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A Nonparametric Procedure for Listing and Delisting Impaired Waters Based on Criterion Exceedances

Pi-Erh Lin, Duane Meeter, and Xu-Feng Niu

Department of Statistics
Florida State University
Tallahassee, FL 32306-4330

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1. Purpose

This technical report provides the Florida Department of Environmental Protection (Department) with a description of the theoretical foundation for its proposed statistical methodology for determining impairment based on water quality criterion exceedances. A similar description for the identification of waters that are no longer impaired is also provided. Based on statistical analysis, it is recommended that a minimum of ten samples be required for listing an impaired water body and that a minimum of 28 samples be required for delisting. Using these recommended minimum samples, the listing and delisting decisions are correct with approximately 95% level of confidence.

2. Background Information

Section 305(b) of the Clean Water Act (CWA) requires states to conduct water quality surveys to determine whether or not their water bodies are healthy and of sufficient quality to meet their designated uses. The United States Environmental Protection Agency (USEPA) collects and utilizes this information to prepare a biennial report, known as the National Water Quality Inventory (or more commonly referred to as the "305(b) Report"), for the Congress of the United States.

Section 303(d) of the CWA requires states to prepare lists of "surface waters that do not meet applicable water quality standards", referred to as **impaired waters**, and to establish Total Maximum Daily Loads (TMDLs) for pollutants causing the impairment of these waters on a prioritized schedule. A TMDL establishes the maximum daily amount of a pollutant that a water body can assimilate from all sources without causing exceedances of water quality standards. As such, the development of TMDLs is an important step toward restoring surface waters to their designated uses.

The 1999 Florida Watershed Restoration Act clarified the Department's authority for the TMDL program and directed the Department to develop a methodology, and adopt it by rule, that clearly defines those waters that should be included in the state's 303(d) list of impaired waters. Given the importance of the TMDL program, the Department formed a Technical Advisory Committee (TAC) for the purpose of developing a clear, consensus-based method to define impaired lakes, streams, and estuaries. Members of the TAC were selected based on their technical expertise in key scientific fields. While the resultant 303(d) list will directly determine which waters are to be targeted for TMDL development, the list could be used to help prioritize a variety of other watershed restoration efforts in Florida.

One important measure of water body health is the concentration of conventional pollutants, metals, and dissolved oxygen. Conventional pollutants include chlorides, total fecal coliform, and fluoride. Metals include arsenic, aluminum, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, thallium, and zinc. Florida's surface water quality criteria are used to assess whether a pollutant or a metal level is too high (or too low for the case of dissolved oxygen) to preclude the water body from meeting its designated uses. More specifically, a state regulatory agency may wish to set a water quality criterion for each pollutant and each metal, and refer to a single observation or measurement as an ***exceedance*** if it exceeds the criterion.

Based on guidance provided by the USEPA, which recommends a "greater than 10% exceedance percentage" for determining that waters only partially meet their designated use for aquatic life use support, the TAC developed a methodology for the listing and delisting of impaired water bodies depending on whether or not the true exceedance percentage is larger than 10%. However, the true exceedance percentage of a pollutant or metal in a water body reach is usually unknown, and must be estimated from random samples. The key question raised by the TAC was *"How do we draw a highly reliable statistical conclusion on the true exceedance percentage based on sample exceedance percentage?"*

The current study will address this and related issues based on statistical methods. In the study, the words "chance", "percentage", "probability", and "proportion" will be used interchangeably. They are used to describe the likelihood of an event and are related in the following way:

$$\text{Chance} = \text{Percentage} = (\text{Probability})\times 100\% = (\text{Proportion})\times 100\%, \qquad (2.1)$$

where Probability = Proportion is expressed as a real number between 0 and 1. For example, the probability (or proportion) of raining today is 0.7 but the chance (or percentage) is 70%.

The Florida 305(b) Report is prepared using the STORET water quality database, and biological data from the state's biology and rapid bioassessment sampling programs. It should be noted that the available data sets for key water quality parameters are quite small for many Florida water bodies over a five-year period. For example, over the five-year period from 1994 to 1998, 590 out of 849 (69%) water reaches had organic nitrogen sample sizes ranging from 1 to 20, and 568 out of 983 (58%) water bodies had dissolved oxygen sample sizes ranging from 1 to 20. Detailed information on available sample sizes is listed in Table 1 for six pollutants: organic nitrogen, dissolved oxygen (DO), Ammonia (NH_4), total nitrogen, total phosphorus, and nitrate (NO_3). Given these small sample sizes, any proposed listing and delisting procedures, based on the calculated sample excceedance percentages, must be applicable to both large and small samples.

For a given pollutant or metal in a water body, the sample proportion of exceedances is a point estimator of the ***true exceedance probability p*** for the pollutant or metal. Since the estimator varies in a random manner from sample to sample, inferences about the true exceedance probability based on the estimator will be subjected to uncertainty. The degree of uncertainty depends on the exceedances and the sample size: the smaller the sample size is, the greater the

uncertainty will be. Therefore, the sample proportion of exceedances should not be used for the determination of water body health without considering its sample size. The reliability of the estimated exceedance probability relating to sample size should be addressed.

In this study, a nonparametric procedure is proposed for listing and delisting impaired water bodies based on criterion exceedances and sample sizes. The uncertainty of estimated exceedance probabilities is examined, and tests of hypotheses about the true exceedance probabilities of pollutants and metals are performed. The proposed nonparametric procedure provides a scientific approach for identifying impaired surface waters based on the measured percentage of exceedances of water quality criteria. Specifically, in Section 3, a nonparametric procedure for listing impaired waters is proposed using both a confidence interval approach and a test of hypothesis approach. A nonparametric procedure for delisting is proposed and discussed in Section 4. The delisting procedure is not a mirror image of the listing procedure because a much larger sample size is required for delisting than for listing impaired waters at a comparable level of confidence. Concluding remarks and discussion are provided in Section 5. The proposed nonparametric listing and delisting procedures are equally applicable to both conventional and toxic pollutants.

3. Listing Procedure

The TAC recommended that a water body reach be listed as impaired whenever the true exceedance probability of a pollutant or metal is greater than 0.1. This recommendation will be referred to as "the 10%-exceedance method." With respect to a criterion threshold, a single observation of a pollutant takes one of two values: "**yes**, the measurement exceeds the threshold" or "**no**, it does not". Of course, the actual distribution of a pollutant measurement in a water body is usually unknown. However, using the number of measured exceedances, the unknown distribution of a pollutant measurement can be transformed to a ***binomial distribution*** that depends only on the sample size and the true exceedance probability p. For example, a single observation for copper can take one of two values: "**yes**, the measurement exceeds the copper threshold of 2.9 $\mu g/l$" or "**no**, it does not". An important question arises for the regulatory agency. That is, how many exceedances out of n samples indicate the water exceeds the true exceedance percentage (e.g., 10%) that has been established to constitute impairment of the designated use? Note that deciding whether or not a single observation is a criterion exceedance is a different thought process than determining the minimum number of exceedances for determining impairment. In developing a listing procedure, the following two approaches were considered.

a. Confidence Interval Approach

In general, a ***binomial distribution*** is defined for experiments that result in a dichotomous response, i.e., responses for which there exist two possible alternatives, such as yes-no or pass-fail. A binomial random variable, X, which represents the total number of **yes** responses, has the following characteristics: (1) the experiment consists of n identical trials, (2) the trials are independent, and (3) the probability of **yes** remains the same from trial to trial. In this study, a

"trial" refers to a single sample taken from a water body reach and the probability of **yes** response for a single trial is denoted by p, which is also the true exceedance probability of a pollutant. Thus, the probability of **no** is 1-p. For a binomial random variable X with n trials, the mean (or expected value) and variance of this variable are np and $np(1-p)$, respectively. The square root of the variance, $\sqrt{np(1-p)}$, is called the standard deviation of the binomial random variable. Both variance and standard deviation measure the variability of a given random variable. For a particular water body reach, the probability p of an observed pollutant exceeding its criterion threshold depends on the unknown distribution of the pollutant and must be estimated. It is well-known that the sample proportion of **yes**, denoted by $\hat{p}$ = (total number of **yes** responses)/(sample size) = X/n, is the best point estimator for the true exceedance probability with expected value p and standard deviation $\sqrt{p(1-p)/n}$. The estimator is "best" in the sense that it is unbiased and has the minimum variance among all unbiased estimators. However, the estimator $\hat{p}$ itself is a random variable varying from sample to sample. Using it for the estimation of p often results in a "hit and miss" scenario and is not reliable. Modern statistics strongly recommends the use of a confidence interval estimation approach that takes into account the variability of the estimator.

The most commonly used interval estimator is a two-sided confidence interval. But, in environmental or ecological applications, it is often more cost-effective to obtain a one-sided confidence interval to assess the true exceedance probability p for the compliance of regulations. Both the two-sided and one-sided confidence intervals are described below. However, in this study, attention will be focused on the one-sided intervals for listing and delisting impaired water bodies.

Two-Sided Confidence Interval: Let [L, U] denote a two-sided (1-α)100% (e.g., 95%) confidence interval for p where L and U are the lower and upper limits, $0 \le L \le U \le 1$, and α is a significance coefficient satisfying the following probability inequality,

$$P(L \le p \le U | n, X) \ge 1 - \alpha, \tag{3.1}$$

with the interval length, U – L, being the shortest when the number of exceedances is observed. Note that both L and U depend on the sample size and the number of exceedances, X, and hence are random variables. The probability inequality in (3.1) is used since X is an integer random variable and the prescribed probability of (1 – α) may not be reached exactly by any integer observation.

One-Sided Confidence Interval: There are two types of one-sided confidence intervals that can be constructed; a **lower** one-sided (1–α)100% (e.g., 95%) confidence interval for p is given by [0, U] and an **upper** one-sided (1–α)100% confidence interval for p is given by [L, 1] where L and U can be computed as follows. Let x denote the observed number of exceedances in a water body. Then,

$$L = \text{largest } p \text{ such that } P(X \ge x \mid n, p) \le \alpha,$$

or

$$L = \text{largest } p \text{ satisfying } P(X \le x-1 \mid n, p) \ge 1 - \alpha, \tag{3.2}$$

and

$$\text{U} = \text{smallest } p \text{ such that } P(X \le x \mid n, p) \le \alpha. \tag{3.3}$$

Two-sided confidence intervals for an exceedance probability p can be obtained following the procedure of Blyth and Still (1983), where a table of two-sided 95% and 99% confidence intervals is provided for $1 \le n \le 30$. Using the table, when the sample size is $n = 10$ and the number of exceedances is $x = 3$, i.e., $\hat{p} = 0.3$, the two-sided 95% confidence interval for p is found to be [0.09, 0.62] and the two-sided 99% confidence interval is [0.05, 0.70]. These intervals can be obtained by an application of (3.2) and (3.3) with α replaced by $\alpha/2$. Under the same example, when $n = 10$, and $x = 3$, an upper one-sided 95% confidence interval [L, 1] for p can be obtained by the use of (3.2) as follows: From (3.2), the lower limit L is calculated as the largest p satisfying the probability inequality,

$$P(X \ge 3 \mid n, p) \le 0.05 \quad \text{or} \quad P(X \le 2 \mid n, p) \ge 0.95. \tag{3.4}$$

Using a computer program, e.g., MINITAB, for binomial distribution, with $n = 10$ and $x = 3$, the value of L is found to be 0.08725. Thus, the upper one-sided 95% confidence interval for p is [0.08725, 1.0], i.e., $p \ge 0.08725$. (If a binomial probability table is used, an interpolation method may be required. With binomial probabilities listed for $p = 0.05$ and 0.1, an approximate value of L is found to be 0.0828.)

