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A PROPOSED WHITEWATER RECREATION MANAGEMENT PLAN FOR THE NORTH AND MIDDLE FORKS OF THE AMERICAN RIVER

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I. INTRODUCTION

A. Summary:

The North Fork and the Middle Fork of the American River are located about 45 miles northeast of Sacramento, near the communities of Auburn, Colfax, and Foresthill. Portions of these two forks of the American River are located within the proposed inundation pool of the US Bureau of Reclamation's Auburn Project. Bureau of Reclamation lands within the project area are currently managed as the Auburn State Recreation Area by the Calif. Dept. of Parks and Recreation as an element of the State Park System. In this project area there are 13 miles of river recreational resources along the North Fork and 24 miles of river recreational resources along the Middle Fork. A third fork, the South Fork of the American River, is located about 15 miles south of the study area and has been a major regional whitewater recreation resource since the mid-1960's.

Whitewater recreational use on the North Fork and the Middle Fork of the American River was very light through the 1960's and 1970's, but in the 1980 through 1983 seasons, whitewater use increased dramatically and they have become important regional resources. The increasing importance of these resources has resulted from a combination of the increase in the regional demand for whitewater recreation through the years and management and water resources development decisions made on other regional rivers which have displaced use to alternative resources. Although there have been increases in non-commercial use, most of the increases in activity on the North and Middle Forks have been a result of commercial operations. Those that use the rivers non-commercially are rafters and kayakers from the San Francisco-Sacramento-Reno area as well as the northern California region. Commercial rafting operations draw clients mainly from the Sacramento, San Francisco, and Los Angeles areas.

The sudden increase in use and the changes in the local recreational use patterns have created real and perceived management problems and conflicts between recreational users and with local residents. Areas of concern have been: 1) the recreational carrying capacity of the river resources; 2) conflicts between commercial and non-commercial users; 3) conflicts between whitewater users and other recreationalists such as recreational miners, campers, and day users; 4) conflicts between whitewater users and the residents of some local communities in terms of traffic and parking; and 5) conflicts between whitewater users and some of the private landowners along the river.

The management of perceived problems has been complicated by a very involved landownership and management situation which includes the Tahoe National Forest, the Eldorado National Forest, the Bureau of Land Management, the Bureau of Reclamation,

California State Parks, and private lands in both Placer and El Dorado Counties. Each of these agencies and jurisdictions have varying management authorities, areas of concern, and issues of concern. They are also affected in varying ways by the type and character of current and potential future whitewater recreation management of these two rivers.

This study reviews the problems and issues associated with whitewater recreation on the two rivers, develops recommendations for use levels and use restrictions that can resolve the observed problems, and suggests management and institutional arrangements that can resolve difficulties associated with the complex agency patterns.

B. Background:

Whitewater recreation use began on both the North and Middle Forks of the American in the mid-1960's with occasional kayak trips (Martin, 1974). At that time, the 4.7 mile long Colfax-Iowa Hill Bridge to Shirttail Canyon reach of the North Fork American (NF) was considered as a very challenging and remote whitewater resource to be used at flows above 1500 cfs by experts only. The remaining 8.3 miles from Shirttail Canyon to Ponderosa Road and to Lake Clementine were considered to be usable for beginner and intermediate boaters. On the Middle Fork (MF), the 15.1 mile long Oxbow Powerhouse to Oregon Bar reach was considered as an advanced boater resource in the 600-1000 cfs range while the 8.9 mile long reach from Oregon Bar to the confluence with the North Fork American was considered as a beginning boater resource; the existence of major rapids and portages, and the resource's remoteness and high scenic quality were known.

Through to the end of the 1960's use on these river resources was not recorded. Only a few commercial whitewater rafting operations were active in California in the late 1960's and they were operating primarily on the South Fork of the American and on the Stanislaus Rivers. Non-commercial rafting was also very limited at that time and it also mostly occurred on the SF American and Stanislaus Rivers. It is likely that in the late 1960's whitewater use on the NF and MF was entirely limited to kayakers in small groups and annual use totals on each river may have been in the 100-300 user day range.

In 1971 (Calif. Resources Agency, 1971), the annual estimated use on the NF from Colfax-Iowa Hill Bridge to Ponderosa Road Bridge was 1000-2000 as was the estimated annual use on the Oregon Bar to the NF confluence reach of the MF. These estimates were derived from a consensus of opinion from the members of various active river boating clubs. Based on the observed kayak use levels in the 1984 and 1985 seasons, it is the author's opinion that these estimates may have been high.

From about 1970 through to the great California drought of 1976-1977, commercial and non-commercial whitewater recreational activity grew very `rapidly´ in California. On the South Fork of the American River, use increased from an estimated 5000-10,000 users days in 1970 to about 40,000 (68% comm./32% non-comm.) user days in 1975; there was about 22,000 user days in the lower water 1976 season, declining to near zero use in the 1977 season when little boatable water was available. On the Stanislaus River, the 1970 use estimate of 5000-10,000 user days increased to about 32,000 (67% comm./33% non-comm.) user days in the 1975 season; there was about 15,000 user days in the low water 1976 season, declining to near zero in 1977. On the Tuolumne River, the 1970 use estimate of 500-1000 user days increased to about 6600 (55% comm./45% non-comm.) by the 1975 season; use in 1976 was significantly reduced, and was near zero in the 1977 season. In 1973 the US Forest Service initiated a commercial use permit system on the Tuolumne.

In the 1970-1977 period on the NF and MF, records of use were not kept but a 1977 NF report (Calif. Fish and Game, 1977) indicated that use on the NF below the Colfax-Iowa Hill Bridge put-in was very low. Use at that time was probably mostly kayaking, however, non-commercial rafting was getting started on this river at very low levels. It is possible that annual use in the mid-1970´s could have been in the 200-400 user day range, however, this is totally unsubstantiated. The use at that time was noted as not causing any problems, however, it was also noted that there was a possibility of increased use and that increased whitewater use could lead to user and resource conflicts; it was recommended that as conflicts began to develop, a specific whitewater management plan be developed (Calif. Fish and Game, 1977). Use on the MF in this period is unknown but it probably was still used only by a limited number of kayakers and may have had about 100-200 user days a year.

Following the low water 1977 season, the return of full streamflows in the 1978 season brought a return of whitewater recreation which continued to grow, state-wide, through the end of the 1970´s. The growth included new non-commercial users, new commercial operators, and most importantly, a trend toward the use of a greater number of the State´s recreational rivers. On the South Fork American, use increased from about 30,000-40,000 (60% comm./40% non-comm.) user days to an estimated 80,000-100,000 (85% comm./15% non-comm.) user days in 1980. On the Stanislaus River, use stayed at about 55,000 (67% comm./33% non-comm.) user days annually in the 1978-1980 period. On the Tuolumne River, use fluctuated between 8200 and 10,300 (60% comm./40% non-comm.) user days annually in the 1978-1980 period.

In the later half of the 1970´s, use on the NF and MF also went unrecorded, however, discussions with various boaters indicate that use on the NF continued to grow at a slow rate, with

substantially greater attention in the 1979 and 1980 seasons, as it became more widely known as a good kayak resource and as some advanced non-commercial rafters became displaced in greater numbers from other rivers by commercial rafting activity. There may have been some limited commercial operations on the NF in the 1979-1980 period. The popular reputation of the NF as a very difficult and hazardous river began to wane somewhat in this period, whereas the MF maintained it's image as a river with both long reaches of flat water and short sections of Class V drops and portages. Toward the end of this period the MF also began to acquire a reputation as one with substantial landowner/whitewater boater conflicts centered around the scouting and running of the Tunnel Chute. These factors, combined with difficult road access to the take-out, kept use on the MF at very low levels. There may have been about 500 annual user days on the NF, and about 200 annual user days on the MF in this period.

Up to this time the NF was considered as a regional resource of limited significance providing a difficult Class IV resource to a small number of boaters. The MF was considered a regional resource of even less significance providing low quality white-water resources for only a few users.

In the early 1980's occurrences on several of the region's whitewater recreational rivers resulted in substantial changes in the use patterns and demand for the recreational resources of the NF and MF American Rivers.

First, as a result of a 1977 El Dorado County ordinance prohibiting whitewater recreation on the South Fork American and subsequent court findings, El Dorado County embarked on a whitewater recreation management planning effort in 1980. In 1981 the county issued commercial permits to 71 operators who had used the South Fork American in the 1980 season and allocated user days to these operators on the basis of the 1980 season reported and documented user levels. Based on the requirement that there had to be documented operations on the South Fork in the 1980 season, 49 applications for commercial permits were rejected.

Second, the 1981 season was the last on the Stanislaus River as the closure of the Corps of Engineers' New Melones Dam backed up water to and just above the normal whitewater recreation take-out at Parrott's Ferry in that year. The following winter of 1981-1982 generated enough runoff to essentially fill the reservoir which eliminated the whitewater resource for the 1982 season.

Third, the management of the Tuolumne River by the US Forest Service for wilderness oriented whitewater recreational experiences for the users tended to establish an annual maximum use level that started to be reached with some consistency toward the mid-1980's. Part of this management has been to limit the number

of commercial permits to 14 operations and to establish limits on the user starts per day. While there was a commercial permit system that started in 1973, in 1983 it was extended to include more commercial operators and to include non-commercial users. Before 1983 use limitations included 25 commercial user starts a day; starting in the 1983 season, use limits were increased to 50 commercial, and extended to limitations of 90 non-commercial raft users, and essentially unlimited one-day kayak use in 1984.

Use on the Tuolumne increased from about 8300 (70% comm./30% non-comm.) user days in 1980 to about 20,000 (55% comm./45% non-comm.) user days in the 1984-1985 period. Use seems to have stabilized at about 20,000 user days probably due to flow patterns and weekend/mid-week recreation patterns. Therefore even though the theoretical maximum use levels are much greater (27,000 user days through a 90 day peak season and perhaps 40,000 for the full season), without an increase in Sunday flows and substantial shifts in the weekend/mid-week recreation pattern the actual user capacity appears to be about 20,000 user days. There appears to be a substantial amount of unsatisfied user demand for weekend days on the Tuolumne due to both unfavorable weekend flow patterns and management use limits.

