Tuckasegee River Paddling Recreational Instream Flow Study
East Fork, West Fork, and Dillsboro Hydroelectric Projects
FERC #'s 2698, 2686, 2602
Dillsboro and Whittier Sections - July 2-3, 2001
West Fork By-Pass Section – May 9 and June 29, 2001
East Fork By-Pass Section – July 9, 2002

Introduction

Duke Power-Nantahala Area, a Division of Duke Energy Corporation (Duke) is in the process of relicensing its hydroelectric projects with the Federal Energy Regulatory Commission (FERC). The East Fork (FERC # 2698), West Fork (FERC # 2686), and Dillsboro (FERC # 2602) Projects are located on the Tuckasegee River in southwestern North Carolina. The area includes rural mountainous terrain and sections of small rural communities and features river sections that currently provide excellent paddling opportunities. Duke Power is utilizing a modification of the traditional relicensing process involving the use of Technical Leadership Teams (TLT). In this study, Duke Power assessed the paddling experience on two sections of the main stem, a section of the West Fork By-Pass, a section of the East Fork By-Pass (Bonas Defeat Section) and determined how flows affect the paddling experience. Duke worked closely with American Whitewater, Western Carolina University, the Carolina Canoe Club, local outfitters, local government representatives and other organizations as well as the TLT in this effort. This document describes study goals and objectives, the area, methodology, and results of the study.

Study Goals and Objectives

This study assessed paddling potential on four sections of the Tuckasegee River. On three of the sections this was done with about 60 paddlers using a variety of boat types – kayaks, canoes, rafts, and inflatable kayaks (duckies). These paddlers used their experiences in this study and their experience of other rivers to identify minimum flow levels and optimal flow ranges for paddling on these reaches and further identify how flow levels affect various factors that make up the paddling experience. On the fourth section (East Fork By-Pass), a four-phase study approach was used as described below.

Specific objectives of the study included:

- Description of current access to each section
- Description of key paddling areas
- Development of relationships between flow levels and quality of paddling experience for the three study reaches that were paddled to identify minimum and optimum flow ranges for paddling
- Identify other recreation opportunities and assess the relative impacts of paddling flows on these activities

Study Area

Both forks of the Tuckasegee River arise in the Blue Ridge Mountains of southwestern North Carolina in the area between Highlands and Brevard. The river flows through the cities of Cullowhee, Sylva, and Bryson City before it joins the Little Tennessee River in Fontana Reservoir almost fifty miles from the headwaters.

Five Duke Hydropower Developments (the East and West Fork Projects) are located about 20 miles above the Dillsboro Project. The Tuckasegee Plant and Thorpe Plant (FERC # 2686), located on the West Fork, are operated in tandem. The usual release from the Tuckasegee Plant (the downstream plant) is about 205 cfs plus a continuous release of 10 cfs from Cedar Cliff (when it is not generating) for a total of about 215 cfs in the riverbed at the Confluence from power generation and continuous releases. Average annual runoff in the West Fork (at the Tuckasegee/Little Lake Glenville Reservoir) is about 158 cfs with significant seasonal variations. The Tennessee Creek (also called Tanassee Creek), Bear Creek, and Cedar Cliff developments (FERC # 2698) on the East Fork are operationally linked to each other and are operated as such. The usual release from the Cedar Cliff Plant (the downstream plant) is about 480 cfs plus a

continuous release of 20 cfs from the West Fork for a total of about 500 cfs from power generation and continuous releases. Average annual runoff in the East Fork (at Cedar Cliff Reservoir) is about 249 cfs with significant seasonal variations. The Dillsboro Project does not significantly affect flow levels in the Tuckasegee River. Water either flows through the generator(s) and back into the riverbed below the 12-foot high dam or it runs over the dam or both. The average annual runoff at Dillsboro is about 779 cfs with significant seasonal variations.

The following river sections were analyzed in this study.

Section	Study Dates	Description	Miles
Dillsboro	July 2-3, 2001	Main Stem – Dillsboro to Barker's Creek	4.5
Whittier	July 2-3, 2001	Main Stem - Whittier to Ela	3.0
West Fork	June 29, 2001	West Fork - By-Pass between Lake Glenville & Thorpe Powerhouse	4.5
East Fork	July 9,2002	East Fork – By-Pass between Tennessee Creek Reservoir & confluence with Wolf Creek	1.5

The Dillsboro Section is the most popular of the four sections. Whitewater rafting outfitters, whitewater canoe/kayak outfitters, summer camps, schools, canoe clubs, and private paddlers all use this class II stretch of whitewater, primarily in the summer and on late spring and early fall weekends. The three local outfitters estimated 40,000 guests (numbers provided by Tuckasegee Outfitters Association) on the river in 2001.

The Whittier Section is used occasionally by canoe clubs, summer camps, and private paddlers but is not generally well known. It is class II whitewater with a short section of fairly continuous ledges including one steep ledge (class II +) worthy of being named.

Paddling information about all sections (except the Bonas Defeat Gorge) from the confluence to Bryson City is provided in "A Canoeing & Kayaking Guide to the Carolinas" (Benner and Benner, 2002).

Local paddlers have used the class III/IV West Fork By-Pass Section occasionally. This section requires substantial rainfall before it can be run. There have been five spills from the dam at Lake Glenville in the 60-year history of the project prior to the paddling study releases.

The East Fork By-Pass (Bonas Defeat) section is popular with local and regional hikers who value it for the extremely rugged terrain, the natural beauty, and for its remoteness. This reach may never have been paddled before. Steep gradient, large potholes, undercut rocks, narrow crevices, and wood in and across the channel characterize this section. A four-phase approach (explained in West Fork By-Pass section) was used to explore the potential for studying this section.

A map of the study area and the study locations is provided in Appendix M.

Methodology

A controlled flow assessment technique (Whittaker, et al., 1993) was used to evaluate opportunities for paddling at a range of flow conditions. A specified group of study participants paddled the Dillsboro Section at four different flows, the Whittier Section at two different flows, and the West Fork By-Pass at two different flows. Participants completed two survey forms as a means of documenting the quality of the paddling experience. They also filled out a Pre-Run Information Survey (Appendix A).

Upon completion of each test release, each paddler filled out a Single Flow Survey (Appendix A) to help him/her describe the quality of the paddling experience specific to each flow. Specifically, participants were asked to rate the flow with regard to (1) paddling experience characteristics, (2) whether they would choose to paddle the level again in the future (3) the whitewater difficulty of the flow, (4) how well suited it

was for different skill levels, (5) whether they would prefer a higher or lower flow level to define minimum acceptable and optimal flows (6) identify particularly challenging rapids (7) the number of boat hits, stops, drags, and portages (8) identifying portage areas and (9) significant problems such as a swim, pin, etc. They were also asked to provide any other comments they wanted to make.

After paddling each section at all the test flows, participants filled out a Comparative (Overall) Survey (Appendix A) to evaluate the flows. Specifically, they were asked to (1) rank the importance of the paddling experience characteristics, (2) to rate the flows as to how well they contributed to a high quality trip (3) make an overall evaluation of the flows, (4) suggest flow levels for minimum acceptable, optimum, "standard" trip optimum, high challenge trip optimum, highest safe flow, and a flow if only one flow could be provided, (5) make an opinion of whether a variety of flows was important, (6) whether they would recommend a standard trip or high challenge trip flow to other paddlers, (7) compare the section to other rivers locally, regionally, and nationally, and (8) compare the section to other rivers in the region with regard to paddling characteristics. They were also asked to add anything they desired about paddling the section. Survey responses were compiled in spreadsheets (Appendix B) and compared across the different flow conditions to see how the flows affected the quality of the paddling experience and to determine minimal acceptable and optimal flow levels. All written comments made on the surveys were compiled (Appendix C).

Paddlers were recruited utilizing American Whitewater sources, Western Carolina University staff, local outfitters, Carolina Canoe Club members, local summer camp staff, Duke employees, newspaper articles about the study, and nonaffiliated private paddlers. All participants signed a waiver (Appendix D) and participated in a short orientation to the study that included an explanation of why Duke was conducting the study, background on the questionnaires including an explanation of the American Whitewater International Scale of River Difficulty (Appendix E), a safety briefing, and the study schedule (Appendix F). The gear options were kayak (river, play, creek), decked canoe, open canoe (solo or tandem), raft, inflatable kayak (or "duckie"). Tuckasegee Outfitters provided the necessary shuttles and other logistical support.

Four flow levels were studied in the Dillsboro Section – (1) base flow + "maximum flow" from generation at Thorpe Powerhouse, (2) base flow + "most efficient flow" from generation at Cedar Cliff Powerhouse, (3) base flow + "most efficient flow" from generation at Thorpe Powerhouse, and (4) base flow + "most efficient flow" from generation at both Thorpe and Cedar Cliff Powerhouses. Flows 2, 3, and 4 are "best efficiency flows" for these facilities and it is difficult to maintain significantly different flows for long periods of time without harming the equipment. Flow 1 is a maximum flow that is at the limit of the capability of the machinery.

The flow levels for the Whittier Study were the afternoon flows (Flows 2 and 4) from the Dillsboro study plus incremental flow from the intervening watershed; base flow + "most efficient flow" from generation at Cedar Cliff Powerhouse, and base flow + "most efficient flow" from generation at both Thorpe and Cedar Cliff Powerhouses. This study was conducted in the evening after the Dillsboro Study was completed and was possible due to the downstream travel times of the flows. Some participants also participated in the Dillsboro Study and others only participated in the Whittier Study.

A four-phase approach was used in the West Fork By-Pass study (Appendix G –Description of Four Phase Approach). The initial flow level for the West Fork By-Pass Study was determined after a preliminary paddle at a lower flow level on May 9, 2001 to evaluate whether the resource values warranted further study (Appendix G – West Fork Results of Phases 1 and 2)). The results indicated that further study was warranted and that the flow level on May 9 was below the minimum acceptable. The initial flow for the June 29, 2001 study was chosen as a best guess at the minimum acceptable flow range. The second flow on that day was determined after the completion of the first flow by the study team. All flows were obtained by raising the tainter gates at Lake Glenville by an amount predicted from a gate opening/cfs chart.

A four-phase approach was used in the East Fork By-Pass study (Appendix G – Description of Four Phase Approach). The visual assessment of flows in Phase 2 resulted in a decision to end the study at this point so no paddling flow study was done (Appendix G – East Fork Results of Phases 1 and 2).

The flow duration was sufficient for all studies for participants to "play the river" at spots as well as paddle down the section. For the Dillsboro and Whittier studies, participants were told what the approximate flow conditions would be in terms of which hydro plant was generating the flow. The flow progression was from the lowest flow (base flow) to the highest flow in the Whittier and West Fork By-Pass studies. The flow progression for each day of the Dillsboro study was low in the morning and higher in the afternoon however the progression from lowest flow to highest flow was Flow 3 (morning of July 3), Flow 1 (morning of July 2), Flow 2 (afternoon of July 2) and Flow 4 (afternoon of July 3).

All flows were documented by video photography. The Dillsboro and West Fork By-Pass studies were also documented by still photography.

Results and Discussion

Results from this paddling recreation flow study are presented below. These results are taken from the Pre-Run Information Form, the Single Flow Survey, filled out after each flow experience, and the Comparative Survey, filled out after the completion of the last flow condition (Appendix A). Actual flow was measured for each section at each flow during the paddling experience. Actual flow (in cfs) is provided in the data tables but discussion of flows uses the Flow 1, Flow 2, etc. terminology. Each section is presented and discussed separately starting with Dillsboro, then Whittier, followed by the West Fork By-Pass and the East Fork By-Pass.

Dillsboro Section

General

This 4.5-mile river section starts at a public access area below the Dillsboro Dam, which is maintained by the town of Dillsboro. It ends at the Barker's Creek Bridge that is just upstream of Tuckasegee Outfitters. As noted above, this is currently the most popular section for paddling on the Tuckasegee River.

Measured flows during this study are shown below for the Dillsboro Section. These are in sequential order from day 1 (Flows 1 and 2) through day 2 (Flows 3 and 4). The mean and median base flow in July historically (about 40 years of measurements) at Dillsboro is about 576 cfs and 483 cfs respectively compared to the measured base flow in this study of about 315 cfs. This appears to be consistent with the drought conditions encountered in this area over the last three or so years.

	Flow 1	Flow 2	Flow 3	Flow 4
Base Flow	315	315	315	315
Flow from Generation	239	506	170	698
Total cfs	554	821	485	1013

Access

Public access is available at the Dillsboro put-in below the Dillsboro Dam. This site is maintained by the town of Dillsboro and has parking space for about 8 vehicles plus a small turn around area for vans pulling trailers. On peak summer days, the area is congested at best. Public access at the take-out is limited to the highway and bridge right of way areas at the Barker's Creek Bridge. There is virtually no public parking. Tuckasegee Outfitters currently allows private and commercial paddling groups to park on its property just downstream of the Barker's Creek Bridge. They also provide shuttles for a small fee.

Information from Single Flow Surveys, Comparative Surveys and Pre-Run Forms

Participant Information (Tables 1 and 2)

Table 1 provides information about the participants. One participant paddled only on day one (raft) and another paddled only on day two (tandem "duckie"). A third participant missed Flow 3 only. A variety of boat types were used in the study and there were a variety of skill levels represented although intermediate

paddlers were the largest single group. While the mean days paddled per year was 33, almost 50% of the participants paddled 0 to 10 days per year.

Table 1. Tuckasegee River Dillsboro Section. Participant Information
Times Boated Score: 1 = 0 times; 2 = 1-10 times; 3 = 11-20 times; 4 = 21-30 times; 5 = >30 times

Participants	Kayak = 9; Decked C1 = 3; Solo Open Canoe = 6; Tandem Open Canoe = 10 (5 Boats); Raft = 9 (2 Boats); Inflatable Kayak = 7 (6 Boats)
Skill Level	Beginner = 7; Novice = 7; Intermediate = 20; Advanced = 8; Expert = 2
Years Using Craft	Mean = 10; Median = 8; Range = 0 to 35
Times Boated Dillsboro Section	Mean = 2.3; Median = 2.0; 8 Participants had never paddled it and 4 had paddled it >30 times
Paddle Whitewater – Days/Year	Mean = 33; Median = 15; 27 participants paddled 21 days/year; 18 participants paddled >21 days/year; Range: 0 to 200 days/year
Age	Mean = 46; Median = 48; Range = 12 to 69

Table 2 presents data from the Pre-Run Form (Appendix A) concerning participant preferences for different kinds of paddling experiences. In general this group preferred running easy (class II and III) whitewater, particularly if it was a unique or interesting place and they tolerated difficult access to rivers and/or portages if they could run a section with interesting whitewater. They also enjoyed running both easy and difficult rivers. They generally did not prefer paddling class IV/V whitewater, rivers with big waves and powerful hydraulics or steep technical rivers. They also would not usually choose to run a short section just for the challenging rapids.

Table 2. Tuckasegee River Dillsboro Section. Percentage, Mean, and Median Score of Participants Agreeing/Not Agreeing with Possible Paddling Experiences
7-Point Scale: 1 = Strongly Disagree; 2 = Moderately Disagree; 3 = Slightly Disagree; 4 = No Opinion; 5 Slightly Agree; 6 = Moderately Agree; 7 = Strongly Agree. Results are expressed as a percentage.

Scale / Experience Preference	1	2	3	4	5	6	7	Mean	Median
	%								
I Prefer Running Rivers with Class II/III Rapids	0	0	2	5	5	42	46	6.3	6.0
I Prefer Running Rivers with difficult Class IV/V Rapids	30	14	20	7	7	11	11	3.2	3.0
Running Challenging Whitewater is Most Important Part of Boating	9	14	20	14	25	11	7	3.9	4.0
I Often Boat Short Sections (< 4 miles) for the "Play Areas"	18	11	14	9	16	23	9	4.0	4.0
I Often Boat a Section to Experience a Unique/Interesting Place	5	5	2	2	14	20	52	5.9	7.0
I Often Boat Short Sections to Run Challenging Rapids	23	11	18	7	18	18	5	3.6	3.0
I Boat Sections Based on Length/Experience Regardless of Difficulty	29	6	18	18	18	6	6	3.3	3.0
I tolerate difficult put-ins/portages to run interesting whitewater	0	11	11	6	22	39	11	5.0	5.5
I prefer rivers with large waves and powerful hydraulics	44	6	11	11	22	6	0	2.8	2.5
I prefer boating steep technical rivers	22	28	6	11	17	17	0	3.2	2.5
I enjoy boating both difficult and easy rivers	0	6	11	6	22	6	50	5.6	6.5

Paddling Experience Characteristics (Tables 3 and 4 and Appendix B)
Participant ratings from the Single Flow Survey for paddling experience characteristics under the four different flow conditions are shown in Table 3. The mean rating for "Safety", "Aesthetics", "Length of Run", and "Number of Portages" for all flows was between "Acceptable" (+1) and "Totally Acceptable (+2) with little variation in the numerical values between flows. For "Navigability", "Availability of Challenging Technical Boating", "Availability of Powerful Hydraulics", and Availability of Whitewater Play Areas", Flow 3 (485 cfs) with "Neutral" (0) ratings had the lowest ratings followed by Flow 1(554 cfs)

with mostly "Neutral" ratings but slightly higher numerical values. Flows 2 (821 cfs) and 4 (1013 cfs) had "Acceptable" to "Totally Acceptable" ratings.

Table 3. Tuckasegee River Dillsboro Section. Mean and Median Ratings of the Four Flows for Paddling Characteristics; 5-point scale: -2 = Totally Unacceptable; -1 = Unacceptable; 0 = Neutral; +1 = Acceptable; +2 = Totally Acceptable.

Characteristic	Flow 1 554 cfs		Flow 2 821 cfs		Flow 3 485 cfs		Flow 4 1013 cfs	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Navigability	1.0	1.0	1.7	2.0	0.5	1.0	1.6	2.0
Availability of challenging technical boating	0.3	0.0	1.0	1.0	0.1	0.0	0.7	1.0
Availability of powerful hydraulics	-0.2	0.0	0.5	0.0	-0.4	0.0	0.6	1.0
Availability of whitewater "play areas"	0.4	0.5	1.2	1.0	0.1	0.0	0.7	1.0
Overall whitewater challenge	0.2	0.0	1.1	1.0	0.1	0.0	0.7	1.0
Safety	1.5	2.0	1.7	2.0	1.5	2.0	1.3	1.0
Aesthetics	1.2	1.0	1.5	2.0	1.2	1.0	1.2	1.0
Length of Run	1.3	1.0	1.3	1.0	1.2	1.0	1.4	1.5
Number of Portages	1.0	1.0	1.3	2.0	1.1	1.0	1.1	2.0
Overall rating	0.9	1.0	1.4	1.0	0.5	1.0	0.8	1.0

Participants were asked in the Comparative Survey to rate the importance of some other factors that can affect participant satisfaction with a whitewater trip. These factors are shown in Table 4 in order of importance to the participants. The top five are "Safe Trip", "Number of Rapids", "Attractive Scenery", "Water Quality", and "Difficulty of Rapids".

Table 4. Tuckasegee River Dillsboro Section. Mean Rating of Some Factors that Can Affect Participant Satisfaction with a Whitewater Trip

Importance Scale: 5-Point Scale where 1 = Not Important; 3 = Somewhat Important; 5 = Very Important

Characteristic	Importance of Characteristic	
	Mean	Median
Safe Trip	4.1	5.0
Number of Rapids	3.8	4.0
Attractive Scenery	3.8	4.0
Water Quality	3.8	4.0
Difficulty of Rapids	3.8	4.0
Crowding	3.5	3.5
Accessibility	3.3	3.0
Driving Distance to River	3.1	3.0
Thrilling Experience	3.1	3.0
Good Guide	2.8	3.0
Weather	2.7	3.0
Shuttle Availability	2.6	2.5
Water Temperature	2.4	2.0

Suitability for Different Skill Levels (Table 5 and Appendix B)

When asked what skill level a paddler would need to safely paddle the Dillsboro Section, Flows 1 (485cfs) and 3 (554 cfs) were noted as primarily "Beginner" and "Novice" levels. Flows 2 (821 cfs) and 4 (1013 cfs) were noted as mainly "novice" with a few participants indicating these flows required an intermediate skill level.

Table 5. Tuckasegee River Dillsboro Section. Number of Participants Selecting the Skill Level Needed to Safely Paddle the Dillsboro Section at the Four Flows

Skill Level	Flow 1 554 cfs	Flow 2 821 cfs	Flow 3 485 cfs	Flow 4 1013 cfs
Beginner	20	11	25	7
Novice	19	23	11	30
Intermediate	0	2	0	7

Whitewater Difficulty Rating (Table 6 and Appendix B)

The majority of participants rated the Dillsboro Section as class II on the American Whitewater International Scale of River Difficulty at all flow levels (Table 6). Smaller numbers rated it at class I, particularly at the two lower flows (Flows 1 and 3).

Table 6. Tuckasegee River Dillsboro Section. Number of Participants Rating the Whitewater Difficulty at the Four Flows

Difficulty Rating	Flow 1 554 cfs	Flow 2 821 cfs	Flow 3 485 cfs	Flow 4 1013 cfs
Class I	12	5	12	4
Class II	26	29	21	31
Class III	0	3	0	0

Estimation of Hits, Stops, Drags, and Portages (Table 7 and Appendix B)

The number of "hits" (hit an obstacle but did not stop) was highest at Flows 3 (485 cfs) and 1 (554 cfs) with a median of 20 and 15 respectively (Table 7). At Flows 2 (821 cfs) and 4 (1013 cfs) the number of hits decreased to a median of 5. The median number of "hits" that would be acceptable to participants was 8-10 for all flows so Flows 3 and 1 exceeded the acceptable range of "hits" but Flows 2 and 4 did not. The number of "stops" (boat stopped but participant(s) did not have to get out of the boat to get it moving again) was 3 or less for all flows with Flow 4 having no "stops". The total number of "drags" (boat stopped and participant(s) had to get out to drag the boat to get it moving again) ranged from 2-5. There were no portages at any of the flows.

Table 7. Tuckasegee River Dillsboro Section. Median Number and Range of Hits, Acceptable Hits, Stops, Drags, and Portages at the Four Flows

Estimate of:	Flow 1 554 cfs		Flow 2 821 cfs		Flow 3 485 cfs		Flow 4 1013 cfs	
	Median	Range	Median	Range	Median	Range	Median	Range
# of Hits	15	3-100	5	1- 29	20	4- 68	5	0- 20
# of Hits Acceptable	10	2-100	10	1-100	10	2-100	8	2-100
# of Stops	2	0- 10	1	0- 3	3	0- 16	0	0- 4
# of Drags	0	0- 5	0	0- 2	0	0- 4	0	0- 2
# of Portages	0		0		0		0	

Evaluation of Flow Preferences (Tables 8, 9, and Figures 1,2 and Appendix B)

The Overall Rating from the Single Flow Survey (Question 3) and the Overall Evaluation from the Comparative Survey (Question 4) show similar trends (Table 8) with Flow 2 (821 cfs) having the highest rating followed by Flows 1 and 4. Figure 1 shows the number of responses (as a %) for each rating on the comparative overall survey. For "Minimal" flow participants desired "No Change" at Flow 1 (554 cfs), a little "Higher" at Flow 3 (485 cfs), a little "Lower" at Flow 2 (821 cfs), and "Lower" at Flow 4 (1013 cfs). For "Optimal" flow participants wanted "Higher" to "Much Higher" levels at Flows 1 and 3, "No Change" at Flow 2 (821 cfs), and "Lower" at Flow 4. Participants would "Possibly" paddle Flow 3 again, "Probably" paddle Flows 1 and 4, and "Definitely" paddle Flow 2.

