TAPOCO PROJECT
FERC NO. 2169

CHEOAH RIVER RECREATION STUDY

FINAL REPORT

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EXECUTIVE SUMMARY

This report details methodologies and results from a four-part recreation study of the Cheoah River downstream of Santeetlah Dam in North Carolina. The study was commissioned by Alcoa Power Generating Inc., Tapoco Division (Tapoco) as part of relicensing the existing Tapoco Project (FERC No. 2169). The study was specifically designed to address issues raised by resource agencies and stakeholders participating in the relicensing process (herein referred to as Participants), and involved extensive input, review, and active participation by Participants.

The study included a characterization of the river as a recreation resource (Part 1), a field evaluation of whitewater and angling opportunities at several different river flows (Part 2 – controlled flow study), an assessment of potential future use of the resource (Part 3), and an evaluation of the potential regional economic impacts of future recreation use (Part 4). The river characterization was conducted through field reconnaissance by trained recreation professionals and the Participants. The evaluation of whitewater opportunities was conducted in close coordination with American Whitewater and regional paddling clubs and involved boating and fishing the river at several different river flows ranging from 75 to 1,130 cubic feet per second (cfs). A total of 44 volunteers (10 anglers and 34 boaters) participated in the study using a variety of fishing gear (fly, spin, and bait) and boating crafts (kayaks, canoes, and rafts). Study participants recorded their observations and experiences at each test flow using a standardized survey designed specifically for the study. The assessment of potential future use involved an assessment of regional angling demand and development of a "paper model" to assess physical and social carrying capacities for whitewater boating on the river. The paper model was developed in close coordination with the U.S. Forest Service, using the USFS's Recreation Opportunity Spectrum (ROS) methodology, and other Participants. The potential regional economic impacts of future recreation use were evaluated based on extensive input from Participants (specifically those knowledgeable of whitewater business operations), a literature review of available user expenditure data, and use of a widely accepted economic input/output model - IMPLAN.

Results of the study indicate that the Cheoah River is characterized by a very continuous average gradient of 100 feet/mile, a rocky bedrock substrate, and a fairly narrow confined stream channel. The river also exhibits dense vegetation, not only along its shores but also within the river channel itself, particularly in the upper reaches of the river. These physical characteristics directly affect the recreation opportunities on the river and as the results of the surveys show, can strongly influence how these opportunities are related to streamflow.

The Cheoah River offers the potential for both angling and whitewater boating opportunities. These opportunities are a function of the physical characteristics of the river, relatively easy access, and proximity (both to major population centers and to other recreation destination sites). Opportunities are also a function of streamflow, with angling activities requiring relatively low flows and whitewater boating activities requiring relatively high flows. At flows around 1,000 cfs and greater, study participants indicated that the Cheoah River offers unique whitewater boating opportunities.

Results of the controlled flow study indicate that the optimum flow for angling on the Cheoah River, within the range of flows tested, is between 75 and 100 cfs. Six out of the ten angling participants rated 75 cfs as the best, with over 75 percent of the participants indicating that they would return to fish the river at similar flows. Flows of 670 cfs and higher offered almost no opportunity for angling and are clearly unsuitable for this activity. When asked if they would return at these higher flows, 90 percent of the study participants said “no”.

With regard to whitewater boating opportunities, study results indicate that optimum conditions (within the range of flows tested) for kayaks and canoes occurred at 1,130 cfs (the highest tested flow), while optimum conditions for rafts occurred at 1,010 cfs. Flows of 950 cfs and 1,010 cfs were also noted as providing good opportunities for kayaking and canoeing, with over 90 percent of the kayakers and canoeists participating in the study indicating that they would return to the river under similar conditions. Study results indicate that the flow of 670 cfs was particularly poor for rafting, with numerous groundings due to shallow water depths and limited route options. When asked about commercial rafting opportunities, participants indicated

that they would not pay for the whitewater experience at 670 cfs. All boaters noted that drops were steeper and more dangerous, with shallower landings at 670 cfs.

Results from the potential future use analysis indicate that annual angling use of the river could vary considerably depending on whether the river is managed as a cold water or a warm water fishery. If the river is managed as a cold water Delayed Harvest trout stream, it is estimated that the river would attract approximately 12,800 trips/year. If the river is managed as a warm water fishery, it is estimated that it would attract approximately 2,600 trips/year. Results relative to whitewater boating indicate that use could range from approximately 900 to 1,400 people/day (assuming eight hours of boatable flows in day) depending on future management decisions and the level of desired social interaction. The maximum safe physical capacity of the river for whitewater boating was estimated at approximately 2,800 people/day.

Results from the regional economic impact analysis indicate that future recreational use of the river, including angling, commercial rafting, and private boating, could result in an annual increase in total output for Graham County (measured as the dollar value of annual production in the county) of between $133,000 and $455,000 per thousand users, depending on the management scenario. Increased employment in the county could range from 1.9 to 11.5 per thousand users, depending on the management scenario. By far, the largest potential economic impact to the county would be associated with future commercial rafting activity. This would be particularly true if commercial outfitters were to actually locate in the county. Currently there are no outfitters located in Graham County.

Additionally, new or modified recreational facilities may be necessary to support whitewater boating and angling on the Cheoah River. A subcommittee of the Recreation and Aesthetics Workgroup met on July 17, 2001 to discuss the need for new or modified recreational facilities and to evaluate the parking capacity along the river corridor. Based on conversations with the subcommittee, if the river becomes a whitewater river and/or a recreational fishery it is likely that put-in and take-out areas will need to be improved, as will access to the river along Highway 129. Specifically, the subcommittee discussed the area immediately below Santeetlah Dam as a potential put-in site and the Cheoah River Tailrace Access Area and/or the Magazine

Branch Boat Access Area as potential take-out areas. The feasibility and cost of many of the proposed recreational facilities will be discussed in an addendum to this report.

1.0 INTRODUCTION

The Tapoco Division of Alcoa Power Generating Inc. (Tapoco) is in the process of relicensing its Tapoco Hydroelectric Project (Tapoco Project or Project) with the Federal Energy Regulatory Commission (FERC). The Tapoco Project is located on the Little Tennessee River and Cheoah River in North Carolina and Tennessee. Tapoco is utilizing an alternative approach to the traditional FERC relicensing process, the Applicant Prepared Environmental Assessment (APEA) that has been approved by the FERC. As part of the APEA process Tapoco has engaged agencies, non-governmental organizations (NGOs), and other interested participants (collectively, the Participants) in an open process to identify issues to be addressed through relicensing.

One of the issues raised by the Participants early in the process was concern about the potential impacts of relicensing on recreation activities and opportunities on the Cheoah River downstream of Santeetlah Dam. This report presents the results of a four-part recreation study conducted on the Cheoah River (Cheoah River Recreation Study) to address specific recreation resource issues raised by the Participants. The four parts of the study are:

Part 1 - River Characterization;
Part 2 - Controlled Flow Assessment;
Part 3 - Potential Future Use Analysis; and
Part 4 - Regional Economic Impact Assessment.

Chapter 2 of this report, following this introduction, provides details on the river characterization and controlled flow assessment (Parts 1 and 2 of the study). Chapters 3 and 4 provide details on the potential future use analysis and the regional economic impact assessment (Parts 3 and 4 of the study). All materials presented in Chapter 2 were previously presented in an interim report, which was reviewed extensively by the Participants in the winter and spring of 2001, modified to reflect comments, and finalized in July 2001. All materials presented in Chapters 3 and 4 were previously distributed and reviewed by Participants during Tapoco

Relicensing Recreation and Aesthetics Technical Work Group (Work Group) meetings held between June and September 2001.

In addition to these four analyses, a subcommittee of the Recreation and Aesthetics Workgroup met in Tapoco, North Carolina on July 17, 2000 to discuss the need for new or modified recreation facilities to support whitewater boating and angling on the Cheoah River and to evaluate the parking capacity along the river corridor. Any requests for new or modified facilities are discussed in Chapter 5.

2.0 RIVER CHARACTERIZATION AND CONTROLLED FLOW ASSESSMENT

The river characterization and controlled flow portions of the study were conducted on the Cheoah River downstream of Santeetlah Dam in July 2000. These analyses focused on evaluating opportunities for angling and whitewater boating at a range of flows from 75 cfs to 1,130 cfs. The evaluations were developed and conducted in cooperation with the relicensing Participants and involved over 40 volunteer anglers and boaters (see Appendix A). A draft study plan describing proposed recreation studies on the Cheoah River, including the river characterization and flow study was distributed for Participant review by Tapoco on May 5, 2000. Based on comments received from resource agencies and interested parties, Tapoco released a final study plan for the river characterization and controlled flow release portions of the study (Parts 1 and 2) in July 2000. This final study plan focused specifically on the recreation flow study and included revised flow targets and expanded survey questionnaires. The methods used in conducting the flow study are described in detail in this final study plan. These methods are briefly reiterated in Section 2.1 of this report for completeness. Section 2.2 of this report presents the results of the study. Results are presented for angling and whitewater boating separately in Sections 2.2.1 and 2.2.2, respectively.

2.1 Methods

The following briefly describes the methods used for the controlled flow assessment conducted on the Cheoah River from July 11 through 14, 2000. These methods are described in more detail in a final study plan released by Tapoco on July 6, 2000.

A Controlled Flow Assessment technique (Whittaker, 1993) was employed to evaluate opportunities for angling and whitewater boating at a range of flow conditions. A predetermined group of study participants fished and boated the river under a set of controlled release flows. Study participants were identified and selected primarily by the boating and angling communities with American Whitewater and Trout Unlimited playing a lead role in coordinating formulation of the final study team with Tapoco. Staff from the Nantahala Outdoor Center (NOC) were also contracted to provide safety during the study and to furnish rafts and guides for the rafting

evaluation. Participants recorded their experiences and observations using two survey instruments - one completed immediately after each test flow (Single Flow Survey), and one completed at the end of the study (after all test flows had been experienced) (Comparative Survey). Copies of the survey instruments are included in Appendix B. Survey forms were completed by each of the study participants. Responses on the survey forms represented each participant's personal experience. While completing the survey, study participants were asked to not discuss their responses with other participants. Participants also participated in open discussion sessions held after the individual survey forms were completed for each test flow and at the end of the study.

Responses recorded on the survey forms were compiled and analyzed using standard statistical procedures. Responses were compared across the different test flows to assess how different flows affect opportunities and the quality of the experience, as well as to assess minimum acceptable and optimum flow levels for each evaluated recreation activity. Minimum acceptable flows were determined by an average rating score equal to 0.0, often referred to as the "neutral" line or the point at which 50 percent of the study participants would return if given the opportunity to recreate on the river again under the same flow condition. Optimum flows were determined based on the highest average overall quality rating. Comments made during the open discussion sessions were also compiled and summarized.

The study area included approximately nine miles of the Cheoah River from Santeetlah Dam to the confluence of the Cheoah and Little Tennessee Rivers. Two distinct reaches of the river were evaluated for boating - from the General Store (RM 7) to the USFS Bridge (RM 2), and from the USFS Bridge (RM 2) to the Little Tennessee River (RM 0). Three reaches were evaluated for fishing: (1) from just below Santeetlah Dam (RM 9) to the General Store (RM 7); (2) from the General Store to the USFS Bridge (RM 2); and (3) from the USFS Bridge to the confluence with the Little Tennessee River (RM 0) (including the area around Tapoco Lodge).

Whitewater boating opportunities were evaluated for kayaks, canoes, and rafts. The specific kayak designs varied depending on the user. All rafts were sixteen-foot non-bailing

rafts. Some participants changed craft types during the study. A variety of fishing gear types was also employed and evaluated during the study, including flies, bait, and lures.

Target flows were identified based on a review of the physical characteristics of the river channel (width, substrate, gradient), available hydrologic information, discussions with resource agencies, non-governmental organizations, and individuals who had boated the river and had experience conducting recreation flow studies on other rivers. Target flows were adjusted during the study based on observed conditions. Four flows were evaluated for angling: 75 cfs, 100 cfs, 670 cfs, and 950 cfs. Four flows were also evaluated for boating: 670 cfs, 950 cfs, 1,010 cfs, and 1,130 cfs. Target flows were released over the course of four days, with two flows evaluated on two of the days. Flows were released and evaluated in the following order: 100 cfs, 75 cfs, 950 cfs, 670 cfs, 1,130 cfs, and 1,010 cfs. The 1,010 cfs flow was selected on-site during the study based on observation of the experience of 670 cfs, 950 cfs, and 1,130 cfs and discussions with study participants. To reduce study bias, participants were not told the actual flow volumes. Rather they were told the relative magnitude of flows compared to the first flow (950 cfs) which was set as the "100 percent" flow. The second flow (670 cfs) was expressed as 75 percent of the first flow and the third flow was expressed as 125 percent of the first. The fourth flow (1,010 cfs) was expressed as 110 percent of the first flow and was chosen as a target flow by the participants during open discussion sessions after boating the 100 percent, 125 percent, and 75 percent flows. The actual test flows were not exactly equal to 75 percent, 125 percent, and 110 percent due to the control structures at the dam and the inability to release highly precise flow volumes.

Many of the participants had never boated the river before. Their first experience on the river was the first test flow (950 cfs). Target flows were specifically not sequenced in an ascending or descending order to prevent introduction of unnecessary bias. However, the ordering of the flows invariably has some influence on results, particularly when users are learning the river for the first time during the study. The use of two survey instruments, one completed directly after each flow, and one completed at the end of the study comparing all four flows was intended to account for ordering bias and allow for a test of its potential influence. Not all study participants experienced all flows and therefore not all participants completed an

overall comparative survey at the end of the study. Some boaters specifically chose not to boat the 125 percent flow (1,130 cfs) based on their experience at the 100 percent flow (950 cfs). Not all boating participants were able to participate for all three days of boating flows. Consequently, a fewer number of boaters experienced and rated the fourth test flow (1,010 cfs) than did the other three flow levels.

Several of the questions contained in the survey instruments asked participants to evaluate the quality of their experience based on a scale from –2 (unacceptable) to +2 (excellent). These rating scores were defined in a Definition of Terms printed on all the survey instruments as follows:

> Unacceptable - A condition that you do not consider to be acceptable for your activity. You would not choose to recreate on the river under these conditions if given the opportunity in the future.
>
> Poor – The activity is doable, but the quality of the experience is poor. Given the opportunity to recreate on the river under these conditions in the future, 75 percent of the time you would choose not to come.
>
> Marginal – The experience is acceptable. Given the opportunity to recreate on the river under these conditions in the future, you would choose to come 50 percent of the time (i.e. 50/50).
>
> Good – The experience is notable and something you would go out of your way for. Given the opportunity to recreate on the river under these conditions in the future, 75 percent of the time you would choose to come.
>
> Excellent – An outstanding experience of very high quality. Something you would definitely make a special effort to do if given the opportunity in the future.

2.2 Results

Results from the recreation flow study are presented below. These include results from the two survey instruments used (one completed after each flow test – referred to as Single Flow Survey, and one completed at the end of the study – referred to as Overall or Comparative Survey) and the open discussion sessions held after each test flow. Results are presented first for the angling evaluation and then for the boating evaluation.

2.2.1 Angling

A total of ten anglers participated in the flow study. Three of these anglers fished using bait, four fly-fished, and three fished with a spin reel using lures. Participants were distributed along the river with between two and four participants evaluating each reach at each test flow. The majority of the study participants stated that they were of an intermediate skill level (six out of ten). Three of the anglers considered themselves experts and one angler did not specify a skill level. In some cases, responses differed depending on location, gear type, and skill level. Where such differences were observed, they are noted below. Of these variables, the one that appears to have had the most influence on responses was location, with flow preferences differing somewhat depending on the river segment. However, due to the relatively small sample size, it is difficult to draw definitive conclusions about the relative influence of location, gear type, or skill on the evaluations of different flow levels.

2.2.1.1 Quality of Experience

Results from the angling evaluation indicate that anglers preferred the lower two flows tested (75 cfs and 100 cfs) to the higher flows of 670 cfs and 950 cfs. The relationship between flow and the overall quality of the angling experience is shown graphically in Figures 2.1 and 2.2. Both of these figures display mean[1] ratings of quality using a scale from one to five with a one being "unacceptable" and a five being "excellent". Figure 2.1 displays data from the Single Flow Survey administered

[1] In response to stakeholder comments - given the relatively limited range and discrete nature of the available response categories (-2 to +2) in the survey question, means, as opposed to medians, better illustrate differences

immediately after each flow, which asked users the following question: *"How would you rate the overall angling experience at this flow?"* Figure 2.2 displays responses from the Comparative Survey completed at the end of the study, which asked participants to rate the overall quality of all four test flows by responding to the following question: *"Provide an overall evaluation for each of the flows you experienced during this study."* The first panel of Figures 2.1 and 2.2 display mean overall experience ratings for each test flow. The 95 percent confidence interval about each mean is also displayed as well as the minimum and maximum rating. The second panel of Figures 2.1 and 2.2 display scatter diagrams of responses for each test flow. The numbers within the panels illustrate the frequency distribution of responses. These figures show that when evaluating each flow independently, participants tended to rate the quality of the experience as similar for 75 cfs and 100 cfs. When asked to evaluate the overall experience of each flow relative to one another at the end of the study, participants tended to rate 75 cfs as slightly better than 100 cfs. However, this difference is not statistically significant.

Figure 2.3 uses a series of bar graphs to further illustrate the frequency distribution of responses derived from the Comparative Survey responses regarding the overall quality of each flow. These data show that responses for 75 cfs and 100 cfs were very similar and that 670 cfs and 950 cfs both received a high proportion of "unacceptable" ratings.

The basic relationship between experience quality and flow level shown in Figures 2.1, 2.2, and 2.3 was similar regardless of skill level or gear type. However, differences were observed by river segment. Figure 2.4 compares mean overall quality ratings from the Single Flow Survey for each of the three reaches. These results indicate that river segment 1 (closest to the dam) was rated better at 75 cfs than at 100 cfs, but that river segment 2 received higher ratings at 100 cfs than at 75 cfs. River segment 3 (below the USFS bridge) received almost identical ratings for both 75 cfs and 100 cfs.

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between responses at different flows. For this reason, results of the angling rating questions are illustrated and discussed using mean as opposed to median values.

2.2.1.2 Flow Preferences

After each test flow, study participants were asked the question *"Compared to this flow level, would you prefer a level that was higher, lower, or about the same?"* Data from this question are displayed in Figure 2.5. Responses to 670 cfs and 950 cfs were almost identical, with the vast majority of participants indicating that they would have preferred much lower flows. However, at these two flows, some anglers did indicate a preference for similar flows. River segment 3 appears to be more acceptable for fishing than segments 1 and 2 at higher flows.

Responses to 75 cfs and 100 cfs were also very similar, with participants fairly evenly split between preferring lower flows, higher flows, and no change. This split in preference is partly explained by observed locational differences. At both 75 cfs and 100 cfs, preferences for lower flows were only noted in river segment 1, with no preferences for higher flows noted in this segment. Preferences for higher flows were noted in both river segments 2 and 3, with 100 percent (2 out of 2) of the participants expressing a preference for higher flows in river segment 3 at 75 cfs, and two thirds (2 out of 3) of the participants expressing a preference for higher flows in river segment 2 at 100 cfs.

2.2.1.3 Advantages and Disadvantages

Noted advantages and disadvantages tended to be similar for the two lower flows (75 cfs and 100 cfs) and for the two higher flows (670 cfs and 950 cfs). Advantages frequently noted at the lower flows included the ability to cast, water velocities, and the depth of pools. The only disadvantage frequently noted at the lower flows was the inability to walk the shoreline due to vegetation. At the higher two flows, few participants noted any advantages. Frequently noted disadvantages included water velocities and an inability to wade.

2.2.1.4 Safety

All of the study participants indicated that they observed safety hazards at 670 cfs and 950 cfs. Typical hazards noted included slick rocks and no visibility, lack of shoreline and inability to wade, fast water, and big boulders with steep drop-offs that were difficult to see. A high percentage (75 percent) also noted observing safety hazards at 100 cfs. Typical hazards noted included slick rocks and no visibility, and difficult access due to vegetation. At 75 cfs, only two of the ten participants noted safety hazards. Hazards noted were slick rocks and no visibility, and big boulders with steep drop-offs that were difficult to see.

2.2.1.5 Requisite Skill Level

When asked to rate the suitability of each flow for different skill levels, nine out of the ten angler participants indicated that the higher two flows (670 cfs and 950 cfs) were unacceptable for novice or intermediate anglers. These flows were also rated as "poor" or "unacceptable" for advanced skill levels. The majority of the participants noted that 75 cfs and 100 cfs were generally "good" for novice and intermediate anglers, and "good" to "excellent" for advanced anglers.

2.2.1.6 Would You Return?

Angler responses to the question, "G*iven the opportunity to fish here again at the same flow level, would you choose to return?*" indicate that both 75 cfs and 100 cfs are attractive for fishing, with eight out of ten study participants indicating that they would return at these flows. The opposite was true for 670 cfs and 950 cfs, with only one out of ten participants indicating that they would return under either of these flows. These results are displayed graphically in Figure 2.6. Responses to this question did differ somewhat by location. In river segments 1 and 2, a few of the participants (2 out of 7) indicated that they would not return at flows of 75 cfs or 100 cfs. In river segment 3, all the participants (5 out of 5) indicated that they would return at these flows. At the higher flows of 670 cfs and 950 cfs, none of the participants indicated that they would return to river segments 1 or 2, but half of the participants indicated that they would return to river

segment 3, at both flows. These results suggest that river segment 3 may be more desirable for fishing than river segments 1 or 2, at the higher flows and may be less sensitive to flow in terms of its overall attractiveness for angling.

2.2.1.7 Comparison to Other Rivers in the Region

In comparing angling opportunities on the Cheoah River to opportunities on other rivers in the region, participants noted that the Cheoah was similar, but a little less desirable than the Tuckaseegee and Watauga Rivers, and less desirable than the Nantahala River. The Nantahala River was noted as being more desirable in all the parameters evaluated. The Tuckaseegee and Watauga were noted as being more desirable in terms of having more available fishing spots, greater ability to walk the shoreline, and better wadability. Several other regional rivers were identified and evaluated, but too few participants had sufficient experiences on those other rivers to draw any broad conclusions from the results.

2.2.1.8 Open Discussions

The following summarizes key points made during the discussion sessions about each of the test flows.

75 cfs (angling flow # 2)

- River access was noted as poor because of dense streambank vegetation.
- Deep pools of water near the streambanks also complicated river access.
- A fishing guide participating in the discussion said he would only organize guided trips on the Cheoah River for very experienced anglers because the wading is difficult (in addition to a lack of a unique fishing opportunity).
- Another angler commented that wading the Cheoah at this flow was the hardest wading he has ever seen.
- One angler felt that the lower section was less fishable at 75 cfs than 100 cfs because the depth of the pools decreased.
- Many thought this flow would be appropriate for novices.

100 cfs (angling flow # 1)

- Collectively, the anglers agreed that access to the river was poor at this flow.
- A dense understory of kudzu and other vegetation made the streambank difficult to maneuver.
- Anglers in the middle section (from the General Store to the Forest Service bridge) could not walk along the banks at all.
- Despite some slick rocks, many of the anglers agreed that wading was difficult but not dangerous at this flow.
- Deeper water in the lower section of the river (below the Forest Service bridge) made wading very difficult.
- Anglers noted that this flow provided deeper pools and therefore, more cover and better habitat than 75 cfs.
- In general, the anglers agreed that more anglers would come to fish the Cheoah River at this flow.
- When comparing 100 cfs to 75 cfs, the anglers in the upper section, just below the dam, preferred 75 cfs, anglers in the middle section expressed no preference, and anglers in the lower section preferred 100 cfs.

670 cfs (angling flow # 4)

- Anglers noted this flow as difficult to fish.
- Anglers assigned to the upper section suggested that it was possible to fish just below the dam, where the water was very clear.
- Others thought it possible that "hard-core" anglers would fish the Cheoah at this flow, but not themselves.

950 cfs (angling flow # 3)

- Anglers found this flow poor to unacceptable for fishing and believed it to be a waste of time.
- There was no other discussion.

2.2.2 Whitewater Boating

A total of 34 paddlers participated in the flow study, including 16 kayakers (including safety boaters), 14 rafters (including guides), and four canoeists (two open boats and two decked boats). Twenty-one of these participants boated the river at all four test flows. The exact number of each craft type varied at each flow. Participation also varied by reach. Table 2.1 displays the number of paddlers by craft type that boated the upper reach at each of the four test flows. Sample sizes differed slightly in the lower reach, but were very similar to those shown in Table 2.1.

Table 2.1 – Number of participants and craft types represented at each test flow - upper reach.

CRAFT	**TYPE**	**TEST FLOW LEVEL (cfs)**			
		670 (flow #2)	**950** (flow #1)	**1,010** (flow #4)	**1,130** (flow #3)
Kayak	Play	11	9	7	11
	River	0	2	0	0
	Creek	3	6	5	5
Canoe	Open	2	3	2	2
	Decked	2	1	1	1
Raft	16’	14	11	7	14
Total		32	32	22	33

Most of the boating participants were of an expert skill level (50 percent). Advanced paddlers were the second most represented skill level (38 percent). Intermediate and novice skill levels were less represented (10 percent and 2 percent, respectively). All of the intermediate and novice paddlers were in rafts. In some cases, responses differed depending on location, craft type, and skill level. Where such differences were observed, they are noted below. Of these variables, the one that appears to have had the most influence on responses was craft type, particularly between hard boats (kayaks and canoes) and rafts. River segment also appeared to influence responses,

with the lower segment (below the USFS Bridge) generally receiving higher ratings than the upper segment, regardless of the flow.

