
BOATING FEASIBILITY ASSESSMENT

Final Document

**LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637**

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Notice!

This report and the accompanying maps consider potential boating, scouting, and portaging options based upon assessments conducted in June 1999 and July 2000. They do not identify or endorse specific boating, scouting, or portaging options for future boaters. All boaters need to make their own decisions about how to scout, run, and/or portage during any on-river boating activities.

SECTION 1: INTRODUCTION

Public Utility District No. 1 of Chelan County (Chelan PUD) owns and operates the Lake Chelan Hydroelectric Project (FERC Project No. 637) on the Chelan River in north central Washington. The project, originally licensed in 1926, consists of a 40-foot high concrete gravity dam, a 2-mile long steel and concrete penstock, and a powerhouse. Chelan PUD is permitted to operate the project according to an existing FERC license issued in 1981 and set to expire in 2004. Chelan PUD intends to seek a new federal license to operate the project and has begun the “relicensing” process. This includes conducting studies to determine if the project can be operated to minimize impacts to, or create benefits for, non-generating resources such as water quality, fisheries, and recreation.

The Chelan River flows approximately four miles from the outlet of Lake Chelan into the Columbia River, providing about three miles of low gradient braided river, one-third-mile of higher gradient water that includes the “Gorge” featuring several significant rapids, and one-half mile of low gradient water that extends to the powerhouse tailrace and the Columbia River (see Map 2-1).

The Chelan River Bypass Reach is dry most of the year except where ground water infiltration enters the river. Spill releases at the project's dam generally occur in June or July as snowmelt from the North Cascade mountains feed into Lake Chelan and the storage capacity of Lake Chelan exceeds the hydraulic capacity of the Project. Depending on the amount of snow-pack and weather conditions, flows in the Chelan River during the spring/summer seasons can range from 2,000 to 15,000 cfs. The Project is managed to not exceed a maximum reservoir (Lake Chelan) elevation of 1,100 feet, and to minimize or avoid extremely high discharges down the river during the reservoir refill period.

While the upstream waters of 50-mile long Lake Chelan provide well-known recreational resources, the bypass reach has received far less attention from recreationists. Access to the bypass reach is difficult, particularly in the Gorge. Although a road runs along the canyon, it only approaches the river in a few places (see Map 2-1).

As part of Chelan PUD’s relicensing process, whitewater boaters have expressed interest in paddling opportunities on the bypass reach, particularly in the Gorge. Although mid-summer spill flows are available in the river, these appear too high for boating. Chelan PUD has agreed to work with whitewater boating organizations such as American Whitewater to assess whether lower flow releases could provide boating opportunities on the bypass reach.

Consultants were contracted to help with the assessment, which occurred in two phases in 1999 and 2000. This report summarizes information from both phases, incorporating information from the June 1999 on-land assessment report (Shelby & Whittaker, 2000) and fully reporting on the July 2000 on-river assessment. The report provides a description of the river relative to potential boating opportunities, then describes and evaluates boating feasibility at several different flow levels. The report contains sections on the study area, methods, results and

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discussion, and recommendations for relicensing negotiations. An appendix includes a sample of photos taken during the assessment.

SECTION 2: STUDY AREA

The Chelan River begins below the dam and continues for approximately 4 miles until it joins the tailrace of the powerhouse near the Columbia River (Map 2-1). For planning purposes, Chelan PUD has divided the bypass reach into four distinct sections, as shown on the map.

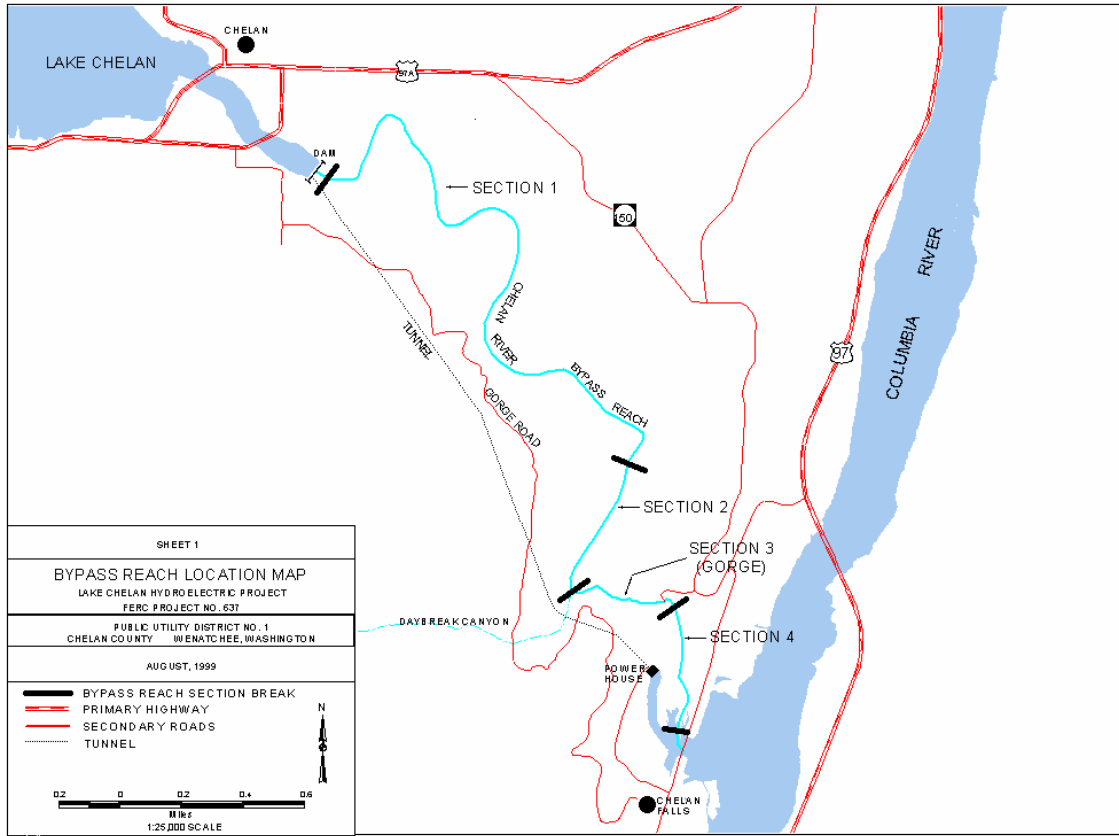
Section 1 is 2.29 miles long, and is characterized by a relatively wide flood plain, low gradient (approximately 55 feet/mile), and substrate comprised of large cobble and boulders.

Section 2 is 0.75 mile long and is a transition zone between the wider floodplain and the Gorge. It is characterized by a narrow channel, canyon walls, moderate gradient (approximately 57 feet/mile), and larger cobble and boulder substrate than Section 1.

Section 3 is “Chelan Gorge,” and is 0.38 mile long. The canyon walls in this section are very steep and narrow, and the gradient of the channel is steep (approximately 480 feet/mile). The channel is characterized by cataracts from 5 to 20 feet high, numerous cascades, bedrock chutes, and large, deep pools. The substrate is very large, with some boulders exceeding 20 feet in diameter.

Section 4 is located below the Gorge area and is 0.49 mile long. It is characterized by a wide flood plain, gravel/cobble/boulder substrate, and low gradient (approximately 22 feet/mile). This section extends from the bottom of the Gorge downstream approximately 2,600 feet to the confluence of the powerhouse tailrace.

For the purposes of this report, the Gorge (Section 3) has been further divided into three areas based on the type of specific rapids. These three reaches have been labeled “Entrance Exam” (a complex, multi-drop rapid at the start of the Gorge; Map 4-1), the “Central Gorge” (the series of drops downstream; Map 4-2), and the “Lower Gorge” (the lower gradient boulder gardens at the end of the Gorge; Map 4-2). Larger scale maps of these areas are presented in the Results and Discussion sections of this report.



Map 2-1: Chelan River and vicinity, including Chelan PUD section designations

SECTION 3: METHODS

The boating assessment for Chelan River was conducted in two stages. The first was an on-land assessment conducted in June 1999; the second was an on-river assessment conducted in July 2000. Both assessments were controlled flow investigations, which are characterized by manipulation of the independent variable, flow. The idea is to release known quantities of water and then describe and evaluate conditions for various kinds of recreation. In this case, the focus was on whitewater boating opportunities using hard shell kayaks, although the study also offered information about other potential recreation opportunities in or along the river. Controlled flow studies are a commonly used method for examining flow-recreation relationships, particularly on short bypass reaches of river (Shelby et al., 1992; Giffen & Parkin, 1993; Whittaker et al., 1993; Shelby et al., 1998).

3.1 On-Land Assessment (June 1999)

The June 1999 assessment was conducted from land, observing flows from viewpoints on the canyon rim and in the Gorge. The general objectives of this phase were to 1) determine if an on-river boating study was feasible, and 2) narrow the range of flows that should be examined by boaters. The on-land phase was particularly focused on assessing safety and management issues associated with conducting the on-river phase.

The assessment was conducted on June 2, 1999. Participants included:

John Gangemi, American Whitewater Association
Doug Whittaker, Confluence Research and Consulting
Bo Shelby, Confluence Research and Consulting
Gregg Carrington, Chelan PUD
Michelle Smith, Chelan PUD

The participants observed the bypassed reach of the river at three different flows (490 cfs, 245 cfs, and 367.5 cfs, in that order). The study began with a request of 500 cfs (an actual release of 490 cfs was provided). From the vantage point of the canyon rim, this flow appeared too high for boating some of the drops in the Gorge, and suggested that higher releases were not necessary to observe from land. This led to a second request for 250 cfs (an actual release of 245 cfs was provided), which appeared too low for some rapids, and led to a final request for about 375 cfs (an actual release of 367.5 cfs was provided). The actual flows provided varied slightly from target requests because spillway gates open in discrete increments and flows could only be estimated at the time of the assessment. Actual flows were calculated post-assessment by Chelan PUD. The time it takes for water levels to stabilize at each flow level (about an hour and a half) required a full day for the assessment.

Gangemi and Shelby provided the expertise regarding kayaking feasibility; both have extensive experience running Class V whitewater.¹ They observed different flows from various vantage

¹ Whitewater difficulty is rated by convention according to the American Whitewater International Scale of River Difficulty (see Appendix A for the full scale). This scale ranges from Class I (“easy”) to Class VI (“extreme and

points along the bypass reach, and assessed whether the various rapids were boatable, scoutable, or able to be portaged.

Whittaker and Shelby were responsible for documenting information with notes and 35 mm slides. Carrington and Smith also took photographs and video footage. Taken together, this information was used to develop schematic maps of the Gorge which identify major rapids, and then describe possible runs as well as scouting and portaging options at different flow levels. The maps, with modifications based on the on-river assessment, are provided in this report.