In a period when there was increased commercial and non-commercial use demand on the whitewater resources in the region and substantial growth in the number of commercial operations; 1) the Stanislaus River was eliminated from the regional resources base and generated about 55,000 user days of unsatisfied demand; and 2) management of the South Fork American and the Tuolumne Rivers removed the potential resource base for new commercial operations and set a cap on commercial user days. On the Tuolumne there has been a surplus of demand for weekend use and therefore a potential for displaced weekend use to other rivers. These occurrences plus the displacement of non-commercial users from "crowded" regional resources resulted in considerable pressures to find and utilize alternative regional whitewater resources.

After the 1980 season commercial operator interest in the NF increased and limited exploration of the MF as a potential commercial resource was undertaken by some operators. Although there were some difficulties recognized, the MF offered potential commercial use. Because the Calif. Dept. of Parks and Recreation has a contractual agreement with the US Bureau of Reclamation to operate the lands of the Bureau's Auburn Project as an element of the State Park system, State Parks initiated a commercial whitewater use permit system on portions of the NF and MF which are in the Auburn Project area. Starting in 1982, State Parks issued six commercial whitewater use permits upon application; by the 1985 season there were a total of 57 commercial permits.

In the 1982 season serious commercial operations started on the NF and MF and reported user information to State Parks and

surveys conducted on the MF for a small-hydro project proposal, indicated that there may have been 1500 (67% comm./33% non-comm.) user days on the NF and about 4000 (65% comm./35% non-comm.) user days on the MF. Non-commercial use in the 1984 and 1985 seasons indicates that the 1982 non-commercial use on the MF may have been significantly over estimated and a more realistic estimate may be 2800 (93% comm./7% non-comm.) user days.

In the 1982 season there were reported conflicts between commercial and non-commercial user groups at the put-in and in some of the rapids of the NF. Observations of the whitewater use on the MF and use patterns around the Tunnel Chute in 1982 indicated that the commercial operations may have, or soon would with increased use, cause non-commercial user displacement on the MF and that a recreation management plan would be necessary to deal with predictable use conflicts before use levels became unmanageable. The 1982 congestion problems were recognized on both rivers by the commercial operators, non-commercial users, and State Parks and were assumed to be associated with the time intervals between commercial trip starts. As part of the 1983 permit, the commercial operators and State Parks developed a 2 commercial groups starts per half hour limitation on both rivers in the attempt to spread out the use and reduce congestion.

By the 1983 season, because of increasing use and the uniqueness of use and resource characteristics, both the NF and MF had become significant regional whitewater resources. As commercial use levels increased on both the NF and MF so did reported commercial/non-commercial conflicts on the NF and conflicts between commercial operations on the MF. On the NF the conflicts were associated with congestion and use patterns at the put-in and the take-out, and congestion in the narrow and technical portions of the run. On the MF the conflicts were associated with congestion at the put-in, Tunnel Chute, the Ruck-A-Chucky take-out, and the Ruck-A-Chucky portage, competition for good camps, and congestion and traffic in Foresthill.

In recognition of the existing whitewater recreation management problems, the real potential for significant growth in demand on the NF and MF which could only exacerbate the problems, and a complex land ownership pattern and agency management responsibilities, State Parks and the US Bureau of Reclamation initiated an interim whitewater management planning effort in 1984.

During the 1984 season, field surveys for the management planning effort were conducted which concentrated on collecting group behavior pattern information at the put-ins and take-outs of the two rivers and on the collection of user information at the take-outs. These data were designed to generate information on the group use patterns and develop user information on travel, regional significance, resource value, and the relationship between use levels and sense of crowding. Because the study got

underway so late in the spring only a few survey days were conducted on the NF. On the MF the group's use patterns at the take-outs were so quick paced that only sketchy information was collected from users as they were rushed from the beach to the passenger vehicles. Even meaningful trip itinerary information was difficult to generate because the head guides of commercial groups most often did not know the place names of activity locations on the river. Fairly good put-in and take-out use pattern information was collected on both rivers, however, it became apparent that because of very concentrated use patterns, time estimates by head guides for on-river activities were much too general to be used in the study. In addition, not enough survey days were undertaken on the NF to result in good estimates of the commercial and non-commercial use levels, and on the MF the survey days were not undertaken in dense enough groups to fully account for multi-day trips.

Although not a success in terms of developing useful information, the 1984 survey season did allow for the development of a more carefully conceived study approach for the 1985 season. The idea of using user survey techniques for generating resource value, quality, and "crowding" parameters was abandoned. Instead, an approach of developing management objectives from a review of river resource characteristics and regional river resource options was adopted. The 1985 study season concentrated on the collection of typical use and behavior patterns of commercial and non-commercial groups at the major activity locations. These observations included mainly times of arrival, departure, and occupation of the sites, the patterns of use and behavior pattern modifications that were adopted by groups at varying use levels. These locations were typically the put-ins, on-river points of congestion, and the take-outs. The 1985 use estimates resulting from the field surveys were 4100 (74% comm./26%non-comm.) user days on the NF, and 12,200 (98% comm./2% non-comm) user days on the MF.

This proposed management plan develops management objectives based on regional resource characteristics, applies observed use patterns of the 1985 season to develop estimated carrying capacities for the two rivers, and recommends daily commercial use level requirements for the permit system to conform to the estimated carrying capacities. Other aspects of the observations conducted were used to develop additional recommendations on use pattern requirement to reduce users conflicts.

Another part of the plan development was a review of the institutional arrangements that have complicated the management of whitewater recreational activities on the two rivers, and issues of funding problems. A consolidated management agreement is proposed and the use of a recently instituted funding mechanism available to State Parks is recommended.

II. RESOURCE PROBLEMS AND PROPOSED WHITEWATER RECREATION MANAGEMENT PLAN

A. Resource Characteristics:

The North and Middle Forks of the American River have remarkably different resource characteristics and recreational use values but each has characteristics and use values that make them unique in the region. The most important resource aspects are seasons of usability, quality of the whitewater, possible trip length, and remoteness and visual qualities.

1: North Fork Resources.

The North Fork American River (NF) is a somewhat steep gradient Class IV whitewater river. It is note worthy on the west slope of the Sierra as a stream channel dominated by large boulders that impose very complex and tight routes for rafts and kayaks, and also imposes a fairly narrow range of suitable flows. At flows below 1000 cfs the narrowness of routes and the exposure of channel boulders increases the possibility of raft wraps, generally slows progress, reduces the recreational values to some users, and greatly increases congestion at bottleneck points, while at flows greater than 3500 cfs the large and tightly placed boulders create a complex channel composed of large and strong hydraulics and with generally swift currents. The recreational reach is generally considered to be a Class IV run.

Throughout the reach typically used for whitewater recreation, the NF is characterized by remote and "wilderness" or "primitive" conditions. Recreational gold mining operations can detract from the remote character particularly in early summer, as can the general activity around Shrittail Canyon. Despite these detractions, from a whitewater recreation perspective, the reach could be classified as wilderness/primitive with high scenic quality.

Because of the undammed nature of the watershed, the watershed's size, and other hydrologic characteristics, average monthly flows in the most "suitable" range of 1000-3500 cfs occur in the January through mid-June period in average water years. In these years the main use season extends from April through mid-June due to weather conditions.

The NF river recreational resource is composed of three segments that can be used either as separate runs or in combination. From the Colfax-Iowa Hill Bridge, 4.7 miles to Shirttail Canyon is the steepest and most technically demanding reach and is the main source of whitewater recreation interest in the NF. This is a 49 ft/mi,bedrock/boulder/gorge Class IV reach in the normal flow range and may be considered a Class V reach at higher flows. In

PLATE I: Chamberlin Falls Area on the NF.

This picture shows the typical channel configuration of the NF which generally has a narrow channel, bedrock channel margins, and steep canyon slopes. This shows rafts waiting to run Chamberlin Falls (in the distance) at about 2300 cfs.

the 4.5 mile reach from Shirttail Canyon to Ponderosa Road Bridge there are scattered boulders and bedrock controls in some of the rapids that create strong hydraulics, however, for the most part this segment is a Class II reach with some Class III rapids and a gradient of 23 ft/mi. In the 4.1 mile reach from Ponderosa Road Bridge to the upper end of Lake Clementine the channel is one of wide gravel riffles dominated by instream gravel deposits. This segment is a Class II reach with occasional strong tailwater hydraulics in some riffles and a gradient of 20 ft/mi.

2: Middle Fork Resources.

The Middle Fork American River (MF) is typically a low gradient whitewater resource interrupted by four major rapids and many secondary rapids over the 24 mile reach. This creates a whitewater resource somewhat unique among west slope Sierran rivers. The long low gradient sections impart a character of very gentle whitewater conditions with subdued hydraulic intensity, while of the four major drops only one (Kanaka Gulch) could be considered as a legitimate and runnable whitewater rapid. Because of the difficulty of dealing with either the running or the portaging of the Tunnel Chute, the reasonable upper end of recreational streamflows are in the 4000 cfs range; above about 2500 cfs the running of the Tunnel Chute should be considered as imprudent (some experienced boaters feel it is imprudently run at any flow). The lower end of recreational flows are about 900 cfs due to the shallow wide channel characteristics of the reach. The river could be classified as a Class III run with isolated Class IV and V rapids and portages.

The broad channel characteristics of the river along with the lack of complex rapids combine to provide a run that does not develop on-river congested with greater use levels, however, because of the open channel characteristic, many rafts and groups can be viewed at once. With increased use levels, congestion does tend to occur at specific locations, particularly at the put-in, Tunnel Chute, the Ruck-A-Chucky take-out, and the Ruck-A-Chucky portage. The river also has many good camping sites on public lands, and with the length of the reach, it is a good multi-day trip resource.