Table 8. Tuckasegee River Dillsboro Section. Mean and Median Ratings for Overall Experience, Flow Preference, and Whether Participants Would Paddle Flows Again

Overall Rating Scale: -2 = Totally Unacceptable; -1 = Unacceptable; 0 = Neutral; 1 = Acceptable; 2 = Totally Acceptable
Flow Preference Scale: 1 = Much Lower; 2 = Lower; 3 = No change; 4 = Higher; 5 = Much Higher
Paddle Again Scale: 1 = Definitely No; 2 = Possibly; 3 = Probably; 4 = Definitely Yes

Questions	Flow 1 554 cfs		Flow 2 821 cfs		Flow 3 485 cfs		Flow 4 1013 cfs	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Single Flow Overall Rating	0.9	1.0	1.4	1.0	0.5	1.0	0.8	1.0
Minimal Acceptable Flow Preference	3.0	3.0	2.5	2.0	3.5	4.0	1.8	2.0
Optimum Flow Preference	4.4	4.0	3.3	3.0	4.0	4.0	2.3	2.0
Paddle Again?	2.8	3.0	3.5	4.0	2.3	2.0	3.3	3.0
Comparative Overall Rating	0.7	1.0	1.6	2.0	0.1	0.0	0.9	1.0

Figure 1 - Tuckasegee River Recreational Flow Study Dillsboro Section - Overall Evaluation of Flows

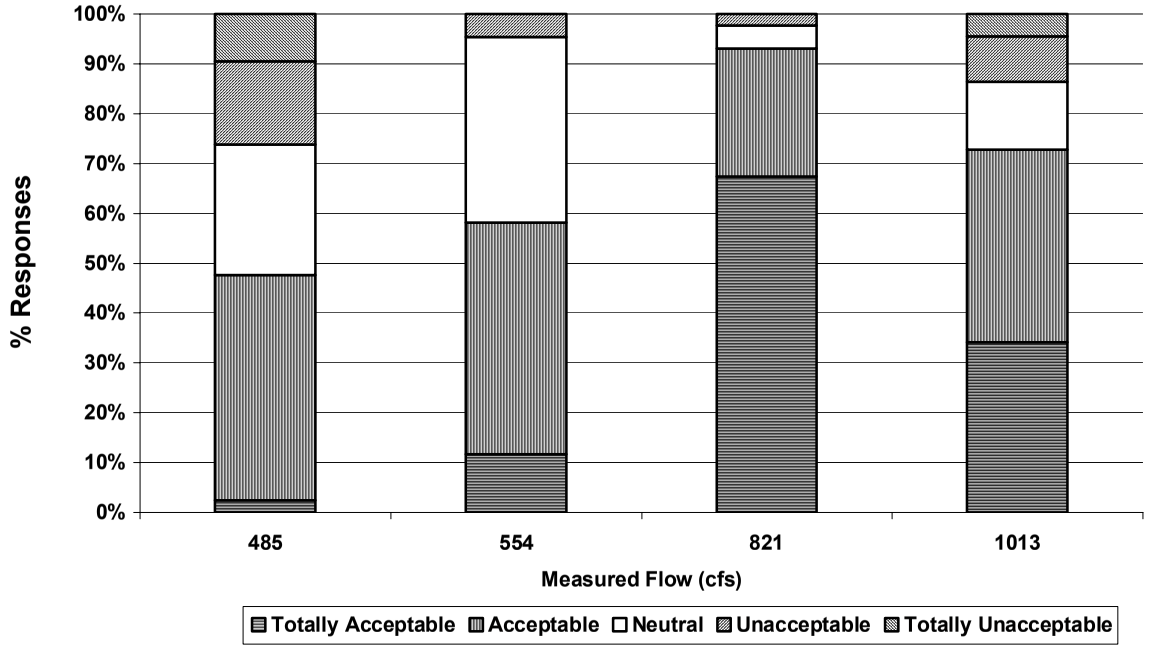
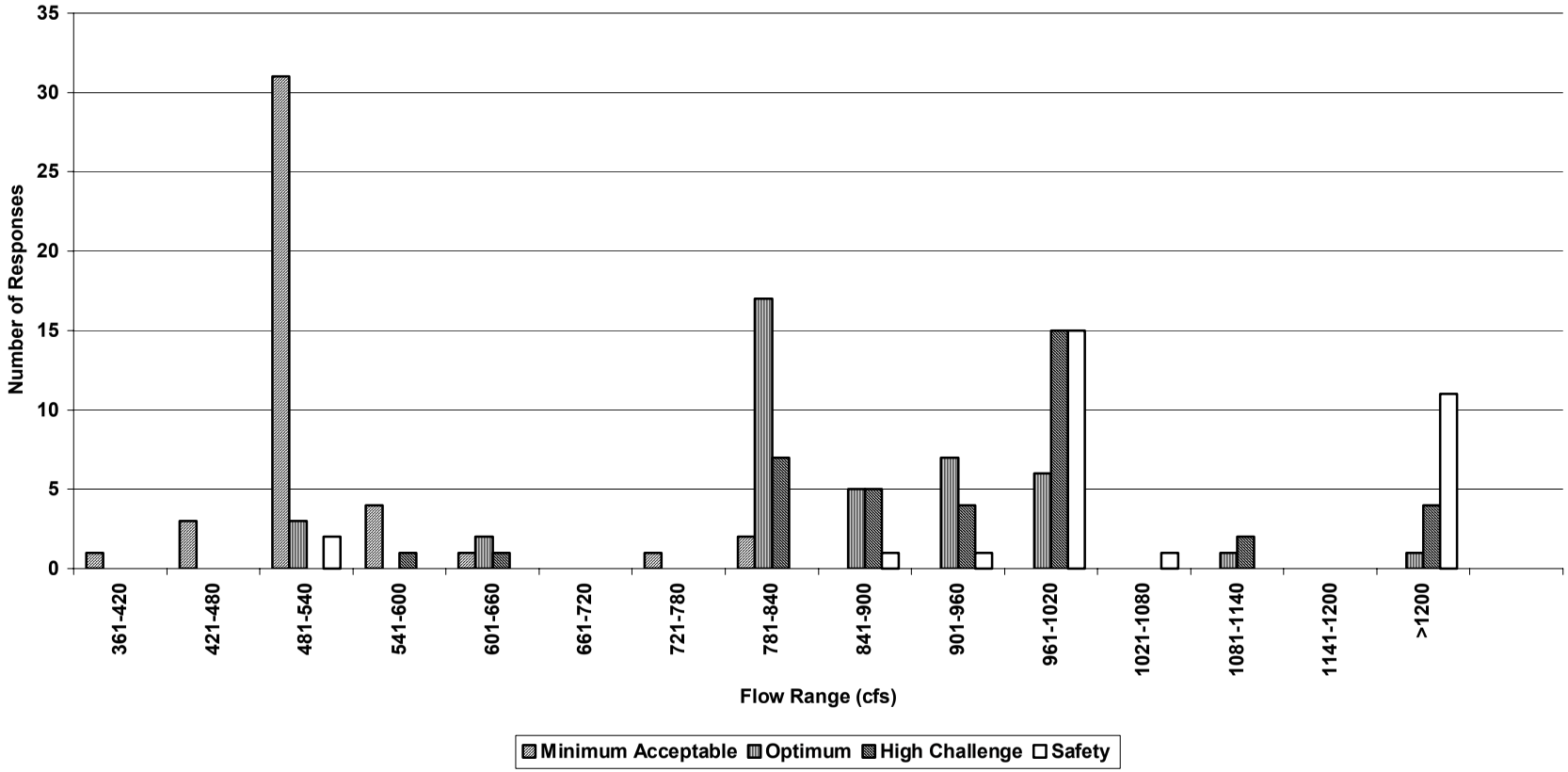


Table 9 shows participant responses when asked to specify flows for specific experiences. The minimal acceptable flow is between Flows 3 and 1 of the study. The flow with the highest ratings (Flow 2 of the study) is between the designated optimal and standard trip flows and close to the 803 cfs desired if there could be only one flow. The highest safe flow is estimated to be 1000 to 2000 cfs though a few participants would be willing to paddle at considerably higher levels. Figure 2 shows the number and distribution of participant choices for flows for minimal acceptable, optimum, high challenge, and safe flow trips. About 98% of the participants would recommend the standard trip to others while only 54% would recommend the high challenge trip to others. In general participants thought it was moderately to very important to have a variety of flows to provide "different types of boating experiences" and "opportunities for people with different skill levels and craft types". The scale choices were "not at all important", "slightly important", "moderately important", "very important", and "extremely important".

Table 9. Tuckasegee River Dillsboro Section. Mean and Median Flows designated by Participants for Specific Experiences

Specify Flows For:	Mean cfs	Median cfs	Comments
Minimal Acceptable	538	540	31 of 43 participants designated 485 and 554 cfs; 4 below & 8 above
Optimum	854	815	17 of 42 participants designated 815 cfs; 5 below & 20 above
Standard Trip at Medium flows	746	815	18 of 43 participants designated 815 cfs; 17 below & 8 above; 98% would recommend this trip to others
High Challenge Trip at Higher flows	1493	1015	16 of 39 participants designated 1015 & 1115 cfs; 19 below & 4 above including 1 at 8215 and 1 at 15215; 54% would recommend this trip to others
Highest safe flow	1828	1015	22 of 31 participants designated 1015 to 1215 cfs; 4 below & 5 above including 1 at 10,215 and 1 at 12,215
Only One Flow	803	815	30 of 44 participants designated 688 to 917; 7 below & 7 above

Figure 2 - Tuckasegee River Recreational Flow Study - Dillsboro Section - Flow Level Choices for Four Different Trip Experiences



Comparison to Other Rivers (Table 10 and Appendix B)
When asked to rate the Dillsboro Section with regard to boating opportunities, participants rated it average when compared to other rivers locally, regionally, and nationally (Table 10).

Table 10. Tuckasegee River Dillsboro Section. Comparison to Other Rivers on a Local, Regional, and National Level
Rating Scale: 1 = Worse than Average; 2 = Average/ 3 = Better than Average; 4 = Excellent; 5 = Among the Very Best

Compared to Other Rivers In:	Median	Mean	% Rating and (No. Responses): The Tuckasegee River is:				
			Worse than Average	Average	Better than Average	Excellent	Among the Very Best
1 Hour Drive	2.0	2.3	26 (10)	39 (15)	13 (5)	21 (8)	0
Western NC	2.0	2.1	32 (12)	41 (15)	14 (5)	14 (5)	0
Southeast	2.0	2.1	33 (10)	40 (12)	13 (4)	10 (3)	3 (1)
USA	2.0	2.0	37 (10)	41 (11)	11 (3)	11 (3)	0

Participants were also asked to compare the boating opportunities at various regional rivers (Nantahala, Little Tennessee, Chattooga II, III, and IV, French Broad/Hot Springs section, Pigeon, Middle and Upper Ocoee, and Hiwassee) to those at the Dillsboro Section of the Tuckasegee (Appendix B, "Compare with Other Rivers"). In general Dillsboro was considered about equal to the Little Tennessee and Chattooga II for novice boaters and more desirable than the other rivers for this skill level boater. For intermediate paddlers, Dillsboro was considered equal to all the other rivers except the Nantahala and Section III of the Chattooga, which were rated more desirable. Most of the other rivers were considered more desirable for advanced boaters except for the Little Tennessee, Section II of the Chattooga and the Hiwassee Rivers. For boating characteristics such as size/difficulty of rapids, play boating, rafting, river running, eddy hopping, technical maneuvering, and river gradient most of the other rivers were considered more desirable than Dillsboro with the exception of the Hiwassee that was similar and the Little Tennessee which was less desirable. For logistical characteristics (driving distance to river, shuttles, and access to river), Dillsboro was considered similar to or more desirable than the rest of the rivers. For scenery, all the rivers were rated similar to Dillsboro except the Chattooga where all sections were rated more desirable. For water quality, the Nantahala and all sections of the Chattooga were rated more desirable, the Pigeon and Upper Ocoee were rated less desirable and the rest were considered equal to Dillsboro. For an overall rating, participants scored the Little Tennessee, Chattooga II, French Broad, and Hiwassee as similar to Dillsboro and the rest of the rivers as more desirable.

Written Comments From Single Flow Surveys and Comparative Surveys (Appendix C)

When asked to identify particularly challenging rapids or sections and rate their difficulty (using the International Whitewater Scale), the rapids most often named were "First Hole", "Second Hole", "Tanya's Rock", "Double Drop", "Surprise", and "Shark's Tooth". All were generally rated Class I-II+ at all flows. At all flows, many participants either did not answer the question or noted that none of the rapids/sections were particularly challenging. There were no portages made during the study. While several participants fell out of rafts, swam from their hard boats, or pinned momentarily on rocks, these incidents are considered part of the sport of whitewater paddling and thus not significant for the purposes of this study.

When asked for additional comments at the end of the Single Flow Surveys, participants noted that Flows 1 (554 cfs) and 3 (485 cfs) were minimal flows with many hits and stops, and many of them said they still had a good time. Several people noted that this section was very good for teaching people to paddle and for people renting rafts and "duckies", particularly for a family outing where children would be present. After Flow 3 (821 cfs), participants noted the fast fun rapids with places to surf and play, the clear channels, and generally thought it was more fun with less work to get through the rapids, particularly in the shallower places. While several participants liked the bigger waves and faster current of Flow 4 (1013 cfs), many participants commented that it was too fast, the river features were less distinct, and that they would prefer a lower level with more defined river features. Several participants noted that this flow would not be as good for teaching novice hard boaters or for family rafting.

Comments from the Comparative Survey included the need for public access at the take-out and the value of this section for teaching people to paddle and for family recreation.

Conclusions for the Dillsboro Section
The Dillsboro Section of the Tuckasegee River is characterized by a fairly continuous average gradient of about 15 feet per mile and a rocky bedrock river channel with rapids, shoals, and pools. The river is generally rated as class II on the International Whitewater Scale. The banks are generally vegetated with shrubs or small trees and are both steep and high along sections of the river.

The put-in has public access courtesy of the Town of Dillsboro, but the area is congested and parking is inadequate for the number of people who utilize the area on busy summer days. The take-out at Barker's Creek is along the highway and bridge right-of-ways with little or no parking available. Parking is currently available on private property courtesy of Tuckasegee Outfitters. Land along the river in this section is in private ownership with business development on both sides of the river in Dillsboro and a trailer park and private homes along the remainder of the stretch on the river left side (left facing downstream).

The results of the controlled flow study indicate that the minimum acceptable flow for paddling is between Flows 1 (554cfs) and 3 (485 cfs), the optimum flow was at Flow 3 (821 cfs), and if only one flow could be provided, participants would prefer it be around 800 cfs. Participants often noted the lower flows as being well suited to beginner/novice users (see Written Comments in Appendix C) both in rafts and hard boats. Beginner/novice users probably make up a large percentage of the current use on this section of river as evidenced by the 40,000 or so participants in commercial raft trips and the extensive use of the river for canoe/kayak instruction by commercial outfitters, summer camps, county/city recreation departments, universities and paddling clubs.

Whittier Section

General
This 3-mile section begins in the town of Whittier at a small dirt pull-off about a quarter mile downstream of the Whittier Post Office on Old Highway 19. The take-out is in the Town of Ela at a TVA/Swain County Access Area. The river parallels Old Highway 19 for about a mile where the river channel is about 300 feet wide with many small ledges. As the road separates from the river, the ledges become higher and more continuous, culminating in a beautiful ledge drop (class II+) about a quarter of a mile above the confluence with the Oconoluftee River. The take-out is about a half mile below on river right.

Measured flows during this study are shown below for the Whittier Section. These flows correspond to Flows 2 and 4 of the Dillsboro Section.

	Flow 1	Flow 2
Base Flow	410	410
Flow from Generation	403	575
Total cfs	813	985

Access
The put-in area is on private property, but has wooden steps to the river and anglers and boaters regularly access the river at this point. There is room for about eight cars in the area. The publicly owned take-out in Ela has parking for about 6 cars, stairs to the river, a grill, and picnic table.

Information from Single Flow Surveys, Comparative Surveys and Pre-Run Forms

Participant Information (Tables 11 and 12 and Appendix H)
Table 11 provides information about the participants. Five participants paddled only on day one (1 tandem open canoe and 3 kayaks). A variety of boat types were used in the study and there were a variety of skill

levels represented although intermediate paddlers were the largest single group. The mean days paddled per year were 49 compared to 33 for the Dillsboro Section. Only two paddlers in this group paddled less than 20 days per year whereas 50% of the Dillsboro participants paddled 0 to 10 days per year.

Table 11. Tuckasegee River Whittier Section. Participant Information
Times Boated Score: 1 = 0 times; 2 = 1-10 times; 3 = 11-20 times; 4 = 21-30 times; 5 = >30 times

Participants	Kayak = 9; Decked C1 = 1; Solo Open Canoe = 1; Tandem Open Canoe = 2 (1Boat); Raft = 3 (1 Boat); Sit-on-Top Kayak = 1
Skill Level	Beginner = 1; Novice = 1; Intermediate = 10; Advanced = 4; Expert = 1
Years Using Craft	Mean = 14; Median = 12; Range = 0 to 35
Times Boated Whittier Section	Mean Score = 1.5; Median = 2.0; 6 Participants had never paddled it and 7 had paddled it 1-10 times
Paddle Whitewater – Days/Year	Mean = 49; Median = 20; 9 participants paddled <21 days/year; 7 participants paddled >21 days/year ; Range: 0 to 200 days/year
Age	Mean = 42; Median = 43; Range = 23 to 60

Table 12 presents data from the Pre-Run Form (Appendix H) concerning participant preferences for different kinds of paddling experiences. In general, this group preferred running easy (class II and III) whitewater, particularly if it was a unique or interesting place and they tolerated difficult access to rivers and/or portages if they could run a section with interesting whitewater. They also enjoyed running both easy and difficult rivers. They generally did not prefer rivers with big waves and powerful hydraulics and were generally more neutral about the other types of paddling experiences.

Table 12. Tuckasegee River Whittier Section. Percentage, Mean, and Median Score of Participants Agreeing/Not Agreeing with Possible Paddling Experiences
7-Point Scale: 1 = Strongly Disagree; 2 = Moderately Disagree; 3 = Slightly Disagree; 4 = No Opinion; 5 = Slightly Agree; 6 = Moderately Agree; 7 = Strongly Agree.

Experience Preference / Scale	1	2	3	4	5	6	7	Mean	Median
	%								
I Prefer Running Rivers with Class II/III Rapids	0	0	6	0	0	50	44	6.3	6.0
I Prefer Running Rivers with difficult Class IV/V Rapids	19	6	12	0	25	19	19	4.4	5.0
Running Challenging Whitewater is Most Important Part of Boating	18	24	12	0	35	12	0	3.5	3.0
I Often Boat Short Sections (< 4 miles) for the "Play Areas"	6	18	18	6	18	23	12	4.3	5.0
I Often Boat a Section to Experience a Unique/Interesting Place	0	6	0	0	12	12	70	6.4	7.0
I Often Boat Short Sections to Run Challenging Rapids	12	6	12	12	29	23	6	4.4	5.0
I Boat Sections Based on Length/Experience Regardless of Difficulty	17	0	17	33	17	0	17	4.0	4.0
I tolerate difficult put-ins/portages to run interesting whitewater	0	0	0	0	33	33	33	6.0	6.0
I prefer rivers with large waves and powerful hydraulics	33	17	0	17	33	0	0	3.0	3.0
I prefer boating steep technical rivers	17	17	0	17	17	33	0	4.0	4.5
I enjoy boating both difficult and easy rivers	0	17	0	0	0	0	83	6.2	7.0

Paddling Experience Characteristics (Tables 13 and 14, Appendix H)
Participant ratings from the Single Flow Survey for paddling experience characteristics under the two different flow conditions are shown in Table 13. There is some slight preference for Flow 1 for most characteristics and they all score in the acceptable range except for "availability of powerful hydraulics" and "aesthetics" (neutral.at Flow 2). The overall rating is generally "acceptable" for both flows.

Table 13. Tuckasegee River Whittier Section. Mean and Median Rating of the Two Flows for Paddling Characteristics

5-point scale: -2 = Totally Unacceptable; -1 = Unacceptable; 0 = Neutral; +1 = Acceptable; +2 = Totally Acceptable. Flow values are in cfs.

Characteristic	Flow 1 813 cfs		Flow 2 985 cfs	
	Mean	Median	Mean	Median
Navigability	0.9	1.0	1.1	1.o
Availability of challenging technical boating	0.9	1.0	0.6	1.0
Availability of powerful hydraulics	0.4	0.0	0.3	0.0
Availability of whitewater "play areas"	0.9	1.0	0.6	0.5
Overall whitewater challenge	0.9	1.0	0.6	1.0
Safety	1.1	1.0	1.0	1.0
Aesthetics	0.5	1.0	0.0	0.0
Length of Run	1.4	1.0	0.7	1.0
Number of Portages	1.0	2.0	1.1	1.0
Overall rating	1.1	1.0	0.7	1.0

Participants were asked in the Comparative Survey to rate the importance of some other factors that can affect participant satisfaction with a whitewater trip. These factors are shown in Table 14 in order of importance to the participants. The top five are "Safe Trip", "Crowding", "Water Quality", "Difficulty of Rapids", and "Number of Rapids".

Table 14. Tuckasegee River Whittier Section. Mean and Median Ratings of Some Factors that Can Affect Participant Satisfaction with a Whitewater Trip

Importance Scale: 5-Point Scale where 1 = Not Important; 3 = Somewhat Important; 5 = Very Important

Characteristic	Importance of Characteristic	
	Mean Score	Median Score
Safe Trip	3.8	4.0
Crowding	3.6	4.0
Water Quality	3.4	3.5
Difficulty of Rapids	3.4	3.0
Number of Rapids	3.4	3.0
Accessibility	3.2	3.0
Driving Distance to River	3.1	3.0
Attractive Scenery	3.1	3.0
Thrilling Experience	2.9	3.0
Good Guide	2.8	2.0
Shuttle Availability	2.4	1.5
Weather	2.3	2.0
Water Temperature	2.3	2.0

Suitability for Different Skill Levels (Table 15 and Appendix H)

When asked what skill level a paddler would need to safely paddle the Whittier Section, both flows were rated as suitable for "Beginner" and "Novice" levels primarily though 15-20% of this group rated it an intermediate section of river..

Table 15. Tuckasegee River Whittier Section. Number of Participants Selecting the Skill Level Needed to Safely Paddle the Dillsboro Section at the Two Flows

Skill Level	Flow 1 813 cfs	Flow 2 985 cfs
Beginner	3	6
Novice	9	3
Intermediate	3	4

Whitewater Difficulty Rating (Table 16 and Appendix H)
The majority of participants rated the Whittier Section as class II on the American Whitewater International Scale of River Difficulty at both flow levels (Table 16). Smaller numbers rated it at class III at the lower flow.

Table 16. Tuckasegee River Whittier Section. Number of Participants Rating the Whitewater Difficulty at the Two Flows

Difficulty Rating	Flow 1 813 cfs	Flow 2 985 cfs
Class I	1	0
Class II	9	10
Class III	3	1

Estimation of Hits, Stops, Drags, and Portages (Table 17 and appendix H)
The median number of "hits" (hit an obstacle but did not stop) was the same for both flow levels at 10. The number of "acceptable hits" was close at 8-10. There were few "stops" (stopped by a hit but did not get out of boat) at either level and no "drags" (had to get out of boat to move it from the "stop"). There were 2 "portages" at the Class II+ ledge at Flow 1 and no portages at Flow 2.

Table 17. Tuckasegee River Whittier Section. Median Number and Range of Hits, Acceptable Hits, Stops, Drags, and Portages at the Four Flows

Estimate of:	Flow 1 813 cfs		Flow 2 985 cfs	
	Median	Range	Median	Range
# of Hits	10	1-40	10	2-44
# of Hits Acceptable	10	4-60	8	1-35
# of Stops	0	0- 3	0	0- 4
# of Drags	0	0	0	0
# of Portages	0	0- 2	0	0

Evaluation of Flow Preferences (Tables 18, 19; Figures 3,4; and Appendix H)
The Overall Rating from the Single Flow Survey (Question 3) and the Overall Evaluation from the Comparative Survey (Question 4) indicate a generally "Acceptable" rating for both flows (Table 18). Figure 3 shows the number of responses (as a %) for each rating on the comparative overall survey.
For "Minimal" flow participants desired "No Change" at Flow 1 and "Lower" to "No Change" at Flow 2. For "Optimal" flow participants wanted "Higher" water at Flow 1 and "No Change" to "Higher" at Flow 2. Participants would "Possibly" to "Probably" paddle both flows again.

Table 18. Tuckasegee River Whittier Section. Mean and Median Ratings for Overall Experience, Flow Preference, and Whether Participants Would Paddle Flows Again

Overall Rating Scale: -2 = Totally Unacceptable; -1 = Unacceptable; 0 = Neutral; 1 = Acceptable; 2 = Totally Acceptable

Flow Preference Scale: 1 = Much Lower; 2 = Lower; 3 = No change; 4 = Higher; 5 = Much Higher

Paddle Again Scale: 1 = Definitely No; 2 = Possibly; 3 = Probably; 4 = Definitely Yes

Questions	Flow 1 813 cfs		Flow 2 985 cfs	
	Mean	Median	Mean	Median
Single Flow Overall Rating	1.1	1.0	0.7	1.0
Flow Preference – Minimal Acceptable Flow	3.1	3.0	2.6	2.5
Flow Preference – Optimum Flow	3.9	4.0	3.4	3.5
Paddle Again?	2.8	3.0	2.6	3.0
Comparative Overall Rating	0.6	1.0	1.1	1.0

Figure 3 - Tuckasegee River Recreational Flow Study - Whittier Section - Overall Evaluation of Flows

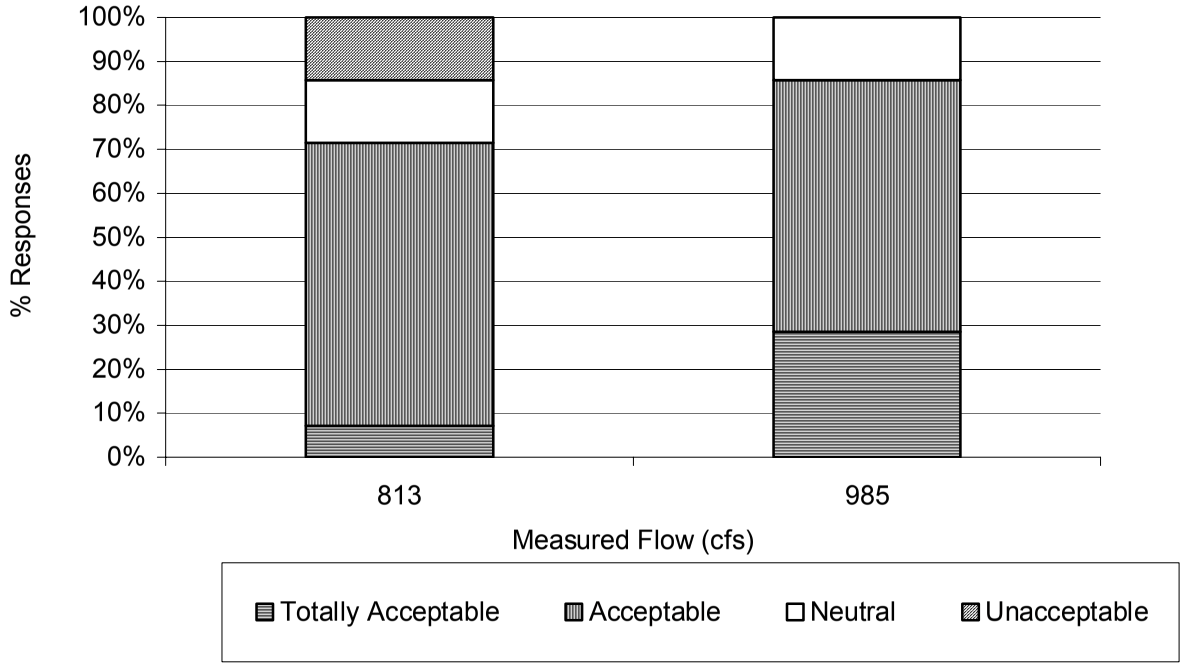


Figure 4 - Tuckasegee River Recreational Flow Study - Whittier Section - Flow Level Choices for Three Different Trip Experiences

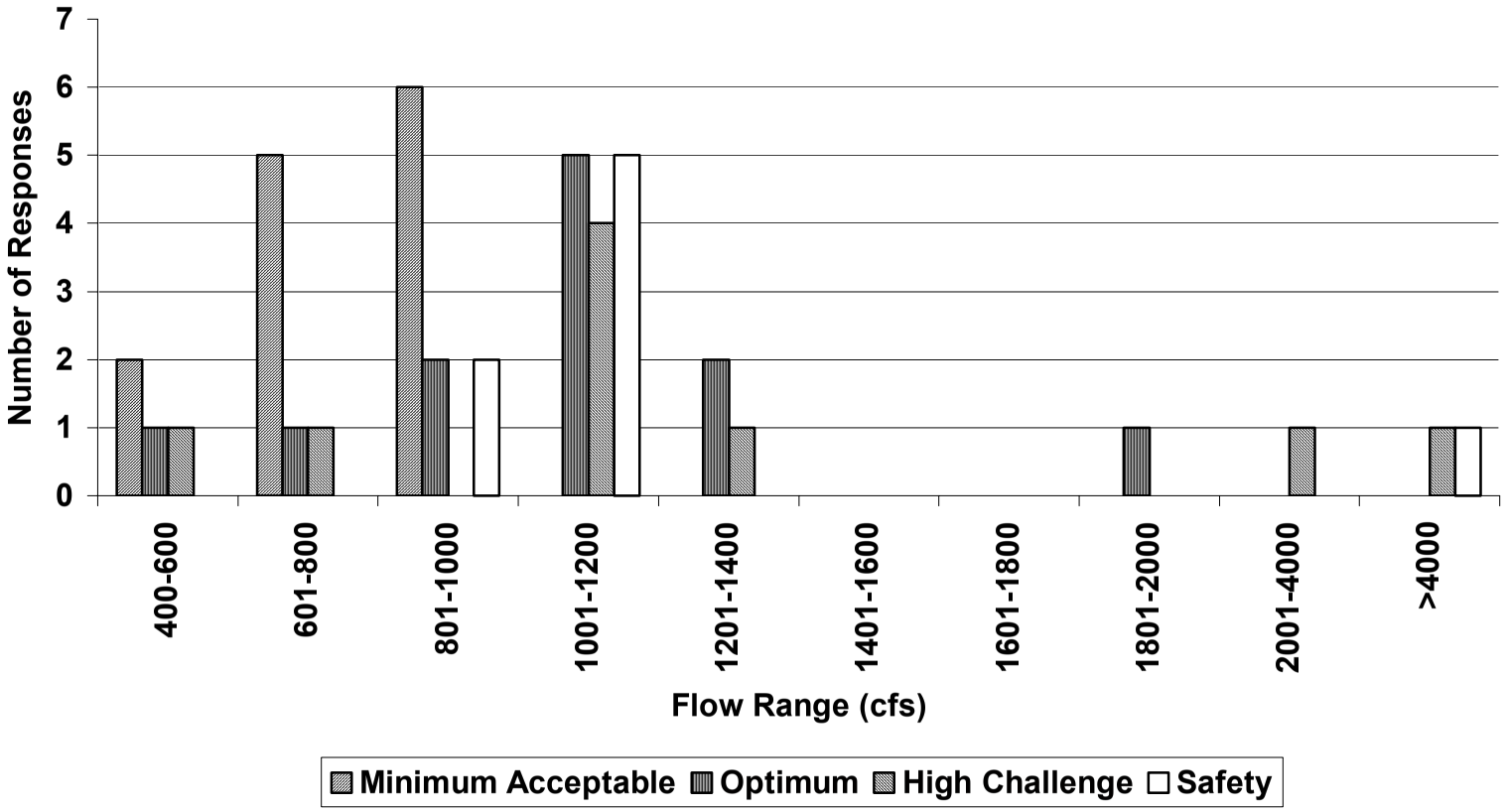


Table 19 shows participant responses when asked to specify flows for specific experiences. The "minimal acceptable" flow is below the 813 cfs of Flow 1. Close to a majority of participants noted 900 to 1000 cfs as the flow range for an "optimum trip", "standard trip at medium flows", "highest safe flow", and if "only one flow" could be provided. The means for "highest safe flow" and "only one flow" drop from 2451 cfs and 1925 cfs respectively to 1073 cfs and 907 cfs when the high estimate of 12,100 cfs is removed (medians for both are 1100). Figure 4 shows the number and distribution of participant choices for flows for a minimal acceptable, optimum, high challenge, and safe flow trips. About 71% of the participants would recommend the standard trip to others while only 15% would recommend the high challenge trip to others. Half of the participants did not believe a variety of flows for either different types of boating experiences or providing opportunities for different skill levels and craft types was important for this section. Of the six that thought flow variety would be important for providing different types of boating experiences, half rated it as "not at all important" and the other half rated it not higher than "moderately important". Of the six that thought flow variety would be important for providing opportunities for different skill levels and craft types the ratings were between "slightly important" to "moderately important". The scale choices were "not at all important", "slightly important", "moderately important", "very important", and "extremely important".

