Methodology for the Evaluation and Development of the 2002 Section 303(d) List of Impaired Water Bodies for Kansas

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September 5, 2002

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1.0 Background

1.1 Requirements Under Section 303(d) of the Federal Clean Water Act

Section 303(d) of the Clean Water Act requires that States develop a list of water bodies needing additional work beyond existing controls to achieve or maintain water quality standards. This Section 303(d) list is meant to identify waters that require Total Maximum Daily Loads (TMDLs) because technology-based effluent limitations, more stringent State or local effluent limitations, and other pollution control requirements such as best management practices, are not stringent enough to implement applicable water quality standards. 40 CFR 130.7(b)(1).

A TMDL refers to the "total maximum daily load" of a pollutant that achieves compliance with a water quality standard, therefore a TMDL is essentially a planning tool which caps the allowable pollutant load and directs and guides practices that will bring a water body into compliance with the applicable water quality standard.

Under the current federal rules, States must submit their 2002 Clean Water Act Section 303(d) lists of impaired waters, as well as the methodologies used to prepare them, by October 1, 2002. On November 19, 2001, the U.S. Environmental Protection Agency issued a guidance document (called the "EPA Listing Guidance"), which recommends that States combine the Section 303(d) list with the required Section 305(b) report into one Integrated Water Quality Monitoring and Assessment Report (or "Integrated Report').

1.2 Water Quality Standards (State of Kansas)

Kansas surface water quality standards create the "yardstick" by which water bodies are measured against. Kansas surface water quality standards are defined by: 1) designating beneficial uses of the water as contained in K.A.R. 26-16-28d; 2) setting criteria necessary to protect the beneficial uses, contained in K.S.A. 28-16-28c; and 3) establishing an antidegradation policy, contained in K.A.R. 28-16-28c(a). Beneficial uses in Kansas include, aquatic life, recreation, domestic water supply, industrial water supply, food procurement, groundwater recharge, irrigation, and livestock watering.

1.3 Description of 303(d) List Purpose and Linkage to 305(b) Water Quality Report

The generation of this 303(d) List is an essential planning and guidance tool for the state. The Kansas 2002 303(d) list not only identifies those water bodies from the 1998 303(d) list which still require TMDLs, but also defines those new water bodies and pollutants for which TMDLs are needed. The new water bodies are sorted in priority by assessing the frequency, magnitude and duration of impairment.

The 305(b) report, although based on similar assessment procedures as the 303(d) list, provides an assessment or measure of *all* waters in the state. Any comparisons made to a 305(b) report should be made to other 305(b) reports through time rather than a list of impaired water bodies. The 305(b) report provides a picture of the water quality within a state from the perspective of a point or, more accurately, a short period in time.

In contrast, although the 2002 303(d) list relies on the 305(b) report in identifying impaired water bodies within the state, the assessment procedures used for 303(d) listing, by necessity, are more intensive. The 303(d) list is subgroup of all surface waters in the state; those water bodies not meeting one or more water quality standards. Because of the associated cost to the state in developing and implementing TMDLs, the state must have a certain amount of confidence that a candidate water body truly is impaired. Hence the need for more vigorous assessment prior to listing a water body as impaired.

1.4 Relationship of Kansas 303(d) List to 2002 Integrated Report Guidance

In as much as possible, the Kansas 2002 303(d) List will be developed and submitted to the EPA in accordance with the November 19, 2001 EPA List Guidance, utilizing a number of the categories in which to place waters of the state, relative to those water's physical, chemical and biological quality.

2.0 Assessment Unit Development

2.1 Description of Kansas Ambient Surface Quality Network

Kansas has an extensive water quality monitoring network consisting of 304 active ambient stream chemistry monitoring sites, 19 sites for fish tissue collection, 68 biological stations and 315 lakes and wetland monitoring sites (Figures 1 - 4, Appendix).

2.2 Delineation Assessment Units (Contributing Areas to Monitoring Sites)

Of the Kansas Department of Health and Environment's (KDHE) 304 ambient stream chemistry monitoring sites, 158 are fixed sites sampled bi-monthly every year, and 146 are rotational sites samples bi-monthly every four years. Assessment units (AU) were defined within the state by delineating the unique contributing area to each monitoring site. Groupings at the HUC 14 level were used as the basis for unique contributing areas to these monitoring sites. The stream segments of the 2002 Kansas Surface Water Register (KSWR) were placed into each AU and a unique watershed name was assigned to each AU based on the National Hydrography Dataset (NHD). A translation table will be provided to convert the KSWR to the NHD.