It is important to understand the meaning of a confidence interval since it is often misunderstood and incorrectly interpreted in practice. In particular, it is important not to use the word "confidence" as a synonym for the word "chance" or the word "probability". Referring to the above example, it is <u>not correct</u> to say that there is a 95% chance that the true exceedance probability p will fall in between 0.0827 and 1.0." A correct interpretation is that we are 95% confident that the true exceedance probability p falls in the interval [0.0827, 1.0]. The "95% confidence" refers to the fact that, in repeated sampling, approximately 95% of all similarly constructed intervals will enclose the true exceedance probability, p. The remaining 5% will not." Suppose that, for the sake of explanation, there is available a total of 1000 random samples each of size $n = 10$. Using the same probability inequality (3.4), 1000 intervals can be constructed. Of these, about 950 (= 1000 × 0.95) intervals will enclose the true exceedance probability p (call these "good intervals"), but the remaining intervals will not. If we randomly select one sample of size $n = 10$ resulting in the interval [0.0827, 1.0], the odds are 19 to 1 (simplified from the odds of 0.95 to 0.05) in our favor that we have selected one of the roughly 950 "good intervals." In other words, the probability is 0.95 that the constructed interval [0.0827, 1.0] is from the pool of about 950 "good intervals". While we do not have 100% certainty that the interval [0.0827, 1.0] includes the true exceedance probability p, we are 95% **confident** that the interval [0.0827, 1.0] **does include** p. In this case, we conclude that, with 95% confidence, $0.0827 \le p \le 1.0$, definitely!

Note that, for an upper one-sided confidence interval, and for a fixed n and given x, the value of p and the $(1-\alpha)100\%$ level of confidence are related by the following inequality,

$$P(X \le x-1 \mid n, p) \ge 1 - \alpha. \tag{3.5}$$

Using (3.5) with $p = 0.10000001$ (to mean $p > 0.1$), $n = 10$, and $x = 3$, it follows that $1-\alpha = 0.9298$. That is, an upper one-sided 92.98% confidence interval for p is [0.10000001, 1.0], or $p > 0.1$. The above illustration shows that, if three or more exceedances are observed among 10 measurements, then with approximately 93% confidence, the water body will be listed as impaired using the 10%-exceedance method. In the current study, the minimum numbers of exceedances, x, required for the listing of a water body reach as impaired, with approximately 95% confidence, are proposed for various sample sizes n, $1 \le n \le 100$. They are given in Table 2. It should be noted that the actual confidence level is not 95% because we are rounding off to the nearest whole number of exceedances and that the confidence level varies from sample size to sample size.

This confidence interval approach could be adopted to develop a set of guidelines for the listing of impaired waters as demonstrated above. A second approach is based on the test of hypothesis.

b. Test of Hypothesis Approach

Testing a hypothesis about exceedance probability is an alternative way to assess an estimator and its uncertainty. Suppose that, for a particular pollutant, two out of ten measurements in a water body exceed the criterion threshold. Is the sample exceedance percentage of 20% (i.e., $\hat{p} = 0.2$) strong evidence to determine the water body as impaired using the 10%-exceedance definition of impairment? Or, equivalently, is the sample percentage of 20% significantly larger than an assumed true exceedance percentage of 10% based on only $n = 10$ measurements? This question can be put in the framework of hypothesis testing. Here, we wish to test the null hypothesis

$$H_0: p \le 0.1, \tag{3.6}$$

that is, the water body is not impaired, versus the alternative hypothesis

$$H_a: p > 0.1, \tag{3.7}$$

that is, the water body is impaired. The test can be performed by referring the observed number of exceedances, x, to a binomial probability table. When $n = 10$ and $p = 0.1$, the probability of observing two or less exceedances is 0.9298 (and the probability of observing three or more exceedances is 0.0702). If the number of exceedances in the ten measurements is two or less, the sample does not provide sufficient evidence to reject the null hypothesis. Thus, the sample 20% is not significantly larger than the assumed 10% exceedance percentage. But, if three or more exceedances are observed, there is sufficient evidence to conclude that, at the 7% significance level, the true exceedance probability p in the water body reach is over 0.1, and the alternative hypothesis H_a: $p > 0.1$ is accepted. That is, a 30% sample exceedance percentage is significantly larger than the assumed 10% exceedance percentage at the 7% level of significance. This is equivalent to saying that a 93% confidence interval would exclude $p \le 0.1$ when there are three exceedances in a sample of ten.

As mentioned in the beginning of Section 3, the TAC recommended a 10%-exceedance definition of impairment. If the recommendation is adopted into the rule, the Department will need to provide ***a set of guidelines on the minimum number of exceedances and sample size required for listing impaired waters.*** In the above example, when ten samples are collected from a water body and analyzed, the minimum number of exceedances required to list the water body as impaired is $x = 3$, with approximately 93% confidence. Using the test of hypothesis approach, the water body will be listed as impaired whenever the random sample results in the acceptance of H_a: $p > 0.1$ at a suitable $100\alpha\%$ significance level or, equivalently, at a suitable $(1-\alpha)100\%$ confidence level. The results turn out to be identical to those obtained by the use of the confidence interval approach. The fact that the two approaches produced identical results for listing impaired water bodies, as presented in Table 2, is not surprising. It is due to the duality relationship between the confidence interval and test of hypothesis approaches. See, e.g., Bickel and Doksum (2001, Section 4.5) for a detail explanation of the duality.

It should be noted that the minimum numbers of exceedances for listing an impaired water body given in Table 2 can be generated by many statistical packages. The Microsoft Excel function CRITBINOM(trials, probability_s, alpha) calculates the smallest number of successes "k" out of "n" trials when the probability of a **yes** response on each trial is p such that $P(X \le k \mid n, p) \ge$ alpha. Here, "k" and "alpha" are, respectively, equal to "$x - 1$" and "$1 - \alpha$" of (3.5). The CRITBINOM(n, p_0, $1-\alpha$) function provides the critical value, $x = k + 1$, for the test of null hypothesis

$$H_0: p \le p_0, \tag{3.8}$$

versus

$$H_a: p > p_0 \tag{3.9}$$

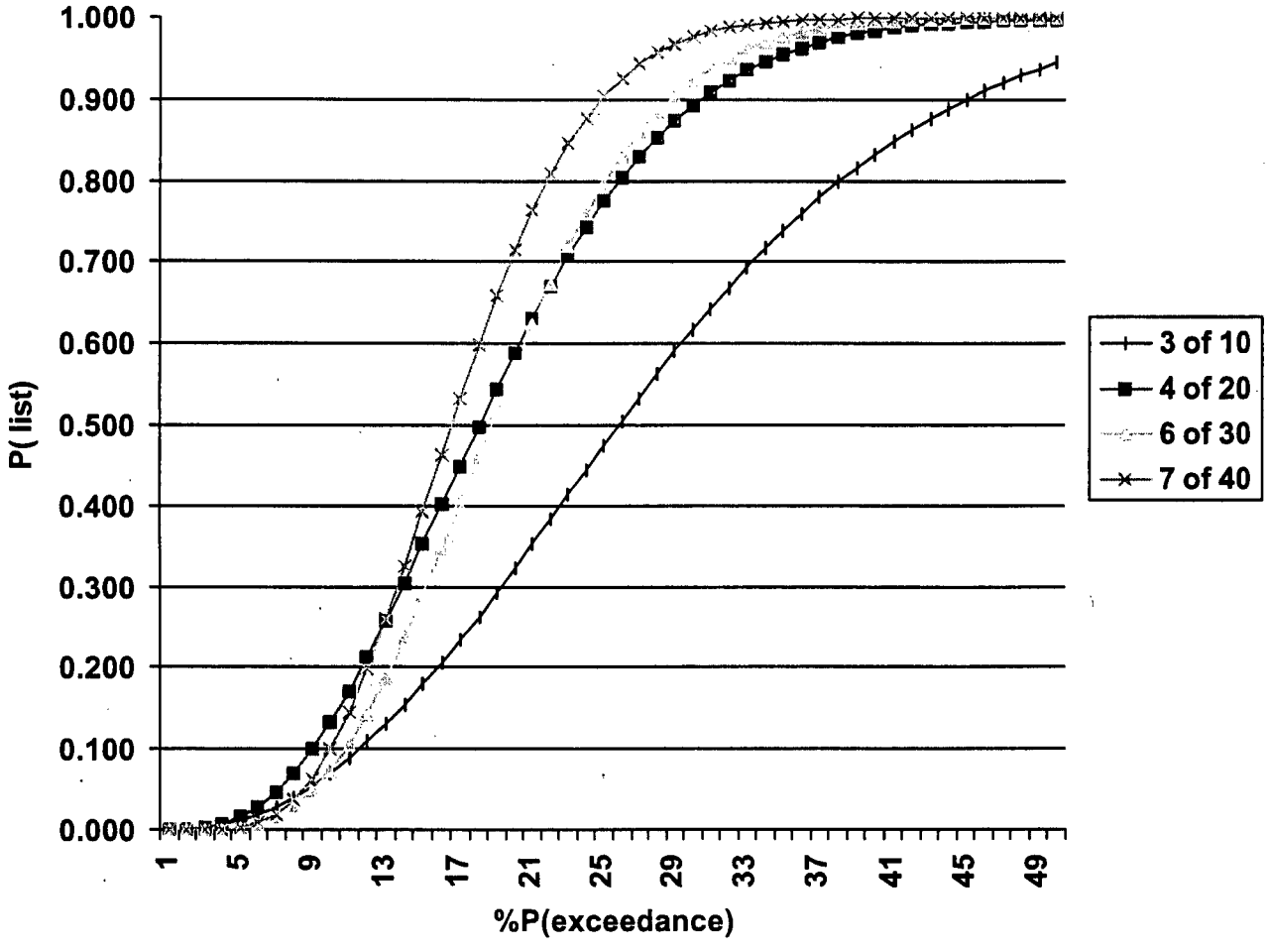
at the $(100\alpha)\%$ level of significance, where p_0 is a number between 0 and 1 to be determined by the regulatory agency. For example, CRITBINOM(10, 0.10, 0.9298) returns the number "two", which means that $P(X \le 2 \mid n = 10, p = 0.1) \ge 0.9298$, i.e., the chance that the number of exceedances is two or less, given the exceedance probability of $p = 0.10$ and a sample size of $n = 10$, is at least 92.98%, and two is the smallest number of exceedances with this property. Therefore, when $p = 0.10$ (or less) the chance of three or more exceedances is less than 7.02%. Other examples can be generated similarly. Some are given below:

CRITBINOM(10, 0.1, 0.95) = 3,
CRITBINOM(15, 0.1, 0.95) = 4,
CRITBINOM(20, 0.1, 0.95) = 4,
CRITBINOM(30, 0.1, 0.95) = 6, and
CRITBINOM(40, 0.1, 0.95) = 7.