On this portion of the MF there are several areas where historical or current activities have an impact on whitewater resources. In the first 2.5 miles there are several large gravel bars that have been disturbed during gold mining operations, and there is currently a large commercial operation. There are several areas where recreational gold mining activities are common. Despite this degree of activity, the Oxbow to Oregon Bar portion of the MF has a very isolated character, high scenic quality, and imparts a wilderness/primitive experience to users.

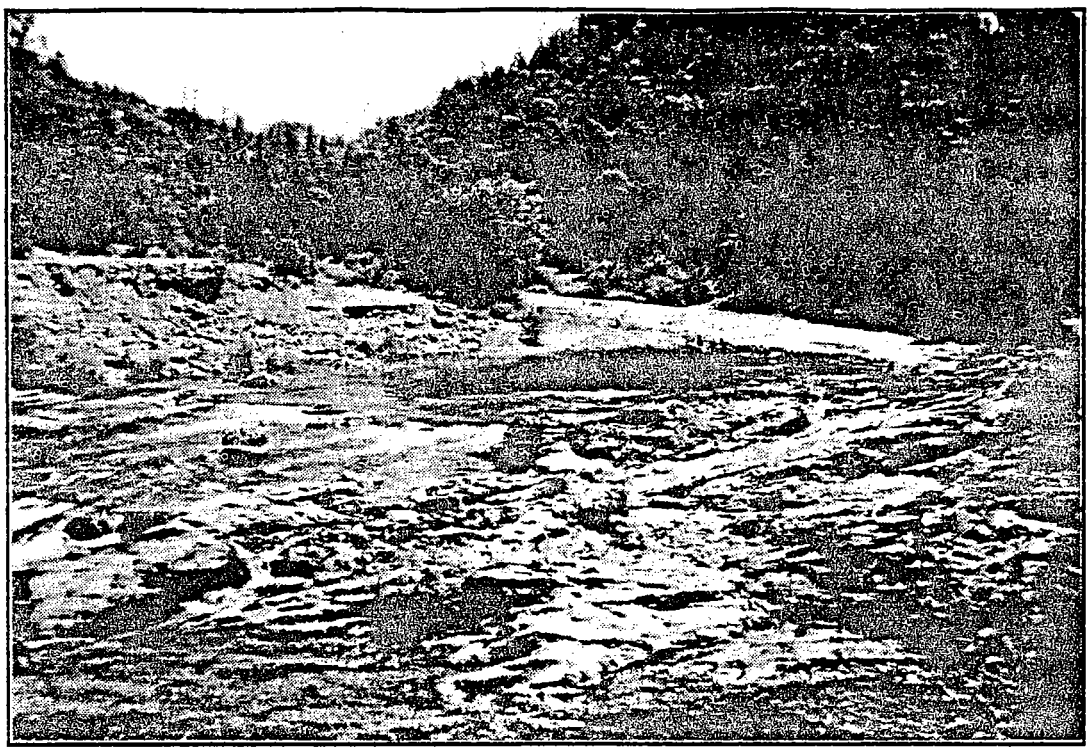

PLATE II: The Area Above the Tunnel Chute on the MF.

This picture shows the typical channel configuration on the MF which generally has a wide channel, a combination of bedrock and broad gravel terrace channel margins, and more or less gentle canyon slopes. This is the bedrock rapid just above the scouting eddy at the top of the Tunnel Chute.

The watershed of the MF is largely controlled by water resources reservoirs that store water in the winter and spring for hydroelectric releases in the summer. The average monthly flows in the winter are in the 1400-1900 cfs range, in May it is 1290 cfs and in the June through December period the average monthly streamflow is in the 600-800 cfs range. The Oxbow Powerhouse is often operated as peak capacity resource with daily peak releases. The powerhouse has a capacity of 900 cfs and the timing, duration, and magnitude of daily releases strongly affect the recreational use downstream and can result in daily peak recreational flows in the 1000 cfs range while average monthly flows may be in the 600-700 cfs range. The hourly, daily, weekly, and monthly pattern of releases can be quite variable but in the 1985 season boatable releases on weekend days usually began before 8:00 am, often reached the Ruck-A-Chucky take-out (RM 13.0) at about 2:00 pm, Oregon Bar access (RM 51.1) at about 3:00 pm, Mammoth Bar access (RM 21.8) at about 6:30 pm, and the confluence (RM 24.0) at about 7:30 pm.

The recreational section of the MF considered here is a 24.0 mile reach with multiple put-ins and take-outs, and has three segments used in a variety of combinations. The first is a 13.0 mile segment, with a gradient of 25 ft/mi, from Oxbow Powerhouse to Canyon Creek that has a broad and shallow channel and has some Class III rapids mostly formed by gravel bars and scattered larger boulders and has two of the four major rapids on the whole river; the Tunnel Chute and Kanaka Gulch. The Tunnel Chute, a major attraction for commercial clients, is a steep chute blasted in bedrock that drops the river about 15 feet over a distance of about 160 ft into a wide, flat gradient 200 ft long tunnel through a low bedrock ridge. The Tunnel Chute could be considered a Class IV or V rapid. The lower 8.9 miles of this reach is characterized by a very wide and shallow channel, and typically has Class II riffles. There are many broad gravel bars and elevated terraces that provide for most of the campsites on this river.

The second segment is the 2.1 miles from Canyon Creek to Oregon Bar. This segment has the unrunnable Ruck-A-Chucky rapid that drops about 25 ft and is portaged by all users using the suspended cable system. Below this initial rapid of this segment, the river is in a bedrock gorge for the 1.6 miles to Oregon Bar. There are several Class III/IV rapids in the upper end of the gorge but the gradient soon flattens out and the overall gradient averages 27 ft/mi.

The third segment is the 8.9 miles from Oregon Bar to the confluence with the NF. It has a broad channel characteristic with typically gravel bar riffle Class II rapids, and has many elevated terraces along the channel. There are a few bedrock and

boulder dominated rapids that could be Class III rapids and Murderer´s Bar Gorge that is considered as a Class V rapid. The gradient of this segment is 19 ft/mi.

B. Use Characteristics:

The user groups that are found on these rivers and use patterns that are undertaken are a result of the overall resource characteristics of the rivers. Also of importance are the locations of the rivers and the regional resource base.

1: North Fork Use.

The main use season on the NF is from about April through mid-June because of the natural winter and spring season runoff streamflow regime and acceptable spring weather. Most of the rafting use occurred in the 9.2 mile reach between the Colfax-Iowa Hill Bridge put-in to the Ponderosa Road Bridge take-out. There were a few commercial raft trips that used the 4.7 mile reach to Shirttail Canyon but this is the main use reach of the kayakers. There was an estimated 4141 users on the NF in the 1985 season. Of these, 62% were the clients of commercial operators, 18% were non-commercial rafters, 12% were guides for the commercial operators, and 8% were kayakers. Since there are essentially no opportunities for multi-day trips there was also an estimated 4141 user days of whitewater recreation in 1985.

About 90% of the full year's use occurs in the 8 or 9 week peak use season and in that period use is highly concentrated on weekend days with from 10 to 20 raft groups on weekend days and 1 to 3 raft groups on mid-week days. Actual trip start times also have a very strong concentration with most groups departing the put-in between 10 am and noon.

State Parks has issued whitewater use permits to 57 commercial operations for the NF and 15 to 25 use this river regularly. Commercial raft trips (55% of all raft trips) are composed mostly of paddle rafts, they average about 4 rafts and 23 users per group. Because of the length of the river trip and the time involved in the run and in staging the trips at the put-in, commercial operations adopt very similar itineraries and concentrate trip starts in the mid to late morning hours. Levels of weekend day commercial use stay high through the peak season and decline sharply with the post season flow recession: some operated on very substandard flow levels at the end of the season because trips had been booked.

Non-commercial raft trips (45% of all raft trips) are a mixture of oar and paddle rafts and sometimes have kayaks along. These trips average about 2 rafts and 7 users per group. Because of the trip length, non-commercial groups tend to have trip departures in the late morning but, because of varying shuttle patterns, there is a stronger bimodal pattern with a peak departure at about 11:00 am and another at about 12:30 pm. The non-commercial raft peak season use pattern on the NF tends to be

earlier than does commercial peak use season; it starts, peaks, and declines slightly ahead of the commercial pattern. Earlier season use occurs due to the greater ability of non-commercial groups to organize trips on short notice and take advantage of good early season weather. The earlier peak and decline is probably due to declining streamflows and crowding due to higher levels of commercial activity.

Kayak use on the NF is significantly different than either non-commercial or commercial rafting use. Kayak use occurs through the late fall, winter, and spring when suitable flows are available. The technical difficulty of the Colfax-Iowa Hill Bridge to Shirttail Canyon segment is a very attractive resource to advanced kayakers and is often used under worse weather conditions than rafting occurs. Use levels remain high through the peak flow season and well into the seasonal flow recession, typically in May and June. During the 1985 season, kayak use was at near peak levels when the surveys began in early April with up to 33 users in 7 groups on weekend days. Use stayed at relatively high levels through early May when there were 23 users in 9 groups. Following the early May peak, kayak use apparently dropped off sharply, however, there was probably a use pattern shift to later trip starts to avoid raft congestion, and this use was missed by the survey.

2: Middle Fork Use.

The main use season on the MF is from June through September because of controlled summer daily peak flow releases of upstream hydroelectric facilities and the summer recreation season. About 80% of all the trips use the 13.0 mile Oxbow to Ruck-A-Chucky reach; that is nearly all 1-day trips and 60% of the 2-day trips. About 17% of all the trips (35% of the multi-day trips) use the 15.1 mile Oxbow to Oregon Bar reach, and the remaining 3% use the 21.8 mile Oxbow to Mammoth Bar reach or the 24.0 mile Oxbow to the NF confluence reach. There were an estimated 8063 users on the MF in the 1985 season. Of these, 82% were the clients of commercial operators, 16% were the guides for the commercial operators, and 2% were non-commercial rafters. Since there are the opportunities for 2 and 3-day trips there was also an estimated 12185 users days of whitewater recreation and 4122 users nights of camping in 1985. Of these, 98% was from commercial trips.