301 stream AUs were created from the 304 ambient stream chemistry monitoring sites. The discrepancy between the number of monitoring sites and AUs is because three AUs have two monitoring sites located within their boundaries.

The 27 largest lakes by surface area of the 315 monitored lakes and wetlands were also delineated in the same method, honoring the existing stream AUs previously created. The establishment of these lake AUs creates an immediate contributing area to the larger reservoirs in Kansas. The remainder of the 288 monitored lakes and wetlands are identified simply as water bodies without a contributing areas and have been identified as to which AU they are located within.

Generally, biological and fish tissue collection sites are located near a stream or lake monitoring site, so a best match for these sites was found from the existing AUs.

Based upon the combined area of all defined AUs within the state, just over 97% of the contributing areas of Kansas are monitored by the KDHE water quality monitoring program.

2.3 Map and Table Formats Used in Description of Assessment Units

For TMDL planning purposes, visual clarity and to make the public participation process consistent with the current state water planning process, the state was broken into 12 basins. Maps locating the AUs and monitoring sites were created for each of these 12 basins (Figures 5 - 16, Appendix). A table of the registered streams or, in the case of a lake AU, streams and the lake in each assessment unit was assembled (Tables 1 - 12, Appendix). The stream segment layout of each AU in these tables is intended to reproduce the hierarchical stream drainage network as it exists in these AUs. The stream segment which contains the monitoring site is noted within each AU table. Table 13 identifies within which AU(s) all 315 monitored lakes and wetlands are located.

3.0 Data Considerations for 2002 List

3.1 Application of 1998 303(d) List

Nothing from the 1998 303(d) list will be delisted based on the assessment of data during the generation of the 2002 303(d) list. The state will complete all required TMDLs from the 1998 303(d) list prior to any delist considerations given to the 1998 list. Error corrections to the 1998 list will be made as set forth in Section 3.2.

3.2 1998 303(d) List - Error Corrections

Errors in the 1998 303(d) list will be corrected by in the 2002 list. Examples of these corrections to the 1998 list are typographical list errors, water bodies that were never impaired but mistakenly listed, and listings based on pollution rather than a pollutant, such as hydrology impairments. Although not an error, listings based strictly on a point source in which pollution control requirements placed on that source are fully expected to result in the attainment of the water quality standard will be noted in a separate category distinct from the 2002 303(d) list.

3.3 2002 305(b) Water Quality Report Use

Because of the relatively small number of sample points from the individual biological, lakes/wetlands and fish tissue network monitoring sites through time, the information used to generate the assessment of these three sections of the 2002 305(b) report will be translated directly to the 2002 303(d) list. The stream chemistry monitoring network sites have a larger number of samples for each monitoring site. This will allowed a more intensive statistical assessment of impairment for these sites which may cause discrepancies from the 2002 305(b) report.

3.4 Spatial Applicability of Data

AUs have been defined based on contributing areas to monitoring points. If an impairment is determined at a monitoring point, the stream segment or lake/wetland associated with that monitoring point will be listed. In the case of a stream AU, this will always be the main stem of the system within the AU and in the case of a lake/wetland AU, it will always be the lake/wetland. The tributaries located within an impaired stream AU will be listed in an appendix of the 303(d) list in tabular form as potential contributors to the impairment. For lake/wetland AUs, if the lake/wetland has directly contributing tributaries associated with it, those tributaries will be listed in the appendix of the 303(d) list in tabular form as potential contributors to the impairment. If the lake/wetland AU is defined as just that water body, then reference to potential contributors in the appendix will not be made. In those cases of lake/wetland AUs where the source impairment (such as sediment) is considered to come from an area larger than the impaired lake/wetland AU, entire upstream stream AUs may be listed in tabular form in the appendix as potential contributors to the impairment in the lake/wetland AU.