The assessment included brief stops at potential put-in and take-out locations, but focused on observations from vantage points along the bypass reach, particularly in the Gorge. All three flows were observed from the two main overlooks along the Gorge Road, above “Daybreak Canyon” and at “Arrowhead Point” (Map 4-1 and Map 4-2). Participants also climbed down to river-level at the mouth of Daybreak Canyon at the 367.5 cfs flow, and to the area between “Super Boof Falls” and “Throne Falls” in the Central Gorge as flows were in transition from 490 to 245 cfs. They did not observe the 490 cfs flow from river-level.

The on-land assessment phase suggested the bypassed reach of the Chelan River offers boating possibilities for highly skilled Class V paddlers,² even though some specific rapids in the Gorge may be unrunnable. It recommended conducting an on-river assessment the following year, and suggested that optimal flows would likely occur between about 300 and 500 cfs. The on-land report also made several recommendations for conducting an on-river study; virtually all were incorporated into the on-river study design described below.

3.2 On-River Assessment (July 2000)

The July 2000 assessment featured a team of six kayakers boating the river at three different flows on consecutive days. The primary objectives of this phase were to 1) determine if boating on the river was feasible, and 2) evaluate different flow levels for different types of opportunities. To meet these objectives, we collected information about how flow levels affected a variety of flow-dependent attributes, including boatability, whitewater challenge, availability of whitewater play areas, safety, and aesthetics. Additional information was also collected about some boating management issues (e.g., facility needs), and the likely importance of Chelan River boating opportunities from a regional and national perspective.

The assessment was conducted July 8-10, 2000. Kayaking participants were invited by American Whitewater. Their names, ages, occupations, and home towns are listed below:

exploratory”). Class V is defined as “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.” In the west, Class VI generally refers to unrun rapids (Amaral, 1990). Rapids may have different ratings at different flows.

² Boaters self-rate their abilities in comparison to the classes of rapids they have successfully run.

Name	Age	Occupation	Home town
Rick Williams	47	Aerospace engineer	Seattle, WA
Britton Gentry	33	Environmental engineer	Portland, OR
Forrest Hubler	27		Hood River, OR
Tracy Clapp	33	Paddle manufacturing representative	Index, WA
John Gangemi	39	American Whitewater conservation director	Bigfork, MT
Bo Shelby	52	Professor/research consultant	Corvallis, OR

Based on survey information, these boaters averaged over 18 years of kayaking experience and spend an average of 76 days per year boating whitewater rivers. While all six were self-rated advanced or expert boaters (and all were invited for their ability and experience running Class V whitewater), they also reported diverse interest running technical and “big water” rivers, as well as playboating. Appendix B contains copies of the survey, including frequency distributions or summary statistics for questions about participants’ whitewater preferences.

Several Chelan PUD and other agency staff also participated in the study, coordinating logistics, managing flow operations, providing safety and rescue support if needed, and closing the gorge road to casual observers to minimize the risk of safety problems for boaters or observers. The United States Geological Survey (USGS) also conducted discharge measurements to verify flows during the study. A complete list of agencies, participating staff, and their responsibilities during the study is provided in Appendix D.

The participants boated the river at three different flows (273 cfs, 391 cfs, and 475 cfs, on July 8, 9, and 10 respectively). The initial flow was based on results from the on-land phase and was designed to identify a low boatable flow (as well as ensure the greatest margin of error for scouting and portaging if needed). The initial request was for 275 cfs, and USGS measurements indicated 273 cfs was released. Requested flows for July 9 were 375 cfs (391 cfs was provided), while 475 cfs was requested and provided on July 10.

Boaters ran all four segments of the river, putting-in just below the dam and taking-out at the confluence of the Chelan and the Columbia at Powerhouse Park. On segments 1, 2, and 4, the boaters made few if any stops for breaks or scouting. In the Gorge (Segment 3), boaters stopped to scout all of the major rapids before deciding to run or portage them. In general, it took about four hours from put-in to take-out at each of the three flows; about 1.5 to 2.0 hours of that time was spent scouting, portaging, providing safety for other boaters, or retrieving equipment after minor mishaps.

Video and still photographers were located along the river during the study. Video stations were established for all three flows at four locations:

- Roadside overlook in Segment 1
- River-level at Entrance Exam (mouth of Daybreak Canyon)
- Near river-level between Super Boof Falls and Throne Falls in the Central Gorge
- Overlook from on top of the Old Highway Bridge facing upstream

In addition, roaming video crews recorded footage from Arrowhead Point overlooking the central Gorge, and at river-level locations below Throne Falls and both upstream and

downstream of the old Highway Bridge. Still photographers also took pictures from many of these locations, although consistent stations for all three days were not formally established as for video. Appendix F contains photos from the study; a video with footage from the study is also available from the Chelan PUD relicensing department.

Safety and liability were key concerns throughout the study. Boaters carried first aid and swiftwater rescue equipment appropriate to the gorge, and additional emergency medical equipment was also available from Chelan PUD and Chelan County, if needed. County and state law enforcement officials were available through the study, and a private security firm was hired by Chelan PUD to prohibit public access along the Gorge road (thus minimizing rockfall risks above boating and scouting areas). Communications between boaters and observers were available via cell phone and line-of-sight radios throughout the study. All boaters signed liability waivers before the study; a copy of the waiver is provided in Appendix F.

Following each day's run, boaters filled out "post-run surveys" that asked about details of the trip and flow evaluations. Survey results are a primary source of information for the study; a copy of the post-run survey is given in Appendix B. At the end of the third and final run, boaters also completed a "close-out survey" with questions asking boaters to re-assess the flows they saw and to evaluate several other flows. This survey is also provided in Appendix B.

Following survey sessions, boaters also participated in short focus group meetings to review that day's run and flow evaluations. The goal here was to add qualitative depth to the quantitative information covered through the surveys. Discussion focused on advantages and disadvantages of each flow, and estimates of how the river would work at higher and lower levels. Brief notes from the focus group meetings are provided in Appendix C.

Analysis for this report focused on survey results, focus group notes, and a review of video footage and still photography. In general, information was designed to support development of "flow evaluation curves" for relevant boating opportunities. Flow evaluation curves describe the relationship between flow levels and boating quality for different types of opportunities, and are considered a primary output from flow-recreation studies (Shelby et al., 1992; Whittaker et al., 1993). More information about these curves is provided in the following section.

SECTION 4: RESULTS AND DISCUSSION

Note: These results and the accompanying maps consider potential boating, scouting, and portaging options based upon on-land and on-river assessments conducted in 1999 and 2000. We do not intend to identify or endorse specific boating, scouting, or portaging options for future boaters. All boaters need to make their own decisions about how to scout, run, and/or portage during any future on-river boating activities.

Results begin with a general description of boating reaches and launch facilities, then focus on general boating conditions and a description of major rapids during the three on-river flows. We then present survey data evaluating the different flows. This section concludes with information helpful in determining the river's regional and national importance, as well as potential demand.

Two larger scale schematic maps have been developed to show locations of major rapids in the Gorge, most of which are in the first two-thirds of Segment 3. Map 4-1 focuses on the series of drops at the entrance to the Gorge, labeled collectively as "Entrance Exam." Map 4-2 focuses on the "Central Gorge," which has the rest of the larger rapids, including "Double Slide," "Super Boof Falls," "Throne Falls," "Pinnacle Falls," and "Boulder Sieve." Names are provided for these features in the hopes that they are descriptive and useful; however, these names may not match previous names that are unknown to the researchers.

4.1 General Description of Segments

The bypass reach has four segments with different boating characteristics, but these do not precisely correspond with the Chelan PUD sections (Map 2-1).

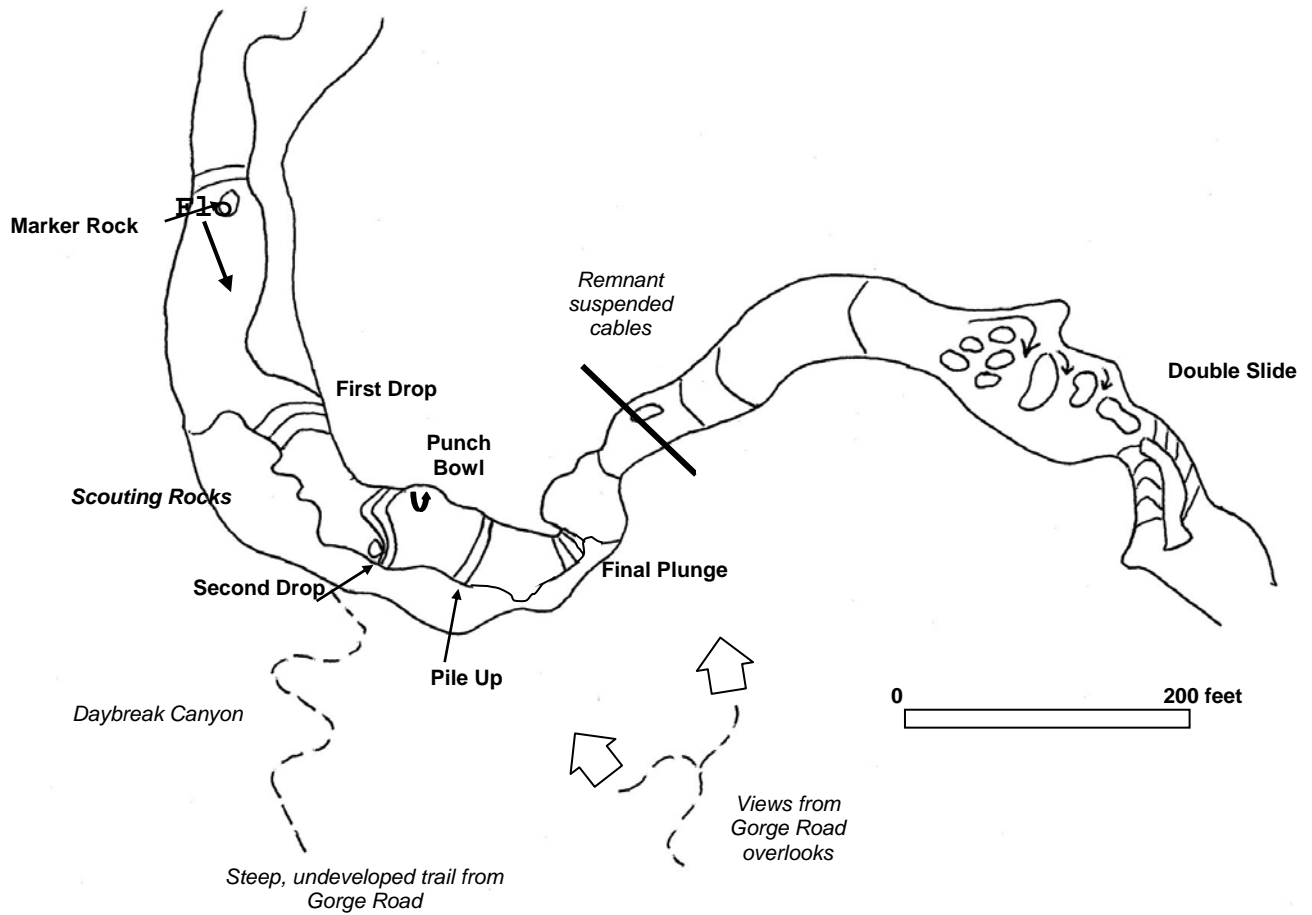
The first three miles (Sections 1 and 2) feature a swift braided low gradient river with occasional islands and riffle areas. At flows up to 500 cfs, the whitewater difficulty in these sections appears to be generally Class II, although there are a few Class III rapids. The river, however, does not appear to provide opportunities for other whitewater craft such as small rafts, catarafts, or inflatable kayaks.

