indicating the relative degree of assurance the user has in the value of a particular environmental data set. Data Code One indicates the least assurance or the least number of samples or analytes and Data Code Four the greatest. Based on EPA's guidance, the Department uses the following rules to assign code numbers to data.

Comment [D18]: Added EPA web link to footnote

- Data Code[6] One: All data not meeting the requirements of Data Code Two, Three or Four.
- Data Code Two: Chemical data collected quarterly to bimonthly for at least three years or intensive studies that monitor several nearby sites repeatedly over short periods of time or at least three fish tissue samples in a water body.
- Data Code Three: Chemical data collected at least monthly for more than three years on a variety of water quality constituents including heavy metals and pesticides; or quantitative biological monitoring of at least one aquatic assemblage (fish, invertebrates or algae) at multiple sites, or multiple samples at a single site when data from that site is supported by biological monitoring at an appropriate control site.
- Data Code Four: Chemical data collected at least monthly for more than three years that provides data on a variety of water quality constituents including heavy metals and pesticides, and including chemical sampling of sediments and fish tissue; or quantitative biological monitoring of at least two aquatic assemblages (fish, invertebrates or algae) at multiple sites.

In Missouri, the primary purpose of Data Code One data is to provide a rapid and inexpensive method of screening large numbers of waters for obvious water quality problems and to determine where more intensive monitoring is needed. In the preparation of the state's 305(b) Report, data from all four data quality levels are used. Most of the data is of Data Code One quality, and without Data Code One data, the Department would not be able to assess a majority of the state's waters.

[5] *Guidelines for the Preparation of the Comprehensive State Water Quality Assessments (305b) and Electronic Updates*, 1997. (http://water.epa.gov/type/watersheds/monitoring/repguid.cfm)
[6] Data Code One is equivalent to data water quality assurance Level One in 10 CSR 20-7.050 General Methodology for Development of Impaired Waters List, subsection (2)(C), Data Code Two is equivalent to Level 2, etc.

In general, when selecting water bodies for the Missouri 303(d) List, only Data Code Two or higher data are used, unless the problem can be accurately characterized by Data Code One data.[7] The reason is that Data Code Two data provides a higher level of assurance that a Water Quality Standard is actually being exceeded and that a Total Maximum Daily Load study is necessary. All water bodies placed in Categories 2B or 3B receive high priority for additional monitoring so that data quality is upgraded to at least Data Code Two.

D. How Water Quality Data is Evaluated to Determine Whether or Not Waters are Impaired for 303(d) Listing Purposes

Physical, Chemical, Biological and Toxicity Data

Each reporting cycle, the Department and stakeholders review and revise the guidelines for determining water quality impairment. These guidelines are shown in Tables 1.1 and 1.2 which provide the general rules of data use and assessment and Tables B-1 and B-2 that provide details about the specific analytical procedure used. In addition, if time trend data indicates that presently unimpaired waters will become impaired prior to the next listing cycle, these "threatened waters" will be judged to be impaired. Where antidegradation provisions in Missouri's Water Quality Standards apply, those provisions shall be upheld. The numeric criteria included in Table 1.1 have been adopted into the state Water Quality Standards, 10 CSR 20-7.031, and are used, as described in Table 1.1, to make use attainment decisions. For narrative criteria, the numeric thresholds included in Table 1.2 have not been adopted into state Water Quality Standards. The Department will use a weight of evidence analysis for all narrative criteria. For those analytes with numeric thresholds, the threshold values given in Table 1.2 will trigger a weight of evidence analysis to determine the existence or likelihood of use impairment and the appropriateness of proposing a listing based on narrative criteria. This weight of evidence analysis will include the use of other types of environmental data when it is available. Examples of other relevant environmental data might include biological data on fish or aquatic invertebrate animals (which will be given greater weight then the other types.) Toxicity testing of water or sediments. When the weight of evidence analysis suggests, but does not provide strong, scientifically defensible evidence of impairment, the Department will place the water body in question in Categories 2B or 3B. The Department will produce a document showing all relevant data and the rationale for the use attainment decision. All such documents will be made available to the public at the time of the first public notice of the proposed 303(d) list. A final recommendation on the listing of a waterbody based on narrative criteria will only be made after full consideration of all comments on the proposal.

Comment [D19]: Added

For the interpretation of biological data, where habitat assessment data indicates habitat scores are less than 75 percent of reference or appropriate control stream scores, and in the

[7] When a listing, amendment or delisting of a 303(d) water is made with only Data Code One data, a document will be prepared that includes a display of all data and a presentation of all statistical tests or other evaluative techniques that documents the scientific defensibility of the data. This requirement applies to all Data Code One data identified in Table 1.1 of this document.

absence of other data indicating impairment by a discrete pollutant, a waterbody judged to be impaired will be placed in Category 4C.

For the interpretation of toxicity test data, standard acute or chronic bioassay procedures using freshwater aquatic fauna such as, but not limited to, *Ceriodaphnia dubia*, *Pimephales promelas* or *Hyalella azteca* will provide adequate evidence of toxicity for 303(d) listing purposes. Microtox toxicity tests may be used to list a water as affected by "toxicity" only if there is data of another kind (freshwater toxicity tests, sediment chemistry, water chemistry or biological sampling) that indicates water quality impairment.

Proposed

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Overall use protection (all beneficial uses)	No data. Evaluated based on similar land use/ geology as stream with water quality data.[9]	Not applicable	Given same rating as monitored stream with same land use and geology.
Any beneficial uses	No data available or where only effluent data is available. Results of dilution calculations or water quality modeling. (see ALRR p.38)	Not applicable	Where models or other dilution calculations indicate noncompliance with allowable pollutant levels and frequencies noted in this table, waters may be added to Category 3B and considered high priority for water quality monitoring.
Protection of Aquatic Life	Water temperature, pH, total dissolved gases, oil and grease.	1-4	Full: No more than 10% of all samples exceed criterion.[10] Non-Attainment: Requirements for full attainment not met.
Protection of Groundwaters	E. coli bacteria	1-4	Full: No more than 10% of all samples exceed criterion.[9] Non-Attainment: Requirements for full attainment not met. The criterion for E. coli is 126 counts/100ml.

Comment [D20]: Previously the LMD repeated this footnote two times. The duplication was removed.

Comment [D21]: Removed wording "The Criteria for E. Coli is 126 counts/100ml 10 CFR 20-7.031(4)(c) - did not need to be stated for this beneficial use

[8] See section on Statistical Considerations, Table B-1 and B-2.
[9] This data type is used only for wide-scale assessments of aquatic biota and aquatic habitat for 305(b) Report purposes. This data type is not used in the development of the 303(d) List.
[10] Some sampling periods are wholly or predominantly during the critical period of the year when criteria violations occur. Where the monitoring program presents good evidence of a demarcation between seasons where criteria exceedences occur and seasons when they do not, the 10% exceedence rate will be based on an annual estimate of the frequency of exceedence.

Proposed

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
			10 CSR 20-7.031 (4)(C)
Protection of Aquatic Life	Dissolved oxygen.	1-4	Full: No more than 10% of all samples exceed criterion.[9] Non-Attainment: Requirements for full attainment not met.
Protection of Aquatic Life	Toxic Chemicals	1-4	Full: No more than one acute toxic event in three years that results in a documented fish kill (does not include fish kills due to natural causes). No more than one exceedence of acute or chronic criterion in the last three years for which data is available. Non-Attainment: Requirements for full attainment not met.
Protection of Aquatic Life	Nutrients in Lakes (total phosphorus, Total nitrogen, Chlorophyll)	1-4	Full: Nutrient levels do not exceed WATER QUALITY STANDARDS following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.[11]
Fish Consumption	Chemicals (water)	1-4	Full: Water quality does not exceed WATER QUALITY STANDARDS following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.
Drinking Water Supply -Raw Water.[12]	Chemical (toxics)	1-4	Full: WATER QUALITY STANDARDS not exceeded following procedures stated in Table B-1.

Comment [D22]: added

Comment [D23]: Added

Comment [D24]: Added

Comment [D25]: Added

[11] Nutrient criteria will be used in the 2016 LMD only if these criteria appear in the Code of State Regulations, and have not been disapproved by the U.S. Environmental Protection Agency.
[12] Raw water is water from a stream, lake or ground water prior to treatment in a drinking water treatment plant.

Proposed

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
			Non-Attainment: Requirements for full attainment not met.
Drinking Water Supply- Raw Water	Chemical (sulfate, chloride, fluoride)	1-4	Full: WATER QUALITY STANDARDS not exceeded following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.
Drinking Water Supply- Finished Water	Chemical (toxics)	1-4	Full: No MCL* violations based on Safe Drinking Water Act data evaluation procedures. Non-Attainment: Requirements for full attainment not met. NOTE: Finished water data will not be used for analytes where water quality problems may be caused by the drinking water treatment process such as the formation of Trihalomethanes (THMs) or problems that may be caused by the distribution system (bacteria, lead, copper).
Whole-Body-Contact Recreation and Secondary Contact Recreation	Fecal Coliform or *E. coli* count	2-4	Where there are at least five samples per year taken during the recreational season: Full: WATER QUALITY STANDARDS not exceeded as a geometric mean, in any of the last three years for which data is available, for samples collected during seasons for which bacteria criteria apply.[13] Non-Attainment: Requirements for full attainment not met.

Comment [D26]: Added

Comment [D27]: Updated to reflect minimum numbers of samples needed to make an assessment

[13] A geometric mean of 206 cfu/100 ml for E. coli will be used as a criterion value for Category B Recreational Waters. Because Missouri's Fecal Coliform Standard ended December 31, 2008, any waters appearing on the 2008 303(d) List as a result of the Fecal Coliform Standard will be retained on the list with the pollutant listed as "bacteria" until sufficient E. coli sampling has determined the status of the water.

Proposed

TABLE 1.1. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NUMERIC CRITERIA THAT ARE INCLUDED IN STATE WATER QUALITY STANDARDS, 10 CSR 20-7.031

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[8]
Irrigation, Livestock and Wildlife Water	Chemical	1-4	Full: WATER QUALITY STANDARDS not exceeded following procedures stated in Table B-1. Non-Attainment: Requirements for full attainment not met.

**Maximum Contaminant Level*

Comment [D28]: Added

Proposed

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[7]
Overall use protection (all beneficial uses)	Narrative criteria for which quantifiable measurements can be made.	1-4	Full: Stream appearance [illegible]al of reference or appropriate control streams in this region of the state. Non-Attainment: The weight of evidence, based on the narrative criteria in 10 CSR 20-7.031(3), dem[illegible]ates the observed condition exceed [illegible]meric threshold necessary for the attainment of a beneficial use [illegible] For example: Color: Color as measured by the Platinum-Cobalt visual method (SM 2120 B) in a waterbody is statistically significantly higher than a control water. Objectionable Bottom Deposits: The bottom that is covered by sewage sludge, trash or other materials reaching the water due to anthropogenic sources exceeds the amount in reference or control streams by more than twenty percent. Note: Water[illegible] mixing zones and unclassified [illegible]ers which support aquatic life on an intermittent basis shall be subject to acute toxicity criteria for protection of aquatic life. Waters in the initial Zone of Dilution (ZID) shall not be subject to acute toxicity criteria.

Proposed

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[7]
Protection of Aquatic Life	Toxic Chemicals	1-4	Full: No more than one acute toxic event in three years (does not include fish kills due to natural causes). No more than one exceedence of acute or chronic criterion in three years for all toxics.[14] [15] Non-Attainment: Requirements for full attainment not met.

Comment [D29]: Added

Proposed

[14] The test result must be representative of water quality for the entire time period for which acute or chronic criteria apply. For ammonia the chronic exposure period is 30 days, for all other toxics 96 hours. The acute exposure period for all toxics is 24 hours, except for ammonia which has a one hour exposure period. The Department will review all appropriate data, including hydrographic data, to insure only representative data is used. Except on large rivers where storm water flows may persist at relatively unvarying levels for several days, grab samples collected during storm water flows will not be used for assessing chronic toxicity criteria.

[15] In the case of toxic chemicals occurring in benthic sediment rather than in water, the numeric thresholds used to determine the need for further evaluation will be the Probable Effect Concentrations proposed in "Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems" by McDonald, D.D. et al. Arch. Environ. Contam. Toxicol. 39,20-31 (2000). These - Probable Effect Concentrations are as follows: 33 mg/kg As; 4.98 mg/kg Cd; 111 mg/kg Cr; 149 mg/kg Cu; 48.6 mg/kg Ni; 128 mg/kg Pb; 459 mg/kg Zn; 561 µg/kg naphthalene; 1170 µg/kg phenanthrene; 1520 µg/kg pyrene; 1050 µg/kg benzo(a)anthracene, 1290 µg/kg chrysene; 1450 µg/kg benzo(a)pyrene; 22,800 µg/kg total polyaromatic hydrocarbons; 676 µg/kg total PCBs. Chlordane 17.6 ug/kg; Sum DDE 31.3 ug/kg; Lindane (gamma-BHC) 4.99 ug/kg. Where multiple sediment contaminants exist, the Probable Effect Concentrations Quotient shall not exceed 0.75. See Table B-1 and **Appendix D** for more information on the Probable Effect Concentrations Quotient.