3.5 Use of Data (Chemical, Biological, Internal, External)

As required by Section 303(d) of the Clean Water Act and 40 CFR 130.7(b)(5), KDHE will compile and consider "all existing and readily available water quality related data and information" in identifying waters to be listed. Existing and readily available data and information includes, but is not limited to:

- 1998 303(d) List;
- 2002 305(b) Report's waters that are threatened, partially meeting or not meeting a designated beneficial use;
- Clean Water Act 319 nonpoint source assessments,
- Drinking water source water assessment under Section 1453 of the Safe Drinking Water Act;
- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical or biological integrity of streams, and lakes/wetlands
- KDHE fish consumption advisories,
- Data, information, and water quality problems reported from local, State, or Federal agencies (especially the USGS water quality studies), Tribal governments, the public, and academic institutions.

As stated earlier, KDHE operates an extensive water quality monitoring network throughout Kansas and feels it is important that the decision to list a water body be based upon credible evidence. KDHE encourages the submittal of additional data and information from the general public during the list development period. Data and information can be in the form of analytical results, numeric data or information or narrative/qualitative submittals. When such information is submitted, the observation date, location(s), quality assurance methods and other pertinent information should also be provided. Other pertinent information includes the rationale supporting the observation being considered outside the normal range of conditions. If not verifiable, narrative and qualitative submittals may not be used in the 303(d) process, however;

this information may be used in the planning of future monitoring activities by KDHE.

In order to solicit available data from other entities, KDHE will request data from various agencies and the public prior to creation of the draft 2002 303(d) list.

3.5.1 Sample Size Requirements

In most cases, a minimum of 12 samples will be required to make a determination of impairment for ambient stream chemistry monitoring sites and their associated AUs. There is not a minimum number of samples needed for the biological, fish tissue, and lake/wetland site AUs.

3.5.2 Temporal Bounds of Data

In order to meet the sample size requirements in 3.5.1, data collected from 1996 though 2001 will be used from lake/wetland, biological, fish tissue surveys and fixed stream chemistry sites or their associated AUs. Data collected from 1990 through 2001 will be use for rotation chemistry sites or their associated AUs in the assessment of stream impairment.

3.6 Designated Use Applications

Where possible, the water quality for use support of all monitored waters will be evaluated for potential inclusion on the 2002 303(d) List. The designated uses of these waters will determine the level of assessment necessary to evaluate impairment. For a complete list of criteria in conjunction with designated uses see K.A.R. 28-16-28e(d) table 1a.

The assessment levels of the designated uses are generally tailored after those suggested in EPA's *Guidelines for the Preparation of the Comprehensive State Water Quality Assessments and 305(b) Reports and Updates: Supplement,* where partial support is defined as exceedance rates greater than 10 percent. The nonsupport level (> 25% exceedance) is immaterial at this level of screening because additional data analysis will be performed to assign priority within the 2002 303(d) list.

3.6.1 Aquatic Life Considerations

Kansas has two categories of aquatic life support. All parameter standards associated with the *chronic* category of aquatic life support will have an assessment level by percent exceedance of:

Not impaired $\leq$ 10%
Impaired >10%

The standards associated with the *acute* category will have a dual assessment level depending on the type of sampling site.

Fixed stream chemistry sites (30 - 36 samples):
Not impaired $\leq$ 2 violations

Impaired >2 violations

Rotational stream chemistry sites (15 - 18 samples):
Not impaired ≤ 1 violation
Impaired > 1 violation

3.6.2 Contact Recreation

Kansas has a Primary Contact Recreation standard of a geometric mean of 200 organisms per 100 mL fecal coliform bacteria taken from at least five samples collected within a 30-day period. These criteria are in effect from April 1 through October 31 each year. The concentration of fecal coliform bacteria should not exceed 2,000 organisms per 100 mL for November 1 to March 31 each year. KDHE monitoring protocols do not collect data to evaluate compliance with the minimum five-sample geometric mean criterion, therefore this designated use cannot be assessed by any monitoring site within the state.

