An Assessment of Methodology and Data Interpretation in the Catawba-Wateree Recreation Use and Needs Study (REC01)

Prepared for:
Catawba-Wateree Relicensing Coalition

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Introduction

The purpose of this document is to respond to the following two items at the request of the Catawba-Wateree Relicensing Coalition:

1. Review the entire study and supporting documentation and provide comments.
3. Assess the interpretation of data and final report.

In the pages that follow, I will comment on the study methodology and data interpretation outlined by the Louis Berger Group (LB) in the Catawba-Wateree Recreation Use and Needs Study (REC01). Before beginning that discussion, though, I would like to make two editorial suggestions. First, in section II.B., LB mentioned the provision of "opportunities for persons with disabilities," then went on the refer to this population as "the handicapped" (p. 4). The word "handicapped" is outdated, and should be changed to "persons with disabilities." Secondly, in section III.C.1, the word "proceeding" (p. 14) should be changed to "preceding."

STUDY METHODOLOGY

DATA COLLECTION

Mail-Back Survey

There was a sizeable difference between the number of surveys mailed to shoreline residents (n = 4,494) and the number of surveys actually delivered (n = 3,310). Why were so many of these surveys undeliverable? The sample of shoreline residents was selected from Duke Power's shoreline permits database and the sample of backlot residents was selected from housing and condominium residential community databases for those communities with

common boating facilities. A large number of undeliverable surveys may indicate an incomplete or out-of-date database.

Also, LB explained that shoreline residents were selected via a sampling strategy which stratified by lake, but they did not explain how backlot residents were selected from the housing databases.

The final report did not specify when mail-back were surveys sent out. In another lake carrying capacity study conducted in Maryland, researchers divided the total number of buffer strip permit holders into three equal subsets (ERM, 2004). One-third of the permit holders were each surveyed in June, July, and August. According to the study, this approach was advantageous because it "controlled for weather-related effects on recreational use and other factors that have the potential to skew the results of the study" (ERM, p. 7).

On-Site Surveys

Regarding on-site sampling techniques, LB described their use of a stratified random sampling strategy for selecting days of the week and times of day during which sampling took place. They did not, however, describe how individual users were sampled during those randomly selected days and times. Was one member of every user group interviewed? If so, how was this individual selected? Interviewers may have inadvertently approached a certain type of person (e.g., someone similar to him/herself in terms of age, gender, or other identifying characteristic) from each group to complete the survey. If this was the case, selection bias on the part of the interviewer may have had an effect on the representativeness of the resulting data. For example, it was stated in the final report that, "[o]f the people who were interviewed at the public recreation areas, 28 percent were female and 72 percent were male" (p. 43). Do these percentages reflect the gender distribution of *all users* in the intercepted groups, or merely the *individuals* from those groups who were approached to complete the survey? Since spot counts on the lake did not report any information about boat passengers, an overall gender distribution of users was not clear from the final report.

How did interviewers handle situations when multiple user groups were exiting the recreation areas simultaneously? If all groups could not be interviewed, did the interviewer

employ random sampling techniques to select a single group? Again, selection bias may have affected the validity of the sample.

Potential Visitor Survey (Survey C)

The percentage of surveys that were received from potential visitors was very low (19.9%). Was a follow-up mailing utilized? Dillman's (2000) method for mail-back surveys is widely known in survey methodology, and consists of a follow-up postcard and a second round of surveys (with cover letter and postage-paid return envelope) for members of the sample who do not respond to the first solicitation.

Peak Season vs. Non-Peak Season

Data were collected under the assumption that peak season fell between May and September. Even though visitation estimates demonstrated that the month of April received more visitors than September (see p. 48), the data were still analyzed with April as a non-peak month. Only after the Study Team provided comments on the draft study was the peak season was redefined to include the month of April. Some data collection efforts (e.g., aerial counts) did not take place during the month of April, but no explanation of or correction for this discrepancy appeared in the final report.

Stakeholder Survey

It was unspecified whether the stakeholder survey that was distributed to federal, state, and local resource planning agencies and relicensing teams included instructions on *who* from the agency should complete the survey. Did the person with the most knowledge of the study area complete the survey? Also relating to this survey is the low response rate (44%). While a 44% response rate might be acceptable in some cases, it is especially low in this situation, considering that this group was comprised of stakeholders (i.e., those with a vested interest in the study). Again, Dillman's (2000) techniques for mail-back surveys would have worked well here to increase response rate.