Table 19. Tuckasegee River Whittier Section. Mean Flows designated by Participants for Specific Experiences

Specify Flows For:	Mean cfs	Median cfs	Comments
Minimal Acceptable	749	800	Range: 400-900; 8 of 12 participants noted 700-813
Optimum	1067	1075	Range: 400-1900; 6 of 12 participants noted 900-1000
Standard Trip at Medium Flows	951	1000	Range: 400-1300; 7 of 12 participants noted 900-1000
High Challenge Trip at Higher Flows	1568	1100	Range: 400-4100; 4 of 9 participants noted 900-1000
Highest safe flow	2451	1100	Range: 1100-12,100; 7 of 8 participants noted 900-1000; mean is 1073 when the 12,100 estimate is removed
Only One Flow	1925	1008	Range: 400-12,100; 6 of 11 participants noted 900-1000; mean is 907 when the 12,100 estimate is removed

Comparison to Other Rivers (Table 20 and Appendix H)

When asked to rate the Whittier Section with regard to boating opportunities (Table 20), participants generally rated it "worse than average" when compared to other rivers locally, regionally, and nationally (Table 20).

Table 20. Tuckasegee River Whittier Section. Comparison to Other Rivers on a Local, Regional, and National Level

Rating Scale: 1 = Worse than Average; 2 = Average/ 3 = Better than Average; 4 = Excellent; 5 = Among the Very Best

Compared to Other Rivers In:	Median	Mean	% Rating (and No. Responses): The Tuckasegee River is:				
			Worse than Average	Average	Better than Average	Excellent	Among the Very Best
1 Hour Drive	1.0	1.5	55 (6)	36 (4)	9 (1)	0	0
Western NC	1.0	1.2	83 (10)	17 (2)	0	0	0
Southeast	1.0	1.1	83 (10)	17 (2)	0	0	0
USA	1.0	1.1	91 (10)	9 (1)	0	0	0

Participants were also asked to compare the boating opportunities at various regional rivers (Nantahala, Little Tennessee, Chattooga II, III, and IV, French Broad/Hot Springs section, Pigeon, Middle and Upper Ocoee, and Hiwassee) to those at the Whittier Section of the Tuckasegee (Appendix H, Tab labeled "Compare with Other Rivers"). Overall, all the rivers were rated "more desirable" than Whittier except for the Little Tennessee and the Hiwassee which were considered "similar to" the Whittier section. Participants rated Chattooga Section II as "more desirable" to the Whittier Section for novice paddlers and

the rest of the rivers were rated "similar to" Whittier. Generally the other rivers were rated "more desirable" for intermediate and advanced paddlers with the exception of the Little Tennessee, Chattooga Section II, and the Hiwassee which were "similar to" Whittier. For boating characteristics such as size/difficulty of rapids, play boating, rafting, river running, eddy hopping, technical maneuvering, and river gradient most of the other rivers were considered "more desirable" than Whittier with the exception of the Hiwassee and the Little Tennessee that were generally considered "similar to" Whittier. For logistical characteristics (driving distance to river, shuttles, and access to river) Whittier was generally considered "similar to" all the rivers except the Nantahala, Pigeon, Middle Ocoee, and Upper Ocoee which were considered "more desirable". For scenery, all the rivers were rated "more desirable" than Whittier except the Little Tennessee, the Middle Ocoee, and the Upper Ocoee, which were rated "similar to". For water quality, all rivers were rated "more desirable than Whittier with the exception of the Pigeon which was considered "similar to" Whittier.

Written Comments From Single Flow Surveys and Comparative Surveys (Appendix I)

When asked to identify particularly challenging rapids or sections and rate their difficulty (using the International Whitewater Scale), the rapid most often named was the steepest ledge, which was called Overlook Rapid by several participants. This rapid was rated Class II+ to III at both water levels. Two participants noted that they portaged Overlook Rapid at Flow 1. Neither of these participants paddled Flow 2 and none of the other participants portaged any rapid during Flow 2. There were no significant problems noted during the two flows and the only incidents noted were one short pin and a swim, which are part of normal paddling trips.

In the "additional comments" section of the Single Flow Survey, participants said that they enjoyed the section with plenty of places to play and to teach others at both levels. A couple of people wanted more water at Flow 1 and another suggested improved access at the put-in and a river gauge.

Comments from the Comparative Survey included a statement about no fees to paddle the river or park while paddling, a question about water quality after perceiving pipes entering the river as possible septic pipes and the value of this section for teaching people to paddle.

Conclusions for the Whittier Section

The Tuckasegee River above Whittier has an average gradient of about 10 feet per mile. The river through the Whittier section has an average gradient of about 18 feet per mile with the majority of the drop in the mile of ledges above the confluence with the Oconoluftee River. Just below the put-in at the Town of Whittier, the riverbed widens significantly. For a mile, small ledges characterize the river. The next mile features larger, more continuous ledges that culminate in the rapid now called Overlook and this section drops at about 30 feet/mile. The 0.8-mile section below the confluence with the Oconoluftee has long swift riffles but few ledges or rapids of significance. The entire section is generally rated on the International Whitewater Scale as Class I-II+ with a mile of relatively continuous Class II ledges and one Class II+ to III ledge (Overlook Rapid). On the river left bank (looking downstream), the river is paralleled by the Great Smoky Mountain Railroad and for the first mile (on river right bank) by Old Highway 19 with home and business development between the road and river. The second mile has little development (two homes) and is characterized by vegetated banks. The last 0.8-miles again presents both home and business development along both sides of the river including a trailer park which is densely developed.

The put-in is apparently on private land that has traditionally been made available for public use. There are old wooden steps leading to the river. The take-out is at the TVA/Swain County Public Access Area, which has a ramp and space for about 8 vehicles. This section is not currently utilized much by boaters.

The results of the controlled flow study indicate that the minimum acceptable flow for paddling is around Flow 1 (813 cfs) and the optimum flow would be slightly higher (1067 cfs) than Flow 2 (985 cfs).

West Fork By-Pass Section

General

The entire By-Pass section below the dam at Lake Glenville to the Tuckasegee Powerhouse is about 6.9 miles. Due to the lack of definitive information on the feasibility of providing whitewater recreation on this section and the quality of those resources, a phased approach (Appendix G) was used to analyze the possible opportunities. The phases were:

- Phase 1: This was an on-land assessment of the By-Pass Section using desktop analysis (length, gradient, hydrology, access, etc) followed by a site visit to inspect the characteristics of the section. The conclusions from this phase indicated that further study of the 1.2-mile section between the Glenville Dam and the put-in section for this study was not needed due in part to difficult portages around three waterfalls, a series of beaver dams obstructing downstream navigation, and the encroachment of vegetation into the river channel.
- Phase 2: This was an on-water reconnaissance at a conservative flow level to determine the quality of the whitewater resource and see if further test releases were needed. The conclusions from this phase indicated that the 1.2-mile section below the Little Lake Glenville Dam to the Tuckasegee Powerhouse could be eliminated due to access difficulties, lack of whitewater features and the similarity of the section to other sections on the main stem of the Tuckasegee River. The section starting 1.2 miles below the Lake Glenville Dam to the Thorpe Powerhouse was determined to have recreation opportunities that required further study.
- Phase 3: This was an on-water assessment of two additional test flows that are documented here utilizing the methodology of Whittaker, et al (1993).
- Phase 4: If needed, this phase provides the additional information necessary to determine minimum acceptable and optimum flows and other resource characteristics and participant preferences. This was not needed for the West Fork since minimum acceptable and optimum flows were determined on the West Fork in Phase 3 as well as sufficient information about participant preferences.

The 4.5-mile study section begins about 1.2 miles below the dam at Lake Glenville. The put-in is accessed by a quarter mile trail from Shoal Creek Road about a mile from its intersection with Highway 107. The first 1.7 miles of the section is away from public roads though the river flows next to the Cullowhee Forest Development with a view of three houses currently. While Highway 107 parallels the river for the next 2.8 miles, the road is often high above the river with steep vegetated banks on one or both sides. The take-out is at Little Lake Glenville near the Thorpe Powerhouse.

Estimated flows (from the tainter gate/cfs chart) during this study (June 29, 2001) and the reconnaissance study (May 8, 2001) are shown below for the West Fork By-Pass Section. An additional 10 to 15 cfs was estimated visually as base flow prior to the releases.

Flows in cfs from:	5/8/01	6/29/01	
	Flow 1	Flow 1	Flow 2
Tainter Gate/cfs Chart	63	160	250
Visual Estimate of Base Flow	12	12	12
Total Estimate of cfs	75	172	262

Access

The put-in area is on private property and currently requires a quarter mile hike to the river. Shoal Creek Road is a small dirt road with parking for 8 to 10 cars near the trailhead. Downstream there are three access areas; one onto private property at the Cullowhee Forest Bridge, one onto probable Highway 107 right-of-way at a small wooden bridge to the Sapphire Development (take-out for Flow 2 on June 29), and the last at either the bridge 50 yards above Little Lake Glenville (take-out for Flow 1 on June 29) or at the head of Little Lake Glenville. The area at the head of Little Lake Glenville is in a dirt pull-off area with a capacity for about six cars. Additional parking might be available across Highway 107 in the area between the Thorpe Powerhouse and the unoccupied employee housing area. The access areas at Cullowhee Forest Bridge and the Sapphire Development Bridge have very limited parking.

Information from Single Flow Surveys and Comparative Surveys (Appendix J)

Participant Information

Six paddlers participated in the May 8, 2001 river test flow of 75 cfs (Appendix G). On June 29, 2001 eight participants paddled Flow 1 (5 of the 6 participants from the May 4 release plus 3 additional paddlers) and six paddled Flow 2 (2 participants opted out of the higher flow). On May 8, 4 paddlers were in kayaks and 2 were in inflatable kayaks. For the June 29 study 7 participants were in kayaks and one was in a sit-on-top kayak during Flow 1 and all 6 paddled kayaks during Flow 2. One participant was an intermediate and the rest were advanced to expert in skill level. All had at least 10 years of paddling experience. One participant had paddled the section between Cullowhee Forest Bridge and Thorpe Powerhouse several times before the study. None of the other participants had paddled any part of the section. The average age was about 36 and the average days paddled per year are estimated at over 100.

Paddling Experience Characteristics (Tables 21 and 22 and Appendix K)

Participant ratings from the Single Flow Survey for paddling experience characteristics under the two different flow conditions are shown in Table 21. There is a definite preference for Flow 2.

Table 21. West Fork By-Pass Section. Mean and Median Ratings of the Two Flows for Paddling Characteristics

5-point scale: -2 = Totally Unacceptable; -1 = Unacceptable; 0 = Neutral; +1 = Acceptable; +2 = Totally Acceptable. Flow values are in cfs.

Characteristic	Flow 1 172 cfs		Flow 2 262 cfs	
	Mean	Median	Mean	Median
Navigability	0.5	1.0	1.8	2.0
Availability of challenging technical boating	0.6	1.0	2.0	2.0
Availability of powerful hydraulics	-0.3	0.0	1.8	2.0
Availability of whitewater “play areas”	0.0	0.0	1.5	1.5
Overall whitewater challenge	0.1	0.0	2.0	2.0
Safety	0.4	0.5	1.3	1.5
Aesthetics	0.8	1.0	1.7	2.0
Length of Run	1.3	1.5	1.8	2.0
Number of Portages	0.0	0.0	1.7	2.0
Overall rating	0.4	0.5	2.0	2.0

Participants were asked in the Comparative Survey to rate the importance of some other factors that can affect participant satisfaction with a whitewater trip. These factors are shown in Table 22 in order of importance to the participants. The top five are “Availability of Challenging Technical Boating”, “Navigability”, “Safety”, “Overall Whitewater Challenge”, and “High Quality Aesthetics”.

Table 22. West Fork By-Pass Section. Mean and Median Ratings of Some Factors that Can Affect Participant Satisfaction with a Whitewater Trip

Importance Scale: 5-Point Scale where 1 = Not at All Important; 2 = Slightly Important; 3 = Moderately Important; 4 = Very Important; 5 = Extremely Important

Characteristic	Importance of Characteristic	
	Mean Score	Median Score
Availability of Challenging Technical Boating	4.7	5.0
Navigability	4.5	5.0
Safety	4.5	5.0
Overall Whitewater Challenge	4.5	4.5
High Quality Aesthetics	3.8	4.0
Availability of Powerful Hydraulics	3.0	3.0
Few Portages	2.7	3.0
Availability of Whitewater "Play Areas"	2.5	3.0
Length of Run	2.5	2.5
Easy Access	2.5	2.5

Suitability for Different Skill Levels (Table 23 and Appendix K)

When asked what skill level a paddler would need to safely paddle the West Fork Section, both flows were rated as suitable for "Advanced" levels primarily (Table 23).

Table 23. West Fork By-Pass Section. Number of Participants Selecting the Skill Level Needed to Safely Paddle the Dillsboro Section at the Two Flows

Skill Level	Flow 1 172 cfs	Flow 2 272 cfs
Intermediate	2	1
Advanced	4	4
Expert	0	0

Whitewater Difficulty Rating (Table 24 and Appendix K)

The majority of participants rated the West Fork By-Pass Section as class IV on the American Whitewater International Scale of River Difficulty at both flow levels (Table 24).

Table 24. West Fork By-Pass Section. Number of Participants Rating the Whitewater Difficulty at the Two Flows

Difficulty Rating	Flow 1 172 cfs	Flow 2 262 cfs
Class III	0	1
Class IV	2	5
Class V	0	0

Estimation of Number of Portages (Appendix K)

There were 17 portages (had to get out of the boat) at Flow 1 (range of 0 to 4 per participant) and 1 portage at Flow 2.

Evaluation of Flow Preferences (Tables 25 and 26 and Appendix K)

The Overall Rating from the Single Flow Survey (Question 5) and the Overall Evaluation from the Comparative Survey (Question 3) show the same trend but with a greater scoring difference between the two flows and a change from a "Neutral" rating at Flow 1 to an "Unacceptable" rating at Flow 2 (Table 25). For "Minimal" flow participants desired "No Change" at Flow 1 and "Lower" at Flow 2. For "Optimal" flow participants wanted "Higher" water at Flow 1 and "No Change" at Flow 2. Participants would "Possibly" to "Probably" paddle Flow 1 and "Definitely Yes" paddle Flow 2 again.

Table 25. West Fork By-Pass Section. Mean and Median Ratings for Overall Experience, Flow Preference, and Whether Participants Would Paddle Flows Again

Overall Rating Scale: -2 = Totally Unacceptable; -1 = Unacceptable; 0 = Neutral; 1 = Acceptable; 2 = Totally Acceptable

Flow Preference Scale: 1 = Much Lower; 2 = Lower; 3 = No change; 4 = Higher; 5 = Much Higher

Paddle Again Scale: 1 = Definitely No; 2 = Possibly; 3 = Probably; 4 = Definitely Yes

Questions	Flow 1 172 cfs		Flow 2 262 cfs	
	Mean	Median	Mean	Median
Single Flow Overall Rating	0.4	0.5	2.0	2.0
Flow Preference – Minimal Acceptable Flow	3.4	3.5	2.2	2.0
Flow Preference – Optimum Flow	4.1	4.0	3.0	3.0
Paddle Again?	2.6	3.0	4.0	4.0
Comparative Overall Rating	-1.0	-1.0	2.0	2.0

Table 26 shows participant responses when asked to specify flows for specific experiences. The "Minimum Acceptable" flow designation is slightly higher than Flow 1 (172 cfs) while all participants selected 262 (250 cfs + 12 cfs) cfs as the "optimal" level. The selection for a "standard trip at medium flows" was in the range of 200-210 cfs.. All of the participants would recommend both the "Standard Trip" and the "High Challenge Trip" to others. On average, the participants thought it was "Very Important" to provide a variety of flows for different types of boating experiences and to provide opportunities for people with different skill levels and craft types.

Table 26. West Fork By-Pass Section. Mean and Median Flows Designated by Participants for Specific Experiences

Specify Flows For:	Mean cfs	Median cfs	Comments
Minimal Acceptable	189	195	Range = 187-212 cfs
Optimum	250	250	All participants noted 262
Standard Trip at Medium Flows	213	200	Range = 212-262
High Challenge Trip at Higher flows	308	300	Range = 262-412
Highest safe flow	375	350	Range = 312-512
Only One Flow	250	250	All participants noted 262

Comparison to Other Rivers (Table 27 and Appendix K)

When asked to rate the West Fork By-Pass Section with regard to boating opportunities, participants generally rated it "Better than Average" to "Excellent" when compared to other rivers locally, regionally, and nationally (Table 27). The West Fork moves from a general rating of "Excellent" in a local context to "Better than Average" in a regional/national context.

Table 27. West Fork By-Pass Section. Comparison to Other Rivers on a Local, Regional, and National Level

Rating Scale: 1 = Worse than Average; 2 = Average; 3 = Better than Average; 4 = Excellent; 5 = Among the Very Best

Compared to Other: Rivers In	Median	Mean	% Rating and (No. Responses): The Tuckasegee River is:				
			Worse than Average	Average	Better than Average	Excellent	Among the Very Best
1 Hour Drive	4.0	3.7	0	0	33 (2)	67 (4)	0
Western NC	3.5	3.3	0	17 (1)	33 (2)	50 (3)	0
Southeast	3.0	3.0	0	17 (1)	67 (4)	17 (1)	0
USA	3.0	2.5	0	20 (1)	60 (3)	20 (1)	0

Written Comments From Single Flow Surveys (Appendix L)

In Question 11, participants where asked to identify particularly challenging rapids or sections and rate the difficulty (using the International Whitewater Scale) at both flow levels. At Flow 1 (172 cfs) the following rapids/sections were named by most participants:

- First Falls (100 yards below put-in) – Class III+ to V- (river left run easier than river right run)
- Second Falls (0.25-mile above Cullowhee Forest Bridge - Class III
- Gorge Section (0.75-mile section below Cullowhee Forest Bridge- Class III-IV

At Flow 2 (262 cfs), First Falls was again identified as particularly challenging (Class IV-V-). A rapid called High Turn Over (Class IV-V) located just below the Cullowhee Forest Bridge was also named by most participants due to the fierce hole that developed there, which allowed a number of participants to cartwheel in the hole before being able to exit.

In Question 13, participants were asked to identify rapids/sections they portaged and rate the difficulty of those portages. A total of 17 portages were made by the group at Flow 1 (172 cfs). One paddler took out after portaging First Falls due to the difficulty of the river for an intermediate paddler. Four of the 17 portages were rated "slightly difficult" and the rest were rated as "easy". Only one portage was recorded during Flow 2 (262 cfs) and it was rated as "easy".

In Question 14, participants were asked if they had any significant problems during the run. At Flow 1 there was a swim below First Falls that led a participant to leave the study indicating a lack of the skills necessary to paddle at this flow level. At Flow 2, a participant got pinned briefly but was able to get himself unpinned and several paddlers were surfed in holes but nothing really out of the ordinary for a river at this difficulty for this skill level paddler.

When asked to provide additional comments, most participants noted the danger presented by the trees ("wood") in the channel at both flow levels. At Flow 1, there were more encounters with trees but the current was not as pushy. Generally paddlers felt that more water would reduce the number of rock scrapes and open up more channels. At Flow 2, additional channels did open up which made portages less likely but there was stronger current pushing toward the two significantly dangerous logs in the river channel. Generally, paddlers said Flow 2 was "awesome", "excellent", "great" and something they would return to paddle again.

Conclusions for West Fork By-Pass Section

The 4.5-mile study section of the 9-mile By-Pass of the West Fork of the Tuckasegee River can be divided into three sub-sections. The first sub-section from the put-in to Cullowhee Forest Bridge is about 1.7 miles long, drops about 240 feet or about 141 feet per mile, and is rated Class III-IV+. The river channel is a combination of bedrock slides/ledges and boulder garden. The second sub-section is about a mile long, drops 120 feet, and is rated Class III-IV. The river channel is bedrock slide/ledge and then enters a narrow bedrock gorge. The third sub-section is about 1.8 miles long, drops about 120 feet or 67 feet per mile, and is rated Class II-III. The river channel is generally a boulder garden. All of the 4.5-mile study section is bordered on both sides by private property. Currently there are three houses and a trailer visible from the river and traffic noise can be heard where Highway 107 parallels the river. Otherwise the river is fairly isolated due to the steep vegetated riverbanks and the height of the road above the river.

There are three significant whitewater features: First Falls and Second Falls, which are in the first sub-section and the Gorge Section that is in the second sub-section. The entire study section was generally rated "Better than Average" to "Excellent" when compared to other rivers locally, regionally, and nationally.

The results of the controlled flow study indicate that the minimum acceptable flow for paddling is around Flow 1 (187 –212 cfs) and the optimum flow is around Flow 2 at 262 cfs.

East Fork By-Pass (Bonas Defeat) Section

General
The entire By-Pass section below the dam at Tennessee (or Tanassee) Lake to the Powerhouse is about 1.5 miles. Due to the lack of definitive information on the feasibility of providing whitewater recreation on this section and the quality of those resources, a phased approach (Appendix G) was used to analyze the possible opportunities. The phases were:

Phase 1: This was an on-land assessment of the By-Pass Section using desktop analysis (length, gradient, hydrology, access, etc) followed by a site visit to inspect the characteristics of the section. The conclusions from this phase indicated that there were potential paddling opportunities for extremely skilled paddlers (teams of experts). Because of the potential hazards in all sections, a visual inspection of flows by paddlers experienced in running Class V water was indicated.

Phase 2: This was a visual flow assessment of three different flows (approximately 170 cfs, 190 cfs, and 325 cfs) utilizing teams of observers with cameras at the most significant rapids. See Appendix G for a report on the visual assessment. The conclusions from this phase indicated that flow of around 325 cfs is needed to open up the majority of the lines in the rapids. Lower flows do not cover up many of the dangerous features of the riverbed, and higher flows would create dangerously large hydraulics. Section 2 (0.5 miles) is generally Class V+. Section 1 (0.5 miles) is primarily Class III+ after the Class 5 Spillway slide. Section 2 (0.5 miles) is generally Class V+ and Section 3 (0.5 miles) is generally Class III+. As anticipated, Bonas Defeat Gorge is a dangerous and challenging whitewater run. However, several members of the study team wanted the opportunity to paddle the gorge and thought other high caliber boaters would also want such an opportunity.

This section should only be paddled by small teams of experts using all precautions. The sections are relatively short but stopping before the most difficult areas might be extremely difficult for all but the most experienced paddlers.

Due to the conclusive results of this study, the pressing schedule of the relicensing process, and the logistical requirements of a flow study in Bonas Defeat Gorge, a paddling flow study with boats will not be done. Other ways for paddlers who wish to experience this section will be explored.

Literature Cited
Benner, B. and Benner, D. 2002. A Canoeing & Kaying Guide to the Carolinas. Menasha Ridge Press.

Whittaker, et. al. 1993. Instream Flows for Recreation: A Handbook on Concepts and Research Methods. National Park Service Publication, Alaska Region.

Appendix A
Whittier and Dillsboro Sections
(1) Single Flow Survey
(2) Comparative Flow Survey
(3) Pre-Run Form

(Surveys for Whittier and Dillsboro are the same except for number of flows)
(Flow designations are in Targeted cfs rather than Measured cfs)

SINGLE FLOW EVALUATION FORM

Dillsboro Hydroelectric Project, FERC No. 2602

Whitewater Controlled Flow Study

Date of run: _____

Your name: _____

Please indicate which flow release this survey corresponds to (check one):

Dillsboro Reach	Flow 1	393 cfs	Monday, June 2nd, 9am	
	Flow 2	613 cfs	Monday, June 2nd, 2pm	
	Flow 3	338 cfs	Tuesday, June 3rd, 9am	
	Flow 4	808 cfs	Tuesday, June 3rd, 2pm	

Whittier Reach	Flow 1	713 cfs	Monday, June 2nd, 6pm	
	Flow 2	908 cfs	Tuesday, June 3rd, 6pm	

CRAFT USED (Circle): Kayak (play, river, creek) OC1 OC2
C1 C2 Raft Ducky

SKILL LEVEL (Circle): Beginner Novice Intermediate Advanced
Expert

1) Please estimate the time you put-in and completed this run.

Put-in time: _____

Take-out time: _____

2) Please evaluate the access.

Access at the put-in	easy	moderate	difficult
Access at the take-out	easy	moderate	difficult

3) Please evaluate this flow on this run for your craft and skill level for each of the following characteristics. (Circle one number for each item).