Kansas has a Secondary Contact Recreation standard of 2,000 organisms per 100 mL. Assessment levels by percent exceedance will be:

Not impaired ≤ 10%
Impaired >10%

3.6.3 Drinking Water

Kansas has a suite of parameters used to protect Domestic Water Supply (K.A.R. 28-16-28e(d) table 1a). The nitrate standard assessment levels by percent exceedance will be:

Not impaired = 0%
Impaired > 0%

All other parameters (excluding chloride and sulfate which will be assessed at the 10% exceedance level) will be reviewed at assessment levels by percent exceedance as:

Not impaired ≤ 50%
Impaired > 50%

3.6.4 Agricultural Use: Irrigation and Livestock Watering

Kansas has a number of parameters used to protect agriculture use of water, which includes livestock watering and irrigation supply (K.A.R. 28-16-28e(d) table 1a). Assessment levels by percent exceedance will be:

Not impaired ≤ 10%
Impaired >10%

3.6.5 Food Procurement

Kansas has a variety of parameters used to protect food procurement use. Assessment levels by percent exceedance will be:

Not impaired ≤ 10%
Impaired >10%

3.6.6 Groundwater Supply

Not assessed by surface water.

4.0 Statistical Methods for Listing Assessment

In evaluating water body monitoring data associated with stream chemistry sites using EPA's 305(b) Guidelines, no more than 10% of the samples obtained from the water body are allowed to exceed a regulatory standard. This method, called the raw score method, simply sets an upper bound on the percentage of measurements at a monitoring site that may violate a standard. Unfortunately, the raw score method does not provide sufficient information to properly deal with the uncertainty concerning impairment, especially when dealing with smaller sample sizes (National Research Council, 2001).

For the Kansas 2002 303(d) list, candidate water bodies will be screened for impairment based on a nonparametric analysis of a confidence limit on a percentile of interest. Where applicable that percentile of the distribution is given by the assessment level of the review above, again based on EPAs 305(b) Guidelines of no more that 10% of the samples allowed to exceed a regulatory standard.

Conceptually, an assessment level by 10% exceedance is really the same as the upper 90^{th} percentile of the sample distribution. The question to answer in this evaluation is whether the true concentration for a particular constituent in a candidate water body meets or exceeds the assessment level of a regulatory standard. With only a certain number of samples to analyze from a monitoring site, the population's true concentration can never be known with certainty. However, it is possible to create an interval that will contain a particular percentile of the true concentration distribution with a given level of confidence. The confidence interval approach allows the incorporation of uncertainty in the true parameters of the distribution into a comparison to the regulatory standard.

In evaluating a water body's monitoring site data for impairment this confidence interval for the upper 90th percentile of the distribution can be used to determine, with a certain level of confidence, if a particular pollutant has exceeded the regulatory standard. This determination is based on whether or not the entire confidence interval exceeds the regulatory standard. More conservatively, a one-sided lower bound on the true 90th percentile of the concentration distribution can be computed as a 100(1 - α)% lower confidence limit (LCL), where for 90%

confidence, $\alpha = 0.1$. Doing so tests the null hypothesis that the true 90th percentile of the concentration distribution is less than or equal to the regulatory standard. If we reject the null hypothesis the pollutant level in the water body is deemed to be an impairment to that water body (Gibbons, 2001).

4.1 Binomial Analysis in Determination of Impairments

(Based on Gibbons, 2001 and Lin, 2000)

To construct a nonparametric confidence limit for the 90th percentile of the concentration distribution from a monitoring site, the fact that the number of samples falling below the p(100)th percentile of the distribution (in this case, $p = 0.9$, where p is between 0 and 1) out of a set of m samples will follow a binomial distribution with parameters m and success probability p, where success is defined as the event that a sample measurement is below the p(100)th percentile. The cumulative binomial distribution ($Bin\ (x;\ m,\ p)$) represents the probability of getting x or fewer successes in m trials with success probability p, and can be evaluated as

$$Bin(x;m,p) = \sum_{i=0}^{x} \binom{m}{i} p^i (1-p)^{m-i} \quad \textbf{E4.1}$$

The notation $\binom{m}{i}$ denotes the number of combinations of m things taken i at a time, where

$$\binom{m}{i} = \frac{m!}{i!(m-i)!}$$

and the *factorial* m! is given by

$$m! = m(m-1)(m-2)\cdots 1$$

Where applicable, KDHE will use a 90% LCL on the 90th percentile of a concentration distribution from a monitoring site.