Upon entering the Gorge (Section 3), there are several major rapids in succession, beginning with "Entrance Exam" (Map 4-1) and continuing through the Central Gorge (see Map 4-2).

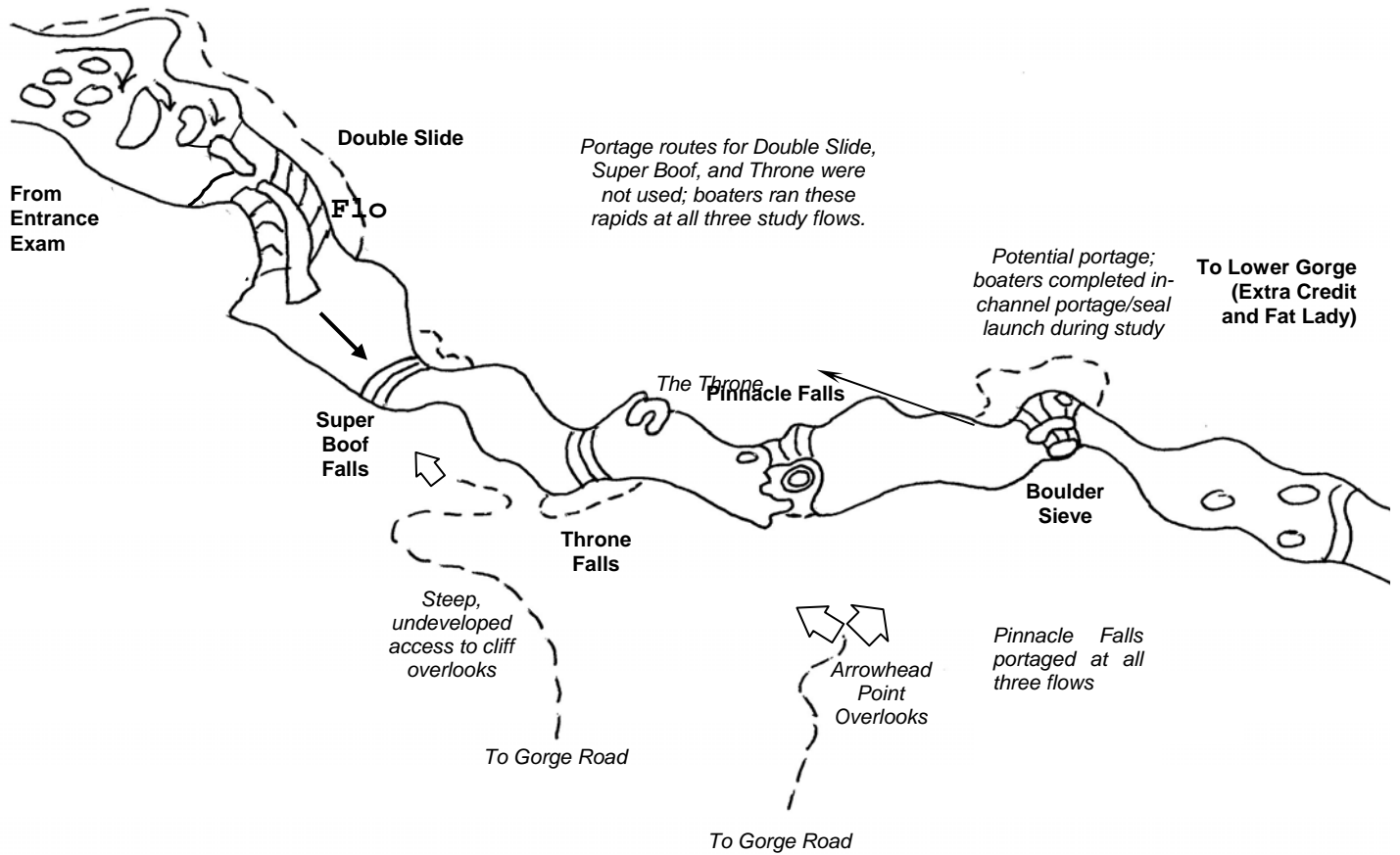
These are generally Class V rapids, although two rapids were not run at any flow during the study (Pinnacle and Boulder Sieve) and should probably be considered Class VI for the time being. In general, rapids in the upper and central Gorge feature strong hydraulics and steep drops (some may approach twenty feet), followed by small pools. Hard shell kayaks and decked canoes appear to be the only craft suitable for this reach.

Below Boulder Sieve, the last major rapid in the Central Gorge (Map 4-2), the channel widens to offer a third type of boating that features a lower gradient, smaller drops, a less constricted channel, and more boulder-dodging. This "Lower Gorge" reach appears to offer Class IV challenge, and is also generally suitable for hard-shelled kayaks.

As the river leaves the Gorge and enters Section 4 (Map 2-1), the river offers essentially Class I boating through a braided channel into the outflow channel of the powerhouse as it joins the Columbia. This section would be suitable for a variety of craft, but is relatively short and unlikely to be boated on its own. Powerboats and personal watercraft from the Columbia occasionally use the lower end of this reach, as do swimmers from Chelan Falls and Powerhouse parks.



Map 4-1: Key drops and other features in Entrance Exam in Section 3 (Chelan Gorge).



Map 4-2: Map of key rapids in the Central Gorge in Section 3 (Chelan Gorge).

4.2 Potential Launch Facilities

Put-in. Just below the dam on river-left, an undeveloped road and short trail approach the river. The trail ends on a wide gravel bar that provides a suitable staging area for kayaks and other similar craft. There are parking and restroom facilities at a nearby City park.

Mid-river access. For boaters interested in avoiding the Gorge (or starting their trip immediately at the top of the Gorge), it is possible to leave the bypass reach at the mouth of Daybreak Canyon. There is an eddy above the Entrance Exam, and at observed flows there is a relatively flat area on rocks next to the river. However, there is no established trail or access, and the climb from the river to the Gorge Road is steep and potentially hazardous, particularly in the first few hundred feet. Hauling a boat up this route would present a significant challenge. During the study, Chelan PUD placed fixed ropes through the steeper parts of this route to facilitate access for observers and video crews.

Take-out. There is a developed boat launch at Powerhouse Park at the confluence of the Chelan and the Columbia. The park also has extensive parking, restrooms, a large picnic shelter, and an extensive lawn for organizing/drying gear.

4.3 General Description of Conditions during the On-River Study Flows

273 cfs. This flow provided marginal boatability in Sections 1, 2, and 4, as boaters hit bottom multiple times (one boater counted over 80 “hits” on the Upper River while other boaters reported too many to count). In the Gorge, this flow was considerably less powerful than the two higher ones, but it also had some boatability issues, particularly at Double Slide and the boulder gardens below the Old Highway Bridge. This flow generally had greater definition in the rapids, less forceful hydraulics below drops, and larger and quieter eddies/pools between rapids. Four of the six kayakers ran Entrance Exam at this flow, although one kayaker had to swim from the final hole in that rapid. Kayakers ran all the other rapids except Pinnacle Falls and Boulder Sieve. Scouting and portaging options were available at every rapid.

391 cfs. This flow offered improved boatability in Sections 1, 2, and 4, but boaters still had multiple hits in the Upper River. In the Gorge, this flow improved boatability in Double Slide and the boulder-dodging section in the Lower Gorge, providing more route options without creating too much power in the hydraulics below the larger drops. Three of the six boaters ran Entrance Exam at this flow; all boaters ran the remaining rapids except Pinnacle Falls and Boulder Sieve. Scouting and portaging options were available at every rapid.

475 cfs. This flow offered further boatability improvement in Sections 1, 2, and 4, and the number of reported hits decreased. Some of the rapids in Section 2 also provided Class III/IV challenge as well as numerous whitewater play areas. In the Gorge, hydraulic power in the drops was noticeably stronger at this flow, and the margin for error was smaller. Eddies between drops were also less stable, and pools between rapids were smaller and had more current. This flow also increased the power in the Lower River without significantly increasing the number of alternative routes. Four of the six kayakers ran Entrance Exam; all boaters ran the remaining rapids except Pinnacle Falls and Boulder Sieve. Scouting and portaging options were available at every rapid.

4.4 Specific Descriptions of Major Rapids in the Chelan River Gorge

Entrance Exam (Class V). This rapid has a series of four drops in short succession at the start of the Gorge (Map 4-1). It is identified by a large rock about 100 feet upstream of a sharp left bend at the mouth of Daybreak Canyon. There is a large pool at the top of the reach, allowing boaters to scout and portage the entire rapid, as well as a smaller eddy downstream of the first drop where boaters can also get out of the river. However, once boaters commit themselves to the second drop in the series, they probably have to run the rest as a group.

First Drop. This initial challenge is a short waterfall with a strong hydraulic at the bottom. The hole appears weaker in the center, and was weaker at the lower two flows (273 cfs and 391 cfs). This hole is not the main problem in the rapid, but it requires a clean run because of the drops that lie ahead. Boaters pushed off line here face a more difficult run. At the 475 cfs flow, some boaters were momentarily stopped or pushed off line.

Second Drop/Punch Bowl. The second major challenge in this rapid features a steep, horseshoe-shaped falls immediately above a turbulent re-circulating eddy (the “Punch Bowl”) that extends below an undercut rock. The more “clean” boating line at all three flows was just left of a distinct flatter rock on river-right; this rock was partially exposed at 391 cfs and nearly dry at 273 cfs. No boater had significant difficulty in this drop, but cleaner runs brought boaters to the surface further downstream and in better position to run the remainder of the rapid.