2.2.2.1 Quality of Experience

Results from the boating evaluation indicate that, across the range of flows tested, on average, the quality of the whitewater boating experience increased as flows increased. This was true for data from the Single Flow Survey as well as the Comparative Flow Survey. In evaluating each flow individually on the Single Flow Survey, study participants generally rated the lowest test flow (670 cfs) as providing a marginal experience (mean rating of 0.1, on a scale of –2.0 to +2.0), and all other test flows (950 cfs, 1,010 cfs, and 1,130 cfs) as providing either a good or excellent overall experience (mean scores of 1.2, 1.5, and 1.9 respectively). The highest flow tested (1,130 cfs) received the highest overall mean score (1.9). Results from the Comparative Flow Survey also indicate that 950, 1,010, and 1,130 cfs were considered good to excellent with mean scores of 0.9, 1.4, and 1.8 respectively. The 670 cfs test flow was rated as poor (mean score of -1.1). These results show that after completing all four test flows, participants downgraded their rating of 670 cfs from a single flow rating of 0.1 to a comparative flow rating of –1.1 on a scale of –2 to 2.

Tables 2.2 and 2.3 show mean overall quality ratings from the Single Flow Survey and the Comparative Flow Survey, respectively. In response to stakeholder requests, Tables 2.4 and 2.5 provide overall median quality ratings from the Single Flow Survey and Comparative Flow Survey respectively. Given the relatively limited range and discrete nature of the available response categories (-2 to +2) in the survey question, means appear to better illustrate differences between responses at different flows. For this reason, results of the rating questions are illustrated and discussed below using mean as opposed to median values.

Tables 2.2 and 2.3 list mean responses by craft type and skill level, as well as for all crafts and all skills combined for the single flow evaluations and comparative flow evaluations respectively. Table 2.2 also distinguishes responses by river segment. These

data show that combined watercraft ratings were generally consistent between the two survey instruments as well as across different skill levels and craft types. However, there is considerable variability in the ratings for 670 cfs between the single flow and comparative flow responses and between different craft types, as noted above. Some differences between rafters and hard boaters (kayakers and canoeists) can also be seen at 1,010 cfs, with rafters rating their experience as better than kayakers or canoeists at this flow.

The data presented in Table 2.2 also show observed differences between the upper and lower river segments. The overall trends are similar for these two segments, but the lower segment was consistently rated as providing a higher quality experience than the upper segment, particularly at 670 cfs, but also at 950 cfs. Differences are much less pronounced at the two higher flow levels.

Table 2.2 – Mean ratings of the overall whitewater experience based on evaluations from Single Flow Survey.

FLOW (CFS)		**670**			**950**			**1010**			**1130**		
Stretch		Upper	Lower	Overall	Upper	Lower	Overall	Upper	Lower	Overall	Upper	Lower	Overall
Kayak													
Beginner													
Novice													
Intermediate													
Advanced		0.3	1.3	0.7	0.9	1.2	1	1	1.4	1.2	1.7	2	1.8
Expert		0.1	1	0.6	1.3	1.4	1.3	1	1.6	1.4	1.8	1.9	1.8
All Skill Levels		0.3	0.8	**0.5**	1.1	1.3	**1.2**	1.2	1.5	**1.4**	1.8	1.9	**1.8**
Open Canoe													
Beginner													
Novice													
Intermediate													
Advanced		-1.5	-1	-1.3	1	*1*	1	1.5	1.5	1.5	2	1.8	2
Expert													
All Skill Levels		-1.5	-1	**-1.3**	1.3	1.5	**1.4**	1.5	1.5	**1.5**	2	2	**2**
Raft													
Beginner													
Novice		*1*	*1*	1				*2*	*2*	2	*2*	*2*	2
Intermediate		-0.7	0.5	-0.2	1	1.7	1.3	2	2	2	2	2	2
Advanced		*0*	0	0	1	0.5	0.8				1.5	1.8	1.7
Expert		-0.5	0	-0.3	1.8	1.8	1.8	2	2	2	2	2	2
All Skill Levels		-0.2	0.1	**-0.1**	1.2	1.5	**1.3**	2	2	**2**	1.8	1.9	**1.9**
All Craft													
Beginner													
Novice		*1*	*1*	1				2	2	2	2	2	2
Intermediate		-0.7	0.5	-2	1	1.7	1.3	2	2	2	2	2	1.8
Advanced		-0.8	0.3	0.1	0.9	1	1	1.1	1.4	1.3	1.7	1.9	1.9
Expert		-0.9	0.7	0.3	1.4	1.5	1.5	1.4	1.6	1.5	1.8	1.9	2
All Skill Levels		-0.7	0.3	**0.1**	1.1	1.4	**1.2**[1]	1.5	1.6	**1.5**[2]	1.8	1.9	**1.9**[3]

Notes:

Results in italics are based on a single observation

Kayak = play, river, creek, C1, IK

Raft = raft

Open Canoe = OC1

[1] Statistically different from rating of 670 cfs (0.1), t(97) = -6.12, p=.000

[2] Statistically different from rating of 950 cfs (1.2), t(108) = --2.13, p=.035

[3] Statistically different from rating of 1010 cfs (1.5), t(-2.951) = -2.13, p=.004

Table 2.3 – Mean ratings of the overall whitewater experience based on evaluations from Comparative Flow Survey.

FLOW (CFS)		**670**	**950**	**1010**	**1130**
Stretch		Overall	Overall	Overall	Overall
Kayak					
Beginner					
Novice					
Intermediate					
Advanced		-0.4	1	1	1.8
Expert		-1.5	0.8	1.1	1.7
All Skill Levels		**-1.2**	**0.8**	**1.1**	**1.8**
Open Canoe					
Beginner					
Novice					
Intermediate					
Advanced		-1.5	1	1	2
Expert					
All Skill Levels		**-1.5**	**1**	**1**	**2**
Raft					
Beginner					
Novice		*1*		2	2
Intermediate		-2	1	2	1.5
Advanced		-1.5	0	*2*	1.5
Expert		0	1.7	2	2
All Skill Levels		**-0.8**	**1.1**	**2**	**1.8**
All Crafts					
Beginner					
Novice		*1*		*2*	*2*
Intermediate		-2	1	2	1.5
Advanced		-0.9	0.8	1.1	1.8
Expert		-1.2	1	1.3	1.8
All Skill Levels		**-1.1**	**0.9**[1]	**1.4**[2]	**1.8**[3]

	Notes:	*Results in italics are based on a single observation.*	[1] Statistically different from rating of 670 cfs (-1.1), t(25) = -8.91, p=.000
		Kayak = play, river, creek, C1, IK	[2] Statistically different from rating of 950 cfs (0.9), t(22) = --3.10, p=.005
		Raft = raft	[3] **Not** Statistically different from rating of 1010 cfs (1.4)
		Open Canoe = OC1	

Table 2.4 – Median ratings of the overall whitewater experience based on evaluations from Single Flow Survey.

FLOW (CFS)		**670**			**950**			**1010**			**1130**		
Stretch		Upper	Lower	Overall	Upper	Lower	Overall	Upper	Lower	Overall	Upper	Lower	Overall
Kayak													
Beginner													
Novice													
Intermediate													
Advanced		0	1	1	1	1.5	1	1	2	1	2	2	2
Expert		1	1	1	1	2	1	1	2	2	2	2	2
All Skill Levels		1	1	**1**	1	1.5	**1**	1	2	**2**	2	2	**2**
Open Canoe													
Beginner													
Novice													
Intermediate													
Advanced		-1.5	-1	-1.5	1	*1*	1	1.5	1.5	1.5	2	2	2
Expert													
All Skill Levels		-1.5	-1	**-1.5**	1	1.5	**1**	1.5	1.5	**1.5**	2	2	**2**
Raft													
Beginner													
Novice		*1*	*1*	1				*2*	*2*	2	*2*	*2*	2
Intermediate		0	0.5	0	1	2	1	2	2	2	2	2	2
Advanced		*0*	0.5	0	1	0.5	1				2	2	2
Expert		-0.5	0	0	2	2	2	2	2	2	2	2	2
All Skill Levels		0	0	**0**	1	2	**1**	2	2	**2**	2	2	**2**
All Crafts													
Beginner													
Novice		*1*	*1*	1				2	2	2	2	2	2
Intermediate		0	0.5	0	1	2	1	2	2	2	2	2	2
Advanced		0	1	0	1	1	1	1	2	1	2	2	2
Expert		1	1	1	1	2	2	2	2	2	2	2	2
All Skill Levels		0	1	0	1	1.5	1	2	2	2	2	2	2
	Notes:	*Results in italics are based on a single observation.*											
		Kayak = play, river, creek, C1, IK											
		Raft = raft											
		Open Canoe = OC1											

Table 2.5 – Median ratings of the overall whitewater experience based on evaluations from Comparative Flow Survey.

FLOW (CFS)		**670**	**950**	**1010**	**1130**
Stretch		Overall	Overall	Overall	Overall
Kayak					
Beginner					
Novice					
Intermediate					
Advanced		-1	1	1	2
Expert		-2	1	1	2
All Skill Levels		-2	1	1	2
Open Canoe					
Beginner					
Novice					
Intermediate					
Advanced		-1.5	1	1*	2*
Expert					
All Skill Levels		-1.5	1[1]	1[1]	2[1]
Raft					
Beginner					
Novice				*2*	*2*
Intermediate		-2*	1*	2*	1.5
Advanced		-1.5	0	*2*	1.5
Expert		0	2	2*	2*
All Skill Levels		-1.5	1.5	2*	2
All Crafts					
Beginner					
Novice				*2*	*2*
Intermediate		-2	1	2	1.5
Advanced		-1	1	1	2
Expert		-2	1	1.5	2
All Skill Levels		-2	1	2	2
	Notes:	*Rating is a constant consisting of at least 2 observations. *Results in italics are based on a single observation.* There are no beginner or novice observations in data set.		Kayak = play, river, creek, C1, IK Raft = raft Open Canoe = OC1	

A statistical analysis of the data shown in Tables 2.2 and 2.3 indicates that the mean values shown for all crafts and skills combined are statistically different from one test flow to the next, with the exception of 1,010 cfs to 1,130 cfs, as reported in the Comparative Flow Survey. These results suggest a statistically significant increase in the quality of the experience as flows increased from 670 cfs to 950 cfs, from 950 cfs to 1,010 cfs, and from 1,010 cfs to 1,130 cfs, with the notable exception of 1,010 cfs to 1,130 cfs in the Comparative Flow Survey analysis. These results further suggest a greater gain in experience quality per increase in flow rate as flows were increased from 670 cfs to 950 cfs and from 950 cfs to 1,010 cfs, than as flows were increased from 1,010 cfs to 1,130 cfs. This result is partly explained by the fact that some users, particularly rafters, gave 1,010 cfs the highest rating while other users, particularly kayakers and canoeists gave 1,130 cfs the highest rating. This is discussed further below.

Data from Tables 2.2 and 2.3 are shown graphically in Figures 2.7 through 2.10. Figures 2.7 and 2.8 show mean responses for all study participants combined for the Single Flow and Comparative Flow surveys, respectively. Figures 2.9 and 2.10 show the data for each craft type, again for the Single Flow and Comparative Flow surveys, respectively.

The first panel of Figure 2.7 displays mean overall experience ratings for each test flow based on responses provided immediately after each flow (Single Flow Survey, question #5). The 95 percent confidence interval for each mean is also displayed as well as the minimum and maximum rating. The second panel of Figure 2.7 displays a scatter diagram of responses for each test flow from the same Single Flow Survey question. The numbers within the figure illustrate the frequency distribution of responses. Both panels of Figure 2.7 display ratings of quality based on a scale from -2 to +2 with a -2 being "unacceptable" and a +2 being "excellent" (see Section 2.0, Methods, for the definitions of terms). For the purpose of this analysis, results from the upper and lower river segments were combined, which results in a larger sample size. Figure 2.8 displays very similar information, but the data is derived from question #5 in the Comparative Flow Survey.

Figures 2.7 and 2.8 both indicate that the quality of the whitewater boating experience increased as flows increased across the range tested. Both figures also show a relatively large difference in the quality of the experience between 670 cfs and 950 cfs, with less of an increase in quality as flows increased from 950 cfs to 1,130 cfs. Mean rating scores for 1,010 cfs and 1,130 cfs were almost identical between the two survey instruments. However, a comparison of Figures 2.7 and 2.8 indicates that participants tended to downgrade their ratings of 670 cfs and 950 cfs after having seen the higher test flows (i.e. scores were higher on the Single Flow Survey right after experiencing the flow, than they were on the Comparative Flow Survey that allowed participants to compare all four flows at the end of the study). It should be noted that the data shown in Figure 2.8 represents a subset of the users represented in Figure 2.7 as not all participants completed the Comparative Survey form. Sample sizes for the data points shown in Figure 2.7 were between 32 and 34 individuals, with the exception of the 1,010 cfs flow, which involved a smaller sample size of 24 individuals. Sample sizes for the data points shown in Figure 2.8 were between 24 and 27 individuals. Some of the differences seen between the data in Figures 2.7 and 2.8 may be due to changes in sample sizes and the specific individuals represented in the data sets.

Figures 2.9 and 2.10 display responses to the single flow survey and comparative flow survey respectively partitioned by watercraft type. The data displayed in these figures suggest a very similar relationship between flow and experience quality, regardless of craft. However, the magnitude of the ratings and differences between flows did differ depending on the craft. This was particularly true on the Single Flow Survey for the lowest test flow of 670 cfs (see Figure 2.9). At this flow level, the combined upper and lower river rating was –1.3 for canoes, -0.1 for rafts, and 0.5 for kayaks. These ratings indicate a poor experience for canoeing, a marginal experience for rafting, and a marginal to good experience for kayaking at 670 cfs. Differences between watercraft are evident in ratings of 1,010 cfs, as visible in Figure 2.9, with rafting participants giving this flow a higher rating than kayakers or canoeists.

Figure 2.10 displays Comparative Flow Survey data similar to Figure 2.9. These data show that kayakers and rafters both downgraded their ratings of the lowest flow (670 cfs) relative to comparison with all four flows. They also show that these same two user groups downgraded their ratings of 950 cfs relative to comparison with all four flows. Figure 2.10 indicates that rafters considered 1,010 cfs a considerably higher quality experience (2.0) than kayakers or canoeists (1.1 and 1.0, respectively). This is consistent with the data shown in Figure 2.9, but indicates an even larger difference between these two user groups Figure 2.11 displays single flow rafter responses to flow by skill level. These data show that novice paddlers generally provided higher ratings for 670 cfs.

In addition to evaluating mean responses for each type of craft, the distribution of responses among the five rating categories for each craft were also examined. These distributions are shown for each flow level and each craft type in Figures 2.12 and 2.13. Figure 2.12 shows responses from the Single Flow Survey, while Figure 2.13 shows responses from the Comparative Flow Survey. Both figures show a general migration of responses towards "good" and "excellent" as flows increased. One notable difference is that Figure 2.12 shows a relatively high proportion of "good" ratings for kayaks and rafts at 670 cfs, while Figure 2.13 demonstrates that participants downgraded their ratings of the 670 cfs to "poor" and "unacceptable", particularly kayakers. Figures 2.12 and 2.13 illustrate relatively similar distributions of responses at 950 cfs, 1,010 cfs, and 1,130 cfs.

2.2.2.2 Flow Preferences

In the Single Flow Survey, participants were asked the following question after each test flow: *"Compared to this flow level, would you prefer a level that was higher, lower, or about the same?"* Responses to this question are shown in Figure 2.14 for each of the major craft types. These data show that in all cases, there were at least a few participants that always expressed a preference for higher flows. However the proportion of these responses generally decreased as flows increased. Similarly, the proportion of participants expressing a preference for no change generally increased as flows increased. These results are consistent with the overall experience trends discussed in the section above.

2.2.2.3 Advantages and Disadvantages

Advantages and disadvantages were noted at all flow levels. At 670 cfs, the most commonly noted advantages were "opportunities for technical maneuvering" and "aesthetics." The most commonly noted disadvantages were "rocks to dodge" and "no clear path through the rapids." Other noted disadvantages associated with this flow included "lack of challenge", "risk to swimmers", "lack of depth for rolling", and "pin potential." At 950 cfs, the most commonly noted advantage was "opportunities for technical maneuvering." The most commonly noted disadvantage was a "lack of ability for learning/teaching." A lack of shoreline eddies was noted as another disadvantage at this flow, as well as at higher flows. At 1,010 cfs, the most commonly noted advantage was the "availability and size of waves." No particular disadvantages were frequently noted at this flow. At 1,130 cfs, the most commonly noted advantages were "exciting/thrilling ride" and "overall power of the water." No particular disadvantages were frequently noted at this flow. Safety concerns, including the presence of trees and brush, the vegetation, confined channel, and risks to swimmers were noted as disadvantages at all four flow levels.

2.2.2.4 Safety

Safety hazards were noted by study participants at all flow levels. Brush and trees were noted as significant safety hazards at all flow levels. Specific comments regarding vegetation in the channel included the following "mistakes would magnify quickly for inexperienced boaters with the number of trees and lack of eddies on shoreline," and "trees and shrubs along the shoreline prevent access to the shore." Other specific hazards noted by participants are listed below by flow level.

670 cfs (boating flow # 2)

- a lot of pin spots
- rocky, too shallow
- several big drops

- too tight for rafts

950 cfs (boating flow # 1)

- lot of debris and narrow channel
- continuous
- a lot of pin spots
- small eddy before big drop

1,010 cfs (boating flow # 4)

- hazardous to swimmers

1,130 cfs (boating flow # 3)

- lots of pin spots
- small eddy before big drop
- hazardous to swimmers
- very technical maneuvers require no mistakes be made
- big ledges, big holes
- speed at which a swimmer could be separated from raft

2.2.2.5 Requisite Skill Level and Difficulty Rating

When asked to rate the suitability of the river for different skill levels, participants noted that overall the river was unacceptable for novice paddlers (78 percent), unacceptable to poor for intermediate paddlers (30 percent and 27 percent, respectively), and good to excellent for advanced and expert paddlers. Reported suitability for advanced and expert boaters increased with increasing flows. The reported suitability for novice and intermediate paddlers remained relatively constant regardless of the flow. These results indicate that, at the flows tested, the Cheoah River requires advanced or expert whitewater skills.

Participants were also asked to provide an assessment of whitewater difficulty for the river after each flow using the International River Difficulty Classification System. Combining responses for all flows and both river segments, the vast majority of the participants rated the river overall as a Class IV (40 percent) or Class III-IV (38 percent). The lower river segment was consistently rated as more difficult than the upper segment, with 55 percent of the respondents rating the lower segment as Class IV and only 25 percent of the respondents rating the upper section as Class IV. The reported level of difficulty also increased with increasing flow. In the upper river segment, the percentage of respondents rating the level of difficulty as a Class IV increased from a low of six percent at 670 cfs to a high of 50 percent at 1,130 cfs. Similarly, in the lower river segment, the percentage of Class IV-V ratings increased from six percent at 670 cfs to 37 percent at 1,130 cfs.

2.2.2.6 Would You Return?

After each test flow, boaters were asked, "*Given the opportunity to boat here again at the same flow level, would you choose to return?* " Responses are shown graphically in Figure 2.15. At 670 cfs, slightly more than half the participants (55 percent) indicated that they would not return. Responses for 950 cfs, 1,010 cfs, and 1,130 cfs were almost identical, with over 95 percent of the participants indicating that they would return under similar flow conditions. These results suggest that the minimum acceptable flow for whitewater boating (as defined by the point at which 50 percent of boaters indicate they would not return under similar flow conditions) is somewhere between 670 cfs and 950 cfs.

When asked why they would return, or not return, the following reasons were noted. Items are listed in order according to how many participants noted the reason. All listed items were mentioned by two or more participants. The number of participants noting each item is shown in parentheses. It should be noted that not all participants provided reasons for their response.

670 cfs – Reasons for Not Returning (boating flow # 2)

- too low (12)
- too much work (3)
- no play – slow (3)

670 cfs – Reasons for Returning (boating flow # 2)

- challenging, but not intimidating, good play spots (3)
- for teaching (2)
- exciting, fun, awesome (2)
- could bring more friends at this level than higher level (2)
- would return at this level, but not as often (2)

950 cfs - Reasons for Returning (boating flow # 1)

- challenging at this level, was rewarding (4)
- fun for a technical rafter (4)
- fun with enough play (4)
- thrilling, total whitewater, long rapids and a lot of maneuvers (3)
- good run and experience (3)
- it was long enough, has good technical whitewater, surfing waves, and holes (3)
- challenging, but not intimidating, good play spots (2)
- it was fun, many enjoyable rapids; very nice river compared to primary alternatives, Pigeon, Ocoee, and Nantahala (2)

1,010 cfs - Reasons for Returning (boating flow # 4)

- fun with enough play (6)
- exciting, fun, awesome (4)
- good run and experience (3)
- would return at this level, but not as often (2)

1,130 cfs - Reasons for Returning (boating flow # 3)

- exciting, fun, awesome (8)
- fun with enough play (4)
- best whitewater in the Southeast (3)
- the increased flow dramatically improved this run, outstanding (3)
- challenging at this level, was rewarding (2)
- fun, big drops, great surf (2)

2.2.2.7 Comparison to Other Rivers in the Region

In comparing whitewater opportunities on the Cheoah River to other rivers in the region, the vast majority of study participants noted that overall the Cheoah River was more desirable at optimum flow levels than almost all the other rivers in the region, including the Nantahala, Tuckaseegee, Ocoee, Hiwassee, Big Laurel, Pigeon, Nolichucky, and French Broad. The only two rivers in the region noted as providing similar opportunities to the Cheoah River were the Chattooga and Tellico Rivers. This result was also true for most of the specific characteristics that participants were asked to compare, including the size and difficulty of the rapids, play boating opportunities, rafting, river running, eddy hopping, technical maneuvering, and river gradient. Where this result did not hold true was in regard to the suitability of the river for novice and intermediate boaters. Most of the other rivers in the region were noted as being more desirable for novice and intermediate boaters. The Chattooga, Tellico, and Big Laurel were noted as being similar to the Cheoah in this regard. Other exceptions were the observation that the Ocoee was similar to the Cheoah for play boating, rafting, and eddy hopping. The Nolichucky was also noted as being similar to the Cheoah for eddy hopping. The Cheoah was noted as being similar to many of the other rivers in the region with regard to driving distance, shuttle, access, scenery, and water quality.

2.2.2.8 Open Discussions

The following summarizes key points made during the discussion sessions. General comments about the river overall are listed followed by comments relative to each of the test flows.

Overall Comments

- Many of the participants noted that the road alongside the river, Highway 129, had "park and play" potential and provided increased opportunity for scouting and safety. However, many also noted that the road is not noticeable, by sight or sound, when on the river lending to the river's "remote" feeling.
- Participants noted advantages of the Cheoah River as a whitewater run, beyond the quality of the river itself, included the rural nature of the surrounding area, the proximity to other recreational opportunities (such as hiking in the Joyce Kilmer Memorial Forest), and the warm water.
- Most boaters reported that the put-in and take-out areas were satisfactory.
- Several boaters commented that the Cheoah was "unique" in character, and would be a good addition to paddling in the southeast.

670 cfs (boating flow # 2)

Several boaters and rafters commented that there was more time to watch, read, and learn on the river at this flow. Several thought that the upper mile and a half of the river at this flow could be appropriate for teaching small instructional groups. It was noted that at this flow, less experienced boaters would be afforded more reaction time and controllability and the upper stretch of the river would become available to more boaters. Boaters recognized bigger eddies and more vertical drops along the run at this flow. Several boaters commented that there were still some good play spots behind the Tapoco Lodge.

Overall, the run at this flow was described by many boaters as "bonier and sharper" than at higher flows. Many stated that the decreased water depth made the run less continuous with few to no play spots. It was also noted that shallow

water made rolling dangerous. Several boaters commented that they felt the potential to be pinned on drops was greater at this flow. It was noted that three boating participants cracked their boats during this run. Someone commented that at this flow, the lines below the Forest Service bridge became less definite, hence harder to follow and potentially more dangerous.

Collectively, the rafters agreed that rafting was unacceptable at this flow and that they would not pay to do this run. At this flow, the rafts were "getting stuck on everything."

950 cfs (boating flow # 1)

Boaters reported that 950 cfs was very boatable and a "great run." Most participants agreed that the quality of the run was a result of a combination of factors including continuous rapids, great play areas, and many technical spots. Participants reported that they found the river to be diverse from top to bottom.

Several of the participants commented that they felt "relatively safe" during their trip down the Cheoah. However, several safety issues were cited as disadvantages to the run at this level. Sharp rocks and foot entrapments for "swimmers" (boaters dislodged from their craft) were identified as safety concerns. In fact, the safety crew limited study participation during this first release flow because they felt that additional runs were required (more guide training) before inexperienced rafters should boat. One or more of the guides suggested that the Cheoah at this flow would not be appropriate for instruction, citing safety as the main concern. Some boaters listed carrying capacity and a limited number of small eddies (few resting or recovery opportunities) as concerns. Other concerns noted were reduced site lines and the possibility of taking the wrong channel. Many thought that 950 cfs was challenging, but not the optimal.

Rafters reported the flow to be enough water to run the river without getting stuck, but not so much that they felt out of control. One raft guide noted that the instream vegetation in the upper reach would make commercial rafting on the Cheoah difficult. Several other boaters emphasized the need to remove the vegetation from the channel.

When asked to discuss the commercial viability of the river at this flow, many of the boaters and rafters characterized the river as a "hard core run" and recommended that customers be 16 years or older, experienced, and physically fit (these screening decisions are typically left up to the outfitter). One boater suggested that the Cheoah would gain a reputation as being a difficult river and that whitewater boaters and rafters would not come until they were ready.

Several participants indicated that they believed that commercial trips would only be viable on the Cheoah if some infrastructure was added and more of the instream vegetation was cleared. It was also noted that commercial activity along the Cheoah would potentially increase traffic along Highway 129 and could clog the take-out at Calderwood Reservoir for lake users.