						If unacceptable was it	
	Totally unacceptable	Unacceptable	Neutral	Acceptable	Totally acceptable	too low	too high
Navigability	-2	-1	0	1	2		
Availability of challenging technical boating	-2	-1	0	1	2		
Availability of powerful hydraulics	-2	-1	0	1	2		
Availability of whitewater "play areas"	-2	-1	0	1	2		
Overall whitewater challenge	-2	-1	0	1	2		
Safety	-2	-1	0	1	2		
Aesthetics	-2	-1	0	1	2		
Length of run	-2	-1	0	1	2		
Number of portages	-2	-1	0	1	2		
Overall Rating	-2	-1	0	1	2		

4) If this test flow were provided periodically, are you likely to return for future boating? (Circle one).

a. Definitely no
b. Possibly
c. Probably
d. Definitely yes

5) At this test flow, how would you rate the whitewater difficulty of the river at this flow? (Use the International Whitewater Scale that ranges from Class I to Class VI).

Difficulty: I II III IV V VI

6) At this test flow, what skill level would a paddler need to safely paddle this section?

Beginner Novice Intermediate Advanced Expert

7) Relative to this flow, would you consider the minimum acceptable flow (defined as the lowest flow you would return to boat) to be higher, lower, or about the same as this flow? (Circle one).

1	2	3	4	5
much lower	**lower**	**no change**	**higher**	**much higher**

8) Relative to this flow, would you consider the optimum flow (defined as the ideal flow you would return to boat) to be higher, lower, or about the same as this flow? (Circle one).

1	2	3	4	5
much lower	**lower**	**no change**	**higher**	**much higher**

9) Using place names, please identify particularly challenging rapids or sections and rate their difficulty at this flow (using the International Whitewater Scale).

Location	Rating	Location	Rating
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	

10) Please estimate the number of **hits**, **stops**, **boat drags**, and **portages** you had on this run.

I **hit** rocks or other obstacles (but did not stop) about ____ times.

Number of hits generally acceptable to you ____.

I was **stopped** after hitting rocks or other obstacles about _____ times (but did not have to get out of my boat to continue downstream).

I had to get out to **drag or pull my boat** off rocks or other obstacles about _____ times.

I had to **portage** around unrunnable rapids or sections about _____ times.

11) Using place names on the map provided, please identify rapids or sections you chose to portage and rate the difficulty of those portages (using your type of craft at this flow level).

Location / reason	Easy	Slightly difficult	Moderately difficult	Extremely difficult
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4

12) Did you have any significant problems during your run (e.g., became pinned, wrapped a boat, had to swim, etc.)? Please provide a brief description and location of any incident.

Incident	Location
_____	_____
_____	_____
_____	_____

13) Provide any additional comments about this test flow below. If necessary, please use place names to identify specific locations.

COMPARATIVE FLOW EVALUATION FORM

Dillsboro Hydroelectric Project, FERC No. 2602

Whitewater Controlled Flow Study at Dillsboro

DATE:_____2001

CRAFT USED (Circle): Kayak (play, river, creek) OC1 OC2
C1 C2 Raft Ducky

SKILL LEVEL (Circle): Beginner Novice Intermediate Advanced Expert

Did you participate in all four test releases? Yes No

Please answer each of the following questions based on your experience or reaction to the river at each of the flows tested. If you have no opinion about a particular item, leave it blank. Please do not discuss these questions or your response with other participants.

1. How many times have you boated the Dillsboro Section of the Tuckasegee River before this study? (Circle one)

0 times 1-10 times 11-20 times 21-30 times >30 times

2. A number of factors can affect your satisfaction with a whitewater trip. How important are each of these factors? (Circle one number for each factor):

	Not Important		Somewhat Important		Very Important
Number of Rapids	1	2	3	4	5
Size/Difficulty of Rapids	1	2	3	4	5
Driving Distance to River	1	2	3	4	5
Accessibility	1	2	3	4	5
Shuttle Availability	1	2	3	4	5
Crowding	1	2	3	4	5
Weather	1	2	3	4	5
Water Temperature	1	2	3	4	5
Attractive Scenery	1	2	3	4	5
Water Quality	1	2	3	4	5
Thrilling Experience	1	2	3	4	5
Safe Trip	1	2	3	4	5
Good Guide	1	2	3	4	5

3. Please evaluate the following flows for your craft and skill level. In making your evaluations, please consider all the flow-dependent characteristics that contribute to a high quality trip (e.g., navigability, whitewater challenge, safety, availability of surfing or other play areas, aesthetics, and length of run). (If you do not feel comfortable evaluating a flow you have not seen, don't circle a number for that flow).

Release Number/Date	Flow (CFS)	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
	200	-2	-1	0	1	2
	250	-2	-1	0	1	2
Flow 3, July 3 Tuesday, AM	350	-2	-1	0	1	2
Flow 1: July 2 Monday AM	400	-2	-1	0	1	2
	450	-2	-1	0	1	2
	500	-2	-1	0	1	2
	550	-2	-1	0	1	2
Flow 2: July 2 Monday PM	600	-2	-1	0	1	2
	650	-2	-1	0	1	2
	700	-2	-1	0	1	2
	750	-2	-1	0	1	2
Flow 4: July 3 Tuesday PM	800	-2	-1	0	1	2
	850	-2	-1	0	1	2
	900	-2	-1	0	1	2
	> 900 _____specify	-2	-1	0	1	2

4. Based on the type of craft you used in the study, provide an overall evaluation for each of the flows. Please give consideration to all the conditions (see question #2) that make up a high quality trip (Circle one rating number for each flow).

	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
350 cfs Tues AM	-2	-1	0	1	2
400 cfs Mon AM	-2	-1	0	1	2
600 cfs Mon PM	-2	-1	0	1	2
800 cfs Tues PM	-2	-1	0	1	2

If different than a flow you tested, estimate optimal flow for your type of craft.
____ cfs.

5. Based on your boating trips on the Dillsboro section of the Tuckasegee River, please specify the flows that provide the following types of experiences. (Note: you can specify flows that you have not seen, but which you think would provide the type of experience in question).

Flow (cfs)

From a recreational perspective what is the **minimum acceptable flow** for this run? Note that the minimum acceptable differs from the minimum flow necessary to navigate. _____

From your perspective what is the optimum flow for this run? _____

Many people are interested in a "standard" whitewater trip at medium flows. Think of this **"standard trip"** in your craft.
What is the best or **optimal flow** for this type of trip? _____

Some people are interested in taking trips at higher flows for increased whitewater challenge. Think of this **"high challenge trip"** in your craft.
What is the best or optimal flow for this type of trip? _____

What is the highest safe flow for your craft and skill level? _____

If Duke Power released only one flow for boating, what flow would you prefer? _____

6. How important is it to release a variety of flow levels on the Dillsboro section of the Tuckaseegee River? Please rate the importance of providing several different flows for the two reasons below, or check the box.

Providing several different flows is necessary to…	Not at all important	Slightly important	Moderately important	Very important	Extremely important
…provide different types of boating experiences.	1	2	3	4	5
… provide opportunities for people with different skill levels and craft types.	1	2	3	4	5

Or… ❑ it isn't important to provide a variety of flow levels.

7. At the optimum flows for standard and high challenge trips would you recommend this section to others?

Standard trip	yes	no
High challenge Trip	yes	no

8. Compared to other rivers, how would you rate boating opportunities on the Dillsboro section of the Tuckasegee River. (Circle one number for each; if you are unsure about a comparison, leave that item blank).

Compared to…	The Tuckasegee River is…				
	Worse than average	Average	Better than average	Excellent	Among the very best
…other rivers within a 1 hr Drive	1	2	3	4	5
…other rivers in Western N. Carolina	1	2	3	4	5
…other rivers in the Southeast	1	2	3	4	5
…other rivers in the country	1	2	3	4	5

9. Based on your experience at other regional rivers please use the following scoring system to compare the boating opportunities at these regional rivers to those at the Dillsboro section of the Tuckaseegee. Please assume optimal flow conditions for boating.

Score using the following system:

1 = More desirable than Dillsboro Section Tuckasegee
2 = Similar to the Dillsboro Section Tuckasegee
3 = Less Desirable than Dillsboro Section Tuckasegee
N = No experience boating the river

	Nantahala	Little Tennessee	Chattooga Sec II	Chattooga Sec III	Chattooga Sec IV	French Broad Hot Springs	Pigeon	Middle Ocoee	Upper Ocoee	Hiwassee	*List other rivers- include other parts of Tuckasegee*				
Suitability For Novice Boater															
Suitability For Intermediate Boater															
Suitability For Advanced Boater															
Size & Difficulty Of Rapids															
Play Boating															
Rafting															
River Running															
Eddy Hopping															
Technical Maneuvering															
River Gradient															
Driving Distance To river															
Shuttles															
Access to River															
Scenery															
Water Quality															
Overall															

10. Any other comparative evaluations you would like to make?

THANK YOU for your participation

PRE-RUN INFORMATION FORM

Dillsboro Hydroelectric Project, FERC No. 2602

Whitewater Controlled Flow Study

Date: _____ / _____ / 2001

Your name: _____

1. What type of craft do you generally use for whitewater paddling? *(Circle one)*

   1. Hard shell kayak
   2. Inflatable kayak
   3. Closed deck canoe
   4. Open canoe with floatation
   5. Cataraft (please indicate length: _____)
   6. Self-bailing raft (please indicate length: _____)
   7. Wrap-floor raft (please indicate length: _____)
   8. Other: (please explain) _____

2. How many years have you been using this type of craft? _____ years

3. How would you rate your skill level with this type of craft?

   1. Novice (comfortable running Class II whitewater)
   2. Intermediate (comfortable running Class III whitewater)
   3. Advanced (comfortable running Class IV-V whitewater)
   4. Expert (comfortable running Class V whitewater)

4. In general, how many days per year do you spend whitewater boating? _____

5. What is your age? _____ years

6. Are you ❑ male or ❑ female?

Please respond to each of the following statements about your river-running preferences.

	Strongly disagree	Moderately disagree	Slightly disagree	No Opinion	Slightly agree	Moderately agree	Strongly agree
I prefer running rivers with rapids Class II and III.	1	2	3	4	5	6	7
I prefer running rivers with difficult rapids, Class IV and V).	1	2	3	4	5	6	7
Running challenging whitewater is the most important part of my boating trips.	1	2	3	4	5	6	7
I often boat short river segments (under 4 miles) to take advantage of whitewater play areas.	1	2	3	4	5	6	7
I often boat river segments to experience a unique and interesting place.	1	2	3	4	5	6	7
I often boat short river segments to run challenging rapids.	1	2	3	4	5	6	7
I select boating opportunities based on length and experience regardless of difficulty	1	2	3	4	5	6	7
I am willing to tolerate difficult put-ins and portages in order to run interesting reaches of whitewater.	1	2	3	4	5	6	7
I prefer boating rivers that feature large waves and powerful hydraulics.	1	2	3	4	5	6	7

I prefer boating steep, technical rivers.	1	2	3	4	5	6	7
I enjoy boating both difficult and easy rivers.	1	2	3	4	5	6	7

Appendix C
Dillsboro Flow Study
Written Comments From
(1) Single Flow Surveys
(2) Comparative Flow Surveys

Tuckasegee River Paddling Flow Study
Dillsboro Section – July 2-3, 2001
Written Comments – Single Flow Evaluations
(Questions correspond to single flow evaluation form)

Question 9: Using place names, please identify particularly challenging rapids or sections and rate their difficulty at this flow (using the International Whitewater Scale).

Flow 1: Monday AM – 554 cfs

Alexander – None were particularly challenging.
Beazley – At all the sites the biggest challenge was finding enough water.
Blackburn, M. – 1st Hole (I+), 2nd Hole (I+), Moonshoot (I+), Double Drop (II)
Blackburn, U. – 1st Hole (I+), 2nd Hole (I+), Moonshoot (II), Double Drop (II), Slingshot (I+)
Borawa – Double Drop (III), Slingshot (II), Surprise Hole (II)
Brueckner – None
Cable – NA
Colburn – NA
Everly -- NA
Gilbert -- None
Gossett – 2nd Hole (III)
Guthrie – NA
Heynie – 1st Hole (II), 2nd Hole (II), Tonya's Rock, Surfing Rapid, Shark's Tooth
Hughes – Railroad (I), 2nd Hole (II), Moonshot (I), Double Drop (II), Slingshot (II), Surfing Rapid (II), Shark's Tooth (I)
Jackson – 2nd Hole (II), Double Drop (II), 1st Hole (II)
Johns – 1st Rapid (I+), 2nd Rapid (I), 1st Hole (II-), Shoals (I), 2nd Hole (II), Tonya's Rock (II), Double Drop (II), Surfing (II), Shark's Tooth (II)
Johnson -- NA
Kane -- 2nd Hole (III)
Kelly – All rock gardens (I)
Koval – 1st Hole (I) near top, 2nd Hole (I) quarter of way down, Double Drop (I) two thirds of way down, Tonya's Rock (I) half way down.
Leatherman -- NA
Lineberger – All were fun but not hard in raft.
Lucic – 1st Hole (II+) below railroad bridge, 2nd Hole (II+) Barry's house, Double Drop (II+) more than half way.
Lynch, S. – No real challenge.
Lynch, W. – None
McPherson -- NA
Mead, J. – None are especially challenging.
Mead, R. – Shoal below 1st Hole where the camera was set up was very shallow and scrapey—kind of a pain. Double drop was fun.
Miller -- NA
Olson – 1st Hole (II), Moon Shoot (II), Double Drop (II)
O'Neal – Railroad (II), 2nd Hole (II+), Tonya's Rock (II), Double Drop (II)
Patterson – 2nd Hole (II), Double Drop (II)
Pennington -- None
Pope – 2nd Hole (I) third of way down, Double Drop (I) two thirds way down, Slingshot (I) three quarters way down, Tonya's Rock (I) half way down.
Robinson – NA
Rosar – Railroad Bridge & 1st Hole (II), 2nd Hole (II)
Smith – None found.
Smith-Lovin – Named rapids were generally Class II.
Walls – No difficult section, but an overall pleasurable experience!
Willenborg, D. – None at this level.
Willenborg, R. – NA

Williams -- NA
Winholtz – 1st Hole (II), 2nd Hole (II)
Wishon – NA

Flow 2: Monday PM – 821 cfs

Alexander – None particularly challenging.
Beazley – Railroad (II), Moon Shoot (II), Surfing Rapid (II)
Blackburn, M, -- Railroad (I+), 1st Hole (II), 2nd Hole (II), Moon Shoot (I+), Double Drop (II), Slingshot (I+).
Blackburn, U. – Railroad (I), 1st Hole (II), 2nd Hole (II), Moonshot (I+), Double Drop (II), Slingshot (I+), Surprise (I+), Surfing (I+).
Borawa – 1st Hole (II), 2nd Hole (III), Moonshot (II), Slingshot (II), Double Drop (III), Surprise Hole (III), Surfing Rapid (II), Shark's Tooth (II).
Brueckner – 1st Hole (II+), Double Drop (II+)
Cable -- NA
Colburn -- NA
Everly – NA
Gilbert -- None
Gossett – Surfing Rapid (II)
Guthrie – Double Drop (II+)
Heynie – 1st Hole (II), 2nd Hole (II)
Hughes – Railroad (I), 2nd Hole (II), Moonshot (I), Double Drop (II), Slingshot (I), Surfing Rapid (I), Shark's Tooth (I).
Jackson – 1st Hole (III), 2nd Hole (III), Double Drop.
Johns -- NA
Johnson – Not qualified to comment.
Kane – Surfing Rapid (II)
Kelly – Railroad (II+), Barry's (II+), Surfing (II+) aka Ghetto
Koval – 1st Hole (1+), 2nd Hole (I+), Double Drop (I+), Tonya's Rock (I+)
Leatherman -- NA
Lineberger – Double Drop (II)
Lucic – 1st Hole (II+) below railroad bridge, Double Drop (II+)
Lynch, S. – They were all fun!
Lynch, W. -- NA
McPherson – NA
Mead, J. – 2nd Drop surfing wave at bottom, surfed morning flow, couldn't surf this afternoon, Double Drop, waves more fun at this flow, Surprise Hole? Above Surfing Rapid, fun surf at this flow.
Mead, R. – Shoal below 1st Hole was a lot less scrapey that the 1st run today—much better. 1st Hole and 2nd Hole were little easier/not quite as much fun as at lower flow. The big surfing wave below 2nd Hole was smaller and not as good to surf as at lower flow. Double Drop had bigger waves and was more fun than at lower flow. Wave above surfing rapid was good at this level.
Miller – 2nd Hole (II+) below railroad.
Olson – 1st Hole (II), Moonshot (II), Double Drop (II)
O'Neal -- NA
Patterson – 2nd Hole (II), Double Drop (II)
Pennington – Double Drop (II+), Railroad Bridge (II), 2nd Hole (II+), Shark's Tooth (II)
Pope – 1st Hole (I+) top, 2nd Hole (I+) third way down, Double Drop (I+) half way down, Tonya's Rock (I+).
Robinson – NA
Rosar – Shark's Tooth (II), Railroad Bridge (II+)
Smith – Named rapids all were an enjoyable Class II.
Smith-Lovine – 2nd Hole (II+) good waves, Surfing (II) fun surfing.
Walls – Good trip with no hard/difficult sections. Good novice run.
Willenborg, D. – Double Drop (II), Surfing Rapid (II)

Willenborg, R. – Railroad (II), 2nd Hole (II), Double Drop (II)
Williams – NA
Winholtz – 1st Hole (II), 2nd Hole (II)
Wishon – NA

Flow 3: Tuesday AM – 485 cfs

Alexander: None particularly challenging.
Beazley – The challenging thing was avoiding rocks in all the rapids.
Blackburn, M. – Railroad (I), 1st Hole (I), 2nd Hole (I+), Moonshot (I), Double Drop (I+), Slingshot (I).
Blackburn, U. – Railroad (I), 1st and 2nd Hole (I+), Moonshot and Double Drop (I+), Slingshot and Surprise (I), Surfing (I).
Borawa – 1st Hole (I), 2nd Hole (I), Moonshot (II), Double Drop (II), Slingshot (I), Surprise Hole (II), Surfing Rapid (II), Shark's Tooth (II).
Brueckner – None
Colburn – NA
Everly -- NA
Faulkner -- NA
Gilbert – None
Gossett -- None
Guthrie – NA
Heynie -- NA
Hughes – Railroad (I), 2nd Hole (II), Moonshot (I), Double Drop (II), Slingshot (I), Surfing Rapid (I), Shark's Tooth (I).
Jackson – 1st Hole (II), 2nd Hole (II), Slingshot (II), Surfing (II)
Johns – NA
Johnson – Shark's Tooth (I)
Kane -- None
Kelly – NA
Koval – NA
Leatherman – NA
Lineberger – Double Drop (II)
Lucic – NA
Lynch, S. – NA
Lynch, W. – NA
McPherson – NA
Mead, J. – NA
Mead, R. – Shoal below 1st Hole is scrapey. Surfing wave below 2nd Hole is smaller/keeps you less than yesterday am. Smaller waves on Double Drop, but still fun.
Miller -- NA
Olson – None
O'Neal -- NA
Patterson – 2nd Hole, Double Drop
Pope -- NA
Robinson – NA
Rosar – Slingshot (II), Double Drop (I), Shark's Tooth (I), 2nd Hole (II)
Smith – All named rapids had narrowed routes at this flow, but were still Class II.
Smith-Lovin – NA
Walls – 2nd Hole (II), Double Drop (II).
Willenborg, D. – 2nd Hole (II), Double Drop (II)
Willenborg, R. – Railroad (II), Double Drop (II), 2nd Hole (II).
Winholtz – NA
Wishon -- NA

Flow 4: Tuesday PM – 1013 cfs

Alexander – None

Beazley – Railroad (II), Moonshot (II+), Double Drop (II+), Shark's Tooth (II).
Blackburn, M. – Railroad (I), 1st Hole (I+), 2nd Hole (II), Moonshot (I), Double Drop (II), Slingshot (I+), Shark's Tooth (I+).
Blackburn, U. – Railroad (I), 1st Hole (I), 2nd Hole (I+), Moonshot (II), Slingshot (I), Double Drop (II), Surprise (I), Surfing and Shark's Tooth (I+).
Borawa – 1st Hole (I), 2nd Hole (II), Moonshot (II), Double Drop (II), Slingshot (I), Surprise Hole (II), Surfing Rapid (II), Shark's Tooth (I)/
Brueckner – 1st Hole (II), 2nd Hole (II), Double Drop (II).
Colburn – NA
Everly – NA
Faulkner – Double Drop (II), Slingshot (II), rest seemed to be Class I.
Gilbert -- None
Gossett – Surprise (III), Surfing (II)
Guthrie – NA
Heynie – NA
Hughes – Railroad (I), 2nd Hole (II), Moonshot (I), Double Drop (II), Slingshot (I), Surprise Hole (I), Surfing Rapid (I), Shark's Tooth (I).
Jackson – 1st Hole (II), 2nd Hole (II)
Johns – NA
Johnson – NA
Kane -- NA
Kelly – NA
Koval – Tonya's Rock (I+) half way down, 2nd Hole (II) two thirds way down, Double Drop (I+) three quarters way down.
Leatherman – NA
Lineberger -- None
Lucic – 1st Hole (II+) below railroad, 2nd Hole (II+) Barry's house.
Lynch, S. – NA
Lynch, W. – NA
McPherson – 1st Hole (I), 2nd Hole (II), Moonshot (II), Double Drop (I)
Mead, J. – NA
Mead, R. – Good surfing at Surprise Hole. Bigger hole at 2nd drop, but can still be avoided. Double Drop still fun.
Miller -- NA
Olson – None
O'Neal – NA
Patterson – 2nd Hole, Double Drop
Pennington – Railroad (I+), 2nd Hole (II), Moonshot (II), Shark's Tooth (II).
Pope – Tonya's Rock (I+), halfway down. 2nd Hole (II) two thirds down, Double Drop (I+) three quarters down.
Robinson -- NA
Rosar – All named drops except Shark's Tooth (II+).
Smith – All named rapids washed out and became shorter and easier.
Smith-Lovin -- NA
Walls -- NA
Willenborg, D. – Surfing Rapid (II)
Willenborg, R. – Railroad (II), 2nd Drop (II), Tonya's Rock (II), Double Drop (II), Shark's Tooth (II)
Williams -- NA
Winholtz – NA
Wishon – NA

Question 11: Using place names on the map provided, please identify rapids or sections you chose to portage and rate the difficulty of those portages (using your type of craft at this flow level).

Flow 1: Monday AM – 554 cfs

Alexander – None

Beazley – NA
Blackburn, M. – NA
Blackburn, U. – NA
Borawa – None
Brueckner – NA
Cable -- NA
Colburn – NA
Everly -- NA
Gilbert – None
Gossett -- None
Guthrie -- NA
Heyner – None
Hughes – None
Jackson – 1st Hole (2), 2nd Hole (3), Double Drop (2), Surfing Rapid (2)
Johns – NA
Johnson -- NA
Kane – None
Kelly -- NA
Koval -- NA
Leatherman – NA
Lineberger – None
Lucic – NA
Lynch, S. -- None
Lynch, W. – None
McPherson -- NA
Mead, J. – None
Mead, R. -- None
Miller – NA
Olson – None
O'Neal -- NA
Patterson – NA
Pennington -- None
Pope -- None
Robinson -- NA
Rosar – NA
Smith – No portages.
Smith-Lovin – NA
Walls -- NA
Willenborg, D. -- NA
Willenborg, R. – NA
Williams -- NA
Winholtz -- NA
Wishon – NA

Flow 2: Monday PM -821
Alexander – None
Beazley – NA
Blackburn, M. -- NA
Blackburn, U. -- NA
Borawa -- None
Brueckner -- None
Cable -- NA
Colburn -- NA
Everly -- NA
Gilbert – None
Gossett – None

Guthrie -- NA
Heyne -- NA
Hughes -- NA
Jackson – 1st Hole (2), 2nd Hole (2), Double Drop (2), Surfing (2)
Johns -- NA
Johnson – Double Drop (3).
Kane -- None
Kelly -- NA
Koval – NA
Leatherman – NA
Lineberger – None
Lucic -- NA
Lynch, S. – None.
Lynch, W. -- NA
McPherson – NA
Mead, J. -- None
Mead, R. – None
Miller -- NA
Olson – None
O'Neal -- NA
Patterson – 2nd Hole (2), Double Drop (2)
Pennington – None
Pope – NA
Robinson – NA
Rosar -- NA
Smith -- None
Smith-Lovin – None
Walls -- NA
Willenborg, D. – NA
Willenborg, R. -- NA
Williams – No problems.
Winholtz – NA
Wishon – NA

Flow 3: Tuesday AM – 485 cfs
Alexander – NA
Beazley -- NA
Blackburn, M. – NA
Blackburn, U. – NA
Borawa – None
Brueckner – None
Colburn – NA
Everly -- NA
Faulkner -- NA
Gilbert – None
Gossett – None
Guthrie – NA
Heyne -- NA
Hughes -- NA
Jackson -- NA
Johns – NA
Johnson – 1st Hole (2), 2nd Hole (2), Moonshot (1), Double Drop (2), Slingshot (1), Surprise (2)
Kane -- None
Kelly – NA
Koval -- NA
Leatherman – NA

Lineberger -- NA
Lucic – NA
Lynch, S. – None
Lynch, W. – NA
McPherson – NA
Mead, J. – None
Mead, R. – None
Miller – NA
Olson – None
O'Neal -- NA
Patterson – No
Pope -- NA
Robinson – NA
Rosar -- NA
Smith – None
Smith-Lovin – NA
Walls – NA
Willenborg, D. – NA
Willenborg, R. – NA
Winholtz – NA
Wishon – NA

Flow 4: Tuesday PM – 1013 cfs

Alexander – None
Beazley – NA
Blackburn, M. – NA
Blackburn, U. – NA
Borawa -- None
Brueckner -- None
Colburn – NA
Everly – NA
Faulkner – NA
Gilbert – None
Gossett – None
Guthrie – NA
Heyne – NA
Hughes – NA
Jackson – NA
Johns – NA
Johnson -- NA
Kane -- None
Kelly -- NA
Koval -- NA
Leatherman -- NA
Lineberger -- NA
Lucic – NA
Lynch, S. – NA
Lynch, W. – NA
McPherson – NA
Mead, J. -- None
Mead, R. -- None
Miller – NA
Olson -- None
O'Neal – None
Patterson -- None
Pennington – None

Pope -- None
Robinson – NA
Rosar -- NA
Smith -- None
Smith-Lovin – None
Walls -- NA
Willenborg, D. – NA
Willenborg, R. – NA
Williams – NA
Winholtz – NA
Wishon -- NA

Question 12: Did you have any significant problems during your run (e.g., become pinned, wrapped a boat, had to swim, etc.)? Please provide a brief description and location of any incident.