Pile Up. The third challenge in the rapid is immediately downstream of the Punch Bowl, and features a river-wide hole at all three flows. This hydraulic appeared weaker in center-right, particularly at the lower two flows, which presented few problems. At the 475 cfs level, however, this hole became more “sticky,” and required extended effort by some boaters to clear it. At the lower two flows, there is a small eddy on river right against the cliff after Pile-up that all boaters were able to catch; at the higher flow, one boater missed this eddy (which was smaller and more unstable), leading to a less clean run.

Final Plunge. This last challenge is a sharp drop and hole between two pinching walls; much of the current is directed at the right hand wall, where there is also considerable turbulence. It was more difficult (“stickier”) at the lowest and highest flows, but “cleaned up” at the medium flow. Boaters generally ran it after catching the small eddy below Pile-up, moving strongly from right to left-center. A flat rock in the river was partially exposed at the low flow and slowed some boaters’ momentum, requiring extended efforts to get clear of the hole. At the low flow, one boater was stuck in the hole for nearly a minute (rolling up several times) before deciding to swim out. At the highest flow, some boaters also had to work to clear the hole.

There are scouting and portage options along Entrance Exam from river-right. Boaters who portage can seal launch³ into the pool below Final Plunge. Boaters can access the area from the Gorge Road (via the steep route down Daybreak Canyon) as well as from the eddy upstream of the rapid. There are options for establishing safety along the rapid, particularly below Pile-up and Final Plunge, the two holes where boaters are more likely to become stuck or have to swim.

³ A seal launch is commonly used maneuver by skilled kayakers; it involves pushing off a rock and plunging into the river.

At the highest flow, however, the rock immediately adjacent to the hole in Final Plunge becomes wet and is less suitable (but still usable) for safety efforts.

Central Gorge. A few hundred feet downstream of Entrance Exam are a series of five major rapids in the Central Gorge (Map 4-2). Unlike Entrance Exam, each of these are separated by pools with less turbulent water, and each can be scouted or portaged independently.

Double Slide (Class V). The first major rapid in the Central Gorge is “Double Slide,” which features a boulder field and swift currents leading to side-by-side chutes. The river-left slide is longer, more gradual, and ends in a less turbulent pool. The river-right slide (labeled “Chelan Chute”) is more abrupt and concentrated, and ends in turbulence against the mid-channel dividing rock, which is undercut.

Both chutes were run at all three flows, but not always in the intended manner. A short drop and hole, followed by an exposed rock and the right-to-left current, made access to the river-left slide more difficult. Several right side runs occurred after boaters were unable to gain access into the left, and required recovery rolls or 180-degree turns just before the drop. Once in the left slide, all boaters found it easy to bump their way down the shallow channel and into the pool below. Right chute runs had a cleaner entrance, but faced considerably more power and turbulence just above and through the slide. Several boaters also made hard contact with the dividing channel wall during their right side runs.

There are good scouting options for this rapid on the river-right side. No boaters portaged this rapid, but there may be a portage route on river-left well upstream of the entrance into the left hand slide. The portage option on river-right would involve a very difficult seal launch into the pool below.

Super Boof Falls (Class IV/V). The next rapid is a pour-over falls directly downstream of Double Slide; during the on-land assessment it was named “Car Wreck Falls” after an abandoned car in the cliffs (this has since slid into the river and is out of sight). All boaters ran this rapid at all three flows, “boofing”⁴ off a rock at the top of the falls on river-left to avoid heavy turbulence at the bottom of the falls. As flows increased, the turbulence also increased, requiring a more precise “boof.” There were scouting options on both sides of the falls. No boaters portaged this rapid, but there appeared to be portage options on river-left.

Throne Falls (Class V). This is another steep drop with strong turbulence at the bottom; the rapid is named for a distinctive boulder shaped like a throne downstream of the falls. All boaters ran this falls at all three flows, generally running center-right but with varying bow angles. There is heavy turbulence on both the right and left sides of the falls, which increases at higher flows. At the lowest flow, there were some mid-falls rocks, which boaters avoided by running further to the right. At the highest flow, some boaters were pushed into the throne, requiring them to exert some effort to cross the relatively strong downstream currents and catch the right eddy above Pinnacle Falls. The pool between Throne and Pinnacle Falls was smaller at the highest flow,

⁴ A maneuver designed to keep the kayak flat upon landing below a drop; a “boof” is often completed by intentionally banking off a rock in or on the edge of the channel.

narrowing the margin of error if boaters fail to have a clean run. Scouting and portaging options are on river-right. There is a good eddy upstream of the falls. No boaters portaged this falls, but there appears to be a portage option from river-right that ends with a short seal launch.

Pinnacle Falls (Class VI). This falls is immediately downstream of the Throne and is identified by a tall pillar of rock on river-right. The falls is steep and high (probably over 20 feet), concentrating the entire flow of the river through a single slot. The bottom of the falls is very turbulent; no boaters chose to run this falls at any flow during the study, although some boaters thought it could and eventually would be run (assuming flows were regularly available). There was less power in the falls at lower flows, but it is premature to suggest which flow would make this more runnable. There are good scouting options from the river-right eddy above the falls. The portage was rated “slightly difficult” by all boaters and involved a short carry over the saddle between the pinnacle and right canyon wall, and then a short seal launch into the pool below.

Boulder Sieve. The final major rapid in the Central Gorge occurs downstream of Pinnacle Falls, and is identified by several large boulders that act as a sieve in the river; there are at least two distinct chutes through undercut rocks; the total drop is about fifteen feet. Boaters did not run this rapid at any flow, choosing instead to ground themselves on a rock on river-left, then seal launch down a partially wetted incline to the side of the slots and their heavier turbulence. On all three days, one boater would get out of his boat to assist the other kayakers onto the rock and then shove them over the other side. As a result, many boaters never even got out of their boats while completing this “portage.” The ride down the incline on the other side is steep and bumpy, and ends in turbulent water that masks rocks that were hit by some boaters at all three flows. These “piton” hits occurred to boaters who were assisted over the rock as well as to those who seal launched. Scouting appears best from the left side. A longer portage to avoid the seal launch may be possible on the left side as well, but might require ropes to bypass larger boulders.

Lower Gorge (Class IV/V). Downstream of Boulder Sieve, the river becomes less constricted and has a slightly lower gradient. There are several significant drops and boulders in this reach, but the rapids generally have less powerful hydraulics than those upstream. The rapids above the Old Highway Bridge have been collectively labeled “Extra Credit,” while the series of larger boulders and constricted routes downstream of the bridge have been collectively labeled “Fat Lady,” a reference to the colloquialism, “the opera isn’t over until the fat lady sings.”

At the lowest flow (273 cfs), there were at least two routes in Fat Lady that were very constricted and caused boaters to hit large rocks as they passed by. One opening was less than the width of a kayak and stopped some boaters’ momentum. At another drop at the very end of the run, all boaters chose to avoid the center route (where most of the water went) in favor of narrow, shallower routes on the sides because of a sieve with potential pinning hazards.

At the 391 cfs flow, there were more route options in both Extra Credit and Fat Lady, but some boaters still made hard contact with boulders on their way through various drops and boulder gardens. The additional water provided more depth and width in passages, without significantly increasing power in the river. At the 475 cfs flow, however, while similar routes were available,

power in the river increased noticeably and made some routes more difficult. One boater swam in Fat Lady at this flow, and his boat subsequently became pinned in the main drop at the end of the run (boaters were able to retrieve the boat a short time later).

In Extra Credit, kayakers found at least one good play hole for rodeo maneuvers (endos, cartwheels, pirouettes, etc.) and this was best at the 391 cfs flow. There are numerous opportunities for boaters to get out and scout either Extra Credit or Fat Lady from the various boulders, and numerous portage and rescue options are also available if needed.

4.5 Post-Run Attribute and Overall Evaluations

Boaters were asked to evaluate a variety of flow-dependent attributes at the end of each run on a seven point-scale from “totally unacceptable” to “totally acceptable” (with a “marginal” midpoint). The specific attributes are listed below. Figure 4-1 and Figure 4-2 provide mean scores for selected attributes (those with noticeable differences at the three different flows). The figures have been truncated just below the marginal line to accent subtle differences within the acceptability range. Mean scores for all attributes are provided in Appendix C.

- Upper River boatability
- Gorge boatability
- Availability of challenging technical boating in Gorge
- Availability of powerful hydraulics in Gorge
- Availability of whitewater “play areas” in Gorge
- Overall whitewater challenge in Gorge
- Safety in Gorge
- Aesthetics in Gorge
- Rate of travel in Gorge
- Number of portages in Gorge
- Overall Rating Upper River
- Overall Rating Gorge
- Overall Rating Entire Run

Individual attribute results Figure 4-1 suggest that all three flows provided a variety of acceptable boating conditions on the river, although there were subtle differences in the type of challenge offered in the Gorge and larger differences in Upper River boatability and the availability of playboating.

The largest difference was for Upper River boatability, which was rated below “slightly acceptable” at the 273 cfs flow, but improved somewhat at 391 cfs and was rated “moderately acceptable” at 475 cfs. There were also larger differences for the availability of playboating areas, with the highest ratings at the 475 cfs flow.

Slight differences were suggested among evaluations for safety, overall whitewater challenge in the Gorge, the availability of powerful hydraulics, and the number of portages. In general, the lowest flow was rated lower for the number of portages and lack of powerful hydraulics, while the highest flow was rated slightly lower for safety, overall challenge [too much challenge], and

[too] powerful hydraulics. The middle flow (391 cfs), in contrast, received unanimous 7.0 ratings for all these attributes.

There were no differences for aesthetics (scoring 7.0 or “totally acceptable” scores for all boaters at all flows), and very small differences for rate of travel and technical challenge (the two lowest flows were rated 7.0 by all boaters, while the 475 cfs flow was rated an average of 6.8). These results are not shown in a figure, but suggest that all three flows seen during the study provide high quality opportunities to enjoy the aesthetic qualities of the river and its technical whitewater.