While Table 2 provides, for each n, $1 \le n \le 100$, the smallest number of exceedances x required for listing, it is important to calculate the probability of listing, $P(X \ge x \mid n, p)$, for each n and for various values of the true exceedance probability p. Table 3 gives the probabilities of listing for four sample sizes: $n = 10$, 20, 30, and 40 with p ranging from 0.01 to 0.50. These probabilities are plotted against the true exceedance probabilities in Chart 1, where the x-axis

represents the true exceedance percentages (100p)% and the y-axis represents the probabilities of listing. Based on Chart 1, if the true exceedance probability of a pollutant at a particular water body is 0.1 (or less) and the proposed listing procedure is used, the chance of this water body reach being listed as impaired is (1) no more than 7% if only ten samples are collected, (2) no more than 13.3% if only 20 samples are collected, (3) no more than 7.3% if 30 samples are collected, and (4) no more than 9.95% if 40 samples are collected. If, on the other hand, the true exceedance probability of a pollutant at a water body is 0.25, then the chances of listing the water body as impaired with 10, 20, 30, and 40 samples are 47.4%, 77.5%, 79.7%, and 90.4%, respectively. It should be noted that, in the context of testing the null hypothesis H_0: $p \leq 0.1$ versus the alternative H_a: $p > 0.1$, the probability plots are actually the power curves for the four sample sizes. For each curve, i.e., for each sample size, the power of the test is an increasing function of the true exceedance probability, p. However, the four curves cross one another at some values of p. Thus, it is not necessary true that the larger the sample size is, the higher the probability of listing will be. For example, when the true exceedance probability is 0.1, the probability of listing is smaller for 30 samples with 6 exceedances than for 20 samples with 4 exceedances. The exact probabilities for both 20 and 30 samples when $p = 0.1$ can be found in Table 3.

Chart 1. Exceedance: 10% to List With 95% Confidence Level



4. Delisting Procedure.

The problem of deciding by a statistical procedure whether or not to delist a body of water that has already been designated as "impaired" is not the same thing as deciding to list an impaired water. If the water body reach is no longer impaired, the regulator would want to be sure to delist it. On the other hand, if the water body reach is still impaired, the regulator would want to be sure to avoid delisting it. However, using a statistical procedure, no decision based on n sample measurements can be free from error; there will always be some chance of making a wrong decision. A sound statistical procedure is one that will minimize the chance of making a wrong decision.

In this section, it is assumed that a water body reach has been listed as impaired due to exceedances of a water quality criterion for a particular pollutant such as fluoride. Suppose that "$p < p_0$" is chosen as the method for delisting a water body reach due to an exceedance of a water quality criterion, where p_0 is a number between 0 and 1 to be determined by the regulatory agency. That is, an impaired water body, listed due to an exceedance, will be delisted whenever the true exceedance probability of the pollutant is less than p_0. The regulatory agency may consider using (1) $p_0 = 0.1$ or (2) $p_0 = 0.15$ or any other candidate value for delisting. A statistical procedure for delisting an impaired water body reach, due to an exceedance of a water quality criterion should provide the maximum number of exceedances, x, of the pollutant out of n sample measurements, allowed for the statistical conclusion "$p < p_0$" to be made with a high level of confidence. This can be achieved by the use of a hypothesis testing approach. The procedure is equivalent to rejecting the null hypothesis

$$H_0: p \geq p_0 \quad \text{(i.e., the water body is impaired)}, \tag{4.1}$$

and accepting the alternative hypothesis

$$H_a: p < p_0 \quad \text{(i.e., the water body is not impaired)}. \tag{4.2}$$

(Note that the null and alternative hypotheses for delisting are completely opposite to those of the listing procedure given in (3.6) and (3.7) for $p_0 = 0.1$.) The most powerful test is to reject the null hypothesis, at the $100\alpha\%$ (e.g., 5%) significance level, whenever the number of exceedances is less than or equal to x, where x satisfies the probability inequality:

$$P(X \leq x \mid n, p = p_0) \leq \alpha. \tag{4.3}$$

The number x obtained from (4.3) is the maximum number of exceedances, out of n sample measurements, allowed for delisting a water body reach with $(1-\alpha)100\%$ confidence. In the following, both options (1) $p < 0.1$ and (2) $p < 0.15$ for delisting an impaired water body are considered.

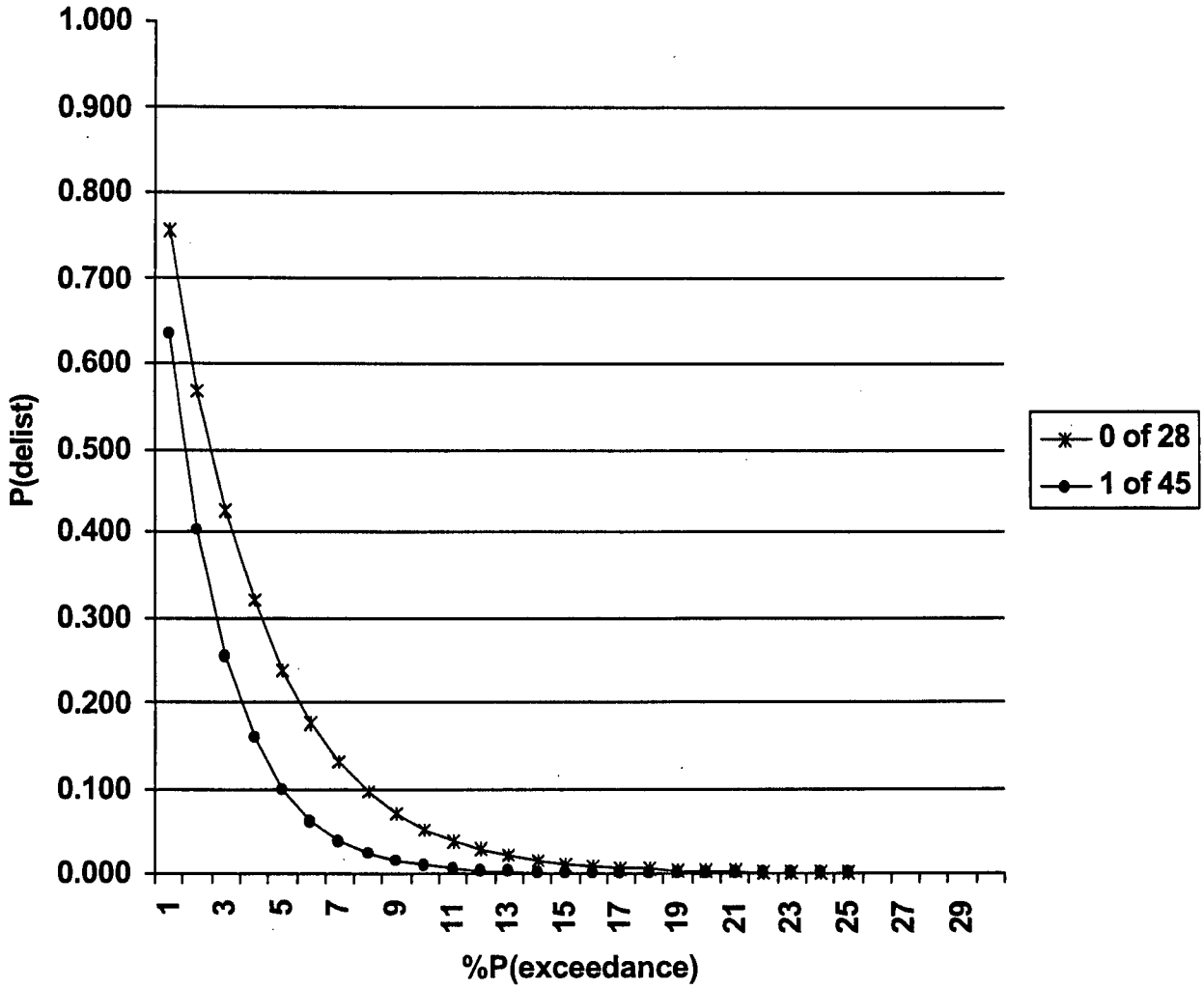
(1) Assume that the regulatory agency decides to use "$p < 0.1$" (i.e., $p_0 = 0.1$) as the delisting method. Then, for example, when $n = 28$, $p_0 = 0.1$, and $\alpha = 0.05$, the maximum number of exceedances is found to be $x = 0$. Equivalently, the Microsoft Excel function CRITBINOM(28, 0.1, 0.05) = 0, yielding the same result. For different sample sizes, and $p_0 = 0.1$, the maximum

number of exceedances, x, which are allowed for the acceptance of the alternative hypothesis $H_a: p < 0.1$ with approximately 95% confidence, are calculated using the Excel function and the results are given in Table 4. Based on the above calculation, when there is no exceedance among $n = 28$ measurements for a pollutant, we are 94.8% (or **approximately** 95%) confident that the true exceedance probability of the pollutant is below 0.1 and the water body will be removed from the impaired water list. Here, $n = 28$ is the smallest sample size that enables us to assess whether or not the true exceedance probability is below 0.1 with approximately (and closest to) 95% confidence. It is noted that the same conclusion should be reached using a lower one-sided 95% confidence interval approach. However, when inequality (3.3) is applied with $n = 28$, $x = 0$, and $\alpha = 0.05$, the smallest p is found to be U = 0.1045 giving the lower one-sided 95% confidence interval as [0, 0.1045], i.e., $p \leq 0.1045$. Notice that a minor discrepancy exists between the two results using the same data. This is because, under the hypothesis testing approach, "$p < 0.1$" is used for delisting with 94.8% confidence, and, under the confidence interval approach, "$p < 0.1045$" is used for delisting with 95% confidence. The exact 95% level of confidence cannot be accomplished if "$p < 0.1$" is to be used for delisting an impaired water. This is due to the fact that we are rounding off to the nearest whole number of exceedances. But for all practical purposes, both approaches provide the same conclusion with **approximately 95% confidence**.

For any sample size n less than or equal to 27, the level of confidence will be less than 95%. For example, when there is no exceedance among $n = 10$, 15, 20, and 25 sample measurements, the confidence levels are 65.13%, 79.41%, 87.84%, and 92.82%, respectively. Thus, $n = 28$ is the smallest sample size that is recommended for delisting with approximately 95% confidence.

Chart 2 plots the probabilities of delisting water body reaches with different true exceedance probabilities when 28 and 45 samples are collected. When the true exceedance probability of a pollutant at a particular water body is 0.01 (or less), the chances of delisting the water body reach based on 28 and 45 samples are 75.5% and 63.6%, respectively. When the true exceedance probability is 0.15, the delisting probabilities using the two sample sizes are 0.011 and 0.001, respectively. The delisting probabilities for 28 and 45 sample sizes for water body reaches with true exceedance probabilities between 0.01 and 0.25 are given in columns 2 and 3 of Table 5.