As an example, to find the minimum number of successes needed to keep a water body off an impaired water body list (or, more importantly, determine the critical number of failures needed to list a water body as impaired), where the number of samples m from a monitoring site is 12 based on the 90th percentile and with as close to a LCL of 90% as possible then from E4.1 starting with $i = 12$ as the first candidate and repeating additional candidates by i - 1 until the cumulative probability is as close to 90% as possible,

$$\binom{12}{12} 0.9^{12}(0.1)^{0} = 0.282$$

$$\binom{12}{11} 0.9^{11}(0.1)^{1} = 0.377 \text{ (cumulative probability is } 0.282 + 0.377 = 0.659)$$

$$\binom{12}{10} 0.9^{10}(0.1)^{2} = 0.230 \text{ (cumulative probability} = 0.282 + 0.377 + 0.230 = \mathbf{0.889})$$

$$\binom{12}{9} 0.9^{9}(0.1)^{3} = 0.085 \text{ (cumulative probability} = 0.282 + 0.377 + 0.230 + 0.085 = 0.974)$$

Comparing cumulative probabilities with an objective of getting as close to 90% as possible we choose the 0.889 option from the above. From this the minimum number of successes out of 12 trials to keep a water body off an impaired list is 10 (or, conversely, 2 failures out of 12 trials). This is the same as saying that 3 failures out of 12 trials will get a water body listed as impaired (or finding only 9 successes out of 12 trials).

In practice, it is a nuisance calculating binomial probabilities by hand. The Microsoft Excel functions BINOMDIST does most of the work for the analyst. Table 14 in the Appendix was created using this Excel BINOMDIST function. The Table 14 shows, using the BINOMDIST function to get as close to 90% confidence as possible, for m = 12 to 50 the minimum number of exceedances needed to list a water body as impaired and the confidence level associated with that number.

4.1.1 Special Considerations in Balancing of Type I and Type II Error

In the case of determining whether or not a water body is impaired, two different kinds of errors can be made. The first is when an unimpaired water body is mistakenly determined to be impaired, called a Type I error. The second is if an impaired water body is erroneously determined to be unimpaired and is called a Type II error. Of significant concern to KDHE is Type I error which could lead to the dedication of time and resources in developing and implementing a TMDL for a water body that was determined to be impaired when it actually isn't impaired. In a policy decision, KDHE has chosen to set the acceptable Type I error rate in advance. The 90% confidence limit used by KDHE in its nonparametric method of assessing water bodies for impairment simply means that about 10% of the time a Type I error will occur.

KDHE also has concerns about Type II errors because failure to detect an impairment in a water body when one actually exists has specific implications related to the designated uses of these water bodies. In an effort to reduce the Type II errors associated with the nonparmetric method of assessing water bodies, KDHE has added additional balances to minimize it; the choice of α = 0.1 rather than 0.05, minimum sample size requirement and trend emphasis (explained in 4.1.2).

4.1.2 Emphasis of Recent Trends

Table 14 of the Appendix shows with as close to 90% confidence as possible for m = 12 to 50, the minimum number of exceedances needed to list a water body as impaired and the confidence level associated with that number. A final step in the listing methodology will be a check of recent exceedances in the samples from a monitoring site. If the number of exceedance is within one of the critical number of exceedances need to list a water body as impaired from Table 14, and any one of those exceedance occurred in the most recent year of sampling, then that water body will also be placed on the 303(d) list. Doing so emphasizes recent impairments in the sample data and creates the final step to minimize Type II errors.

5.0 Statistical Methods for Priority within Listings

Although a nonparametric method of analysis will be used to determine whether or not impairment from a pollutant exists for a candidate water body, the priority for TMDL development will be determined by a parametric method.

Consider two monitoring sites each with 12 samples and each with 3 exceedances. The exceedances at one site are slightly above the standard and the exceedance at the other site are ten times the standard. By the nonparametric method, the sample data from both sites would cause their associated AUs to be listed (Table 14), but the information about the magnitude of the exceedances is lost. Clearly, the site whose exceedances are ten times the standard should be given a higher priority for TMDL development than the site whose exceedances are only slightly above the standard.

An approach more effective at extracting the information from the available data at each monitoring site will be used to determine the priority for TMDL development of those sites listed by the nonparametric method. This parametric approach essentially quantifies the magnitude of impairment for prioritization within the listed AUs by polluntant.