Flow 1: Monday AM – 554 cfs

Alexander – No
Beazley – NA
Blackburn, M. – No
Blackburn, U. – NA
Borawa – No
Brueckner – NA
Cable -- No
Colburn – NA
Everly -- NA
Gilbert – None
Gossett – None
Guthrie -- NA
Heynie – None
Hughes – Big sticks! Moonshot—stuck on a rock. Shark's Tooth—stuck on rock.
Jackson – None
Johns – NA
Johnson -- No
Kane – None
Kelly -- NA
Koval -- NA
Leatherman – No significant problems.
Lineberger -- None
Lucic -- NA
Lynch, S. – No problems.
Lynch, W. -- No
McPherson – NA
Mead, J. – None
Mead, R. -- None
Miller -- No
Olson – None
O'Neal -- No
Patterson – NA
Pennington -- No
Pope -- NA
Robinson – NA
Rosar -- No
Smith -- None
Smith-Lovin – No
Walls – Swam—talking too much.
Willenborg, D. – None
Willenborg, R. -- NA

Williams – No
Winholtz -- NA
Wishon – None

Flow 2: Monday PM – 821 cfs
Alexander – NA
Beazley – No problems.
Blackburn, M. – No
Blackburn, U. -- No
Borawa – No
Brueckner – Pinned on rock below Shark's Tooth
Cable -- No
Colburn -- NA
Everly -- NA
Gilbert -- No
Gossett – None
Guthrie -- NA
Heyne -- NA
Hughes – Hung on rock at Moonshot.
Jackson -- None
Johns – Rescued a boat not in our group.
Johnson -- No
Kane – None
Kelly -- NA
Koval – NA
Leatherman – No problems.
Lineberger – NA
Lucic – NA
Lynch, S. – No problems!
Lynch, W. – None
McPherson -- NA
Mead, J. – None
Mead, R. -- None
Miller – NA
Olson -- None
O'Neal – NA
Patterson -- NA
Pennington – None
Pope -- NA
Robinson -- NA
Rosar – NA
Smith -- None
Smith-Lovin – None
Walls – NA
Willenborg, D. – None
Willenborg, R. – NA
Williams -- Nope
Winholtz – NA
Wishon – NA

Flow 3: Tuesday AM – 485 cfs
Alexander – NA
Beazley -- No
Blackburn, M. – No
Blackburn, U. – NA
Borawa – NA

Brueckner – None
Colburn – NA
Everly – Washed sideways on rock and turned over at second drop.
Faulkner -- NA
Gilbert – No
Gossett -- None
Guthrie -- NA
Heyne – NA
Hughes – 4 hard sticks
Jackson -- None
Johns – NA
Johnson -- NA
Kane – None
Kelly – NA
Koval – NA
Leatherman – No significant problems.
Lineberger -- NA
Lucic – NA
Lynch, S. -- NA
Lynch, W. – NA
McPherson – NA
Mead, J. – None
Mead, R. – None
Miller – NA
Olson – None
O'Neal -- NA
Patterson – No
Pope – None
Robinson – NA
Rosar – NA
Smith – NA
Smith-Lovin – NA
Walls – NA
Willenborg, D. – None
Willenborg, R. – NA
Winholtz – NA
Wishon – NA

Flow 4: Tuesday PM – 1013 cfs

Alexander – NA
Beazley – NA
Blackburn, M. – No
Blackburn, U. – NA
Borawa – No
Brueckner – None
Colburn – NA
Everly – NA
Faulkner -- Broadsided a rock, fell out. Partner error. Near take-out.
Gilbert – No
Gossett -- None
Guthrie – NA
Heyne – NA
Hughes – 2 rock snags—huge rocks just under surface that spun ducky at Railroad Rapid.
Jackson – Random boater flipped and got hurt. We helped. 1st Hole.
Johns – NA
Johnson -- No

Kane -- None
Kelly – NA
Koval – NA
Leatherman – No significant problems.
Lineberger – None
Lucic – NA
Lynch, S. -- None
Lynch, W. – NA
McPherson – NA
Mead, J. – None
Mead, R. – None
Miller -- NA
Olson -- None
O'Neal -- NA
Patterson -- NA
Pennington – None
Pope – None
Robinson -- NA
Rosar -- NA
Smith – None
Smith-Lovin -- None
Walls – NA
Willenborg, D. – None
Willenborg, R. – NA
Williams -- None
Winholtz – NA
Wishon -- NA

Question 13: Provide any additional comments about this test flow below. If necessary, please use place names to identify specific locations.

Flow 1: Monday AM – 554 cfs

Alexander – This was an easy run for young couples with small (5-8) kids and older folks in their 50s who do not exercise regularly. I think the positive camaraderie among these participants--and any other family or social group--would override any concerns related to flows at this level and somewhat lower flows. That is, "having a good time" is not necessarily related to water quality.

Beazley – This flow was bare minimum—in fact it was too low, not even minimum flow! I would only boat this flow if every other river was completely dry (and there was a gun to my head).

Blackburn, M. -- NA
Blackburn, U. -- NA
Borawa – Generally the flow was not difficult. Not knowing the river caused a lot of the hits.

Brueckner – There is no public access at the take-out. Access that is owned and maintained by a government entity should be provided in the event that the outfitter is unable to provide access in the future.

Cable -- NA
Colburn – Very low water for this river. It is runnable but any lower would be miserable.
Everly -- NA
Gilbert – Most "rapids" would have been more enjoyable, even easier, with a higher flow.
Gossett -- None
Guthrie – Perfect for sightseeing.

Heynie – I could always find a channel. The channels required quick maneuvering but it was possible. This level made the trip the most enjoyable I've ever done because I didn't have to work constantly to steer around and look for rocks.

Hughes – For beginners, this level may be too low because it was very frustrating to hit and bump off rocks.

Jackson – Good water for beginners to intermediates. What will it be like if the natural flow is lower?
Johns -- NA
Johnson -- NA
Kane -- None
Kelly – Not near enough water!
Koval -- NA
Leatherman – I have never been down this section of river 'til today. At this level there were about 5 times (give or take) that we were hung on rocks—I believe this had more to do with a novice/beginner "team" lacking the ability to "read the river" and navigate rocks and/or ledges. For a family (of novices) it might be a little discouraging to get stuck or "hung" but still safe and fun. A guide would have been helpful.
Lineberger – Due to river bed width, this flow seemed most suitable for kayaks and canoes, although the raft was also fun. Would have been a good flow to paddle in a canoe, stopping to fish often. All the hang ups (where we had to get out) were in the first half.
Lucic – 1st run—good minimum flow.
Lynch, S. – This was fun, but I would not want to paddle it at a lower level.
Lynch, W. – Fun, good group.
McPherson -- NA
Mead, J. – Hard to find scrape free route in shoal area downstream of 1st Hole, and also in ledges between put-in and railroad bridge.
Mead, R. -- NA
Miller – Little bit scrapey in places, but sometimes that could be attributed to boater's decisions.
Olson -- NA
O'Neal – Most rapids low resulting in scraping.
Patterson -- NA
Pennington – Good training river or trip with children at this level.
Pope -- NA
Robinson – NA
Rosar – Too many hits for me to willingly paddle a C-1 made of Kevlar (instead of plastic).
Smith – No problem for unguided "tourist" type floats.
Smith-Lovin – Some places had rocks in eddys. Some shallow places where it was hard to paddle (paddle hit rocks). Major rapids had enough water to be fun. In-between areas generally very navigable, if you were paying attention.
Walls – Great trip for beginning boaters.
Willenborg, D. – Good level for beginners with some skills.
Willenborg, R. – NA
Williams – Great teaching level.
Winholtz – Very nice not to drag much, but still able to find channels.
Wishon – NA

Flow 2: Monday PM – 821 cfs

Alexander – I got stuck or hung up more often on this run or at least certainly had to work harder to get off rocks than in the first run. Presumably I did this because this run was easier because of the higher flows, which, in my case, meant I paid less attention to paddling and much more to enjoying the scenery and talking with fellow paddlers.
Beazley – Good, fun level for beginners, intermediates—something for everyone.
Blackburn, M. – Good play level.
Blackburn – Good run. Plenty of weather.
Borawa – The additional water meant fewer hits and it was easier to get off stops. The aesthetics were better. Less paddling made for a faster trip.
Brueckner – Need public access at take-out. Good run for intermediates; current velocity too swift in places for beginners. Suitable for novices accompanied by more experienced paddlers. Suitable for intermediate instruction; too swift for beginner or novice students.
Cable – I had a great time.
Colburn – Many more play spots. Better playspots. A low but fun level for this river.

Everly -- NA
Gilbert – This flow provided a number of stop and play waves. Flat water was moving nicely. But level was still OK for beginner boaters. Still huge recovery pools.
Gossett – Awesome ride!
Guthrie -- NA
Heynie – Like the waves. Less paddling required. The "channel" was sometimes harder to see.
Hughes – Some of the surfing areas near ledges were washed out. Trees just under water level but didn't seem too dangerous, easy to avoid.
Jackson – Good recreational flow.
Johns – NA
Johnson – This was a good flow. Safer in many respects because less getting out of boats and stops.
Kane – Great ride!
Kelly – Better flow with this extra water.
Koval – This flow was lots of fun for me as a beginner.
Leatherman – Overall good/fun ride. Few "hits", enjoyable float speed. Less need to be able to "read river". Novice family could enjoy and do safely without the need of guide—mainly because of less hits.
Lineberger – NA
Lucic – 2nd run flow was much better. Less scrapey.
Lynch, S. – I really enjoyed this level. There were many, many places to play, work on skills, etc. This was a fun level. This would, also, be a great level for teaching.
Lynch, W. – Too fast a run. Wanted more time to play.
McPherson – Good fun at this level.
Mead, J. – Overall, better than morning flow. A few surf spots not as good, but others were good
Rapids whose appeal was waves (Slingshot, Double Drop) were better at this flow.
Mead, R. – NA
Miller – Much improved from Flow 1. Less rock dodging, more surfing.
Olson – River in general was more fun and play spots were better than lower level. Many more lines through most all of the rapids.
O'Neal – Still some scraping at certain shoals—Childress property below Railroad Rapid and Moonshot.
Patterson – NA
Pennington – Nice trip to do in general going home or when Nanty is not running and I need to paddle. It was much more fun than this am.
Pope – NA
Robinson – NA
Rosar – Acceptable level for Kevlar hulled boats but still hitting enough rocks with paddle that I wished I had not brought my wooden paddle.
Smith – At this level you were not crowded by rental craft due to the better route had widened out.
Smith-Lovin – At this level waves and other play spots a lot more fun. Slow sections require less concentration to get through clearly and go faster. More fun, less work.
Walls – This flow was an excellent flow for any novice paddler.
Willenborg, D. – Good level.
Willenborg, R. – NA
Williams – Good for surfing and river running. Not so good for novice.
Winholtz – Much river flow, more variety of lines to follow.
Wishon -- NA

Flow 3: Tuesday AM – 485 cfs

Alexander – Good fun!
Beazley – Pretty minimum flow. I would only use it if I was desperate.
Blackburn, M. – Still some play waves but they were not very exciting.
Blackburn, U. – Enjoyed the river. Not much different from 7/2 am.
Borawa – Too many scrapes and hang ups. Had to work too hard to get down river. Aesthetics not much different except less whitewater.

Brueckner – This flow was almost identical to flow number one. Suitable for teaching beginners and novices.
Colburn – Very low water. Few play opportunities. Bumpy and scrapey.
Everly – Very scrapey and hard on boat.
Faulkner – Generally pleasant run, great scenery!
Gilbert – Expected level to cause many more hits, stops, etc. Surprised to find out channels were usable and OK to pass. Actually hit fewer times than on 1st run at higher flow. Could be due to more focus on my part or to channeling of water. While I would not return for a river trip for pleasure, I would come back for the sake of beginners or novices in the group.
Gossett – Nice ride, needed more water.
Guthrie -- NA
Heyne – This was a little more challenging than the 400 level because you had to make quick adjustments. Therefore this level could actually be harder for beginners than the 400 level where channels were more defined and deeper. This level allows for "safe" drill and practice and testing new skills.
Hughes – For a ducky run this was blah, not too exciting.
Jackson – Good water for beginners.
Johns – NA
Johnson – A little too low for my taste.
Kane – Nice, easy ride.
Kelly -- NA
Koval – Due to lower water I had more difficulty paddling to avoid obstacles (couldn't get the paddle deep enough in the water to maneuver boat).
Leatherman – Good float trip for a family—actually better than yesterday's low flow run. I believe this would be a safe and fun run for a novice/beginning family or individual.
Lineberger – No noticeable difference in river features from Flow 1 on 7/2/01.
Lucic – Silty water made it hard to see rocks in river. Hit more rocks.
Lynch, S. – This is a great river for teaching and developing skill levels.
Lynch, W. – NA
McPherson – Too low.
Mead, J. – Double Drop—waves less exciting than flow #1. 2nd Hole—surf spot at bottom, more available than flow #2, not as sticky as flow #1. Surprise Hole—surf spot not as good asflow#2. Shoals by "fugitive train" and between 1st and 2nd hole, not significantly more than flow #1. However, we also may be learning the best routes to avoid scraping after 2 prior runs.
Mead, R. – Very similar experience to first flow yesterday. Both felt like the minimum acceptable.
Miller – Boney in places, benign overall.
Olson – Too low!
O'Neal – Too low to be much challenge to intermediate or greater paddlers. Some danger to beginners at 2nd Hole and ?
Patterson -- NA
Pope – At this level I believe it to be unsafe for beginning canoes.
Robinson – I hit rocks less frequently today largely because my own paddling and ability to see the rocks improved over the last 2 days.
Rosar -- NA
Smith – At this level damage to bottom of boat starts to happen.
Smith-Lovin – Fine level for a pleasant, contemplative paddle—but the river isn't really pretty enough for that (traffic noise, development, trash). Would bring a beginner friends but wouldn't paddle this level for my own enjoyment.
Walls – Good trip for teaching but maybe too low for rafts.
Willenborg, D. – Need more water.
Willenborg, R. – NA
Winholtz – Not sure I'd come back at this level? Had to work harder at navigating.
Wishon – NA

Flow 4: Tuesday PM – 1013 cfs

Alexander – Given that the primary recreational use of this section is young families with small kids, this flow would be either off-putting or dangerous. At this velocity things happen much more rapidly, reducing parental response time.

Beazley – This was a nice water level. Good for novice/intermediate. Maybe a little high for beginners.

Blackburn, M. – Some surfing waves washed out.

Blackburn, U. – Fast run most places washed out.

Borawa – There was too much water in the named areas that took away some of the challenges. It was more enjoyable in the riffle area (less hits). More aesthetic in riffle areas (more "white" water).

Brueckner – Some rapids were washed out, particularly at 2nd Hole. This rapid offered a better surfing wave and attaining opportunities at 613 cfs than it did today. I did not feel that the additional water improved the overall quality of the trip.

Colburn – 2-3 cool mystery move spots, 1 awesome one. Good level. Lots of small waves. Less good for beginners.

Everly -- NA

Faulkner – Good trip. Fast moving water which made better waves to ride. Harder to read river although there was less need due to deeper water. Preferred second run in ducky.

Gilbert – This flow washed out a lot of features which took away the definition that creates river play and moves. There were a few surfing spots and a number of eddy moves but I would prefer more definition.

Gossett – Nice run, too much water.

Guthrie -- NA

Heynie – Wave trains fun but less technical.

Hughes – Thought this flow was too high. There were many floating branches and other debri that made me nervous about what else was floating just below the surface. Huge rocks were barely covered and the lines from lower flows were completely washed out.

Jackson -- NA

Johns – NA

Johnson – It was a lot easier because of the volume of water, but I don't think it was any more challenging or exciting. Just easier for raft.

Kane – Great ride. A little too much water.

Kelly – Fun, maybe a touch high for ideal novice instruction.

Koval – NA

Leatherman – There were fewer "hits" and "hangs" at this level. But this level increased your exposure to free overhangs and low limbs. I was surprised to find that the length of the run was about the same as the others. From the viewpoint of a family, this run would be a challenge and once again I wonder about someone, without a guide, getting out to move a stuck boat in that volume of water and current speed.

Lineberger – Way too much flow. River features were all washed out.

Lucic – Good surfing level.

Lynch, S. – This was a fun level. A loved the bigger waves. I would not want to teach beginners on this level.

Lynch, W. – Liked the larger waves more places to surf, etc.

McPherson – Good flow for experienced paddlers.

Mead, J. – Great surf spot at Surprise Hole. Fun wave train at Double Drop. Moonshot more interesting—long, continuous at this flow. Other than named rapids, less concentration required, not sure this is necessarily better. More turbid at this flow. Some surf spots better, others washed out.

Mead, R. – Muddier water at this flow level.

Miller – Some new play spots, but some washout on others.

Olson – Some play spots starting to wash out, but new ones starting to appear.

O'Neal – Some of spots are washed out at this level others are present.

Patterson -- NA

Pennington – At this level, river seems washed out at rapids and "pooling" between. Most rapids

seemed much less technical, less water reading required overall. This level would be good for tubers.

Pope – Most of drops and ledges washed out at this level. Best level was Monday afternoon's.

Robinson – This one was great fun.

Rosar – Some spots that were good for playing at Flow #2 were not worth playing at Flow #4 (wash out or too powerful). Overall, I enjoyed Flow #4 the best of all.

Smith – NA

Smith-Lovin – Some good spots to practice bigger water moves, but actually fewer play spots for an open boat than Flow 2. Still fine for less experienced people, but it's a big, fast flush for them. Would be a nice, fairly quick run.

Walls – Water level was too high and the runs were washed out.

Willenborg, D. – 2nd Hole and Double Drop were washed out. Surfing and Surprise Hole were much better. Great level for us. Thanks.

Willenborg, R. – Tonya's Rock became a real rapid. Fun practice river for novice/intermediate.

Williams – Too high for the average boater that uses this river.

Winholtz – Bigger wares, less technical.

Wishon – Too fast.

Tuckasegee River Paddling Flow Study
Dillsboro Section – July 2-3, 2001
Written Comments - Comparative Evaluation Survey
(Question Numbers Correspond to those on Comparative Survey Form)

Question 10: Any other comparative evaluations you would like to make?

- I had fun on each run in the raft. I have tandem canoed Chattooga and Nantahala River with an expert boater. As you know it is a different ride than a raft, more challenging/exciting, and each river noted above in rafts, the raft rides were guided. I enjoy the more challenging ride and of course feel safe with a guide since they know how to "read the river". From conversation with individuals in the study group, the Dillsboro Section would be a good section for a beginning boater to learn. I don't see the Dillsboro Section becoming Nantahala River in popularity. But would probably be safe and fun ride with Mom/Dad and the kids without a guide. My concern would be someone getting stuck/hung on a rock and getting out of the boat to dislodge it and getting hurt, stuck themselves.
- Some of the questions would not make a passing grade in survey research 101.
- Really enjoy this river for practicing skills.
- I still think this is an excellent teaching drill and practice river because of the easy recoveries, and non-threatening for small kids. Water temp is better for little kids too.
- Please add up boats on the river. Big issue on the Nantahala!
- I am glad to know about the Tuckasegee.
- River needs more public access from Dillsboro to Ela.
- None.
- NO FEES for parking or using the river. Free access to all rivers!
- All releases but the heaviest were LOW, but OK for those that use this river.
- This section of the Tuck is a great alternative to other rivers in the region—and it's not as crowded! Also, the river provides good opportunity for teaching beginners and novices.
- This is one of the best training rivers for beginners in Western NC/SE—used by clubs from Atlanta, for example.
- Need a public access at Tuck take-out. It is very nice of the outfitter to let the public use his business as a take-out.
- 31 Participants had no response.

Comments on Other Pages of the Comparative Survey

- Overall, I believe this survey form is deficient in clarity, which will produce less accurate results. Also – discussions after rides are not focus groups. To use this term is to be misleading.
- A beginner 's or novice's perception of "having a good time" is more important than particular river /water characteristics. A person of this kind will not have much – or any – prior experience to compare with their Tuck Float. What may be old hat and boring to a more experienced boater may be as thrilling as they can stand to a beginner or novice. Also, a raft, for example, with a guide, can have greater satisfaction with poorer water quality, all other factors remaining equal.
- With regard to Question 3 – Not having the table in chronological order may create skewed results.
- With regard to Question 5 – when asked for an estimation of optimal flow – "none I can think of"; when asked to estimate highest safe flow – "don't know – maybe short of flood"
- With regard to Question 6 – It isn't important to provide a variety of flow levels – skill levels above beginner novice boaters have other nearby options.
- With regard to Question 7 – Would you recommend standard trip and/or high challenge trip to others? Response would depend on my perception of the skill of the others. Generally I send people to Nantahala (for a high challenge trip).
- Question 7 - No, not for intermediate kayakers
- With regard to Question 8 – Makes no sense (to compare Dillsboro to other rivers) unless the skill level is specified. I even heard others asking each other what this meant.

- Question 8 – Comparing to rivers of my skill level (rated all 1's)
- Question 8 – Haven't been on many rivers – nothing for me to compare to except Lower Pigeon
- Question 8 – This scale is inappropriate since this river is better suited for novice level boaters. They are sure to drive regardless.
- Question 8 – At what flow? 600…
- Question 9 – only rated Lower Pigeon
- Question 9 – I hate comparative evaluations

Appendix D
Dillsboro Flow Study
Acknowledgement and Assumption of Risk Forms
Dillsboro and Whittier
(Dillsboro and Whittier Forms are the same)
West Fork By-Pass
East Fork By-Pass (Bonas Defeat)

Acknowledgement and Assumption of Risk
And
Release of Liability

As a prudent person who has decided to participate in this recreation flow study on the Dillsboro and/or Whittier sections of the Tuckasegee River I understand that this whitewater trip will expose me to numerous known and unknown risks which could result in personal injury, illness, death or damage to myself or my property. A very few of the many risk factors include:

- Travel in a canoe, kayak or inflatable craft, in rough water conditions
- Swimming/floating in unfamiliar and sometimes turbulent water
- The forces of nature including lightning
- Paddling on 4 different water flows during this study
- The physical exertion required to paddle the Tuckasegee River at 4 flows over 2 days and/or paddle a second section in the evening of each day

My participation in these trips is voluntary and I participate in spite of these named and other unnamed risks. I accept and assume all responsibility for and risk of personal injury, illness, death or damage to myself and my property arising from this trip.

In consideration that Duke Power has provided the water for these paddle trips I voluntarily release and forever discharge Duke Energy, Inc., American Whitewater and their officers, agents, and employees from any and all liability or claim for any injury, illness, or death, or damage to myself or property arising out of my participation in this trip.

I fully recognize that if injury, illness, death or damage occurs to me while participating in this trip that I will have no right to make a claim or file a lawsuit against Duke Energy or its officers, agents or employees, even if any of them negligently cause my injury, illness, death, or damage.

I also grant Duke Energy and American Whitewater the right to use any photographs or videos taken of me during this trip for documentation and purposes related to studies for the hydropower relicensing of the Thorpe and Tuckasegee power plants.

_____

Signature of Participant **Printed Name** **Date**

If participant is under 18 years old, please fill out the following:

_____

Parent or Guardian Signature

Participant's Age_____

Acknowledgement and Assumption of Risk
And
Release of Liability

As an expert paddler with experience paddling rivers with big drops, unknown rapids, and multiple hazards I understand and accept that this trip on the West Fork of the Tuckasegee River will expose me to numerous known and unknown risks which could result in personal injury, illness, death or damage to myself or my property. In addition to the usual hazards of whitewater some of the specific known factors creating risk on this section include:

- This section of the river is not run often and water is seldom released from the spillway. This results in trees and vegetation in the river, some vertical and some horizontal that must be avoided.
- There will be floating debris of all sizes in the river bed.
- The releases of approximately 250 to 400 cfs will present unknown navigability problems and there may be places the channel is not navigable.
- Several water falls or other large drops.

My participation in this trip is voluntary and I participate in spite of these named and other unnamed risks. I accept and assume all responsibility for and risk of personal injury, illness, death or damage to myself and my property arising from this trip.

In consideration that Duke Power has provided the water for this paddle trip I voluntarily release and forever discharge Duke Energy, Inc., American Whitewater and their officers, agents, and employees from any and all liability or claims for any injury, illness, or death, or damage to myself or property arising out of my participation in this trip.

I fully recognize that if injury, illness, death or damage occurs to me while participating in this trip that I will have no right to make a claim or file a lawsuit against Duke Energy or its officers, agents or employees, even if any of them negligently cause my injury, illness, death, or damage.

I also grant Duke Energy and American Whitewater the right to use any photographs or videos taken of me during this trip for documentation and purposes related to studies for the hydropower relicensing of the Thorpe and Tuckasegee power plants.

Signature **Printed Name** **Date**

East Fork Tuckasegee River Bonas Defeat Section
Bypass Recreational Flow Study Visual Assessment
Acknowledgement and Assumption of Risk
And Release of Liability

As an expert paddler with experience walking in steep river channels with big drops, unknown rapids, large and small boulder sieves, and multiple hazards, I understand and accept that participating in this whitewater recreational flow study visual assessment in the Bonas Defeat Section will expose me to numerous known and unknown risks which could result in personal injury, illness, death or damage to myself or my property. In addition to the usual hazards of walking in this steep congested river channel there will also be three or more releases of water from the Tennessee Dam which will have unknown impact on water levels in the river channel where I will be walking and observing these flows. I understand this section is steep and technically difficult to walk in when dry and that I will be in the channel when it is wet which poses a greater probability of falls onto rocks or into extremely dangerous whitewater rapids and requires me to have expert skills in navigating this type of terrain.

My participation in this flow study is voluntary and I participate in spite of these named and other unnamed risks. I accept and assume all responsibility for and risk of personal injury, illness, death or damage to myself and my property arising from this trip. I assume all financial responsibility for any medical, rescue or other expenses that may be incurred in connection with my participation in this flow study. In addition, it is my responsibility to insure the safety of the equipment I will use and to see that it is operated properly, and I accept that Duke Energy Corporation and American Whitewater, and their officers, agents, and employees assume no responsibility for the condition of the study site on which the study is to be held, or of such equipment, its operation, or safety of the activities involved in this study.

In consideration that Duke Energy Corporation has provided the water and accepted my registration for this flow study, I voluntarily release and forever discharge Duke Energy Corporation, American Whitewater and their officers, agents, and employees from any and all liability or claims for any injury, illness, or death, or damage to myself or property arising out of my participation in this trip even if such injury, illness, death, or damage is caused by the negligence of Duke Energy Corporation or American Whitewater and further agree to pay, protect, indemnify, hold harmless and save Duke Energy Corporation, and American Whitewater and their officers, agents, and employees against all liabilities, damages, costs, expenses, causes of action, suits, demands, judgments and claims of any nature whatsoever arising from, by reason of, or in connection with any injury or death of persons or damage to property arising from, by reason of or in connection with my participation in this flow study..

I fully recognize that if injury, illness, death or damage occurs to me while participating in this flow study that I will have no right to make a claim or file a lawsuit against Duke Energy Corporation or American Whitewater or their officers, agents or employees, even if any of them negligently cause my injury, illness, death, or damage. This Release shall be binding upon me, my heirs, executors and administrators. I agree that if any portion is held invalid, the remainder will continue in full legal force and effort.

I also grant Duke Energy Corporation and American Whitewater the right to use any photographs or videos taken of me during this whitewater flow study visual assessment for documentation and purposes related to studies for the hydropower relicensing of the East Fork Tuckasegee power plants (FERC Project No. 2698).

I have read this document completely and understand its contents.