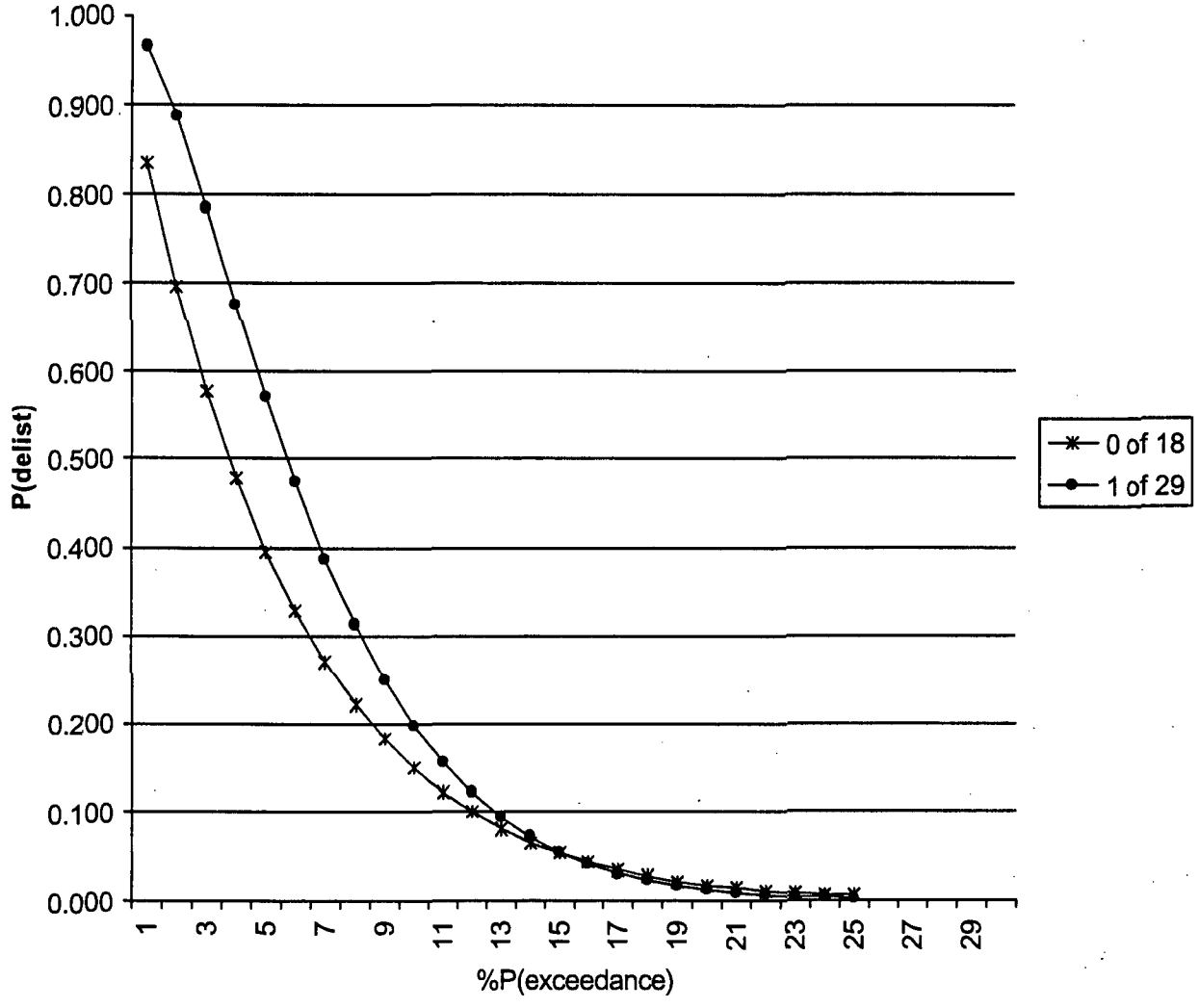
Chart 2. Exceedance: 10% to Delist With 95% Confidence Level



(2) Now, assume that the regulatory agency decides to use "$p < 0.15$" (i.e., the less-than-15%) method for delisting. Based on the calculation using (3.3), when there is no exceedance among 18 measurements, we can claim that, with 95% confidence, the true exceedance probability is below 0.15. Here, $n = 18$ is the smallest sample size that enables us to assess whether the true exceedance probability is below 0.15, with approximately (and closest to) 95% confidence. Similarly, when the sample size $n = 29$ and with only one exceedance in the 29 measurements, we are approximately 95% confident that the true exceedance probability is below 0.15 and the water body will be removed from the impaired water list. For different sample sizes, the maximum numbers of exceedances, x, for which we are approximately 95% confident that the true exceedance probability is less than 0.15, are also given in Table 4.

Assuming the less-than-15% method for delisting, Chart 3 plots the probabilities of delisting waterbody reaches with different true exceedance probabilities when 18 and 29 samples are collected. When the true exceedance probability of a pollutant at a particular water body is 0.01, the chances of delisting the water body reach for the 18 and 29 samples are 83.5% and 96.6%, respectively. When the true exceedance probability is 0.2, the delisting chances drop significantly to 1.8% and 1.3%, respectively. The delisting probabilities for 18 and 29 samples with true exceedance probabilities between 0.01 and 0.25 are given in columns 5 and 6 of Table 5, respectively.

Chart 3. Exceedance: 15% to Delist With 95% Confidence Level



4. Conclusions and Discussion

In this study, we propose a nonparametric procedure for identifying impaired water body reaches in Florida based on the binomial distribution theory. The confidence interval approach and hypothesis testing approach are recommended for assessing the exceedance probability of a particular pollutant over its criterion. The starting premise for the listing procedure is that the water body should be listed if its true exceedance probability p of a pollutant is over 0.1. The decision to list an impaired water will be based on the minimum number of exceedances, x, found in n sample measurements. The minimum numbers required for listing are given in Table 2. For the delisting procedure, we provide two options depending on the true exceedance probability p: (1) $p < 0.1$ or (2) $p < 0.15$. Table 4 provides the maximum numbers of exceedances allowed for the water body reach to be removed from the impaired water list with approximately 95% confidence for both $p < 0.1$ and $p < 0.15$ options. In addition to the listing and delisting methods given in Tables 2 and 4, a table of listing probabilities and a table of delisting probabilities are provided. Also, three charts are presented showing the listing and delisting probabilities for selected sample sizes with different true exceedance probabilities.

In concluding this study, the issues on sample size, and on spatial and temporal coverage of samples are addressed below.

Sample Size. Because of limited sources and limited resources, the currently available samples for the majority of Florida water body reaches are quite small. (See, e.g., Table 1.) When estimating the true exceedance probability of a pollutant or testing hypotheses about the true exceedance probability, small sample sizes are associated with large uncertainty. For the proposed listing procedure, we suggest that ten or more sample measurements (minimum sample size $n = 10$) be required for assessing whether or not a water body reach is impaired based on criterion exceedances. The proposed delisting procedure requires stronger evidence and more information from sample than the listing procedure, if the same level of confidence is required. In order to assess whether or not the exceedance percentage of a pollutant in a particular water body is less than 10% for delisting, with approximately 95% confidence, we recommend that 28 or more water samples be collected for analysis.

The numbers of water samples required for the proposed listing and delisting procedures are different. Requiring "more samples" for delisting than for listing an impaired water at a comparable level of confidence seems somewhat puzzling to many readers, but it is strictly a matter of statistical theory. For example, suppose the agency decides that if p is shown to be greater than 0.1 then the water body will be listed as impaired. Assuming a null hypothesis of $p = 0.1$, the variance of each observation is $0.1 \times 0.9 = 0.09$. Now suppose the water body is listed as the result of a random sample. Then the agency will assume a null hypothesis of 0.2 for the purpose of testing for delisting. Now the variance of each observation is $0.2 \times 0.8 = 0.16$. Since the sample size necessary *to create the same level of confidence* for the estimation of p is roughly inversely proportional to the variance of an observation in the random sample, it will take more observations to provide the same standard of proof when $p = 0.2$ as when $p = 0.1$.

Consequently, it is not possible to use the same sample size to list and delist an impaired water body reach at the same level of confidence using the 10%-exceedance method for both listing and delisting. However, the same sample size could be used for listing and delisting at the expense of a lesser confidence level for delisting. As already demonstrated, we may use $n = 10$ samples for both listing and delisting. With three exceedances, the water body reach is listed as impaired with 92.98% confidence (from Table 2), while with no exceedance observed, out of the ten sample measurements, the water body is removed from the impaired water list with only 65.13% confidence (from Table 4). However, any statistical conclusion that has a confidence level of less than 90% is considered not acceptable by most statistics practitioners.

Spatial and Temporal Coverage of Samples. It is well-known that the concentration levels of many pollutants and metals depend on spatial location and season, and some physical or chemical properties, such as dissolved oxygen, vary dramatically at different time periods during a day. Based on these observations, we recommend that the sample measurements of a water body reach be collected randomly and at reasonably spread locations across the water surface. They are to be collected with sufficient temporal separation to ensure independence. In this way, the samples will be independent and unbiased. The true water quality of the whole reach will likely be represented by the sample measurements.

In this study, various statistical scenarios for listing and delisting an impaired water body are presented. These results should provide sufficient information and strong probabilistic evidence for the regulatory agency to render their decisions on the setting of clear guidelines for listing and delisting.

5. Acknowledgment. This research was supported in part by Contract LAB015 with the Bureau of Laboratories, the Florida Department of Environmental Protection. The authors wish to thank the assistance received from Mrs. Lori Wolfe and Mr. Daryll Joyner during the preparation of this report.

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Table 1: Sample sizes for six pollutants in Florida 17

Organic Nitrogen		
No. of Samples	No. of Reaches	Percent
1-10	400	47%
11-20	190	22%
21-30	76	9%
31-40	75	9%
41-50	27	3%
51-60	14	2%
61-80	15	2%
71-80	9	1%
81-90	12	1%
91-100	2	0%
>100	29	3%
Grand Total	849	100%

Dissolved Oxygen		
No. of Samples	No. of Reaches	Percent
1-10	380	39%
11-20	188	19%
21-30	77	8%
31-40	103	10%
41-50	42	4%
51-60	25	3%
61-80	26	3%
71-80	21	2%
81-90	11	1%
91-100	11	1%
>100	99	10%
Grand Total	983	100%

Total Nitrogen		
No. of Samples	No. of Reaches	Percent
1-10	373	36%
11-20	194	19%
21-30	98	9%
31-40	110	11%
41-50	37	4%
51-60	24	2%
61-80	40	4%
71-80	28	3%
81-90	20	2%
91-100	18	2%
>100	99	10%
Grand Total	1041	100%

Total Phosphorus		
No. of Samples	No. of Reaches	Percent
1-10	371	36%
11-20	189	18%
21-30	100	10%
31-40	108	10%
41-50	36	3%
51-60	24	2%
61-80	42	4%
71-80	26	3%
81-90	19	2%
91-100	18	2%
>100	104	10%
Grand Total	1037	100%

NH4 (Ammonia)		
No. of Samples	No. of Reaches	Percent
1-10	413	49%
11-20	197	23%
21-30	78	9%
31-40	58	7%
41-50	27	3%
51-60	10	1%
61-80	15	2%
71-80	9	1%
81-90	7	1%
91-100	4	0%
>100	24	3%
Grand Total	842	99%