5.1 Parametric Analysis in Assigning Priority of Listed AUs

The comparison by pollutant of the $LCL_{0.9,0.9}$ between listed AUs is the basis for assigning priority for TMDL development in each of the 12 basins in Kansas. The development of the $LCL_{0.9,0.9}$ is described in the remainder of Section 5.

5.1.1 Distribution Test

(Sections 5.1.1 - 5.1.3 based on Gibbons, 2001)

The first step for the parametric analysis will be a sample data distribution test for normality. The Ryan-Joiner test in MINITAB will be utilized in checking for normal distribution of the sample data. Should the sample data fail this test, it will be natural log transformed and the test rerun. It has been KDHE's experience to date that the transformed lognormal data has always

passed the Ryan-Joiner test.

Based on whether or not the sample data needed transformation the following two methods will be applied (5.1.2 and 5.1.3).

5.1.2 Normally Distributed Sample Data

A normal lower confidence limit for the 90th percentile of the sample distribution will be computed as

$$LCL_{1-\alpha,p} = \bar{x} + K_{\alpha,p}s,$$

where $\bar{x}$ is the sample mean of the *m* measurement from the monitoring site,

$$\bar{x} = \sum_{i=1}^{m} \frac{x_i}{m}$$

and *s* is the observed sample standard deviation,

$$s = \sqrt{\sum_{i=1}^{m} \frac{(x_i - \bar{x})^2}{m-1}}$$

and $K_{\alpha,p}$ is the one-sided normal tolerance limit factor for (α)100% confidence and p(100)% coverage (Hahn and Meeker, 1991). Table 15 of the Appendix provides values of $K_{0.9,0.9}$ which will be use by KDHE in this analysis. Table 15 was created using *StInt* (Meeker and Chow, 1993) and this command driven DOS program and user's manual is available at: http://www.public.iastate.edu/~wqmeeker/other_pages/wqm_software.html.

5.1.3 Lognormally Distributed Sample Data

For lognormal data the same method as describes in 5.1.1 applies with exponentiation of the resulting limits.

$$LCL_{1-\alpha,p} = \exp[\bar{y} + K_{\alpha,p}s_y]$$

where $\bar{y}$ and s_y are the mean and standard deviation of the natural log transformed data. Table 15 in the Appendix is applied in the same manner as 5.1.1.

5.2 Data Below Detection Limits

Modifications to the equations in 5.1.1 and 5.1.2 for data below detection limits are described in this section.

(Using Gibbons, 2001)

If the data from a monitoring site are normally distributed and nondetects are present, the adjusted mean of the *m* samples is computed as:

$$\bar{x} = \left(1 - \frac{m_0}{m}\right)\bar{x}'$$

where $\bar{x}'$ is the average of the m - m_0 detected values, and m_0 is the number of samples in which the pollutant was not detected. The adjusted standard deviation is:

$$s = \sqrt{\left(1 - \frac{m_0}{m}\right)(s') + \frac{m_0}{m}\left(1 - \frac{m_0 - 1}{m - 1}\right)(\bar{x}')^2}$$

where *s'* is the standard deviation of the m - m_0 detected measurements. The normal confidence limit can then be computed as previously described (5.1.2).

With nondetects in natural log transformed data, replace $\bar{x}'$ with $\bar{y}'$ and *s'* with s'_y in the respective equations in this section and follow Section 5.1.3.

6.0 Overview of 2002 Listing Methodology

Figure 17 in the Appendix charts the Kansas 2002 Listing Methodology as it applies to the previous discussions. Categories are as defined in Diagram 1 (pg 9) of EPA Listing Guidance.

6.1 Lake and Wetland Assessment Units - Categorization for Listing

1) Determine if the lake or wetland assessment unit appears on 1998 Section 303(d) list and has not had a TMDL developed for its specified impairments. If so, list in Category 5.

2) For lakes unlisted in 1998 for eutrophication, if lake has designated use of primary contact recreation and chlorophyll a average concentration greater than 12 ppb, list in Category 5.

3) For lakes unlisted in 1998 for eutrophication, if lake has designated use of secondary contact recreation and chlorophyll a average concentration greater than 20 ppb, list in Category 5.

4) If a lake has average total phosphorus concentration greater than 50 ppb over the last five years, list in Category 5.