About 97% of the full year's use occurs in the 10 to 12 week peak use season and in that period, use is highly concentrated on weekend days with from 6 to 25 groups on weekend days and 1 to 3 raft groups on mid-week days. Actual trip start times also have a very strong concentration with most groups departing the put-in between 10:30 and 11:30 am.

State Parks has issued 57 permits for commercial whitewater operations on the MF and about 20 to 35 use it regularly, of these 20 to 30 ran multi-day trips, and about 20 were regular overnight operators. Commercial raft trips (about 90% of the total) typically had about 3 to 5 rafts per group for 1 and multi-day trips. The number of users per group average about 25 to 29 for 1-day and multi-day trips respectively. Because of the length of the river trip and the time involved in the run and in staging the trips at the put-in, commercial operations adopt very similar itineraries and concentrate trip starts in the mid morning hours. Because of the rate of movement of release water from the powerhouse and trip times, the itineraries of the groups stay similar throughout the run. Levels of weekend day commercial use stay reasonably high throughout the peak use season.

Non-commercial raft trips (about 10% of the total) average about 1 to 2 rafts and about 6 to 7 users per group; this amounts to only about 4% of the total rafts and 2% of the total whitewater users. This level of activity is very small and was found to be of little consequence on the MF. There is also some kayak use but the total observed in the 1985 season was less than 10 users. The winter season may see a greater, but still very low, level of kayak use.

C. Current Management:

1: Whitewater Recreation Management Authority.

The reaches of the North Fork and Middle Fork American River which are the focus of this management plan are within the boundaries of the federal Auburn Dam and Reservoir project proposed for construction by the U.S. Bureau of Reclamation (USBR). USBR may have jurisdiction within the project area through outright ownership, through proposed or final withdrawals of federal lands managed by other agencies or by interagency agreements. A review of USBR ownership maps indicates that most of the federal lands of the river corridors appear to have either been proposed or finally withdrawn. Of the original private lands of the study area some have been purchased by the USBR. While there are scattered private parcels along both rivers, none of the principal put-ins, take-outs, and only some limited camping areas are on private lands.

The USBR has contracted with the California Department of Parks and Recreation for the management and protection of Auburn Project lands as part of the State Park System. Since the State does not directly own any of the lands in the area in which whitewater recreational activities are occurring, State Parks' jurisdiction is derivative to authority of other agencies, particularly USBR. However, once State Parks does properly have administrative jurisdiction, state law gives State Parks broad authority to manage and regulate lands as part of the State Parks System.

This agreement between USBR and State Parks calls for the recreation management of "Project Lands" both after the completion of the project and in the interim. As part of this responsibility, State Parks has been involved in the management of whitewater recreation by issuing permits for commercial operations on the two rivers and establishing certain use conditions.

Although State Parks has clear authority to manage whitewater recreation on USBR lands, the reaches of the rivers used include lands managed by the U.S. Bureau of Land Management (BLM), Tahoe National Forest, and Eldorado National Forest, and private lands under the authority of Placer and El Dorado counties. The authority of State Parks to manage the whitewater recreation on these rivers does not extend to non-USBR lands without specific agreements between the appropriate agencies.

Since 1980, the USBR has had an agreement with BLM which authorizes the USBR to manage BLM lands as part of the Auburn Project Lands. Because of the USBR/State Parks agreement, the authority to manage BLM lands for recreational purposes is transferred to State Parks.

USBR's authority to manage U.S. Forest Service (USFS) lands is presently more limited. None of the USFS lands in the project area have been fully withdrawn and USBR and USFS have agreed that until lands are finally withdrawn by USBR for project purposes, the USFS retains exclusive jurisdiction over their management. Even for lands which are finally withdrawn, the lands remain part of the National Forest system and USBR would have primary jurisdiction for "reclamation purposes" only. There are agreements between USBR and the USFS that establishes the area that would include "reclamation purposes" as the reservoir surface and lands 300 ft horizontally from the reservoir edge. However, this agreement does not extend to pre-construction conditions.

The current USFS position is that USBR does not have authority to contract directly with State Parks for management of National Forest lands within the project area. The net effect of this mix of statutory provisions and agency understandings is to give State Parks jurisdiction over BLM and USBR acquired lands, but little or no jurisdiction over USFS lands. However, USFS does acknowledge that it has the authority to transfer management authority over National Forest lands, to USBR or State Parks, by agreement.

2: Current North Fork Management.

On the North Fork, the put-ins, take-outs, and most of the river frontage lands are on either USBR acquired or BLM lands and State Parks has recreation management jurisdiction. State Parks has issued whitewater use permits to various commercial operators which carry limits on group sizes, daily limit on the number of trip starts, trip start times, and various behavior pattern requirements. Permits were not required of non-commercial users. In the 1985 season enforcement of the permit requirements was affected by occasional site visits to the main put-in and take-out.

State Parks, Placer County Sheriffs Dept., and local emergency response organizations are responsible for search and rescue operations associated with whitewater recreation.

3: Current Middle Fork Management.

On the Middle Fork, the put-ins are on Tahoe National Forest lands and a significant portion of the river frontage is Eldorado National Forest lands. The remaining portions of the corridor are mostly of BLM and USBR acquired lands with a small amount of private lands. All but a very small reach of the Middle Fork whitewater resource is within the Auburn Project boundaries and State Parks has taken the whitewater recreation management lead by issuing use permits to commercial operators and collects use

fees. The permits carry limits on group sizes, daily limits on the number of trip starts, trip start times, and various behavior pattern requirements. Permits were not required of non-commercial users. In the 1985 season enforcement of the permit requirements was effected by occasional site visits to the main take-out areas.

To aid in the whitewater recreation management of the Middle Fork the Tahoe National Forest has agreed, in a 1983 letter, to the transfer of responsibilities in the area of the Oxbow put-in that is just outside of the Auburn Project boundary to State Parks. Because of manpower limitations, State Parks has not yet been able to assume these responsibilities. Tahoe National Forest also issues commercial road permits to commercial operators and collects use fees.

The Eldorado National Forest issues special use camping permits to commercial operators for overnite use on Eldorado National Forest lands and collects use fees. The camping permits did not designate sites but they carried minimum impact requirements. There has been no direct management of campsites.

State Parks, Placer County Sheriffs Dept., and local emergency response organizations are responsible for search and rescue operations associated with whitewater recreation.

Placer County has responsibility for the management of traffic problems in the community of Foresthill associated with the whitewater recreation of the Middle Fork. Little active parking and traffic management was undertaken in the 1985 peak season.

D. Use and Management Problems:

The main use problems on the NF and MF are associated with congestion at specific locations and reaches of the river which result from the concentration of use into weekend days and into narrow hour ranges of the day. The areas of congestion include:- 1) off-site traffic and parking, 2) put-ins and take-outs, 3) on-river points of constriction, and 4) campgrounds. These congestion problems are a function of the user patterns and of facility and physical capacities and translate into; 1) on-river crowding in a wilderness/primitive river setting, 2) use conflicts between commercial operations, 3) use conflicts between commercial and non-commercial river recreational users, 4) some conflict between river recreational users and other recreational users, 5) conflicts between on-river recreational users and the residents of Foresthill, and 6) reduced environmental quality of the trips which reduces the experiential values to the users.

1: Facility, Physical, and Social Capacities.

On the NF, many of the weekend days of the peak use season have on-river use levels so high that continuous lines of rafts develop in some of the constriction points. In some cases this could lead to very tight spacing between rafts and the intermingling of groups, while in other cases it forces waiting in line to run a particular rapid for periods of time upwards to a half hour. In other situations rafts can wrap on rocks and because of the narrow channel characteristics of the NF, all downstream transit is halted. Because of the rate at which trips depart the put-in, more or less constant contact and adjustment of behavior occurs through the steep portion of the run. After the last major rapid, Staircase, use tends to spread out and the absence of narrow channels and technical water reduces bottlenecks and congestion.

The narrow and technical aspect of the NF channel and the lines required for incident-free runs leads to a situation where levels of congestion as high or higher than are found on other regional rivers, can be created on the NF with far fewer rafts. The observed levels of accommodation required by rafting groups to deal with congestion and bottlenecks, the length of delays imposed, and the degree of contact with other groups that occurs on the NF on weekend days during the peak use season would indicate that this is a "High Contact" river recreation resource under existing use patterns.

At about mid-season State Parks began enforcing the separation of commercial and non-commercial put-ins on the NF and this has greatly reduced conflicts between commercial operations and both non-commercial whitewater and camping recreationalists. The capacity of the commercial put-in location is limited in that

only 4 or 5 companies can use the staging area at once without spilling out on the roadway. Parking capacity at Shirttail Canyon is also exceeded on weekend days and this is sometimes associated with commercial whitewater use. At the Ponderosa Road Bridge take-out parking is also limited, however, the capacity is greater than at Shirttail Canyon. Parking associated with commercial and non-commercial trips, as well as other day use activities occurring at the site, is accommodated along the narrow roadway on both sides of the bridge. There is also limited space for the staging of raft trips at this location and it is sensitive to congestion on heavy use days when arrivals are concentrated in a narrow time frame.

On the MF many of the weekend days have use levels so high and so concentrated in time that congestion created at access points and at on-river locations causes time delays, alterations of itinerary, and shifts in use patterns. Because of the rate at which groups arrive and depart the put-in, more or less constant contact and adjustment of behavior occurs through the first portion of the run. The general lack of technical rapids and potential bottlenecks after the Tunnel Chute tends to spread out the use pattern so that there are only rare occurrences of on-river congestion in the middle portion of the run provided that adequate flows are present.

Although there appear to be abundant campsites on the MF, there is a surprisingly low number of medium and high quality sites with capacities great enough to accommodate typical overnight commercial trips. This, along with a tendency for some operators to leave camp equipment in campsites - in a sense reserving and permanently occupying the sites, has resulted in a reduction of the possible campsites for those operators who do not leave equipment in camps.