NO3 (Nitrate)		
No. of Samples	No. of Reaches	Percent
1-10	388	37%
11-20	197	19%
21-30	72	7%
31-40	82	8%
41-50	24	2%
51-60	16	2%
61-80	16	2%
71-80	10	1%
81-90	10	1%
91-100	4	0%
>100	26	3%
Grand Total	845	81%

Table 2: To list a waterbody as impaired

With about 95% confidence, the minimum number of exceedances where you are sure the percentage of exceedances is greater than 10%

Sample Size n	*# exceedances*	*Conf Level %*	*Sample Size n*	*# exceedances*	*Conf Level %*
1	1	89.99	51	9	93.54
2	1	80.98	52	9	92.85
3	1	72.88	53	9	92.12
4	2	94.76	54	9	91.34
5	2	91.84	55	9	90.52
6	2	88.55	56	9	89.65
7	2	85.01	57	10	94.49
8	2	81.82	58	10	93.92
9	3	94.57	59	10	93.31
10	3	92.98	60	10	92.65
11	3	91.02	61	10	91.97
12	3	88.89	62	10	91.24
13	3	86.58	63	10	90.47
14	3	84.13	64	11	94.81
15	4	94.43	65	11	94.3
16	4	93.14	66	11	93.75
17	4	91.71	67	11	93.17
18	4	90.15	68	11	92.56
19	4	88.47	69	11	91.91
20	4	86.67	70	11	91.29
21	5	94.77	71	11	90.51
22	5	93.76	72	12	94.67
23	5	92.66	73	12	94.18
24	5	91.46	74	12	93.66
25	5	90.17	75	12	93.11
26	5	88.78	76	12	92.53
27	5	87.3	77	12	91.91
28	6	94.48	78	12	91.27
29	6	93.6	79	12	90.6
30	6	92.65	80	13	94.58
31	6	91.63	81	13	94.11
32	6	90.52	82	13	93.62
33	6	89.35	83	13	93.1
34	6	88.1	84	13	92.55
35	7	94.46	85	13	91.97
36	7	93.69	86	13	91.37
37	7	92.86	87	14	90.74
38	7	91.97	88	14	90.08
39	7	91.02	89	14	94.09
40	7	90.01	90	14	93.62
41	7	88.94	91	14	93.13
42	8	94.58	92	14	92.61
43	8	93.9	93	14	92.06
44	8	93.18	94	14	91.49
45	8	92.4	95	15	90.9
46	8	91.56	96	15	90.28
47	8	90.68	97	15	94.1
48	8	89.75	98	15	93.66
49	9	94.79	99	15	93.19
50	9	94.18	100	15	92.69

Table 3. Listing Probabilities

(Using Greater-than-10% Exceedance for Listing)

Exceedance Prob.	Listing Probabilities			
	3 of 10	4 of 20	6 of 30	7 of 40
0.01	0.000	0.000	0.000	0.000
0.02	0.001	0.001	0.000	0.000
0.03	0.003	0.003	0.000	0.000
0.04	0.006	0.007	0.001	0.001
0.05	0.012	0.016	0.003	0.003
0.06	0.019	0.029	0.008	0.009
0.07	0.028	0.047	0.016	0.020
0.08	0.040	0.071	0.029	0.038
0.09	0.054	0.099	0.048	0.064
0.1	0.070	0.133	0.073	0.100
0.11	0.088	0.171	0.105	0.144
0.12	0.109	0.213	0.143	0.198
0.13	0.131	0.257	0.187	0.259
0.14	0.155	0.304	0.236	0.324
0.15	0.180	0.352	0.289	0.393
0.16	0.206	0.401	0.345	0.463
0.17	0.234	0.450	0.403	0.532
0.18	0.263	0.497	0.461	0.597
0.19	0.292	0.544	0.517	0.658
0.2	0.322	0.589	0.572	0.714
0.21	0.353	0.631	0.625	0.764
0.22	0.383	0.671	0.674	0.808
0.23	0.414	0.708	0.719	0.845
0.24	0.444	0.743	0.760	0.877
0.25	0.474	0.775	0.797	0.904
0.26	0.504	0.804	0.830	0.925
0.27	0.534	0.830	0.859	0.943
0.28	0.562	0.853	0.884	0.957
0.29	0.590	0.874	0.905	0.968
0.3	0.617	0.893	0.923	0.976
0.31	0.643	0.909	0.939	0.983
0.32	0.669	0.923	0.951	0.988
0.33	0.693	0.936	0.962	0.991
0.34	0.716	0.946	0.970	0.994
0.35	0.738	0.956	0.977	0.996
0.36	0.759	0.963	0.982	0.997
0.37	0.779	0.970	0.986	0.998
0.38	0.798	0.976	0.990	0.999
0.39	0.816	0.980	0.992	0.999
0.4	0.833	0.984	0.994	0.999
0.41	0.848	0.987	0.996	1.000
0.42	0.863	0.990	0.997	1.000
0.43	0.876	0.992	0.998	1.000
0.44	0.889	0.994	0.998	1.000
0.45	0.900	0.995	0.999	1.000
0.46	0.911	0.996	0.999	1.000
0.47	0.921	0.997	0.999	1.000
0.48	0.930	0.998	1.000	1.000
0.49	0.938	0.998	1.000	1.000
0.5	0.945	0.999	1.000	1.000

Table 4: To delist a waterbody from impaired

With 95% confidence, the maximum number of exceedances, x, where you are sure the percentage of exceedances is less than 10%					
n	x	% Conf	n	x	% Conf
1			51	2	89.61
2			52	2	90.44
3			53	2	91.02
4			54	2	91.66
5			55	2	92.26
6			56	2	92.81
7			57	2	93.34
8			58	2	93.82
9			59	2	94.27
10	0	65.13	60	2	94.7
11	0	68.62	61	3	87.1
12	0	71.76	62	3	87.9
13	0	74.58	63	3	88.66
14	0	77.12	64	3	89.47
15	0	79.41	65	3	90.04
16	0	81.47	66	3	90.68
17	0	83.32	67	3	91.28
18	0	84.99	68	3	91.84
19	0	86.49	69	3	92.38
20	0	87.84	70	3	92.88
21	0	89.06	71	3	93.35
22	0	90.15	72	3	93.79
23	0	91.14	73	3	94.2
24	0	92.02	74	3	94.59
25	0	92.82	75	3	94.96
26	0	93.54	76	4	88.79
27	0	94.19	77	4	89.44
28	0	94.77	78	4	90.06
29	1	80.11	79	4	90.65
30	1	81.63	80	4	91.1
31	1	83.06	81	4	91.73
32	1	84.36	82	4	92.23
33	1	85.58	83	4	92.7
34	1	86.71	84	4	93.15
35	1	87.76	85	4	93.57
36	1	88.74	86	4	93.97
37	1	89.64	87	4	94.34
38	1	90.47	88	4	94.7
39	1	91.24	89	5	89.08
40	1	91.95	90	5	89.68
41	1	92.61	91	5	90.24
42	1	93.22	92	5	90.78
43	1	93.77	93	5	91.3
44	1	94.29	94	5	91.79
45	1	94.76	95	5	92.25
46	2	85.16	96	5	92.69
47	2	86.17	97	5	93.11
48	2	87.11	98	5	93.51
49	2	88	99	5	93.88
50	2	88.83	100	5	94.24

With 95% confidence, the maximum number of exceedances, x, where you are sure the percentage of exceedances is less than 15%					
n	x	% Conf	n	x	% Conf
1			51	4	89.78
2			52	4	90.69
3			53	4	91.54
4			54	4	92.31
5			55	4	93.02
6			56	4	93.67
7			57	4	94.27
8			58	4	94.81
9			59	5	89.44
10	0	80.31	60	5	90.32
11	0	83.27	61	5	91.14
12	0	85.78	62	5	91.89
13	0	87.91	63	5	92.59
14	0	89.72	64	5	93.24
15	0	91.26	65	5	93.83
16	0	92.57	66	5	94.38
17	0	93.69	67	5	94.88
18	0	94.64	68	6	90.1
19	1	80.15	69	6	90.89
20	1	82.44	70	6	91.62
21	1	84.5	71	6	92.3
22	1	86.33	72	6	92.93
23	1	87.96	73	6	93.52
24	1	89.41	74	6	94.06
25	1	90.69	75	6	94.56
26	1	91.83	76	6	95.03
27	1	92.84	77	7	90.75
28	1	93.73	78	7	91.45
29	1	94.51	79	7	92.11
30	2	84.86	80	7	92.73
31	2	86.41	81	7	93.3
32	2	87.82	82	7	93.83
33	2	89.1	83	7	94.33
34	2	90.25	84	7	94.79
35	2	91.3	85	8	90.68
36	2	92.24	86	8	91.36
37	2	94.08	87	8	92
38	2	94.85	88	8	92.6
39	2	94.53	89	8	93.16
40	3	86.98	90	8	93.68
41	3	88.21	91	8	94.16
42	3	89.33	92	8	94.62
43	3	90.36	93	9	90.68
44	3	91.29	94	9	91.33
45	3	92.15	95	9	91.95
46	3	92.93	96	9	92.52
47	3	93.64	97	9	93.07
48	3	94.28	98	9	93.57
49	3	94.87	99	9	94.05
50	4	88.79	100	9	94.49

Table 5. Delisting Probabilities

Exceedance Prob.	Less than 10% to delist: 0 of 28 (Delisting Prob.)	Less than 10% to delist: 1 of 45 (Delisting Prob.)
0.01	0.755	0.925
0.02	0.568	0.773
0.03	0.426	0.607
0.04	0.319	0.458
0.05	0.238	0.335
0.06	0.177	0.239
0.07	0.131	0.167
0.08	0.097	0.115
0.09	0.071	0.078
0.1	0.052	0.052
0.11	0.038	0.035
0.12	0.028	0.023
0.13	0.020	0.015
0.14	0.015	0.009
0.15	0.011	0.006
0.16	0.008	0.004
0.17	0.005	0.002
0.18	0.004	0.001
0.19	0.003	0.001
0.2	0.002	0.001
0.21	0.001	0.000
0.22	0.001	0.000
0.23	0.001	0.000
0.24	0.000	0.000
0.25	0.000	0.000

Exceedance Prob.	Less than 15% to delist: 0 of 18 (Delisting Prob.)	Less than 15% to delist: 1 of 29 (Delisting Prob.)
0.01	0.835	0.966
0.02	0.695	0.886
0.03	0.578	0.784
0.04	0.480	0.676
0.05	0.397	0.571
0.06	0.328	0.474
0.07	0.271	0.388
0.08	0.223	0.314
0.09	0.183	0.251
0.1	0.150	0.199
0.11	0.123	0.156
0.12	0.100	0.122
0.13	0.082	0.094
0.14	0.066	0.072
0.15	0.054	0.055
0.16	0.043	0.042
0.17	0.035	0.031
0.18	0.028	0.023
0.19	0.023	0.017
0.2	0.018	0.013
0.21	0.014	0.009
0.22	0.011	0.007
0.23	0.009	0.005
0.24	0.007	0.004
0.25	0.006	0.003

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

Mr. Jerry Brooks
Assistant Director
Division of Water Facilities
Florida Department of Environmental Protection
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Dear Mr. Brooks:

The purpose of this letter is to provide the U.S. Environmental Protection Agency's (EPA) comments on the March 14, 2001 draft rule concerning the Identification of Impaired Surface Waters currently under development by the Florida Department of Environmental Protection (FDEP). We believe, based on our discussions with your staff, that this version of the Rule or a similar one will be presented to your Environmental Regulation Commission (ERC) for its consideration this month. EPA presented comments on earlier drafts of the Impaired Waters Rule (IWR) by letters dated September 5, 2000, and September 22, 2000. Today's letter will make current EPA's view of the IWR.