5) If a wetland has average total phosphorus concentration greater than 100 ppb over the last five years, list in Category 5.

6) If the lake or wetland, for any other parameter, exceeded water quality standards or regional norms for more than one year in the last five, list in Category 5.

6.2 Stream Biology Assessment Units - Categorization for Listing

1) Determine if the stream biological impairment appears on 1998 Section 303(d) list and has not had a TMDL developed. If so, list in Category 5.

2) For biological monitoring stations with three or more samples over 1996-2001, if one or more of the biological metrics indicate partial or non-support, list in Category 5.

3) If fish tissue samples show excessive amounts of bio-accumulative pollutants (PCB, chlordane, mercury, etc.) for two or more years over 1996-2001, list in Category 5.

6.3 Stream Chemistry Assessment Units - Categorization

From Figure 17 in the Appendix after an initial check to make sure the AU has 12 or more samples and is not already on the 1998 303(d) List for the same pollutant, the following ordered steps will apply:

1) Screen for the domestic water supply nitrate criteria where a single exceedance provides support for listing in Catergory 5, 2nd priority.

2) Screen for acute aquatic life violations for each monitoring site. If more than 2 samples from a fixed monitoring site (1996-2001 data) exceed acute aquatic life criteria and more than 1 sample from a rotational monitoring site (1990 to 2001 data) exceed acute aquatic life criteria, then the monitoring site's AU will be listed on the 2002 303(d) List (Category 5, 2nd priority).

3) The EPA 10% exceedance raw score will provide the next screen for the sample data from monitoring sites. Those sites that fail the raw score test (>10% exceedance) will be subject to the binomial test described in Section 4.1.

4) If the binomial test indicates impairment then the AU will be placed on the 2002 303(d) List.

5) If the binomial test indicates full support, those sites will be subject to the final screen, a check for evidence of recent exceedances in the sample data. If the number of exceedances is within one of the critical number of exceedances (Table 14,

Appendix) needed to list an AU *and* any one of those exceedance occurred within the most recent year of sampling at the monitoring site, then that AU will also be listed on the 2002 303(d) List.

7.0 Establishment of Priority within List (Category 5) for TMDL Development

7.1 Lake Priority Determination Method

1) First priority goes to lake and wetland impairments appearing on 1998 Section 303(d) list and have yet to have a TMDL developed or that are located in the Smoky Hill/Saline, Solomon, or Upper Republican Basins.

2) Second priority goes to lakes with latest five year average chlorophyll a concentrations between 12-16 ppb and have existing primary contact recreation uses.

3) Third priority goes to lakes with latest five year average chlorophyll a concentrations exceeding 40 ppb or total phosphorus concentrations exceeding 100 ppb.

4) Fourth priority goes to lakes with latest five year average chlorophyll a concentrations between 16-40 ppb, or total phosphorus concentrations between 50-100 ppb or wetlands.

5) Should any lakes with eutrophication impairments also have a problem with deficient dissolved oxygen, their priority will be moved up one rank.

6) Should any lakes with eutrophication impairments also have a problem with elevated pH or siltation, their priority will remain based on the level of chlorophyll a present over the last five years.

7) For other pollutants, if exceedance appears in three or more years of the last five, place in second priority; if exceedance appears in two years of the last five, place in third priority.

7.2 Stream Biology Priority Method

Use the following biological metrics to assess fully supporting streams from those that are partially supporting or non-supporting:

Aquatic Life Support	MBI	KBI-NO	EPT Abundance
Fully Supporting	$\leq$4.5	$\leq$2.60	$\geq$48%
Partially Supporting	4.51-5.39	2.61-2.99	47% - 31%
Non-supporting	$\geq$5.4	$\geq$3.0	$\leq$30%

Apply the following criteria on 1996 - 2001 data to determine the priority:

1) First priority goes to stream biological impairments appearing on the 1998 Section 303(d) list and have yet to have a TMDL developed.
2) Second priority goes to streams with two or more of the above metrics showing non-support.

3) Third priority goes to streams with two or more of the above metrics showing partial support or impairments appearing through fish tissue analysis. Third priority would go to a stream with one metric showing full support, one indicating partial support, and one showing non-support.

4) Fourth priority goes to streams with two of the above metrics showing full support.