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[7]
Protection of Aquatic Life	Biological: Aq. Invertebrates-DNR Protocol.[16]	3-4	Full: For seven or fewer samples and following DNR wadeable streams macroinvertebrate sampling and evaluation protocols, 75% of the stream condition index scores must be 16 or greater. Fauna achieving these scores are considered to be very similar to regional reference streams. For greater than seven samples or for other sampling and evaluation protocols, results must be statistically similar to representative reference or control stream[17] Non-Attainment: For seven or fewer samples and following DNR wadeable streams macroinvertebrate sampling and evaluation protocols, 75% of the stream condition index scores must be 14 or lower. Fauna achieving these scores are considered to be substantially different from regional reference streams. For more than seven samples or for other sampling and evaluation-protocols, results must be statistically dissimilar to control or representative reference streams.
	Biological: MDC Fish Community (RAM) Protocol (Ozark Plateau only)	3-4	Full: For seven or fewer samples and following MDC RAM fish community protocols, 75% of the IBI scores must be 36 or greater. Fauna achieving these scores are considered to be very similar to regional reference streams. For greater than seven samples or for other sampling and evaluation protocols, results must be

[16] DNR invert protocol will not be used for assessment in the Mississippi Alluvial Plains (bootheel area) due to lack of reference streams for comparison.
[17] See Table B-1 and B-2. For test streams that are significantly smaller than bioreference streams where both bioreference streams and small control streams are used to assess the biological integrity of the test stream, the assessment of the data should display and take into account both types of control streams.

Proposed

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[7]
	Other Biological Data	3-4	statistically similar to representative reference or control stream[18] Suspected of Impairment: data not conclusive (Category 2B). For first and second order streams IBI score < 29. Non-Attainment: First and second order streams will not be assessed for non-attainment. For third to fifth order streams; For seven or fewer samples and following MDC RAM fish community protocols, 75% of the stream condition index scores must be lower than 36. Fauna achieving these scores are considered to be substantially different from regional reference streams. For more than seven samples or for other sampling and evaluation-protocols, results must be statistically dissimilar to control or representative reference streams.[19],[20] Full: Results must be statistically similar to representative reference or control streams.[15] Non-Attainment: Results must be statistically dissimilar to control or representative reference streams.

Comment [D30]: Added

[18] See Table B-1 and B-2. For test streams that are significantly smaller than bioreference streams where both bioreference streams and small control streams are used to assess the biological integrity of the test stream, the assessment of the data should display and take into account both types of control streams.

[19] IBI scores are from "Biological Criteria for Stream Fish Communities in Missouri" 2008. Doisy, et al. for MDC. If habitat is a likely problem the waterbody won't be listed as Category 5 based on this data but still could be Category 4C, 2B, or 3B.

[20] For determining influence of poor habitat on those samples that are deemed as impaired, consultation with MDC RAM staff will be utilized. If, through this consultation, habitat is determined to be a significant possible cause for impairment, the water body will not be rated as impaired, but as suspect of impairment (categories 2B or 3B).

Proposed

TABLE 1.2. METHODS FOR ASSESSING COMPLIANCE WITH WATER QUALITY STANDARDS USED FOR 303(D) LISTING PURPOSES: NARRATIVE CRITERIA BASED ON NUMERIC THRESHOLDS NOT CONTAINED IN STATE WATER QUALITY STANDARDS (10 CSR 20-7.031)

BENEFICIAL USES	DATA TYPE	DATA QUALITY CODE	COMPLIANCE WITH WATER QUALITY STANDARDS[7]
Protection of Aquatic Life	Toxicity testing of streams or lakes using aquatic organisms	2	Full: No more than one test result statistically significant deviation from controls in acute or chronic test in a three-year period.[15] Non-Attainment: Requirements for full attainment not met.
Fish Consumption	Chemicals (tissue)	1-2	Full: Fish tissue levels in fillets, plugs, and eggs do not exceed guidelines.[21] Non-Attainment: Requirements for full attainment not met.

Comment [D31]: Added

Duration of Assessment Period

Except where the assessment period is specifically noted in Table 1.1, the time period for which data will be used in making the assessments noted in Table 1 will be determined by the data age considerations provided in Section II.C.3.3.1 and data representativeness considerations in Table 1.1 and footnote 14.

Assessment of Tier Three Waters

Waters given Tier Three protection by the antidegradation rule at 10 CSR 20-7.031(2), shall be considered impaired if water quality data indicate a reduction in the waters' historical quality. Historical quality is determined from past data that best describes the waters' quality following promulgation of the antidegradation rule and at the time the water was given Tier Three protection.

[21] Fish tissue threshold levels are; chlordane 0.1 mg/kg (Crellin, J.R. 1989, *"New Trigger Levels for Chlordane in Fish-Revised Memo"* Mo. Dept. of Health inter-office memorandum. June 16, 1989); mercury 0.3 mg/kg based on "Water Quality Criterion for Protection of Human Health: Methylmercury" EPA-823-R-01-001. Jan. 2001.

- In a 2012 DHSS Memo (not yet approved) these values have changed: Chlordane – 0.2 ; Mercury -0.27 ; PCBs – 0.540 ; lead has not changed, but they do add atrazine and PDBEs **(Fish Fillet Advisory Concentrations (FFACs) in Missouri)**
- http://www.epa.gov/waterscience/criteria/methylmercury/merctitl.pdf; PCBs 0.75 mg/kg, MDHSS Memorandum August 30, 2006 *"Development of PCB Risk-based Fish Consumption Limit Tables"*; and lead 0.3- mg/kg (World Health Organization 1972. *"Evaluation of Certain Food Additives and the Contaminants Mercury, Lead and Cadmium"*. WHO Technical Report Series No. 505, Sixteenth Report on the Joint FAO/WHO Expert Committee on Food Additives. Geneva 33 pp. Assessment of Mercury will be based on samples solely from the following higher trophic level fish species; walleye, sauger, trout, black bass, white bass, striped bass, northern pike, flathead catfish and blue catfish.

Proposed

Historical data gathered at the time the waters were given Tier Three protection will be used if available. Because historical data may be limited, the historical quality of the waters may be determined by comparing data from the assessed segment with data from a "representative" segment. A representative segment is a body or stretch of water that best reflects the conditions that probably existed at the time the antidegradation rule first applied to the waters being assessed. Examples of possible representative data include 1) data from segments upstream from assessed segments that receive discharges of the quality and quantity that mimic the historical discharges to the assessed segment; and 2) data from other bodies of water in the same ecoregion having a similar watershed and landscape and receiving discharges and runoff of the quality and quantity that mimic the historical discharges to the assessed segment. The assessment may also use data from the assessed segment gathered between the time of the initiation of Tier Three protection and the last known point in time in which upstream discharges, runoff and watershed conditions remained the same may if the data do not show any significant trends of declining water quality during that period.

The data used in the comparisons will be tested for normality and an appropriate statistical test will be applied. The null hypothesis for the test will be that assessed segment and the representative segment have the same water quality. This will be a one-tailed test (the test will consider only the possibility that the assessed segment has poorer water quality) with the alpha level of 0.1, meaning that the test must show greater than a 90 percent probability that the assessed segment has poorer water quality than the representative segment before the assessed segment can be listed as impaired.

Other Types of Information

1. Observation and evaluation of waters for noncompliance with state narrative water quality criteria. Missouri's narrative water quality criteria, as described in 10 CSR 20-7.031 Section (3), may be used to evaluate waters when a quantitative value can be applied to the pollutant (see Table 1 page 15). These narrative criteria apply to both classified and unclassified waters and prohibit the following in waters of the state:
    a. Unsightly, putrescent or harmful bottom deposits,
    b. Oil, scum and floating debris,
    c. Unsightly color, turbidity or odor,
    d. Substances or conditions causing toxicity to human, animal or aquatic life,
    e. Human health hazard due to incidental contact,
    f. Acute toxicity to livestock or wildlife, when used as a drinking water supply,
    g. Physical, chemical or hydrologic changes that impair the natural biological community, and
    h. Used tires, car bodies, appliances, demolition debris, used vehicles or equipment and any solid waste as defined by Missouri's Solid Waste Law,
    i. Acute toxicity.

Proposed

2. Habitat assessment protocols for wadeable streams have been established are conducted in conjunction with sampling of aquatic invertebrates and the analysis of aquatic invertebrates data. The Department will not use habitat assessment data alone for assessment purposes.

E. Other 303(d) Listing Considerations

1. Adding to the Existing List or Expanding the Scope of Impairment to a Previously Listed Water

   The listed portion of an impaired water may be increased based on recent monitoring data following the guidelines in this document. One or more new pollutants may be added to the listing for a water already on the list based on recent monitoring data following these same guidelines. Waters not previously listed may be added to the list following the guidelines in this document.

2. Deleting from the Existing List or Decreasing the Scope of Impairment to a Previously Listed Water

   The listed portion of an impaired water may be decreased based on recent monitoring data following the guidelines in this document. One or more pollutants may be deleted from the listing for a water already on the list based on recent monitoring data following these same guidelines. Waters may be completely removed from the list for several reasons[22], the most common being (1) water has returned to compliance with water quality standards or (2) the water has an approved Total Maximum Daily Load study.

3. Prioritization of Waters for Total Maximum Daily Load Development

   Section 303(d) of the Clean Water Act and federal regulation 40 CFR 130.7(b)(4) require states to submit a priority ranking of waters still requiring Total Maximum Daily Loads. The department will prioritize development of Total Maximum Daily Loads based on several variables including:

   - severity of the water quality problem
   - amount of time necessary to acquire sufficient data to develop the Total Maximum Daily Load
   - court orders, consent decrees or other formal agreements
   - budgetary constraints, and
   - amenability of the problem to treatment

   The department's Total Maximum Daily Load schedule will represent its prioritization.

4. Resolution of Interstate/International Disagreements

[22] see, "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act". USEPA, Office of Water, Washington DC.

Proposed

The Department will review the draft 303(d) Lists of all other states with which it shares a border (Missouri River, Mississippi River, Des Moines River and the St. Francis River) or other interstate waters. Where the listing in another state is different than in Missouri, the department will request the data upon which the listing in the other state is based. This data will be reviewed following all data evaluation guidelines previously discussed in this document. The Missouri list may be changed pending the evaluation of this additional data.

Proposed

Appendix A

Excerpt from *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act.* July 29, 2005. USEPA pp.39-41.

G. How should statistical approaches be used in attainment determinations?

The state's methodology should provide a rationale for any statistical interpretation of data for the purpose of making an assessment determination.

1. Description of statistical methods to be employed in various circumstances:

The methodology should provide a clear explanation of which analytic tools the state uses and under which circumstances. EPA recommends that the methodology explain issues such as the selection of key sample statistics (arithmetic mean concentration, median concentration, or a percentile), null and alternative hypotheses, confidence intervals, and Type I and Type II error thresholds. The choice of a statistic tool should be based on the known or expected distribution of the concentration of a pollutant in the segment (e.g., normal or log normal) in both time and space.

Past EPA guidance, 1997 305(b) and 2000 CALM, recommended making non-attainment decisions for "conventional pollutants" – Total Suspended Solids, pH, Biochemical Oxygen Demand, fecal coliform bacteria and oil and grease – when more than 10% of measurements exceed the water quality criterion; however, EPA guidance has not encouraged use of the 10% rule with other pollutants, including toxics. Use of this rule in addressing conventional pollutants, is appropriate if its application is consistent with the manner in which the applicable water quality criterion are expressed. An example of a water quality criterion for which the assessment based on the 10% rule would be appropriate is the EPA acute water quality criterion for fecal coliform bacteria, applicable to protection of water contact recreational use. This 1976-issued water quality criterion was expressed as, "...no more than ten percent of the samples exceeding 400 CFU per 100ml, during a 30-day period. This assessment methodology is clearly reflective of the water quality criterion.