The release pattern of the Oxbow Powerhouse is typically such that boatable flows reach the Ruck-A-Chucky area in the afternoon and the overnight trips and one-day trips tend to arrive in very narrow time frames; congestion can develop at both the portage and the take-out areas. There is also, at times, limited parking at the take-out locations.

The 1985 State Park commercial permit on the NF and MF had several elements intended to decrease congestion and to increase the daily capacity of various sites and facilities by directing certain aspects of commercial use patterns. The use pattern directives that were designed to reduce conflicts include; 1) designated operator trip start times, 2) trip size limits, 3) daily trip start limits to be controlled by the companies, 4) a designated commercial put-in on the NF, 5) parking limitations at the NF and MF take-outs. Because of limited on-river management presence, State Parks relied on the commercial operators to voluntarily assume these use patterns.

The observations of user patterns on both the NF and MF through the peak use season conducted for this study conclude that the use patterns of commercial trips did not voluntarily conform to the suggested patterns in the permit. Only when there were State Park personnel present did the commercial operators use the designated put-in location on the NF or conform to parking restrictions at the take-out on the MF. Trip start times were regularly not met and weekend day mornings had highly concentrated peak hours of activity. While there were not regular problems on the NF, on the MF the number of daily commercial trip starts on weekend days were consistently greater than the established limits. There were also a substantial number of commercial operators and trips that exceeded trip size limitations. Particulary on the MF there were several operators that held more than one permit by owning more than one company. This in itself was not a problem, however, to create more efficient operations these operators often ran both companies on the same days using the same vehicles, which forced the groups to have the same itinerary. These groups then traveled essentially as one unit of up to 10 rafts and 80 users.

While appropriate commercial put-in location and take-out use pattern can reduce conflicts and are reasonable management expectations, trip start times, perhaps the most important in reducing on-river conflict, are beyond the reasonable control of the operators. Consistent trip start times cannot be maintained by operators because the specific time that a trip is ready to depart the put-in is a function of meeting their clients either off-site or at the put-in (a process difficult to keep on schedule) and many other possible exogenous circumstances. It appears that requirements such as trip start times are not appropriate management approaches.

2: Commercial/Non-Commercial Use Conflict.

Observations during the 1984 and 1985 seasons indicated that the there are serious commercial/non-commercial conflicts on the NF but on the MF, few elements of conflict were observed.

The element of conflict between commercial and non-commercial use results from congestion characteristics of the NF and the use patterns and group characteristics of the raft trips. As the commercial use increases to a peak about mid-season, the level of non-commercial use drops to near zero; this shift occurred in both the 1984 and 1985 seasons. The elements of conflict include; 1) the daily number of rafts on the river that commercial operations can generate (up to 58/day) and the resulting general congestion, 2) the number of rafts per commercial group (3-5) creates additional on-river congestion by "filling up" considerable lengths of the narrow channel in blocks requiring unusual accommodation by the smaller non-commercial groups, and

3) the number of rafts and users (15-25) per group on commercial trips is visually out of scale on this narrow channel and create an impression of "High Contact" and crowding to the smaller non-commercial groups. Compared to other rivers in the region, these conflict elements occur with lower commercial activity because of the narrow and technical characteristics of the NF channel.

The continuous transit of rafts through specific "play" points on the NF has resulted in a noticeable decline in resource values for kayakers and has lead to a "High Contact" recreational resource for this group. To reduce this conflict these users have adopted a use pattern of a shorter trip length and a later put-in time.

On the MF, observations of resource characteristics and use patterns indicate that this river is not suited for significant non-commercial use. While there are potential conflicts, the non-commercial use is so limited that accommodation of use and behavior patterns can resolve problems.

3: Whitewater/Other Recreation Conflicts.

The conflicts observed between whitewater users and other recreational users have been mainly associated with the use activities and parking at the access/put-in/take-out points. A secondary conflict has been the aesthetic impact of mining activities on whitewater users.

On the NF, the Colfax-Iowa Hill Bridge non-commercial put-in is located in the campground and the level of whitewater activity for 4 or 5 hours during the mornings of peak season weekend days tends to create a sense of crowding for the campground users. To date, the problems have not been due to the capacity of the facility, but rather a basic conflict between the recreational expectations of the campers and the level of raft trip staging activity. Fortunately, the peak non-commercial use is over by June and the conflict is over at the start of the summer season.

On the NF at Shirttail Canyon the nature of the conflict between whitewater users and other recreational users is in the capacity of the limited parking along the roadway. Although only occasionally used by raft groups and more often by kayak trips, whitewater recreation vehicles often contribute to the lack of available parking for the local day use recreationalists. Ponderosa Road Bridge take-out area also has limited parking, however, in the 1985 season the parking capacity was not observed to be a problem to the day users. The main beach area at this location is used for the take-out and the rate of raft trip arrivals on Saturday and Sunday afternoons in the peak season are such that day users choose to leave. Once again, the peak rafting season is over by mid-June and this conflict

does not exist during most of the summer day use recreational season.

At the Ruck-A-Chucky and Oregon Bar take-outs on the MF there are some low levels of day-use that were observed to be dislocated in the afternoons of the weekend days. The use is minor and does not seem significant.

Although recreational mining occurs throughout most of the year, the level of activity increases with warming weather, warming water, and reduced streamflow toward summer. Our on-river surveys indicate that on the NF the level of conflict during the peak use season is not unduly severe and the greatest potential for conflict occurs after the whitewater use season. On the MF the mining and whitewater recreation seasons are the same but few conflicts were observed as long as the mining operations kept the cross-river lines higher than 5 feet above the water surface. The miners on the MF also occupy many camps for the full summer but the location of these sites does not cause itinerary problems for the multi-day trips.

4: Whitewater/Foresthill Conflicts.

While on the NF most commercial operators meet their clients off-site at a variety of locations, most of the commercial operators on the MF meet their clients in the community of Foresthill. Since there are often more than 15 commercial groups on Saturdays, and the trip itineraries of the groups are so similar, there is significant congestion along the highway on Saturday mornings from about 7 to 10 am. Between congestion created by general traffic, very dense parking patterns, random and often illegal parking, and pedestrians wandering across the highway the local population often feels severely impacted by the commercial whitewater operations despite the increased sales by local business.

5: Safety/Search and Rescue.

Whitewater recreational activities on these two rivers have resulted in many instances where rafts have flipped, become lodged on mid-channel rocks, filled with water and wrapped around mid-channel rocks, and where users have been disassociated from rafts in any number of alternative ways. Kayakers with intermediate skills (and some times those with greater skill levels) have spent their share of time floating short portions of the rivers in pursuit of their kayaks. Sometimes, albeit infrequently, these occurrences result in damaged or lost equipment and in minor injuries to users such as cuts or bruises. For the most part adequately equipped and experienced user groups quickly rectify these problems through self or group supported rescue and

in more difficult situations other user groups typically assist. By enlarge, these problems and solutions are considered as quite normal on whitewater resources, but for some users it appears to be a recurrent part of their typical on-river experience.

At flows greater than 3000 cfs, long rapids with very intense hydraulics develop on the NF which can result in raft flips and users being washed out of the rafts by waves. Swimmers can be easily and quickly separated by long distances from the rafts and other users by the swift and somewhat eddyless current. At flows less than 1200 cfs the routes through rapids become very narrow and there are may exposed mid-channel rocks and short near vertical drops which can result in rafts being wrapped and users being thrown from the rafts.

On the MF, problems are typically a result of congestion at the put-in, runs through the Tunnel Chute, runs through Chunder Rapid on the approach to Ruck-A-Chucky, and the Ruck-A-Chucky portage. Injuries have been varied and mostly minor but some have been deep cuts, broken bones, and trauma associated with impact on the rocks of the Tunnel Chute after a raft flip or being washed out of the raft.

The vast majority of these on-river and injury/equipment damage situations have been adequately dealt with by the on-river users at the scene. Over the past several years there have been several instances where the help of local emergency response organizations was required. The most common situation appears to be at the Tunnel Chute on the MF where some injuries have required emergency evacuations by helicopter or vehicle. There have been some injuries at Chunder Rapid on the MF that were responded to, however, with the road access and the number of raft operations usually found at this location, it is questionable as to how frequently emergency help will be required. On the NF there have been some occurrences requiring assistance in the early season when rafts and users were completely separated and ground personnel were needed.

Members and officials of local and county search and rescue organizations report that whitewater recreation, and in particular, non-commercial use are hazardous activities. It has been stated that: 1) there have been many deaths on the two rivers over the past several years, 2) that most of these are associated with non-commercial users who are typically inexperienced, and 3) that every year non-commercial rafting on the river claims lives.

A review of the Placer and El Dorado County Coroner's reports and the records of the Cal. Dept. of Boating and Waterways found that from 1980 through 1985 there were 16 drownings on the NF and MF American River upstream of Folsom Reservoir. Of these, 6 drownings occurred in the reaches of the NF and MF considered in

this study and of the 10 that were outside of the study reaches, 9 were associated with activities other than whitewater recreation. Of the 6 drownings that occurred in the study reaches in the 1980-1985 period only one was associated with whitewater recreation. The 14 drownings that were not associated with whitewater recreation typically occurred at or near road access points and involved the use of rubber-ducky rafts, inner tubes, and canoes, or simply swimming and individuals without any swift water experience.

During the 1984 and 1985 seasons it has been the experience of the field observers that the non-commercial whitewater users and groups and the commercial guides and groups were about equal in ability, experience, and equipment in terms of dealing with both the NF and the MF. Commercial rafts were observed to have the full range of potential on-river problems at rates equal to or greater than non-commercial rafts. On the other hand commercial groups tend to be larger and can resolve on-river problems more quickly than can non-commercial groups and therefore commercial groups tend to lend occasional manpower assistance to non-commercial groups.

Even though whitewater recreation is inherently a hazardous activity to users, by and away the vast majority have the equipment and experience to deal with the situations that typically arise. In an around the study reaches the main safety/search and rescue issues involve non-whitewater recreational use and alcohol near major road access points.