When asked to compare the Cheoah at this flow with other rivers in the region, several comparisons were made. Several boaters agreed that the Cheoah at this flow was comparable to the lower part of the Tallulah below Oceana and Big Laurel Creek. One boater felt that the Cheoah is the "Ocoee plus, plus." Several participants speculated that boaters would come from far away and at the very least, the eastern half of the United States to run the Cheoah River at this flow level.

1,010 cfs (boating flow # 4)

At 1,010 cfs, several of the participants noted that the lines were open, rocks were padded, and there were lots of eddies and good play spots. At this flow, the upper section of the river was much easier than the lower section of the river. One

boater noted that the best thing about the run was the "world-class" rodeo hole at the end of the run, near Tapoco Lodge. Several rafters reported that the waves produced at this flow level were good for rafting.

Several boaters characterized this flow as "boring" in comparison to 1,130 cfs. Some of the factors cited by boaters concluding that this flow was not as good as 1,130 cfs were that the approaches were not as open, the eddies were fewer and shallower, there were more paddle touches, many of the play holes were too shallow to drop in to, and a lot of "boof spots" (specific maneuver) were eliminated. Several participants felt that 1,010 cfs was almost identical to 950 cfs.

The rafters concluded that 1,010 cfs was optimal for rafting because there was less push and better setups; they could concentrate more on having fun rather than on "surviving."

1,130 cfs (boating flow # 3)

At 1,130 cfs, many boaters reported more of the advantages that they experienced at 950 cfs, including well defined eddies, waves, pools, "boofs", and play spots. These boaters indicated that the deeper water padded the rocks and gave the boaters more confidence to play. Many of the boaters agreed that the river provided a good combination of play and technically difficult spots at this flow. Several boaters cited the increased safety risks at holes and the potential for swimmers to get separated at higher flows as causes for concern. Someone observed that the higher flow opened up a lot of "B-routes" (alternatives) and made the lines bigger and easier to find. Several boaters indicated that at this flow, the upper section of the Cheoah was closer in difficulty to the lower section, making it appropriate only for "elite," or highly experienced and capable boaters. Boaters and rafters categorized the overall difficulty of the river as a continuous class IV with a class IV+ rapid.

Generally, hard boaters and rafters alike reported that it was easier to move downstream (less physical effort was required). Rafters noted cleaner approaches to the rapids, fewer drag spots, and bigger waves (necessary for getting vertical). One rafter opined that self-bailing rafts would have made a significant difference for many at 1,130 cfs.

During the portion of the discussion where participants were asked to compare the Cheoah to other regional rivers, several participants opined that at this flow the Cheoah River would become a "must do" river in the southeast. Some predicted that whitewater enthusiasts from all across the country would travel to boat the Cheoah at this flow. One boater commented that he would be willing to leave the country for this whitewater.

At this flow level, several boaters compared the Cheoah to the best sections of the Upper Gauley, the Watauga River, the Tellico running over 1,000 cfs, Section IV of the Chattooga, and the Lower Rocky Broad. In general, participants agreed that while these rivers were similar to the Cheoah, none of them were the same, and some participants opined that none were as good as the Cheoah at this flow.

2.3 Conclusions

The Cheoah River offers the potential for both angling and whitewater boating opportunities. These opportunities are a function of the physical characteristics of the river, relatively easy access, and proximity (both to major population centers and to other recreation destination sites). Opportunities are also a function of streamflow, with angling activities requiring relatively low flows and whitewater boating activities requiring relatively high flows.

The Cheoah River is characterized by a very continuous average gradient of 100 feet/mile, a rocky bedrock substrate, and a fairly narrow confined stream channel. The river also exhibits dense vegetation, not only along its shores but also within the river channel itself, particularly in the upper reaches of the river. These physical characteristics directly affect the

recreation opportunities on the river and as the results of the surveys show, can strongly influence how these opportunities are related to streamflow.

For anglers, access to and along the shoreline is difficult due to dense vegetation and the rocky nature of the stream. Wading is also difficult for these same reasons. The substrate of the river is also very slippery due to sediment and algae growth. Higher flows (greater than 100 cfs) make the river almost impossible to wade in most areas due to swift water velocities. For boaters, survey results indicate that the river is a Class IV to Class III-IV run depending on the flow level and river section, with numerous long rapids and several large vertical drops. The overall difficulty of the river increases with increasing flows. Vegetation in the channel significantly increases the difficulty and potential dangers associated with boating the river, regardless of flow. Navigating the river generally requires an advanced to expert level of skill.

The presence of the highway paralleling the river is also an important characteristic, which generally enhances recreation opportunities. The highway provides easy access to the river throughout the study area, both for angling and boating. The highway offers multiple access points and the potential for "park and play" whitewater opportunities. The highway also provides an easy shuttle, allows for scouting and portaging as necessary, and offers emergency access (into, or out of the river). Multiple access points also provide for boating trips of varying lengths, including opportunities for intermediate paddlers to utilize the upper section of the river without having to boat the lower section (which is more difficult than the upper section).

2.3.1 Optimum and Maximum Flows for Angling

The results of the controlled flow study indicate that the optimum flow for angling on the Cheoah River, within the range of flows tested, is in the 75 cfs to 100 cfs range. Six out of the ten angling participants rated 75 cfs as the best, with over 75 percent of the participants indicating that they would return to fish the river at similar flows. Flows lower than 75 cfs were not tested, so it is possible that lower flows may be more desirable. In fact, a fairly large percentage of the study participants (40 percent) indicated that conditions at 75 cfs were "marginal," and only one individual rated conditions as "excellent." Conditions at 100 cfs were noted as similar to 75 cfs, but with

less ability to move along the shoreline due to higher water and a greater degree of difficulty in wading.

Flows of 670 cfs and higher offered almost no opportunity for angling and are clearly unsuitable for this activity. When asked if they would return at these higher flows, 90 percent of the study participants said "no".

The maximum acceptable flow for angling is a flow somewhere between 100 cfs and 670 cfs. Discussion comments from study participants indicate that conditions were fairly difficult at 100 cfs and that this flow may be relatively close to the maximum acceptable flow. It is not possible to determine a minimum acceptable flow level for angling based on this study, except to conclude that the minimum acceptable flow is less than 75 cfs. Given that 75 cfs was rated very high as an angling flow, it seems likely that that the river would be considered acceptable for fishing at very low flows.

2.3.2 Optimum and Minimum Flows for Whitewater Boating

The results of the controlled flow study indicate slightly different preferences for hard boats (kayaks and canoes) than for rafts. Based on results from the Comparative Flow Survey, which compares the quality of the experience across all flows tested, the optimum flow for hard boats (within the range tested) was 1,130 cfs (the highest tested flow). This flow level received the highest overall average rating for both kayaks and canoes (1.8 and 2.0, respectively) and was rated as "excellent" by over 85 percent of the hard boaters. At this flow level, the river offers opportunities for advanced and expert kayakers and canoeists with numerous high quality surfing waves and rodeo holes. Many of the boaters participating in the study noted that at this flow level the Cheoah River offers a very unique experience that could be considered among the best in the eastern United States.

Flows of 950 cfs and 1,010 cfs also provided good opportunities for kayaking and canoeing. Numerous high quality play spots were noted at both these flows and water depths were noted as acceptable for passage. Results from the Comparative Flow Survey

indicate overall experience ratings for these two flows of 0.8 and 1.1 for kayakers and 1.0 and 1.0 for canoeists respectively, with a rating of 1.0 being "good". Over 90 percent of the hard boaters participating in the study indicated that they would return to the river under similar conditions, both at 950 cfs and 1,010 cfs.

Results from the Comparative Flow Survey and open discussions indicate that for rafting 1,010 cfs was the optimum of the flows tested. Participants indicated that at this flow there was enough reaction time to adjust the rafts, with plenty of good hydraulics. Rafters also noted that there was adequate time to bail the rafts before entering the next rapid at this flow. All rafting participants that floated the river at 1,010 cfs rated the experience as a 2.0 or "excellent". This was true for both the Single Flow Survey results and the Comparative Flow Survey results.

Research indicates that the minimum acceptable flow for boating is reflected by a comparative experience rating of 0.0 on a scale of –2.0 to +2.0, also commonly referred to at the "neutral line" (Whittaker, 1993). This rating reflects a point at which 50 percent of the respondents would chose to return for the experience and 50 percent would not. None of the flows tested for this study received a comparative rating of exactly 0.0, therefore it is difficult to determine the exact minimum acceptable flow. However, collective comparative flow responses for all watercraft indicate that the 670 flow was below a minimum acceptable level (score –1.1), while the 950 cfs flow as above a minimum acceptable level (score 0.9). From these results, it can be inferred that the minimum acceptable flow is between 670 cfs and 950 cfs. Because the relationship between flow volume and boating quality is not a linear relationship, the exact minimum flow is not discernible from the data in this study.

Results from the Single Flow Survey, in which participants were specifically asked if they would return under similar flow conditions, support the conclusion that the minimum acceptable flow for whitewater boating is between 670 cfs and 950 cfs. After boating the river at 670 cfs, 56 percent of the kayakers, none of the canoeists, and 35 percent of the rafters indicated that they would return (average of 55 percent for all

participants). After boating the river at 950 cfs over 90 percent of the participants indicated that they would return, regardless of watercraft type. Overall, results from the Single Flow Survey indicate that 670 cfs was more problematic for canoes and rafts than for kayaks. The flow of 670 cfs was particularly poor for rafting, with numerous groundings due to shallow water depths and limited route options. On average, rafters rated this flow between poor and marginal. When asked about commercial rafting opportunities, participants indicated that they would not pay for the whitewater experience at 670 cfs. All boaters noted that drops were steeper and more dangerous, with shallower landings at 670 cfs.

3.0 POTENTIAL FUTURE USE

This chapter presents estimates of potential future angling and whitewater boating use of the Cheoah River downstream of Santeetlah Dam (Part 3 of the Cheoah River Recreation Study). These estimates were developed in consultation with the Tapoco Relicensing Recreation and Aesthetics Technical Work Group (Work Group), including discussions at the June 13, 2001 Work Group meeting and a subsequent two-day workshop held on July 17-18, 2001.

The purpose of this analysis is to provide reasonable estimates of potential future recreational use. These estimates will be combined with other information to evaluate the potential environmental impacts associated with relicensing the Tapoco Project, including potential impacts to recreation resources as well as potential economic impacts to the local community, which could result from changing recreational use of the Cheoah River.

The analysis is not intended to establish any limits or caps on future use, either private or commercial, but rather is designed to provide reasonable estimates of potential future use based on recreation demand, the physical limits of the resource, and consideration of the existing recreation setting (as defined by the U.S. Forest Service's Roaded Natural 2 Recreation Opportunity Spectrum designation for the river). Actual future use will be determined by opportunity, future demand, and management decisions made by the U.S. Forest Service and the North Carolina Wildlife Resources Commission. Management scenarios presented herein, particularly those regarding whitewater boating use, were developed to simulate potential future conditions and to evaluate social carrying capacity issues. They were developed by a subcommittee of the Work Group strictly for the purpose of analysis.

It is acknowledged that for some activities, particularly commercial rafting, the actual number of useable days, and the timing of those days will influence use and may affect the viability of the activity. However, for the purposes of this analysis it is assumed that there would be enough days to support each activity. The analysis does not attempt to quantify how many days would be needed in a given season or from year to year to support commercial operations.

Estimates of potential future use presented herein assume some level of enhancement for recreation use, recognizing that potential changes to project operations associated with relicensing could result in an enhanced fishery and/or more opportunities for whitewater boating. The analysis has specifically been structured to deal with the fact that future project operations and specific management decisions by the U.S. Forest Service and North Carolina Wildlife Resources Commission, which may affect recreation use, are uncertain at this time. It should also be noted that biological or ecological factors were not included in this analysis, but will be considered later and may influence future use.

3.1 Background

The Cheoah River is currently a warm water fishery that receives very light angling pressure, primarily for smallmouth bass. Preliminary surveys conducted by the North Carolina Wildlife Resources Commission to scope a potential creel survey indicate that during April (the highest use month) the average number of anglers per day on the river was estimated at less than one (0.67). It should be noted that these data represent a very limited number of sample days and not a full creel survey. The river also receives some very limited whitewater boating use during infrequent spill events. The river offers Class IV whitewater opportunities when flows are suitable. The Cheoah River and surrounding area retains a U.S. Forest Service Recreation Opportunity Spectrum (ROS) designation of "Roaded Natural".

A draft study plan for Parts 3 and 4 of the Cheoah River Recreation Study was prepared in December 2000 and discussed at a Work Group meeting on February 12, 2001. Based on comments received at the February 12, 2001 meeting, a revised draft study plan was prepared and reviewed with the Work Group at a meeting held on March 22, 2001. A final study plan reflecting all comments received to date was prepared in April 2001.

Preliminary results for Parts 3 and 4 of the Cheoah River Recreation Study were presented to the Work Group on June 13, 2001. At this meeting, Work Group members expressed concerns regarding the preliminary use estimates and the methods used to develop the whitewater boating use estimates. Representatives from the U.S. Forest Service suggested development and use of a "paper model" to assess the social carrying capacity of the river for

whitewater boating. Other Work Group members agreed that such a model would be useful and a subcommittee of the Work Group was formed to develop the model and use it to derive revised whitewater use estimates for the river. The subcommittee convened a two-day workshop on July 17-18, 2001 and developed revised use estimates for whitewater boating. These results were presented to, and accepted by, the full Work Group at its August 8 meeting.

3.2 Methods

Potential future use estimates for the Cheoah River were developed based on an analysis of the existing recreation setting (using the U.S. Forest Service ROS methodology), physical and social carrying capacity considerations, and estimates of regional demand. Because specific management alternatives, particularly with regard to future project operations and river flows, are unknown at this time, use estimates for whitewater boating were developed on a per-day basis assuming that opportunities exist. This approach allows for estimates of seasonal or annual whitewater boating use to be developed for specific management alternatives at a later date. Use estimates for angling were developed on a monthly basis and summed to develop annual estimates. This is based on the assumption that river flows will be generally suitable for angling most of the time, recognizing that some opportunity may be forgone if high flow releases are made to accommodate whitewater boating.

Rather than develop a single estimate of potential daily or annual use, a range of estimates was developed for each activity reflecting various management and societal choices. These ranges provide a sensitivity analysis that brackets potential future visitation and allows for a broader assessment of potential impacts, including both the costs and benefits. It should be noted that both the high and low future use estimates presented herein represent reasonable and feasible estimates given the specific characteristics of the river and the stated considerations (not including biological or ecological considerations, which were not part of this analysis).

For angling activity, it was assumed that future use would be driven primarily by opportunity, future fishery management decisions, and demand, rather than by the physical or social capacity of the resource. Based on this assumption, a range of potential future use estimates for angling on the Cheoah River was developed based on available use statistics for

other comparable river resources in the region and consideration of the specific characteristics of the Cheoah River. Two estimates of potential future angling use were developed on a per day basis; one that reflects a high use scenario and one that reflects a low use scenario. The high use scenario was generated using available state creel data for delayed harvest trout fisheries (which typically receive the highest use). The low use estimate was generated using available state creel data for wild trout fisheries (which typically receive lower use). The wild trout fishery data were used as a surrogate for a warm water fishery because adequate data does not exist on other riverine smallmouth bass fisheries in the state to draw any direct comparisons to the Cheoah River.

For whitewater boating activity, it was assumed that the primary limiting factors affecting future use, on a per day basis, would be flows and the carrying capacity of the river (including physical, social, and ecological capacity considerations). It was assumed that when flows were suitable for boating, demand would exceed capacity, making the capacity of the resource the limiting factor.

Use estimates for whitewater boating were developed using a "paper model" and open discussions of a Work Group subcommittee focused on evaluating the social and physical carrying capacity of the river. The subcommittee convened a two-day workshop on July 17-18, 2001 to evaluate and discuss physical constraints within the river corridor, particularly with regard to parking and recreation facilities needed to accommodate whitewater use, and to discuss and develop estimates of the social and physical carrying capacity of the river for whitewater boating use downstream of Santeetlah Dam.

The following Recreation and Aesthetics Work Group members participated on the subcommittee. As noted, subgroup members provided a broad representation of recreation and management interests.

Carolyn Allison	Wildwater Rafting
Rod Baird	Western Carolina Paddlers
Wendy Bley	Long View Associates
Bruce DiGennaro	Kleinschmidt Associates

Frank Findley*	U.S. Forest Service
Jack Frisch	Trout Unlimited
John Gangemi*	American Whitewater
Bob Hathcock	Nantahala Outdoor Center
Ray Johns	U.S. Forest Service
Ken Kastorff	Endless River Adventures
Charlotte Lackey	Sierra Club
Andy MacKinnon	Rafting in the Smokies
Robert Moseley*	Town of Robbinsville
Norm Pierson	Tapoco
Steve Reed	NC Division of Water Resources
Jack Wise*	Wildwater Rafting
David Wright	U.S. Forest Service

* Participant attended a portion of the 2-day workshop

The agenda for the two-day workshop was as follows:

July 17, 2001 - Day one of the workshop focused on possible physical carrying capacity issues and included a review and discussion of parking opportunities in the corridor, including a field visit to an area below Santeetlah Dam considered suitable for a future put-in area, accounting of potential parking along Highway 129, and a field visit to potential take-out areas on Calderwood Reservoir. The afternoon of July 17 was used to review observations made in the field regarding parking (and other physical carrying capacity issues) and to discuss and revise assumptions for the Paper Model exercise to be conducted the following day.

July 18, 2001 – Day two if the workshop focused on development and testing of a Paper Model to evaluate likely recreation experiences and encounter rates under various use scenarios (as described below).

The "paper model" was designed to simulate how groups of boaters would likely progress down the river over time and what level of interaction would be expected under various launching scenarios. The model consisted of a map of the Cheoah River and simulated water velocities for a flow of 1,130 cfs. Surface water velocities were based on field measurements taken during the instream flow study conducted for aquatic resources. Using the water velocity

data shown on the map, travel times were developed for each one-tenth mile segment of the river. These travel times were then used to plot the distribution of boats under various launching frequencies. Using trace paper overlays, marker dots were placed on the map to indicate the location of each group after four hours of boating and a set launching frequency. The resulting maps were used to examine how quickly boats could be expected to float through given sections and how many other groups they would likely see during their trip. This produced a graphical display of the distribution of boating groups under various launching scenarios and allowed the subcommittee to visualize and understand potential interactions associated with various levels of use.

Three launching frequencies were examined, every five minutes, every ten minutes, and every fifteen minutes. Map overlays were generated for each scenario showing the distribution of boating groups after a four hour time period. Launching frequencies were selected by the group through open discussion. The ten-minute scenario was evaluated first, followed by the fifteen-minute scenario, then the five-minute scenario. All mapping was done as a group and discussed as it was being created.

Based on agreed-upon launch scenarios (considering opportunities for both commercial and private users) and agreed upon party sizes, daily use estimates (in terms of numbers of people) were generated. Rather than identify an absolute carrying capacity estimate, a range of social carrying capacity estimates was developed to allow for future management flexibility. In addition to social carrying capacity, an estimate of the maximum physical daily capacity was developed based on parking and on-river safety considerations.

The assumptions used as the basis for the “paper model” were discussed in detail by the subcommittee prior to conducting the model exercises. Several key assumptions were refined collectively by the subcommittee as the model was tested. The following assumptions were used in developing and testing the “paper model”. All assumptions were agreed upon by the group prior to “running” the model.

1. *All launching occurs just below Santeetlah dam, near RM 9.* The only area within the river corridor potentially suitable for launching large groups is near RM 9. Smaller groups of kayaks and canoeists could launch at other locations, but these locations could support only a small number of users. For the purpose of the model it was assumed that all parties would launch from one location.

2. *Launching occurs over an eight-hour period from 9 AM to 5 PM.* This assumes boatable water during the eight-hour period. Releases would be made in advance of 9 AM to provide for this.

3. *Craft types include 13' self-bailing rafts, kayaks, and/or whitewater canoes*. These represent the most likely crafts that would be used on the river.

4. *Maximum raft group size of 6 boats accommodating up to 42 people (36 paying customers and six guides).* USFS ROS guidelines for river management do not specify a maximum party size for a Roaded Natural 2 ROS class (which is the designation for the Cheoah River). However, for the next ROS class down (Semi-Primitive Motorized), the guidelines suggest a maximum party size of 20 people. Based on this information, USFS representatives expressed a desire to keep party size on the Cheoah River to less than 40 people per group. The subcommittee agreed and selected the number of 42 people based on the assumed raft size (13 feet) and six individuals per raft.

5. *Maximum hard boat group size of 16 boats accommodating up to 16 people.* Initial discussions of the subcommittee set hard boat group based on "typical" use, which was approximated at four boats per group. However, this assumption was modified during testing of the model to account for the fact that kayaks are smaller and less visible when in the water and the fact that the ROS classification allows for larger groups. The primary purpose for the modification was to allow for more flexibility and to acknowledge that some hard boaters would likely launch during the commercial launch window.

6. *Launching windows established in 2-hour blocks alternating between commercial and private blocks.* From a management perspective, the subcommittee agreed that it would be appropriate to establish "blocks of time" dedicated to commercial use and "blocks of time" dedicated to private use. This assumption assures that equal opportunities are provided for both commercial and private users.

7. *Rafting groups maintain an average 50-foot distance between crafts within their group, for a total of 250 feet of river (longitudinally) per group. Hard boat groups maintain an average 10-foot distance between crafts within their group, for a total of 160 feet of river (longitudinally) per group*. While it was acknowledged that distances between boats in a group would change as the group progresses down the river, an average distance is needed to predict how much space a given group would occupy and therefore how visible they would be to other groups near them. The subcommittee agreed that 50 feet and 10 feet were reasonable estimates.

8. *Boats move at 0.75 times the river surface velocity*. This assumption was arrived at based on calculations of total travel time and discussions with the subcommittee. If boats were assumed to move at a pace equal to the surface velocity, the total nine-mile trip would take 2 hours and 45 minutes. During the Controlled flow Study conducted in July 2000 it took boaters between 3 and 4 hours to paddle a seven-mile section of the river. Based on this, the subcommittee agreed that a 2 hour and 45 minute trip was unrealistic. At 75 percent of surface velocities, the total calculated trip duration (for nine miles) is 3 hours and 40 minutes. The subcommittee agreed that this was a reasonable estimate, though some felt the trip would be in the 3 hour and 20 minute range. For the purpose of the model exercise, the 75 percent estimate was used.

9. *Additional time is factored in for the "Land of Holes" and "Big Uns" rapids for every fifth party to account for potential incidents.* There was considerable discussion by the subcommittee regarding what to assume for potential bottlenecks or

areas where boaters may need additional time to set up safety of deal with an incident. Because of the continuous nature of the river, the subcommittee agreed that safety would likely be handled from the boats with the two lead boats waiting at the bottom of the larger rapids to deal with swimmers or other problems. It was also agreed that for the Big Uns' rapid, a permanent shore-based safety could be set up by having individuals stationed on shore with ropes for the entire day. Under this assumption, additional time would not be needed. However, some subcommittee members felt strongly that some allowance for the inevitable problem should be made and built into the model. To account for this, the subcommittee agreed that extra time for every fifth boat would be reasonable to assume. Ultimately, based on initial runs of the "paper model" the group agreed that if adequate time was built-in between groups, that extra time would not necessarily be needed in order to achieve the desired level of user interaction. Based on this conclusion, this assumption was not employed for the actual model runs conducted.

10. *The assumed flow for the purpose of analysis is 1,130 cfs.* All surface water velocity calculations used for the model exercise were based on a flow of 1,130 cfs.

11. *Approximately 15 minutes is required for each group to load and leave the take-out area.* Based on experience on other rivers, the subcommittee agreed that this would allow adequate time to load passengers and equipment

3.3 Results

The following presents potential future use estimates for angling and whitewater boating on the Cheoah River. As described above, the estimates are presented as ranges to reflect uncertainty regarding future management decision. Actual future recreational use of the Cheoah River will be affected by numerous factors, including future Project operations, which will affect future opportunities (including the number of days and time of year that flows are suitable for angling and whitewater boating, and the type and quality of the fishery, management decisions by the U.S. Forest Service and North Carolina Wildlife Resources Commission, carrying capacity, and recreation demand.

3.3.1 Angling Use

Results from the potential future use analysis indicate that annual angling use of the river could vary considerably depending on whether the river is managed as a cold water or a warm water fishery. If the river is managed as a cold water Delayed Harvest trout stream, it is estimated that the river would attract approximately 12,800 trips/year. If the river is managed as a warm water fishery, it is estimated that it would attract approximately 2,600 trips/year. Regional demand data used to generate these use estimates are displayed in Tables 3.1 and 3.2, which present available data on angling activity at nine stream reaches in North Carolina, four managed as delayed hatchery streams and five managed as wild trout streams. These data were provided by the North Carolina Wildlife Resources Commission and represent several recent creel surveys. Based on the data shown in Tables 3.1 and 3.2, average seasonal use estimates were developed on a per mile basis and used to estimate potential future angling pressure on the Cheoah River under two future management scenarios. The results of this analysis are displayed in Tables 3.3 and 3.4, including estimated number of hours, trips per month, and total estimated annual use. Table 3.3 displays potential future use estimates assuming a Delayed Harvest fishery while Table 3.4 shows estimates assuming a warm water fishery (using wild trout stream data as a surrogate for a warm water fishery).

3.3.2 Whitewater Boating Use

Results of the potential use analysis for whitewater boating indicates that use could range from approximately 900 to 1,400 people/day depending on future management decisions and the level of desired social interaction. In developing these estimates, it was assumed that conditions would be suitable for commercial activity, including commercial rafting, and that this activity would occur. However, the analysis makes no assumptions about the need for and/or management of permits or use caps, how many outfitters might operate on the river, or how use would be allocated between private and commercial uses (or between different commercial outfitters). For the purpose of this analysis, no assumptions were made regarding the amount of future

private versus commercial use of the river. Daily use estimates for whitewater boating presented herein represent peak use times assuming ideal conditions.