As you know, EPA has reviewed the draft IWR on various occasions as the Rule has proceeded in development, and we have had many discussions with your staff regarding the Rule. As a result of these discussions, many modifications to the IWR have been adopted to address inconsistencies between the IWR and federal guidance and regulation. We believe the IWR, as it is now drafted, has resolved almost all of EPA's earlier concerns. The enclosure to this letter identifies all of EPA's earlier concerns expressed in the September 5th and September 22nd letter, and provides a brief explanation of how the March 14th version of the IWR resolves each concern. In performing our review, EPA considered the requirements of Section 303(d) of the Clean Water Act (CWA), the Total Maximum Daily Load (TMDL) regulations (40 CFR § 130.7) and the October 29, 1997, "Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b)) Reports and Electronic Updates."

A summary of the major resolved issues is presented below:

EPA expressed concern in past correspondence on the IWR's reliance on a statistical binomial methodology for determining the number of exceedances of a water quality criterion for a given sample size that are necessary to list a water body on the planning or verified list. Earlier versions of the IWR required a 95-percent confidence interval for exceedances before a water body would be designated as impaired. EPA expressed concern that this high confidence interval, when applied to small sample sizes, required a higher number of exceedances to indicate impairment than currently advised in EPA's current Section 305(b) Guidance. The current version of the IWR modified the statistical approach to require an 80-percent confidence interval for placing a water on the State's planning list. Once a water is on the State's planning list, the water will undergo additional data collection to verify impairment. Once this additional data is collected, the State will apply a higher confidence interval. With this additional data, the State will apply a higher confidence interval of 90-percent to determine impairment for the verified list. EPA is satisfied that this change will help to ensure that impaired waters are identified and included on the verified list.

EPA expressed significant concern that, under earlier versions of the IWR, waters currently identified as impaired on the State's 1998 Section 303(d) list which were determined to have "insufficient data" would be removed from the State's Section 303(d) list and also not appear on the State's planning list with its associated requirement for additional data collection. As a result of EPA's concerns, the latest version of the IWR provides that waters on the current 1998 Section 303(d) list that do not meet the data sufficiency requirements of the planning list will be placed on the IWR's planning list, and sufficient data will be collected to verify the water's impairment status.

In further discussions with the State regarding EPA's concern about the 2002 Section 303(d) list, the State has committed to review all waters on the 1998 303(d) list and include all waters that meet the verification requirements of the IWR on the State's 2002 list. In addition, the State will also review all available data from 1989 to 1998 for development of a statewide planning list and include on the 2002 list any additional waters that meet the verification requirements, based on data from 1994 to 1998. (The State is unable to do a complete assessment for data gathered in 1999, 2000, and 2001 because of a national problem in the upload of data into the new Federal STORET data system.) Those waters on the 1998 303(d) list that do not meet the verification requirements will be de-listed for "good cause" and placed on the State's planning list if the data is insufficient to verify the water's use-support status according to the methodology in the IWR. The "good cause" justification for de-listing the waters is based on several factors: 1) the requirements in the State Rule that these waters be moved to a planning list for additional data collection and assessment that will occur within a reasonable period of time; 2) a determination will be made that the waters are either impaired (and placed on the 303(d) list) or attaining its uses; and 3) the State's commitment to EPA that waters on the

planning list that appeared on the State's 1998 Section 303(d) list will be monitored and assessed during the first or second rotation through the State's Watershed Management Process consistent with the schedule for TMDL development in EPA's consent decree with Earthjustice. High priority water/pollutant combinations will be monitored and assessed during the first rotation of the watershed cycle (i.e., within 5 years of 2001), and low priority water/pollutant combinations will be monitored and assessed during the second rotation of the watershed cycle (i.e., within 10 years of 2001). After this additional data collection and assessment, the water will be added to the appropriate future Section 303(d) list if the water is verified to be impaired, or the water will be "de-listed" based on the "good cause" justification that the water is attaining its uses. Waters on the 1998 Section 303(d) list where sufficient data exists to demonstrate the water is meeting the IWR's planning list criteria for use support will be de-listed in the 2002 303(d) list submittal. It is EPA's view that this process will achieve the intent of the CWA and will provide sufficient documentation of the waters still requiring TMDLs by FDEP.

EPA also expressed concern that a few provisions of the IWR could potentially be viewed as a change to the State's water quality standards (WQS) regulations, and as such would need review by EPA to determine if the IWR and the WQS regulations are consistent. In response to this concern, the IWR has been modified to clarify that the IWR expresses how the State implements its WQS rules for Section 303(d) listing purposes only, and does not change any existing WQS regulation. While EPA believes this revision to the IWR should resolve any discrepancies with the State's WQS regulations, the State is advised that if a water body exceeds a State numeric criteria due to natural conditions, and is therefore not listed on the State's Section 303(d) list, EPA would expect the State to concurrently pursue adoption of appropriate site-specific criteria, if necessary under the WQS regulations.

The State modified the IWR to indicate that data from sources other than the STORET data base may be considered in listing decisions. EPA considers this an important revision to ensure that appropriate data provided by other agencies and the public will be given consideration in listing decisions. In addition, the IWR was modified to allow waters with less than 10 samples to be listed if enough samples (at least 3) exceed the applicable water quality criterion.

While the March 14th version of the IWR resolves almost all of EPA's concerns, there are two remaining issues concerning consistency of the IWR with the CWA that we need to highlight. The first one is a provision in the draft rule at 62-303.100 (5) that allows the State to not list a water on the verified list (the State's Section 303d list) if an existing or proposed pollution control mechanism can demonstrate "reasonable assurance" that water quality standards will be met at some point in the future, and that "reasonable progress" towards attainment of water quality standards will be made before the next Section 303(d) listing cycle. Current federal regulations at 40 CFR §130.7(b)(1)(iii) allow an impaired water to not be listed if an existing pollution control mechanism required by local, state or federal authority will bring the waterbody into attainment

with the applicable water quality standard. How the State applies "reasonable assurance" and "reasonable progress" will determine whether this approach is consistent with federal regulations, and will be done on a case by case basis subject to EPA review. EPA believes 62-303.100(5) may be implemented consistent with the CWA if the provision is used to leave waters off the list only in cases where the State has a high degree of certainty that the existing pollution control mechanism will, in fact, achieve the applicable water quality standards in a reasonable period of time.

The second issue we need to highlight concerns the IWR's methodology for determining impairment of waters with exceedances of water quality standards for toxic pollutants. EPA's Section 305(b) Guidance sets toxic pollutants apart from conventional pollutants, and recommends that a water with more than one exceedance in a 3-year period of an acute or chronic criteria for a toxic pollutant should be considered as not fully supporting designated uses. Although Florida's IWR uses this methodology for acute criteria for toxic pollutants, the IWR considers chronic criteria for toxic pollutants in the same way it addresses conventional pollutants using the statistical binomial approach to determining when a water is impaired. This approach varies from the approach identified in the federal guidance, especially for large sample sizes, and would result in waters not being listed that have more than one exceedance in a 3-year period for chronic criterion. For example, if the State has monthly sampling of a toxic pollutant over a 3-year period, or 36 samples, under the IWR, 6 or more exceedances would be required before the water would be placed on the planning list, and 7 or more would be required for the verified list. On the other hand, it is not clear whether this approach in application would be inconsistent with the intent of the CWA Section 305(b) guidance. It is our understanding that the State believes that this proposed methodology for chronic toxicity is an appropriate approach for implementing the State's water quality standards for purposes of Section 303(d) listing. During our discussions with the State, we have developed a better understanding of the State's approach and believe it has merit. However, since this is an issue of first impression, has national implications and differs from current federal guidance, EPA is seeking assistance from our EPA Headquarters.

I appreciate the efforts you and your staff have made to address EPA's concerns regarding the IWR. The State developed the IWR through an extensive public participation process, and has produced a draft Rule that documents a method for determining water quality impairment of State waters. We commend the State for the process used, and for being one of the first states to take on this ambitious and controversial challenge. It is our view that because the State used a technical advisory group to develop the Rule which included a cross-section of the public including scientists and statisticians, and the State has gone through a formal Rule review procedure, that EPA should give the State as much discretion as possible in defining its methodology. We must caution, however, that the science of water quality assessment is continuing to evolve, and additional federal guidance on Section 303(d) listing is expected. EPA and the State will need to continue to work closely together to resolve concerns with the IWR

and how it is implemented to assure that the 303(d) lists developed under this Rule are consistent with the requirements of the CWA. Please feel free to contact me at 404/562-9326 or Gail Mitchell, Chief of the Water Quality Planning and Assessment Branch at 404/562-9234, if you would like to discuss this issue.

Sincerely,

for Beverly H. Banister, Director
Water Management Division

Enclosure

RESOLUTION OF COMMENTS BY THE USEPA ON THE FLORIDA DRAFT RULE – "IDENTIFICATION OF IMPAIRED SURFACE WATERS" (IWR) 62-303

APRIL 23, 2001

PREVIOUS CONCERNS FOLLOWED BY STATUS: The concerns below were identified in earlier comment letters dated September 5th and September 22nd. They are included here as background to assist in understanding how the issues have been resolved.

(1) PAGE 2, 62-303.100 Scope and Intent

The rule's intent to focus on "impairment of designated uses as the critical element for determining impairment" is inconsistent with both the Clean Water Act and the implementing regulations. The statute and the regulations require that states list on their Section 303(d) list waters that fail to meet any applicable water quality standard "including numeric criteria, narrative criteria, water body uses, and antidegradation requirements." (40 CFR 130.7(b)(3)). The natural failure of a water to meet one or more established water quality criteria must be provided for in the State's water quality standards if the water is to be determined not impaired for the purposes of Section 303(d).

Re: Moderating provisions. Any effective standard established by the State through the application of a "moderating provision" must have been applied to an individual segment in order to be considered for listing purposes. Please include a list of possible moderating provisions and the regulatory implementation provisions for each type of moderating provision.

Resolution: *Florida DEP deleted the sentence that said it would focus on designated uses, leaving the broader language of the Federal Statute regarding water quality standards (WQS). In addition, the applicability of most WQS within mixing zones was recognized, and "moderating provisions" were limited to such as Site-Specific Alternative Criteria. Only for the purpose of listing, the State is using its legal discretion to interpret its WQS to exclude waters not meeting standards because of natural conditions. (This exclusion is also required by State Statute.) The State also added the wording, "nothing in this rule is intended to limit any actions by federal, state, or local agencies or citizens pursuant to other rules or regulations."*

(2) PAGE 3, 62-303.200(7) and PAGE 7, 62-303.300 Definition of Impairment

See the comments in (1) above. The same issue applies here. For the purposes of Section 303(d), impairment must be defined as the failure of the water to meet any of its applicable water quality standards, including applicable criteria and anti-degradation as well as designated uses.