E. Management Objectives:

A review of the resource characteristics of the NF and MF indicate that they are unique whitewater resources in the region. Their uniqueness in resource characteristics and user experiential values direct some of the most important elements of the management plan.

The NF whitewater recreational reach has a small, steep, and complex channel with a decidedly technical aspect best used by advanced rafters. The run has an isolated and wilderness/primitive character, is relatively close to users populations, and is a spring season resource. When considering raft use, season of use, trip length, channel characteristics, and technical difficulty, only the NF is easily available to the population centers of northern California for weekend use. There are other rivers in the region with wilderness/primitive and technical characteristics similar to those of the NF, however, they tend to be either in areas more removed from population centers or are larger west slope Sierran rivers which, when flows on the NF are ideal, have high spring streamflows that are often too high for the majority of potential users. The sum of all these parameters makes the NF a very important whitewater recreational resource element in the region.

On the MF the reliable summer season boatable flows, the isolated environment with high visual quality, and a reach length that offers 1-day to 3-day trip options combine to make the resource one of regional significance. Only three whitewater resources in the region have reliable summer season flows and options for multi-day trips; the Tuolumne, the South Fork American, and the Middle Fork American. The Tuolumne is managed as a very "Low Contact"/wilderness/primitive experience by the National Forest and has very low use levels. The South Fork American is managed as a very "High Contact"/rural experience by El Dorado County and has very high use levels. The MF in contrast, has high visual and amenity values and moderate to low "whitewater" resource values and moderate use levels. Therefore, with the exception of "whitewater" resource values, the MF has resources intermediate between the Tuolumne and South Fork American. For commercial operations the MF is a very valuable summer resource that offers 1-3 day trips in a high quality setting. Although lacking significant "whitewater" resource values, the MF offers important options to the South Fork American and Tuolumne rivers.

Demand in the region for whitewater recreational resources will increase for both the commercial and non-commercial sectors. Non-commercial demand for spring season, technical, and isolated whitewater resources should increase at relatively high rates in the future as the number of skilled non-commercial rafters grows and these resources become more rare. Commercial and non-commercial demand on the NF is therefore expected to grow in the

future. Because of the tendency of commercial operations to adversely affect non-commercial use and reduce resource values for this group the future use pattern on the NF will probably be one of increased commercial use and decreased non-commercial use through the process of displacement. While the isolated, high visual and amenity aspects of the MF are highly regarded resource values by non-commercial users, the lack of significant "whitewater" resources and difficult logistics of the MF combine to make this resource one that will probably never be significant for non-commercial use. The 13 mile length is a long 1-day trip and multi-day trips are complicated by Tunnel Chute and Ruck-A-Chucky. The difficulties that non-commercial users encounter on the MF are typically greater than the resource values realized.

Given the expected increases in regional demand for general whitewater recreational resources and the resource characteristics of the NF and MF, it appears that both should be managed for "Moderate Contact" use levels and the NF should focus of non-commercial use values and the MF should focus on commercial use values.

Issues of resource characteristics and values, user group characteristics and use patterns, and future demand, as presented above, and the management options available to State Parks leads to the following management objectives:

1) The resources should be managed to maintain their wilderness/primitive character, to the degree possible, by maintaining "Moderate Contact" recreational resource opportunities.

2) Non-commercial use should be the whitewater recreational focus of the NF and levels of commercial use should be managed such that a "Moderate Contact" recreational resource opportunity is maintained for all whitewater user groups.

3) Commercial use should be the whitewater recreational focus of the MF and the levels of commercial use should be managed such that a "Moderate Contact" recreational resource opportunity is maintained.

4) The management plan should rely on the natural use patterns of the user groups and employ use level management rather than use pattern or behavior management to meet contact level objectives; it should be as self-enforcing as possible.

5) There should be accommodation for changes in the allowed use levels in future based on changes in demand for the resources and changes in use patterns.

6) Whitewater/non-whitewater recreational conflicts should be reduced where possible by altering facility capacities,

whitewater use patterns, and whitewater use levels.

To develop a management plan that addresses these objectives the analysis should:

1) Use the capacity of access points and on-river constriction points to establish the appropriate use level that maintain "Moderate Contact" levels.

2) Use the existing use patterns of the user groups as the basis for capacity evaluations.

F. Capacity Evaluations:

1: Carrying Capacity Background.

The use patterns and use levels on the NF and MF have resulted in complaints of crowding by whitewater recreationalists, complaints and observations of congestion problems by commercial operators, and observations of congestion by State Park field personnel. Early Management Plan meetings with agency personnel from the USBR, State Parks, Tahoe National Forest, Eldorado National Forest and the Placer County Planning Dept. stressed the need for use levels that conformed to the carrying capacities of access points and facilities, and on-river resources.

To adequately address the issue of the carrying capacity of a river recreation resource it is necessary to consider a variety of factors, to establish threshold capacity levels for the factors, and to establish management threshold targets that direct a management plan outcome which can provide for the desired recreational experience.

There are typically four kinds of carrying capacity factors involved in river recreation situations. These factors are;

1. Physical Capacity: This factor refers to the amount of space afforded by the "unimproved" resource base. It may refer to the amount of space on the water surface, the rate at which users can pass a given constriction point, or the number or capacity of campsites, etc.

2. Facility Capacity: This factor is similar to the Physical Capacity factor but it refers to the space afforded by the "improved" facility resource base. It may refer to the space in parking areas, staging areas, improved and designated camping areas, or the rate at which users can pass through a constricting facility, etc.

3. Environmental Capacity: This factor refers to the amount of recreational use that can be absorbed by the natural environment without resulting in a specified level of degradation. It may refer to sustaining a fishery resource in the face of fishing pressure, acceptable levels of soil erosion and vegetation trampling in campsites, the rate of firewood consumption, or the protection of unique natural or historical resources, etc.

4. Social Capacity: This factor refers to the amount of contact with other individuals and groups that

recreational users are willing to accept. It refers to acceptable rates and quantities of interaction within the group, between groups, and between user types.

Each of the above carrying capacity factors can be viewed in terms of two spatial dimensions that depend on one another. These spatial dimensions are:

1. Site Capacity: This is the capacity of specific features, facilities, or locations on the river in terms of any or all of the above capacity factors.

2. River Capacity: This is the capacity of the whole river run, or significant portions of the river, in terms of the integration of the various site capacities and use and behavior patterns.

Each of the above carrying capacity factors can be viewed in terms of three time dimensions that have significant bearing on the ultimate carrying capacities. These time dimension capacities are:

1. Instantaneous Capacity: This is the upper limit of users or user groups that can be provided for, at one instant, by any of the above carrying capacity factors.

2. Daily Capacity: This is the instantaneous capacity of the above carrying capacity factors extended over the use-day by applying an assumed behavior or use pattern.

3. Seasonal Capacity: This is the daily capacity extended over the expected use season based on daily, weekly, and monthly use patterns.

The evaluation of the above carrying capacity factors does not often result in single quantities that represent instantaneous capacities. For each capacity factor, variable instantaneous carrying capacity values can result when different management criteria and approaches are applied. The possible variable management criteria and approaches are:

1. Acceptable Impact: By altering the degree of acceptable adverse impacts to natural resources, instantaneous capacities can be changed.

2. Site Hardening: By making overt alterations to features that serve to reduce the susceptibility to

adverse impacts, greater instantaneous capacities can be provided.

3. Facility Improvements: By increasing the size of existing features or facilities, or by developing new facilities, instantaneous capacities can be increased.

4. Acceptable Contact: By assuming differing acceptability levels of user interactions and "crowding", instantaneous capacities can be changed.

The basis for establishing the criteria for acceptable resource degradation and levels of user interaction that result in the instantaneous capacities, and the decisions on changing instantaneous capacities by site hardening or facility improvement need to be derived from an evaluation of natural resource and recreational resource conditions and values, and agency management options. The evaluative parameters should include:

1. Management Options: The management authority of the responsible agencies should be reviewed to establish the degree to which use levels can be controlled in terms of both authority and existing directives.

2. Resource Protection Objectives: The desired level of resource protection needs to be set which establishes the limits of acceptable resource degradation with respect to either basic resource values or to the contribution of resource qualities to users.

3. User Experiential Value Objectives: The desired level of acceptable interaction among the users and groups needs to be set in terms of desired upper limits of crowding which establishes the general type of recreational experience the users should realize.

The above evaluative parameters can be derived by several lines of analysis that can relate to one another and can combine to determine appropriate parameters. These lines of analysis include:

1. Agency Policy: Existing agency policy, directives, or related land management planning may already direct the level of natural resource protection or the desired level of user experiential value that can result in the establishment of instantaneous capacities..

2. Analyses of On-River Conditions: The review of the natural resources base of the river corridor and use level experiences and expectations can result in the

establishment of resource protection objectives and objectives for user experiential values that can be used to establish instantaneous capacities.

3. Regional Resource Analysis: The regional river recreational resource base can be reviewed in terms of comparable or substitutable resources for the subject river. By considering levels of acceptable natural resource degradation, use levels, and acceptable contact, set the resource protection and user experiential objectives on the subject river on the basis of providing a range of available experiential opportunities in the region.

The typical process of developing a carrying capacity analysis for river recreation is multi-staged. It involves extending the instantaneous site capacities to daily site capacities to daily river capacities for the whole resource. This process involved:

1. Conducting a review of agency authority and policy directives.

2. Developing natural resource protection and user experiential value objectives.

3. Conducting on-river resource evaluations, developing capacities of features and facilities, and developing characteristic user patterns.

4. Using resource protection and user experiential value objectives, and initial evaluations of on-river resources, etc., developing specific resource protection and user interaction standards for the four carrying capacity factors.

5. Using the resource protection and user interaction standards, developing instantaneous site capacities for the various features and facilities, and on-river points of congestion.