The following briefly summarizes results of Work Group subcommittee discussions, including discussions regarding parking and infrastructure options, and consensus on a range of potential future whitewater use estimates.

3.3.2.1 Parking Assessment

There appear to be a number of potential options for accommodating commercial and private whitewater users of the river. However, all options would require development of additional facilities, carefully managed parking, and a possible shuttle for private users (to minimize vehicles and traffic in the corridor during any future whitewater releases). Specific observations are noted below.

Put-in Site – There is a large area of land located below Santeetlah Dam that appears suitable as a potential future put-in site. The site appears large enough to accommodate several hundred vehicles. The site is located on Tapoco and USFS lands (actually two separate potential parking areas). There may need to be improved road access to the site to enhance traffic flow. There may also be issues regarding siting of a leach field if flush restrooms are considered.

River Corridor Parking – An initial enumeration of areas suitable for parking along Highway 129, indicates that there is a potential capacity for approximately 50-60 vehicles within the river corridor. This enumeration was based on consideration of state standards for formal highway parking, including site distances and distance from highway. Most of the potential parking spaces (over 80 percent) are located in the upper four miles of river.

Take-out Site – The subcommittee examined potential take-out options in the immediate vicinity of the Highway 129 bridge over Calderwood Reservoir, including the existing Tapoco recreation site/boat ramp located on Calderwood Reservoir (Magazine Branch). Specific options identified and discussed included:

a. Use of the overlook parking lot and existing informal access area across the reservoir from the Cheoah Powerhouse as a private take-out area, and/or as an alternative commercial take-out (at least for passengers).

b. Use of the existing Calderwood Reservoir boat launch area (Magazine Branch) as a commercial take-out with buses either parked at the far downstream end of the site and loading occurring here (as opposed to the existing boat ramp), or parked off-site and brought in only to load passengers. A limited number of buses could be parked along the entrance road, at the put-in site, or adjacent to the highway bridge.

c. Development of multiple locations near the bridge to off-load passengers and use of the existing Magazine boat launch area for loading equipment only. The intent of this option would be to disperse the commercial take-out activity and keep buses and commercial passengers out of the Magazine recreation site to minimize potential impacts on existing recreational uses. (The Magazine boat launch is the only boat launch on Calderwood Reservoir).

3.3.2.2 Social Carrying Capacity

Figures 3.1, 3.2, and 3.3 display results from three Paper Model scenarios that were evaluated by the subcommittee. These include 5-minute, 10-

minute, and 15-minute launch scenarios. The figures also display the elapsed time associated with each craft over a four-hour period.

Assuming alternating two-hour launch windows for commercial and private use, and group sizes of 42 people per commercial trip and 16 people per private trip, total daily use for each evaluated scenario is as follows:

15-minute launches – 928 people/eight hour day
10-minute launches –1,392 people/eight hour day
5-minute launches – 2,784 people/eight hour day

Based on an assessment of likely interactions that would be associated with each of these three scenarios, the subcommittee agreed that a range of 10-15 minute launches would be consistent with the existing Recreation Opportunity Spectrum (ROS) designation for the river of Roaded Natural 2. Within this range of launching frequency, boaters would likely encounter other groups at five locations: (1) in a large, slow-moving pool near RM 8.4; (2) in a large pool area near RM 7; (3) at the Land of Holes; (4) at the Big Uns' rapid; and (5) and at the take-out. Each of these encounters would likely involve only one other group and therefore would not be expected to detract from the overall recreation experience. Incidents such as wrapped or flipped boats could result in additional encounters. However, the subcommittee felt that with 10-15 minutes between each group there would be adequate time to deal with an incident and any additional encounters would be limited. Due to the nature of the river channel, it is expected that groups will spread out more as they move down river, particularly once they get passed the Land of Holes rapid.

3.3.2.3 Physical Carrying Capacity

Discussions regarding the physical capacity of the river focused on river safety considerations and parking capacity in the river corridor. The subcommittee agreed that a launching frequency of one group every five minutes

(as shown in Figure 3.1) represented a maximum use level while still maintaining a reasonable level of safety and margin for error. The subcommittee agreed that launching groups at any frequency shorter than five minutes could result in an increased likelihood of problems and potential safety hazards associated with groups "stacking up" in the event of a flip, wrap, or portage. This conclusion results in an effective physical capacity for the river of approximately 3,000 (2,784) people/eight hour day.

3.3.2.4 Use Estimates for Economic Modeling Purposes

After determining the social and physical carrying capacity for whitewater boating on the Cheoah River, the subcommittee discussed the realities of the physical capacity estimate of 3,000 users per day, and agreed that this level of use, while physically possible, does not represent a reasonable alternative for future management of the river given the ROS designation and concerns regarding potential traffic and congestion on Highway 129. Consequently, the subcommittee decided that for the purposes of the regional economic analysis, the range of social capacity use figures (1,392 and 928) should be used as the high and low use estimates.

Table 3.1 – Listing of available angling use data from Delayed Harvest Trout streams in North Carolina that are comparable in size to the Cheoah River.

	1992			1996-97				
	Nantahala	East Prong		Nantahala	East Prong	N. Fk. Mills	Watauga	Mean
Jan				180	231	146	149	177
Feb				180	231	146	149	177
Mar	177	251		650	754	594	553	638
Apr	177	251		650	754	594	553	638
May	177	251		650	754	594	553	638
Jun	347	334		633	636	622	645	634
Jul								
Aug								
Sep								
Oct				180	231	146	149	177
Nov				180	231	146	149	177
Dec				180	231	146	149	177

Numbers are fishing pressure (angler hours/km/month).
They represent the total pressure by period (fall DH = Oct-Feb; spring DH = Mar-May; harvest = Jun) estimated by a creel survey.
The total pressure was then divided by the number of months in the period to calculate an average pressure per month.
Actual monthly pressure estimates would be expected to vary, especially during the fall DH months.
Pressure would be expected to drop significantly in Jul - Sep (after stocking ends).

Stream Descriptions

Stream	County	Land	Stream Type
Nantahala	Macon	USFS	Bypass
East Prong	Wilkes	State Park	Unregulated
N. Fk. Mills	Henderson	USFS	Unregulated
Watauga	Watauga	Private	Unregulated

Delayed Harvest Streams
1992 was the first year for the DH program in North Carolina.
1996-97 was the first year for the expanded DH season (stocking began in Oct).
1996-97 also represents a maturation of the program and acceptance by the angling public.
Currently, DH consists of stocking hatchery trout once per month in Oct, Nov, Mar, Apr, May at a rate of 150 fish/ha.
Regulations: Oct-May is catch and release; Jun-Sep is harvest

Table 3.2 – Listing of available angling use data from Wild Trout streams in North Carolina that are comparable in size to the Cheoah River.

	Wild			Wild w/Bait		C&R/FFO
	1982-83	1993	1993	1995	1995	1993
	Nantahala	South Toe (1)	Looking Glass	Buck	Kimsey	South Toe (2)
Jan						
Feb						
Mar	84					
Apr	84	130	26	7	43	62
May	84	130	26	21	26	92
Jun	84	130	26	35	29	92
Jul	84	130	26	33	19	72
Aug	84	130	26	15	38	75
Sep	84	130	26	12	19	65
Oct	84	130	26	4	11	
Nov	84					
Dec						

Numbers are fishing pressure (angler hours/km/month).
For the Wild streams the numbers represent the total pressure estimated for the entire survey divided by the number of months surveyed.
Compared to stocked streams, monthly pressure estimates for unstocked streams do not vary widely.

Stream Descriptions

Stream	County	Land	Stream Type	Regulation
Nantahala	Macon	USFS	Unregulated	Wild
South Toe (1)	Yancey	USFS	Unregulated	Wild
Looking Glass	Transylvania	USFS	Unregulated	Wild
Buck	Clay	USFS	Unregulated	Wild w/Bait
Kimsey	Macon	USFS	Unregulated	Wild w/Bait
South Toe (2)	Yancey	USFS	Unregulated	C&R/FFO

Wild Regulations: not stocked; open year round; artificial lures only; 1995 was first year for this regulation type.
Wild w/Bait Regulations: not stocked; open year round; bait allowed
C&R/FFO Regulations: no stocked; open year round; catch & release; fly-fishing only

Table 3.3 – Estimated angling use of the Cheoah River assuming a Delayed Harvest management scenario

Delayed Harvest Fishery (High End)			
	Angler Hours/km	# of trips/km	Estimated # of trips on Cheoah
Jan	177	44	645
Feb	177	44	645
Mar	638	160	2326
Apr	638	160	2326
May	638	160	2326
Jun	634	159	2311
Jul	30	8	109
Aug	30	8	109
Sep	30	8	109
Oct	177	44	645
Nov	177	44	645
Dec	177	44	645
Total	3523	881	**12,841**

Assumptions:

- Data supplied by Chris Goudreau at the NC Wildlife Resources Commission
- Data reflect average use at four streams, including Nantahala, East Prong, N. Fork Mills, and Watauga.
- Use data reflects streams managed as delayed harvest for approximately 5 years.
- Delayed Harvest consists of stocking hatchery trout once per month in Oct, Nov, Mar, Apr, May at rate of 150 fish/ha. Oct-May is catch and release; Jun-Sep is harvest.
- Streams managed as Hatchery Supported (stocked Mar-Jul), and those non-stocked (wild) receive considerably less use.
- Data for July - Sep are estimates made by Chris Goudreau.
- Calculation of # trips/km assumes average trip length of 4 hours.
- Calculation of estimation of # of trips on Cheoah is based on 14.58 kms.
- The Nonresident to Resident use ratio is approximately 4:1 (80% non-resident). This estimation is based on limited data from Creel studies done on the Nantahala and the opinions of Chris Goudreau at the NC Wildlife Resources Commission.

Table 3.4 – Estimated angling use of the Cheoah River assuming a Warm Water Fishery management scenario

Warm Water Fishery (Low End)			
	Angler Hours/km	# of trips/km	Estimated # of trips on Cheoah
Jan			
Feb			
Mar	80	20	292
Apr	80	20	292
May	80	20	292
Jun	80	20	292
Jul	80	20	292
Aug	80	20	292
Sep	80	20	292
Oct	80	20	292
Nov	80	20	292
Dec			
Total	720	180	**2,624**

Assumptions:

- Data supplied by Chris Goudreau at the NC Wildlife Resources Commission
- Data reflect average use at three streams, including Nantahala, South Toe, and Looking Glass.
- Use data reflects streams managed as Wild, which consists of no stocking and open year round.
- Calculation of # trips/km assumes average trip length of 4 hours.
- Calculation of estimation of # of trips on Cheoah is based on 14.58 kms.
- The Nonresident to Resident use ratio is approximately 2:5 (40% non-resident). This estimation is based on the opinions of Chris Goudreau at the NC Wildlife Resources Commission.

4.0 REGIONAL ECONOMIC IMPACT ASSESSMENT

The fourth component of the Cheoah River Recreation Study involved assessing the potential impact that future recreational use of the Cheoah River could have on the regional economy. A draft study plan covering this component of the study was prepared in December 2000 and discussed at a Work Group meeting on February 12, 2001. Based on comments received at the February 12, 2001 meeting, a revised draft study plan was prepared and reviewed with the Work Group at a meeting held on March 22, 2001. A final study plan reflecting all comments received to date was prepared in April 2001.

Estimating potential regional economic impacts associated with recreation expenditures involves the following major steps:

Step 1: Estimate Total Expected Use
Step 2: Define Local Impact Region
Step 3: Estimate recreation expenditures per person per trip by major expenditure categories
Step 4: Estimate local trip expenditures
Step 5: Allocate estimates of local expenditures to economic sectors in the IMPLAN model
Step 6: Use the IMPLAN model to estimate economic impacts in the local impact region resulting from changes in local expenditures

Each of these steps are described in more detail below, including results relative to the Cheoah River.

4.1 Estimate Total Expected Use (Step 1)

The economic impacts on the local impact region of a potential Cheoah River whitewater boating and angling resource were determined by aggregate expenditures calculated by multiplying expenditures per person per trip by expected total person trips. A "person trip" is defined as one person making one trip to the Cheoah River for whitewater rafting, private

boating or angling. For example, suppose a group of five persons takes one rafting trip to the Cheoah River. This group visit would translate into five person trips to the Cheoah River for whitewater rafting.

Total maximum person visits to the Cheoah River for whitewater rafting, private boating and angling were estimated using a regional demand and a carrying capacity approach (see Chapter 3). Seasonal estimates for angling were developed based on regional demand. Maximum daily use estimates for whitewater boating were developed based on social and physical considerations. Results from this analysis are presented in Chapter 3 of this report.

4.2 Define Local Economic Impact Region (Step 2)

The selection of the local economic impact region for a particular economic impact study involving natural resource management is dependent upon a number of criteria. These criteria include the question of key policy or management interest, individuals and groups affected by policy or management actions, expenditure patterns related to policy or management actions, economic consumption and production linkages, geographic features and constraints, and political and institutional boundaries (MIG, Inc., 1999; U.S.D.A. Forest Service, 1992). An economic impact analysis related to natural resource policy and management is ultimately driven by the policy and management question of interest. In the case of the Cheoah River, the primary policy or management question related to economic impacts was: *What are the potential economic impacts on nearby resource-dependent communities of whitewater boating and angling activity at a potential Cheoah River resource?*

The first issue of concern related to the policy or management question above is the definition of "nearby resource-dependent communities". Because most economic data can be disaggregated only to the county level, including available IMPLAN data, the geographic definition of a "community" is a single county or group of counties defined by county political boundaries. Previous economic impact studies of natural-resource based outdoor recreation have typically defined the local or nearby economic impact region as the county in which the resource is located since that county is likely to experience the greatest positive and negative impacts directly related to natural resource management.

At the single county level, the county in which the potential Cheoah River resource is geographically located, Graham County, North Carolina, fits the definition or concept of a "nearby resource-dependent community". For example, local retail stores and services including lodging, restaurants, service stations, etc. catering to Cheoah River boaters and anglers in closest proximity to the river will mostly be located in Graham County. These establishments also likely fit the definition of being "resource-dependent" in that a portion of total sales or revenue could be directly linked to expenditures by Cheoah River boaters and anglers.

Graham County is also "resource-dependent" in the sense that the potential Cheoah River boating and angling resource is located entirely within the county. Thus, natural resources in the county including land and water will be committed to supporting the Cheoah River boating and angling resource. Many of the actual costs of supporting the Cheoah River boating and angling resource including infrastructure (e.g., roads), maintenance (e.g., litter disposal) and provision of other community services (e.g., police protection) will also be concentrated in Graham County. This economic assessment of a potential Cheoah River boating and angling resource does not consider the potential costs to Graham County associated with supporting whitewater boating and angling on the Cheoah River. Such a "resource provision cost" analysis may be considered separately from this report, which focuses on the regional economic impacts of a potential Cheoah River whitewater boating and angling measured in terms of total output, total value added, and employment. In summary, from both a benefit and cost perspective, Graham County has a large stake in how the Cheoah River is managed since different management actions may pose different levels of economic benefits and costs on the county.

Considering the factors discussed above, the impact region for the proposed Cheoah River resource was defined as Graham County, North Carolina for the purpose of this analysis.

4.3 Estimate Recreation Expenditures Per Person Per Trip By Major Expenditure Categories (Step 3)

Regional economic impact analysis of a potential Cheoah River recreation activity requires development of trip expenditure profiles for potential boating and angling visitors. The

expenditure profile for the Cheoah River economic analysis needs to include an estimate of expenditures per person per trip by specific expenditure categories (e.g., lodging, food, gasoline, guide fees). Because a whitewater boating resource does not currently exist at the Cheoah River, the Cheoah River study plan proposed that a "similar site" analysis be conducted. Following this approach, expenditure profiles based on primary data collected at sites similar to the Cheoah River were used to develop likely local expenditure profiles for Cheoah River commercial rafting customers, private boaters, and anglers.

A detailed literature review was conducted to develop likely local expenditure profiles for Cheoah River anglers, commercial rafting customers and private boaters. Appendix C describes the previous studies that were reviewed and criteria for transferring trip expenditure estimates from whitewater boaters to the Cheoah River. Angling expenditures were estimated from the most recent U.S. Fish and Wildlife Service National Survey of Fishing, Hunting and Wildlife-Associated Recreation and a previous study of North Carolina trout fishing. Appendix D describes these angling data sources in more detail.

4.3.1 Rafting and Private Boating Expenditures

In the literature review of rafting and private boating expenditures, six studies that report economic expenditures of whitewater boaters on 10 different rivers were reviewed. Of the ten rivers considered in the literature review, six are located in the southeast, two in the northeast and two in the western United States. Most of the work that has been done to date on the subject of economic impacts of whitewater boating (studies that report expenditure data) has focused on commercial rafting. All six studies report expenditure estimates for commercial rafting (on all ten rivers). Of these, three also provide expenditure estimates for non-commercial boating (on three different rivers).

The findings of the literature review suggest that there are adequate existing data for transfer of expenditure values to the Cheoah River, particularly for commercial rafting. Based on criteria for selecting similar sites and comments received during the June 13, 2001 Recreation and Aesthetics Work Group (Work Group) meeting, rafting expenditure estimates from previous studies of the Gauley River and Chattooga River

were selected to represent likely commercial rafting expenditures at the Cheoah River, and private boating expenditure estimates from previous studies of the Dead River, Upper Youghiogheny River and Nantahala River were selected to represent likely private boating expenditures at the Cheoah River (Appendix C, Table C.4). In the case of commercial rafting, these studies suggest a range of $45.89 to $72.53 per person per trip for state plus local spending (Chattooga River) up to $111.22 per person per trip for just local spending (Gauley River). In the case of private boating, these studies suggest a range of local spending from $55.03 per person per trip (Nantahala River) to $89.30 per person per trip (Upper Youghiogheny River). Finally, the literature and actual fees charged suggest a spending range for guide fees from $91.00 (Chattooga River) to $166.85 (Gauley River) per person per trip. Additional information about each study is presented in tabular form in Appendix C. Table C.1 of Appendix C lists the studies by river, the specific whitewater activity each study focuses on (i.e., commercial rafting, private kayaking etc.) and select characteristics of the user population (as reported in the study). Table C.2 of Appendix C lists detailed average per person trip expenditures, as reported by each study.

For the economic impact analysis, total trip expenditures must be allocated to specific expenditure categories. Previous studies of the Gauley River, Chattooga River, Dead River and Upper Youghiogheny River did not provide detailed expenditure category breakdowns. A study conducted of the Nantahala River which provides detailed expenditure breakdowns (English, 1995) was therefore used to estimate a likely trip expenditure allocation profile for the Cheoah River. The English (1995) study provides a detailed breakdown of local trip expenditures for whitewater rafting and boating on the Nantahala River by the major expenditure categories shown in Table 4.1 below (see Appendix A for more detail on the study). The breakdown of expenditures shown in Table 4.1 is based on survey information collected from Nantahala River whitewater rafters and private boaters.

Using the information in Table 4.1, we estimate the likely allocation of local trip expenditures by major expenditure category for a typical whitewater rafting or boating

trip to the Cheoah River shown in Table 4.2. The proportions shown in Table 4.2 are calculated as the expenditure per category divided by the total trip expenditure shown in Table 4.1.

4.3.2 Angling Expenditures

The literature review for angling expenditures turned up very few studies applicable to the Cheoah River from a benefit or value transfer standpoint. Several future scenarios are possible for the Cheoah River angling resource including high quality cold-water fishing experiences, lower quality cold-water and warm-water fishing experiences, and medium quality cold-water and warm-water fishing experiences. In case of high quality cold-water fishing experiences, expenditure estimates for trout fishing trips to North Carolina mountain rivers and streams are available from a PhD dissertation conducted by SoEun Ahn. This study is discussed in more detail in Appendix D. The Ahn dissertation results suggest a high-end estimate of trout fishing trip expenditures equal to $95.78 per person per trip.

Table 4.1. Local Per Person Per Trip Expenditures* for Nonresident Rafters and Boaters, Nantahala River (English, 1995)

Expenditure Category	Guided Rafting Trips	Private Boating Trips
Private Hotel Lodging	16.98	13.07
Private Camping	0.99	8.19
Food and beverages at retail stores	4.35	6.26
Food and beverages at restaurants	9.17	8.53
Car Rental	0.12	0.00
Gasoline and Oil	2.54	3.56
Car Repairs	0.00	0.50
Fishing Permits	0.00	0.27
Fishing Bait	0.00	0.00
Recreation Equipment Rental	1.96	1.70
Film Purchase	0.58	0.40

Film Development	0.29	0.00
Footwear	0.03	0.87
Clothing	1.56	8.31
Souvenirs	2.22	1.10
Other miscellaneous retail	1.66	3.96
TOTAL	**42.44**	**56.72**

*All expenditure amounts inflated to 2000 dollars

Table 4.2. Estimated Allocation of Local Per Person Per Trip Expenditures by Expenditure Categories for Nonresident Rafters and Boaters, Cheoah River, North Carolina

Expenditure Category	Commercial Rafting Trips	Private Boating Trips
Private Hotel Lodging	0.40	0.23
Private Camping	0.02	0.14
Food and beverages at retail stores	0.10	0.11
Food and beverages at restaurants	0.22	0.15
Car Rental	0.00	0.00
Gasoline and Oil	0.06	0.06
Car Repairs	0.00	0.01
Fishing Permits	0.00	0.00
Fishing Bait	0.00	0.00
Recreation Equipment Rental	0.05	0.03
Film Purchase	0.01	0.01
Film Development	0.01	0.00
Footwear	0.00	0.02
Clothing	0.04	0.15
Souvenirs	0.05	0.02
Other miscellaneous retail	0.04	0.07

Every five years the U.S. Fish and Wildlife Service conducts the National Survey of Fishing, Hunting and Wildlife-Associated Recreation (NSFHWR). The most recent survey was conducted in 1996. For this study, fishing expenditure data was obtained from the 1996 NSFHWR for the states of North Carolina, South Carolina, Georgia and Tennessee. From these data, average fishing trip expenditures by state and across all four states were calculated for all freshwater anglers (Table D.1) and for river anglers only (Table D.2). For all freshwater anglers, average expenditures per person per trip by state ranged from $19.89 to $31.20 with a mean across the four states of $24.47. For river anglers only, average expenditures per person per trip by state ranged from $21.67 to $30.29 with a mean across the four states of $24.79.

Angling expenditure allocations by specific expenditure categories were derived from the National Survey of Fishing, Hunting and Wildlife-Related Recreation (NSFHWR) results shown in Table 4.3, and the Ahn dissertation results shown in Table 4.4. Because the Cheoah River is a river angling resource, expenditures for river anglers from the NSFHWR (Table D.2) are most appropriate for transfer to the Cheoah River and were therefore used to develop Table 4.3. Several assumptions were made to allocate expenditures reported in Table D.2 to the expenditure categories shown in Table 4.3 which are consistent with the expenditure categories used for commercial rafters and private boaters, and which represent standard categories used in previous studies to allocate recreation expenditures to IMPLAN economic sectors (e.g., Cordell et al., 1990; English and Bowker, 1996). First, the NSFHWR does not break total food and beverage expenditures into food and beverages purchased at retail stores and restaurants. In Table 4.3, we therefore allocated 50 percent of the total food and beverage expenditures reported in Table D.2 to food and beverages purchased at retail stores and 50 percent to food and beverages purchased at restaurants. Ice expenses reported in Table D.2 were also allocated to the food and beverages at retail stores category in Table 4.3.

In the NSFHWR, public transportation includes rental cars, airplanes, trains and buses. Assuming that air, train and bus travel to the Cheoah River for angling is likely to

be minimal, we allocated 100 percent of the public transportation expenses reported in Table D.2 to the car rental category in Table 4.3. The NSFHWR does not break up private transportation expenses into gasoline and oil and maintenance (or car repair). In Table 4.3, we therefore allocated 50 percent of the private transportation expenses reported in Table D.2 to the gasoline and oil category, and 50 percent to the car repair category. Boat fuel expenses reported in Table D.2 were also allocated to the gasoline and oil category in Table 4.3. The sum of private use fees, launch fees and moorage fees reported in Table D.2 is $1.86. Of this $1.86, $.27 was allocated to the fishing permit category in Table 3 consistent with the expenditures by private boaters for fishing permits reported in Table 4.1. The remainder, $1.59 ($1.86 - $.27), was allocated to private use/access fee category in Table 4.3. Expenditures on lines/leaders, lures, and hooks/sinkers reported in Table D.2 were consolidated into the fishing tackle category in Table 3. Expenditures on heat/cook fuel, rods, tackle boxes, creel and seines reported in Table D.2 were consolidated into the other miscellaneous retail category in Table 4.3.

Table 4.3. Per Person Per Trip Expenditures* for Nonresident Anglers Derived from the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

Expenditure Category	**River Angling Trips**
Private Hotel Lodging	$2.16
Food and beverages at retail stores	$4.25
Food and beverages at restaurants	$3.48
Gasoline and Oil	$4.42
Car Repairs	$2.75
Car Rental	$.06
Fishing Permits	$.27
Fishing Bait	$2.24
Fishing Tackle	$1.60
Recreation Equipment Rental	$.48
Public Use/Access Fees	$.11

Private Use/Access Fees	$1.59
Other miscellaneous retail	$1.24
Sub-Total	**$24.65**
Guide Fees	$.14
Total	**$24.79**

*All expenditure amounts inflated to 2000 dollars

The NSFWHR expenditure results shown in Table 4.3 provide a detailed breakdown of angling trip expenditures by category needed for economic impact analysis. The Ahn dissertation provides a more limited breakdown of trip expenditures by category shown in Table 4.4.