Traffic Counters

Calibration of the traffic counters was a wise inclusion. However, the fact that some counters did not record any data for long periods of time – sometimes months – raises a red flag. Were counters ever recalibrated over the course of the study period? If the counters stopped recording data because they had been tampered with, then the validity of the data could be in question.

The extrapolation of data from functional traffic counters to those sites with missing data (e.g., Wateree Creek Access Area, where the counter was stolen; other sites where data was not recorded for periods of time) affects the validity of the data. Extrapolating data to fill in missing values can be problematic when it is unknown whether there were significant differences between respondents (i.e., sites with consistent traffic count data) and non-respondents (i.e., sites with missing traffic count data).

Aerial Counts

Aerial photographs did not provide enough detail for the researchers to distinguish boat types. Thus, all of the boat distribution information came from on-water observation. There is nothing methodologically unsound about relying upon on-water observation for distribution figures; other boating carrying capacity studies have faced the same issue. It should be noted, however, that there are some aerial photography techniques that are detailed enough to be able to differentiate among various boat types.

DATA ANALYSIS

Recreation Use Assessment

Public Area Visitors

To estimate the total number of public area visitors to a Project lake, LB used the traffic count data and the average group size, obtained from on-site interviews. The figure calculated for average group size was an overall mean, representing data collected over the course of the entire study. This grand mean was then multiplied by the traffic count subtotals, and the resultant products were the figures reported for monthly total visitation,

peak recreation season visitation, non-peak recreation season visitation, and total visitation during the study period. Use of an overall group size mean as the multiplier assumes that group size remained consistent from month to month and between peak and non-peak recreation season. It may be, however, that group size varies from month to month or between peak and non-peak seasons (e.g., groups may increase in size during peak season because there are more holiday weekends and children are not in school). This trend would be masked by the use of an overall mean group size as a multiplier.

Shoreline Residents

Recreation use for shoreline residents was calculated using shoreline permit database information obtained from Duke Power combined with survey information on shoreline residents' recreation participation days. Only 43.7% of shoreline permit holders and backlot residents returned the survey. Using respondents' reported use behavior to represent the entire population of shoreline residents assumes that those who did not respond to the survey would have responded similarly to those who did respond. Perhaps those shoreline residents who took the time to complete the mail-back survey were fundamentally different from residents who did not respond. For example, respondents may have been more prone to complete the survey because they were more frequent users of the recreation area. (Note that this is merely a hypothetical example of nonresponse bias.) In order to determine if nonresponse bias did indeed exist, the researchers would need to make an effort to contact a sample of nonrespondents and convince them to complete the survey. Reported use behavior from these former nonrespondents could then be compared to initial respondents' use behavior to test whether there were any significant differences.

Potential Visitors

Recreation use for potential visitors was estimated using responses from mail-back Survey C. LB stated that "more than half of the respondents completing the survey did not indicate a location where they primarily participate in recreation activities" (p. 15). Perhaps a map should have been included in the survey instrument to encourage more respondents to specify a primary recreation location. The inclusion of a map may also have assisted in more accurate identification of primary use areas. Assuming that nonrespondents recreate at lakes

and river reaches with the same primary location distribution as respondents could be problematic; perhaps nonrespondents did not provide a response because they did not know the name of the recreation area in which they were recreating. This may have been because the area was more remote or obscure, in which case, application of the primary recreation location distribution of respondents to nonrespondents would be invalid.

Regarding the confidence intervals calculated for population estimates, the interpretation of the interval can be stated as follows: "Based on our sample data, we are 95% confident that the true population mean falls between __ and __." I am not sure that this interpretation of confidence intervals comes across in the explanation on pages 15 and 16.

Boat Carrying Capacity Assessment

The Bureau of Outdoor Recreation's (BOR) (1977) *Guidelines for Understanding and Determing Carrying Capacity* and Warren and Rea's (1989) *Management of Aquatic Recreational Resources* are common references in the recreational carrying capacity literature (e.g., EDAW, 2004a, 2004b; ERM, 2004). LB explained that they decided to use Warren and Rea's guidelines instead of BOR's because of Warren and Rea's inclusion of a social capacity component. In fact, however, Warren and Rea based their work on the earlier BOR report. The incorporation of both physical and social carrying capacities is a feature common to some other recreational carrying capacity studies (e.g., ERM, 2004).