Extending these instantaneous site capacities on to an analysis of daily site capacities involves the use of assumptions of daily use and behavior patterns, and the extrapolation of patterns to the full day. This involves:

1. Using observations of user or group patterns in terms of times and duration of site occupation, set the peak daily occupation of the sites at the determined instantaneous capacities and distribute additional daily use in accordance with the daily user pattern.

2. Using the instantaneous site capacities as guides, manage for user or group use pattern alterations to smooth use through the day which would result in greater daily capacities than would be the case for #1 above.

The choice between these two approaches turns mainly on an agency's management authority and commitment to high levels of enforcement. The former approach implies the use of use-level limits while the latter implies the use of use-level limits and use-pattern restrictions.

Following the conversion of instantaneous site capacities to daily site capacities, the various sites of the river reach should be analyzed as an integrated set of point daily site capacities against which the user or groups use patterns are used to generate a final daily river capacity. The final daily river capacity can be modified through management decisions whether or not the daily site capacities have been increased by use-pattern management. The methods by which total daily river capacities can be altered include:

1. Increasing the instantaneous capacities of specific sites through the improvement or enlargement of features and facilities that are particular bottlenecks.

2. Allowing for use levels to exceed the limits that were defined as necessary to maintain natural resource protection or user experiential value objectives at specific sites, that will allow greater use of the rest of the reach.

3. Further control of use-pattern and behavior-pattern that may serve to increase the total recreational use at the expense of user freedom by spreading out the daily distribution of use to reduce congestion.

2: NF/MF Carrying Capacities.

The approach to questions of carrying capacity adopted on the NF and MF is a result of the level of potential involvement in management and enforcement by agencies, the ability of agencies to manage segments of the whitewater recreation users, observed user patterns, and limited research funds.

The low level of funding for this study dictated that the carrying capacity approach used be one that is simple and not requiring extensive analysis or users surveys. To accomplish this, carrying capacity considerations combined physical and

facility carrying capacity factors within the context of the social carrying capacity factor. Due the dominance of channel bedrock and gravel bars and the lack of significant species, environmental carrying capacity was not found to be a significant factor. The concept of "User Contact" was developed to combine physical, facility, and social capacity factors and is intended to relate recreational use levels to physical and facility capacity factors in terms of contact with other users and groups. "Crowding", as a subjective measure of the user recreational experience, was not used because this would have required extensive user interviews or questionnaires. The "User Contact" concept was intended to act as an observable surrogate for crowding in that with increasing contact among groups at a site there should be a degree of behavioral adjustment and accommodation. With the use of contact thresholds the "User Contact" approach integrates the social carrying capacity factor.

The "User Contact" thresholds employed in this study are:

> "Low Contact": This is a level of contact that does not result in a sense of excessive contact with other users or groups that may occur due to on-river or access point physical or facility capacities. While contact occurs, users and groups need not make itinerary or use pattern accommodations to others. A low contact, "wilderness experience" is possible and user perceptions range from no user/group contact to some sense of contact.
>
> "Moderate Contact": This is a level of contact that imparts a sense of user/group contact as an obvious element in the experience and may require some accommodation of itinerary or use pattern, but is not great enough to make contact a major element of the experience. A moderate contact, "primitive experience" is possible and user perceptions range from a sense of user/group contact to a sense that "crowding" may be an identifiable element of the experience.
>
> "High Contact": This is a level of contact that imparts a sense of contact as a major element in the experience and requires accommodation of itinerary and use pattern changes to the degree that some aspect of the recreational experience is degraded. A moderate contact recreation experience is not possible and user perceptions usually involve congestion as a major element of the experience.

Observations were made at the major access points and the major on-river congestion points through the peak use season on both rivers. These observations included the recording of group sizes, times of arrival, times of departure, normal group and

user behavior patterns, levels of use when congestion began, and the accommodation behavior patterns employed to adjust to congestion. Also, using the behavior patterns as guides, the instantaneous site capacities of the various locations were estimated for each of the three defined user contact thresholds.

In 1985, the State Parks commercial permits called for designated trip start times and limits on total daily trip numbers to be controlled by the commercial operators. Observations indicate that as a whole the operators were unwilling and/or unable to voluntarily conduct commercial trips within these management limitations. Discussions with State Parks indicates that the personnel necessary to maintain a constant management presence at the major access points is not currently feasible.

Given these limitations on the possible future management of the rivers, the instantaneous capacities of the various access points and on-river locations were converted to daily site capacities based on the assumption that use and behavior pattern control would not be possible; neither followed by the operators nor enforceable by State Parks. Therefore, the daily site capacities were calculated by adjusting the average site occupation during the peak hour of the cumulative daily use distribution to conform to the observed instantaneous site capacities and adding additional daily capacity as the times of arrival, departure, and occupation warranted. Because the daily capacities were derived from the average peak hour occupation, not the peak instantaneous occupation through the season, it is likely that the resulting daily capacities and existing use patterns will combine to create short periods (<30 minutes) when site instantaneous occupation will exceed the target contact threshold instantaneous site capacity. The daily site capacities were also calculated on the basis of the three user contact thresholds.

On-river resources were reviewed for the whitewater resource qualities as were visual and aesthetic values. The main whitewater resource values of the rivers were identified along with the main season of use. The NF was found to be a spring resource and to have high "whitewater" values in an isolated, high quality visual/aesthetic environment. The MF was found to be a summer resource and to have relatively low "whitewater" values but relatively high visual/aesthetic qualities in an isolated environment. A review of regional whitewater resources indicated that the resource characteristics of the NF and MF were significant in the region in that they offered important resource alternatives and were essentially not replicated by other rivers.

Access point and on-river observations showed that both rivers were subject to the degradation of resource quality with increasing use levels. The NF was very sensitive to on-river congestion due to long, tight, and complex rapids. The MF was very sensi-

tive to congestion at the access points with secondary limitations set by the camping resources. The conclusions of resource value of the two rivers, the regional uniqueness of these resource characteristics, and observations of the sensitivity of the resources to use levels, indicate that they should be managed for "Moderate Contact" use thresholds. Conversations with commercial operators and non-commercial users on the two rivers corroborate this conclusion by indicating that the on-river congestion of the NF tends to crowd out non-commercial users on peak weekend days and the that the "wilderness" and high visual/aesthetic qualities of the MF were degraded by conflicts and congestion at major access points.

By processes explained above, the "Moderate Contact" instantaneous site capacities were extended to "Moderate Contact" daily site capacities on the basis that use and behavior patterns were not going to be controlled. The suite of daily site capacities on each river were analyzed for the limiting factor or site within the context of typical use patterns and the overall daily river capacities were derived. On the NF, the daily river capacity was found to be about 13 raft groups based on the typical raft group sizes, the capacity of congested on-river bottlenecks, and the typical rate of raft group start times at the put-in. On the MF, the daily river capacity was found to be about 7 raft groups based on the typical raft group sizes and the use and behavior pattern at the put-in.

The facilities of the NF were reviewed for the possibility of increasing the instantaneous site capacities, however, as the problem was on-river congestion, improved facilities would not result in improved conditions or higher daily capacities. Because the NF is to be managed to focus on non-commercial use and because the majority of the non-commercial use occurs on weekend days, the daily river capacities are used to determine the daily river capacity available to commercial operations. On weekend days in 1985 there were typically 7 non-commercial trip starts, making 6 trip starts available for commercial use. On mid-week days there was essentially no non-commercial use indicating that the full daily river capacity is available for commercial use. The available commercial capacity on the NF should change in the future as non-commercial use changes.

The facilities of the MF were reviewed for the possibility of increasing the instantaneous site capacities, however the main capacity limiting facility was the put-in at Oxbow and while the site can be improved by certain actions, the instantaneous capacity could not be increased without substantial channel improvements. Because; 1) the daily site capacity of the put-in was so low compared to other facilities and on-river resources, 2) the period of time that congestion is experienced by users at the put-in is very short compared to the whole trip, and 3) because there is a secondary put-in downstream that receives

light but relatively consistent peak season and weekend day use, it was decided that the best use of the MF resource was to manage the river at higher levels than the minimum daily site capacities may imply.

If the daily river trip starts were increased to 10 groups there would not be any other points on the river that would have congestion at greater than the "Moderate Contact" threshold. The next most limiting daily site capacity is camping with 10 medium and high quality sites with capacities exceeding 30 users. In addition the secondary Volcano Creek put-in would receive some of the total trip starts, reducing the pressure and short-term congestion at the main put-in. Since the MF is to be managed with a commercial operation focus, and the non-commercial use level is extremely low (and will probably remain low), all of the daily river capacity should be available for commercial use.

G. Findings and Management Recommendations:

1: Findings.

Field surveys conducted in the 1985 peak use season, observations of access point and on-river use patterns and conflicts, a review of the resource characteristics of the NF and MF, and regional resource characteristics have lead to several findings that have directed the management recommendations. These findings include:

- Because of the season of suitable flows and resource characteristics, both the NF and MF are significant regional resources and deserve careful management.

- Because of the isolated nature of the NF and the speed at which "High Contact" conditions occur with increased use due to channel/hydraulic characteristics, the NF should be managed for "Moderate Contact" levels.

- Because of the isolated nature of the MF and the general lack of "whitewater" rapids, the MF should be managed for "Moderate Contact" use levels to maintain a "wilderness/primitive" character.

- Because of the degree of commercial/non-commercial conflict induced by user pattern and channel/hydraulic characteristics of the NF, the demand for the NF by non-commercial users, and the difficulty of State Parks to limit non-commercial use, the management of the NF should give priority to non-commercial use.

- Because of the general lack of non-commercial interest in the MF due to relatively difficult logistics and low whitewater intensity, and the relatively high demand for commercial use, the management of the MF should give priority to commercial use.

- Because observed commercial use patterns indicate that required changes in use pattern (intended to reduce congestion) will not be followed without strict enforcement, the management plan should emphasize daily commercial use limits to reduce conflicts rather than use pattern and behavior requirements.

- Because of the heavy weekend day non-commercial use, commercial daily use limits on the NF can be different for weekend days and week days.

- Because of complex agency responsibility mixes and jurisdictional authorities, a consolidated permitting and management agreement is needed between USFS, USBR, and State Parks.