Table 4.4. Per Person Per Trip Expenditures* for Nonresident Anglers Derived from Ahn dissertation

Expenditure Category	River Angling Trips
Private Hotel Lodging	$21.82
All Food and Beverages	$31.13
Gasoline and Oil	$21.31
Car Repairs	$4.04
Fishing Bait and Tackle	$12.67
Other miscellaneous retail	$4.81
Total	**$95.78**

*All expenditure amounts inflated to 2000 dollars

Using the information in Tables 4.3 and 4.4, we estimate the allocation of trip expenditures by major expenditure category for a typical river angling trip to the Cheoah River shown in Table 4.5. The proportions shown in Table 4.5 were calculated as follows. First, the expenditures per category were divided by the total trip expenditure shown in Tables 4.3 and 4.4. Percentage allocations for common categories across Tables 4.3 and 4.4 were then averaged and rescaled so that the sum of percentages across all categories shown in Table 4.3 equals 100 percent. The resulting estimated percent

allocation of expenditures across specific categories for Cheoah River angling trips are shown in Table 4.5.

Table 4.5. Estimated Allocation of Local Per Person Per Trip Expenditures by Expenditure Categories for Anglers, Cheoah River, North Carolina

Expenditure Category	River Angling Trips
Private Hotel Lodging	0.15
Food and beverages at retail stores	0.17
Food and beverages at restaurants	0.13
Gasoline and Oil	0.19
Car Repairs	0.07
Car Rental	0.00
Fishing Permits	0.01
Fishing Bait	0.08
Fishing Tackle	0.06
Recreation Equipment Rental	0.02
Use/Access Fees	0.06
Other miscellaneous retail	0.05
Guide Fees	0.01

4.4 Estimate local trip expenditures or local final demand (Step 4)

In order to estimate the economic impacts of recreation expenditures in the local impact region, it is necessary to estimate the proportion of potential commercial rafting customers, private boaters, and anglers who live within Graham County, versus those who might travel from outside Graham County to utilize the Cheoah River. Because expenditures from resident users represent *within* impact region transfers of money from one individual or group to another, these expenditures would be excluded from local economic impact analyses that focus on the effects of "new" money brought into the local impact region (Graham County) from external sources. For the purposes of this study and analysis, the assumption is made that all commercial rafting, private boating, and angling trips to the Cheoah River will be nonresidents of Graham County.

The question may be asked, "Will some residents of Graham County spend more money in the county as a result of a new whitewater rafting, private boating, or angling resource at the Cheoah River?" Such "new money" expenditure impacts on the part of residents are possible. The converse situation is also possible - a new whitewater rafting, private boating, and angling resource at the Cheoah River could result in some Graham County residents reallocating recreation expenditures from within the county to outside of the county. Without more detailed data on resident recreation expenditure patterns related to whitewater rafting, private boating, and angling, "new money" expenditure impacts on the part of residents would be based on speculation and therefore are not included in the economic impact analysis.

4.4.1 Rafting and Private Boating Expenditures

With respect to potential Cheoah River commercial rafting customers, private whitewater boaters and anglers who live outside of the local impact region (nonresidents), estimates are needed of local trip expenditures or final local demand for goods and services. Recreation expenditures per person per trip may occur in the immediate vicinity of a person's home, en-route to the recreation site, and in the immediate vicinity of the recreation site. For nonresidents, at-home expenditures are not be included in the local economic impact analyses. Assumptions need to be made about the amount of total trip expenditures (e.g., gasoline, food) that will occur locally.

In the case of rafting, the Gauley River study reported an upper bound local spending estimate of $111.22 per person per trip (Table C.4, Appendix C) which we will use as a "high estimate" of local commercial rafting trip expenditures or local final demand. For value or benefits transfer, it is important to account for geographic comparability. From a geographic perspective, the Chattooga River provides the best available data for transfer to the Cheoah River since it is located in the same geographic region of the Cheoah River; thus, the broad recreational setting, portions of the likely user population, and prices and costs faced by users will be similar for the Chattooga River and Cheoah River. Previous studies testing the accuracy of value or benefits transfer suggest that transfers within the same geographic region appear to be the most reliable (Loomis et al., 1995; Downing, M. and T. Ozuna, 1996).

The Chattooga River study reported a lower bound state plus local spending estimate of $45.89 per person per trip (Table C.4, Appendix C). In the Gauley River study, local expenditures were 92 percent of state expenditures, which we will use as an estimate of the percentage of state expenditures that occur locally. 92 percent of $45.89 is equal to $42.22. We will use this number as the "low estimate" of local commercial rafting trip expenditures or local final demand per person per trip. We will use the mean of these two estimates, or $76.72, as the “medium estimate” of local commercial trip expenditures or local final demand per person per trip. The low, medium and high commercial rafting estimates reported above in this paragraph do not include guide fees. Economic impacts will also be estimated adding guide fees to the low, medium and high trip expenditure estimates. The average of the guide fees for the Chattooga River ($91.00) and Gauley River ($166.85) reported in Table C.4 (Appendix C) is equal to $128.92 which we will use as the estimate of guide fees for the Cheoah River.

In Table C.4 (Appendix C), local spending for private boating trips ranges from $55.03 per person per trip for the Nantahala River to $89.30 per person per trip for the Upper Youghiogheny River. We will use the Upper Youghiogheny River estimate of $89.30 as the “high estimate” of local private boating trip expenditures or local final demand per person per trip. For the “low estimate” of local private boating trip expenditures or local final demand per person per trip, we will use the average of the Dead River ($67.63) and the Nantahala River ($55.03), which equals $61.33. The rationale for this averaging is as follows. As with commercial rafting, for value or benefits transfer, it is important to account for geographic comparability. Within the geographic region where the Cheoah River is located, private boating expenditure data are only available for the Nantahala River. From a whitewater boating experience perspective, the Nantahala River and Cheoah River provide different classes of experiences; in particular, the Cheoah River will provide a more technically difficult experience. As a result, the Cheoah River will attract a greater proportion of more experienced technical boaters as compared to the Nantahala River. The average skill level of private boaters using the Cheoah River is therefore likely to more comparable to

the Dead River in Maine. However, the broad recreational setting, prices and costs faced by users, and at least some portion of the likely user population are likely to be more similar across the Cheoah River and the Nantahala River. Combining the Dead River data to account for technical difficulty with the Nantahala River data to account for spatial location represents a compromise approach for estimating a reasonable "low estimate" for Cheoah River private boating expenditures or local final demand that reflects major value or benefits transfer criteria including geographic comparability. We will use the mean of the "low estimate" ($61.33) and "high estimate" ($89.30), which equals $75.32, as the "medium estimate" of local private boating trip expenditures or local final demand per person per trip.

By applying the proportions of trip expenditures by the major expenditure categories shown in Table 4.2 to the low, medium and high estimates for commercial rafting and private boating trips to the Cheoah River reported above, we estimate the low, medium, and high estimates of local trip expenditures or local final demand per person per trip by major expenditure category shown in Table 4.6.

Table 4.6. Estimated Local Expenditures Per Person Per Trip*, Commercial Rafting and Private Boating, Cheoah River, North Carolina

Expenditure Category	Per Person Per Trip Expenditures					
	Commercial Rafting Trips			Private Boating Trips		
	Low	Medium	High	Low	Medium	High
Private Hotel Lodging	$16.89	$30.69	$44.49	$14.11	$17.32	$20.54
Private Camping	$0.84	$1.53	$2.22	$8.59	$10.54	$12.50
Food and beverages at retail stores	$4.22	$7.67	$11.12	$6.75	$8.29	$9.82
Food and beverages at restaurants	$9.29	$16.88	$24.47	$9.20	$11.30	$13.40
Car Rental	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gasoline and Oil	$2.53	$4.60	$6.67	$3.68	$4.52	$5.36
Car Repairs	$0.00	$0.00	$0.00	$0.61	$0.75	$0.89
Fishing Permits	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fishing Bait	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Recreation Equipment Rental	$2.11	$3.84	$5.56			

Film Purchase	$0.42	$0.77	$1.11	$0.61	$0.75	$0.89
Film Development	$0.42	$0.77	$1.11	$0.00	$0.00	$0.00
Footwear	$0.00	$0.00	$0.00	$1.23	$1.51	$1.79
Clothing	$1.69	$3.07	$4.45	$9.20	$11.30	$13.40
Souvenirs	$2.11	$3.84	$5.56	$1.23	$1.51	$1.79
Other miscellaneous retail	$1.69	$3.07	$4.45	$4.29	$5.27	$6.25
TOTAL	**$42.22**	**$76.72**	**$111.22**	**$61.33**	**$75.32**	**$89.30**

*All expenditure amounts inflated to 2000 dollars

4.4.2 Angling Expenditures

The estimates of mean expenditures per person per trip reported in Tables 4.3 and 4.4 apply to an angler's entire trip from home to the Cheoah River and from the river back home. For economic impact analysis, we need to estimate the proportion of total trip expenditures that are likely to occur locally. Unlike the literature review for whitewater rafters and boaters, our search of literature did not turn up economic impact studies of river angling applicable for transfer to the Cheoah River. Consistent with the whitewater rafting and private boating economic impact analysis, we will therefore assume that for angling trips, local expenditures represent 92 percent of total trip expenditures.

We will use the Ahn dissertation expenditure estimate of $95.78 x .92 equal to $88.12 as the "high estimate" of local angling trip expenditures or local final demand per person per trip. This "high estimate" assumes that in the future the Cheoah River will develop into a high quality, cold-water fishery with the predominant angling activity being trout fishing from nonresident visitors. As suggested by the Ahn dissertation survey results, this type of mountain cold-water fishery would likely attract a more high-end clientele who have relatively high income levels and are willing to travel relatively long distances to engage in cold-water trout fishing in mountain rivers and streams.

The National Survey of Fishing, Hunting and Wildlife-Associate Recreation (NSFHWR) river angling results represent a mix of cold-water and warm-water river fishing experiences with trip expenditure results most likely weighted more towards day-trip type warm-water fishing experiences. Assuming that in the future the Cheoah River

develops into a mixed cold-water and warm-water fishery, angling trip expenditure estimates should reflect a mix of users that includes people who travel shorter distances and spend relatively less per trip as compared to high-end trout anglers. To represent this mix of users and potential expenditures, we will use average expenditures per person per trip derived from the NSFHWR results for river anglers from the states of North Carolina, South Carolina, Georgia and Tennessee ($24.79) x .92 which is equal to $22.81 as the "low estimate" of local angling trip expenditures or local final demand per person per trip. We will use the average of these high and low estimates which is equal to $55.47 as the "medium" estimate of local angling trip expenditures or local final demand per person per trip. Applying the low, medium and high local economic impact region expenditure estimates to the expenditure category coefficients reported in Table 4.6 results in the low, medium and high estimates of local angling trip expenditures per person per trip by the major categories shown in Table 4.7.

Table 4.7. Estimated Local Expenditures Per Person Per Trip* for River Anglers, Cheoah River, North Carolina

Expenditure Category	**River Angling Expenditures Per Person Per Trip**		
	Low	**Medium**	**High**
Private Hotel Lodging	$3.42	$8.32	$13.22
Food and beverages at retail stores	$3.88	$9.43	$14.98
Food and beverages at restaurants	$2.97	$7.21	$11.46
Gasoline and Oil	$4.33	$10.54	$16.74
Car Repairs	$1.60	$3.88	$6.17
Car Rental	$0.00	$0.00	$0.00
Fishing Permits	$0.23	$0.55	$0.88
Fishing Bait	$1.82	$4.44	$7.05
Fishing Tackle	$1.37	$3.33	$5.29
Equipment Rental	$0.46	$1.11	$1.76
Use/Access Fees	$1.37	$3.33	$5.29

Other miscellaneous retail	$1.14	$2.77	$4.41
Guide Fees	$0.23	$0.55	$0.88
TOTAL	**$22.81**	**$55.47**	**$88.12**

*All expenditure amounts inflated to 2000 dollars

4.5 Allocate Estimates of Local Expenditures to Economic Sectors in the IMPLAN Model (Step 5)

The next step in the economic impact analysis process is to allocate the estimates of local expenditures or local final demand by the major expenditure categories shown in Table 4.6 and Table 4.7 to specific IMPLAN economic sectors. General background on the IMPLAN model is provided first.

4.5.1 Description of IMPLAN Modeling System

IMPLAN (IMpact Analysis for PLANning) is a computer-based, input-output economic modeling system designed specifically to conduct economic impact analysis that has been in use since 1979. IMPLAN was originally developed by the U.S.D.A. Forest Service in order to provide a comprehensive, science-based system for estimating the economic impacts of natural resource related projects. In 1993, the Minnesota IMPLAN Group, Inc. (MIG, Inc.) was formed to privatize development of IMPLAN data and software for wider distribution and application. The IMPLAN modeling system has since been used in a multitude of private and public sector applications to estimate the economic impacts of natural resource related and non-natural resource related projects on regional economies. In IMPLAN applications, regional economies may be as small as a single county or as large as multi-state regions. The IMPLAN modeling system has two major components; a nationwide database describing county-level economic activity and a computer model for constructing regional input-output models and estimating economic impacts from changes in economic activity. The IMPLAN modeling system is based on input-output accounting and analysis procedures used by the U.S. Bureau of Economic Analysis and recommended by the United Nations (Taylor et al, 1992; MIG, Inc., 1999).

4.5.2 Expenditure Allocation to IMPLAN Sectors

Estimating the economic impacts of changes in recreational activity is a particular challenge for economic impact analysis because recreational expenditures are spread out over numerous sectors within a regional economy. Beginning in the late 1980s, U.S.D.A Forest Service and university researchers began to develop and apply a standard methodology for estimating the regional economic impacts of recreational expenditures using the IMPLAN modeling system. As a result of this research, standard procedures for allocating recreation expenditures to impact regions and IMPLAN sectors have been developed. Over the past ten years, this basic methodology has been applied in a wide variety of economic impact studies of natural resource related projects (Bergstrom et al., 1996; Bergstrom et al, 1990a; Bergstrom et al, 1990b; Cordell et al, 1990; Cordell et al, 1992; English et al, 1995; English and Bowker, 1996). The expenditure allocation table provided in English et al, 1995 (Table 1, pages 12-14), which is based on the standard methodology applied and reported in the above studies was used to match expenditure categories with IMPLAN sectors in this study.

4.6 Use IMPLAN Model to Estimate Economic Impacts in the Local Impact Region Resulting From Changes in Local Expenditures or Local Final Demand (Step 6)

The final step in the economic impact analysis process is to calculate economic impacts of local recreation expenditures or local final demand using the IMPLAN model. First, the expenditures reported in Table 4.6 and Table 4.7 are multiplied by 1,000 to obtain total expenditures by major expenditure category per 1,000 person visits for commercial rafting, private boating, and angling. These aggregate expenditures provide estimates of changes in local final demand per 1,000 trips by major expenditure categories associated with rafting, private boating, and angling trips to the Cheoah River. These changes in final demand are allocated to appropriate IMPLAN sectors using the methodology discussed in Step 5 above, and entered into the IMPLAN model. The IMPLAN model then calculates changes in economic activity and impacts stimulated by these final demand changes. The most recent IMPLAN data available (1998) describing the Graham County economy was used to construct the local region impact

model. Default values within the IMPLAN model were used for regional purchase coefficients and trade and transportation margins (English and Bowker, 1996; MIG, Inc., 1999).

Estimated economic impacts for commercial rafting and private boating per 1,000 person visits are shown in Tables 4.8 and 4.9. Commercial rafting impacts are shown with and without guide fees. The without guide fee analysis therefore does not include economic impacts associated directly with commercial rafting companies since these companies are assumed to be located outside of Graham County as is the current situation. Impacts with guide fees were estimated by adding the $128.92 guide fee estimate to the low, medium and high rafting expenditure estimates reported in Table 4.6. Economic impacts in Graham County resulting from guide fees assume the location of commercial rafting outfitters in Graham County where guide fees are spent. The "with guide fee" economic impact estimates therefore include impacts (e.g., employment) associated directly with commercial rafting companies. The estimates of economic impacts with guide fees are only applicable to Graham County if commercial rafting outfitters eventually do locate in the county and capture all guide fees associated with Cheoah River whitewater rafting. Estimated economic impacts for angling per 1,000 person visits are shown in Table 4.10.

Economic impacts are measured in terms of total output, total value added, and employment. Total output is the dollar value of annual production. Total value added includes employee compensation, proprietary income, other property income and indirect business tax. Employee compensation refers to all income paid to employees including wages and salaries, health benefits, and retirement benefits. Proprietary income refers to income received by self-employed individuals such a private business owners and professional service providers (e.g., physicians). Other property type income refers to interest payments, rents, royalties, dividends, and profits. Indirect business taxes refers to taxes that individuals pay to businesses such as sales and excise taxes (MIG, Inc., 1999). Total value added is a comprehensive measure of "new income" entering Graham County as a result of rafting, private boating, and angling visits to the Cheoah River by nonresidents of the county.

Table 4.8. Estimated Economic Impacts* of Cheoah River Commercial Rafting in Graham County, North Carolina per 1,000 Visits

Economic Impact Measure	Estimated Economic Impacts per 1,000 person visits for commercial rafting by low, medium and high expenditure scenarios (without guide fees)			Estimated Economic Impacts per 1,000 person visits for commercial rafting by low, medium and high expenditure scenarios (with guide fees)		
	Low	Medium	High	Low	Medium	High
Total Output	$45,175	$82,118	$119,021	$197,435	$234,378	$271,281
Total Value Added	$16,416	$29,837	$43,249	$116,399	$129,819	$143,232
Employment	0.7	1.3	1.9	7.8	8.3	8.9

*output and value added impacts inflated to 2000 dollars

Table 4.9. Estimated Economic Impacts* of Cheoah River Private Boating in Graham County, North Carolina per 1,000 Visits

Economic Impact Measure	Estimated Economic Impacts per 1,000 person visits for private boating by low, medium and high expenditure		
	Low	Medium	High
Total Output	$65,019	$79,836	$94,666
Total Value Added	$22,665	$27,825	$32,996
Employment	0.9	1.2	1.4

*output and value added impacts inflated to 2000 dollars

Table 4.10. Estimated Economic Impacts* of Cheoah River Angling in Graham County, North Carolina per 1,000 Visits

Economic Impact Measure	Estimated Economic Impacts per 1,000 person visits for angling by low, medium and high expenditure		
	Low	Medium	High
Total Output	$23,412	$56,904	$90,422
Total Value Added	$7,006	$17,030	$27,063
Employment	0.3	0.7	1.2

*output and value added impacts inflated to 2000 dollars

4.7 Comparison to Previous Studies

Previous studies of the economic impacts of river recreation have focused primarily on whitewater rafting. English (1995) examined the economic impacts of both Nantahala River commercial rafting and private boating on a three county region in North Carolina (Macon, Swain, and Cherokee Counties). In the case of private boating, English (1995) estimated economic impacts per 1,000 visits of $83,400 in total output (2000 dollars), $55,719 in total value added (2000 dollars) and 1.82 jobs measured in full-time equivalents. These results compare well to the Cheoah River private boating estimates reported in Table 4.9 particularly considering that these estimates represent impacts for a single-county region (Graham County). The English (1995) estimates of the economic impacts of whitewater rafting on the three county region used in this study are reported in Table 4.11.

In 1993, English and Bowker conducted a comprehensive study of economic impacts of whitewater rafting on five rivers (English and Bowker, 1996). The study examined the four eastern rivers reported in Table 4.11, and one western river (Middle Fork of the Salmon). Total output per 1,000 visits in the state where the river is located for the four eastern rivers examined by English and Bowker (1996) ranged from $116,235 to $468,015 with an average of $244,081 per 1,000 visits. The range of total output estimates reported in Table 4.11 compare well to the Cheoah River whitewater rafting estimates reported in Table 4.8. For example, the average state-level total output impact of $244,081 derived from the English and Bowker (1996) results includes guide fee impacts. To compare this average state-level economic impact estimate to the results reported in Table 4.8, we need to adjust state-level impacts to local-level impacts. English (1995) estimated economic impacts of Nantahala River whitewater rafting on a three county region in North Carolina that can be compared to the English and Bowker (1996) estimated economic impacts of Nantahala River whitewater rafting on the state of North Carolina. This comparison suggests that the total output impacts of Nantahala River whitewater rafting in the three-county region are about 70 percent of the state-level impacts. 70 percent of $244,081 is equal to $170,857 per 1,000 visits which falls between the high “without guide fee” and low “with guide fee” Cheoah River rafting total output impacts reported in Table 4.8. An assumption that up to 90 percent of state-level total output impacts of whitewater rafting occur

locally applied to the average state-level total output impact of $244,081 would result in a local impact estimate of $219,673 per 1,000 visits which falls between the low and medium estimates of Cheoah River rafting "with guide fee" total output impacts reported in Table 4.8. The Cheoah River "with guide fee" impact estimates may not be directly comparable to the English and Bowker (1996) results because of differences in guide fee estimates used and the condition in the Cheoah River "with guide fee" scenario that commercial rafting outfitters would locate in Graham County and capture all Cheoah River rafting guide fees. If guide fees associated with Cheoah River rafting end up being spent both within and outside of Graham County, estimated economic impacts would fall somewhere between the "with guide fee" and "without guide fee" estimates reported in Table 4.8 which would likely place these estimates even closer to those reported in English and Bowker (1996).

For a river-by-river comparison, average expenditures for the Gauley River reported by English and Bowker (1996) were equal to $177.00 per person per trip. These expenditures generated estimated state-level total output impacts equal to $257,685 per 1,000 visits. If we assume that 70 percent of the Gauley River total output impacts occur at the local level, the $257,685 state-level estimate suggests local economic impacts equal to $180,380 per 1,000 visits which is close to the low Cheoah River "with guide fee" total output impacts reported in Table 4.8. An assumption that up to 90 percent of state-level Gauley River total output impacts occur at the local level applied to $257,685 suggests local economic impacts equal to $231,916 which is close the medium Cheoah River "with guide fee" total output impacts reported in Table 4.8.

The average estimated total value added impacts for the rivers shown in Table 4.11 and for the Gauley River show a similar comparability as discussed for total output above. Whereas we are able to inflate estimated total output and total value added results to 2000 dollars using the consumer price index to facilitate comparison of impact results across studies, we do not have a similar "inflation" index for employment. Thus, it is difficult to directly compare the estimated employment impacts for the Cheoah River with previous studies. Presumably, economic development from 1992 (the base year for the Gauley River IMPLAN economy and analysis) to 1998 (the base year for the Cheoah River IMPLAN economy and analysis) would

increase estimated employment impacts of Gauley River rafting bringing these estimates closer to the estimated employment impacts of a potential Cheoah River rafting industry.

Table 4.11. Economic Impacts of Whitewater Rafting on Eastern Rivers*

	Chattooga River: GA	Chattooga River: SC	Gauley River	Kennebec River	Nantahala River 1	Nantahala River 2
Economic Impact Region	state	state	state	state	state	3 county region
Average Expenditures Per Person Per Trip in Impact Region	$116.61	$113.35	$177.00	$243.82	$72.53	$51.74
Total Output per 1,000 Trips	$199,875	$178,596	$257,685	$468,015	$116,235	$76,137
Total Value Added per 1,000 trips	$128,535	$111,069	$161,130	$292,002	$73,062	$44,772
Total Employment per 1,000 trips	3.5 (1992)	3.4 (1992)	5.1 (1992)	9.7 (1992)	2.2 (1992)	1.7 (1992)

*total output and total value added reported in 2000 dollars

5.0 CHEOAH RIVER RECREATION FACILITIES

There are a number of recreational facilities, as identified by various members of the Recreation and Aesthetics Workgroup, that may be necessary to support angling and whitewater boating on the Cheoah River. A subcommittee of the Recreation and Aesthetics Workgroup met in Tapoco, North Carolina on July 17, 2001 to examine potential put-in and take-out areas and to estimate the parking capacity along the Cheoah River corridor. Subsequent to this meeting, on October 24, 2001, Tapoco met with several commercial outfitters and the U.S. Forest Service to again discuss potential recreational facilities to support whitewater boating and angling on the Cheoah River. Recommendations for new facilities and/or modified facilities are discussed separately for angling and whitewater boating below. The feasibility of and costs associated with many of the recommended facilities will be discussed in an addendum to this report.

5.1 Angling

Many anglers participating in the July 2000 controlled flow study noted that access to the Cheoah River is poor because of dense streambank vegetation. Anglers fishing the section of the river from the General Store (RM 7) to the USFS Bridge (RM 2) could not walk along the banks at all. In an email dated September 6, 2001, Chris Goudreau, North Carolina Wildlife Resources Agency, recommended that adequate and safe access to the Cheoah River be provided if a recreational fishery is established.

The U.S. Forest Service, in a letter dated September 19, 2001, suggested improving several of the Cheoah River pull-off areas (currently, these areas are not officially maintained by the North Carolina Department of Transportation or the U.S. Forest Service as public access areas) to provide safe access to and parking along the river.

In all, approximately ten areas along the Cheoah River have been identified that could be improved to provide safe access to the river. These areas could also provide recreational opportunities for whitewater boaters who wish to “park and play”, picnickers, and sightseers. The feasibility and cost of improving these areas to provide safe access to the river will be discussed in greater detail in an addendum to this report.