On the other hand, use of the 10 percent rule for interpreting water quality data is usually not consistent with water quality criterion expressed either as: (1) instantaneous maxima not to be surpassed at any time; or (2) average concentrations over specified times. In the case of "instantaneous maxima (or minima) not to occur" criteria use of the 10 percent rule typically leads to the belief that segment conditions are equal to or better than specified by the water quality criterion, when they in fact are considerably worse. (That is, pollutant concentrations are above the criterion concentration a far greater proportion of the time than specified by the water quality criterion). Conversely, use of this decision rule in concert with water quality criterion expressed as average concentrations over specific times can lead to

concluding that segment conditions are worse than water quality criterion, when in fact, they are not. If the state applies different decision rules for different types of pollutants (e.g., toxic, conventional, and non-conventional pollutants) and types of standards (e.g., acute versus chronic criteria for aquatic life or human health) the state should provide a reasonable rationale supporting the choice of a particular statistical approach to each of its different sets of pollutants and types of standards.

2. Elucidation of policy choices embedded in selection of particular statistical approaches and use of certain assumptions:

EPA strongly encourages states to highlight policy decisions implicit in the statistical analysis that they have chosen to employ in various circumstances. For example, if hypothesis testing is used, the state should make its decision-making rules transparent by explaining why it chose either "meeting Water Quality Standards" or "not meeting Water Quality Standards" as the null hypothesis (refutable presumption) as a general rule for all waters, a category of waters, or an individual segment. Starting with the assumption that a water is "healthy" when employing hypothesis testing means that a segment will be identified as impaired, and placed in Category 4 or 5, only if substantial amounts of credible evidence exist to refute the presumption. By contrast, making the null hypothesis "Water Quality Standards not being met" shifts the burden of proof to those who believe the segment is, in fact, meeting Water Quality Standards.

Which "null hypothesis" a state selects could likely create contrasting incentives regarding support for additional ambient monitoring among different stakeholders. If the null hypothesis is "meeting standards", there was no previous data on the segment, and no additional existing and readily available data and information is collected, then the "null hypothesis" cannot be rejected, and the segment would not be placed in Category 4 or 5. In this situation, those concerned about possible adverse consequences of having a segment declared "impaired" might have little interest in collection of additional ambient data. Meanwhile, users of the segment would likely want to have the segment monitored, so they can be assured that it is indeed capable of supporting the uses of concern. On the other hand, if the null hypothesis is changed to "segment not meeting Water Quality Standards": then those that would prefer that a particular segment not be labeled "impaired" would probably want more data collected, in hopes of proving that the null hypothesis is not true.

Another key policy issue in hypothesis testing is what significance level to use in deciding whether to reject the null hypothesis. Picking a high level of significance for rejecting the null hypothesis means that great emphasis is being placed on avoiding a Type I error (rejecting the null hypothesis, when in fact, the null hypothesis is true). This means that if a 0.10 significance level is chosen, the state wants to keep the chance of making a Type I error at or below 10 percent. Hence, if the chosen null hypothesis is "segment meeting Water Quality Standards", the state is trying to keep the chance of saying a segment is impaired, when in reality it is not, under 10 percent.

An additional policy issue is the Type II errors (not rejecting the null hypothesis, when it should have been). The probability of Type II errors depends on several factors. One key factor is the number of samples available. With a fixed number of samples, as the probability of Type I error decreases, the probability of a Type II error increases. States would ideally collect enough samples so the chances of making Type I and Type II errors are simultaneously small. Unfortunately, resources needed to collect those numbers of samples are quite often not available.

The final example of a policy issue that a state should describe is the rationale for concentrating limited resources to support data collection and statistical analysis in segments where there are documented water quality problems or where the combination of nonpoint source loadings and point source discharges would indicate a strong potential for a water quality problem to exist.

EPA recommends that, when picking the decision rules and statistical methods to be utilized when interpreting data and information, states attempt to minimize the chances of making either of the following two errors:

- Concluding the segment is impaired, when in fact it is not, and
- Deciding not to declare a segment impaired, when it is in fact impaired.

States should specify in their methodology what significance level they have chosen to use, in various circumstances. The methodology would best describe in "plain English" the likelihood of deciding to list a segment that in reality is not impaired (Type I error if the null hypothesis is "segment not impaired"). Also, EPA encourages states to estimate, in their assessment databases, the probability of making a Type II error (not putting on the 303(d) List a segment that in fact fails to meet Water Quality Standards), when: (1) commonly-available numbers of grab samples are available, (2) the degree of variance in pollutant concentrations are at commonly encountered levels. For example, if an assessment is being performed with a water quality criteria (WQC) expressed as a 30-day average concentration of a certain pollutant, it would be useful to estimate the probability of a Type II error when the number of available samples over a 30-day period is equal to the average number of samples for that pollutant in segments statewide, or in a given group of segments, assuming a degree of variance in levels of the pollutant often observed over typical 30-day periods.

Comment [D32]: Added

Proposed

Appendix B
Statistical Considerations

The most recent EPA guidance on the use of statistics in the 303(d) listing methodology document is given in Appendix A. Within this guidance there are three major recommendations regarding statistics:

- Provide a description of which analytical tools the state uses under various circumstances,
- When conducting hypothesis testing, explain the various circumstances under which the burden of proof is placed on proving the water is impaired and when it is placed on proving the water is unimpaired, and
- Explain the level of statistical significance used under various circumstances.

Description of Analytical Tools

The Tables B-1 and B-2 below describe~~s~~ the analytical tools the department will use to determine impairment (Table B-1) and to determine when listed waters are no longer impaired (Table B-2).

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
Narrative Criteria	Color (Narrative)	Hypothesis Test Two Sample, one tailed "t "Test	Null Hypothesis: There is no difference in color between test stream and control stream.	Reject Null Hypothesis if calculated "t" value exceeds tabular "t" value for test alpha	0.10

[23] Where hypothesis testing is used for media other than fish tissue, for data sets with five samples or fewer, a 75 percent confidence interval around the appropriate central tendencies will be used to determine use attainment status. Use attainment will be determined as follows: (1) If the criterion value is above this interval (all values within the interval are in conformance with the criterion), rate as unimpaired. (2) If the criterion value falls within this interval, rate as unimpaired and place in Category 2B or 3B. (3) If the criterion value is below this interval (all values within the interval are not in conformance with the criterion), rate as impaire[illegible] fish tissue this procedure will be used with the following changes: (1) it will apply only to sample sizes of less than four [illegible]) a 50% confidence interval will be used in place of the 75% confidence interval.

Proposed

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
	Bottom Deposits (Narrative)	Hypothesis Test, Two Sample, one tailed "t "Test ,	Null Hypothesis: Solids of anthropogenic origin cover less than 20% of stream bottom where velocity is less than 0.5 feet/second.	Reject Null Hypothesis if 60% Lower Confidence Limit (LCL) of mean percent fine sediment deposition (pfsd) in stream is greater than the sum of the pfsd of the control and 20 % more of the stream bottom. i.e., where the pfsd is expressed as a decimal, test stream pfsd > (control stream pfsd)+ (0.20)[24]	0.40
Aquatic Life	Biological Monitoring (Narrative)	For DNR Invert protocol: Binomial probability for Sample sizes 8 or more. For RAM Fish IBI protocol: Binomial probability for Sample sizes 8 or more.	Using DNR Invert. protocol: Null Hypothesis: Frequency of full sustaining scores for test stream is the same as for biological criteria reference streams.	Reject Null Hypothesis if frequency of fully sustaining scores on test stream is significantly less than for biological criteria reference streams.	0.10

Comment [D33]: Added, and removed "one sided confidence limit"

Comment [D34]: Added, and removed "30 or more"

Comment [D35]: Same comment as above

[24] If data is non-normal a nonparametric test will be used, a comparison of medians. The same 20% difference still applies. With current software we use the Mann-Whitney test.

Proposed

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
		For DNR Invert protocol and sample sizes greater than 30: Direct comparison. For RAM Fish IBI protocol and sample sizes greater than 30: Direct comparison.	A direct comparison of frequencies between test and biological criteria reference streams will be made	Rate as impaired if biological criteria reference stream frequency of sustain-ing scores is more than five percent more than test stream	Not applicable
		For other biological data: An appropriate parametric or nonparametric test will be used.	Null Hypothesis, Community metric(s) in test stream is the same as for a reference stream or control streams.	Reject Null Hypothesis If metric scores for test stream are significantly less than reference or control streams.	0.1
			Other biological monitoring to be determined by type of data.		
Aquatic Life	Toxic Chemicals in Water. (Numeric)	Not applicable	No more than one toxic event, toxicity test failure or exceedence of acute or chronic criterion in 3 years.	Not applicable	Not applicable
	Toxic Chemicals in Sediments (Narrative)	Comparison of mean to PEL value.	Waters are judged to be Impaired if sample mean Exceeds 150% of PEL or 150% of PEQ.[25]		
Aquatic Life	temperature, pH, total diss. gases, oil and grease, diss. oxygen (Numeric)	Binomial probability	Null Hypothesis: No more than 10% of samples exceed the water quality criterion	Reject Null Hypothesis if the Type I error rate is less than 0.1	Not applicable

Comment [D36]: Added

Comment [D38]: Added, removed "0.10"

Comment [D37]: Added, removed " exceedance frequency is significantly more than 10%"

[25] Where there is convincing evidence of a healthy biological community (fish and/or a[illegible] invertebrate monitoring data) or convincing evidence of a lack of toxicity (two species bioassay tests of sediment elutriate water or sediment pore water), this evidence will be evaluated in conjunction with the sediment PEL data.

Proposed

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
Groundwater Protection	E.coli	Binomial Probability	Null Hypothesis: No more than 10% of samples exceed the water quality criterion	Reject Null Hypothesis if the Type I error rate is less than 0.1	0.10
Fish Consumption	Toxic Chemicals in water (Numeric)	Hypothesis test 1-Sided Confidence Limit	Null Hypothesis: Levels of contaminants in water do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Fish Consumption	Toxic Chemicals in Tissue (Narrative)	Four or more samples: Hypothesis test 1-Sided Confidence Limit	Null Hypothesis: Levels in fillet samples or fish eggs do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Toxic Chemicals (Numeric)	Hypothesis test 1-Sided Confidence limit	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Non-toxic Chemicals (Numeric)	Hypothesis test 1-Sided Confidence limit	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Drinking Water Supply (Finished)	Toxic Chemicals	Methods stipulated by Safe Drinking Water Act	Methods stipulated by Safe Drinking Water Act	Methods stipulated by Safe Drinking Water Act	Methods stipulated by Safe Drinking Water Act
Whole Body Contact and Secondary Contact Rec.	Bacteria (Numeric)	Geometric Mean	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the Geometric Mean is greater than the criterion value.	-Not Applicable

Comment [D39]: Removed "10% Exceedance"

Comment [D40]: Added, removed "exceedance frequency is significantly more than 10%"

Proposed

TABLE B - 1. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING IF WATERS ARE IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [23]	Significance Level
Irrigation & Livestock Water	Toxic Chemicals (Numeric)	Hypothesis test 1-Sided Confidence limit	Null Hypothesis: Levels of contaminants do not exceed criterion.	Reject Null Hypothesis if the 60% LCL is greater than the criterion value.	0.40
Protection of Aquatic Life	Nutrients in Lakes (Numeric)	Hypothesis test[26]	Null hypothesis: Criteria are not exceeded.	Reject Null hypothesis if 60% LCL value is more than criterion value.	0.40

Proposed

[26] State nutrient criteria require at least four samples per year taken near the outflow point of the lake (or reservoir) between May 1 and August 31 for at least four different, not necessarily consecutive, years.

TABLE B - 2. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING WHEN WATERS ARE NO LONGER IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [19]	Significance Level
Narrative Criteria	Color (Narrative)	Same as Table B-1	Same as Table B-1	Same as Table B-1	0.40
	Bottom Deposits (Narrative)	Same as Table B-1	Same as Table B-1	Same as Table B-1	0.40
Aquatic Life	Biological Monitoring (Narrative)	DNR Invert Protocol: For 8 to 30 samples Same as Table B-1 RAM Fish IBI Protocol: For 8 to 30 samples Same as Table B-1	Same as Table B-1	Same as Table B-1	0.40
		For DNR Invert Protocol For more than 30 Same as Table B-1 RAM Fish IBI Protocol: For 8 to 30 samples Same as Table B-1	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.
		For other biological data: Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	0.40
	Toxic Chemicals in Water.	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.
	Toxic Chemicals in Sediments	Comparison of mean to PEL value.	Water is judged to be unimpaired if sample mean does not exceed 150 % of PEL or 150% of PEQ.[25]	Not applicable	Not applicable
Aquatic Life	Temperature, pH, total diss. gases, oil and grease, diss. oxygen	30 or fewer samples: Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.
		More than 30 samples: Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.
Groundwater Protection	E.coli	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.
Fish Consumption	Toxic Chemicals in water	Same as Table B-1.	Same as Table B-1.	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40

Comment [D41]: Previously footnote 27 was a duplicate of footnote 25. Removed duplication.