In addition to the physical and social components, however, it should be noted that some other recreational carrying capacity studies include an ecological component (e.g., EDAW, 2004a, 2004b). Ecological capacity is one of the four categories of carrying capacity outlined by Shelby and Heberlein (1986) in their seminal work, *Carrying Capacity in Recreation Settings*. The remaining three categories are social capacity, facility capacity, and physical/space capacity. Shelby and Heberlein's book is a cornerstone of the recreational carrying capacity literature, but was not mentioned in the LB study.

Usable Lake Surface Area

A significant component of lake carrying capacity estimation is usable lake surface area. To calculate usable surface area, LB explained that they first calculated the total

surface area at full pond, then subtracted island areas, all isolated areas not accessible by boat from the main lake, a 120-foot buffer around the entire lake, and shallow areas where boating was not likely to occur. The subtraction of a buffer zone is a common practice in calculating usable surface area, and 120 feet is a relatively conservative buffer zone width. Typical buffer zone width ranges from 100 to 200 feet. The other measures taken (e.g., removing island areas and shallow areas) would also result in a more conservative estimate.

If a conservative estimate were the goal, though, one other step that could have been taken would have been to consider the lake at its *minimum* depth so as to account for depth fluctuations. Even though "[s]urvey results indicate that lake levels during the study period did not negatively affect the ability of recreation users to access the water during the study period" (p. 127), fluctuating lake levels *do* have an effect on carrying capacity estimates, since they influence usable surface area.

The explanation of the summation of Warren and Rea's (1989) assessment factors on page 18 would have been clearer if a "-1" were written instead of just the negative sign since the process is additive and results in a numeric assessment factor (e.g., -2). Warren and Rea did not include the numeral, either, which was probably why LB chose not to, but the explanation in the original context was clearer because Warren and Rea's example was embedded within a more detailed explanation, while LB's example was just one isolated part of the final report.

Bating Carrying Capacity Assessment Factors

Regarding Warren and Rea's (1989) second assessment factor, multiple use of water area, it is not necessarily the case that the presence of multiple user groups will result in conflict. In fact, in other carrying capacity studies, it was found that the majority of conflict-related comments dealt specifically with personal watercraft (PWC). So for lakes or river reaches where PWC usage is either low, contained within a certain area, or prohibited, a negative assessment factor may not be accurate.

How is the third assessment factor, shoreline configuration, operationally defined? A study discussed in the accompanying document, *Techniques for Estimating Boating Carrying Capacity: A Literature Review*, offers a measure called shoreline development factor, which

is calculated by comparing the actual length of the shoreline around a lake to the minimum shoreline length of a lake with the same area (i.e., if the lake were a perfect circle) (Progressive Architecture Engineering, 2001). This size-independent measure could be applied to the lakes contained in the study area in order to compare relative shoreline regularity.

Since bathymetry data were incorporated into the determination of usable surface area, the application of Warren and Rea's (1989) fourth assessment factor, amount of open water, may be extraneous.

Perceived crowding in the present study was assessed using a 5-point Likert-type scale, anchored by the response options of "not at all crowded" (1) and "extremely crowded" (5). Other studies reviewed have used this 5-point scale; however, another commonly used perceived crowding measures use the 9-point scale proposed by Shelby and Heberlein (1986). The 9-point scale provides more opportunities for analysis, such as categorizing three groups of response options as low (1-3), moderate (4-6), and high (7-9).

Boating Density Assessment

Two experts in the field of GIS were asked to review the section on boating density calculations using ESRI ArcGIS. Both remarked that the procedure outlined on page 20 seemed solid, so long as the data collection efforts behind the analysis were valid and reliable.

Recreation Needs Assessment

Recreation Facilities Need Assessment

North and South Carolina's Statewide Comprehensive Outdoor Recreation Plans (SCORPs) were used to estimate regional population participation behavior. "The demand population for 2004 was estimated by taking the average of the North Carolina SCORP (1999) and South Carolina SCORP (2002) participation rates (percentage of population participating per recreational use category) and days (average number of days participation per recreational use category) and multiplying these estimates by the impact zone population for the counties within the Project area" (LB, p. 23). In this situation, a *weighted average*

may have been more appropriate than a conventional mean, since the population of the study area (i.e., the demand population) is comprised of more North Carolina residents than South Carolina residents.