5.2 Whitewater Boating

During the July 2001 controlled flow study, whitewater boaters put-in at the General Store at RM 7 on Highway 129 and paddled seven miles downstream to the take-out at the existing Magazine Branch Boat Access area, below the confluence of the Cheoah and Little Tennessee Rivers (RM 0). During the study, many of the boaters reported that the put-in and take-out areas were satisfactory. Subsequent to the study, several commercial outfitters (such as the Nantahala Outdoor Center, Wildwater Rafting, Endless River Adventures, and Rafting in the Smokies) identified a need for a larger put-in area, with adequate parking, a building for commercial outposts, and a permanent restroom/changing facilities. During the July 17, 2001 field visit, a subcommittee of the Recreation and Aesthetics Workgroup, identified the area just below Santeetlah Dam as a potential put-in area. The property immediately below the dam is owned by APGI, Tapoco Division and the U.S. Forest Service. Currently, there is a one-way in and out access road off State Road 1134 (Joyce Kilmer Road) to the area, which is typically gated. Specifically, the subcommittee discussed the need for the following facilities to be located at the proposed put-in:

- A put-in (launch area) and parking[2] below the dam at river mile nine (potentially separate launch areas for commercial rafters and private boaters);
- An improved entrance/exit road (either a one-way loop or a two-way road);
- Permanent restroom/changing facilities;
- A "barn" or building for rafts and other equipment (to include commercial check-in areas); and
- Picnic areas and dispersed camping.

The feasibility and cost of each of these recommended facilities will be discussed in greater detail in an addendum to this report.

During the same subcommittee field visit, the USFS estimated the potential parking capacity along the Cheoah River corridor to be approximately 50-60 vehicles; however, a

[2] A satellite parking area may be necessary.

majority of these potential parking areas (more than 80 percent) are located in the upper four miles of the river corridor. There are fewer opportunities downstream near the Tapoco Lodge, where many private boaters might "park and play" and anglers will fish. The subcommittee discussed that additional parking along the Cheoah River (to meet state standards for formal highway parking, including site distances and distance from the highway) would be needed to support whitewater boating and angling on the Cheoah River. The U.S. Forest Service also suggested that there might be additional parking opportunities on the opposite side of the Cheoah River, on USFS property (approximately RM 1.5).

Also during the July 2001 field visit, the subcommittee examined the following as potential take-out areas below Cheoah Dam:

- The Cheoah Dam Tailrace Access Area could be used as a take-out for private boaters and/or as an alternative commercial take-out for commercial boaters (passengers). Currently, the area is used by anglers fishing in the tailrace. There is a paved parking area, which can accommodate approximately 12-16 vehicles and an unimproved access trail down to the tailrace. On October 24, 2001, the U.S. Forest Service offered more specific recommendations (e.g. a hardened access trail, steps down to the river, and additional parking) that will be discussed in greater detail in an addendum to this report.

- The Magazine Branch Boat Access Area, located off Highway 129 on Calderwood Reservoir, is also a potential take-out area. Existing recreation activities at the access area are boat launching (Magazine Branch is the only boat launch on Calderwood Reservoir), camping, and picnicking. Due to limited space and the narrow access road, additional traffic and parking at the boat launch and campground could congest the area and displace existing users. Recommended facilities at the potential take-out area include improved access and parking and restrooms/changing facilities. Buses could be parallel parked at the entrance to the access area or at the far end of the access area (approximately five buses). Additional parking may be necessary. Again, the feasibility and cost of the recommended facilities will be discussed in an addendum to this report.

- Ken Kastorff, Endless River Adventures, also suggested (July 17, 2001 subcommittee field visit) that take-out areas, with steps, could be developed on either side of the Highway 129 bridge below Cheoah Dam for commercial boaters (the guides would take the rafts out at the Magazine Branch recreation area). This option would eliminate the need for buses to travel into the Magazine Branch Boat Access Area.

5.3 Other

During a subsequent field visit to the Cheoah River and the potential put-in and take-out sites on October 24, 2001, the U.S. Forest Service recommended the following additional facilities to support whitewater boating and angling on the river:

- An accessible fishing pier at the proposed put-in site below Santeetlah Dam;
- In addition to picnic tables, facilities to support mountain biking and hiking near the proposed put-in site below Santeetlah Dam;
- A historical/interpretive structure at the entrance to the proposed launch area;
- An information/bulletin board at the proposed put-in below Santeetlah Dam;
- Paved parking areas and access trails to the river; and
- An observation deck/area (suggested location RM 6).

The feasibility and cost of these facilities will be discussed in Tapoco's Preliminary Draft Environmental Assessment (PDEA).

Additionally, the Fish, Aquatics, and Water Quality Workgroup, at a workgroup meeting on October 17, 2001, recommended that interpretive materials and programs (cultural) be established along the Cheoah River corridor.

6.0 FIGURES

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Figure 3.1 – Cheoah River 5-Minute Launch Window

Figure 3.2 – Cheoah River 10-Minute Launch Window

Figure 3.3 – Cheoah River 15-Minute Launch Window

7.0 CONCLUSIONS

The Cheoah River Recreation Study was designed to evaluate whitewater boating and angling opportunities on the Cheoah River in North Carolina, as well as to evaluate the potential future use of the river and the regional economic impacts associated with recreation on the river. The recreation study was divided into four parts: 1) a river characterization, 2) a controlled flow study, 3) a potential future use analysis, and 4) a regional economic impact assessment. The results of each part of the study are summarized below. Additionally, the Recreation and Aesthetics Workgroup has discussed, on several occasions, the need for new facilities to support angling and whitewater boating on the Cheoah River. Requests and/or recommendations from the workgroup are also summarized below.

7.1 River Characterization

The Cheoah River is approximately nine miles long from the base of Santeetlah Dam to its confluence with the Little Tennessee River. The river is characterized by a very continuous average gradient of 100 feet/mile, a rocky bedrock substrate, and a fairly narrow confined stream channel. The river and its shoreline are heavily vegetated. Together, these physical characteristics directly affect the recreation opportunities on the river.

7.2 Controlled Flow Assessment

Results of the controlled flow study, conducted in July 2000, indicate that the optimum flow for angling on the Cheoah River, within the range of flows tested (75 cfs to 1,130 cfs), is between 75 cfs and 100 cfs. Six out of the ten angling participants rated the 75 cfs flow as the best, with more than 75 percent of the participants indicating that they would return to fish the river at similar flows. Flows of 670 cfs and above offered almost no opportunity for angling and are clearly unsuitable for this activity.

The controlled flow study results indicate that optimum conditions, within the range of flows tested, for kayaks and canoes occurred at 1,130 cfs (the highest tested flow), while optimum conditions for rafts occurred at 1,010 cfs. Flows of 950 cfs and 1,010 cfs were noted as providing good opportunities for kayaking and canoeing, with over 90 percent of the kayakers

and canoeists participating in the study indicating that they would return to the river under similar conditions. Study results indicate that the flow of 670 cfs was poor for rafting because of the limited route options and the numerous groundings due to shallow water depths. All boaters noted that drops were steeper and more dangerous, with shallower landings at 670 cfs.

7.3 Potential Future Use Analysis

The potential future use analysis indicates that annual angling use of the Cheoah River could vary considerably depending on whether the river is managed as a cold water or warm water fishery. If the river is managed as a cold water Delayed Harvest trout stream, it is estimated that the river would attract approximately 12,800 trips/year. If the river is managed as a warm water fishery, it is estimated that it would attract approximately 2,600 trips/year.

Based on the paper model exercise conducted by a subcommittee of the Recreation and Aesthetics Workgroup in July 2001, whitewater boating use could range from approximately 900 to 1,400 people per/day depending on future management decisions and the level of desired social interaction. The maximum safe physical capacity of the Cheoah River for whitewater boating was estimated at approximately 2,800 people/day.

7.4 Regional Economic Impact Assessment

Results from the regional economic impact assessment indicate that future recreational use of the river including angling, commercial rafting, and private boating could result in an annual increase in total output for Graham County (measured as the dollar value of annual production in the county) of between $133,000 and $455,000 per thousand users, depending on the management scenario. Increased employment in the county could range from 1.9 to 11.5 per thousand users. The largest potential economic impact to the county would be associated with future commercial rafting activity, particularly if commercial outfitters actually locate in the county. Currently, there are no outfitters located in Graham County.

7.5 Cheoah River Recreation Facilities

New or modified recreational facilities may be necessary to support whitewater boating and angling on the Cheoah River. A subcommittee of the Recreation and Aesthetics Workgroup

met on July 17, 2001 to discuss the need for new or modified recreational facilities and to evaluate the parking capacity along the river corridor. Based on conversations with the subcommittee, if the river becomes a whitewater river and/or a recreational fishery it is likely that put-in and take-out areas will need to be improved, as will access to the river along Highway 129. Specifically, the subcommittee discussed the area immediately below Santeetlah Dam as a potential put-in site and the Cheoah River Tailrace Access Area and/or the Magazine Branch Boat Access Area as potential take-out areas. The feasibility and cost of many of the proposed recreational facilities will be discussed in an addendum to this report.

8.0 COMMENT SUMMARY

Alcoa Power Generating Inc., Tapoco Division (Tapoco) distributed a copy of the Cheoah River Recreation Study River Characterization and Controlled Flow Assessment (Parts 1 and 2) Draft Interim Report to all relicensing participants on December 21, 2000. Tapoco met with participants on February 12, 2001 in Asheville, North Carolina to discuss the draft interim report. Kleinschmidt Associates revised the report based on comments received at the February 12, 2001 meeting and Tapoco distributed a revised draft interim report at the March 22, 2001 Cheoah River Recreation Study meeting, also in Asheville, North Carolina. Subsequent to the March 22, 2001 meeting, the revised draft report was also distributed to all relicensing participants on March 26, 2001. Tapoco reviewed all verbal and written comments received on the draft study report and after Kleinschmidt Associates revised the report, Tapoco distributed the Cheoah River Recreation Study River Characterization and Controlled Flow Assessment (Parts 1 and 2) Final Interim Report to the Recreation and Aesthetics Workgroup (formed May 2001) on July 23, 2001.

A companion to the study report, the Cheoah River Recreation Study controlled flow release video was also reviewed at the February 12, 2001 meeting. After reviewing the video at the meeting, several participants indicated that there might be some mistakes in the video (e.g. mislabeled flows). Tapoco solicited additional comments on the video, subsequent to the meeting, from those participants who both attended the February 12, 2001 meeting and participated in the July 2000 controlled flow study. Tapoco revised the video based on all comments received. Copies of the video were distributed upon request.

In preparation for a meeting of the Recreation and Aesthetics Workgroup on June 13, 2001, Tapoco distributed draft copies of the Potential Future Use Analysis and Economic Impact Analysis on May 31, 2001. Tapoco hosted a meeting on June 13, 2001 in Asheville, North Carolina to review the preliminary results of the Cheoah River Potential Future Use Analysis and Economic Impact Analysis (Parts 3 and 4). Based on comments received on the Potential Future Use Analysis, Tapoco met with a subcommittee of the Recreation and Aesthetics Workgroup on July 17-18, 2001 in Tapoco, North Carolina to discuss the Cheoah River's physical and social

carrying capacity for whitewater boating. Based on all verbal and written comments received, Kleinschmidt Associates revised the two reports, which were distributed and reviewed at a workgroup meeting on August 8, 2001 in Asheville, North Carolina. Again, Kleinschmidt Associates revised the two reports based on comments received at the meeting and in writing. On August 22, 2001 Tapoco met with the Recreation and Aesthetics Workgroup to again discuss the results of the Cheoah River Economic Impact Analysis. Revised versions of the Potential Future Analysis and the Economic Impact Analysis information are now incorporated into the final report (January 2002).

Table 8.1 below outlines all comments received on the various draft reports and the controlled flow release video and describes Tapoco's response to each.

Table 8.1 – Comment Summary

River Characterization and Controlled Flow Assessment (Parts 1 and 2)		
Source of Comment	**Comment**	**Response**
Wildwater Ltd. (letter dated April 18, 2001)	Page 27 "Why are there no negative comments except at 670 cfs? I have heard numerous comments at the public meetings stating 950 cfs was very difficult for raft navigation."	Study results do not indicate that the river was "very difficult for raft navigation" at 950 cfs and few negative comments were reported at this flow. In fact, over 90 percent of the rafting participants rated their experience at 950 cfs as either "good" (50%), or "excellent" (41%) (see Figure 2.12). When asked to compare the 950 cfs flow to all the other flows, the experience was rated as a 1.1 on a scale from –2 to +2 with a 1 being "good" (see Table 2.3). The most commonly noted disadvantage of 950 cfs was "lack of ability for learning/teaching".
Wildwater Ltd. (letter dated April 18, 2001)	Page 30 & 31. "950 cfs". "Why are there no comments reflecting that this was considered an absolute minimum rafting level and far from optimum?"	No comments were made during the study suggesting that 950 cfs was an absolute minimum level for rafting.
Wildwater Ltd. (letter dated April 18, 2001)	"There is no discussion about the fact that it rained during the whitewater boating study and additional inflows were experienced as boaters traveled downstream. This may help explain why in many places the lower section got higher ratings."	All flows reported in the study were measured at the USGS gauging station located at the USFS bridge just upstream of the lower section of the river.
Wildwater Ltd. (letter dated April 18, 2001)	"The report refers to a level between 670 and 950 cfs as a minimum level for boating without differentiating between Rafting and kayaking."	Study results are differentiated by watercraft in Tables 2.2 and 2.3, and in Figures 2.9, 2.10, 2.12, 2.13, and 2.14. Overall rating scores for 950 cfs were not significantly different between different watercrafts. Recorded mean scores from the Comparative Flow survey ranged from .8 for kayaks to 1.1 for rafts on a scale of –2 to +2 with a "1" defined as "good".
Wildwater Ltd. (letter dated April 18, 2001)	"When boaters looked at levels from the perspective of experiencing all flows, 950 cfs was considered an unacceptable rafting flow."	Study data do not support this statement. Of the 8 rafters that experienced all four test flows and completed a Comparative Flow Survey at the end of the study, 3 reported 950 cfs as "good" and 4 reported it as "excellent". One rafting participant reported 950 cfs as unacceptable. These results are shown in Figure 2.13.
Wildwater Ltd. (letter dated April 18, 2001)	Page 37: "These data indicate that 950 cfs is well above the minimum acceptable flow for whitewater boating on the river." This statement is very misleading. The data and graphs show that at the higher water releases perceived value of these releases had reached a plateau, but at the lower whitewater release levels perceived value was climbing rapidly. This steep	The sentence referred to on page 37 has been removed to avoid any potential misleading phases. However, the data do indicate that ratings for 950 cfs are significantly greater than a "minimum acceptable" level as defined by the neutral line on the graph (score = 0.0) (see Figures 2.7 and 2.8). The original statement on Page 37 was intended to refer to the difference in

	curve indicates that the minimum acceptable flow is only slightly below 950 cfs."	the magnitude of the rating score rather than any difference in the magnitude of the flow (i.e. it is true that a small change in flow between 670 and 950 cfs could result in a large change in the rating score and thus the minimum acceptable flow could be a flow slightly less than 950 cfs). The report makes no attempt to interpolate between the two test flows.
Wildwater Ltd. (letter dated April 18, 2001)	"I would like some language added to the final conclusion that discusses the optimum levels experienced. Whitewater boaters experienced three levels with cfs unknown to them and then were asked to pick a level they would like to see next. The boaters selected a flow they considered optimum given the acknowledged constraint that the amount of water released had monetary value. The boaters picked a level that met the goals of the paddlers and preserved water for other users. This level of 1010 should therefore be considered a minimum acceptable flow given the existing stream conditions (heavily vegetated)."	The purpose of this study was to objectively evaluate four different flows for whitewater boating, without consideration of the various tradeoffs that might be made at some later date. After experiencing three flows, boaters were asked to select a fourth flow for evaluation. This fourth flow was not necessarily intended to represent an optimum flow (in fact study data indicate that many boaters reported the 1130 cfs flow as an optimum). Study results show that the 1010 cfs flow scored very well, both on its own merits and in comparison to the other three flows tested. For the purpose of analysis, the "minimum acceptable" flow is defined as a rating score of 0.0 based on well established recreation research. The 1010 cfs flow scored 1.4 and 1.5 on average for the Single Flow Survey and the Comparative Flow Survey respectively.
Nantahala Outdoor Center (letter dated April 18, 2001)	"…the conclusion reached on page 26 p. 3 and page 36 p. 4, that the minimum acceptable flow for boating is somewhere between 670 cfs and 950 cfs, is drawing a conclusion not based on evidence from the study."… "To assume that any level below 950 cfs would be acceptable is speculation not backed by research."	Study results indicate that 950 cfs resulted in an acceptable whitewater boating experience with average rating scores around "1", which was defined as "good" (see Tables 2.2 and 2.3, and Figures 2.7, 2.8, 2.9, 2.10, 2.12, 2.13, and 2.14). For the purpose of analysis, the "minimum acceptable" flow is defined as a rating score of 0.0 based on well-established recreation research. Given the rating scores reported for 950 cfs, it is safe to assume that the minimum acceptable flow is some flow less than 950 cfs. However, of the flows actually tested, 950 cfs was the lowest flow that received a numeric rating above the acceptable level.
USA Raft (letter dated April 9, 2001)	"My first concern is with the limited number of commercial outfitters involved with the actual flow study."	One commercial outfitter (the Nantahala Outdoor Center) was contracted to provide safety and rafting equipment and guides for the study. This was done purely for logistical reasons and was not intended to represent commercial interests or to provide any competitive advantage to a given outfitter. Staff from the Nantahala Outdoor Center had no responsibility for decisions regarding study participants beyond safety personnel and raft guides. The majority of "rafters" that participated in the study had no affiliation with a particular commercial outfitter.

USA Raft (letter dated April 9, 2001)	"Another area of concern is the type of watercraft that was used in evaluating the flows for commercial rafting purposes. The traditional non-bailers that were used are outdated and not used regularly on anything above class III by most commercial rafting companies."	The purpose of this study was to evaluate whitewater boating opportunities regardless of whether they were commercial or private. Efforts were made to evaluate a range of watercrafts, however, not all craft types were evaluated. Non-bailing rafts were selected for safety reasons and are regularly used for commercial operations on the Chattooga and other Class IV rivers. The potential influence of raft craft type is noted in the report.
Western Carolina Paddlers (email dated April 17, 2001)	"Please insert a table which correlates flow rates in cfs with river gage stage readings in feet. After some reflection on boaters' collective concern about navigability, I think we are incorrectly focusing on cfs instead of river stage. . . Stream flow elevation is the sole physical measure that has a chance of specifying operation conditions that provide consistent rock coverage. I would like to begin expressing flows in elevation v. volume."	The USGS monitors river stage and stream flow at their gage station on the Cheoah River (0351751500). Information on the daily mean gage height in feet and daily mean stream flow in cfs is available on their website at www.usgs.gov.
Western Carolina Paddlers (email dated April 17, 2001)	"The documentation doesn't clearly highlight the order of the four flows except in the text. This is important because of the amount of attention devoted to comments made after each individual flow. The 950 cfs flow had a large number of comments about safety. That made sense because it was the first run for most boaters. The subsequent higher flows had far fewer safety related comments. That doesn't imply these flows were 'safer' but that boaters were more experienced and had already commented on these aspects of the river. At a minimum, each time user comments are presented relative to a flow, please insert the sequence that the flow had among the four flows (e.g. 1 of 4)."	The flow sequence has been added to each set of user comments in Section 2.2 "Results".
Western Carolina Paddlers (email dated April 17, 2001)	"The boating flows occurred over a three day period, I believe the text allocates the flows to two days. The third day corresponds to the 1,010 cfs flow, the one with the lowest number of participants"	The final report accurately reports that the flows for the controlled flow study for angling and whitewater boating were released over the course of four days (July 11, 12, 13, and 14, 2000). Boating flows began on July 12 and continued through July 14.

Western Carolina Paddlers (email dated April 17, 2001)	"Reduce the relative amount of attention paid to comments on the individual flows. Concentrate on the summary questions which compare all four flows to each other; I think this is the most valid comparison."	The report has been modified to provide equal presentation of results from both the Single Flow Survey, which represents reactions immediately following a given flow and responses to the Comparative Flow Survey, which represents reactions after experiencing all flows. Both results are relevant and valid. No attempt has been made to weight one over the other.
American Whitewater (letter dated April 16, 2001)	"American Whitewater offers the following comments on the Cheoah River Recreation Study Draft Interim Report. American Whitewater has a number of specific comments, which are included in the attached red-line of the draft report."	Where appropriate, Kleinschmidt Associates has incorporated the edits offered by American Whitewater in their red-line of the draft report into the final report
American Whitewater (letter dated April 16, 2001)	"There remains too much analysis of the single flow results to form the basis of conclusions. Responses to single flows represent a participants experience relative to that flow only. The primary value of this type of study is the comparative survey questions at the conclusion of the study. Participants are able to respond to questions comparing the experience of one release flow to another. As such, the analysis and conclusions should be based on these comparisons."	The report has been modified to provide equal presentation of results from both the Single Flow Survey, which represents reactions immediately following a given flow and responses to the Comparative Flow Survey, which represents reactions after experiencing all flows. Both results are relevant and valid. No attempt has been made to weight one over the other.
Potential Future Use Analysis (Part 3)		
July 13, 2001 Workgroup Meeting US Forest Service Western Carolina Paddlers	" . . . the social carrying capacity assumptions are oversimplified." The USFS suggested that the social carrying capacity number not be based on an individual's professional judgment, but rather on the knowledge of a panel of experts. Specifically, the USFS asked Tapoco to convene a small group or subcommittee of experts to model, on paper, a run down the Cheoah River to determine an approximate social carrying capacity for the river. Rod Baird disagreed with the high and low daily use numbers. He said that the low daily use number on the Chattooga River, a wild and scenic river, is 668 people (almost two-fold of the low use number estimated for the Cheoah River).	Based on the paper model exercise conducted on July 17-18, 2001 (discussed in greater detail in Section 3.2 Methods) a subcommittee of the Recreation and Aesthetics Workgroup calculated the social and physical carrying capacity of the Cheoah River: Social Carrying Capacity: 928 (15-minute launch window) to 1,392 (10-minute launch window) Physical Carrying Capacity: 2,784 (5-minute launch window)
July 13, 2001 Workgroup Meeting	"The trip size (30 people – five rafts, six people per raft) is too small; a trip size of 48 people is a more appropriate trip size."	During the paper model exercise conducted on July 17-18, 2001, the USFS expressed a desire to keep the party size on the Cheoah River to less than 40 people per group. After some

Wildwater Ltd.		discussion, the subcommittee of the Recreation and Aesthetics Workgroup assumed that the average commercial trip size on the Cheoah River would be six boats accommodating up to 42 people (36 paying customers and six guides).
Regional Economic Impact Assessment (Part 4)		
July 13, 2001 Workgroup Meeting USA Raft Pigeon River Outdoors Western Carolina Paddlers Nantahala Outdoor Center	" . . . the expenditures of commercial rafters on the Cheoah River (page 7) would not be similar to a trip on the Nantahala River. Rather, a trip on the Gauley River would be the most similar to a trip on the Cheoah River." " . . . the total spending for the Gauley River, $273.12 is closer to what should be expected on the Cheoah River." "Private boating expenditures on the Cheoah River will likely be close to private boating expenditures on the Dead River."	The probable per person per trip expenditures for commercial rafting and private boating were revised and IMPLAN was rerun. The per person per trip expenditures for commercial rafting, using the benefit transfer method, are based on Chattooga River data (low) and Gauley River data (high); a range of $42.22 to $111.22 (Table 4.6) The low estimate of per person per trip expenditures for private boating is now an average of the Dead River and Nantahala River per person per trip expenditures ($61.33) and the high estimate is based on the Upper Youghiogheny River estimate of $89.30 (Table 4.6).
July 13, 2001 Workgroup Meeting Western Carolina Paddlers	" . . . page five on the Cheoah River Regional Economic Impact Analysis Preliminary Results paper, 'because no commercial rafting outfitters are currently located in Graham County, we assume that guide fees expenditures will occur outside of Graham County. . . It is very likely that commercial outfitters would have outposts in Graham County.	Kleinschmidt Associates and Dr. John Bergstrom calculated the regional economic impacts of whitewater rafting with and without guide fees (a sensitivity analysis). The results are reported in Table 4.8.
NC Wildlife Resources Commission (phone call from Jim Borawa)	Jim Borawa contacted Tapoco on June 29, 2001 to discuss estimated angling expenditures on the Cheoah River. Preliminary estimates of angling expenditures on the Cheoah River were presented at a July 13, 2001 Recreation and Aesthetics Workgroup meeting. Subsequently, Trout Unlimited contacted the NCWRC to express their dissatisfaction with the angling expenditure estimates being used for the Cheoah River Recreation Study. The NCWRC provided Tapoco copies of three documents (a NC State University Graduate Study Dissertation, a 1989 Sport Fishing Institute Study, and a 1988 Arkansas Study), which they thought might help Tapoco better estimate angling expenditures on the Cheoah River.	Based on additional information received from NCWRC, the per person per trip angling expenditures were revised to include a high and a low per person per trip estimate. Initially, the per person per trip angling expenditures was based solely on expenditure information from the USFWS National Survey of Fishing, Hunting, and Wildlife-Associated Recreation ($24.79 per person per trip). A 1997 dissertation conducted by SoEun Ahn at NC State University entitled, "Economic Analysis of the Potential Impacts of Climate Change on Trout Fishing in the Southern Appalachian Mountains" provided some limited data on the expenditures of trout anglers in North Carolina. Using this information, the per person per trip expenditures for angling on the Cheoah River range from $22.81 (freshwater fishing) to $88.12 (trout fishing) – Table 4.7.
August 22, 2001 Workgroup Meeting	"The guide fees for the Chattooga River in Table A4 on page 25 are low; Wildwater's guide fees for Section IV of the Chattooga are much higher than the range in Table A4 ($44.31	Based on current pricing, the guide fee for the Chattooga River (in Table C.4) was revised from a range of $44.31-$67.68 to $91.00. The average of the Chattooga River and Gauley River