Proposed

TABLE B - 2. DESCRIPTION OF ANALYTICAL TOOLS FOR DETERMINING WHEN WATERS ARE NO LONGER IMPAIRED

Beneficial Use	Analytes	Analytical Tool	Decision Rule/ Hypothesis	Criterion Used with the Decision Rule [19]	Significance Level
	Toxic Chemicals in Tissue	Same as Table B-1.	Same as Table B-1.	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Toxic Chemicals	Same as Table B-1.	Same as Table B-1.	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Drinking Water Supply (Raw)	Non-toxic Chemicals	Same as Table B-1.	Same as Table B-1.	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Drinking Water Supply (Finished)	Toxic Chemicals,	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.
Whole Body Contact and Secondary Contact Rec.	Bacteria	Same as Table B-1.	Same as Table B-1.	Same as Table B-1	Not applicable
Irrigation & Livestock Water	Toxic Chemicals	Same as Table B-1.	Same as Table B-1.	Reject null hypothesis if the 60% UCL is greater than the criterion value.	0.40
Protection of Aquatic Life	Nutrients in Lakes	Same as Table B-1.	Same as Table B-1.	Same as Table B-1.	0.40

Proposed

Rationale for the Burden-of-Proof

Hypothesis testing is a common statistical practice. The procedure involves first stating a hypothesis you want to test, such as "the most frequently seen color on clothing at a St. Louis Cardinals game is red" and then the opposite or null hypothesis "red is not the most frequently seen color on clothing at a Cardinals game." Then a statistical test is applied to the data (a sample of the predominant color of clothing worn by 200 fans at a Cardinals game on July 12) and based on an analysis of that data, one of the two hypotheses is chosen as correct.

In hypothesis testing, the burden-of-proof is always on the alternate hypothesis. In other words, there must be very convincing data to make us conclude that the null hypothesis is not true and that we must accept the alternate hypothesis. How convincing the data must be is stated as the

"significance level" of the test. A significance level of 0.10 means that there must be at least a 90 percent probability that the alternate hypothesis is true before we can accept it and reject the null hypothesis.

For analysis of a specific kind of data, either the test significance level or the statement of null and alternative hypotheses, or both, can be varied to achieve the desired degree of statistical rigor. The department has chosen to maintain a consistent set of null and alternate hypotheses for all our statistical procedures. The null hypothesis will be that the water body in question is unimpaired and the alternate hypothesis will be that it is impaired. Varying the level of statistical rigor will be accomplished by varying the test significance level. For determining impairment (Table B-1) test significance levels are set at either 0.1 or 0.4, meaning the data must show a 90% or 60% probability respectively, that the water body is impaired. However, if the department retained these same test significance levels in determining when an impaired water had been restored to an unimpaired status (Table B-2) some undesirable results can occur.

For example, using a 0.1 significance level for determining both impairment and nonimpairment, if the sample data indicate the stream had a 92 percent probability of being impaired, it would be rated as impaired. If subsequent data was collected and added to the database and the data now showed the water had an 88 percent chance of being impaired , it would be rated as unimpaired. Judging as unimpaired a water with only a 12 percent probability of being unimpaired is clearly a poor decision. To correct this problem, the department will use a test significance level of 0.4 for some analytes and 0.6 for others. This will increase our confidence in determining compliance with criteria to 40 percent and 60 percent respectively under the worst case conditions, and for most databases will provide an even higher level of confidence.

Level of Significance Used in Tests

The choice of significance levels is largely related to two concerns. The first is concerned with matching error rates with the severity of the consequences of making a decision error. The second addresses the need to balance, to the degree practicable, Type I and Type II error rates.
For relatively small databases, the disparity between Type I and Type II errors can be large. The table below shows error rates calculated using the binomial distribution for two very similar situations. Type I error rates are based on a stream with a 10 percent exceedence rate of a standard and Type II error rates for a stream with a 15 percent exceedence rate of a standard. Note that choosing a Type I error rate of 0.05 rather than 0.10 increases an already very large Type II error rate by about 10 percent. Also note that for a given Type I error rate, the Type II error rate declines as sample size increases.

Table B - 3. Effects of Type I Error Rates and Sample Size on Type II Error Rates

No. of Samples	No. Meeting Standards	Type I Error Rate	Type II Error Rate	No. of Samples	No. Meeting Standards	Type I Error Rate	Type II Error Rate
6	5	.469	.78	4	2	.05	.89
11	9	.302	.78	9	6	.05	.86
18	15	.266	.72	15	11	.05	.82
25	21	.236	.68	21	16	.05	.80
				27	20	.05	.78

Use of the Binomial Probability Distribution for Interpretation of the Ten Percent Rule

There are two options for assessing data for compliance with the ten percent rule. One is to simply calculate the percent of time the criterion value is not met and to judge the water to be impaired if this value is greater than ten percent. The second method is to use some evaluative procedure that can review the data and provide a probability statement regarding the compliance with the ten percent rule. Since the latter option allows assessment decisions relative to specific test significance levels and the first option does not, the latter option is preferred. The procedure chosen is the binomial probability distribution.

Comment [D42]: Removed from sentence "for data sets up to size 30. Use of the binomial probability is difficult for larger sample sizes. And for these larger data sets impairment will be determined by making direct comparison of percent of samples not compliant with the criterion value with the ten percent guideline."

Other Statistical Considerations

Prior to calculation of confidence limits, the normality of the data set will be evaluated. If normality is improved by a data transformation, the confidence limits will be calculated on the transformed data.

Time of sample collection may be biased and interfere with an accurate measurement of frequency of exceedence of a criterion. Data sets composed mainly or entirely of storm water data or data collected only during a season when water quality problems are expected could result in a biased estimate of the true exceedence frequency. In these cases, the department may use methods to estimate the true annual frequency and display these calculations whenever they result in a change in the impairment status of a water.

For waters judged to be impaired based on biological data where data evaluation procedures are not specifically noted in Table 1, the statistical procedure used, test assumptions and results will be reported.

Proposed

Appendix C
Examples of Statistical Procedures

Two Sample "t" Test for Color

Null Hypothesis: Amount of color is no greater in test stream than in a control stream. (As stated, this is a one-sided test, meaning that we are only interested in determining whether or not the color level in the test stream is greater than in a control stream.) If the null hypothesis had been "amount of color is different in the test and control streams" we would have been interested in determining if the amount of color was either less than or greater than the control stream, a two-sided test).

Significance Level (also known as the alpha level): 0.10

Data Set: Platinum-Cobalt color units data for the test stream and a control stream samples collected at each stream on same date.

Test Stream	70	45	35	45	60	60	80
Control Stream	50	40	20	40	30	40	75
Difference (T-C)	20	5	15	5	30	20	5

Statistics for the Difference: Mean = 14.28, standard deviation = 9.76, n = 7
Calculated "t" value = (square root of n)(mean)/standard deviation = 3.86
Tabular "t" value is taken from a table of the "t" distribution for 2 alpha (0.20) and n-1 degrees of freedom. Tabular "t" = 1.44.

Since calculated "t" value is greater than tabular t value, reject the null hypothesis and conclude that the test stream is impaired by color.

Statistical Procedure for Mercury in Fish Tissue

Comment [D43]: This example was [illegible] from the 50% CL to the 60% LCL that is [illegible]tly used. The 60% LCL is followed regardless of sample size. Therefore reference to fish tissue samples less than or greater than 4 data set for fish tissue were removed.

Data Set: data in µg/Kg 130, 230, 450. Mean = 270, Standard Deviation = 163.7
The 60% Lower Confidence Limit Interval = the sample mean minus the quantity:
((0.253)(163.7)/square root 3) = 23.9. Thus the 60% LCL Confidence Interval is 246.088 µg/Kg.

The criterion value is 300 µg/Kg. Therefore, since the 60% LCL Confidence Interval is less than the criterion value, the water is judged to be unimpaired by mercury in fish tissue, and the waterbody is placed in either Category 2B or 3B.

Proposed

Appendix D
The Meaning of the Sediment Quotient and How to Calculate It

While sediment criteria in the form of Probably Effect Concentrations[27] are given for several individual contaminants, it is recognized that when multiple contaminants occur in sediment, toxicity may occur even though the levels of each individual pollutant does not reach toxic levels. The method of estimating the synergistic effects of multiple pollutants in sediments given in McDonald et al [10] is the calculation of a Probably Effect Concentrations Quotient. This calculation is made by dividing the pollutant concentration in the sample by the Probably Effect Concentrations value for that pollutant. For single samples, the values are summed and normalized by dividing that sum by the number of pollutants. For multiple samples, the mean of the concentration value for each parameter will be used for the quotient.

Example: A sediment sample contains the following results in mg/kg.
Arsenic 2.5, Cadmium 4.5, Copper 17, Lead 100, Zinc 260.

The Probably Effect Concentrations values for these five pollutants in respective order are
33, 4.98, 149, 128, 459.

Probably Effect Concentrations Quotient =
((2.5/(33)) + (4.5/(4.98)) + (17/(149)) + (100/(128)) + (260/(459)))/5 = 0. 488

Based on research by McDonald (2000) 83% of sediment samples with Probably Effect Concentrations quotients less than 0.5 were non-toxic while 85% of sediment samples with Probably Effect Concentrations quotients greater than 0.5 were toxic. Based on these findings a Probably Effect Concentrations to insure consistency with the threshold values used for individual pollutants (150% of PEC value), a quotient greater than 0.75 will be judged to be toxic.

Comment [D44]: Added

Comment [D45]: Removed " *Since the LMD uses 150% of the PEL as the "threshold value", we have modified the calculation of the sediment quotient by using 150% of the PEL value in the calculation.*"

Comment [D46]: Added

Proposed

[27] Level at which harmful effects on the aquatic community are likely to be observed.

Metropolitan St. Louis Sewer District
2350 Market Street
St. Louis, MO 63103

RECEIVED
FEB 0 4 2014
WATER PROTECTION PROGRAM

January 31, 2014

Ms. Trish Rielly
Water Protection Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

RE: Public Comments for the proposed Methodology for the Development of the 2016 Section 303(d) List in Missouri

Ms. Reilly:

The Metropolitan St. Louis Sewer District (MSD) is offering this letter into the public record during the public notice period associated with the Missouri Department of Natural Resources' (MDNR or Department) proposed Methodology for the Development of the 2016 Section 303(d) List in Missouri (listing methodology document, or LMD). MSD very much appreciates the Department's consideration of public comments, as the listing and delisting decisions that result from applying the LMD protocols significantly influence operations, management, and capital improvements planning efforts for private, municipal, and state environmental programs across Missouri. The professionalism and technical expertise of you and your supporting scientists is well-recognized. For this reason, we hope you will consider these comments on their technical merit, regulatory basis, and in accordance with a science-based policy approach and direct your staff to work with stakeholders to make sure critical comments (such as burden of proof to list/delist) are adequately addressed.

In general, we are concerned that the 2016 LMD public notice process was very disjointed and resulted in a document that is inconsistent and confusing. Many of the inconsistencies are likely due to the fact that the original draft public notice document was revised during the public notice period after the Department held the first of two public information sessions. Although we appreciate that the Department hosted these sessions, we believe revising the LMD during the public notice period complicated the process and added to the document's inconsistencies. These inconsistencies impact our ability to make specific, informed comments on important sections of the LMD. For example, several narrative descriptions and statistical analyses presented in Tables 1.1, 1.2, B-1, and B-2 are incomplete or provide conflicting information. Because these tables form the basis for listing and delisting decisions, it is important that they accurately define the rationale and methods that will be used. More specific comments regarding these and other issues are included below.

MSD also remains concerned about several issues that were identified during the 2012 public notice period but not addressed in the final 2014 LMD. Because the issues were not addressed, they remain outstanding in the draft 2016 LMD. These issues include, but are not limited to, using a greater burden of proof to delist a waterbody than to list it for some parameters, applying environmental indicators that are listed as criteria or requirements in the water quality standards (e.g., applying E. coli requirements as groundwater criteria), clarifying how the Department will interpret "other biological data," determining appropriate sample sizes and data age, and defining methods for choosing appropriately-sized reference or control streams. We discussed some of these issues in our 2012 comment letter, which is attached for your reference. We have also included comments on these issues in this letter.

Comment 1. The methods used to list a water as impaired should be the same as those used to delist the same water.