5) If percent mussel loss data is available and shows partial or non-support, then the stream priority would be moved up one rank.

Aquatic Life Support	% Mussel Loss
Fully Supporting	≤10%
Partially Supporting	11-25%
Non-supporting	≥26%

6) Category 3 goes to streams that have less than three samples from 1996 to 2001.

7) Category 2 goes to streams that are designated as being fully supporting on the 2002 305(b) report yet have one or more of the above metrics showing partial support.

7.3 Stream Chemistry Priority Method

Those AUs found to be impaired by a pollutant and placed on the 2002 303(d) List not already assigned to a priority within category 5 will be prioritized for TMDL development. The prioritization method is described in Section 5. The resulting $LCL_{0.9,0.9}$ from the methods in Section 5 will be ordered from highest to lowest by pollutant. The top 3rd of the $LCL_{0.9,0.9}$ by pollutant will be assigned a 2nd priority within category 5. The middle third will be the 3rd priority and the bottom third the 4th priority in category 5. Those AUs that are located in the Smoky Hill/Saline, Solomon, or Upper Republican Basins will be assigned 1st priority within category 5.

7.4 Additional Considerations in Priority

Acute aquatic life impairments within category 5 will be place in the 2nd priority level. Domestic water supply nitrate impairments within category 5 will also be placed in the 2nd priority level.

The top priority of category 5 impairments will be reserved for all 1998 303(d) listed waters which still require the development of a TMDL.

7.4.1 Weight of Evidence Approach in Priority within Listing

A biological monitoring site impairment in conjunction with a reasonably related stream chemistry site impairment (or *visa versa*) located within the same AU will elevate that AU's priority within category 5 to which ever is higher of the two listings. For example, if an AU is listed as impaired by data from an ambient stream chemistry monitoring site for a pollutant and its current priority level is 3rd priority in category 5, and a biological monitoring site indicates a reasonably related impairment to the aquatic community and it is currently assigned a 4th priority in category 5, then the priority of the biological site's impairment will be upgraded from 4th priority to 3rd priority to match the higher priority of the stream chemistry site impairment.

7.4.2 Subdivisions of Priority by Basin Grouping

The priority groupings from Sections 7.1 - 7.4.1 will be placed into the 12 basins in Kansas based on AU location. This defines the next 5 year schedule of TMDL development. The next 5 years of TMDL development will follow the original 5 year schedule by basin and is provided in Table 16 of the Appendix.

8.0 Public Participation

The public are invited to comment on this methodology and the draft list generated through this methodology. This methodology will be posted on the KDHE TMDL Web site at http://www.kdhe.state.ks.us/tmdl/303d.htm by June 7, 2002. The draft list is scheduled to be released on July 22, 2002 for public review and comment.

8.1 Public Hearing Dates and Locations

KDHE intends to hold three public hearings to receive comments on the proposed 2002 Section 303(d) List. The tentative dates and locations are as follows:

August 13, 2002, 2:00 p.m.	Kansas Department of Health and Environment, 1000 SW Jackson, Suite #530, Topeka, Kansas
August 14, 2002, 7:00 p.m.	Sunflower Room, Wichita 4-H Building, 7001 W. 21 St. N., Wichita, Kansas
August 15, 2002, 7:00 p.m.	Engel Education Center, Sternberg Museum, 3000 Sternberg Dr., Hays, Kansas

All public hearings are slated to begin at 9:00 a.m. on each date. Specific locations will be clarified with public notice of the release of the draft list on July 22, 2002 as stated in the Kansas Register.

8.2 Public Comments and Agency Response

Public comments will be taken at the three public hearings and during the open comment period spanning August 13 to September 3, 2002. Upon closure of the public record on September 3, KDHE will respond to received comments and post comments and responses on its TMDL Web site.

9.0 Submittal to EPA Region 7

The finalized Section 303(d) List for 2002, public comments received by KDHE regarding the 303(d) List, and KDHE response to public comments will be submitted to EPA Region 7 on October 1, 2002.

10.0 References

National Research Council. 2001. Assessing the TMDL Approach to Water Quality Management. Committee to Assess the Scientific Basis of the Total Maximum Daily Load Approach to Water Pollution Reduction. Water Science and Technology Board. Division on Earth and Life Studies. Washington D.C. Page 41.

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