Signature **Printed Name** **Date**

Appendix E
Dillsboro Study
International Scale of Whitewater Difficulty

(Same for all three sections)

INTERNATIONAL SCALE OF RIVER DIFFICULTY
STANDARD RATED RAPIDS

This is the American version of a rating system used to compare river difficulty throughout the world. This system is not exact; rivers do not always fit easily into one category, and regional or individual interpretations may cause misunderstandings. It is no substitute for a guidebook or accurate first-hand description of a run.

Paddlers attempting difficult runs in an unfamiliar area should act cautiously until they get a feel for the way the scale is interpreted locally. River difficulty may change each year due to fluctuations in water level, downed trees, recent floods, geological disturbances, or bad weather. **Stay alert for unexpected problems!**

As river difficulty increases, the danger to swimming paddlers becomes more severe. As rapids become longer and more continuous, the challenge increases. There is a difference between running an occasional Class IV rapid and dealing with an entire river of this category. Allow an extra margin of safety between skills and river ratings when the water is cold or if the river itself is remote and inaccessible.

THE SIX DIFFICULTY CLASSES:

Class I: Easy Fast moving water with riffles and small waves. Few obstructions, all obvious and easily missed with little training. Risk to swimmers is slight; self-rescue is easy.

Class II: Novice Straightforward rapids with wide, clear channels which are evident without scouting. Occasional maneuvering may be required, but rocks and medium sized waves are easily missed by trained paddlers. Swimmers are seldom injured and group assistance, while helpful, is seldom needed. Rapids that are at the upper end of this difficulty range are designated “Class II+”.

Class III: Intermediate Rapids with moderate, irregular waves which may be difficult to avoid and which can swamp an open canoe. Complex maneuvers in fast current and good boat control in tight passages or around ledges are often required; large waves or strainers may be present but are easily avoided. Strong eddies and powerful current effects can be found, particularly on large-volume rivers. Scouting is advisable for inexperienced parties. Injuries while swimming are rare; self-rescue is usually easy but group assistance may be required to avoid long swims. Rapids that are at the lower or upper end of this difficulty range are designated “Class III-” or “Class III+” respectively.

Class IV: Advanced Intense, powerful but predictable rapids requiring precise boat handling in turbulent water. Depending on the character of the river, it may feature large, unavoidable waves and holes or constricted passages demanding fast maneuvers under pressure. A fast, reliable eddy turn may be needed to initiate maneuvers, scout rapids, or rest. Rapids may require “must'” moves above dangerous hazards. Scouting may be necessary the first time down. Risk of injury to swimmers is moderate to high, and water conditions may make self-rescue difficult. Group assistance for rescue is often essential but requires practiced skills. A strong Eskimo roll is highly recommended.

Rapids that are at the upper end of this difficulty range are designated “Class IV-” or “Class IV+” respectively.

Class V: Expert. **Extremely long, obstructed, or very violent rapids which expose a paddler to added risk.** Drops may contain large, unavoidable waves and holes or steep, congested chutes with complex, demanding routes. Rapids may continue for long distances between pools, demanding a high level of fitness. What eddies exist may be small, turbulent, or difficult to reach. At the high end of the scale, several of these factors may be combined. Scouting is recommended but may be difficult. Swims are dangerous, and rescue is often difficult even for experts. A very reliable Eskimo roll, proper equipment, extensive experience, and practiced rescue skills are essential. Because of the large range of difficulty that exists beyond class IV, Class 5 is an open ended, multiple level scale designated by Class 5.0, 5.1, 5.2, etc. Each of these levels is an order of magnitude more difficult than the last. Example: Increasing difficulty from class 5.0 to class 5.1 is a similar order of magnitude as increasing from class IV to Class 5.0.

Class VI: Extreme and Exploratory These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability and danger. The consequences of errors are very severe and rescue may be impossible. For teams of experts only, at favorable water levels, after close personal inspection and taking all precautions. After a Class VI rapids has been run many times, its rating may be changed to an appropriate Class 5.x rating.

Appendix F
Dillsboro Flow Study
Whittier Flow Study
West Fork By-Pass Study
East Fork By-Pass (Bonas Defeat) Study
Study Schedule and Participant Information

(includes information for both studies)

June 24, 2000

Dear Tuckasegee River Recreation Study Participant:

Thank you for your interest in, and willingness to volunteer for, the Tuckasegee River Recreation Study. This letter serves as an official invitation and orientation to the study. It provides very important information about the study and your participation. Please read it carefully.

Purpose of the Study

The purpose of the Tuckasegee River Recreation Study is to collect information on how various flows in the Tuckasegee River may affect recreation opportunities and the quality of those opportunities for whitewater boating. The study will focus on the 4.5 mile Dillsboro Section (Dillsboro to Barker's Creek) below the Dillsboro Dam. We will also evaluate the Whittier Section in a less detailed way. You can choose to do either the Dillsboro or the Whittier study or both. This study is one of many studies being undertaken by Duke Power as part of the relicensing of their eleven hydropower facilities on the Tuckasegee, Nantahala, Hiwassee and Little Tennessee Rivers. Duke Power is conducting the study in collaboration with study team members from American Whitewater, Western Carolina University, Tuckasegee Outfitters Association, various state and federal agencies, and others. And, most importantly – YOU.

Schedule and Commitment

The dates for the Tuckasegee River Recreation Study are July 2 and 3. The study methodology requires a commitment from you for **two full days.** It is necessary that you commit to both days in order to participate in the study.

The study will begin at **8 AM on July 2**, with a mandatory orientation and safety meeting at Tuckasegee River Outfitters located about 2 miles west (towards Bryson City) of the intersection of highways 74 and 441. There will be different flow releases on both days. Participants will be required to sign a liability waiver.

The boating schedule will be as follows:

July 2:	8 AM – Orientation to Study
	9 AM - First evaluation run - Dillsboro
	12 Noon – Lunch (provided)
	2 PM – Second evaluation run - Dillsboro
	6 PM – First evaluation run - meet at Whittier Post Office
July 3:	8 AM – Orientation
	9 AM – Third evaluation run - Dillsboro
	12 Noon – Lunch (provided)
	2PM – Fourth evaluation run - Dillsboro
	6PM – Second evaluation run – meet at Whittier Post Office

PLEASE NOTE: The Dillsboro study requires all participants boat the river twice each day for two days. The Whittier study requires participants boat the river once each day for two days. The Dillsboro Section is almost 5 miles long and the Whittier Section is 3 miles long. Both sections are from class I – II, with some II+. You can participate in either or both of these studies but you must fully participate in whatever you choose. Please make sure you are willing and able to commit to this much paddling. If you have any reservations about your ability to do two trips in one day, please do not commit to the study.

Study Plan and Logistics

The Tuckasegee River Recreation Study will involve paddling on sections of the Tuckasegee River at several different, pre-arranged flow levels. As a participant, after each flow level, you will be asked to evaluate specific characteristics of the river, as well as the quality of your experience using a standard survey questionnaire. At the end of the two-day evaluation period, after you have experienced several different flows, you will also be asked to complete a second survey questionnaire that compares the different flow levels. The intent of the study is to collect objective information about various aspects of the flows being tested, so it is important that your responses to the survey questions be as objective as possible.

The Dillsboro study begins each day **promptly at 8 AM** with an orientation and safety meeting at Tuckasegee Outfitters. Paddlers should be ready for paddling at this time. The orientation will consist of a detailed review of the questionnaires, a safety review, and the detailed logistics for each day. These meetings will be **mandatory for all study participants**. The orientation meeting for the Whittier Study will begin at **6PM at the Whittier Post Office.** To get there take the Whittier exit off US 74 about 13 miles west of Dillsboro. Post Office is within 200 yards of exit. There will be rafts, inflatable kayaks, kayaks and canoes utilized in the study. Tuckasegee Outfitters will provide rafts and inflatable kayaks. All shuttle logistics will be arranged and provided for as part of the study.

RSVP

If you would like to participate in the study, and can commit to the study dates and plans, please RSVP by **June 28th** by calling Bunny Johns at 828 488 8539 or by email at bunnyjohns@yahoo.com. **Please indicate which craft you will paddle and whether you will participate in the Dillsboro study, the Whittier study, or both.**

If you have any questions about the study or need further clarification, please do not hesitate to contact Bunny Johns or John Gangemi at (406) 837-3155.

We appreciate your participation in this important study.

Sincerely,

Chuck Borawa
Duke Study Lead

John Gangemi
Conservation Director
American Whitewater

Bunny Johns
Field Study Coordinator

June 26,2991

To: Kevin Colburn, Leland Davis, James Jackson, Ken Kastorff, Trip Kinney, John

Miller, Danny Mongo, Shane Williams; Ian Bondi (Still Photographer)
Re: West Fork Tuckasegee Flow Study on June 29, 2001

Thank you for being willing to participate in this study. I would like to ask:

- **Everyone to bring a rope and any other rescue gear you normally carry.**
- **Trip Kinney to bring a first aid kit. I will also have a small one.**
- **Leland Davis to document the trip on video; John Miller to be the back-up**
- **James Jackson to provide a large pickup truck for the shuttle for the second run.**
- **Directions to Put-In: From Sylva, take Highway 107 past Cullowhee and Western Carolina University and towards Cashiers. You'll pass a dam with a very small lake (on the right) and a powerhouse (on the left). After a 290 degree bend in road (at entrance to Cullowhee Forest Development) look for Shoal Creek Road (next road on right; there is a sign). Go 0.9 miles and look for a pull off. There is a trail down hill that leads to the trail to the river. About 20 miles from Sylva to Shoal Creek Road.**

Logistics:

- **We should be at the trailhead at 7:00AM. This will give us tine to discuss safety and trip logistics as well as watch the water come over High Falls at around 8:30AM. From the road we carry down about 300 yards, leave the boats, and walk to High Falls (about 0.6 mile). It's another 300 yards to the river. Water should be at the put in site by about 9AM.**
- **Attached is the study plan, which contains a brief description of the study area for those who need some night time reading.**
- **After the first run we'll decide about the second flow so that can be communicated to staff opening the gates. We'll also fill out the evaluation form for the first flow and discuss the flow. Lunch is provided**
- **The second flow is scheduled to start at 2PM; at put in by about 3PM.**
- **After second flow, fill out evaluations and discuss the flows, possibly over dinner if everyone can stay around for that.**

If you have questions or comments email (bunnyjohns@yahoo.com) or call (828 488 8539) me.
Thanks again, Bunny Johns

East Fork Tuckasegee (Bona's Defeat Section) Paddling Study
Operating Procedure for Visual Assessment
DRAFT

Study description:

This study will assess whether paddling opportunities are present on the 1.5-mile Bona's Defeat Section of the East Fork of the Tuckasegee River. This will be done via a visual assessment of three flow levels utilizing a small group of whitewater boaters who will observe (but not paddle) the three flows. These observations will be used to evaluate whether a flow study utilizing paddlers is needed in this river section. The proposed flow levels are 150 cfs, 200 cfs, and 250 cfs.

Pairs of observers will be positioned in the Gorge at six to seven vantage points. Video will be taken at several of the locations. Please bring video cameras or still cameras if you have one. All observers will meet afterwards to discuss each location, view video footage, and discuss whether subsequent studies are necessary. We will have a TV and video player. Please bring any specific hook ups needed for your system.

July 9, 2002 – Schedule for Visual Observation

9:00 AM – Meet at Duke gate entrance to site. Kevin and Bunny will work to consolidate cars prior to arriving there. This is necessary due to restricted access at the site. There will be an orientation and safety briefing prior to moving to sites in the gorge. Simple lunch stuff will be available for you to take into the gorge – apples, granola bars, nuts, etc. Please bring water as it can be very hot in the gorge. Directions to the site are provided below. Once on the site we must leave the road passable for Duke Maintenance trucks.
10:00 AM – Begin placing observers in the Gorge
11:30 AM – Start first flow – 150 cfs
1:00 PM – Start second flow – 200 cfs
2:30 PM – Start third flow – 250 cfs
4:00 PM – Start walking out of Gorge when water level has decreased significantly
5:00 PM – Debrief and dinner for those who can stay.
All flows will end as soon as cfs measurements are completed with no less than 45 minutes observation time.

This schedule is tentative but it will be a long day in any case. Please come prepared to stay at your observation point for at least 5 hours. Some of the observation points will allow only minimal movement once the flows arrive. We will have radios at some sites that can communicate with the powerhouse and others that will allow communication with those observation points in close proximity to each other but not with the powerhouse.

Starting when all observers are at their observation locations (approximately 11:30AM), there will be 150 cfs (approximately) release. After the flow has been measured and all stations have reported in, the second flow will start (approximately 1:00 PM) and the same with the third flow. We will not start a flow if any observer is uncomfortable with his/her safety situation with regard to the upcoming flow. After the third flow observers must wait until the flow is significantly decreased before walking out of the gorge. Travel times for the second and third flows may be much reduced so the start of those flows may be earlier than shown in the schedule.

We would like all observers to wear PFD's when there is water in the gorge and to have ropes and other simple rescue gear available. Observers will be walking on wet rocks so use appropriate shoes. Small waterproof bags that are easy to carry will also be helpful.

Directions to Entrance Gate Site: From Highway 74 in Sylva, take the Cullowhee Exit (Hwy 107). Drive past Western Carolina University and continue south on Hwy 107. Approximately 13 miles from the intersection with Hwy 74 and approximately 3 miles from East LaPorte, turn left on Highway 281. Drive about 11-12 miles to Wolf Lake. The road will go over the dam at Wolf Lake. About a mile from the dam is a road that leads to the gate. As you drive from the dam you will see an RV Park on the left and then at the top of the hill a wood house on a small hill on the right. Just past the house is a road – turn right and go past the house. Turn left onto road to gate. Do not block any roads or driveways.

Thank you for your contribution of time and energy. If you have questions please contact Bunny Johns or Kevin Colburn.

Bunny – 828 488 8539 or bunnyjohns@yahoo.com
Kevin – 828 252 6482 or Kevin@amwhitewater.org

Appendix G
Recreational Paddling Instream Flow Study

(1) **Description of Four-Phase Approach for By-Pass Sections**

(2) **West Fork By-Pass Results from Phases 1 and 2**

(3) **East Fork (Bonas Defeat) By-Pass Results from Phases 1 and 2**

Recreational Paddling Instream Flow Study
Description of Four-Phase Approach for By-Pass Sections
West Fork By-Pass Section – FERC #2686
East Fork By-Pass Section – Bonas Defeat Section – FERC # 2698

Overview

This document describes the four-phase process used to assess whitewater boating opportunities in the By-Pass Sections of the East and West Fork Projects. Since 1941 when Glenville Reservoir was built, water has spilled into the approximately 6.9-mile By-Pass Section a total of five times. Since 1955 when the Tennessee Creek Reservoir was completed, water has spilled numerous times into the approximately 1.5-mile By-Pass Section that is called the Bonas Defeat Section. As a result of the dewatering, the lack of access, and (for Bonas Defeat) the extremely steep river channel, conditions have rarely been suitable for whitewater recreation in the By-Pass Sections. Consequently, little information is available regarding the feasibility of these sections to provide whitewater recreation or the quality of those recreational opportunities.

Because of the lack of definitive information on these potential whitewater resources, Duke has elected to use a four-phase approach to investigate the whitewater resources in these sections. Each phase of the study is sequential, building off the results of the previous step. Progression to successive phases is usually undertaken if results from the previous step warrant further investigation. Phases 2, 3, and 4 require releasing test flows.

Key objectives include:

- Assess and evaluate existence and quality of whitewater resources in the By-Pass Sections
- Describe current access to the sections
- Describe and classify key rapids and sections
- Develop a relationship between flow levels and quality of experience

The Four-Phase Approach includes:

- Phase 1: This involves an on-land assessment of the river section including desktop analysis of length, gradient, hydrology, access points and notable physical features. This information is then used for a site visit to visually inspect the characteristics of the section and the access points.
- Phase 2: This requires an on-water reconnaissance study at a pre-determined flow level to determine:
    1. If a whitewater resource exists in the By-Pass section
    2. The quality of the whitewater resource
    3. Based on the results of 1 and 2 determine if further test release are warranted

  The pre-determined test flow in Phase 2 is conservative so that investigators can safely explore the resource by foot and/or by boat and make recommendations for further test flow releases should it be warranted.
- Phase 3: This is an on-water assessment of additional test flows utilizing protocols developed by Whittiker, et al (1993). A designated number of participants (often a small number) paddle one or two test flows to determine minimum acceptable and optimum flows as well as participant preference information. If uncertainty exists regarding identification of minimum acceptable and optimum flow levels for whitewater recreation then the additional flows of Phase 4 is required.
- Phase 4: This involves increasing the study to encompass the additional flows necessary to determine minimal acceptable and optimal water volumes for whitewater paddling recreation. It may also involve a larger number of participants in a wider variety of crafts or other factors deemed necessary by the study team.

Recreational Paddling Instream Flow Study
Results of Phases 1 and 2 of the Four-Phase Assessment
West Fork By-Pass Section of the Tuckasegee River – FERC # 2686
May 9, 2001

Overview

This document describes the results of Phases 1 and 2 from the assessment of the West Fork By-Pass Section of the Tuckasegee River (See Description of Four-Phase Approach for By-Pass Sections). Since construction of the Glenville Reservoir in 1941, water has spilled from the reservoir into the 6.9 miles of natural river channel between the dam and the Tuckasegee Powerhouse on five occasions prior to this study.

Results and Discussion

Phase 1: Desktop Assessment and Site Visit
The approximately 6.9-mile section was divided into 5 sections based on potential access points or stream characteristics. These sections are:

1. 0.6 miles: Glenville Dam to High Falls
2. 0.6 miles: High Falls to Put-in point below Beaver Dams
3. 1.7 miles: Put-in point to Cullowhee Forest Bridge
4. 2.8 miles: Cullowhee Forest Bridge to Thorpe Powerhouse
5. 1.2 miles: Below Little Lake Glenville Dam to Tuckasegee Powerhouse

The 6.9-mile section was visually inspected, either from the road or by hiking parts of the channel. This inspection was done by Bunny Johns (Duke Consultant), Chuck Borawa (Duke Study Lead for Recreational Instream Flow Studies), Shane Williams, and Ken Kastorff (both on the Technical Leadership Study Team for Recreational Paddling Instream Flow Studies).

Desktop and visual inspection provided the following descriptions of Sections 1 and 2.

1. Section 1 from the Glenville Dam to High Falls is about 0.6 miles long and characterized by a bedrock channel with several small to moderate slides and drops. The segment ends at High Falls, which has a series of three waterfalls, each 40 to 60 feet high. A large tree was found to block the channel below the upper most falls. The riverbanks are uniformly steep and a portage around the three falls would be arduous at best.
2. High Falls to a potential Put-in Area below the Beaver Dams is about 0.6 miles with bedrock slides for about 0.3-mile below the third drop at High Falls. Several small beaver dams then impound the river and there is considerable vegetation in the channel.

The conclusions from Phase 1 indicated that:

1. Sections 3, 4, and 5 had potential for whitewater recreation and warranted further study, particularly Sections 3 and 4, which appeared particularly suitable for whitewater recreation. A substantial number of trees blocked the river channel in these sections and potentially provided significant hazards to boaters.
2. It was determined that Sections 1 and 2 did not warrant further study due in part of the encroachment of vegetation into the river channel, the series of beaver dams obstructing downstream navigation, and the difficulty of portaging around three significant waterfalls surrounded by steep banks.

Phase 2: Reconnaissance Trip
From the conclusions from Phase 1 and the possibility of trees and significant floating debris in the river channel, a reconnaissance trip was planned for May 9, 2001. Six boaters paddled Sections 3, 4, and 5 at a

targeted flow level of 100 cfs. The actual cfs turned out to be about 63 cfs. Video photography was taken by one of the paddlers and still photos were taken from on land. This reconnaissance trip provided the opportunity to further evaluate the whitewater resources in Sections 3, 4, and 5.

1. Section 3. The put-in is about 1.2 miles below the Glenville Dam. The put-in is on private land and is accessed by a trail approximately 400 yards long from Shoal Creek Road, which is about 1 mile from Highway 107. Randy Bennett who is developing the land and marketing the area for its aesthetic and fishing appeal owns the land. He has opened up an old roadbed to the river (which we used to put-in) and is developing trails along the river downstream from where we put in. This section is about 1.7 miles long and drops about 240 feet or 141 feet per mile. The first 200 yards is very exciting with 3 or 4 bedrock ledges and slides culminating in a forty foot water fall which is a double drop on the right and a steep slide on the left. Three paddlers went over the left slide and three walked this one. Several paddlers speculated that the right side could be run with more water. The left side had just enough water to allow a bumpy entrance at the top. From here to just above the Cullowhee Forest Bridge the riverbed contained boulders and several trees. The paddlers thought this section was class III+. At 63 cfs the water level was well below the deck of house number two which is the closest man-made object near the river. Ian (still photos) talked with the owners of house number one (currently under construction) who expressed dismay that there might be releases and paddlers in the river. There is another bedrock slide of about 30 feet just above the bridge to Cullowhee Forest. All the paddlers ran this slide. The take-out was at the Cullowhee Forest Bridge that is also private property. Both the put-in and the take-out have limited parking in the form of pull-offs on one-lane dirt roads.
2. Section 4. This section runs from the Cullowhee Forest Bridge to Thorpe Power Plant/Little Lake Glenville. It is about 2.8 miles long and drops about 240 feet or about 86 feet per mile. The bedrock slides continue for about 0.3-mile past the Cullowhee Forest Bridge and then the river enters a much narrower bedrock gorge for about 0.75-mile (estimated at Class IV difficulty). The remainder of the run is more open with boulder and generally smaller ledges and is probably class II+ to III-. The put-in is on private property as noted above. The take-out is acroos the road from the Thorpe Powerhouse either at the small wooden bridge directly across from the Powerhouse of the firt pull-off at the head of Little Lake Glenville. It is about 0.5-mile from the bridge to the Dam on Little Lake Glenville.
3. Section 5. This section is 1.2 miles long with the put-in at the base of the dam at Little Lake Glenville and the take-out at the Tuckasegee Powerhouse. The trail to the river below the dam is steep and dissolves into a sea of poison ivy. The river channel has a lot of vegetation in the river and logs across the river. The gradient is minimal and was rated as Class I+ by the group. The take-out is easy and there is adequate and there is parking at the Tuckasegee Powerhouse. Sections of the Main Stem of the Tuckasegee River are easier to access and are comparable in whitewater features.
4. In general, the water was quite silty but there was not much debris floating in the water. There were about 12 major trees across the river which had to be avoided as well as several smaller trees. Often the only paddling route went through dense over hanging branches but that might be alleviated with more water, as the boatable channel would probably be wider. The major tree fall below the upper most falls at High Falls did not move from the 63 cfs release though leaves washed onto the trees/tree limbs to a height of about 1.5 to 2 feet in this constricted area but nothing major moved downstream. The bedrock just above the lip of the second major falls was scoured clean where there had been some vegetation prior to the release. All three sections are bordered by private property on both sides of the river throughout its length with potential access issues both from ownership patterns and parking/other facilities.

The conclusions from Phase 2 indicated that:

1. Sections 3 and 4 contain whitewater opportunities worthy of further study utilizing protocols outlined in Phase 3. The 63 cfs release was below a minimum acceptable flow level in these two sections.
2. Section 5 was eliminated from further study due in part to the difficult access below the dam, lack of whitewater opportunities, similarity to other sections of the mainstem Tuckasegee River and obstructions in the river channel.

Recreational Paddling Instream Flow Study
Results of Phases 1 and 2 of the Four-Phase Assessment
East Fork By-Pass Section (Bonas Defeat) of the Tuckasegee River – FERC # 2698
July 9, 2002

Overview

This document describes the results of Phases 1 and 2 from the assessment of the East Fork By-Pass Section (Bonas defeat) of the Tuckasegee River (See Description of Four-Phase Approach for By-Pass Sections in Appendix H).

Results and Discussion

Phase 1: Desktop Assessment and Site Visit
Access to this site is possible through Duke property by paddling across Tennessee (also called Tanassee) Lake with a portage in the area of the dam to the put-in either at or below the Spillway Slide. The take-out can be accessed by paddling across Bear Lake to a North Carolina Wildlife Resources Commission public access area.

The approximately 1.5-mile section was divided into 3 sections based on gradient. These sections are:

1. Section 1 - First 0.5 miles below the dam – about 100 feet of elevation change
2. Section 2 - Middle 0.5 miles – about 200+ feet of elevation change
3. Section 3 - Last 0.5 miles – about 90 feet of elevation change

The 1.5-mile section was visually inspected by hiking the channel. This was done by Bunny Johns (Duke Consultant) and Kevin Colburn (American Whitewater). Shane Williams and Ken Kastorff (both on the Technical Leadership Study Team for Recreational Paddling Instream Flow Studies) hiked the channel one or more times. In addition, most members of the visual inspection team had been in the river channel prior to the visual observation with released flows. All sections were characterized by a bedrock channel varying in width from about 20 feet to over a hundred feet in several areas with significant obstructions, rock and log sieves, large potholes, and large boulders in the channel. In July there is about 3-5 cfs in the river channel contributed form dam leakage and two small creeks - Slickens Creek, and Doe Creek.

Desktop and visual inspection provided the following descriptions of the sections:

1. Section 1 includes the spillway, which is a Class V very steep runnable bedrock slide approximately 100 yards long. Around the corner from the spillway is a section with vertical walls and a narrow channel area. This section was evaluated to potentially have Class III+ rapids but with some concern about hazards in the area.
2. Section 2 starts at the Bonas Wall and ends below "The Crack", an area where the river enters a very narrow crack, which also has undercut areas. With 200+ feet of elevation change, numerous boulder and wood sieves, undercut rocks, large potholes and other whitewater obstacles, this area was determined to be the most crucial for visual observations with water in the channel.
3. Section 3 starts below The Crack and has a couple of drops before entering a section with greater channel width, smaller boulders in the channel and generally much less gradient. The section ends at the confluence with Wolf Creek.

The conclusions from Phase 1 indicated that there were potential paddling opportunities for extremely skilled paddlers (teams of experts). Because of the potential hazards in all sections (particularly Section 2), a visual inspection of flows by paddlers experienced in running Class V water was indicated.