As we noted in our 2012 comments, the LMD prescribes a greater burden of proof to delist waters than to list them for some parameters by changing the statistical significance (biological data, color) or confidence levels (some toxics) associated with the recommended tests. Appendix B includes a description of the analytical tools that will be used to determine if a waterbody is impaired (Table B-1) or if a waterbody that was previously determined to be impaired is now unimpaired (Table B-2). As the Department explains (pages 40-41) in the section "Rationale for the Burden of Proof," the major difference between Tables B-1 and B-2 is that the burden of proof for delisting is greater than for initial listing. This is accomplished by changing the significance level of statistical tests in Table B-2 for several data types. The Department justifies this approach with the following explanation (page 41, emphasis added):

> "However, if the department retained these same test significance levels in determining when an impaired water had been restored to an unimpaired status (Table B-2) **some undesirable results can occur**. For example, using a 0.1 significance level for determining both impairment and non-impairment; if the sample data indicate the stream had a 92 percent probability of being impaired, it would be rated as impaired. If subsequent data was collected and added to the database and the data now showed the water had an 88 percent chance of being impaired, it would be rated as unimpaired. Judging as unimpaired a water with only a 12 percent probability of being unimpaired **is clearly a poor decision**."

In the example given by the Department, it is not apparent what undesirable environmental effects would occur from implementing a 0.1 significance level for listing purposes that would suddenly not occur when delisting. By changing the significance level and acceptable Type 1 error after a stream is judged to be impaired, the Department is effectively making the policy decision that it should be more difficult to remove an impairment (e.g., increasing the statistical rejection region). The rationale for changing the burden of proof is not clear as waterbodies that are very close to the water quality standard (slightly above or below) are not likely to represent a fundamentally different biological or chemical condition. The issue is further complicated by the fact that for some parameters, such as lake nutrients and bacteria, the burden of proof is indeed the same for listing and delisting.

As the Department is aware, these statistical decisions have major ramifications on future planning, monitoring, and TMDL development efforts and incorrect decisions can lead to unnecessary financial and resource burdens to both the state and permittees, with little to no defined environmental benefit. To illustrate the point, consider a theoretical stream from which three of 10 macroinvertebrate samples had a Missouri Stream Condition Index (MSCI) score of less than the required 16. Assuming reference streams met the MSCI threshold 90% of the time, the stream would be listed as impaired using the binomial probability approach because the calculated type 1 error rate of 0.07 is less than the required level of significance (0.1). Because the burden of proof changes once a stream is listed (required significance of 0.4) under the current protocols, 13 additional, consecutive samples that score above a 16 would have to be collected for the stream to be delisted (p = 0.408). However, if the burden of proof were not changed, only two additional, consecutive samples (p = 0.111) that score a 16 would have to be collected to delist the stream.

Theoretical Stream Listing/Delisting Example for 10 Biological Samples*			
LMD Requirement	**Required Alpha to List/Delist**	**# of Exceedances that Would Trigger Initial Listing**	**# of Additional Samples Needed w/out an Exceedance to Delist**
Differing Burden of Proof (Existing LMD)	0.1/0.4	3/10	**13**
Similar Burden of Proof	0.1/0.1	3/10	**2**

***Assumes reference streams score 16 or higher in 90% of samples.**

It is apparent that increasing the burden of proof for delisting decisions is an onerous and unnecessary requirement which has no ecological basis. Furthermore, increasing the burden of proof almost ensures that waters will be listed for a longer period of time than what otherwise may be necessary; considering that macroinvertebrates are generally only collected once during the spring and fall, the theoretical stream above would be listed as impaired for at least another 6.5 years, assuming 13 more samples with a MSCI score above 16 were collected.

We continue to request that methods and decision criteria used to list a stream also be used to delist a stream. We recognize that some may believe that this request constrains the Department's ability to exercise best professional judgment in some situations, however additional data can always be collected for streams that are of questionable quality.

Comment 2. The Department should improve the consistency of language within and between Tables 1.1, 1.2, B-1, and B-2.

In the draft LMD, there are a number of instances where language presented in Tables 1.1, 1.2, B-1, and B-2 is inconsistent both within and between the tables. The tables also reference each other quite a bit. These inconsistencies and references make it difficult to understand MDNR's proposed method and provide substantive comments, and will cause significant confusion in future listing and delisting decisions if left unchanged.

For example, in Table B-1 two analytical tools each (binomial probability and direct comparison) are presented for both macroinvertebrates and fish with eight or more samples. It is not clear if this was done on purpose or is a typographical error, but it gives the impression that two different methods could or would be used to evaluate impairment. Then in Table B-2, the same biological monitoring analytical tool section differentiates between waters with between 8 to 30 and more than 30 samples, instead of only 8 or more as indicated in Table B-1, and then follows with "Same as Table B-1." For this section, it is not clear what should and should not be the same between the two tables. This is an example of just one of many confusing items in the tables.

MSD requests that MDNR reevaluate the information in the tables to ensure that language and tools are consistent and clear. One approach that may be helpful is to combine the tables so that information regarding data requirements, listing thresholds, and analytical tools to list and delist are presented together in a single table for each beneficial use/analyte combination. This would greatly facilitate understanding, review, and implementation of the methodology.

Comment 3. A complete fact sheet should be provided for each listing and delisting decision.

While we appreciate the time and effort MDNR invests in preparing the Excel worksheets that are made available during the public notice period, we note that critical information that may help to interpret listing decisions is often missing. This includes, but is not limited to, information related to quality assurance, detection limits, habitat scores and quality (including the number of habitats sampled), and the environmental conditions before or during sample collection.

We would therefore request that the Department provide a complete fact sheet for each waterbody proposed for assignment to Categories 2B, 3B, 4C, or 5, as well as those proposed for delisting. At a minimum, the fact sheet should include a summary of all relevant information, explain the scope and basis for the decision, provide the raw data (including the information mentioned above), the proposed listing category, and demonstrate how the data meet thresholds outlined in the LMD. We believe that these fact sheets would help improve transparency and incorporate sound science into the 303(d) process.

Comment 4. Waterbodies currently listed as impaired for water quality criteria or beneficial uses that are expected to change in the near future should be considered a low priority for TMDL development.

A number of new water quality standards regulations were adopted following the recent triennial review. These new regulations represent a significant change in how water quality standards will be administered in the state. Additionally, several existing water quality criteria may be changing in the near future. Stakeholders have requested that MDNR evaluate the implementation issues related to these changes and if necessary, modify the regulations during the next one to three triennial reviews to address any uncertainties. MSD is concerned that these new and changing regulations introduce significant uncertainty into the water quality standards and assessment process. Based on our understanding of potential water quality standards changes, we request that MDNR identify existing impairments for chloride, ammonia, losing stream bacteria, recreational bacteria, dissolved oxygen, and nutrients as low TMDL priorities. This would allow MDNR to concentrate resources on waters where impairment thresholds are more certain. We would request that MDNR include this consideration in Section II.E.3 of the LMD.

Comment 5. Data age, quality, and minimum sample sizes should be addressed when making impairment decisions.
The LMD states (page 15) that when data older than seven years are used to make a listing decision, the Department will provide a written justification for using those data. To our knowledge, very few listing decisions that incorporate older data have explored whether or not those data should be used. The LMD also states (page 16) that only Data Code Two or above are generally used for making listing decisions; however, data quality or codes is rarely discussed or apparent in the listing worksheets. We note that data age and quality are critical issues that must be considered to make a fully informed listing decision. Therefore, MSD requests that the Department provide data age and quality information in listing fact sheets discussed in Comment 3 above. If this information is not available or suggests the data are not representative, the Department should consider waters with suspected impairments as Category 2B or 3B until sufficient data are collected.

Another data concern we have is related to the minimum number of samples needed to make a listing determination. In 2012, we also raised this issue specifically with respect to fish community data. Other than the five minimum samples required for assessing compliance with recreational uses, this issue is not addressed in the LMD. As the Department is aware, environmental data, and particularly biological data, can be highly variable and may introduce significant uncertainty into conclusions regarding impairment status. We therefore request that the Department set appropriate minimum sample sizes for all data types that will be used to make listing decisions.

Comment 6. The *E. coli* value listed in Table 1.1 is not a groundwater protection criterion.
The proposed LMD identifies *E. coli* bacteria as a criterion to assess attainment of groundwater protection uses (page 19). We recognize this likely represents the Department's intent to address the *E. coli* losing stream criterion of 126 cfu/100 mL found at 10 CSR 20-7.031(4)(C). However, we note that Missouri's water quality standards do not include a groundwater protection beneficial use for bacteria. We request the Department either better define the linkage between the *E. coli* decision threshold and groundwater protection use or remove the threshold altogether. If this is retained in the LMD, bacteria TMDLs for losing streams should be a low priority until the appropriateness of this "criterion" can be further analyzed.

Comment 7. Environmental indicators used to detect beneficial use impairment on a statewide basis should be limited to criteria or requirements listed in Missouri's Water Quality Standards.
As we noted in our 2012 comments, there are several environmental indicators used to detect impairment that are not approved water quality standards. Examples of these unapproved standards include total cobalt color, biocriteria (e.g., benthic macroinvertebrates, fish, and "other biological data"), sediment quality guidelines, and others. The net result of this approach is issuance of water quality-based permit limits in TMDL watersheds that are not based on approved water quality standards. We understand that setting TMDL-specific water quality targets may be needed for unique situations and waterways. However, it appears that unapproved standards could be used throughout the state and applied to multiple waterways which will unnecessarily commit departmental and permittee resources on problematic TMDLs. Therefore, we request that the LMD should state that unapproved standards cannot be used to place waters in Category 5. In this request, we note that fiscal impacts associated with implementation of unapproved standards have not been quantified.

Comment 8. Including considerations for habitat limitations have strengthened the LMD protocols but these protocols may need to be refined.

MSD supports the Department's willingness to further consider habitat as a limiting factor when evaluating biological community data. Minimum habitat requirements for macroinvertebrates have been in the LMD for some time (bottom of page 17) and the new inclusion of Appendix E for fish community data is necessary, as habitat is a critical element that must be evaluated to better understand biological results. However, to our knowledge, habitat data are rarely evaluated or presented in the listing worksheets even though it is required in the LMD. With respect to macroinvertebrates, we would expect that Stream Habitat Assessment Project Procedure (SHAPP) scores and information related to the number and quality of individual habitats sampled would be relevant to the evaluation.

We believe that as long as habitat-related listing decisions are appropriately documented and available for review and comment, they play an important role in evaluating impairment status. Therefore, we suggest that MDNR review all waters currently in Category 4A or 5 as the result of a biological impairment to determine if those waters are habitat-limited. If they are, they should be moved to Category 4C as outlined in the existing LMD procedures.

With respect to Appendix E, we have several questions about how the habitat metrics and 0.39 threshold were chosen. For example, the QCPH1 index was selected as being the best overall indicator of habitat condition, but little justification was presented to support that assertion. Further, it appears that MDNR and MDC only evaluated the QCPH1 with respect to unimpaired stream communities, and did not test it against impaired streams. As a result, it is unclear how well the metric or 0.39 threshold can differentiate between impaired and unimpaired streams. Until these and other questions are better understood, the 2016 LMD should, in addition to the 0.39 QCPH1 threshold, allow for consideration of other habitat measures. This could be addressed by revising Appendix E to include the original workgroup recommendation:

> *When fish IBI scores indicate waterbody impairment as determined by the LMD rules, DNR assessment staff will consult with MDC on the habitat scores associated with these samples. Based on the results of this consultation, if DNR concludes that:*
>
> - *the majority of the low scores also have physical habitat scores that are suspect but do not clearly indicate either good habitat or poor habitat, the fish community will be assessed as "suspect" and in the absence of other data indicating impairment, the water body will be placed in category 2B or 3B.*
> - *the majority of the low scores have physical habitat scores that indicate poor habitat condition, the fish community will be assessed as impaired by habitat and in the absence of other data requiring 303(d) listing, the water body would be placed in category 4C.*
> - *the majority of the low scores have physical habitat scores that indicate good habitat condition, the water body will be assessed as having a fish community impaired by a stressor other than habitat and placed in category 5, the state 303(d) List unless a TMDL that addresses these stressors has been approved, in which case, the water body will be placed in category 4A.*

We also suggest revising footnote 20 to improve consistency with Appendix E as follows:

> [20]IBI scores are from "Biological Criteria for Streams and Fish Communities in Missouri" 2008. Doisy, et al. for MDC. If **habitat limitations (as measured by either the QCPH1 score or other appropriate metrics)** ~~habitat is~~ **are judged to contribute to low fish community scores,** ~~likely a problem~~, the waterbody ~~won't be listed as Category 5 based on this data. It still could be~~ **will be included in** Category 4C, 2B, or 3B.

Comment 9. The Department should specify the methods for choosing appropriate reference or control streams for biological data comparisons. Also, MDNR should generally limit biological data comparisons to streams that have the same Valley Segment Type (VST) code.