Economic Value of Recreation Assessment

In the recreation field, *economic impact* and *economic value* are not synonymous. (See Appendix A, *The Economics of Recreation*, for a detailed description of the differences.) The Impact Analysis for Planning (IMPLAN) economic impact program is designed to analyze the direct, indirect, and induced impacts of *new money* injected into the economy of a study area. To use IMPLAN, the study area must first be operationally defined, and then only money spent within the study area by those who live outside of the study area can be included in the analysis. LB, however, incorporated local resident spending into the analysis. The fact that 87% of respondents to surveys A, B, and C were residents of counties adjacent to the Project (see p. 121) further strengthens the case that a revised economic impact analysis should be conducted.

The National Park Service (NPS) reinforces the notion that local resident spending should not be included in economic impact studies. In their publication, *Economic Impacts of Parks and Recreation Resource Book* (1992), NPS provides an equation for calculating park-related expenditures which reads:

(Number of Park Visitors From Out of Region)*(Average Total Overnight Visitor Expenditures) = (Park-Related Expenditure).

In this particular case, "out of region" is defined as distance greater than 100 miles from the park, but an economic impact analysis can be conducted on any area, large or small, as long as the region is operationally defined.

Despite the fact that residents of the study area cannot technically contribute to an economic impact analysis, the fact that a large majority of respondents were local residents is important because it means that residents are not leaving the area to participate in recreation activities. When recreation opportunities are unavailable or undesirable in a particular area, residents often travel to other areas to recreate. The dollars they spend on recreation then

leave the region, which is what recreation economists call *leakage*. Leakage can be minimized through the provision of attractive local recreation opportunities.

LIMITATIONS

Recreation Use Estimates

Regarding traffic counters, LB reported that not every counted vehicle belonged to a recreation area user group. Maintenance vehicles, for example, enter and exit recreation areas on a routine basis. Researchers could have considered a consultation with public recreation area management to ascertain the maintenance schedule of these areas. Park managers and their staff rely on operations and maintenance plans to guide them through their routine duties, so a fairly accurate estimate of maintenance vehicle traffic could have been made and the traffic count data adjusted accordingly.

Future Use Estimates

Using surrogate activities to project future recreation use for activities that do not currently take place in the study area may result in issues similar to those of nonresponse bias discussed above.

RESULTS AND DISCUSSION

Comparison to 1999 Recreation Use Study – Recreation Use

"The 2004-2005 study results showed a marked increase in annual visitation at the public recreation areas. However, with the exception of Lake Norman and Lake Wylie, the relative percentage of visitation among the lakes is very similar to the 1999 results" (LB, p. 59).

Lake Norman and Lake Wylie, however, comprise over 50% of total visitation to the study area. Changes in visitation distribution at these major lakes should not be dismissed so casually. Also, there was a considerable change in the distribution of recreation activities from 1999 to 2004-2005, but these changes were not commented on, either.

Study Area Recreation Resources – Summary by Development

This section is quite straightforward; I have no comments on these summaries. I was asked to try to clarify the recommendation regarding swimming areas at Lake Norman, but the study's recommendations on page 91 are too general to translate to something meaningful.

APPENDIX A

Boating Carrying Capacity

The boating carrying capacity calculations that appear in Appendix A were based on the methodology outlined by Warren and Rea (1989). A study I reviewed in the accompanying literature review critiqued Warren and Rea's method because it "did not maintain the boating use mix" (ERM, 2004, p. 9). What was meant was that the observed percentages of watercraft types (i.e., distribution) were not incorporated into the calculation of optimum carrying capacity per watercraft type, the sum of which is an optimum BAOT estimate). Since LB followed the model outlined by Warren and Rea, this same problem of not maintaining the boating mix is carried over to the present study. For example, in Table A.1-22 (p. A-35), the percent usage for fishing is specified as 44%. This percentage, along with the percent usages indicated for other boating activities in the table, were the result of on-water observation. The optimum boat activity mix of 358 fishing boats, however, does not comprise 44% of the total BAOT recommendation of 769 boats. The same holds true for the other boating activities, supporting ERM's argument that the boating mix was not maintained in the calculation of optimum boating capacity.

I met with Dr. Phil Rea (personal communication, August 17, 2005) to discuss this discrepancy, and while we agreed that the boating use mix was not maintained in the original Warren and Rea (1989) methodology, we also found that the new carrying capacity equations provided by ERM (2004) were incomplete. Application of the procedure developed by ERM did not result in the estimates that were given in the accompanying tables. At the present time, then, there is no ideal method for estimating optimum carrying capacity for various

watercraft types. However, the overall capacity recommendations of this all seem reasonable, despite the fact that the capacity recommendations for watercraft types are inaccurate.