[Note: The two definitions of an impaired water are inconsistent. Page 3 says that a water is impaired if all of the designated uses are not met. Page 7 says that a water is impaired if any of its designated uses are not met.]

Resolution: *See resolution of Item #1 above. The inconsistency was also eliminated.*

(3) PAGE 4, 62-303.200(8) Definition of Natural Background

See the comments in (1) above. For the purposes of Section 303(d), the basis for determining a water to "naturally" exceed an applicable numeric criteria, and, therefore, not be impaired, must be provided for the in the State's water quality standards regulations. Once the state's water quality standards provide for this determination, the date and information upon which the determination of a natural background condition is made must be documented in the record and readily available to the public and EPA. Please note: Without a provision addressing "natural background" in the state's water quality standards, this provision is likely to be considered a revision to the state's water quality and as such will need EPA review and approval.

Resolution: *See resolution of Item #1 above.*

(4) PAGE 4, 62-303.200(10) Definition of Pollutant

The definition of "pollutant" is less stringent than the federal regulatory definition. By this rule definition a substance or contaminant would only be a pollutant if it is discharged in quantity or level to result in alteration of chemical, physical, biological, or radiological integrity of a water body. The federal regulations do not associate some triggering quantity of a discharged substance or contaminant with defining the substance or contaminant as a pollutant.

This definition may cause problems in areas not related to water quality impairment decisions, such as in NPDES permitting and enforcement where the federal definition of "pollutant" likely originated.

Resolution: *These concerns have been addressed by adopting the definition of "pollutant" used in the Clean Water Act (CWA).*

(5) PAGE 5, 62-303.200(11) Definition of Pollution

The definition of "pollution" is not consistent with the federal definition. The federal definition is "the man-made or man-induced alteration of the chemical, physical, biological, or radiological integrity of water".

The State's definition says that the presence of substances, contaminants, noise, or man-made or man-induced alteration of the chemical, physical, biological, or radiological integrity of air or water in quantities or levels which are not or may not be potentially harmful or injurious to human health or welfare, animal or plant life, or property is not pollution. The definition also says that pollution does not exist if it is authorized by applicable law. This definition is inconsistent with the federal definition. While it is unclear how this would affect the State's Section 303(d) list, we recommend that the definition be revised to be consistent with the federal definition.

Resolution: *These concerns have been addressed by adopting the definition of "pollution" used in the Clean Water Act (CWA).*

(6) PAGE 5, 62-303.200(14) Definition of Tier 2 Data Validation

This TIER 2 Data Validation can be interpreted to mean that data will not be considered by the State if the validation is not supplied with the data. Under this interpretation, much of the data in STORET will not be considered by the State for making use-impairment decisions. Waters could be removed from the list because of insufficient data validation. This would be inconsistent with the CWA statutory and regulatory language which requires the state to consider "all existing and readily available water quality-related data and information."

Resolution: *This concern is partially alleviated by limiting the requirement for Tier 2 Data Validation to data that are entered into STORET beginning one year after the rule goes into effect. Historical data would not be required to meet Tier 2 data validation. The IWR now commits FL-DEP to consider data from other sources if they meet the State's sufficiency and data quality requirements. In addition, DEP plans to change the terminology slightly for the data assessment. Their Lab staff developed a separate guidance document specific for the IWR, with a smaller subset of required data elements to better accommodate STORET.*

(7) PAGE 6, 62-303.200(15) Definition of TMDL

The definition of a TMDL is inconsistent with the definition in the Clean Water Act by not including a margin of safety and requiring implementation of water quality standards with seasonal variations.

Resolution: *The definition has been modified to be consistent with the definition of "TMDL" used in the CWA.*

(8) PAGE 7, 62-303.300 Methodology to Determine Impairment

See comment #1.

Resolution: *See resolution for Item #1 above.*

(9) PAGE 8, 62-303.410 Exceedances of Aquatic Life-Based Water Quality Criteria

Since the aquatic life-based criteria listed in 62-302 are listed as "not to be exceeded" values, the provisions of this section may be a revision to Florida WQS. This is especially true for the paragraphs which set up exclusions of data collected during certain events or periods. (This comment also applies to similar provisions of other sections of the rule.)

Resolution: *See resolution for Item #1 above.*

(10) PAGE 8, 62-303.410(1)

The 10% exceedance rule does not agree with section 305B guidance for toxics which allows for no more than one exceedance in a 3 year period. The minimum exceedance of 10% is included in EPA's 305(b) guidance only for conventional pollutants, not for toxic parameters.

Resolution: *Unresolved: The IWR provides that exceedances of chronic water quality standards for toxic pollutants will be considered using the binomial statistical approach. We believe that this approach may have merit; however, because of the potential national implications of this decision, the Region is seeking assistance on this issue from EPA Headquarters. It should be noted that in response to EPA's concern, DEP added a provision to the rule to list waterbodies that have more than one exceedance of an acute toxicity -based water quality criterion in a three year period.*

(10) PAGE 8, 62-303.410(1)

EPA is concerned with the Rule's provision to base determination of impairment on a 95% confidence limit. This "high confidence " will assure that waters listed are truly impaired would, however, it could allow for waters that are impaired to not be listed. A lower confidence limit, in the range of 65 to 80%, would provide more assurance that waters are listed and de-listed appropriately, and would provide greater conformity to the section 305(b) guidelines.

Resolution: *The State has modified the confidence intervals for the planning and verified lists. The proposed confidence level of 80% for the planning list and 90% for the verified list are acceptable to EPA. It should be noted that the state developed the*

statistical approach for determining impairment through a technical advisory group which represented a cross-section of the public, and which included scientists and statisticians as well as other non-scientists. The approach is scientifically based and supported by the State's technical advisory group.

(11) PAGE 8, 62-303.410(2)

The primary and possibly sole use of STORET for Florida's listing decisions will exclude use of data from some sources, e.g. USGS, COE who do not use STORET. This would be inconsistent with the CWA which requires consideration of "all existing and readily available water quality-related data and information."

Resolution: *See resolution for Item #6 above.*

(12) PAGES 8 and 9, 62-303.410(3)

The first sentence states that "data older than five years shall not be used to develop draft basin-specific 303(d) lists." This section is inconsistent with EPA guidance and must be clarified to reflect that data older than 5 years will be used for impairment decisions as long as they are valid. The section 305(b) guidelines do not provide that data older than 5 years are not valid. These data are described as evaluated information. Old data should continue to be used as long as it is valid. Newer data should take precedent over older data as long as they are unbiased and of good quality. For the purposes of this rule the same criteria should be applied to their use, i.e., new data collection must follow all of these new rules and a limited data set can not be used to "trump" old data. The new data must show that the waters meet criteria, not merely indicate an improving trend, before the water can be delisted.

Resolution: *This concern is alleviated by specifying that the Planning List will be based on data up to 10 years old and the Verified List on data up to 7 years old. In addition, language has been added to the IWR that "The Department shall consider all readily available water quality data." The State has also agreed that no waters on the 1998 303(d) list will be dropped without being evaluated with at least 10 samples. The monitoring required under the State's Basin Management Cycle will preclude any water "falling off the list" for lack of recent data. Waters that make the planning list based on data older than 5 years will be monitored such that there is sufficient data less than five years old.*

(13) PAGE 9, 62-303.410(4)

The State rule is requiring that a minimum of 10 samples is necessary before the State will assess the water for use impairment. This is inconsistent with section 305(b) guidance which directs the state to use discretion when fewer than 10 samples are available. The

305(b) guidance advises the states to consider "other factors, such as the number of pollutants having a single violation and the magnitude of the exceedance(s)." The section 305(b) guidance intends for the State to consider the data, even if less than 10 samples are available. The section 305(b) guidance allows discretion to be used in determining the use status of the water (not whether to consider the data at all.)

Resolution: *DEP has added language to include waters on the Planning List with less than 10 samples if there are 3 or more exceedances, or if there is more than 1 exceedance of an acute criterion within 3 years.*

(13) PAGE 9, 62-303.410(4)

EPA does not agree with the blanket protocol that all samples collected within a seven day period will be considered one sample and the values will be averaged. A standards violation should be listed as a standards violation if it is measured and not averaged away unless it is designed to be a composite sample under steady state conditions.

Resolution: *The State originally agreed to consider the worst case value over the sampling period, but industry raised the strong objection that the sample showing the worst case is subject to all the statistical variability of any sample and using only that value is scientifically indefensible. The language is currently changed to consider the median value, which is acceptable to EPA only because Florida's chronic toxicity values, developed by EPA to represent a 4-day duration, are specified in the State WQS as "never to be exceeded" values and are therefore much more conservative than originally intended. The rule was also revised to allow for the use of the worst case value if any of the values exceed EPA's acute toxicity-based guidelines.*

The State should define "temporally independent samples".

Resolution: *"Temporally independent samples" are defined to be taken at least a week apart from a given station.*

(14) PAGE 9, 62-303.410(5)

These exceptions are unacceptably vague. Who defines severe drought or storms? A record must be kept showing both the data used and that not used, including the reasons or logic why it was not used to make the impairment decision.

The rule needs to say that the record will include information that data were excluded from the water quality impairment assessment and will provide details about the spill, discharges due to upsets or bypasses from permitted facilities, or other short-term perturbations, including, but not limited to, severe storms and severe droughts.

Resolution: *The exceptions originally found to be vague have been deleted and language has been added that "Outliers identified through statistical procedures shall be excluded from the assessment. However, the Department shall note for the record that the data were excluded and explain why they were excluded."*

(15) PAGE 10, 62-303.410(7)

It is inappropriate for the State to assume that surface water data for mercury, collected before the effective date of the rule, is inadequate for use for § 303(d) listing purposes. Each mercury listing would have to be evaluated and the determination made that the original analysis was flawed (i.e., clean sampling and analytical techniques were not used) before the water body is de-listed. This decision should be documented for each listing.

Resolution: *The State revised the rule to require that mercury data be collected and analyzed using clean techniques. This does not directly exclude any data, but instead requires the State to evaluate each mercury exceedance and determine whether clean sampling and analytical techniques were used before the waterbody is listed. In addition, the State has pointed out that all its previous listings for mercury are based on tissue accumulations in aquatic life, not on mercury levels in ambient waters. This observation, coupled with the State's commitment to include all waters on the 1998 303(d) list on the Planning List, is sufficient to resolve this issue.*

(16) PAGE 10, 62-303.420

It is unclear that these biological methods allow, or include the application of the State's numeric criteria for the Shannon Weaver diversity index. These provisions also appear to modify the State's narrative WQS criteria for biological health, and as such, would be a revision to the State's water quality standards requiring EPA review and approval.

Resolution: *The State added text to clarify that waters that fail the State's biological integrity criteria (which uses the Shannon-Weaver diversity index) will be listed. Florida's biological methods are incorporated by reference. The Rule also states clearly that it is intended only to "interpret existing water quality criteria" for listing, and for no other purpose.*

(17) PAGE 10, 62-303.420(2)

Requiring that there be 2 failed bioassessments (rather than just 1) over a five year period before a water is deemed impaired could result in impaired waters not being listed. One biological sampling should be sufficient unless one is unsure of the result and then one should resample relatively quickly. This section should be reworded appropriately.