In footnote 18 the Department states, "For test streams that are significantly smaller than bioreference streams where both bioreference streams and small control streams are used to assess the biological integrity of the test stream, the assessment of the data should display and take into account both types of control streams." We fully support MDNR's stance that biological data should be considered with respect to stream size. However, the Department should be more specific with respect to what it considers a significant difference in size, as well as the methods that should be used to choose appropriate comparison streams.

In our past comments, we have suggested that the Department use an approach[1] that relies on watershed area and streamflow as a guide for choosing comparison streams. However, recent revisions to Missouri's water quality standards integrate the Missouri Resource Assessment Partnership's (MoRAP) VST mapping layer into the state waterbody classification system. Because the VST layer is already attributed according to categories of stream size, flow, gradient, temperature, and geology[2], it should be used as a guide for choosing comparison streams. This would be advantageous because it would standardize the selection process and improve consistency with the water quality standards.

When accurately defined, reference or control streams are the most accurate way to characterize attainable conditions for a stream or region. Because the VST classification layer already groups waterbodies with similar important characteristics, it would seem reasonable that the VSTs should also serve as the basis for defining attainable conditions for similar-sized streams. In other words, biological data collected from a test stream should only be measured against comparison streams from the same VST code, as these streams would be the best available representatives of biological potential in the region.

MSD requests that MDNR specify that 1) the VST layer will be used as the basis for choosing biological comparison streams, and 2) biological data comparisons will generally be limited to streams that have the same VST code.

---

[1] Hughes, R., D. Larsen, and J. Omernik. 1986. Regional Reference Sites: a Method for Assessing Stream Potentials. Environmental Management 5:629-635.

[2] Sowa, S., D. Diamond, R. Abbitt, G. Annis, T. Gordon, M. Morey, G. Sorensen, and D. True. 2004. The Aquatic Component of Gap Analysis: A Missouri Prototype. Final Report Issued to The United States Department of Defense Legacy Program. Missouri Resource Assessment Partnership, University of Missouri-Columbia. Columbia.

Comment 10. The Department should clarify how it intends to apply and interpret "other biological data" when listing or de-listing waterbody segments.
In Table 1.2 of the draft LMD, "other biological data" is listed as an acceptable data type that may be used to determine impairment status. Although we acknowledge that a variety of biological data may be useful in assessing the status of an aquatic community, we are concerned that data requirements and procedures for applying "other biological data" are not mentioned in the LMD. Specifically, we are concerned that 1) it is not clear if the same data type must be used to de-list a stream as to list it, and 2) the use of "other biological data" may inadvertently lower the burden of proof than would otherwise be required to make a listing decision (e.g., using a single metric rather than a multi-metric index such as the MSCI score). We request that the "other biological data" allowance be removed until approvable data collection, analysis, and application methods can be developed and presented in the appropriate public participation process. Should the Department choose to retain the "other biological data" allowance in the LMD, we request that the LMD be revised to include language that clarifies these uncertainties.

Comment 11. The weight of evidence approach used to translate narrative criteria should be more clearly explained.
On page 17 of the LMD, MDNR discusses that a "weight of evidence" analysis will be used when analyzing compliance with numeric thresholds used to translate narrative water quality criteria. These numeric thresholds include parameters listed in Table 1.2 and sediment toxicity listed in Table B-1. While we recognize the Department's need to exercise best professional judgment in some circumstances, we request that MDNR more clearly explain the process that will be used to conduct a weight of evidence analysis. More specifically, we believe the Department should better outline the data types, sample sizes, relative data weightings, and decision-making processes; we note that the revised redline version of the draft LMD also included a comment (see Comment RAV20 on page 17) that the reference to "other [data] types" needed clarification.

We are also concerned that there may be considerable uncertainty in listing decisions made based on a single numeric translator. For example, for sediment toxicity the LMD uses Probable Effects Concentrations (PECs) to estimate toxicity thresholds. As the Department knows, actual sediment toxicity is ultimately based on bioavailability, which varies with site-specific conditions. Without additional lines of evidence, PECs alone may not be adequate indicators of biological health. Another numeric translator of concern is the "other biological data" category. Although we acknowledge that biological data other than macroinvertebrate MSCI or fish IBI scores may be useful, this category is very vague - data requirements and procedures for applying it are not mentioned in the LMD. For the reasons discussed in Comment #10 above, we would question its ("other biological data") reliability as an impairment indicator if it were the only line of evidence used.

Therefore, we request the Department more clearly explain the weight of evidence approach and specify that where multiple lines of evidence are not available, MDNR will assign waters to Category 2B or 3B until additional data are available to make an informed impairment decision.

Comment 12. Revise the section on "Threatened Waters" to more accurately reflect EPA guidance.

Currently, the LMD is not specific when addressing how MDNR will evaluate threatened waters (pages 6 and 17). We request that the sections that discuss threatened waters be revised to more accurately reflect EPA's 2006 Assessment and Reporting Guidance document referenced on page 4 of the LMD. The guidance states (emphasis added):

> EPA recommends that states consider as threatened those segments that are currently attaining WQS, but are projected **as the result of applying a valid statistical methodology** to exceed WQS by the next listing cycle (every two years). For example, segments should be listed if the analysis of existing data and information demonstrates a declining trend in the segment's WQS, and the projected trend will result in a failure to meet that standard by the date of the next list (i.e., 2008 for purposes of the 2006 assessment cycle). **The state assessment and listing methodology should describe how the state identifies threatened segments**.

We suggest revising the section on page 6 as outlined below. Language regarding threatened waters on page 17 should also be updated, as appropriate. In accordance with the guidance, we also request that MDNR define the statistical methods and thresholds that will be used to conduct time trend analyses.

> When a **statistically-valid time trend analysis indicates** that **a** water ~~that would otherwise be~~ currently in Categories 1, 2, or 3 ~~has a time trend analysis~~ for one or more discrete water quality pollutants ~~that indicates the water is currently maintaining all beneficial uses but~~ will not continue to ~~meet these~~ maintain designated beneficial uses before the next listing cycle, it will be considered a "threatened water." A threatened water will be treated as an impaired water and placed in the appropriate Category (4A, 4B, or 5).

Comment 13. The Department should add language to Section II.B. that allows the use of site-specific calculations, as opposed to default assumptions, when evaluating compliance for some parameters.

Oftentimes, the Department relies on default data assumptions when evaluating water quality standards compliance for parameters that vary seasonally or with environmental conditions. Default assumptions for pH, hardness, and water temperature assumptions are generally the most common. MDNR should amend Section II.B., and any other relevant section, to both identify any default data assumptions that will be used to make listing decisions and indicate that site-specific data may be used in place of these default assumptions.

Comment 14. Typographical errors.

- Remove the word "All" in the heading for Section II.B. To be consistent with the text that indicates "[t]hese sources presently include, but are not limited to…", the word "all" should be removed from the heading.
- The word "inverts" should be replaced with "macroinvertebrates" throughout the document.
- Section I.B.21. refers to data sources 22-25 but there is no data source 24 or 25 listed.

Thank you for the opportunity to comment on the proposed methodology. We look forward to working with MDNR to develop an LMD document that is transparent, objective, and repeatable. Please contact John Lodderhose, Assistant Director of Engineering, at (314) 436-8714 or jlodderhose@stlmsd.com if you have any questions or would like to discuss these issues further.

Sincerely,

Susan M. Myers
General Counsel

cc: Jay Hoskins
John Lodderhose
Rich Unverferth
Kristol Whatley

Metropolitan St. Louis Sewer District
2350 Market Street
St. Louis, MO 63103

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WATER PROTECTION PROGRAM
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March 15, 2012

Mr. John Ford
Water Quality Monitoring and Assessment Section
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102

RE: Public Comments for Missouri's 2014 Listing Methodology Document

Dear Mr. Ford:

This comment letter is offered into the public record during the public notice period associated with Missouri's proposed 2014 Listing Methodology Document (LMD). With this letter, the Metropolitan St. Louis Sewer District (MSD) requests the Missouri Department of Natural Resources (Department) to remove or better support several proposed changes to the LMD.

Comment 1. The weight of available evidence and methods used to list a waterway as impaired should be equal and comparable to information needed to de-list the same waterway.

The proposed LMD includes several new methods or rationale for placing a waterbody on the 303(d) list. These newly proposed methods include use of 'other biological data', fish IBI data provided by the Missouri Department of Conservation, and sediment quality guidelines – among others. Should these newly proposed methods be adopted into the LMD, we believe the same decision criteria used to list a waterway as impaired also be applied when evaluating the waterway for delisting. This request is in many ways intuitive, and speaks directly to the scientific weight of evidence principle. Clearly, a situation to be avoided is Hinkson Creek, where a macroinvertebrate bio-criteria excursion frequency of 0% (i.e., 100% achievement) initially placed in the Total Maximum Daily Load study contradicts the allowable excursion frequency (i.e., approximately 25%) in the bio-criteria protocol. Another example would be where a crayfish or mussel study (e.g., 'other biologic data') is used to list a stream, but application of Missouri's macroinvertebrate protocol is needed to delist that same stream. As we are sure the Department is aware, each aquatic indicator assemblage (e.g., benthic macroinvertebrates, fish, plankton, etc.) features unique and differing sensitivities to pollution or stress. Consequently, an impairment detected by a crayfish or mussel study may, or may not be, reflected in macroinvertebrate scores. Thus, we request that methods and decision criteria used to list a stream also be used to delist a stream. We recognize this request apparently constrains the Department to exercise best professional judgment in some situations, but believe any methodological procedure should feature comparable listing and delisting decision criteria.

Comment 2. Any environmental indicator used to detect beneficial use impairment on a statewide basis should be published in Missouri's Water Quality Standards.

In our review of the LMD, we note that several environmental indicators used to detect impairment are not approved water quality standards. Examples of these unapproved standards include cobalt color criteria, bio-criteria (e.g., benthic macroinvertebrates, fish, and 'other biological data'), sediment quality guidelines, and others. The net result of this approach is issuance of water quality-based permit limits in TMDL watersheds that are not based on approved water quality standards. We understand that setting TMDL-specific water quality targets is needed for unique situations and waterways. However, it appears that unapproved standards could be used throughout the state and applied to multiple waterways. Therefore, we request that these unapproved standards be formally incorporated into Missouri's Water Quality Standards prior to use as listing decision thresholds. In this request, we note that fiscal impacts associated with implementation of unapproved standards have not been characterized.

Comment 3. Technical rationale for reducing the fish tissue sample size from three to one should be provided.

The proposed LMD includes a reduction in fish tissue sample size from three to one (Page 3). Understanding that all environmental parameters have variability, it is not clear why multiple samples are no longer required to describe fish tissue data. Representing fish tissue regimes with a single point-in-time sample appears to conflict with the multi-year averaging period that applies to human health criteria. A LMD approach that better aligns with the human health averaging period would include multiple samples collected over multiple years. Therefore, we request that the Department use the same fish tissue sample size requirement as specified in the 2012 LMD.

Comment 4. Fish IBI data reported by the Department appear to be highly variable. A longer averaging period or larger minimum sample size should be considered.

Some fish IBI data presented in spreadsheets provided as part of the 2012 303(d) listing process are highly variable. For example, three reported IBI scores collected over a five-year period from two locations in Dry Creek (WBID 3418) ranged from 15 (impaired) to 37 (unimpaired). At Fox Creek (WBID 1842), IBI scores were even more variable; three IBI scores ranged from 11 (impaired) to 37 (unimpaired) at one site over a one-month sampling period.

These results suggest that IBI scores for a waterbody are spatially and temporally variable, and could introduce significant uncertainty into the Department's conclusions regarding impairment status for waterbodies in the Ozarks. We request that the Department consider this variability by setting an appropriate minimum sample size and averaging period requirement for Ozark fish IBI data in the LMD before they can be used to assess impairment decisions.

Comment 5. For biological data comparisons, the Department should specify the allowable watershed area and annual stream flow differences between test streams and control or reference streams when evaluating biological data.

In Table 1.2, footnote 15 on page 21 the Department states, "For test streams that are significantly smaller than bio-reference streams where both bio-reference streams and small control streams are used to assess the biological integrity of the test stream, the assessment of the data should display and take into account both types of control streams."

We fully support the Department's stance that biological data should be considered with respect to stream size however, we would ask that the Department be more specific in what it considers to be a significant difference in size. We suggest the Department adopt the approach used by Hughes et. al (1986, citation below). In their methodology, they suggest only using comparison streams with a watershed area and mean annual discharge that are within an order of magnitude of the control stream. This specification is generally used in many state bio-criteria programs and provides a more objective, defensible method for determining data applicability.