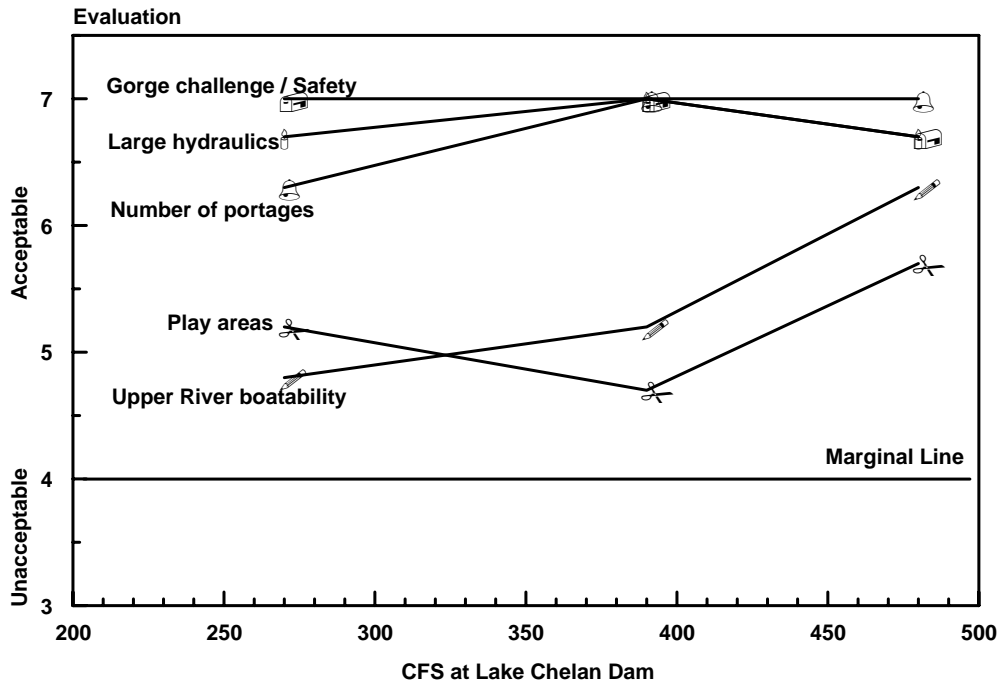


Figure 4-1: Mean acceptability evaluations for several attributes from post-run surveys.

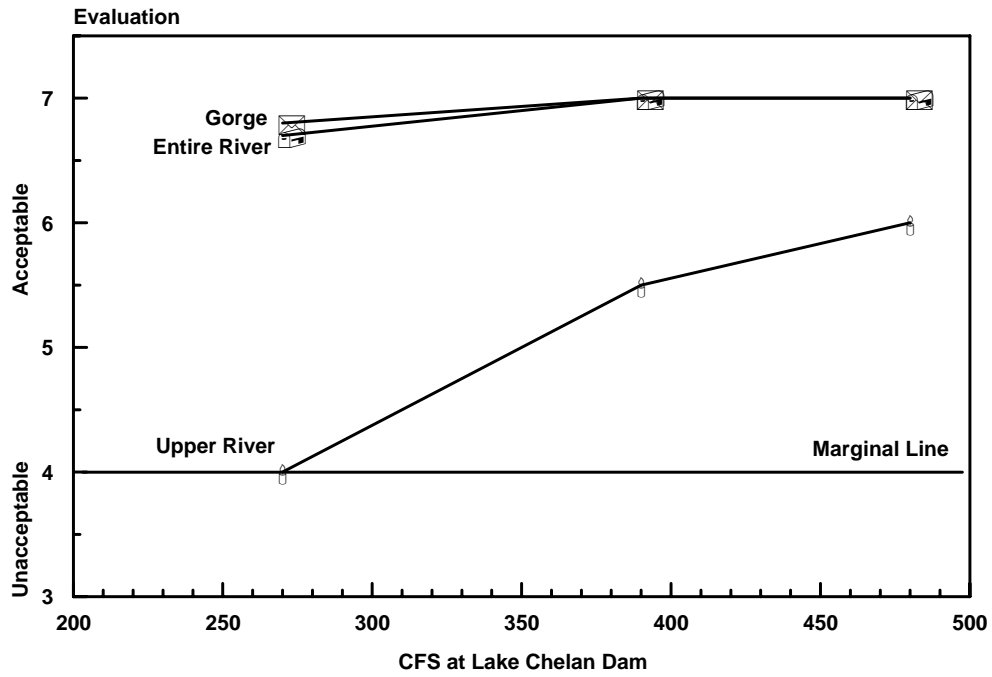


Figure 4-2: Mean overall acceptability evaluations from post-run surveys.

Overall ratings Figure 4-2 generally follow from the individual attribute ratings. On the Upper River, overall ratings followed from boatability ratings, with the lowest flow rated near marginal, while the 391 cfs flow showed some improvement and average ratings were “moderately acceptable” for 475 cfs. During focus group discussion following the 273 cfs flow, several boaters reported that the Upper River was “bony” and involved too many hits for a high quality run, while the two higher flows improved those conditions.

Gorge ratings were relatively high for all three flows, but were slightly lower at the 273 cfs level. Focus group discussion suggests the higher flows had softer, more aerated water below the major drops as well as smoother and cleaner boating lines. Discussion also suggested there were better and more route options in the Lower Gorge. The slightly lower ratings for safety and powerful hydraulics at the highest flow did not detract from overall ratings, which were unanimously high.

Overall ratings for the entire river tended to follow from Gorge ratings rather than Upper River ratings. This is consistent with focus group discussions, which tended to focus on the major drops in the Gorge as key features of a boating trip. Aesthetic ratings, which were uniformly high for all three flows, may also have affected overall ratings from the post-run survey. Boaters unanimously rated aesthetics as totally acceptable at all three flows.

This point is reinforced by other results from the close-out survey, which asked boaters to rate the importance of various trip attributes on a five point scale. Results are given in Figure 4-3, and suggest that safety, aesthetics, and overall challenge are the most important attributes, followed closely by the availability of technical rapids and boatability. Powerful hydraulics, rate of travel, few portages, easy access, and the availability of play areas, in contrast, were relatively less important.

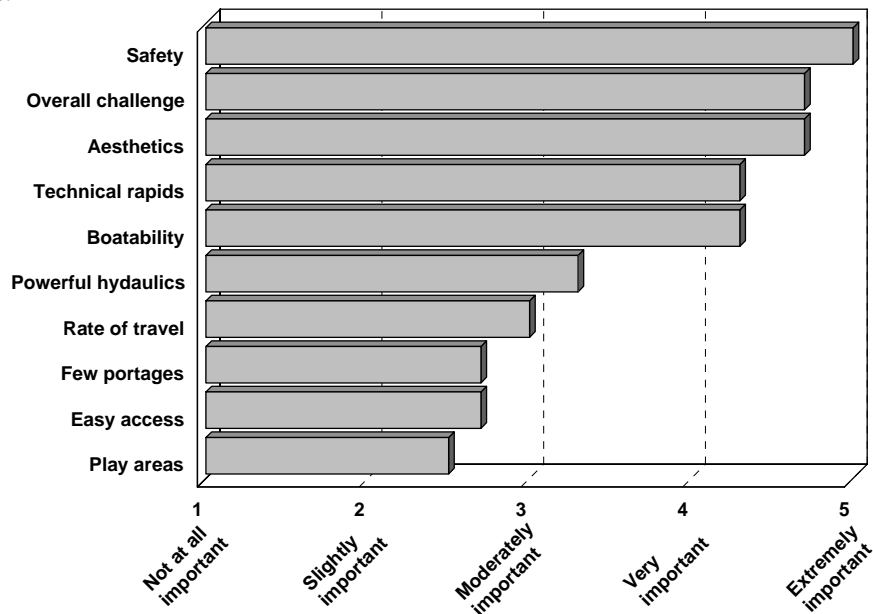


Figure 4-3: Mean importance ratings of various attributes from close-out survey.

4.6 Close-Out Overall Evaluations and Specified Flows

The close-out survey offered boaters opportunities to re-assess their evaluations after seeing the range of flows, as well as specify flows that provide acceptable and optimal quality for different types of trips. Figure 4-4 summarizes mean overall evaluations from the post-run and close-out surveys on the same seven point scale from “totally unacceptable” to “totally acceptable.” Note: On the close-out survey, boaters were asked to rate a larger range of flows based on their experiences at the three study flows. Some boaters were reluctant to make evaluations of flows higher than those they saw, but all boaters were willing to evaluate lower and in-between flows. The close-out survey asked boaters to rate eight flows (100, 200, 273, 330, 391, 475, 550, and 650 cfs).

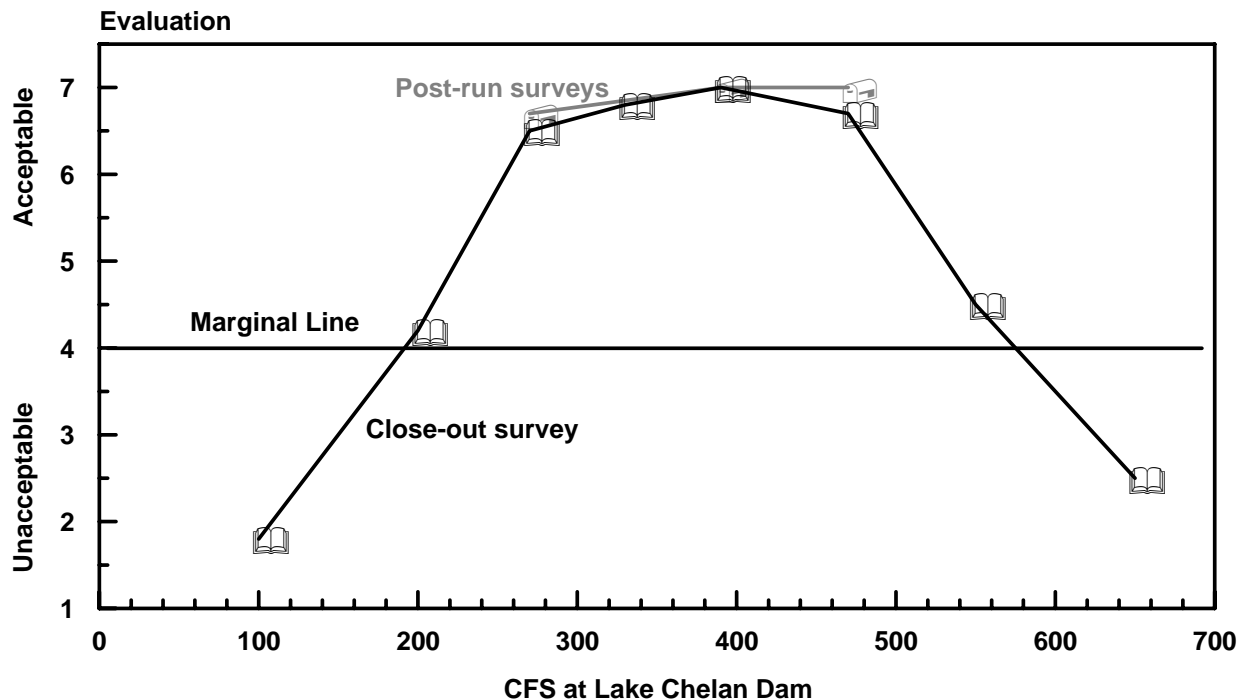


Figure 4-4: Mean post-run and close-out survey evaluations of various flows.