Wildwater Ltd.	- $67.68)."	guide fees ($128.92) is used as the estimate of guide fees for the Cheoah River.
August 22, 2001 Workgroup Meeting Wildwater Ltd.	"Add a sentence to the report, which explains that the employment figures (an IMPLAN output) do not have a direct relationship to rafting employment. I am concerned that the county commissioners will conclude, from the report, that rafting will not provide a huge boost to employment."	See page 70, "The 'with guide fee' economic impact estimates therefore include impacts (e.g. employment) associated directly with commercial rafting companies."
August 22, 2001 Workgroup Meeting Endless River Adventures	"The report should acknowledge that the number of people visiting the county will be greater than the number of rafters on the Cheoah River (e.g. out of a family of four, two might raft and the other two might hike or picnic in Joyce Kilmer)."	Comment acknowledged. The economic impact of other recreational visitors to Graham County was evaluated in a separate study.
Controlled Flow Release Video		
NC Division of Water Resources (email dated March 2, 2001)	"The rafting footage is mislabeled at the 1,010 cfs and 1,130 cfs flow at all locations (A, B, C, and D). The 1,010 cfs flows (as labeled) are actually the 1,130 cfs flows and vice versa. Only one raft boated the 1,010 cfs flow; therefore, if there is more than one raft in the shot, then it is not the 1,010 cfs flow."	The raft footage was mislabeled at all four locations at the 1,010 cfs and 1,130 cfs flows. The 1,010 cfs flow was actually the 1,130 cfs flow and vice versa. The flow labels and footage have been corrected in the final controlled flow release video.
American Whitewater (letter dated March 7, 2001)	"The video does not capture the experience of open boaters, kayakers, and rafters at all locations (A, B, C, and D) at all four flows. If additional footage is unavailable, then the video's narration should explain the absence of open boats, kayaks, or rafts at the respective flows."	Additional rafting footage has been added at location B at the 670 cfs and 1,010 cfs flows and at location C at the 670 cfs, 950 cfs, and 1,010 cfs flows. No additional raft footage exists at location A at the 670 cfs or 950 cfs flows or at location D at 670 cfs. Additional open boat footage has been added at location B at the 1,010 cfs flow and at location C at the 950 and 1,010 cfs flows. No additional open boat footage exists at location A at the 950 cfs, 1,010 cfs, and 1,130 cfs flows, at location B at the 950 cfs and 1,130 cfs flows, at location C at the 670 cfs or 1,130 cfs flows, and location D at the 670 cfs, 950 cfs, or 1,130 cfs flows.
American Whitewater (letter dated March 7, 2001)	"The video does not document the rafts at any location (A, B, C, or D) at the 670 cfs flow."	Footage of the rafts at the 670 cfs flow at locations B and C has been added to the video.
American Whitewater (letter dated March 7, 2001)	"At the 950 cfs flow, the video excludes rafts at all locations except D (A, B, and C)."	Footage of the rafts at the 950 cfs flow at location C has been added. No additional footage of the rafts at the 950 cfs flow exists at locations A and B.
American Whitewater (letter dated March 7, 2001)	"The open boats are only included in the video at location A (at 670 cfs only), location B (670 cfs only) and location D (at 1,010 cfs only)."	Footage of the open boats at location B at the 1,010 cfs flow and at location C at the 950 cfs and 1,010 cfs flows has been added to the video.
American Whitewater (letter dated March 7, 2001)	"A disclaimer that explains that the video is not representative of the controlled flow study should be added to the video."	The video visually documents the angling and boating experience on the Cheoah River under a variety of test flows

		and is intended as a companion to the Cheoah River Controlled Flow Study Interim Report. No disclaimer was added to the video.
American Whitewater (letter dated March 7, 2001)	"The video does not consistently document each flow (i.e. the camera angles and zoom change) and therefore does not allow for unbiased flow comparisons."	The purpose of the video is to visually document the angling and boating experiences during the Cheoah River controlled flow assessment under a variety of test flows. The video was not intended to be used to make direct visual comparisons of the flows.
American Whitewater (letter dated March 7, 2001)	"The narration of the video states that the study investigated "six different flows for angling and boating activity." The narration does not distinguish between the number of flows fished (4) and the number of flows boated (4)."	The narration has been revised to read, "The recreation flow study looked at four different flow levels for angling activity and four different flow levels for boating activity." The narration is correct later in the video when it reads "the study looked at four different flows for angling" and "four different flows were looked at four boating opportunities."
American Whitewater (letter dated March 7, 2001)	"The narration of the video states that "the 670 cfs and 950 cfs flows were too high for fishing based on visual observations . . . these flows are shown in the boating portion of this video." The Cheoah River Recreation Study Draft Interim Report indicates that these flows (670 cfs and 950 cfs) were fished. If so, angling at these flows should be included in the video and the narration should be adjusted to indicate that these flows were fished."	The anglers attempted to fish the 670 cfs and 950 cfs flows, as stated in the Cheoah River Recreation Study Interim Report, however, footage of the anglers fishing the 670 cfs and 950 cfs flows does not exist.
American Whitewater (letter dated March 7, 2001)	"The narration should avoid identifying the best flow for fishing and boating so that viewer can form an opinion based on his or her own observations."	The video does not characterize one flow as better than another for angling or boating. The video does state, "the 670 cfs and 950 cfs flows were too high for fishing based on visual observations". This is a fact, not an opinion that was recorded during group discussions with the anglers after each test flow.
American Whitewater (letter dated March 7, 2001)	"The angler on the lower reach during the 75 cfs flow may have actually been fishing the 100 cfs flow."	The footage in question was double checked for accuracy. The angler fishing on the lower reach during the 75 cfs flow is fishing the 75 cfs flow, not the 100 cfs flow.
American Whitewater Western Carolina Paddlers	"Tapoco received several requests, from American Whitewater and the Western Carolina Paddlers, to share copies of the raw video footage shot during the study."	Because so much raw footage was shot during the controlled flow release study, Tapoco believes that it is not practical to make copies of the raw video footage available for distribution.

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APPENDIX A – Boaters and Anglers Participating in the July 2000 Controlled Flow Study

First Name	Last Name	Organization Name	Address	City	State	Postal Code	Phone Number
Keith "Zog"	Aitken	American Whitewater	P.O. Box 842	Weaverville	NC	28787-	(828) 645-5299
Carolyn	Allison	Wildwater Ltd.	223 Wesser Ridge Lane	Bryson City	NC	28713-	(828) 488-0415
Rod	Baird	AW Regional Coordinator, WCP, Cheoah Alliance	33 Grovewood Road	Asheville	NC	28804-	
Rob	Barham	NOC	13077 Highway 19 West	Bryson City	NC	28713-	(828) 488-2176
Roger	Barr	Wildwater Ltd.	1405 Shirley Drive	Anderson	SC	29621-	(864) 296-1278
Jerry	Beckwith	Tuskaseegee, NP&L Volunteer	Post Office Box 507	Dillsboro	NC	28725-	
Chris	Bell	WCP	7 Garden Terrace	Asheville	NC	28804-	
Ben	Bergen	Wildwater Ltd.	P.O. Box 231	Almond	NC	28702-	(828) 488-2384
Richard	Bernardi						(828) 488-8311
Jim	Borawa	North Carolina Wildlife Resources Commission	NCWRC, 4960 Parks Creek Drive	Morganton	NC	28655-	(828) 299-7023
Bob	Brown	North Carolina Wildlife Resources Commission	NCWRC, 4960 Parks Creek Drive	Morganton	NC	28655-	(828) 437-3977
Brian	Burns	NOC	1740 Winding Stairs	Topton	NC	28781-	(828) 321-9415
Melissa	Caldwell		Route 1, Box 10C	Robbinsville	NC	28771-	(828) 479-4059
Marshall	Campbell	Tapoco Lodge	P.O. Box 352	Robbinsville	NC	28771-	
Jon	Christensen	Kleinschmidt Associates	Kleinschmidt Associates, 75 Main Street	Pittsfield	ME		
David	Cody	Tapoco Lodge	Tapoco Lodge, Route 72 Box A-1	Tapoco	NC	28771-	(828) 479-3003
Mark	Copeland		1722 Curi Street	Alcoa	TN	37701-	(865) 977-3230
John	Cramp	Wildwater Ltd.	P.O. Box 507	Ducktown	TN	37326-	(423) 496-4904
Jason	Darby	Chota/Cheoah Alliance	910 Forest Ridge Circle	Knoxville	TN	37932-	
Ceana	Dia Hoffmann		945 Silvermine Road	Bryson City	NC	28713-	(828) 488-0574
Dan	Dixon	Nantahala Outdoor Center	13077 Hwy 19 West	Bryson City	NC	28713-	
Dean	Eschmann		250 Applevalley Road	Sevierville	TN	37862-	(423) 516-9813
Chuck	Estes	AW Board, ETNWW Club, Cheoah Alliance	114 Bay Path Drive	Oak Ridge	TN	37830-	
John	Gangemi	American Whitewater	American Whitewater, 482 Electric Avenue	Bigfork	MT	59911-	
Doug	Geiger		P.O. Box 276	Bryson City	NC	28713-	(828) 488-6199
Christopher	Goudreau	North Carolina Wildlife Resources Commission	NCWRC, 645 Fish Hatchery Road	Marion	NC	28752-9229	(828) 652-4360

First Name	Last Name	Organization Name	Address	City	State	Postal Code	Phone Number
Joe	Greiner	AW Board, Carolina Canoe Club	7316 Chicaora Court	Raleigh	NC	27615-	
Richard	Guin		14690 Highway 19 West	Bryson City	NC	28713-	(828) 488-2386
Alex	Harvey	AW Regional Coordinator/Tuck Relicensing Team	AviGenics, CCRC-UGA Bldg., 220 Riverbend Road	Athens	GA	30602-4712	
Bob	Hathcock	Nantahala Outdoor Center	13077 Hwy 19 West	Bryson City	NC	28713-	
Steve	Hendricks	USFS	Cherokee National Forest, P.O. Box 2010	Cleveland	TN	37320-	(423) 476-9748
Chris	Houston		7697 McHenry Circle So.	Germantown	TN	38138-	(901) 757-1329
Brady	Hudkins		19292 Wayah Road	Aquone	NC	28751-	(828) 321-3350
Meredith	Hunter	Wildwater Ltd.	P.O. Box 231	Almond	NC	28702-	(828) 488-0469
Brian	Jacobson	AW Regional Coordinator, Hydrology Expert	2064 Old Forge Way	Marietta	GA	30068-	
Matt	Jennings		13077 Highway 19 West	Bryson City	NC	28713-	
Bunny	Johns	Nantahala Outdoor Center	Nantahala Outdoor Center, 13077 Highway 19 W	Bryson City	NC	28713-	
Mike	Kelly		350 Thunderbird Trail	Lake Santeetlah	NC	28771-	(828) 479-9221
Rob	Kelly	Nantahala Outdoor Center	13077 Hwy 19 West	Bryson City	NC	28713-	
Payson	Kennedy	NOC	13077 Highway 19 West	Bryson City	NC	28713-	(828) 488-6706
Joanne	Knight		Route 3, Box 117B	Robbinsville	NC	28771-	(828) 479-4069
Jonathan	Lopez		8207 Sawyer Brown Road H-3	Nashville	TN	37221-	(615) 662-9051
Andy	MacKinnon		P.O. Box 592	Gatlinburg	TN	37738-	(865) 436-5008
Ed	McGee	Tri-Fly	103 Talon Drive	Cary	NC	27511-	
Reve	McNamara		945 E. Silvermine Road	Bryson City	NC	28713-	(828) 488-0574
Harrison	Metzger	Hendersonville Times					
Brian	Miller	Wildwater Ltd.	1605 Pisgau Highway	Caldler	NC	28715-	(704) 906-3963
John	Miller	Nantahala Outdoor Center	13077 Hwy 19 West	Bryson City	NC	28713-	
Robin	Nelson		9400 Highway 19 West	Bryson City	NC	28713-	(828) 488-2826
Cynthia	Rapp	Wildwater Ltd.	P.O. Box 190	Almond	NC	28702-	(828) 488-2384
Steve	Reed	NC Division of Water Resources	NC Division of Water Resources, 1611 Mail Service Center	Raleigh	NC	27699-1611	(919) 715-5424
Phillip	Rhodes		745 Cherokee Trail	Robbinsville	NC	28771-	(828) 479-9243
Randell	Sellens	Wildwater Ltd.	P.O. Box 1275	Robbinsville	NC	22871-	(828) 479-9108
Risa	Shimoda Callaway	American Whitewater Board/Cheoah Alliance	113 Kelly Lane	Easley	SC	29642-	
Ted	Smethers	Entergy - Hydro Operations	Highway 270 West, P.O. Box 218	Jones Mill	AR	72105-	
Don	Stanger		3940 Dover Road	Durham	NC	27707-	(919) 489-2248
Leslie	Swientek	Wildwater Ltd.	P.O. Box 190	Almond	NC	28702-	(828) 488-2384

First Name	Last Name	Organization Name	Address	City	State	Postal Code	Phone Number
Fred	Tarver	NC Division of Water Resources	NC Division of Water Resources, 1611 Mail Service Center	Raleigh	NC	27699-1611	
Tim	Trobridge		102 Timber Hollow Court Apt. 309	Chapel Hill	NC	27514-	(919) 929-7210
George	Vital	Trout Unlimited - Triangle Fly Chapter	4704 Sumerton Place	Raleigh	NC		(919) 850-9681
Charles	Walbridge		Route 1 Box A43B	Bruceton Mills	WV	26525-	(304) 379-9002
Nolan	Whitesell		14690 Highway 19 West	Bryson City	NC	28713-	(828) 488-6367
Shane	Williams	Nantahala Outdoor Center	13077 Hwy 19 West	Bryson City	NC	28713-	
Josh	Workman	Wildwater Ltd.	3498 Stockton	Benton	AR	72015-	(828) 488-0469
Alan	Wray	Wildwater Ltd.	P.O. Box 150	Hartford	TN	37753-	(423) 487-3308

APPENDIX B – Controlled Flow Study Survey Instruments

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APPENDIX C – Whitewater Boating Expenditures Literature

The following documents and describes efforts to characterize potential spending associated with boating trips to the Cheoah River using "benefit transfer" methods. The first two basic steps in accomplishing this include the following:

1) Determine whether adequate data (expenditure estimates for visits to other rivers) exists to reasonably characterize what spending would be for Cheoah trips, and
2) Assuming adequate data does exist, begin to determine a range of appropriate values.

The findings of the literature review suggest that there are adequate existing data for transfer of expenditure values to the Cheoah River, particularly for commercial rafting. Based on criteria for selecting similar sites and comments received during the June 13, 2001 Recreation and Aesthetics Workgroup (Workgroup) meeting, rafting expenditure estimates from previous studies of the Gauley River and Chattooga River were selected to represent likely commercial rafting expenditures at the Cheoah River, and private boating expenditure estimates from previous studies of the Dead River, Upper Youghiogheny River, and Nantahala River were selected to represent likely private boating expenditures at the Cheoah River. In the case of commercial rafting, these studies suggest a range of $45.89 to $72.53 per person per trip for state plus local spending (Chattooga River[3]) up to $111.22 per person per trip for just local spending (Gauley River). In the case of private boating, these studies suggest a range of local spending from $55.03 per person per trip (Nantahala River) to $89.30 per person per trip (Upper Youghiogheny River). Finally, the literature suggests a spending range for guide fees from $44.31 (Chattooga River) to $166.85 (Gauley River) per person per trip[4]. Gauley River guide fees also include some regular trip expenditure items such as lodging and food and beverage expenses.

Step 1 – Review of Literature

Six studies that report economic expenditures of whitewater boaters on ten different rivers are reviewed here. Of these ten rivers, six are located in the southeast, two in the northeast and two in the western United States. Most of the work that has been done to date on the subject of economic impact of whitewater boating (studies that report expenditure data) has focused on commercial rafting. All six studies (covering the ten rivers) report expenditure estimates for commercial rafting. Of these, three also provide expenditure estimates for non-commercial boating (on three different rivers).

[3] The Chattooga flows, and is boated in both the state of South Carolina and Georgia. The low end of the range for the Chattooga River, $45.89 represents average per person trip expenditures made within the state of South Carolina by non-residents of that state. The high end of the range, $72.53, represents average per person trip expenditures made within the state of Georgia by non-residents of that state.

[4] The low end of the range for the Chattooga River, $44.31 represents average per person spending for activities within the state of South Carolina by non-residents of that state. "Activity" fees are assumed to be predominantly guide fees for rafting.

Depending upon the specific objectives of each study, expenditures are reported in various manners with respect to who makes them and where they make them. For example, sometimes the authors of a study express expenditures in terms of average spending by all individuals (e.g., both residents and non-residents of the state or local area). Sometimes average expenditures are only reported for users that are non-residents of the state or local area. Similarly, when reporting average expenditures, some studies only consider spending within the local geographic area (near the river), while others may consider the entire state or even areas outside of the state. Most studies express average expenditures in more than one manner. [5]

Each study is briefly described below. Following these short descriptions, more specific information about each study is presented in tabular form. Table A.1 lists the studies by river, the specific whitewater activity each study focuses on (i.e., commercial rafting, private kayaking etc.) and select characteristics of the user population (as reported in the study). Table A.2 lists detailed average per person trip expenditures, as reported by each study.

Nantahala, Gauley, Kennebec, Middle Fork of the Salmon, and Chattooga

As part of a study that estimates statewide economic impacts of guided whitewater rafting on five rivers in six states, including the Nantahala (NC), Gauley (WV), Kennebec (ME), Middle Fork of the Salmon (ID), and Chattooga (GA/SC), English and Bowker (1996 and 1994) report average per person trip expenditures at each river. Data were collected via mail survey of a random sample of individuals who had taken trips on any of the five rivers during the 1993 rafting season. Between two publications (1996 and 1994), the authors express average expenditures in three ways: All respondent's (residents and non-residents) total spending (within state + outside of state where river is located), non-resident's total spending, and non-resident's within state spending.

Dead River

As part of a study estimating economic values for whitewater boating on the Dead River in Maine, Boyle, Bergstrom and Reiling (1995) provide average per person per trip expenditures for both commercial boaters (primarily rafts) and non-commercial boaters (primarily kayaks and open canoes). Data were collected via mail survey. Commercial participants were randomly selected from commercial rafting company trip rosters. Non-commercial participants were randomly selected form a list of private boaters who had been intercepted on-site as they completed their trips. The authors express average expenditures in terms of all respondents total spending and all respondents local spending[6].

Nantahala River

As part of a study on the economic impact of guided and non-guided rafting on the Nantahala, English (1995) provides average per person trip expenditures for three groups of

[5] In an effort to compile as complete of information as possible, and to be sure that "apples to apples" comparisons can be made between the various studies (and the expenditure data they report), the Table A.2, below, reports any and all manners of expenditure measures provided by each author.
[6] The authors define local spending simply as spending in "the local area around the Dead River". A political region for the local area was not defined.

boaters; guided rafters (with guides in boat), non-guided rafts, and inflatable kayaks (rented but no guide in boat), and privately owned hard boats (canoes and kayaks). English presents estimates of non-resident's (of the county) spending in the local community[7].

Klamath River

In a study of whitewater recreation impacts on a two-county economy along the Klamath River in Oregon, Johnson and Moore (1993) provided estimates of average per person per trip expenditures for, what is, primarily commercial boating (the authors estimate 90% commercial and 10% non-commercial). They present estimates that include expenditures of all users who would have gone elsewhere had the Klamath not been available (includes both residents and non-residents spending in local area[8]).

Cheat, New, and Gauley

As part of a report on the economic impacts of commercial whitewater rafting in West Virginia, Whisman et al. (1998) reports estimates of trip expenditures for commercial rafters on three rivers in that state; the Cheat, New and Gauley. The authors report aggregate expenditures for all users by three geographic strata including aggregate spending within the local area[9], spending in other parts of West Virginia (outside of the local area), and spending outside of the state of West Virginia.[10] For purposes of reporting individual (per person) trip expenditures, the authors suggest dividing aggregate expenditures for each category by the total number of users (personal communication with Whisman).[11]

Upper Youghiogheny

In an assessment of the economic impacts associated with whitewater boating that occurred on the Upper Youghiogheny River in 1988, Graefe et al. (1989) provides average per person per trip expenditures made by rafters and kayakers. Data were collected via mail survey.

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[7] The author defines local spending as spending made within Macon, Cherokee, and Swain Counties, North Carolina. However, the manner in which the data was collected actually only includes spending within Macon county. (Survey respondents were asked to report the amount of money they spent in Macon County during their trip.) The author does warn that, as a result of this, his results, expressed in terms of the three county area, should be considered conservative estimates.

[8] The authors define local spending as spending made within a two county area.

[9] The authors define local spending as "expenditures made within 50 miles of the respective rivers".

[10] The authors do report average individual expenditures, but only for the proportion of respondents who actually spent a positive amount in that category (those who spent zero in a category were not considered as part of this average). This, in effect, yields to misleadingly high individual averages. The authors report that they adjust for his method when extrapolating the averages to aggregate by adjusting the aggregate by the proportion of the sample represented (multiplying by the percentage of those who spent a positive amount).

[11] Whisman suggests that this method "renders a conservative, but reasonable estimate" of average individual per trip expenditures. Related to this, the authors report that aggregate "estimates are considered somewhat conservative in that they included only survey respondents who provided dollar values for the expenditures made during their trip" and that "including those boaters who provided no dollar values for their expenditures alone would have increased total expenditure estimates by 9.4% on the Cheat, 18.7% on the New River, and 3% on the Gauley". (personal communication and www.caf.wvu.edu/for/pandr/wvww/VW_Econ.htm)

The authors provide average trip expenditures of all respondents in terms of the local area[12], the state, and total spending (local + state + outside state).

Table C.1 (below) lists the studies by river, the specific whitewater activity each study focuses on (i.e., commercial rafting, private kayaking etc.) and select characteristics of the user population (as reported in the study). Following Table C.1, Table C.2 lists detailed average per person trip expenditures, as reported by each study.

Table C.1. Whitewater Boating Economic Studies

River and State	Study (Data)	Activity	Characteristics of User Population
Cheat WV	Whisman et. al. 1998 *(1995)*	Commercial Rafting	• About 98% of users are non-residents of WV. • 96% said that running the Cheat was the main reason for their trip. • On average, boaters spent 2 nights away from home during their trip (both spent within 50 miles of river). • Average one way travel distance was 269 miles (Std Dev = 164). • Most boaters come from NY, MI, PA, MD, VA, OH, IN, NJ and DC. • 11% of time, rafting fee included lodging (2 nights).
New WV	Whisman et. al. 1998 *(1995)*	Commercial Rafting	• About 92% of users are non-residents of WV. • 92% said that running the New was the main reason for their trip. • On average, boaters spent 2 nights away from home during their trip (both spent within 50 miles of river). • Average one way travel distance was 304 miles (Std Dev = 366) • Most boaters come from OH, NY, MI, WV, VA, and IN. • 24% of the time rafting fee included lodging (2 nights)
Gauley WV	Whisman et. al. 1998 *(1995)*	Commercial Rafting	• About 99% of users are non-residents of WV. • 92% said that running the Gauley was the main reason for their trip. • On average, boaters spent 2 nights away from home during their trip (both spent within 50 miles of river). • Average one way travel distance was 436 miles (Std Dev = 519) • Most boaters come from NY, VA, OH, IN, MI, and Puerto Rico • 31% of the time rafting fee included lodging (2 nights).
	English & Bowker 1996 & 1994 *(1993)*	Commercial Rafting	• At least 98% said that running the Gauley was the main reason for their trip. • About 99% of users are non-residents of WV. • Average 1993 annual household income = $63,300 • Miles traveled to river from home – mean = 384, median = 350
Chattooga SC/GA	English & Bowker 1996 & 1994 *(1993)*	Commercial Rafting	• 80% said that running the Chattooga was the main reason for their trip. • About 67% of users are non-residents of GA. • About 70% of users are non-residents of SC. • Average 1993 annual household income = $69,300 • Miles traveled to river from home – mean = 282, median = 180
Kennebec ME	English & Bowker 1996 & 1994 *(1993)*	Commercial Rafting	• At least 91% said that running the Kennebec was the main reason for their trip. • About 78% of users are non-residents of ME. • Average 1993 annual household income = $48,500 • Miles traveled to river from home – mean = 245, median = 250
Nantahala NC	English & Bowker 1996 & 1994 *(1993)*	Commercial Rafting	• 66% said that running the Nantahala was the main reason for their trip. • About 71% of users are non-residents of NC. • Average 1993 annual household income = $66,700 • Miles traveled to river from home – mean = 219, median = 120
	English 1995 *(1994)*	Commercial Rafting, Non-commercial Rafting, and Kayak & Canoe	• Distance traveled (Terrant et al.) (median) • Guided Rafters = 300 • Non-Guided Rafters = 245 • Private Hard Boaters = 200

[12] The author defines local spending as spending made within Garrett County, MD.

Table C.1. Whitewater Boating Economic Studies (continued)

River and State	Study (Data)	Activity	Characteristics of User Population
Middle Fork Salmon ID	English & Bowker 1996 & 1994 *(1993)*	Commercial Rafting	• At least 91% said that running the Middle Fork was the main reason for their trip. • About 95% of users are non-residents of ID. • Average 1993 annual household income = $110,000 • Miles traveled to river from home – mean = 1516, median = 1500
Dead ME	Boyle et. al. 1995 *(1994)*	Commercial Rafting, Non-commercial Boating (combination of rafts, kayaks and canoes).	• Commercial passengers spent 65% of their money in communities located near the Dead River, private boaters 53%. • Approximately 88% of commercial boaters were non-residents of Maine. Forty-nine percent came from MA, 12% ME, 10% NH, 9% CT and 6% RI • Approximately 62% of non-commercial boaters were non-residents of Maine. Thirty-eight % came from Maine, 20% MA, 14% NH, 6% CT, and 4% VT. • 90% of commercial boaters and 93% of non-commercial boaters specified that boating the Dead was the primary purpose of their trip. • Average 1993 household income = $50,236 for commercial boaters and $53,838 for private boaters.
Klamath OR	**Johnson and Moore 1993**	Commercial (90%) and Non-commercial (10%)	
Upper-Youghiogheny MD	Graefe et al. 1989 *(1988)*		• Eighty seven percent of the kayakers and 90 percent of the rafters visited the county (Garett) for the primary reason of running the Upper Youghiogheny. • This study also discusses costs (incurred by local and state governments) associated with managing whitewater boating on the Upper Youghiogheny. Author reports a cost estimate of $50,000 per year (1989 dollars).