We also request that the Department expand the stream size requirement in footnote 15 to apply to all types of biological data. As the LMD is currently written, it appears as if the Department intends only to use comparable sized-streams when evaluating macroinvertebrate data.

Hughes, R., D. Larsen, and J. Omernik. 1986. Regional Reference Sites: a Method for Assessing Stream Potentials. Environmental Management 5:629-635.

Comment 6: The Department should apply the same significance levels when evaluating the attainment status of impaired and unimpaired waters.

In Appendix B, the Department includes a description of the analytical tools that will be used to determine if a waterbody is impaired (Table B-1) or if a waterbody that was previously determined to be impaired is now unimpaired (Table B-2). As the Department explains (page 32) in the section "Rationale for the Burden of Proof," the major difference between Tables B-1 and B-2 is that the burden of proof for demonstrating attainment is higher than for demonstrating impairment. This is accomplished by changing the significance level of statistical tests in Table B-2 for several data types. The Department justifies this approach with the following explanation (page 32, emphasis added):

> "However, if the department retained these same test significance levels in determining when an impaired water had been restored to an unimpaired status (Table B-2) **some undesirable results can occur**. For example, using a 0.1 significance level for determining both impairment and non-impairment; if the sample data indicate the stream had a 92 percent probability of being impaired, it would be rated as impaired. If subsequent data was collected and added to the database and the data now showed the water had an 88 percent chance of being impaired, it would be rated as unimpaired. Judging as unimpaired a water with only a 12 percent probability of being unimpaired **is clearly a poor decision**."

It is clear that the Department believes that it is inappropriate to apply the same probability thresholds when going from impaired to unimpaired but the rationale for doing so is not clear. In the example given by the Department, it is not apparent what undesirable results or poor decision will occur if the significance level is held constant at 0.1. By increasing the significance level and acceptable Type 1 error after a stream is judged to be impaired, the Department is effectively making the policy decision that it should be more difficult to get a stream de-listed than listed (e.g., increasing the statistical rejection region and burden of proof). The rationale for changing the burden of proof is not clear as waterbodies that are very close to the water quality standard (slightly above or below) are not likely to represent a fundamentally different biologic condition. Therefore, we respectfully request that the Department maintain consistent significance levels (0.1 for most tests) between Tables B-1 and B-2.

Thank you for the opportunity to comment on the proposed 2014 Listing Methodology Document. Please contact John Lodderhose at 314-436-8714 if you have any questions or require additional information.

Sincerely,

COPY

Susan M. Myers
General Counsel

SMM/lad

cc: John Lodderhose, MSD

City of St. Joseph
1100 Frederick Avenue, St. Joseph, Missouri 64501

RECEIVED
FEB 04 2014
WATER PROTECTION PROGRAM

January 31, 2014

Ms. Trish Rielly
Water Protection Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Subject: Public Comments Regarding the Proposed Methodology for the Development of the 2016 Section 303(d) List in Missouri Document

Ms. Reilly:

The City of St. Joseph, Missouri (City) submits these comments regarding the proposed Methodology for the Development of the 2016 Section 303(d) List in Missouri placed on public notice by the Missouri Department of Natural Resources (MDNR or Department) on October 15, 2013. This listing methodology document (LMD) is extremely important as it lays out the process for making impairment decisions. If these processes inappropriately lead to false impairment decisions, ensuing regulatory actions will lead to unwarranted resources spent by MDNR, the US Environmental Protection Agency (USEPA), regulated point sources, and the public. Alternatively, appropriate water quality protections are not afforded if Missouri's methodology does not sufficiently identify truly impaired waters. Therefore, it is paramount that MDNR develop and apply sound methods to make impairment decisions.

Modifications to the proposed 2016 LMD during the public notice process makes public comment difficult and likely led to inconsistencies.

MDNR posted a revised proposed 2016 LMD to the Department's website during the public comment period. We are unaware of the posting date, although the revised LMD filename suggests that it was posted on or after November 26, 2013. MDNR documents indicate that the revisions were made to improve the LMD based upon comments received during the November 14, 2013 public availability session and incorporate recent habitat data analyses. These revisions have led to inconsistencies between Tables 1.2, B-1, and B-2, which are critical tables that define the methods to make impairment decisions. In particular, the biological data analysis methods are inconsistent with respect to sample size and statistical significance levels. These inconsistencies make meaningful public comment difficult. If Tables B-1 and B-2 are accurately displayed, we assert that delisting decisions based on biological data

should use equivalent significance levels as listing decisions. The apparently proposed higher confidence level for delisting waters using macroinvertebrate or fish data poses an extremely high bar given the typically small datasets that form the basis for these listing decisions.

Data used to make impairment decisions should be well documented and data use restrictions should be consistently applied.

MDNR appropriately characterizes the need for high quality and representative data in making impairment decisions. However, MDNR does not typically provide data quality information with individual data during public notice of impairment decisions. We assert that this information is critical for the public's ability to review impairment decisions and to document MDNR's process in screening data of insufficient quality. In addition, the LMD places a data age restriction of seven years unless MDNR demonstrates that older data are still representative of current conditions. Given the investments that are being made into point and nonpoint source reductions, data older than seven years old should typically be considered suspect with respect to representativeness of current conditions. Therefore, MDNR should provide sound justification when using data older than seven years. Data quality information should also be provided in all impairment decision worksheets. Lastly, MDNR should not use small datasets to make impairment decisions. For example, no fewer than 10 samples should be used to judge datasets against the "10% rule". Given the financial impacts to MDNR, USEPA, and the public, additional data should be collected to make more informed impairment decisions when datasets are limited in size. If data quality information is not available, representativeness is questionable, or datasets are limited in size, MDNR should place waters with suspected impairments into Category 2B or 3B until sufficient data are available to make informed decisions.

Habitat impacts should be carefully considered when making impairment decisions based upon biological data.

We strongly support MDNR's inclusion of habitat considerations when assessing biological data and making impairment decisions based upon these data. MDNR includes habitat threshold values when assessing both macroinvertebrate and fish communities; however, these habitat assessment measurements differ between these two communities. We urge that MDNR, the Missouri Department of Conservation (MDC), and other resource professionals work together to develop a single habitat assessment procedure and metrics, if possible. A single habitat protocol would greatly improve data collection efficiency and ability to assess both fish and macroinvertebrate data with a single habitat metric.

MDNR and MDC chose a habitat metric (QCPH1) and threshold value (0.39) to determine if habitat limitations lead to fish community impairments. We appreciate the efforts of these agencies to develop this threshold; however, this metric and threshold value was first assigned in the LMD with the revision released during the public notice period. Therefore, additional documentation and stakeholder input should be gathered prior to making impairment decisions based upon fish community data.

The LMD specifies that macroinvertebrate communities are considered impaired due to habitat if habitat scores are less than 75% of reference stream habitat scores. This provision is consistent with

previous listing cycle LMDs. While the scoring system is not defined, we believe that MDNR uses the Stream Habitat Assessment Project Procedure (SHAPP) to make these decisions. MDNR has made at least one recommendation to categorize a macroinvertebrate community as habitat impaired (Troublesome Creek). We support this decision; however, we are unaware of habitat assessment documentation in other 303(d) listing decisions. We also believe that additional habitat assessments are relevant in implementing the Missouri macroinvertebrate protocol for listing decisions. In particular, macroinvertebrate data should not be used for impairment decisions if a sample habitat is not present or very limited for sample collection. For example, MDNR should not make a listing decision on macroinvertebrate data if rootmat substrate is not available or disproportionately small in the study stream compared to reference or control streams. We also contend that natural losing stream conditions may also reduce macroinvertebrate communities and should be taken into account as MDNR does with fish communities. Therefore, we assert that MDNR should include habitat assessment information related to the number and quality of individual habitats sampled in all listing decision documentation. We also urge MDNR to review possible habitat limitations for all current Categories 4A and 5 waters listed as impaired due to macroinvertebrate scores.

Fish data comparisons should be made only where science supports and consistent with Missouri's new stream classification system.

We support MDNR's assertion that fish community Index of Biotic Integrity (IBI) comparisons should only occur in ecoregions and stream sizes where adequate relationships between IBI scores and impairment exist. Currently, the IBI metric only applies to third through fifth order streams in the Ozark Plateau. MDNR should redefine this limitation in terms of the new stream classification system included within 10 CSR 20-7.031, which will be effective by the time of the 2016 303(d) list. These stream orders would likely only apply to creeks and possibly small rivers in the Missouri Resource Assessment Partnership's (MoRAP) Valley Segment Type (VST) mapping layer, adopted by reference in Missouri's water quality standards. We urge MDNR to begin using this classification system within the 2016 LMD to provide greater transparency and consistency in the assessment process.

Macroinvertebrate data analyses should be made with comparable reference or control streams.

The proposed 2016 LMD includes revisions to better define the importance of using only comparable reference or control streams when analyzing macroinvertebrate communities. However, we are aware of only two delistings from the proposed 2014 303(d) list attributed to reference and study stream comparability issues. We urge MDNR to provide greater specificity to ensure only comparable reference or control streams are used. Specifically, we believe that MDNR should only compare study and reference or control streams that have identical VST size classification unless there is a compelling reason to broaden the comparison. For example, it may be appropriate to compare biological data from the downstream portion of a headwater segment to the upstream portion of a creek segment. In addition to stream size, MDNR should also limit comparisons to streams with similar VST attributes (i.e., flow, gradient, temperature, and geology). After making these refinements to the process of ensuring comparability between study and reference or control streams, MDNR should reevaluate all previous listing decisions of waters in Categories 4 and 5 to determine if these were influenced by comparability issues.

Impairment decisions based upon "other" biological data evaluations should be done very carefully.

Macroinvertebrate and fish communities should serve as the primary biological endpoints for assessment of narrative criteria given the amount of effort expended to develop an understanding of these communities. In addition, the Missouri Stream Condition Index and fish IBI should be the primary metrics used for these assessments provided the amount of State resources that were invested to develop scientifically sound metrics. Other biological endpoints should be carefully assessed if considered for impairment decisions. In fact, we suggest that in most cases MDNR should assign waters to Categories 2B or 3B if use impairment is suspected based upon other biological endpoints. MDNR should then prioritize macroinvertebrate and fish sampling and use a weight of evidence approach to make an impairment decision.

The proposed 2016 LMD inaccurately assigns the losing stream E. coli criterion to groundwater protection.

The proposed 2016 LMD lists *E. coli* bacteria as a criterion to assess attainment of groundwater protection uses (Tables 1.1, B-1, and B-2). We recognize this likely represents the Department's intent to address the *E. coli* losing stream criterion of 126 cfu/100 mL in 10 CSR 20-7.031. However, Missouri's water quality standards do not include a groundwater protection beneficial use for bacteria. Therefore, these tables should be modified to refer to losing stream protection. In addition, the City again asserts that Missouri's losing stream criterion is not justified by sound science as this value is was meant to be a long-term geometric mean for protection of swimming. We urge MDNR to reevaluate this criterion during the next triennial review of water quality standards.

Additional detail should be provided under the weight of evidence approach.

Missouri's LMDs have included for quite some time a weight of evidence approach for evaluation of numeric translators of narrative criteria. The pertinent section of the 2016 LMD follows.

> *"The Department will use a weight of evidence analysis for all narrative criteria. For those analytes with numeric thresholds, the threshold values given in Table 1.2 will trigger a weight of evidence analysis to determine the existence or likelihood of use impairment and the appropriateness of proposing a listing based on narrative criteria. This weight of evidence analysis will include the use of other types of environmental data when it is available. Examples of other relevant environmental data might include biological data on fish or aquatic invertebrate animals (which will be given greater weight than the other types) or toxicity testing of water or sediments. When the weight of evidence analysis suggests, but does not provide strong, scientifically defensible evidence of impairment, the Department will place the water body in question in Categories 2B or 3B."*

We urge MDNR to provide greater detail into the types of environmental data that may be considered when assessing the weight of evidence. We believe that Missouri should rely on additional measures of potential aquatic life impacts that account for the true toxicity of contaminants in the environment. In the case of sediment toxicity, MDNR should rely on multiple lines of evidence including biological,

chemical, and toxicity data. The proposed LMD includes Probable Effects Concentrations from McDonald (2000) as the primary measures of sediment toxicity. However, the true aquatic life impacts from these constituents is complicated by the actual bioavailability, which can vary significantly based upon site conditions. We suggest that MDNR provide additional detail with respect to the weight of evidence and not rely on a single line of evidence in complicated situations, such as potential sediment toxicity. Where multiple lines of evidence are not available, MDNR should assign waters to Categories 2B or 3B until additional data are available to make a sound impairment decision.

Greater detail should be provided with respect to sediment quality data and analysis.