Results suggest that boaters were relatively consistent in their assessments from the post-run to the close-out survey. However, the lowest and highest flows were rated slightly higher in the post-run survey than in the close-out. Close-out evaluations also show that all three of the study flows were rated very acceptable, and can be considered within the optimal range, with the 391 cfs considered best. The close-out survey evaluations, however, also suggest that flows less than about 200 cfs are likely to be unacceptable, while flows starting about 475 cfs also decline in quality, becoming near-marginal about 550 cfs and unacceptable by 650 cfs.

Focus group discussion provides some explanation of these ratings. At the low end, after the 273 cfs run, several boaters noted that they would not want to boat flows much lower. Major concerns were that the Upper River would become increasingly bony, the Gorge drops would

become steeper and perhaps more dangerous, equipment damage would become more likely, and some of the slots in the Lower River might become unrunnable or create greater pinning hazards. Five of the six boaters said they preferred higher flows than 273 cfs, while only one thought this level was “about the optimal flow.”

At the high end, no boaters said they preferred flows higher than 475 cfs and only one thought that level was about optimal. Concerns were that higher flows would decrease the margin for error, increasing the power of hydraulics (particularly in Entrance Exam and at Throne Falls), and perhaps begin linking some of the drops in the Gorge (less room between rapids). While some boaters thought it would be interesting to see higher flows, there was general agreement that higher flows would significantly increase the level of challenge, and most boaters would prefer flows less than 475 cfs.

Results suggest the middle of the range (from about 300 to 450 cfs) is generally optimal, although focus group discussion suggests that conditions change gradually through that range. Boaters noted that the drops in the Gorge tend to “clean-up” with more water, but they also became more pushy and Entrance Exam in particular became more intimidating. After the 391 cfs run, two of the three boaters thought an optimal flow would be lower, one thought 391 cfs was optimal, and three preferred something higher. After the 475 cfs run, five out of six thought optimal flows might be somewhat lower.

Boaters were asked to specify flows that provided different types of opportunities. The specific questions and median responses are given in Table 4-1. In Figure 4-5, we have overlaid “range bars” based on median responses for two different opportunities, as well as minimum navigation flows, with evaluation curves from the post-run and close-out surveys in Figure 4-5. The “range bars” show the lowest flow that provides a quality experience for that opportunity, as well as the optimal range for that opportunity.

Results are generally consistent with the previous run descriptions and both post-run and close-out evaluation data. Results suggest that kayaks could probably navigate the river at flows around 225 to 250 cfs, but that these are clearly marginal levels. As flows approach the lowest study flow (273 cfs), conditions improve enough for an acceptable quality “standard trip,” but the optimal range is probably between about 300 to 400 cfs. Around 400 cfs, standard trips transition into “high challenge trips,” where the margin for error is smaller and the hydraulics are more powerful. These high challenge trips are probably optimal between about 400 and 500 cfs, although two of the six boaters were unsure of the high end of the range and avoided speculating how high it should go. When boaters were asked to specify the highest safe flow, 500 cfs was the median response, but two boaters withheld responses due to uncertainty.

Table 4-1: Median responses to specified flow questions.

Survey question	Median flow in cfs
Think of the river as a waterway used for transportation. What is the lowest flow you need to simply get down the river in your craft?	250
Many people are interested in a “standard” whitewater trip at medium flows. Think of this “standard trip” in your craft... What is the lowest flow that provides a quality experience for this trip?	270
What is the best or optimal range of flows for this type of trip?	295 to 400
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 lowest flow that provides a quality experience for this trip?	391
What is the best or optimal range of flows for this type of trip?	400 to 500
What is the highest safe flow for your craft and skill level?	500
If Chelan PUD released only one flow for boating, what flow would you prefer?	391
If Chelan PUD released two flow levels that offer different types of boating experiences, what two flows would you prefer?	300 & 395

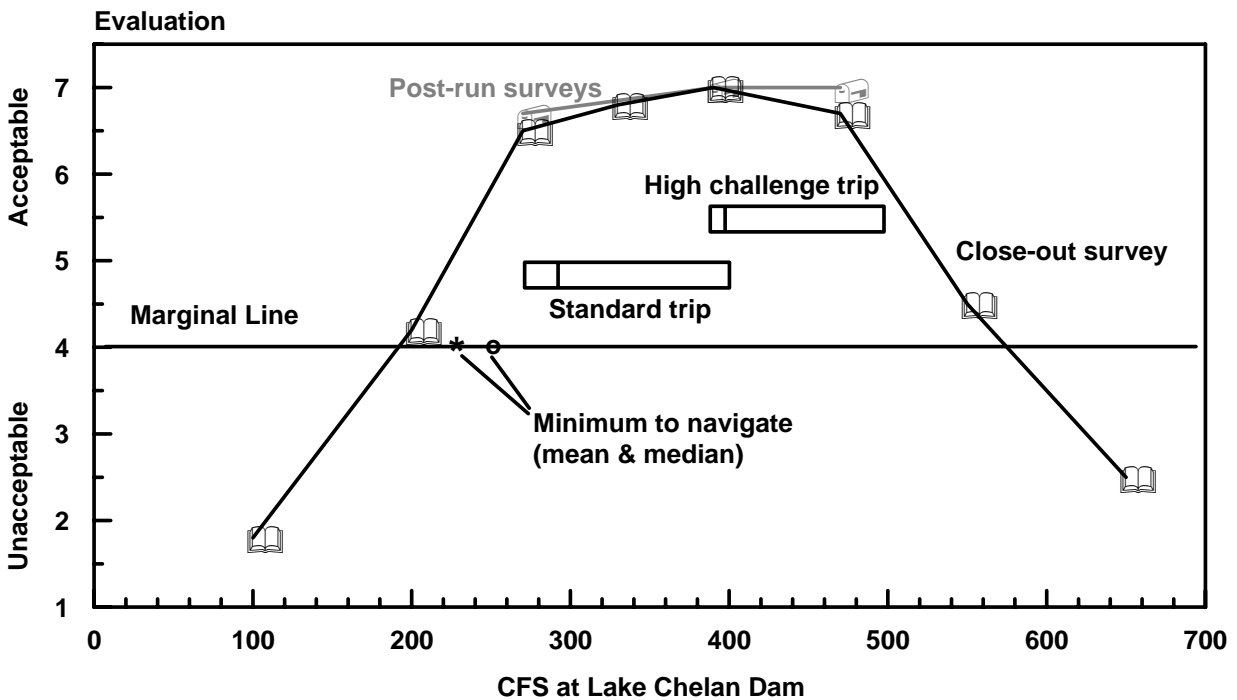


Figure 4-5: Mean post-run and close-out survey evaluations of various flows, with median specified flow ranges for two types of boating opportunities.

Recognizing that the relicensing process might lead to choosing one or two threshold levels to be provided for whitewater boating, we asked kayakers to specify a single flow they would like provided, or two flows that would provide distinct opportunities. Median results suggest that a single optimum choice would 381 cfs (the mean was 377 cfs), or just less than the second day’s flow of 391cfs. This flow is close to the transition range between standard and higher challenge trips, and near the apex of the flow evaluation curve from the close-out survey.

Median results for the two-flow question were 300 and 395 cfs (mean results were 293 and 410 cfs). At the low end, the range was from 250 cfs to 320 cfs, with three boaters reporting 300 cfs. At the high end, the range was from 375 cfs to 500 cfs, but four boaters reported flows between 390 and 420 cfs. In general, these results suggest that if two flows were to be provided, boaters would generally recommend choices at the low end of the optimal ranges for both standard and high challenge trips.

4.7 Integrated Flow Evaluation Curves

Taken together, the preceding information suggests there are essentially two boating opportunities on the Chelan River, distinguished mostly by the level of challenge they provide in the Gorge. Figure 4-6 presents idealized flow evaluation curves for both opportunities based upon professional judgments that integrate survey data and focus group discussion.

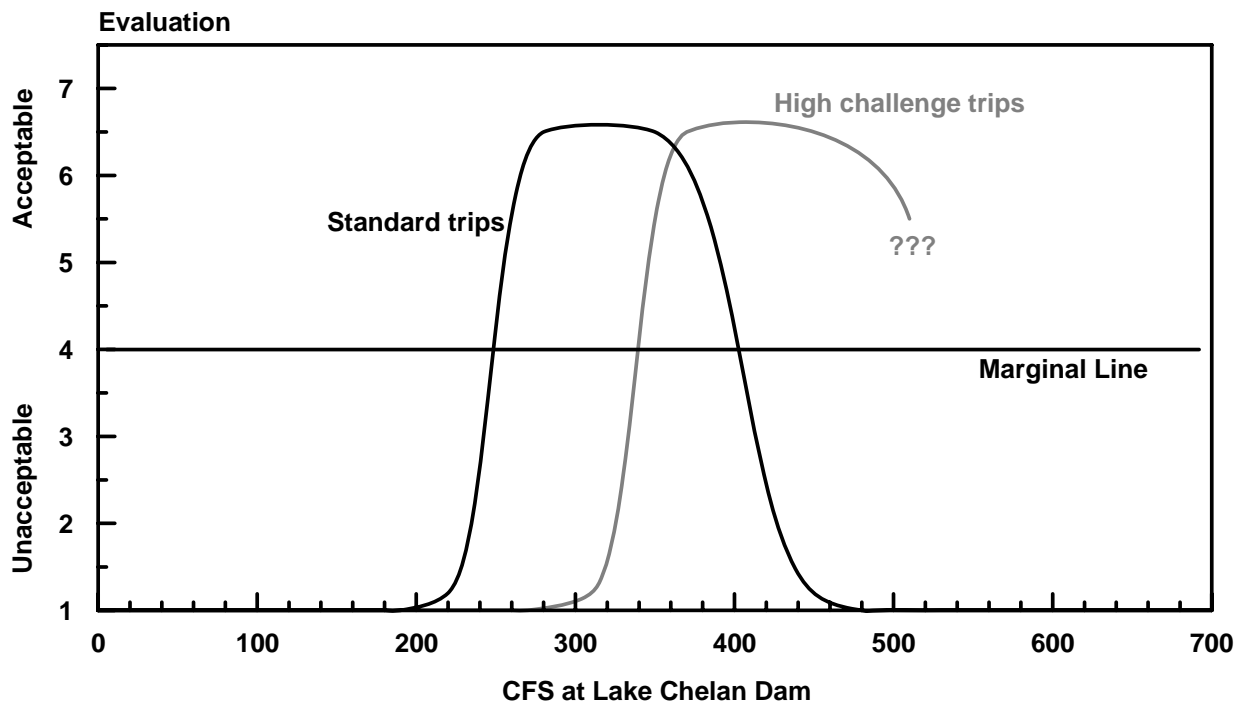


Figure 4-6: Professional judgment flow evaluation curves for two opportunities based on integrated information from surveys and focus groups.