The State should define "temporally independent failed bioassessments."

Resolution: *The Rule now requires 1 failed bioassessment.*

The State should consider explaining the acronyms "SCIs" and "BioRecon."

Resolution: *The Rule now modifies the definitions for "SCIs" and "BioRecon".*

(18) PAGE 11, 62-303.420(2)(a)

EPA is opposed to the requirement to identify waters as impaired only where the water is not meeting minimum thresholds for all 3 metrics. This provision allows for too much pollution before finding the water impaired. A water should be found impaired if it is not meeting 2 of the 3 metrics. This should be reworded.

Resolution: *After discussion with FEDP staff involved in development of the Biorecon Survey Method, EPA understands the methodology was developed to be used as a screening tool to identify very high quality waters. Therefore, the scoring level required to fail the metrics were set conservatively high and using a failure rate of 2 of the 3 metrics would likely result in erroneously identifying a large number of streams as biologically impaired. Therefore, we accept the State's position regarding the requirement in 62-303(3)(a) related to the use of the Biorecon metrics for the planning list purposes.*

(19) PAGE 11, 62-303.430

These provisions appear to modify the State's narrative WQS criteria for toxicity, and as such, would be a revisions the State's water quality standards requiring EPA's review and approval.

Resolution: *See note in Item # 16 above regarding interpreting WQS.*
EPA questions why the demonstration of chronic toxicity impairment should be more stringent than the demonstration of acute toxicity impairment by also requiring a failed bioassessment. In EPA's view, impairment is determined by the failure of the chronic toxicity test, (i.e., it is not necessary to also have a failed bioassessment.) It would be appropriate to conduct a second toxicity test to verify the toxicity determination, but in the absence of such a second sampling, the water must be considered impaired.

Resolution: *This issue has been addressed in the latest draft of the rule by requiring that waters that have had two failed chronic toxicity tests be placed on the planning list without the necessity of having a failed bioassessment.*

(20) PAGE 11, 62-303.430(4)

The rule needs to say that the record will include information that toxicity test data were excluded from the water quality impairment assessment and will provide details about the spill, discharges due to upsets or bypasses from permitted facilities, or other short-term perturbations, including, but not limited to, severe storms and severe droughts.

Resolution: *The Rule now commits to explaining why any of these data are excluded.*

(21) PAGES 12-14, 62-303.440, 441, 442, & 443

These sections appear to establish an implementation methodology for the State's narrative criteria for nutrients, and, as such, appear to be revisions to Florida WQS requiring EPA's review and approval.

Resolution: *The IWR now clarifies that any unique methodology specified now applies only for purposes of listing.*

(22) PAGE 12, 62-303.440(1)

It is reasonable to expect that anecdotal and other types of information would be appropriate and significant sources of information in determining whether narrative nutrient criteria are being met. (The State refers to algal mats in sufficient quantities to pose a nuisance or hinder reproduction of certain species in 62-303-441(1).) The State's intention to use STORET as the primary source of data for this determination seems likely to result in the failure to consider all existing and readily available water quality-related data and information since the algal mat information and other anecdotal information is unlikely to be in STORET. The only location this kind of information could be found in STORET is in the "Comments" field, which cannot be searched. STORET can appropriately be considered the primary source of data if specific secondary sources are also noted.

Resolution: *The Rule now provides that "other information" will be considered as well.*

(23) PAGE 12, 62-303.440(2)

There appears to be contradiction concerning whether or not and how data older than five years should be used. The statement is made that data older than 5 years shall not be used to calculate TSIs. Immediately after, the statement is made that more recent data shall take precedence over older data if the newer data indicate a change in water quality, etc. This section needs to be reworded to clarify that data older than 5 years can be used where they are still valid, and where more recent data do not exist.

Biological terms should be defined.

Resolution: *The Rule now specifies ten years as the nominal cut-off for the Planning List and 7 years for the Verified List. See also Item 6 above for consideration of older data.*

(24) PAGE 12, 62-303.440(3)

The State should define "temporally independent samples".

Resolution: *"Temporally independent samples" are defined as taken at least a week apart.*

(25) PAGE 12, 62-303.440(4)

The rule needs to say that the record will include information that data were excluded from the water quality impairment assessment and will provide details about the spill.

Resolution: *The Rule now has such a provision.*

(26) PAGE 13, 62-303.441(1)

EPA encourages the State to follow through with setting the appropriate concentration of chlorophyll a. This is even more important than the presence of algal mats. The entire national thrust of dealing with nutrient impairment is to develop specific numerical interpretations of narrative standards.

Resolution: *Numeric criteria for listing purposes are now included.*

(27) PAGE 13, 62-303.442(1)(a)

A definition of "eutrophic" (and "naturally eutrophic") should be included.

See comment (1) regarding naturally-occurring conditions. The statement "unless paleolimnological information indicates the lake was naturally eutrophic" should be handled by the WQS process of defining site specific natural background.

Resolution: *TSI limits are now specified. See comments above on the limited scope here for interpreting WQS.*

(28) PAGES 14 and 15, 62-303.500(1)(b)

Item "b" is not consistent with 305(b).

Resolution: *Item "b" has been modified.*

(29) PAGE 15, 62-303.500(2)

This provision is unacceptable as written. It says that a water covered by a swimming advisory will not be considered to be impaired if the advisory is based on red tides, sewage spills, and medical wastes, among other things. Red tides, sewage spills, and medical waste are all pollutants which can cause exceedances of water quality standards. If the issue here is that data from short-term, one-time spills or breaks will not be considered in making use-support determinations, the rule should so specify. The current language is too broad. If the issue being addressed is the short-term, one-time issue, the rule needs to specify that the Department will note for the record the data/ information that were excluded and provide details about the swimming advisories. Further, the rule needs to say that the record will include information that data/ information were excluded from the water quality impairment assessment.

Resolution: *This provision has been revised, including a provision that "the Department shall note for the record that data were excluded and explain why they were excluded."*

(30) Page 15, 62-303-600

This section appears to preclude the application of ambient water column data in the determination of the State's fish and shellfish consumption use. EPA objects to this omission in the application of State WQS for this purpose.

Resolution: *The Rule now specifies that "the applicable Class II water quality criteria for bacteriological quality" apply.*

(31) PAGE 15, 62-303.600(1)(b)

Changes in classification of prohibited to unclassified should not affect its listing unless the shellfish area has improved to meet standards.

Resolution: *Although there is a concern by some local citizens that unclassified areas may not be monitored and, therefore, they can never be upgraded or harvested, EPA agrees with FDEP that this is not an issue for the impaired waters rule.*

(32) PAGE 15, 62-303.600(2)

This provision is unacceptable because it is not consistent with the CWA and the federal regulations. The CWA and the regulations require that states list waters which are not attaining the applicable water quality standards. A water with a fish consumption advisory

does not allow full use of the water, therefore, it is impaired, regardless of the pollutant causing the advisory. The federal regulations at 40 CFR § 130.7(b)(6)(iv) specify good cause justifications for not including a water or pollutant on the § 303(d) list. The fact that a TMDL may not be an appropriate mechanism to address a fish consumption advisory is NOT an appropriate reason for determining that a water is not impaired.

Resolution: *This is now addressed in 62-303-370, and is consistent with the CWA.*

(33) PAGE 17, 62-303.800(4)

This section needs to be re-worded. "All segments shall be prioritized based on the following factors:" The reference to "prioritizing" the medium priority segments should be moved to an earlier part of the rule where it is stated that impaired waters will be prioritized for TMDL development by denotation of high, medium, or low priority.

Resolution: *This is now addressed in 62-303-500, and is consistent with the CWA.*

(34) PAGE 17, 62-303.810(2)

This provision is not consistent with the federal regulations. The current federal regulations allow waters not to be listed if there are enforceable control mechanisms in place that will bring the water into compliance with the applicable water quality standards. Guidance specifies that a water may be left off the list IF the enforceable control mechanisms will bring the water into compliance by the next listing cycle (currently within 2 years.) Florida's rule will allow impaired waters to be left off the list if any technologies or pollution control programs will bring the water into compliance at some time in the future. This will not be acceptable to EPA.

Resolution: *The current draft rule (March 14, 2001), at 62-303.100 (5), provides that the State will not list a water on the verified list (the State's Section 303d list) if an existing or proposed pollution control mechanism can demonstrate "reasonable assurance" that water quality standards will be met at some point in the future, and that "reasonable progress" will be made before the next Section 303(d) listing cycle. To resolve this concern, the Region discussed with EPA Headquarters the interpretation of 40 C.F.R. §130.7(b)(1)(iii) which provides that a water may not be listed if an existing pollution control mechanism required by state, local or federal authority will attain the applicable water quality standard. Following these discussions, we have concluded that the State's proposal could be consistent with federal regulations because of the State's requirement for "reasonable assurance" that water quality standards will be met, and "reasonable progress" towards attainment is demonstrated. We have advised the State that a case by case determination subject to EPA review will be necessary for waters left off the State's 303(d) list based on this provision.*

(35) PAGE 18, 62-303.830(2)

Refer to comment (1) regarding "natural" exceedances of an applicable water quality standard.

Resolution: *See resolution for comment (1).*

(36) PAGE 18, 62-303.830(3)

According to 40 C.F.R. Part 130.7, the § 303(d) list must clearly indicate the waters targeted for TMDL development during the next two years. The State rule does not provide for this.

Resolution: *The State acknowledges this deficiency and has agreed to provide a detailed schedule for the two year period following the Section 303(d) list submittal. In fact, the State submitted an FY 2001-2002 TMDL development plan to EPA on March 20, 2001.*

(37) PAGE 19, 62-303.820(2)

The State rule must provide the public with an opportunity to review and comment on § 303(d) list and that opportunity must provide for the conditions described in 40 CFR Part 25, at a minimum.

Resolution: *This is now provided.*

(38) PAGE 20, 62-303.900(1)

The exclusion of waters from the next § 303(d) list must be appropriately supported by good cause justifications that are defined in 40 CFR § 130.7(b)(6)(iv). For each water body/pollutant combination to be de-listed must, a specific good cause justification must be provided.

Resolution: *A commitment to provide this is now included.*

(39) PAGE 20, 62-303.900(2)

Water segments may be removed from the § 303(d) list after demonstration that the waters meet ALL applicable water quality standards and not just the designated use portion of the standards.

The language of the draft State rule indicates that delisting decisions will be based solely on new data without any consideration of the historical data for the water. This may be appropriate for some cases, but it is inappropriate for all.

The exclusion of waters from the next § 303(d) list must be appropriately supported by good cause justifications that are defined in 40 CFR § 130.7(b)(6)(iv). For each water body/pollutant combination to be de-listed must, a specific good cause justification must be provided.

Resolution: *The Rule now provides for good cause justification.*

(40) PAGE 20, 62-303.900(2)(a)2.

Under the current regulations, delisting of a water may occur if implementation of enforceable pollution control requirements are expected to result in attainment of all applicable water quality standards within two years. When the new regulations go into effect, this time frame will be extended to 4 years.

Resolution: *See response to Response 34.*