Phase 2: Visual Inspection
On July 9, 2002, fifteen observers were distributed primarily in Section 2 with one observer in Section 1 and a flow measurement team in Section 3. Radio contact between the dam and primary observation points in the gorge was maintained during the study. All observers walked into the gorge prior to the first release of water and remained there until the flow subsided substantially after the last flow. Still cameras and video cameras were used to record the major areas of interest:

1. The Spillway Slide
2. The steep walled area around the corner from the Spillway Slide
3. Bonas Wall Waterfall area
4. The Middle Section with observers at several locations
5. The Pothole/Slide Rapid
6. The Crack

The targeted flows were 150 cfs, 200 cfs, and 250 cfs. The first flow was around 170 cfs, the second flow was about 190 cfs, and the third flow was around 325 cfs. All flows initially carried a small amount of sediment but quickly cleared up. The targeted flow of 250 cfs was increased after consultation with observers in the gorge. A debrief was held with all observers in the evening with opportunity for discussion and observation of videos and digital camera images of many of the critical areas. Major points from the debrief include:

1. Section 1. Section 1 at the Spillway Slide could probably be run at Flows 1 and 2. Flow 3 appeared more problematic due to the force of the water as it hit the rock ledges and a large rock flake on river left at the bottom where most of the water ended up. The area around the corner was runnable at all three levels with the increased water generally smoothing out the run. There were no other observations in this section. Still photos are available from this section.
2. Section 2.
    a. The Bonas Wall Waterfall appeared to have different lines at the different flows. Flow 3 opened up more of the rapid to be run but with significant consequences for missing the line. This rapid was described as Class V+ and "runnable on the right day". Both still and digital photos were taken at this rapid. This rapid could be portaged if necessary.
    b. The next corner downstream from the Bonas Wall contained two runnable Class V rapids. The observer described a "must make" move which was most doable at Flow 3 but again with serious consequences. There are no photos available from this site. These rapids could be portaged if necessary.
    c. About 100 yards or so further downstream. Observers described one drop that might have to be portaged but described ways to run the rest of the drops in the area but again with potentially serious consequences for a swim or missed line. This area was described as a complex series of Class V+ drops. This section could be portaged in its entirety or in pieces if necessary. Photos are available for this area.
    d. The Pothole Slide. Observers here indicated this rapid could be run at all the flows along the left side of the rapid with the judicious trimming of a few rhododendron bushes. This rapid was described as Class V. Photos are available for this area. This rapid could easily portaged if necessary.
    e. The Crack. Observers here indicated that the final part of this rapid could not be run at any water level observed making the entire rapid unrunnable. It appeared that higher water levels would not make this rapid runnable. This rapid could be portaged if necessary. The area below the Crack appeared to have several significant but runnable drops. Photos are available for this area.
3. Section 3. The area below the "Danger Water Can Rise" sign appears to be in the class II-III range with the bedrock channel including some small rock boulder gardens.

Conclusions from Phase 2

Generally, a flow of around 325 cfs is needed to open up the majority of the lines in the rapids. Lower flows do not cover up many of the dangerous features of the riverbed, and higher flows would create dangerously large hydraulics. Section 2 is generally Class V+. Section 1 is primarily Class III+ after the Class 5 Spillway slide. Section 2 is generally Class V+ and Section 3 is generally Class III+. As anticipated, Bonas Defeat Gorge is a dangerous and challenging whitewater run. However, several members of the study team wanted the opportunity to paddle the gorge and thought other high caliber boaters would also want such an opportunity.

This section should only be paddled by small teams of experts using all precautions. The sections are relatively short but stopping before the most difficult areas might be extremely difficult for all but the most experienced paddlers.

Due to the conclusive results of this study, the pressing schedule of the relicensing process, and the logistical requirements of a flow study in Bonas Defeat Gorge, a paddling flow study with boats will not be done. Other ways for paddlers who wish to experience this section will be explored.

Appendix I
Whittier Flow Study
Written Comments From
(1) Single Flow Surveys
(2) Comparative Flow Surveys

Tuckasegee River Paddling Flow Study
Whittier Section – July 2-3, 2001
Written Comments – Single Flow Evaluations
(Question numbers correspond to those on single flow survey)

Question 9: Using place names, please identify particularly challenging rapids or sections and rate their difficulty at this flow (using the International Whitewater Scale).

Flow 1: Monday PM – 813 cfs

Beazley – NA
Borawa – Overlook Ledge (III)
Brueckner – Overlook Ledge (III-)
Colburn – NA
Hughes – Ledges 1 (I), Big Ledge (II), Overlook (II+)
Jackson, E. – Dick's (III)
Jackson, J. – Dick's Creek (II-III)
Johns – Overlook Rapid (III) just upstream of Oconoluftee confluence.
Keller – 1st Rapid (II) halfway; 2nd Rapid (III) I mile downstream of 1st Rapid.
Kelly – Ledges (III)
Mead, J. – (II+) by the house, the big one.
Mead, R. – The biggest rapid (II+, III) a lot of fun.
Olson – (II) ledge
Smith, C. – Ledges (III)
Smith, M. – Overlook Rapid (III) near house.
Walls – Overlook Rapid (III) by house.
Williams -- ?

Flow 2: Tuesday PM – 985 cfs

Beazley – 1 challenging rapid
Borawa – Overlook Fall (II)
Brueckner – Overlook Ledge (III)
Colburn – NA
Dill – Big Drop Overlook (III)
Jackson, E. – NA
Jackson, J. – House Rapid (III), Dick's (II)
Johns -- NA
Kelly – Ledge (II-)
Miller – NA
Olson – ? (II) big ledge
Smith, C. – Ledges (III)
Walls – Overlook Rapid (II+)
Williams – No problems.

Question 11: Using place names, please identify rapids or sections you chose to portage and rate the difficulty of those portages (using your type of craft at this flow level).

Flow 1: Monday PM – 813 cfs

Beazley – NA
Borawa – None
Brueckner – None
Colburn – NA
Hughes – Overlook Rapid (2)
Jackson, E. – Dick's (3)
Jackson, J. – Dick's (3)
Johns – NA
Keller – Class III rapid at house (30
Kelly – NA

Mead, J. – None
Mead, R. -- None
Olson -- None
Smith, C. – None
Smith, M. – NA
Walls -- NA
Williams – NA

Flow 2: Tuesday PM – 985 cfs
Beazley – NA
Borawa – None
Brueckner – None
Colburn – NA
Dill -- NA
Jackson, E. – NA
Jackson, J. -- NA
Johns -- NA
Kelly – NA
Miller -- NA
Olson – None
Smith, C. – None
Walls -- NA
Williams – NA

Question 12: Did you have any significant problems during your run (e.g., become pinned, wrapped a boat, had to swim, etc.)? Please provide a brief description and location of any incident.

Flow 1: Monday PM – 813 cfs
Beazley – Just needs a little more water
Borawa – No
Brueckner – None
Colburn – NA
Hughes – Hit rock after 1st ledge, quick pin.
Jackson, E. – NA
Jackson, J. – None
Johns -- NA
Keller – Swam, hit a small hole bottom of 1st Rapid at ledges on right.
Kelly – NA
Mead, J. – None
Mead, R. – None
Olson -- None
Smith, C. – None
Smith, M. -- NA
Walls -- NA
Williams – NA

Flow 2: Tuesday PM – 985 cfs
Beazley – No probs
Borawa – No
Brueckner – None
Colburn – NA
Dill – Can't get in boat at put-in—whoops!
Jackson, E. – NA
Jackson, J. -- NA
Johns -- NA
Kelly – NA
Miller -- NA

Olson – None
Smith, C. -- None
Walls – NA
Williams -- None

<u>Question 13:</u> Provide any additional comments about this test flow below. If necessary, please use place names to identify specific locations.

<u>Flow 1: Monday PM – 813 cfs</u>

Beazley – Ok for beginners, a little more water would be nice.
Borawa – NA
Brueckner – Need to improve access at the put-in. Need a gauge in Dillsboro to provide more precise level. The Oconaluftee dumps a considerable amount of water into the Tuck just above the take-out. The only existing gauge for this section is downstream in Bryson City.
Colburn – Neat run. Good play. Herons. A bit heavier—better.
Hughes – If the water level was any lower, I wouldn't run this section. Very rocky!
Jackson, E. -- NA
Jackson, J. – Need more water.
Keller – It was great. I loved it! I had a really good time. Nice run. Good for intermediate kayak clinics or for recreational paddling.
Mead, J. – Good section for practicing/teaching eddy turns. Eddys in ledges were clear and easy to use to scout route through ledges. Line at "the big one" fairly easy to find and approach.
Mead, R. -- None
Olson -- None
Smith, C. -- NA
Smith, M. – This was a really fun section of the river that I had never paddled before. It would be wonderful if this could be runnable more often.
Walls – Good run. Possibly best of the day! Excellent way to end the day.
Williams – Some really good spots. Some really scrapey stuff.

<u>Flow 2: Tuesday PM – 985 cfs</u>

Beazley – This is OK for beginners/novices.
Borawa – Some rapids washed out. Less hits made trip more enjoyable.
Brueckner – Need to provide public walking trail around Overlook Ledge for boaters who choose to portage. Novices can negotiate most rapids but would need assistance at Overlook Ledge. Beginners could be guided through most of the ledges above Overlook. Concerned about water quality after passing RV park because of smell and pipes coming our of park.
Colburn – Need holes for learning to surf. Adequate flow.
Dill -- NA
Jackson, E. – NA
Jackson, J. – NA
Johns -- NA
Kelly – Straight pipe septic into river is disgusting.
Miller – More water = more fun compared to the 7/02 run!
Olson – NA
Smith, C. -- NA
Walls – NA
Williams – None

Tuckasegee River Paddling flow Study
Whittier Section – July 2-3, 2001
Written Comments – Comparative Evaluation Survey
(Question numbers correspond to those on comparative survey form)

Question 10: Any other comparative evaluations you would like to make?

- NA
- NA
- NA
- NA
- NA
- NA
- NA
- NA
- I like it! I'll teach here. Good surfing.
- NA
- NA
- NO FEES to park or paddle river. Free access to all rivers.
- The water quality is probably very bad. We saw several septic lines coming out of the mobile trailer park and into the river—yuk!!!!
- NA

Appendix J
West Fork By-Pass Section of Tuckasegee River
(1) Single Flow Survey
(2) Comparative Flow Survey

SINGLE FLOW EVALUATION FORM
West Fork Tuckaseegee Whitewater Study, FERC No. 2686

Date of run: _____

Your name: _____

Flow Release (circle one): **Flow 1 (5/09/01)** **Flow 2 (6/29/01, AM)** **Flow 3 (6/29/01, PM)**

1) What type of craft did you use for this run (Circle one)?

   a. Hard shell kayak

   b. Inflatable kayak

   c. Closed deck canoe

   d. Open canoe with floatation

2) What was the flow on this run?

   _____ cfs

3) Please estimate the time you put-in and completed this run.

   Put-in time: _____

   Take-out time: _____

4) Please evaluate the access.

   Access at the put-in easy moderate difficult

   Access at the take-out easy moderate difficult

5) Please evaluate this flow on this run for your craft and skill level for each of the following characteristics. *(Circle one number for each item).*

						If unacceptable was it	
	Totally unacceptable	Unacceptable	Neutral	Acceptable	Totally acceptable	too low	too high
Navigability	-2	-1	0	1	2		
Availability of challenging technical boating	-2	-1	0	1	2		
Availability of powerful hydraulics	-2	-1	0	1	2		
Availability of whitewater "play areas"	-2	-1	0	1	2		
Overall whitewater challenge	-2	-1	0	1	2		
Safety	-2	-1	0	1	2		
Aesthetics	-2	-1	0	1	2		
Length of run	-2	-1	0	1	2		
Number of portages	-2	-1	0	1	2		
Overall Rating	-2	-1	0	1	2		

6) If this test flow were provided periodically, are you likely to return for future boating? *(Circle one).*

a. Definitely no
b. Possibly
c. Probably
d. Definitely yes

7) At this test flow, how would you rate the whitewater difficulty of the river at this flow? (Use the International Whitewater Scale that ranges from Class I to Class VI).

Difficulty: I II III IV V VI

8) At this test flow, what skill level would a paddler need to safely paddle this section?

Novice Intermediate Advanced Expert

9) Relative to this flow, would you consider the minimum acceptable flow (defined as the lowest flow you would return to boat) to be higher, lower, or about the same as this flow? *(Circle one).*

1	2	3	4	5
much lower	**lower**	**no change**	**higher**	**much higher**

10) Relative to this flow, would you consider the optimum flow (defined as the ideal flow you would return to boat) to be higher, lower, or about the same as this flow? *(Circle one).*

1	2	3	4	5
much lower	**lower**	**no change**	**higher**	**much higher**

11) Using place names, please identify particularly challenging rapids or sections and rate their difficulty at this flow (using the International Whitewater Scale).

Location	Rating	Location	Rating
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

12) Please record the number of **portages** you had on this run.

I had to **portage** around unrunnable rapids or sections _____ times.

13) Using place names, please identify rapids or sections you portaged and rate the difficulty of those portages (using your type of craft at this flow level).

Location / reason	Easy	Slightly difficult	Moderately difficult	Extremely difficult
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4
_____	1	2	3	4

14) Did you have any significant problems during your run (e.g., became pinned, wrapped a boat, had to swim, etc.)? Please provide a brief description and location of any incident.

Incident	Location
_____	_____
_____	_____
_____	_____

15) Provide any additional comments about this test flow below. If necessary, please use place names to identify specific locations.

COMPARATIVE FLOW EVALUATION FORM

West Fork Tuckaseegee Hydropower Project, FERC No. 2686
Whitewater Recreation Study

Today's Date: _____

Did you participate in the 5/09/01 test release? Yes No

Your name: _____

1) What type of craft did you use for this run (Circle one)?

a. Hard shell kayak
b. Inflatable kayak
c. Closed deck canoe
d. Open canoe with floatation

2) For a high quality trip on the West Fork Tuckasegee River, please rate the importance of the following components.

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Navigability	1	2	3	4	5
Availability of challenging technical boating	1	2	3	4	5
Availability of powerful hydraulics	1	2	3	4	5
Availability of whitewater "play areas"	1	2	3	4	5
Overall whitewater challenge	1	2	3	4	5
Safety	1	2	3	4	5
High quality aesthetics	1	2	3	4	5
Length of run	1	2	3	4	5
Few portages	1	2	3	4	5
Easy put-ins and take-outs	1	2	3	4	5

3) Please evaluate the following flows for your craft and skill level. In making your evaluations, please consider all the flow-dependent characteristics that contribute to a high quality trip (e.g., navigability, whitewater challenge, safety, availability of surfing or other play areas, aesthetics, and length of run). *(If you do not feel comfortable evaluating a flow you have not seen, don't circle a number for that flow).*

Release No	Flow (cfs)	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
Flow 1 5/09/01	100	-2	-1	0	1	2
	150	-2	-1	0	1	2
	200	-2	-1	0	1	2
Flow 2 6/29/01 AM	250	-2	-1	0	1	2
	300	-2	-1	0	1	2
	350	-2	-1	0	1	2
	400	-2	-1	0	1	2
	450	-2	-1	0	1	2
	500	-2	-1	0	1	2
	600	-2	-1	0	1	2
	700	-2	-1	0	1	2
	> 700 cfs ____specify	-2	-1	0	1	2

4) Based on the two test flows boated in this study, do you feel comfortable identifying minimum acceptable and optimum flows for whitewater recreation?

Yes No Uncertain

5) What additional flows would you recommend testing to aid you in the identification of minimum acceptable and optimum flows for this run? (circle two flows or identify two flows not listed)

100	400	700
150	450	750
200	500	800
250	600	
300	650	

6) Based on your boating trips on the West Fork Tuckasegee River, please specify the flows that provide the following types of experiences. (Note: you can specify flows that you have not seen, but which you think would provide the type of experience in question).

Flow in cfs

From a recreational perspective what is the **minimum acceptable flow** for this run? Note that the minimum acceptable differs from the minimum flow necessary to navigate. _____

From your perspective what is the optimum flow for this run? _____

Many people are interested in a "standard" whitewater trip at medium flows. Think of this **"standard trip"** in your craft.
What is the best or **optimal flow** for this type of trip? _____

Some people are interested in taking trips at higher flows for increased whitewater challenge. Think of this **"high challenge trip"** in your craft.
What is the best or optimal flow for this type of trip? _____

What is the highest safe flow for your craft and skill level? _____

If Duke Power released only one flow for boating, what flow would you prefer? _____

7) How important is it to release a variety of flow levels on the West Fork Tuckasegee River? Please rate the importance of providing several different flows for the two reasons below, or check the box.

Providing several different flows is necessary to…	Not at all important	Slightly important	Moderately important	Very important	Extremely important
…provide different types of boating experiences.	1	2	3	4	5
… provide opportunities for people with different skill levels and craft types.	1	2	3	4	5

Or… ❑ it isn't important to provide a variety of flow levels.

8) At the optimum flows for standard and high challenge trips would you recommend this section to others?

Standard trip	yes	no
High challenge Trip	yes	no

9) Compared to other rivers, how would you rate boating opportunities on the West Fork Tuckasegee River. *(Circle one number for each; if you are unsure about a comparison, leave that item blank).*

Compared to…	The WF Tuckasegee River is…				
	Worse than average	Average	Better than average	Excellent	Among the very best
…other rivers within a 1 hr Drive	1	2	3	4	5
…other rivers in Western N. Carolina	1	2	3	4	5
…other rivers in the Southeast	1	2	3	4	5
…other rivers in the country	1	2	3	4	5

Single Flow Evaluations for West Fork By-Pass Section - Tuckasegee River Paddling Flow Study - June 29, 2001

		Question 5																				Question 6		Question 7		Question 8		Question 9		Question 10		Question 12	
		Rate Flow for Each Characteristic																				Would You		Please Rate		Skills Needed		Flow Preference		Flow Preference		How Many	
		-2 is totally unacceptable; -1 is unacceptable; 0 is neutral; 1 is acceptable; 2 is totally acceptable																				(Note 3)		Note (4)		Note (5)		Note (6)		Note (5)			
Participant	Craft (2)	Navigability		Technical Boating		Powerful Hydraulics		Play Areas		Overall challenge		Safety		Aesthetics		Length of Run		Number of Portages		Overall Rating		Paddle Flow Again		Whitewater Difficulty		To Paddle Section		Minimum Acceptable		Optimum Flow		Portages Did You Make	
Flow (1)		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Colburn	K	0	2	-1	2	0	2	0	1	1	2	0	1	-1	2	2	1	-1	1	0	2	3	4	4	4	I	I	3	2	4	3	4	0
Davis	K	1	2	1	2	-1	2	-1	1	0	2	0	1	1	2	1	2	0	2	1	2	2	4		3	I		4	2	5	3	0	0
Jackson	SOT	-1		1		0		0		-1		-2		2		2		-1		0		2				A		2		2		1	
Johns	K	1		1		1		1		1		1		2		2		1		1		3				A		3		4		3	
Kastorff	K	1	2	0	2	-1	2	1	2	0	2	1	0	1	2	2	2	1	2	1	2	3	4		4	A	A	4	2	5	3	0	0
Miller	K	0	2	1	2	1	2	0	2	0	2	0	2	1	1	1	2	0	2	0	2	3	4		4	A	A	4	2	4	3	4	0
Mongo	K	1	1	2	2	-2	1	0	1	0	2	2	2	0	1	0	2	0	1	1	2	3	4		4		A	3	3	4	3	1	1
Williams	K	1	2	0	2	0	2	-1	2	0	2	1	2		2	0	2	0	2	-1	2	2	4	4	4		A	4	2	5	3	4	0
Sum		4	11	5	12	-2	11	0	9	1	12	3	8	6	10	10	11	0	10	3	12	21	24	8	23			27	13	33	18	17	1
Average		0,5	1,8	0,6	2,0	-0,3	1,8	0,0	1,5	0,1	2,0	0,4	1,3	0,8	1,7	1,3	1,8	0,0	1,7	0,4	2,0	2,6	4,0	4,0	3,8			3,4	2,2	4,1	3,0	2,1	0,2

(1) Flows: 1 = 160 cfs; 2 = 250 cfs

(2) K =Kayak; SOT = Sit On Top

(3) 1 = Definitely No; 2 = Possibly; 3 = Probably; 4 = Definitely Yes

(4) 1 = I; 2 = II; 3 = III; 4 = IV; 5 = V; 6 = VI

(5) B = Beginner; N = Novice; I = Intermediate; A = Advanced; E = Expert

(6) 1 = Much Lower; 2 = Lower; 3 = No Change; 4 = Higher; 5 = Much Higher

West Fork By-Pass Section
Recreational Paddling Instream Flow Study
Written Comments
(1) Single Flow Survey

(No written comments on Comparative Flow Survey)

Tuckasegee River Paddling Flow Study
West Fork By-Pass Section – June 29, 2001
Written Comments – Single Flow Evaluations
(Questions correspond to those on Single Flow Evaluation Sheet)

Question 11: Using place names, please identify particularly challenging rapids or sections and rate their difficulty at this flow (using the International Whitewater Scale).

Flow # 1 – 160 cfs

Colburn – Big Slide (IV+), countless others (IV)
Davis – First Falls (V-), Gorge Section (IV)
Jackson – Took out after first big drop.
Johns – First Falls (IV) 100 yd below, 2nd Falls (III), Gorge (III-IV)
Kastorff – Falls (III+), Mid Falls Slide (III), Lower Canyon (III+).
Miller – Waterfalls 100 yards below put-in (IV), Gorge below C. Forest Bridge (IV)
Mongo – First Drop (IV+), Upper Section (III-IV), Gorge Section (III), below Gorge (II).
Williams – Waterfall (IV), Gorge (III-IV)

Flow # 2 – 250 cfs

Colburn – Big Slide (IV), High Turn Over (V).
Davis – High Turn Over (V), First Falls (V-).
Kastorff – Falls (IV), High Turn Over (IV), (IV+) with the tree.
Miller – Falls near put-in (IV), Gorge below Cull F. Bridge (IV).
Mongo – First Rapid (IV), High Turn Over (IV).
Williams – Falls (IV), Log Rapid (IV).

Question 13: Using place names, please identify rapids or sections you portaged and rate the difficulty of those portages (using your type of craft at this flow level). ***(5-Point Scale: 1 = Easy; 2 = Slightly Difficult; 3 = Moderately Difficult; 4 = Extremely Difficult)***

Flow # 1 – 160 cfs

Colburn – Wood (1) at five different locations.
Davis – NA
Jackson – NA
Johns – Tree (1), tree (1), tree (1).
Kastorff – NA
Miller -- ? (1), ? (1), ? (1), ? (1).
Mongo – Above Bridge, big tree in water (1).
Williams – Just for wood (2).

Flow # 2 – 250 cfs

Colburn – NA
Davis – NA
Kastorff – NA
Miller -- NA
Mongo – High Turn Over (1)
Williams – Log Rapid (2)

Question 14: Did you have any significant problems during your run (e.g., became pinned, wrapped a boat, had to swim, etc.)? Please provide a brief description and location of any incident.

Flow # 1 – 160 cfs

Colburn – NA
Davis – NA
Jackson – Swim. Half below waterfall.
Johns – NA
Kastorff – NA
Miller – No
Mongo – NA

Williams – No

Flow # 2 – 250 cfs

Colburn – Backendered at High Turn Over, Stuck in log sieve at High Turn Over.
Davis – NA
Kastorff – Stuck in two hole for a while. Fun! At High Turn Over. Sligh nose hit on the Falls.
Miller – Pinned, got off myself.
Mongo – Surfed in hole/not a big deal but I was in there, below High Turn Over.
Williams – If trees were gone, no problem.

Question 15: Provide any additional comments about this test flow below. If necessary, please use place names to identify specific locations.

Flow # 1 – 160 cfs

Colburn – Upper run = too much wood. 4-5 big trees, the rest would reorganize with high flow. Lower run = fun, easier and more open than upper. Slides were all scrapey. Flow was OK with wood. Way too low without wood.
Davis – Felt that wood would need to be removed for optimal paddling and safety. Once this is accomplished, a little more water would probably make this an excellent intermediate run.
Jackson – Too difficult for intermediate boaters on this section. Lots of danger from debris, undercuts, lots of trees in river bed.
Johns – Enough flow for a good paddler coming off the couch.
Kastorff – NA
Miller – Water was a little low; more water would make it less scrapey, clean up some of the lines. The logs in the river make it significantly more difficult. This would be a good upper intermediate run if the wood was taken out.
Mongo – I feel this would be an excellent resource for a first time creek experience. I think it would be better if the take-out was not the powerhouse, this seemed too long. It would be valuable in providing folks who paddle the local Nantahala and Tuckasegee a harder, more challenging option. More water would make it less boney.
Williams – Wood needs to be removed. I think this would provide a more even playing field for different level of boaters. Also, more lines would "open up" making the availability to use less or more water.

Flow # 2 – 250 cfs

Colburn – Awesome level. Awesome unique run. Falls were easier/cleaner. All slides more fun/less scrapey. Good play. Still had eddys. Lots of smiles. High Turn Over was harder and the log sieve dangerous.
Davis – This flow was perfect! Both sections got much cleaner. Upper was easier, lower was harder but better. With two logs removed from lower this run would be an awesome resource.
Kastorff – Great run at 350.
Miller – Excellent! This is a flow that good boaters will travel to do. Need to remove 2 big logs, everything else is manageable. One rapid below Cull. Falls Bridge (about 3rd down) has a dangerous log in it. Without that log, everything is pretty clean and easy to get around at this level. Good advanced river.
Mongo – This flow changed the user base. It was now a river I would travel to do on my own. Without wood, it could still be a river I would take a non-expert down, but with wood this was a harder run. It moved faster and was not boney. Overall I had a much better time and I think boaters of advanced to expert skill would travel here to boat. With the possibility of lower skill trips. This flow opens the river to more folks.
Williams – Great flow.