The first curve, for standard trips, suggests that the river may be boatable as low as 225 cfs, but that the quality is unacceptable until about 240 cfs. From this flow, conditions improve steadily with increases in flow, becoming optimal about 275 cfs and remaining so until about 325 cfs. A single “representative flow” for this type of opportunity would be about 300 cfs. About 325 to 350 cfs, standard trips begin the transition into more challenging trips, and boaters looking for a standard trip would probably rate flow levels above 400 cfs as “marginal.”

The second curve, for higher challenge trips, suggests that flows below about 340 cfs are less acceptable, and that an optimal range for this trip is between about 375 and 475 cfs. As discussed above, there is some uncertainty about how high boaters can go, although we suspect even very skilled boaters would find 550 to 600 cfs at their limit. A single “representative flow” for this opportunity is probably around 425 cfs, although this may have to be adjusted upwards as the river becomes known, or if skill and equipment improvements continue as they have in the past decade.

4.8 Interest in Flow Diversity

Boaters were asked about the importance of releasing a diversity of flows to provide 1) different types of boating experiences, or 2) different opportunities for people with different skill levels or craft types. Responses were given on a five point scale from “not at all important” to “extremely important;” check-off response was also available if boaters did not think it was important to provide a variety of flows for any reason. The average importance for different experiences was 3.7 (“very important”), while it was 3.2 (“moderately important”) for different skill types. In focus groups, boaters were clear that the Gorge provides Class V challenge at all three flows they observed, but that there may be two different types of experiences at different flows.

In general, boaters appeared to favor some variety of releases, perhaps on consecutive days in a weekend. In focus groups, boaters discussed the utility of weekend releases with a lower flow on Saturday and a higher flow on Sunday that would allow boaters to understand the boating lines under less demanding conditions, as well as provide for a diversity of experiences.

4.9 Regional Importance and Potential Demand

Boaters were asked several questions on the survey and in focus groups that may help estimate the regional importance and potential demand for whitewater boating on the Chelan River if boatable flows were provided.

After each run, boaters were asked “if this flow were provided periodically, are you likely to return for future boating?” Possible response categories were “definitely no,” “possibly,” “probably,” or “definitely yes.” At the two lowest flows, all six boaters responded “definitely yes,” while at the highest flow, five of the six responded “definitely yes” and the sixth responded “probably.”

In focus group discussions, boaters were very positive about the river and the whitewater opportunities it could provide. Key features were the scenic beauty of the canyon, clear water, warm water (rare for challenging whitewater rivers in the Pacific Northwest), and the number of challenging rapids in such a short reach.

Boaters also discussed the benefits of having other recreation opportunities and tourism amenities in the Chelan area. Boaters noted numerous other activities that could be appended onto a kayak trip or used to entertain family and friends who do not run Class V rivers. They also extolled the good camping, hotel accommodations, and restaurants in the Chelan area as potential draws.

Boaters were asked to compare the Chelan River with other rivers in Central Washington, Washington, the Pacific Northwest, and the country on a five point scale including: “worse than average,” “average,” “better than average,” “excellent,” and “among the very best.” Average responses suggest that the Chelan was “among the very best” in Central Washington, and “excellent” for Washington, the Pacific Northwest, and the country.

Boaters were asked to list other river segments in the Pacific Northwest that provide similar whitewater opportunities to those available on the Chelan. Boaters were able to provide the following list, but they also noted that the Chelan was relatively unique in providing so many challenging rapids in such a short reach, as well as having warm water and a spectacular canyon.

Little White Salmon
Lower Cispus
Green Truss reach on the White Salmon
Silver Creek (tributary to the Skykomish)
Robe Canyon
Richland Creek
South Fork of the Yuba (California)

SECTION 5: SUMMARY

Taken together, the on-land and on-river phases of the study suggest several conclusions and recommendations about boating feasibility, optimal flow levels for different boating opportunities.

5.1 Boating Feasibility

The on-land assessment suggested that the river would be boatable by skilled Class V paddlers, and the on-river assessment confirmed this finding. All six boaters were able to run the river at all three flows (273, 391, and 475 cfs), although all boaters chose to portage two rapids (Pinnacle Falls and Boulder Sieve) and some boaters chose to portage Entrance Exam at some flows. Two boaters also swam at two separate rapids, but these were relatively minor incidents (no one was injured; all equipment was recovered; boaters completed their runs).

At the three study flows, the Chelan River offers boatable conditions on the Upper River and challenging Class V whitewater in the Gorge for kayaks or similar hard-shelled craft. The river, however, does not appear to provide opportunities for other whitewater craft such as small rafts, catarafts, or inflatable kayaks.

5.2 Optimal Flows

All three study flows provided acceptable to optimal boating conditions, but also offered distinct conditions and types of trips. In general, there appear to be two types of opportunities on the river. At lower flows (about 275 to 400 cfs) a “standard opportunity” is provided, with more boatability problems in the Upper River and the Lower Gorge, but with less power in the difficult rapids in the Gorge (e.g., Entrance Exam, Double Slide, Throne Falls). At higher flows (about 400 to 500 cfs), a “high challenge opportunity” is provided, with fewer boatability issues, but less margin for error in the major drops of the Gorge.

If a single flow were to be provided for boating, 375 cfs appears to make the most sense. This is where standard trips transition into high challenge trips, but both opportunities are provided at near-optimal levels. An alternative scenario, however, might provide two different flows for boating at different times. This would allow optimal releases for both opportunities, providing diversity that boaters appear to appreciate. Under this option, flows about 300 cfs and 425 cfs could be provided on consecutive days over weekends when flows are provided.

If boating flows are provided at these or other levels, we recommend periodic reviews of those releases over the years. As boaters become more familiar with the river and the runnable boating lines in rapids, they may be interested in some flow adjustments. Based on advances in skills and equipment over the past five to ten years, we would not be surprised to see some interest in higher flows develop after a few years. Based on these study results and current skill levels, however, about 500 cfs would probably be the limit for most boaters.

APPENDIX A: INTERNATIONAL SCALE OF RIVER DIFFICULTY

(Borrowed by permission from the American Whitewater web page)

The following 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 descriptions 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. There are few obstructions, all obvious and easily missed by people 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 can be easily avoided 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 for kayakers. 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 paddlers 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 (for kayakers), 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 V.

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 several times, its rating may be changed to an appropriate Class 5.x rating.

APPENDIX B: SURVEY INSTRUMENTS

Pre-Run Survey

Date: _____ / _____ / 2000

Your name: _____

1. What type of craft do you generally use for whitewater paddling? (*Circle one*)
 1. Hard shell kayak
 5. Cataract (please indicate length: _____)
 2. Inflatable kayak
 6. Self-bailing raft (please indicate length: _____)
 3. Closed deck canoe
 7. Wrap-floor raft (please indicate length: _____)
 4. Open canoe with floatation
 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?

Novice (comfortable running Class II whitewater)
 Intermediate (comfortable running Class III whitewater)
 Advanced (comfortable running Class IV whitewater)
 Expert (comfortable running Class V whitewater)
4. In general, how many days per year do you spend whitewater boating? _____ days per year
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 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 short 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
Good whitewater play areas are more important than challenging rapids.	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 technical and big water rivers.	1	2	3	4	5	6	7

Post-Run Survey

Date of run: _____ / _____ / 2000

Your name: _____

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

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

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. About how many times did you stop and get out of your boat for breaks, or for scouting and portaging in the Gorge?

About _____ times for breaks.

About _____ times for scouting or portaging.

5. Please estimate the total amount of time you spent out of your boat for breaks, or for scouting and portaging in the Gorge.

About _____ minutes for breaks.

About _____ minutes for scouting or portaging.

6. In general, how would you rate the whitewater difficulty on the two reaches of the river at this flow? (Use the International Whitewater Scale that ranges from Class I to Class VI).

Upper river (from put-in to the start of Gorge): _____

Lower river (from start of Gorge to take-out): _____

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

Location:	Rating:	Location:	Rating:
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Boating Feasibility Assessment

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

	Totally unacceptable	Moderately unacceptable	Slightly unacceptable	Marginal	Slightly acceptable	Moderately acceptable	Totally acceptable
Upper River boatability	1	2	3	4	5	6	7
Gorge boatability	1	2	3	4	5	6	7
Availability of challenging technical boating in Gorge	1	2	3	4	5	6	7
Availability of powerful hydraulics in Gorge	1	2	3	4	5	6	7
Availability of whitewater "play areas" in Gorge	1	2	3	4	5	6	7
Overall whitewater challenge in Gorge	1	2	3	4	5	6	7
Safety in Gorge	1	2	3	4	5	6	7
Aesthetics in Gorge	1	2	3	4	5	6	7
Rate of travel in Gorge	1	2	3	4	5	6	7
Number of portages in Gorge	1	2	3	4	5	6	7
Please make an overall evaluation considering all of the flow-related conditions that contribute to a high quality trip.							
Overall Rating Upper River	1	2	3	4	5	6	7
Overall Rating Gorge	1	2	3	4	5	6	7
Overall Rating Entire Run	1	2	3	4	5	6	7

In general, would you prefer a flow that was higher, lower, or about the same as this flow? (Circle one).

1. Much lower flow
2. Slightly lower flow
3. About the same; this was close to an optimum flow
4. Slightly higher flow
5. Much higher flow

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

1. Definitely no
2. Possibly
3. Probably
4. Definitely yes

Provide any additional comments about this flow below. If necessary, please use the names on the map provided to identify specific locations.

Close-out Survey

Date: _____ / _____ / 2000

Your name: _____

For a high quality trip on the Chelan River, please rate the importance of the following components.

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Boatability	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
Good rate of travel	1	2	3	4	5
Few portages	1	2	3	4	5
Easy put-ins and take-outs	1	2	3	4	5

Given what you know about the quality of whitewater and other features along the Chelan River, please tell us how many **hits**, **stops**, **boat drags**, and **portages** are acceptable for a high quality trip? If you "don't care," place an X in the space provided.

I will accept about _____ **hits** per trip (contacts with rocks/other obstacles that do not stop you).

I will accept about _____ **stops** per trip (contacts with rocks or other obstacles that stop you, but you do not have to get out of your boat to continue downstream).

I will accept about _____ **boat drags** per trip (times where you have to get out of your boat to get it off of rocks or other obstacles).

I will accept about _____ **portages** around unrunnable sections per trip.

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

Compared to...	the Chelan River is...				
	Worse than average	Average	Better than average	Excellent	Among the very best
...other rivers in Central Washington	1	2	3	4	5
...other rivers in Washington	1	2	3	4	5
...other rivers in the Pacific Northwest	1	2	3	4	5
...other rivers in the country	1	2	3	4	5

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., boatability, whitewater challenge, safety, availability of surfing or other play areas, aesthetics, and rate of travel).