MDNR relies upon Probable Effect Concentrations (PECs) and Quotients (PEQs) to predict sediment toxicity as outlined by McDonald (2000). While the proposed 2016 LMD provides the magnitude of the PECs, little detail is provided on how to analyze sediment quality data. Sediment datasets typically include multiple spatial and temporal sample results; however, the LMD does not include averaging procedures for these situations. We assert that the type of mean (i.e., arithmetic or geometric) should be based upon the statistical distribution of the dataset. As sediment data are typically log normally distributed, geometric means should typically be used for data analysis. In addition, multiple samples collected within one segment or reach should be averaged into a single data point for temporal comparisons and averaging. Lastly, sediment quality data frequently include numerous values below detection or reporting limits. We assert that these values should be considered "0" as detection or reporting limits can be above the PECs and potentially lead to false positive impairment decisions if the limit or one-half the limit is used for data censoring.

Sediment data quality assurance also needs to be appropriately assessed during the impairment decision-making process as collecting representative samples and laboratory analyses can be difficult. We contend that MDNR should provide all sediment data quality assurance information within impairment decision worksheets.

Total Maximum Daily Loads (TMDLs) for impairments of water quality criteria that MDNR expects to modify in the near to intermediate term should be assigned low priority.

MDNR should prioritize TMDLs carefully to ensure that MDNR, USEPA, and regulated entity resources are used efficiently. Impairments for water quality criteria that MDNR expects to modify in the next one to three triennial reviews of water quality standards should be assigned low priority so that resources are not spent chasing a moving target. Based upon our understanding of potential changes to numeric water quality criteria, impairments for chloride, bacteria for losing streams and whole body contact recreation, dissolved oxygen, and nutrients as low TMDL priority by MDNR.

St. Joseph greatly appreciates this opportunity to provide public comment and your thoughtful consideration of these comments. Please feel free to contact me at anytime to discuss any of these issues.

Sincerely,

Andrew Clements
Asst. Director of Public Works
City of Saint Joseph, MO
816-271-4653
aclements@ci.st-joseph.mo.us

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FEB 04 2014

WATER PROTECTION PROGRAM

January 31, 2014

Ms. Trish Rielly
Water Protection Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102

Subject: Public Comments Regarding the Proposed Methodology for the Development of the 2016 Section 303(d) List in Missouri Document

Ms. Rielly:

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Modifications to the proposed 2016 LMD during the public notice process makes public comment difficult and have likely led to inconsistencies.

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CITY OF Springfield
ENVIRONMENTAL SERVICES

The Revisions of Tables 1.2, B-1 and B-2 result in more stringent requirements to delist a stream than to list a stream as impaired.

If Tables B-1 and B-2 are accurately displayed, we assert that delisting decisions based on biological data should use equivalent significance levels as listing decisions. The apparently proposed higher confidence level, for delisting waters using macroinvertebrate or fish data, poses an extremely high bar given the typically small datasets that form the basis for these listing decisions.

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In addition, the LMD places a data age restriction of seven years unless MDNR demonstrates that older data are still representative of current conditions. Given the investments that are being made into point and nonpoint source reductions, data older than seven years old should be considered suspect with respect to representativeness of current conditions. Therefore, MDNR should not use data older than seven years, unless sound justification for using the older data is provided. Data quality information should also be provided in all impairment decision worksheets.

Listing methodology should specify that listing decisions will only be made when 10 valid samples are available for all pollutants.

Lastly, MDNR should not use small datasets to make impairment decisions. For example, no fewer than 10 samples should be used to judge datasets against the "10% rule". Given the financial impacts to MDNR, USEPA, and the public, additional data should be collected to make more informed impairment decisions when datasets are limited in size. If data quality information is not available, representativeness is questionable, or datasets are limited in size, MDNR should place waters with suspected impairments into Category 2B or 3B until sufficient data are available to make informed decisions.

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Impairment decisions based upon "other" biological data evaluations should be done very carefully.

Macroinvertebrate and fish communities should serve as the primary biological endpoints for assessment of narrative criteria given the amount of effort expended to develop an understanding of these communities. In addition, the Missouri Stream Condition Index and fish IBI should be the primary metrics used for these assessments considering the amount of State resources that were invested to develop scientifically sound metrics. Other biological endpoints should be carefully assessed if considered for impairment decisions. In fact, we suggest that in most cases MDNR should assign waters to Categories 2B or 3B if use impairment is suspected based upon other biological endpoints. MDNR should then prioritize macroinvertebrate and fish sampling and use a weight of evidence approach to make an impairment decision.

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> *strong, scientifically defensible evidence of impairment, the Department will place the water body in question in Categories 2B or 3B."*

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Greater detail should be provided with respect to sediment quality data and analysis.

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Total Maximum Daily Loads (TMDLs) for impairments of water quality criteria that MDNR expects to modify in the near to intermediate term should be assigned low priority.

MDNR should prioritize TMDLs carefully to ensure that MDNR, USEPA, and regulated entity resources are used efficiently. Impairments for water quality criteria that MDNR expects to modify in the next one to three triennial reviews of water quality standards should be assigned low priority so that resources are not spent chasing a moving target. Based upon our understanding of potential changes to numeric water quality criteria, impairments for chloride, bacteria for losing streams and whole body contact recreation, dissolved oxygen, and nutrients should all be assigned low TMDL priority by MDNR.

The City of Springfield greatly appreciates this opportunity to provide public comment and your thoughtful consideration of these comments. If you have any questions or comments, please do not hesitate to contact me at (417) 864-1910 or ekemper@springfieldmo.gov.

Sincerely,

Errin Kemper, P.E.
Assistant Director – Environmental Services
Springfield Missouri

cc:
Steve Meyer, P.E. – Director
Jan Y. Millington – Assistant City Attorney
Paul Calamita - Aqualaw

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ASSOCIATION OF MISSOURI CLEANWATER AGENCIES

January 31, 2014

By Electronic Mail (Trish.Rielly@dnr.mo.gov)

Ms. Trish Rielly
Department of Natural Resources
Water Protection Program
P.O. Box 176
Jefferson City, MO 65102

RE: AMCA Comments on 2014 Water Quality Assessment Methodology & 303(d) List

Dear Ms. Rielly:

The Association of Missouri Cleanwater Agencies ("AMCA") appreciates the opportunity to provide comments on the Department's 2014 draft 303(d) list and listing methodology. AMCA comprises public water, sewer, and storm water utilities statewide serving a significant majority of the sewered population in the state.

The assessment methodology has significant ramifications for the regulated community and the public at large because it determines which waterbodies will be listed as impaired. Such listings trigger regulatory restrictions and burdens which can range from more stringent point source discharge requirements (monitoring and limits) to public and private land use restrictions.

With these implications in mind, we offer the following comments for the Department's consideration:

QAPP Availability and Compliance Certification. We would like a copy of the MO DNR QAPP/Quality Management Plan for 303(d) data. We think DNR's QAPP should be available on the 303(d) web page. We also think that with each 303(d) list, DNR should certify that all the data used for actual 303(d) listings met the requirements in the QAPP.

All Data Used to Support an Actual 303(d) Listing Should Be Available on the Website from the Outset of the Public Comment Period. In order to make the public comment period meaningful, DNR must make the data supporting each listing available to the public. Ideally, all such data would be available on an ongoing basis as it has been validated. This is critical to allow stakeholders a meaningful opportunity to evaluate DNR's available data with an eye toward correcting errors, filling any data gaps or to collect additional data where more data will better help determine the water body's true impairment status.

We also think that DNR's website should indicate the source and quality of all data provided (i.e., the name of the state agency, private party, etc., that collected the data and certification regarding QA/QC procedures).

Finally, underlying information about biological sampling also should be made available, including survey sheets, sampling dates, and any other relevant information (or at least indicate its prompt availability upon request). Additionally, the requisite procedures for biological sampling should be clearly stated, and each survey used for 303(d) purposes should include a certification that the requirements were followed.

Qualified Data Should be Disclosed and Explained. DNR should identify any data which are qualified and the nature of the qualification. Qualified data should not be the sole basis for any listing decision.

DNR Should Explain its Treatment of Non-Quantified Data. We are unclear whether DNR uses any data which are found to be below applicable quantitation levels. We believe that data below PQLs should be assigned values of "0". We would like to know what DNR's procedure is in relation to such data.

DNR Should Prepare a Fact Sheet for Each New 303(d) Listing. For DNR to really make public review and comment meaningful, DNR should prepare an electronic listing fact sheet for each new listing. The fact sheet should include the following:

1. Summary of the waterbody
2. Identify the pollutant(s) of concern
3. Provide a link to the raw data and associated information (QA/QC, etc)
4. Explain how the data meet the listing criteria
5. Other appropriate information

Such fact sheets are entirely warranted for impaired waters listings to readily inform interested stakeholders as to the scope and basis for the listing. While we would like to see such fact sheets for all listed waters, we recognize DNR staff limitations. Accordingly, we propose that DNR start fact sheet development for waters which will be added (and, maybe, subtracted) to

the 2016 list. We believe the preparation of such fact sheets will play a significant role in enhancing the quality of the listing program and the public's ability to provide meaningful input.

Minimum of 10 Samples for Listings Based Upon the 10% Methodology - No Listings Based Upon a Single Sample. We feel very strongly that no listing should be based upon a single data point. DNR should modify its listing methodology to specify that listing decisions will only be made where at least 10 valid samples are available for all pollutants where compliance will be judged by the "no more than 10% of samples exceed the WQS" criterion. This is critical so that a listing will not be made based upon one data point above the criterion. The chances of a false positive or non-representative sampling condition are far too high to make a listing determination based upon a single data point. Waters with one high data result out of fewer than 10 data points should be put in a category for additional data collection during the next listing cycle.

No Listing Based Upon A Single Fish Community or Benthos Sample Unless the Impairment is Severe. We also feel strongly that no stream should be listed as having an impaired fish community or benthos based upon a single stream survey unless the survey results show extreme impairment. In particular, stream surveys showing marginal impairments are not a proper basis to solely support a listing.

DNR Needs to Consistently and Properly Express its One-in-Three-Year Listing Criterion for Toxics. In the section of the list for Protection of aquatic life for toxic chemicals, DNR identifies a secondary listing criterion:

> Full Attainment: No more than one acute toxic event in three years that results in a documented fish kill (does not include fish kills due to natural causes). No more than one exceedence of acute or chronic criterion in the last three years for which data is available.
>
> AMCA Comment: The one-in-three year policy is just that, an EPA policy and not a binding rule. Thus, DNR does not need to use it in the listing methodology.[1] Our strong preference is that DNR not use this policy to make listing decisions and, instead rely on the greater than 10 percent provision. Thus, DNR should delete this unnecessary listing criterion.
>
> However, if DNR insists on using this policy, and while reserving our rights to challenge its use, DNR must apply it properly. To that end, DNR proposes to add the underlined language to the first sentence above. AMCA agrees with this important addition. It captures the intent of the policy - namely to allow the aquatic community three years to recover from a catastrophic event without a

[1] EPA's 1-in-3 year criteria exceedance policy is not mandated by the Clean Water Act, nor has it been properly promulgated as a regulation. Therefore, EPA lacks the authority to impose it as a binding legal requirement on the state, and DNR is not obligated to incorporate the 1-in-3 year criterion into the water quality assessment methodology. *See National Mining Association v. Jackson*, Nos. 10-1220, 11-0295, 11-0446, 11-0447, 2012 WL 3090245, at *8 & n.10, 14, 17 __ F. Supp. 2d __ (D.D.C. July 31, 2012).

subsequent toxic instream event/condition. The first sentence - with the underlined addition - gets this right. The second sentence, however, lacks this important qualifier and must be deleted. Otherwise, two samples which slightly exceed the criteria could trigger a completely unnecessary listing - which would be inconsistent with the first sentence. Note that the toxic chemical criteria are very overprotective such that it makes no sense whatsoever to list a stream just because the criteria might have been exceeded twice in a three year period while the total number of high samples does not exceed 10% of the overall sample results.

The 10% listing criterion should control unless there is a document major toxic event (due to other than natural causes) followed by a second toxic event within three years. Then a precautionary listing might be appropriate (again, we reserve the right to challenge this unpromulgated listing criterion).

Same comment in Table 1.2 for narrative criteria for the protection of aquatic life in relation to "toxic chemicals".

We Question the E.Coli Value Stated for Groundwater. Table 1.1 -shows an e.coli criterion of 126 for groundwater . We believe that is the public health recreation number and not a groundwater value. Accordingly, please delete the 126 value from Table 1.1.

Thank you for considering our comments. Please do not hesitate to contact me should you have any questions.

Sincerely,

Paul Calamita
General Counsel

C: AMCA Members
Mr. John Madras