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APPENDIX A

The Economics of Recreation:
A Terminological Clarification

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In the expansive body of research on recreation and leisure, there are three words that, at first glance, are used in a seemingly interchangeable way to describe the economic effects of recreational programs and events: ***economic impact***, ***economic benefit***, and ***economic value***. Although we might consider these to be synonymous in colloquial speech, there is a distinct meaning associated with each expression. Clear working definitions of these concepts are necessary so that we may communicate planning strategies and goals in an accurate manner. We have developed the following resource in an attempt to provide such definitions, along with a list of works for suggested further study (if desired).

Economic Impact

"Economic impact is defined as the net change in the host economy as a result of spending attributed to a parks and recreation special event" (Turko & Kelsey, p. 3).

Of the three terms listed above, *economic impact* is the most straightforward. Economic impact assessments are conducted to demonstrate the importance of an event, to help gain tax support, and to enhance department image, among other reasons (Turko & Kelsey, p. 6). Researchers seem to agree on a common definition of economic impact, and this definition includes the point that economic impact studies do not consider local resident spending as a component of the equation, because their spending does not inject *new money* into the economy.

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Economic Benefit

"The economic definition of benefits really concerns the measurement of the value of goods and services which contribute to an individual's utility or well-being" (Johnson & Brown, 1991, p. 385).

While economic *impact* is fairly straightforward, the terms *benefit* and *value* prove to be more problematic, especially considering that they function as synonyms in everyday language. Johnson and Brown's definition of *economic benefit* (see above) provides a simple summary of a complex issue, but it should be noted that other definitions appear in the literature, as well. Some of these definitions complement the concepts outlined by Johnson and Brown, while others are contradictory. It is up to you to develop your own operational definition of economic benefit, and to then use the term in a consistent, appropriate manner.

Driver et al. (1991), in their textbook *Benefits of Leisure*, provide two classifications of an economic benefit that complement Johnson and Brown's (1991) idea of a benefit as a manifestation of the measurement of value. The first is from the perspective of the economist, where a benefit signifies "an economic gain, measured in monetary terms (or, as strictly defined, a 'potential Pareto improvement')" (p. 4). This application of this type of economic benefit would be found primarily in cost/benefit and economic impact analyses, and correlates with Johnson and Brown's above statement concerning the measurement of perceived value.

The second type of benefit described by Driver et al. (1991) is: "a *change* that is viewed to be advantageous – an improvement in condition, or a gain to an individual, a group, to society, or to another entity" (p. 4). But Godbey et al. (1992) found that "few individuals associated local recreation and park services with economic benefits" (p. 81). Therefore, one way to distinguish between economic *benefit* and economic *value* is to say that economic benefits are those positive societal changes resulting from park and recreation programs, while economic value is perceived at the individual level (more on economic value in the following section).

This distinction between societal benefits and individual values corresponds to Driver et al.'s first definition, since individual constituents have little interest in the overall economic impact of a recreation program. This is confirmed in the Parks and Recreation Federation of Ontario's (1992) comprehensive publication, *The benefits of parks and recreation: A catalogue*, in which the economic benefits that are listed are primarily societal. Economic benefits include:

- Recreation as a preventive health service.
- Parks and recreation services as an attractor for business relocation and expansion.
- Parks and recreation as a catalyst for tourism.
- Leisure services helping to decrease vandalism and crime.

None of these benefits are likely to be items that individual constituents would report when asked to describe the benefits of their local park and recreation department.

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Economic Value

"Economic value is the amount of money one is willing to exchange for a good or service" (Peterson & Loomis, 2000, p. 218).

As mentioned in the previous section, economic value can be interpreted as an individual's perceptions of the positive changes that result from recreation. These perceptions can be converted into dollars through a willingness to pay inquiry. Reports by Bishop (1987) and Godbey et al. (1992) confirm the role of willingness to pay as a measure of economic value. Godbey et al. also add that value is correlated with personal use of parks. In other words, those constituents who assign a higher monetary value to recreation services are more likely to be frequent users of these services. Peterson and Loomis note, however, that it is difficult to measure "the nonpriced component of the economic value of outdoor recreation" (p. 220), and even costly methods such as travel cost analysis and contingent valuation have their flaws.

Peterson and Loomis propose that, "'value' is an expression of human preference and appreciation" (p. 215). Johnson and Brown (1991) state that, "economic values…are a function of consumer behavior" (p. 389), which relates to Peterson and Loomis' conclusion, since consumer behavior is indeed a reflection of preference and appreciation.

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