Single Flow Evaluations for Dillsboro Section - Tuckasegee River Paddling Flow Study - July 2-3, 2001

			Question 3																																Question 4			
			Rate Flow for Each Characteristic																																Would You			
			5 Point Scale -2 is totally unacceptable; -1 is unacceptable; 0 is neutral; +1 is acceptable; +2 is totally acceptable																																Note (4)			
			Navigability				Challenging Boating				Powerful Hydraulics				Play Areas				Overall Challenge				Safety				Aesthetics				Length of Run				Numberf of Portages				Overall Rating				Paddle Flow Again			
Participant	Craft (2)	Skill (3)																																				
Flow (1)			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
FA	DKY	B	2	2	1	2	0	0	1	0	0	0	0	0	0	0	0	1	0	2	1	0	2	2	2	1	2	2	2	2	1	2	1	1	2	2	1	2	2	2	2	1	3	3	3	3
BB	K-P	A	1	1	0	2	-2	1	0	2	-2	0	-1	1	-1	1	-1	1	-1	1	-1	1	1	2	2	2	0	1	1	0	1	1	0	1	0		0	0	-1	1	-1	1	1	3	1	2
MB	OC2	I	1	2	1	2	0	1	-1	1	0	0	-2	0	1	2	0	1	1	1	0	1	2	2	2	2	2	2	2	2	1	1	1	1	2	2	2	2	1	2	0	1	3	4	3	4
UB	OC2	I	2	2	1	2	0	1	-1	1	-2	0	-2	0	2	2	0	1	0	1	0	1	2	2	2	2	2	2	2	2	1	1	1	1	2	2	0	0	2	2	0	1	4	4	3	4
CB	Raft	N	1	2	-1	2	0	2	1	2	0	1	0	2	1	2	1	1	1	2	0	2	2	1	1	2	1	2	1	2	2	1	2		0	0	0	0	1	2	0	0	4	4	2	4
BBr	K-R	I	-1	2	0	2	-2	1	-1	1	-2	1	-2	1	1	2	2	1	-2	1	0	1	2	2	2	1	0	0	0	0	2	2	2	2	2	2	2	2	0	1	1	0	2	4	2	3
LC	Raft	B	1	2			1	1			1	1			1	1			0	1			0	2			2	2			1	1			1	1			1	1			4	4		
KC	K-P	E	2	2	1	2	1	1	-1	1	-2	0	-1	1	-1	1	-2	2	0	1	-1	2	0	2	1	2	1	2	0	2	2	2	1	2	2	2	2	2	0	1	0	2	2	3	2	4
JE	OC1	N	1	1	0	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	0	1	1	1		1	1	1	1	1	2	0	0		1	1	1	1	2	3	2	3
RF	OC2	I			0	2			0	1			0	1			0	0			1	0			1	1			2	2			2	2			1				1	1			4	4
NG	K	I	0	2	0	2	-2	-1	-2	-2	-2	-1	-2	-2	0	1	-1	1	-1	0	-2	-2	2	2	2	2	1	1	1	1	2	1	1	1	2	2	2	2	0	1	0	1	1	4	1	2
WG	DKY	B	1	2	1	2	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	2	2	1	1	2	2	1	1	1	1	0	0	0	0	1	1	1	1	4	4	3	3
NG	Raft	N	1	1	1	1	1	1	1	0	0	0	0	-1	0	1	-1	-1	0	1	-1	-1	1	2	1	0	2	1	1	1	2	1	1	1			0	0	1	1	1	0	3	4	2	4
MH	OC2	I	1	1	1	2	1	2	1	1	1	2	0	2	1	2	1	1	1	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	4	4	3	3
KH	DKY	N	1	2	1	0	1	1	1	0	1	2	1	1	1	1	0	-1	1	2	1	-1	1	1	1	-1	2	2	2	2	2	2	1	2	0	0	0	0	1	2	1	-1	3	4	2	2
JJ	SOT	I	2	2	2	2	2	2	2	1	2	2	2	0	2	2	2	0	2	2	2	1	2	2	2	-1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	4	4	4	3
BJ	OC1	A	2	2	1	2	1	1	0	1	0	0	0	1	1	2	1	1	0	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	4	4	4	4
SJ	Raft	N	1	2	1	1	0	2	0	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2	2	1	1	2	1	1	1	2	2	1	1	2	2	1	1	2	1	1	4	4	4	4
BK	DKY	I	1	2	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	2	2	2	1	1	1	1	1	2	2	2	0	0	0	0	1	1		1	4	4	3	4
RK	Raft	E	-1	1	-1	2	-1	1	-1	0	-2	0	-2	1	-2	1	-2	0	-1	1	-2	0	1	2	1	1	0	1	0	2	1	2	1	2	0	2	0	2	-1	1	-2	1	1	2	1	3
LK	OC2	B	1	2	0	1	1	2	1	1	0	1	0	1	0	2	0	1	1	1	-1	1	1	2	-1	1	0	1	0	0	0	2	1	0	0	2	1	2	1	2	0	1	3	4	1	4
LL	Raft	N	1	2	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	1	1	1	1	2	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	2	3	2	2
JL	Raft	B	2	1	1	2	0	1	0	-1	0	0	0	-1	1	0	1	-1	0	1	1	-1	2	2	2	2	2	2	2	1	2	1	2	1	0	1	2	2	1	1	2	-1	4	4	4	2
PL	K-C	E	1	1	0	2	1	1	1	1	0	0	0	1	-1		0	2	1		0	1	1		1	1	1		1	1	1		1	1	0		0	0	1		0	1	2	2	2	3
SL	K	I	1	2	1	1	1	2	1	1	0	0	0	0	1	2	1	1	1	1	1	1	1	2	2	1	2	2	2	2	1	2	2	2	0	0	2		1	2	1	1	3	4	3	4

			Question 3																																		Question 4			
			Rate Flow for Each Characteristic																																		Would You			
			5 Point Scale -2 is totally unacceptable; -1 is unacceptable; 0 is neutral; +1 is acceptable; +2 is totally acceptable																																		Note (4)			
			Navigability				Challenging Boating				Powerful Hydraulics				Play Areas				Overall Challenge				Safety				Aesthetics				Length of Run				Numberf of Portages				Overall Rating				Paddle Flow Again			
Participant	Craft (2)	Skill (3)																																						
Flow (1)			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
WL	C1	I	1	2	1	2	0	1	0	1	-1	0	0	0	0	1	0	1	0	1	1	1	2	2	2	2	2	2	2	2	1	0	1	2	0	0	0		1	1	1	1	3	4	3	4
MM	DKY	A	1	2	0	2	0	1	-2	1	-1	0	-2	1	1	2	-1	2	0	1	-1	2	2	2	2	2	1	2	0	2	0	0	-1	2	0				1	2	-2	2	3	3	1	4
JM	OC2	I	0	2	0	2	0	0	0	1	0	0	0	1	0	0	0	1	1	1	0	1	2	1	1	1	2	2	2	0	2	2	2	2	2	2	2	2	3	1	2	2	2	3	2	4
RM	OC2	I	1	2	1	2	0	1	0	2	2	0	1	1	1	1	1	1	-1	1	0	1	2	1	2	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	2	3	2	3
Rmi	K	I	0	1	0	1	0	1	0	1	0	2	0	2	0	2		1	0	1		2	2	1	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	2	0	1	2	4	2	4
AO	C1	A	2	2	0	2	1	1	0	1	0	0	0	0	0	1	0	1	0	0	0	1	2	2	2	2	-2	-1	-1	-1	1	2	1	1	0	0	0	0	1	1	0	1	3	3	1	3
DO	K	I	0	2	-2	2	-1	0	-2	1	-2	0	-2	0	-1	0	-2	0	-1	0	-2	0	2	2	-1	1	2	2		2	0	-2	-2	2	0	2			-1	1	-2	1	2	3	1	3
TP	OC1	N	1	1	1	2	1	2	1	2	1	1	0	2	1	2	1	2	1	2	1	2	2	2	2	2	1	2	2	2	2	0	0	0	0	0	1	2	1	2	3	4	2	4
AP	OC1	I	1	1		2	0	2		1	0	1		1	0	2		1	0	1		1	2	2		2	0	0		1	1	1		1	2	2		2	0	1		1	2	3		3
AJP	OC2	A	1	2	1	2	0	2	1	0	0	1	0	0	1	2	0	0	0	1	-1	0	0	2	2	1	0	2	2	1	1	2	2	1	2	2	2	2	1	1	0	0	2	3	1	3
DR	OC2	B	1	2	1	2	0	1	0	2	0	1	0	2	1	1	0	2	1	1	0	1	1	2	1	2	2	2	1	2	1	2	1	2	0	2	1	2	1	2	1	2	4	4	2	4
BR	C1	I	-1	1	0	1	0	1	-2	2	-1	1	-2	2	0	1	-1	2	0	1	-1	2	1	1	1	2	0	1	1	1	2	1	1	2	2	2	2	2		1	0	2	2	3	2	4
CB	OC1	I	1	2	1	1	-1	0	1	-1	-2	-2	-2	-2	-1	0	-1	-1	-1	1	0	-1	2	2	2	1	0	1	-1	-1	1	1	1	1	2	2	2	2	0	2	1	-1	2	4	3	1
LSL	OC1	A	2	2	1	2	1	1	0	1	1	1	-1	1	1	1	0	1	0	1	-1	1	2	2	2	1	0	1	0	1	2	2	0	2	0	2	2	2	1	2	0	1	4	4	2	4
JAW	Raft	I	1	1	1	2	-1	0	0	-1	-1	0	0	0	0	0	0	-1	0	1	0	0	1	2	1	0	1	1	1	0	1	1	1	1	0	0			0	1	1	0	3	3	3	3
DW	OC2	I	1	2	0		1	2	0		-1	1	0		0	1	0		0	1	0		2	2	2		0	0	0		1	0	1		2	2	1		1	2	0		2	3	2	
RW	OC2	I	1	2	1	2	0	0	0	1	0	1	0	1	0	1	0	2	0	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	3	4	3	4
SW	K-R	A	1	1		-2	1	1		-2	-1	0		-2	0	1		-2	1	1		-2	2	1		-2	2	2		-2	2	1		-2	0	2		-2	2	0		-2	4	4		3
WW	OC2	I	1	2	0	2	2	2	1	1	0	1	0	2	1	2	1	1	0	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	0	1	2	2	2	2
JW	Raft	B	1	1	1	1	1	1	1	-1	0	0	0	0	0	1	0	0	1	2	1	-1	1	1	2	0	2	2	2	1	1	1	1	1	1	0	0	0	1	1	1	-1	4	3	3	2
Sum			42	74	21	69	11	46	5	29	-9	23	-15	25	17	53	2	30	10	48	3	29	66	75	64	54	52	63	48	52	59	58	51	59	41	52	41	41	37	62	20	35	125	154	98	140
Mean			1,0	1,7	0,5	1,6	0,3	1,0	0,1	0,7	-0,2	0,5	-0,4	0,6	0,4	1,2	0,1	0,7	0,2	1,1	0,1	0,7	1,5	1,7	1,5	1,3	1,2	1,5	1,2	1,2	1,3	1,3	1,2	1,4	1,0	1,3	1,1	1,1	0,9	1,4	0,5	0,8	2,8	3,5	2,3	3,3
Median			1,0	2,0	1,0	2,0	0,0	1,0	0,0	1,0	0,0	0,0	0,0	1,0	0,5	1,0	0,0	1,0	0,0	1,0	0,0	1,0	2,0	2,0	2,0	1,0	1,0	2,0	1,0	1,0	1,0	1,0	1,0	1,5	1,0	2,0	1,0	2,0	1,0	1,0	1,0	1,0	3,0	4,0	2,0	3,0
Mode			1,0	2,0	1,0	2,0	0,0	1,0	1,0	1,0	0,0	0,0	0,0	1,0	1,0	1,0	0,0	1,0	0,0	1,0	1,0	1,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	1,0	2,0	1,0	2,0	0,0	2,0	2,0	2,0	1,0	1,0	1,0	1,0	2,0	4,0	2,0	4,0
	(1) Flow 1 = 554 cfs; Flow 2 = 821 cfs; Flow 3 = 485 cfs; Flow 4 = 1013 cfs																																												
	(2) K = Kayak; P = Play; R = River; C = Creek; C1 = Decked Canoe Solo; OC1 = Open Canoe Solo; OC2 = Open Canoe Tandem; Ra = Raft; Dky = Inflatable Kayak (ducky)																																												
	(3) B = Beginner; N = Novice; I = Intermediate; A = Advanced; E = Expert																																												
	(4) 1 = Definitely No; 2 = Possibly; 3 = Probably; 4 = Definitely Yes																																												

	Question 5				Question 6				Question 7				Question 8				Question 10																	
	Please Rate				Skills Needed				Flow Preference				Flow Preference				Please Estimate																	
	Note (5)				Note (3)				Note (6)				Note (6)																					
Participant	Whitewater Difficulty				To Paddle Section				Minimum Acceptable				Optimum Flow				# of Hits				# of Hits Acceptable				# of Stops				# of Drags				# of Portages			
Flow (1)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
FA	1	1	1	2	B	B	B	N	2	2	2	1	4	3	4	2	20	5	15	1	100	100	100	100	2	2	6	0	0	0	3	0	0	0	0	0
BB	2	2	2	2	B		B		4	3	4	2	5	4	5	3	20	6	4	0	3	6	2	2	4	2	3	0	0	0	0	0	0	0	0	0
MB	2	2		2	N	N	B	I	3	3	4	2	4	3	4	2	12	3	10	8	10	10			0				1				0			
UB		1		2	B	N	B	I	2	3	4	2	5	3	4	2	12	3	10	8		10		8	0				1		0	0	0		0	0
CB	2	2	2	2	B	N	B	B	3	2	4	1	4	3	5	2	43	14	67	16	20	20	15	15	4	1	16	1	2	1	1	0	0	0	0	0
BBr	2	2		2	N	N	N	I	4	2	3	2	4	3	4	2	40	5	30	10	5	5	5	5	3	1	0	1	0	0	0	0	0	0	0	0
LC	1	1			N	N			4	3			4	3			43	3			3	3			4	2			2	1			3	2		
KC	1	2	2	2	B	B	B	N	3	3	3	2	5	4	4	3	20	5		2	5	5	5	5	1	0	0	0	0	0	0	0	0	0	0	0
JE	2	2	2	2	N	N		N	3	2	3	2	3	2	4	2	6	3	20	3					1	0	2	0	0	0	0	0	0	0	0	0
RF				2			B	N			4	3			4	3			20	8			5	5			6	3			3	0				0
NG	2	2	2	2	B	B	B	N	4	3	4	2	4	4	5	2	20	3	5	0	10	10	10	10	6	1	1	0	0	0	0	0	0	0	0	0
WG	2	3	2	2	N	N	N	N	2	2	3	1	4	3	5	2	15	13	26	8	9	10	10	5	7	2	7	0	2	1	0	0	0	0	0	0
NG	2	2	1	1	N		B	N	4		4	2	4		5	2	30		47	15			30		9		7	0	5		3	0	0		0	0
MH	1	2	2	2	N	N	B	B	2	2	4	1	4	3	4	2	12	6	24	3	20	20	20	20	0	0	1	0	0	0	0	0	0		0	0
KH	2	2	1	1	N	N	B	N	4	3	4	2	4	3	5	2	50	29	75	20	6	6	6	6	4	3	8	4	0	0	1	0	0	0	0	0
JJ	2	2	2				B	I	3			1		3		2	10	2	10	6	10	6	10	6	1	1	3	2	0	0	0	0	0	0	0	0
BJ	2	2	2	2	B	N	B	I	3	2	3	2	4	3	4	2	4	4	10	4	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0
SJ	1	3	2	2	B	N	N	N	3	3	4	4	4	3	4	4	40	5	68	15	30	10	20	20	3	2	16	2	1	1	1	1	0	0	0	0
BK	2	3	2	2	N	I	N	N	2	2	3	2	3	3	5	2	15	13	26	6	10	10	10	10	7	2	7	1	2	1	0	0	0	0	0	0
RK	2	2	1	2	B	B	B	N	4	3	4	2	5	4	5	3	20	6	25	0	2	1	2	2	10	2	8	1	2	0	4	0	0	0	0	0
LK	1		1		B	B	N	N	3	3	4	2	4	3	4	2	20	5	40	3	20	20	20	20	2	0	3	0	0	0	0	0	0	0	0	0
LL	1	2		2				N	3	3	3	2	4	3	4	2	20	5	50	6	5	5	5	5	3	1	12	2	1	0	2	2	0	0	0	0
JL	1	2	1	1	B	B	B	B	2	2	2	3	3	2	3	1	30	25	46	15	30	30	46	46	9	1	7	0	5	1	2	0	0	0	0	0
PL	2		2	2	B		B	N	3	2	3	2	4	3	4	3	5	3	7	2	5	5	5	5	0	0	1	0	0	0	0	0	0	0	0	0
SL									3	2	3	2	5	3	4	2	12	3	10	5	3	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0

	Question 5				Question 6				Question 7				Question 8				Question 10																	
	Please Rate				Skills Needed				Flow Preference				Flow Preference				Please Estimate																	
	Note (5)				Note (3)				Note (6)				Note (6)																					
Participant	Whitewater Difficulty				To Paddle Section				Minimum Acceptable				Optimum Flow				# of Hits				# of Hits Acceptable				# of Stops				# of Drags				# of Portages			
Flow (1)	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
WL		2	2	2		N		N	3	3	3	2	5	4	4	3	10	7	12	5	3	3	3	3	0	0	2	0	0	0	0	0	0	0	0	0
MM	2	2	1	2	N	N	B	N	2	2	5	1	4	4	5	3	12	2	15	4	8	2	0	4	2	1	2	0	0	0	2	0	0	0	0	0
JM		2	2	2	B	N	B	N	3	2	3	1	4	2	5	3	12	4	14	5	10	10	10	10	1	0	1	0	0	0	0	0	0	0	0	0
RM					B	B	B	N	3	2	3	2	4		4		10	4	14	4	10	10		15	1	0	1	0	0	0	0	0	0	0	0	0
Rmi	2				N			N	3	2	4	2	4		5	2	100	10		7					6	2	7	2	0	0	0	0	0		0	0
AO	2	2	1	2	B	B	B	N	3	3	1	2	3	4	5	2	10	10	30	5	10	10	10	8	0	0	6	0	0	0	0	0	0	0	0	0
DO	2	2	1	2	N	N	N	N	4	4	5	2	4	4	5	2	10	2	20	3	2		5	2	0		0	0	0	0	0	0	0	0	0	0
TP	2	2	2	2	N	N	N	N	3	3	4	2	4	3	4	3	15	5	10	5	10	5	5	5	4	5	5	0	0	2	2	0	0	0	0	0
AP		2		2	N	N		N	3	3		2	4	4		2	20	5		3	5	5		5	0	1		0	0	0		0	0	0		0
AJP	1		1		B	B	N	N	3	3	4	2	4	3	5	2	20	5	40	3	20	20	20	20	2	0	3	0	0	0	0	0	0	0	0	0
DR	1	1	1	`	B	B		B	3	3	4	2	3	4	5	3	20	8	10	3					2	1	2	0	0	0	0	0	0	0	0	0
BR	2	2	2	2	N	I	N	I	3	2	3	1	4	4	5	3	12	6	15	6	5	5	5	5	3	2	5	1	0	0	0	0	0	0	0	0
CB	2	2	2	2	N	N	B	N	2	2	3	1	4	4	4	2	10	10	10	10	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0
LSL	2	2	2	2	N	N	B	N	3	2	3	1	4	3	5	2	6	3	3	3	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0
JAW	1				B		B	N	3	2	4	2	4	4	4	2	30	25	46	15					9	1	7	0	5	1	2	0	0	0	0	
DW	2	2	2		N	N	N	I	3	2	4	1	5	3	5	2	7	0	20	1	2	2	2	2	0	0	2	0	0	0	0	0	0	0	0	0
RW	2	2	2	2	B	N	B	N		2		2	4	3	5	3	4	2	20	1	10	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0
SW	2	2		2		N		B	3	2		1	3	4		2	3	1		0	20	26		36	0	0		0	0			0	0	0		0
WW	2	2	2	2	N	N	N	B	3	3	4	1	4	3	4	2	12	6	24	3	20	20	20	20	0	1	1	0	0	0	0	0	0	0	0	0
JW	1	1	1	1	B	B	B	B	3	2	3	2	4	3	4	2	30	25	46	14					9	1	7	0	5	1	2	0	0	0	0	0
Sum	64	72	54	66					129	104	139	79	173	134	182	99	872	309	994	264	501	490	490	514	119	38	165	20	34	10	28	3	3	2	0	0
Mean	1,7	1,9	1,6	1,9					3,0	2,5	3,5	1,8	4,0	3,3	4,4	2,3	20	7	25	6	14	13	14	14	3	1	4	0	1	0	1	0	0	0	0	0
Median	2,0	2,0	2,0	2,0					3,0	2,0	4,0	2,0	4,0	3,0	4,0	2,0	15	5	20	5	10	10	10	8	2	1	3	0	0	0	0	0	0	0	0	0
Mode	2,0	2,0	2,0	2,0					3,0	2,0	4,0	2,0	4,0	3,0	4,0	2,0	20	5	10	3	10	10	5	5	0	0	0	0	0	0	0	0	0	0	0	0
	(5) 1 = I; 2 = II; 3 = III; 4 = IV; 5 = V; 6 = VI																																			
	(6) 1 = Much Lower; 2 = Lower; 3 = No change; 4 = Higher; 5 = Much Higher																																			

	Comparative Evaluations for Whittier Section - Tuckasegee River Paddling Flow Study - July 2-3, 2001																																		
				Q1	Question 2													Question 3														Question 4		
					Characteristics that Can Affect Satisfaction													Evaluate Flows - 5 Point Scale														Overall Evaluation		
					Scale of 1 (Not Important to 5 (Very Important)													-2 to +2														Of Flows		
																		-2 is Totally Unacceptable																	
																		-1 is Unacceptable																	
																		0 is neutral																	
																		+1 is Acceptable																	
																		+2 is Totally Acceptable																	
			Paddle	Times Boated Whittier	Number of Rapids	Difficulty of Rapids	Drive Distance to River	Accessibility	Shuttle Availability	Crowding	Weather	Water Temperature	Attractive Scenery	Water Quality	Thrilling Experience	Safe Trip	Good Guide	cfs														5-Pt Scale -2 to +2	cfs	Estimate Optimal cfs
Participant	Craft	Skill	All															400	500	600	700	813	900	985	1100	1200	1300	1400	>1400	813	985	
	(1)	(2)	Flows	(3)	See Note (4)																														
1	K-R	E	y		1	1	1	1	1	1	1	1	1	1	1	1	1					-2	-2							1	1	
2	SOT			2	3	4	2	4	5	5	4	3	3	4	4	3	1	2	2	2	2	2	2	2	2	2	2	2	2	1	0	
3	Raft	I	y	2	3	3	2	2	3	3	3	1	3	3	2	5	2	-1	-1	-1	0	1		1	1					1	1	1100
4	Raft	N	y	1	4	3	3	4	4	3	3	4	3	3	3	4	3					2		1						2	1	
5	K-R	B	y	2	5	4	3	3	4	2	2	2	4	4	5	4	5					o	1	1						0	1	
6	Raft	A	y	2	3	3	3	2	1	4	2	2	4	4	3	5	2		-2	-2	0	1	1	1	1				2	1	1	
7	K	I	y	1	3	3	3	3	1	3	1	1	3	3	3	2	1							2						-1	2	
8	OC1	I	y	2	3	5	3	2	2	5	2	2	5	2	1	5	2					1		1						1	1	
9	K-P		y	1	3	3	3	2	1	4	1	1	4	4	3	3	1	-2	-2	-2	-1	1	1	1	2	2	2	2	2	1	2	
10	K-R	I	y	1	4	4	5	5	1	5	2	2	4	5	1	5	5						1		2					1	2	
11	K-P	I	y	2	3	2	4	4	4	5	2	4	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
12	C1-P	A	y	1	4	3	5	5	1	4	1	1	3	3	3	5	5					0		2						1	2	
13	K-R	A	y	2	5	5	5	5	5	5	3	5	3	5	5	5	5					0		1						0	1	
14	K-R	E	y	1	3	4	2	3	1	2	5	2	2	4	4	4	5					-2		0						-1	0	1700
Sum				**20**	**47**	**47**	**44**	**45**	**34**	**51**	**32**	**31**	**44**	**47**	**40**	**53**	**39**	**0**	**-2**	**-2**	**2**	**5**	**5**	**14**	**9**	**5**	**5**	**5**	**7**	**9**	**16**	**2800**
Mean				**1,5**	**3,4**	**3,4**	**3,1**	**3,2**	**2,4**	**3,6**	**2,3**	**2,2**	**3,1**	**3,4**	**2,9**	**3,8**	**2,8**	**0,0**	**-0,4**	**-0,4**	**0,4**	**0,5**	**0,7**	**1,2**	**1,5**	**1,7**	**1,7**	**1,7**	**1,8**	**0,6**	**1,1**	**1400**
Median				**2,0**	**3,0**	**3,0**	**3,0**	**3,0**	**1,5**	**4,0**	**2,0**	**2,0**	**3,0**	**3,5**	**3,0**	**4,0**	**2,0**	**0,0**	**-1,0**	**-1,0**	**0,0**	**1,0**	**1,0**	**1,0**	**1,5**	**2,0**	**2,0**	**2,0**	**2,0**	**1,0**	**1,0**	**1400**
	(1) K = Kayak; P = Play; R = River; SOT = Sit On Top Kayak; OC-1 = Solo Open Canoe; C1 = Solo Decked Canoe																																
	(2) B = Beginner; N = Novice; I = Intermediate; A = Advanced; E = Expert																																
	(3) 1 = 0; 2 = 1-10; 3 = 11-20; 4 = 21-30; 5 = >30																																

				Q1	Question 2												Question 3												Question 4	
					Characteristics that Can Affect Satisfaction												Evaluate Flows - 5 Point Scale												Overall Evaluation	
					Scale of 1 (Not Important to 5 (Very Important)												-2 to +2												Of Flows	
				mes Boated Whittier																								5-Pt Scale -2 to +2	Estimate Optimal cfs
																	-2 is Totally Unacceptable													
																	-1 is Unacceptable													
																	0 is neutral													
																	+1 is Acceptable													
																	+2 is Totally Acceptable													
			Paddle	mber of Rapids													cfs												cfs	
				fficulty of Rapids																										
				ive Distance to River																										
				ccessibility																										
				uttle Availability																										
				owding																										
				eather																										
				ater Temperature																										
				tractive Scenery																										
				ater Quality																										
				rilling Experience																										
				fe Trip																										
				od Guide																										
	(4) Scale - 1 = Not Important; 3 = Somewhat Important; 5 = Very Important																													

	Question 5 Specify Flows For						Question 6 Varienty of Flows For			Question 7 Recommend To Others		Question 8 Compare to Other Rivers			
	Minimal Acceptable	Optimum	Standard Trip	High Challenge	Safety	Only One Flow Level	Different Experiences	Different Skill/Craft	Variety Not Important	Standard Trip?	High Challenge Trip?	Within 1 Hour	In Western NC	In Southeast	In the USA
Participant	**Flows in cfs**						**See Note (5)**					**See Note (6)**			
1	400	400	400	400	1100	400			n	y	n	1	1	1	1
2	700	700	800	800	1100	600	1	3		n	n	2	1	2	1
3	600	1100	900		1100		3	3		y	n	1	1	1	1
4	700	850	850			850			n	y	n				
5	700	1000	1000	1100	1000	1000	3	4		y	n				
6	813	1300	1300	4100		813			n	y	n	2	2	2	2
7	900	1050	1000						n	y	y		1	1	
8									n	y	n	1	1	1	1
9	800	1300	1000	1400		1100	2	2		y	y	3	1	1	1
10	900	1100	1100			1100			n	y		2	1	1	1
11	700		800	1100	1100	1100	1	3		n	n	1	1	1	1
12	813	1008	1008	1008	1008	1008	1	1		y	n	2	2	1	1
13	813	1100	1100	1100	1100	1100	3	4		n	n	1	1	1	1
14	900	1900	1100	3100	12100	12100			n	n	n	1	1	1	1
Sum	**9739**	**12808**	**12358**	**14108**	**19608**	**21171**	**14**	**20**				**17**	**14**	**14**	**12**
Mean	**749**	**1067**	**951**	**1568**	**2451**	**1925**	**2,0**	**2,9**				**1,5**	**1,2**	**1,2**	**1,1**
				987	**1073**	**907**									
Median	**800**	**1075**	**1000**	**1100**	**1100**	**1008**	**2,0**	**3,0**				**1,0**	**1,0**	**1,0**	**1,0**

(5) 5-Point Scale; 1 is Not Important; 2 is Slightly Important; 3 is Moderately Important; 4 is Very Important; 5 is Extremely Important

(6) 5-Point Scale: 1 is Worse than Average; 2 is Average; 3 is Better than Average; 4 is Excellent; 5 is Among the Very Best

	Question 5						Question 6			Question 7		Question 8																						
	Specify Flows For						Varienty of			Recommend		Compare to																						
							Flows For			To Others		Other Rivers																						
	Minimal Acceptable	Optimum	Standard Trip	High Challenge	Safety	Only One Flow Level	Different Experiences	Different Skill/Craft	Variety Not Important	Standard Trip?	High Challenge Trip?	Within 1 Hour	In Western NC	In Southeast	In the USA																			