Table C.2. Economic Expenditures of Whitewater Boaters
(Values in **bold** are inflated to year 2000 dollars with consumer price index)

		SPENDING WITHIN:		
		LOCAL AREA	**STATE OVERALL**	**STATE OVERALL AND OUT OF STATE**
S P E N D I N G B Y	**ALL RESPONDENTS (RESIDENTS & NON-RESIDENTS)**	Total – $123.48 **139.57** Rafting Expenses - $66.00 **74.62** Local Spending - $57.48 **64.99** *River:* **Cheat (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total **-** $147.80 **167.10** Rafting Expenses - $72.23 **81.66** Local Spending - $75.57 **85.44** *River:* **New (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total - $245.12 **273.12** Rafting Expenses - $147.58 **166.85** Local Spending - $97.54 **111.22** *River:* **Gauley (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting	Total – $127.75 **144.43** Rafting Expenses - $66.00 **74.62** Spending in State - $61.75 **69.81** *River:* **Cheat (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total - $154.86 **175.86** Rafting Expenses - $72.23 **81.66** Spending in State - $82.63 **93.42** *River:* **New (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total - **$**254.59 **287.83** Rafting Expenses - $147.58 **166.85** Spending in State - $107.01 **120.98** *River:* **Gauley (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting ***Rafting*** Total - $196.40 **286.05** Guide Service - $80.83 **117.73** Other Expenses – $115.57 **168.32** ***Kayaking*** Total – $77.61 **113.04** Guide Service – $4.19 **6.10** Other Expenses – $73.42 **106.93** *River:* **Youghiogheny** *Author:* Graefe et al. *Activity:* Rafting (mostly commercial) and Kayaking (mostly non-commercial)	Total – $147.73 **167.02** Rafting Expenses - $66.00 **74.62** Local Spending - $81.73 **92.40** *River:* **Cheat (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total - $183.34 **207.28** Rafting Expenses - $72.23 **81.66** Local Spending - $111.11 **125.62** *River:* **New (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total - $276.71 **312.84** Rafting Expenses - $147.58 **166.85** Local Spending - $129.13 **145.99** *River:* **Gauley (WV)** *Author:* Whisman et al. 1998 *Activity:* Commercial Rafting Total - $293.11 **349.50** Activity Expenses - $143.33 **170.90** Other Expenses - $149.78 **178.60** *River:* **Gauley (WV)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $195.19 **232.74** Activity Expenses - $77.20 **92.05** Other Expenses - $ 117.99 **140.69** *River:* **Chattooga (SC/GA)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $234.44 **279.54** Activity Expenses - $107.78 **128.52** Other Expenses - $126.66 **151.03** *River:* **Kennebec (ME)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting

Table C.2. Economic Expenditures of Whitewater Boaters (continued)
(Values in **bold** are inflated to year 2000 dollars with consumer price index)

		SPENDING WITHIN:		
SPENDING BY		**LOCAL AREA**	**STATE OVERALL**	**STATE OVERALL AND OUT OF STATE**
	ALL RESPONDENTS (RESIDENTS & NON-RESIDENTS) **(Continued)**	Commercial: Total - $174 **202.30** Rafting Fee - $110 **127.89** Other Expenses - $64 **74.41** Non-commercial: Total - $58 **67.43** *River:* **Dead (ME)** *Author:* Boyle et al. *Activity:* Commercial Rafting & Non-commercial Boating (canoe / kayak) Total: $157.00 **192.81** *River:* **Klamath (OR)** *Author:* Johnson & Moore 1993 *Activity:* Commercial (90%) and Non-commercial (10%) combined. ***Rafting*** Total - $171.11 **249.22** Guide Service - $80.83 **117.73** Other Expenses – 90.27 **131.48** ***Kayaking*** Total – $65.50 **95.40** Guide Service – $4.19 **6.10** Other Expenses – $61.31 **89.30** *River:* **Youghiogheny** *Author:* Graefe et al. *Activity:* Rafting (mostly commercial) and Kayaking (mostly non-commercial)		Total - $201.50 **240.27** Activity Expenses - $60.62 **72.28** Other Expenses - $140.88 **167.98** *River:* **Nantahala (NC)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $1,574.08 **1876.91** Activity Expenses - $1055.14 **1258.14** Other Expenses - $518.94 **618.78** *River:* **Middle Fork Salmon (ID)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Commercial: Total - $267 **310.42** Rafting Fee- $110 **127.89** Other expenses - $157 **182.53** Non-commercial: Total - $110 127.89 *River:* **Dead (ME)** *Author:* Boyle et al. *Activity:* Commercial Rafting & Non-commercial Boating (canoe / kayak) ***Rafting*** Total - $263.94 **384.42** Guide Service - $80.83 **117.73** Other Expenses – $183.11 **266.69** ***Kayaking*** Total – $146.40 **204.49** Guide Service – $4.19 **6.10** Other Expenses – $142.21 **207.12** *River:* **Youghiogheny** *Author:* Graefe et al. *Activity:* Rafting (mostly commercial) and Kayaking (mostly non-commercial)

Table C.2. Economic Expenditures of Whitewater Boaters (continued)
(Values in **bold** are inflated to year 2000 dollars with consumer price index)

		SPENDING WITHIN:		
SPENDING BY	**NON-RESIDENTS OF STATE WHERE RIVER IS LOCATED**	**LOCAL AREA**	**STATE OVERALL**	**STATE OVERALL AND OUT OF STATE**
			Total - $148.74 **177.36** Activity Expenses - $73.40 **87.52** Other Expenses - $75.34 **89.83** *River:* **Gauley (WV)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting ***Georgia*** Total - $97.99 **116.84** Activity Expenses - $37.16 **44.31** Other Expenses - $60.83 **72.53** ***South Carolina*** Total - $95.25 **110** Activity Expenses – $56.76 **67.68** Other Expenses - $38.49 **45.89** *River:* **Chattooga (SC/GA)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $204.89 **244.31** Activity Expenses - $107.90 **128.66** Other Expenses - $96.99 **115.65** *River:* **Kennebec (ME)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $60.95 **70.95** Activity Expenses - $24.80 **29.57** Other Expenses - $36.15 **43.10** *River:* **Nantahala (NC)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $1,283.63 **1530.58** Activity Expenses - $982.67 **1171.72** Other Expenses - $300.96 **358.86** *River:* **Middle Fork Salmon (ID)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting	Total - $480.08 **572.44** Activity Expenses - $343.74 **409.87** Other Expenses - $136.34 **162.57** *River:* **Gauley (WV)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting ***Georgia*** Total - $354.97 **423.26** Activity Expenses - $237.80 **283.55** Other Expenses - $117.17 **139.71** ***South Carolina*** Total - $231.18 **275.66** Activity Expenses – $128.24 **152.91** Other Expenses - $102.94 **122.74** *River:* **Chattooga (SC/GA)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $275.15 **328.09** Activity Expenses - $150.07 **178.94** Other Expenses - $125.08 **149.14** *River:* **Kennebec (ME)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $197.21 **235.15** Activity Expenses - $96.07 **114.55** Other Expenses - $101.14 **120.60** *River:* **Nantahala (NC)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting Total - $2,895.31 **3452.33** Activity Expenses - $2,338.89 **2788.86** Other Expenses - $556.42 **663.47** *River:* **Middle Fork Salmon (ID)** *Author:* English & Bowker 1996 & 1994 *Activity:* Commercial Rafting

Table C.2. Economic Expenditures of Whitewater Boaters (continued)
(Values in **bold** are inflated to year 2000 dollars with consumer price index)

		SPENDING WITHIN:		
SPENDING BY		**LOCAL AREA**	**STATE OVERALL**	**STATE OVERALL AND OUT OF STATE**
	NON-RESIDENTS OF LOCAL AREA WHERE RIVER IS LOCATED	Totals: Guided Rafts - $43.48 **53.33** Guide Fees - $6.95 **8.08** Other Expenses – 36.53 **42.44** Non-Guided Rafts - $47.33 **55.03** Non-Guided Kayak/Canoe - $59.15 **68.77** *River:* **Nantahala** *Author:* English 1995 *Activity:* Guided rafting, non-guided rafting, and kayak/canoe.		

As Table C.2 illustrates, between the various rivers, quite a large range of average expenditures are reported. For example, studies that report expenditures in terms of local spending by commercial rafters provide values in the range of $43.10 (Nantahala) to $131.48. For expenditures in terms of state + local spending, the range of values increase (as would be expected) from $43.10 to $358.86. Ranges for all expenditure categories, by both commercial and non-commercial boaters, that take all of the rivers into consideration, are provided in Table C.3.

Table C.3. Range of Expenditures Reported on Twelve Rivers

	Commercial	**Non-Commercial**
Local	**$42.44** (Nantahala, English) to **$131.48** (Youghiogheny, Graefe et al.)	**$55.03** (Nantahala, English) to **$89.30** (Youghiogheny, Graefe et al.)
State + Local	**$43.10** (Nantahala, English & Bowker) to **$358.86** (MF Salmon, English & Bowker)	**$106.93** (Youghiogheny, Graefe et al.)
Outside State + State + Local	**$92.40** (Cheat, Whisman et al.) to **$663.47** (English & Bowker)	**$207.12** (Youghiogheny, Graefe et al.)
Guide Fees	**$8.08** (Nantahala, English) to **$1,530.58** (MF Salmon, English & Bowker)	

Note: All values are adjusted with the consumer price index to 2000 dollars.

Step 2. Determine an Appropriate Range of Expenditure Values for Transfer to Cheoah

The next step in considering an appropriate range of expenditure estimates is to determine which estimates, of those presented in Table C.2, best characterize potential spending associated with recreational boating visits to the Cheoah. Benefit transfer methods offer a general framework to this end. Boyle and Bergstrom (1992) recommend specific criteria that should be met in order to transfer estimates of non-market values to a new study, which is different from the study for which the values were originally estimated.[13] A generalization of the criteria prescribed by Boyle and Bergstrom (1992), and others, yields the following framework for narrowing down which studies are appropriate for transferring expenditure estimates from.

1. *Commodity Valued* – The commodity valued must be identical to the commodity of interest. In this case, expenditure estimates for commercial rafting and non-commercial boating activity are only appropriate. Expenditure estimates by flat water boaters, for example, are not appropriate. This fairly simple criteria (in this case anyway), was addressed in the literature search phase.

2. *Appropriateness of the Value Measures* - The means and unit of measure need to be identical. In this case, studies that provide expenditures per person per trip, that reflect local (and perhaps state + local for analysis of the multi county region) spending, are required. This criteria does not necessarily eliminate any of the seven studies reviewed here, but does eliminate expenditure values that reflect state + outside of state spending.

3. *Validity of Data* – This criteria simply requires that in order to transfer data, the study that generated that data needs to have been implemented correctly, somewhat assuring its validity. Was the study conducted well? Did the study adhere to accepted methodologies – in data collection procedures, statistical analysis, reporting? Do values generally approximate those of other studies of the same resource (when other studies are available). All of the studies reviewed above generally satisfy these criteria. However, there is some question over a uniquely low estimate of average expenditures for guide fees, of $8.08, provided by English for the Nantahala (English 1995). Comparing this estimate with those provided by other studies as well as examination of current pricing for trips on the Nantahala[14], suggests this value may be a function of the rental, or livery, market on the Nantahala, and that this guide fee estimate should be eliminated from the range of values. The next lowest guide fee of any of the studies is $29.57 (Nantahala), provided by English & Bowker, 1996.

4. *User Population* – In general, only expenditure estimates from studies of rivers that have similar user populations should be considered. For value or benefits transfer, it is particularly important to account for geographic comparability. Previous studies testing the accuracy of value or benefits transfer suggest that transfers within the same geographic region appear to be the most reliable (Loomis et al., 1995; Downing, M. and T. Ozuna, 1996). From a geographic perspective, the Chattooga River (studied by English & Bowker, 1996) provides the best

[13] In Benefit Transfer Studies: Pragmatism, and Idealism, Boyle and Bergstrom discuss the transfer of non-market values (consumer surplus values), as opposed to economic impact or expenditure values (the intent of this analysis). Nonetheless, the author points out the appropriateness of similar methods, although possibly less rigorous criteria (for transferring expenditure estimates). (personal conversation with John Bergstrom).
[14] See price lists at www.wildwaterrafting.com and www.nocweb.com.

available data for transfer to the Cheoah River since it is of similar difficulty and is located in the same geographic region of the Cheoah River. The broad recreational setting, portions of the likely user population, and prices and costs faced by users will be similar for the Chattooga River and Cheoah River. However, data from the Chattooga River is only available for commercial boaters. For private boaters, the only available expenditure data from the same geographic region as the Cheoah is for the Nantahala River (studied by English & Bowker, 1996 and English, 1995). From a whitewater boating experience perspective, the Nantahala River and Cheoah River provide different classes of experiences; in particular, the Cheoah River will provide a more technically difficult experience. As a result, the Cheoah River will attract a greater proportion of more experienced technical boaters as compared to the Nantahala River, and is expected to attract a different user population. The average skill level of private boaters using the Cheoah River is likely to be more comparable to the Gauley River in West Virginia and the Dead River in Maine. However, the broad recreational setting, prices and costs faced by users, and at least some portion of the likely user population (in terms of geographic origin) will be similar to the Nantahala River.

5. *Resource Characteristics and Experience* – At a minimum, this criterion requires that the studied river should have similar characteristics (difficulty and feel) and offer the boater a similar experience. The Cheoah has similarities in terms of level of difficulty to the Gauley River, the Chattooga River, the Dead River, and the Upper Youghiogheny River.

Given the above criteria, the most appropriate "benefit transfer" values for the Cheoah River are expenditure data available from the Chattooga River, the Gauley River, the Upper Youghiogheny River, the Nantahala River, and the Dead River. Accepting the above assumptions, the available literature suggests commercial boating expenditures estimates of $45.89 - $72.53 per person per trip for state plus local spending (Chattooga River) up to $111.22 per person per trip for just local spending (Gauley River). In the case of private boating, available studies suggest a range of local spending from $55.03 per person per trip (Nantahala River) to $89.30 per person per trip (Upper Youghiogheny River). Finally, the literature suggests a spending range for guide fees from $44.31 (Chattooga River) to $166.85 (Gauley River) per person per trip. Gauley River guide fees also include some regular trip expenditure items such as lodging and food and beverage expenses. Table A.4.(?) summarizes the results of the "benefit transfer" analysis.

Table C.4. Range of "Appropriate and Reasonable" Expenditure Values*

	Commercial	**Non-Commercial**
Local Spending	**$111.22** (Gauley)	**$55.03** (Nantahala) **$67.63** (Dead) **$89.30** (Upper Youghiogheny)
State + Local Spending	**$45.89 – $72.53** (Chattooga) **$120.98** (Gauley)	**$106.93** (Upper Youghiogheny)
Guide Fees	**$ 91.00** (Chattooga) **$166.85** (Gauley)	NA

* All estimates represent per trip per individual expenditures inflated to year 2000 dollars with consumer price index

APPENDIX D – Angler Expenditures

The literature review for angling expenditures turned up very few studies applicable to the Cheoah River from a benefit or value transfer standpoint. Several future scenarios are possible for the Cheoah River angling resource including high quality cold-water fishing experiences, lower quality cold-water and warm-water fishing experiences, and medium quality cold-water and warm-water fishing experiences. A broad assessment of angler expenditures in North Carolina, including both warm water and cold water fisheries, is available from a national survey conducted by the U.S. Fish and Wildlife Service (USFWS). The survey, planned in consultation with state and federal organizations and non-governmental organizations, collects various information from anglers, hunters and wildlife viewers, including their level of participation and associated expenditures. The last such survey completed collected data from 1996. The 1996 USFWS survey results suggest average fishing trip expenditures equal to $24.47 per person per trip (adjusted to year 2000 dollars). In the case of high quality cold-water fishing experiences, expenditure estimates for trout fishing trips to North Carolina mountain rivers and streams are available from a PhD dissertation conducted by Ahn (Ahn, 1997). The Ahn dissertation results suggest a high-end estimate of trout fishing trip expenditures equal to $95.78 per person per trip (adjusted to year 2000 dollars).

National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

Every five years the USFWS conducts the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. In total, the USFWS data set includes approximately 22,000 observations of angler, hunter and wildlife viewer trip data from throughout the nation. USFWS publishes a series of reports that summarize analyses of the data including an overall report (U.S. overall) and individual reports for each state.[15] In each state report, estimates of all freshwater annual angling expenditures, in limited spending categories, are reported. For example, the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, North Carolina report, reports annual expenditures by freshwater anglers of $89 for food and lodging, $50 for transportation, $71 for other trip costs, and $168 for equipment[16]. Average expenditure per trip is calculated by dividing the annual average expenditures by average angling trips per angler per year (provided by report), yielding $6.72 for food and lodging, $3.78 for transportation, $5.36 for other trip costs, and $12.67 for equipment.

While these data appear to offer adequate specification of trip spending, they fall somewhat short in a few ways. First, one can not help but wonder whether expenditure profiles may differ between anglers who predominately fish rivers as opposed to those who predominately fish lakes and ponds. The estimates reported by USFWS report spending for all freshwater fishing (both lakes and rivers). The Cheoah is obviously a river angling resource and will predominately attract river anglers. Using the estimates as reported for all freshwater angling may result in overestimation or underestimation of expenditures. Second, in terms of IMPLAN modeling, the more specific manner in which spending is reported within spending categories, the better. For example, USFWS reports estimates of spending for food and lodging

[15] Reports and other information may be obtained at http://fa.r9.fws.gov/surveys/surveys.html#surv_status.
[16] Equipment costs include fishing equipment, auxiliary equipment and special equipment. Most of these costs are not relevant in a regional economic impact context, particularly auxiliary and special equipment.

together. In the actual survey spending on these two goods were reported separately (USFWS combined them in their analysis). Separation of these categories will yield more accurate model results. Finally, USFWS only reports equipment spending in terms of the sum of fishing, auxiliary and special equipment. As it is not appropriate to include all of these equipment expenditures in a regional economic impact context, different types of equipment purchases should be broken out.

In order to extract more specific information from the 1996 USFWS survey data further analysis of the data (available on CD-ROM) was conducted. Tables D.1 and D.2 are the result of this analysis. A subset of the original data set including only observations of all freshwater anglers who fished in North Carolina, Tennessee, South Carolina, or Georgia (regardless of the anglers origin) was created (just under 1000 observations). From this data set, average trip expenditures per angler for each state, and in cumulative, are calculated (Table D.1). The categories listed in the table include all trip expenditure categories as provided by design in the survey and all angling equipment expenditures (but not auxiliary or special equipment purchases). Table D.2 expresses average trip expenditures per angler in a similar manner, but for a sub-set of anglers who spent the majority of their time fishing in rivers (in 1996).[17] All expenditure estimates are inflated to year 2000 dollars.

Trout Fishing Expenditures in the Southern Appalachian Mountains

A 1997 dissertation conducted by SoEun Ahn at North Carolina State University entitled "Economic Analysis of the Potential Impacts of Climate Change on Trout Fishing in the Southern Appalachian Mountains" (Ahn, 1997) provides some limited data on the expenditures of trout anglers in North Carolina. While the objective of the study was not specifically to evaluate expenditure information or assess the regional economic impact of trout angling, the study included a mail questionnaire administered in 1996 that asked survey respondents to estimate their expenditures for gasoline, vehicle maintenance, food/beverages, bait/tackle, lodging, and other supplies. Mail surveys were sent to 1,400 people who held North Carolina trout fishing licenses. A total of 546 anglers responded to the survey. Thirteen major river systems were included in the study area. These include: the Hiwassee, Cheoah, Little Tennessee, Tuckaseegee, Pigeon, Savannah, French Broad, Broad, Nolichucky, Watauga, Catawba, Yadkin, and the New River system. Over half the survey respondents (55 percent) fished hatchery supported streams, while just under thirty percent (26 percent) fished wild trout waters, and approximately ten percent fished both hatchery supported and wild trout waters.

A summary of expenditure data from the Ahn study is shown in Table D.3. These data represent average expenditures per person per trip. Total trip expenditures were not reported, but a summation of the averages presented in Table D.3 results in a total of $87.07 (in year 1996 dollars).

[17] This subset includes observations of anglers who fished more in rivers than in lakes/ponds in 1996. While this is not a perfect method of isolating "river" anglers, it is assumed an adequate proxy.

Table D.1. Average Trip and Angling Equipment Expenditures – All Freshwater Anglers

		North Carolina	South Carolina	Georgia	Tennessee	Average Overall
Trip Expenses		n=194-202	n=312	n=223-226	n=227-230	n=963-970
	Food & Drink	$5.54	$5.44	$8.24	$7.88	$6.62
	Lodging	$1.74	$1.88	$2.59	$2.09	$2.04
	Public Transportation	$0.07	$0.79	$0.32	$0.05	$0.36
	Private Transportation	$4.23	$4.57	$7.03	$4.89	$5.06
	Guide Fees	$0.13	$0.09	$0.46	$0.11	$0.18
	Public Use Fees	$0.08	$0.26	$0.32	$0.15	$0.20
	Private Use Fees	$0.17	$0.27	$0.05	$0.08	$0.16
	Equipment Rental	$0.17	$0.11	$0.53	$0.59	$0.33
	Boat Fuel	$1.56	$2.25	$2.94	$2.61	$2.33
	Launch Fees	$0.21	$0.20	$0.21	$0.37	$0.25
	Moorage	$1.37	$1.87	$1.38	$2.25	$1.76
	Bait	$1.81	$2.58	$2.26	$2.03	$2.22
	Ice	$0.50	$0.56	$0.78	$0.63	$0.61
	Heat/Cook Fuel	$0.14	$0.18	$0.39	$0.11	$0.20
Equipment Expenses						
	Rods	$0.73	$0.35	$1.15	$0.63	$0.66
	Lines/Leaders	$0.17	$0.09	$0.29	$0.12	$0.15
	Lures	$0.22	$0.12	$0.49	$0.23	$0.24
	Hooks/Sinkers	$0.99	$0.82	$1.68	$0.88	$1.04
	Tackle Boxes	$0.05	$0.02	$0.05	$0.03	$0.03
	Creel	$0.02	$0.01	$0.03	$1.49	$0.01
	Seine	$0.02	$0.02	$0.02	$0.01	$0.01
	TOTAL	**$19.89**	**$22.49**	**$31.20**	**$27.24**	**$24.47**
Mean Trips/Year		13.73	13.45	11.2	13.32	12.95
Mean Days/Year		16.2	16.63	12.86	15.2	15.33

Table D.2. Average Trip and Angling Equipment Expenditures – River Anglers

		North Carolina	South Carolina	Georgia	Tennessee	Average Overall
Trip Expenses		n=52	n=37	n=36 to 38	n=55	n=179 to 182
	Food & Drink	$5.86	$6.81	$7.18	$7.32	$**6.95**
	Lodging	$4.00	$0.36	$2.23	$1.53	$**2.16**
	Public Transportation	$0.05	$0.20	$0.00	$0.00	$**0.06**
	Private Transportation	$4.10	$4.76	$8.10	$5.43	$**5.50**
	Guide Fees	$0.24	$0.00	$0.40	$0.00	$**0.14**
	Public Use Fees	$0.07	$0.19	$0.08	$0.10	$**0.11**
	Private Use Fees	$0.20	$0.65	$0.02	$0.00	$**0.22**
	Equipment Rental	$0.36	$0.00	$2.07	$0.00	$**0.48**
	Boat Fuel	$2.16	$1.48	$1.96	$1.03	$**1.67**
	Launch Fees	$0.31	$0.11	$0.05	$0.76	$**0.36**
	Moorage	$1.51	$1.19	$0.54	$1.43	$**1.28**
	Bait	$1.03	$3.25	$2.31	$2.37	$**2.24**
	Ice	$0.71	$0.91	$1.06	$0.52	$**0.78**
	Heat/Cook Fuel	$0.36	$0.28	$0.18	$0.11	$**0.24**
Equipment Expenses						
	Rods	$0.96	$0.57	$1.28	$0.88	$**0.93**
	Lines/Leaders	$0.13	$0.12	$0.30	$0.23	$**0.18**
	Lures	$0.24	$0.05	$0.42	$0.33	$**0.26**
	Hooks/Sinkers	$0.84	$0.70	$2.06	$1.18	$**1.16**
	Tackle Boxes	$0.05	$0.00	$0.00	$0.05	$**0.03**
	Creel	$0.00	$0.00	$0.02	$0.06	$**0.02**
	Seine	$0.00	$0.04	$0.03	$0.01	$**0.02**
	TOTAL	**$23.18**	**$21.67**	**$30.29**	**$23.34**	**$24.79**
Mean Trips/Year		13.29	14.89	11.18	13.28	12.82
Mean Days/Year		15.35	18.95	12.16	14.29	15.09

Table D.3. Average Trip and Angling Equipment Expenditures – River Anglers*

Items	Mean	Median	Minimum	Maximum	Count
Gasoline	19.37	10	0	100	326
Vehicle Maintenance	3.67	0	0	80	331
Food/Beverages	28.30	10	0	300	331
Bait/Tackle	11.52	5	0	200	329
Lodging	19.84	0	0	480	331
Other supplies	4.37	0	0	150	331

* All dollar values in year 1996 dollars