Boating Feasibility Assessment

(If you do not feel comfortable evaluating a flow you have not seen, don't circle a number for that flow).

	Totally unacceptable	Moderately unacceptable	Slightly unacceptable	Marginal	Slightly acceptable	Moderately acceptable	Totally acceptable
Flow 1	1	2	3	4	5	6	7
Flow 2 (on ___/___)	1	2	3	4	5	6	7
Flow 3	1	2	3	4	5	6	7
Flow 4 (on ___/___)	1	2	3	4	5	6	7
Flow 5	1	2	3	4	5	6	7
Flow 6	1	2	3	4	5	6	7
Flow 7 (on ___/___)	1	2	3	4	5	6	7
Flow 8	1	2	3	4	5	6	7

Based on your boating trips on the Chelan 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).

Think of the river as a waterway used for transportation. What is the lowest flow you need to simply get down the river in your craft? Flow in cfs

Many people are interested in a "standard" whitewater trip at medium flows. Think of this "standard trip" in your craft.
 What is the lowest flow that provides a quality experience for this type of trip? _____
 What is the best or optimal range of flows for this type of trip? _____ to _____

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 lowest flow that provides a quality experience for this type of trip? _____
 What is the best or optimal range of flows for this type of trip? _____ to _____

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

If Chelan PUD released only one flow for boating, what flow would you prefer? _____

If Chelan PUD released two flow levels that offer different types of boating experiences, what two flows would you prefer? _____ & _____

How important is it to release a variety of flow levels on the Chelan 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.

APPENDIX C: NOTES FROM FOCUS GROUP MEETINGS

Saturday 7/8 Notes

Advantages:

manageable speed
can see rocks
can see what is under water
good introduction to the gorge
good to learn the lines in rapids

Disadvantages:

upper reach is bony
run out below boulder sieve is bony
gorge rapids might clean up at higher flows

If higher:

fewer boaters might be attracted to gorge
upper reach may get more boatable
lower gorge is likely to improve – more choices

If lower:

wouldn't want to go much lower
gorge drops might get steeper and more dangerous
equipment likely to get damaged
below the bridge slots might get unrunnable (pinning hazards)
above gorge would be very bony

Sunday 7/9 Notes

Advantages:

gorge cleaned up/smoothed up some drops
upper braided reach was more boatable

Disadvantages:

entrance exam got more intimidating
more power in boulders near the bridge area

If higher:

entrance exam may begin to change and get bigger, pushier

If lower:

maybe a nice median? between 275 and 400 cfs?

Monday 7/10 Notes:

Advantages:

more fun to watch
softer landings in major rapids (more air)
pushier water
lines still all there
smoother lines in some rapids

Disadvantages:

harder to get lines
less margin for error
hydraulics at entrance exam get bigger

If higher:

interesting to see
less margin for error, especially at Throne
drops might start to be linked; less time/room for rolls
best is between Sat and Sun flow? 350 cfs?

If lower:

We've covered this with previous notes/discussions

Similar runs:

Little White Salmon
Lower Cispus
Green Truss on White Salmon
Silver Creek on Skykomish
Robe Canyon
Richland Creek
So Fork Yuba

How does this rate compared to others:

good destination, lots of other things in the area; good for a family trip (boaters can run Gorge, others can find other things to do...)
great weather
beautiful water (clear)
great pace in the canyon – takes a good ¾ day
warm water
good facilities/accommodation in area

**APPENDIX D: LIST OF INDIVIDUALS AND AGENCIES WHO
ASSISTED WITH THE STUDY**

Chelan County PUD

Event Coordinator:

Michelle Smith, Relicensing Specialist

Operations and spill:

Dave Brown, Operations Superintendent

Rob Campbell, Chelan Hydro Operator/Maintainer

Greg Perry, USGS (gjperry@usgs.gov,) 509-353-2633

Communications and media:

Steve Lachowicz, Relicensing

Wayne Wright, Manager of Corporate Communications

Kim Craig, Public Information Assistant

Logistics and film crew safety:

Jeff Osborn, Fish & Wildlife Relicensing

Keith Truscott, (Sat only) Parks and Facilities Supervisor

Bill Christman, (Mon only) Supervising Principal Civil Engineer

Chelan PUD Commissioners:

Jim Wall, Bob Boyd, Gary Montague, Barbara Tilly, Dave Pflugrath

Chelan PUD General Counsel:

Carol Wardell

Film crews:

Entrance Exam

Eric and Damon Ristau (Spokane, snakeriverfilms@yahoo.com)

Central Gorge

Brett and Lance McGinnis

(M&M Productions, 150 SE 1st Street, East Wenatchee, WA 98802; 509-886-5139)

Accommodations: Caravel Resort

Chelan County Sheriff's Department:

Doug Tangen, Steve Goodman

APPENDIX E: BOATER LIABILITY WAIVER FORM

ASSUMPTION OF RISK AND GENERAL RELEASE OF LIABILITY

1. I have requested access to the Chelan River Gorge for the purpose of whitewater paddling. Public Utility District No. 1 of Chelan County, Washington (hereinafter referred to as the "PUD") has agreed to grant such access without charge. I fully accept all of the conditions of this agreement and understand its terms. I understand that the access granted by the PUD is effective only for the specific date(s) agreed upon by the PUD in 2000.

2. I recognize that the whitewater paddling in the Chelan River in which I have requested to participate is a rigorous activity that may be physically, mentally and emotionally stressful and may aggravate existing physical, mental or emotional conditions or cause new ones. I recognize that the activity could be dangerous and hazardous and poses known and unanticipated risks. I understand that the dangers may include damage to or destruction of personal property; serious physical injury or even death, arising from a variety of hazards including, but not limited to, and by way of example only, rocks, hazardous terrain, trees, debris, powerful waves, waterfalls, hydraulics and various other man-made or natural hazards; and difficulty or improbability of rescue. I understand that American Whitewater has determined the Chelan River Gorge to contain difficult Class IV and V rapids. I understand that Class V waters represent the most difficult and dangerous level of whitewater paddling. I understand that the Chelan River has not been previously used for whitewater recreation. I further understand that American Whitewater, not the PUD, has determined that Chelan River is suitable for whitewater paddling. I further understand that there is no prepared access into or exit from the river canyon/gorge. I am personally responsible for choosing the method, route and equipment necessary to gain access to and exit from the river and gorge. I acknowledge that under these circumstances the usual hazards associated with whitewater paddling will be compounded. I also understand that there may be variations in river flows that could alter the character of the river . The PUD will attempt to provide the flows that have been requested by American Whitewater for the controlled flow study. However, I understand that the PUD cannot guarantee that particular water flows will be provided. I further understand that the amount of flow can only be estimated and cannot be controlled with any certainty.

3. I have requested the opportunity to participate in this activity. The PUD has not requested nor required that I participate.

4. I take full responsibility for my own safety and am not relying upon the PUD, Chelan County or any other entity or person for my safety or rescue. I have personally investigated the conditions and have made my own determination as to the suitability of the river and the gorge for whitewater paddling and my competency and ability to participate.

5. In addition, I recognize and accept:
 - a. that none of the participants will be acting as a professional river guide;
 - b. that I am personally and solely responsible for determining whether I have the skill and expertise to safely navigate the river;
 - c. that I am solely responsible for selecting equipment suitable for use during my participation;
 - d. that I am solely responsible for my own safety; and
 - e. that no other person or entity has any obligation to attempt to rescue me, and that any attempted rescue may, in fact, exacerbate my condition and/or cause injury or death.

6. I understand and expressly assume all the dangers incident to my decision to whitewater paddle the Chelan River. I hereby release all claims that I, my spouse or my children may have, including, but not limited to, property damage or destruction and personal injury or death which relate to, arise out of or are in any way connected with my participation in this activity, including specifically but not limited to any liability of or claims against: (a) the PUD, its officers, commissioners, employees, or any other persons or entities that may be involved in facilitating any use and enjoyment of the river segment involved; (b) Shelby Research and Consulting and EDAW, Inc.; (c) Chelan County, its commissioners and employees; and (d) each and every other participant.

7. I have personally inspected the route and conditions of the Chelan River Gorge. I have read and understand the following documents.
 - a. The barrier analysis of the Chelan Gorge and the descriptions of the rocks, falls, eddies, hydraulics and other conditions of the Gorge prepared by R2 Resource Consultants, Inc.
 - b. Memoranda from the Chelan County Sheriff dated June 22, 1998 and April 29, 1999.
 - c. Memorandum from the Chelan County Fire District No. 7 dated April 26, 1999.
 - d. Letters from Chelan PUD to FERC dated February 18, 2000 and May 3, 1999 and all attachments to said letters.

8. I recognize that neither the PUD nor its commissioners, officers, directors, employees, agents, successors or assigns are providing any liability, health or other insurance in connection with my decision to whitewater paddle the Chelan River Gorge. I agree to assume all financial responsibility for medical, rescue or other reasonable and necessary expenses that may be incurred on my behalf. I agree to defend, hold harmless and indemnify the PUD, its commissioners, officers, directors, employees, agents, successors or assigns, Shelby Research and Consulting, EDAW, Inc., and Chelan County, its commissioners and employees, for any loss or damage, including attorneys fees, that may result should I or anyone else pursue an action or claim for which I have accepted responsibility or that I have waived or surrendered by this release and waiver.

9. I also assume full responsibility for and agree to defend, hold harmless and indemnify the PUD, its commissioners, officers, directors, employees, agents, successors and assigns,

Shelby Research and Consulting, EDAW, Inc., and Chelan County, its commissioners and employees, against any claims, losses or judgments that may arise from any damage or harm that I may incur or cause. I shall be responsible for any equipment used by me.

- 10. This waiver shall be binding upon me, my heirs, executors and administrators.
- 11. I understand that this is the entire agreement and release. I understand that this agreement and release cannot be modified or changed in any way by representations or statements by the employees or agents of the PUD, Shelby Research and Consulting or EDAW, Inc.
- 12. I represent that:
 - a. I am 18 years of age or older.
 - b. I am submitting this release and waiver voluntarily and of my own free will.
 - c. I have no physical, mental or emotional problems, nor any history thereof, which could impair my ability to participate or to understand the meaning and intent of this waiver and release document.
 - d. **I AM FULLY AWARE OF THE CONTENTS OF THIS RELEASE AND HAVE READ THE ENTIRE DOCUMENT. I HAVE READ AND UNDERSTAND THIS DOCUMENT AND AM BOUND BY ITS TERMS.**

DATED this _____ day of _____, 2000.

SIGNED BY: _____
 Print Name: _____
 Address: _____

WITNESSED BY: _____
 Print Name _____
 Address _____

APPENDIX F: PHOTOS FROM THE ON-RIVER STUDY