2: Recommended Agency Responsibilities.

a) State Parks: A new interagency agreement between USFS, State Parks, USBR and, probably, BLM is needed to consolidate permitting and management authority and responsibility for all whitewater recreation activities in the Auburn Project area under State Parks. The agreement would enable State Parks to assume overall regulatory authority of whitewater recreation in the NF and MF corridors. It would not change authority for the issuance of road use permits for Mosquito Ridge Road by the Tahoe National Forest.

This new agreement should include provisions establishing the scope and geographical extent of State Park jurisdiction for whitewater recreation management and the sharing of cost responsibility. This will avoid future confusion concerning State Park's authority and responsibility and will more clearly establish the legal basis for requirements included in State Parks commercial whitewater use permits. The scope of jurisdiction of the agreement should apply to all appropriate lands of the agencies that are parties of the agreement and should include: 1) the authority to issue commercial whitewater use permits; 2) the authority to issue commercial camping permits; 3) the authority to enforce the rules and regulations developed for commercial whitewater recreation; and 4) the authority to establish facilities in support of whitewater recreation use and to conduct facilities maintenance. The geographical extent of the agreement should include: 1) the federal lands adjacent to the rivers within the Auburn Project boundaries normally used by commercial whitewater users; and 2) the federal lands in and around the Oxbow put-in on the MF and downstream to the Auburn Project boundary.

These management activities by State Parks will represent greater commitments of manpower resources and costs associated with the development and maintenance of certain facilities. For the most part these greater funding requirements can be generated through the existing contractual agreement between State Parks and USBR for the interim recreation management of the project area. Additional funds could be generated through additional commercial rafting and camping fees and transferred to State Parks through mechanisms in the new interagency agreement. The camping permits should be issued by State Parks for overnight commercial use on either USFS or State Park management lands. The agreement should specify the portion of the commercial camping permit fees that State Parks may keep for administrative and management expenses.

Under normal State Park budgeting procedures, funds generated at a facility are transferred to the State general fund and are not automatically available for expenditure at the facility. However, Public Resources Code Section 5080.30, which gives

State Parks the authority to enter into agreements with other agencies for the management of lands as part of the State Park System, states that:

> 5080.30. Agreements may be entered into between the department and any agency of the United States...for the care, maintenance, administration, and control by any party to the agreement, of lands under the jurisdiction of any party to the agreement for the purpose of the state park system. The expenses of the care, maintenance, administration, and control may be paid...from the funds of the department, from any funds available to the agency of the United States for the purposes, as the case may be, or from revenues generated on the lands subject to the agreement. (emphasis added)

Secondly, Section 5080.32 directs the disposition of collected reviews and states that:

> 5080.32. All revenues from lands subject to an agreement entered into pursuant to this article shall be expended only for the care, maintenance, operation, administration, improvement, or development of the unit of the state park system in which the lands from which the revenues were derived are located... (emphasis added)

Therefore State Parks can enter into a contractual agreement with USBR to manage the lands of the Auburn Project area as an element of the state park system and management expenses can come from the contracting agency or from revenues generated on the lands of the unit itself. If funds are generated on the lands of the unit, the monies must be spent on the management of that unit. Fees can be collected by State Parks for commercial rafting and camping permits on the NF and MF and, not only can these funds be used, but they must be used for management of the Auburn Unit. The use of these funds within the unit would be at the discretion of the manager. State Parks has considerable latitude in developing a fee schedule for the whitewater use permit. This may provide a substantial funding source for whitewater recreation management as long as USBR does not subtract equal amounts from the annual management contract.

b) Placer County: Two areas of management concern outside of the responsibility of State Parks are the parking and traffic problems in Foresthill, and manpower and expenses associated with emergency responses for search and rescue situations. While a reduction of the daily peak use that is contemplated on the MF should result in a reduction in the congestion in Foresthill,

these problems may still occur. If so, Placer County currently has several options available which may be used. First, specific no parking zones can be created and the county sheriffs can enforce these regulations. Second, Placer County can require commercial rafting operators to have business licenses to operate in the county and the business license can require that the operators have guaranteed legal parking facilities for their clients. The business license may also be used as a mechanism for generating special funds for specific purposes such as parking facilities or to supplement local emergency responses organizations for search and rescue operations. This business license need not deal with rafting permits, allocation, or other management concerns which will be treated under the State Parks permit system. Other county emergency response units presently have options for reimbursement from County Or City and County Of Residence agreements under Government Code Section 26614.5 when the costs of any search and rescue operation exceeds $100.

3: State Park Management.

a) Commercial Whitewater Use Permit: Following from the observations on the two rivers and the findings above, the State Park whitewater use permits should be used to promote the desired objectives within the management and enforcement limitations of the agencies. The following are general recommendations for the State Park whitewater use permits; specifics on these recommendations are found in the respective chapters.

- The permits should be limited to commercial operations.

- The permits should apply to the full peak season.

- Requirements for meeting clients off-site.

- Requirements for specific areas and modes of operations at put-ins and take-outs.

- A limitation of 6 and 12 commercial trip starts on weekend days and mid-week days respectively on the NF, a limitation of 4 rafts per commercial trip, and a prohibition on raft supported overnight trips.

- A limitation of 10 daily commercial trip starts on the MF, a limitation of 5 Ruck-A-Chucky portages per day, a limitation of 5 or 6 rafts per commercial trip, and a provision for non-reserved, minimum impact camping.

b) Other Management Actions: The above commercial whitewater use permit requirements should be fairly self-enforcing and should result in the realization of many of the management plan objectives, however, there are some actions that can be taken by State Parks to affect enforcement and to improve conditions. These actions include:

- A pre-season commercial allocation system that assigns commercial daily trip starts on a company by company basis so that a daily use limit can be assured, commercial operators can develop schedules, and State Park field personnel can enforce the management plan. The specifics of the allocation system should provide for the requirements of both the NF and MF and for the present may apply to only weekend days but as demand increases it should include the full peak season.

- Occasional patrols of the put-in and take-out areas by State Park personnel on random days through the use season to enforce commercial put-in and take-out restrictions.

- Occasional user surveys at put-in on weekend days in the peak season by State Park personnel to record commercial and non-commercial use patterns.

- Seasonal adjustments of the commercial daily use limits based on trends of non-commercial use or changes in use patterns.

- State Parks should contract for occasional trips with commercial operators to observe on-river congestion and to review campsite conditions (the levels of use called for in this plan are low enough that periodic on-river patrols by management personnel are not necessary).

- The steep trail between the commercial staging area and the water at both the NF and MF put-ins should be improved with the construction of firm steps using set logs or other suitable material.

- There should be a one time effort to clean up the Oxbow put-in area on the MF to remove various pieces of metal which represent a potential safety hazard to users.

- At least two pit or vault toilets are needed at the Oxbow put-in area on the MF.

- Construction of a vehicle barrier across the turn-out at the Ponderosa Road Bridge on the NF and a "No Parking" zone in front the barrier.

III. NORTH FORK AMERICAN RIVER

A. Resource Characteristics:

The North Fork American River (NF) is a somewhat steep gradient Class IV whitewater river. It is note worthy on the west slope of the Sierra as a stream channel dominated by large boulders that impose very complex and tight lines for rafts and kayaks, and also imposes a fairly narrow range of suitable flows. At flows below 1000 cfs the narrowness of lines and the exposure of channel boulders increases the possibility of raft wraps, generally slows progress, reduces the recreational values to some users, and greatly increases congestion at bottleneck points, as well as creates new bottlenecks. At flows greater than 3500 cfs the large and tightly placed boulders create a complex channel composed of large and strong hydraulics with generally swift currents. Runs by rafts and kayaks occur at flows above and below this range, however, use is limited and usually involves greater skill levels and safety support at higher flows, and smaller rafts and a shift to one or two man inflatables at lower flows.

Throughout the reach typically used for whitewater recreation, the NF is characterized by remote and "wilderness" or "primitive" conditions. Recreational gold mining operations can detract from the remote character particularly in early summer, as can the general activity around Shrittail Canyon. Despite these detractions, from a whitewater recreation perspective, the reach could be classified as wilderness/primitive with high scenic quality.

Because of the undammed nature of the watershed (it is a designated State and National Wild and Scenic River above the put-in), the watershed's size, and other hydrologic characteristics, average monthly flows in the most "suitable" range of 1000-3500 cfs occur in the January through mid-June period in average water years. In high water years the most "suitable" flows can occur in the December through the end of June period, and in low water years these flows may not occur at all. Spring snowmelt runoff occurs typically in May and can generate short periods of flow above 3500 cfs in average water years and high flow periods greater than a month long in high water years.

The NF river recreational resource is composed of three segments that can be used either as separate runs or in combination. From the Colfax-Iowa Hill Bridge 4.7 miles to Shirttail Canyon the river drops from an elevation of 1130 ft to 900 ft with a gradient of 49 ft/mi. This is the steepest and most technically demanding reach and is the main source of whitewater recreation interest on the NF. The channel/hydraulic conditions are basically characterized by a narrow bedrock gorge with generally long more or less continuous rapids with short calmer "pools" between

boulder gardens and short steeper bedrock drops. There is a 2.4 mile section, that contains all of the major rapids on this run, which drops 185 ft at a gradient of 77 ft/mi. This 4.7 mi. segment is a Class IV reach in the normal flow range and a Class V reach at higher flows.

In the reach from Shirttail Canyon to Ponderosa Road Bridge the river drops from an elevation of 900 ft to 795 ft in 4.5 miles with a gradient of 23 ft/mi. This segment has a channel/hydraulic characteristic that is relatively broad with gravel fill in the bedrock channel dominating the form and creating mostly gravel bar rapids. There are scattered boulders and bedrock controls in some of the rapids that create strong hydraulics, however, for the most part this segment is a Class II reach with some Class III rapids.

From Ponderosa Road Bridge to the upper end of Lake Clementine is a 4.1 mi. segment that drops from an elevation of 795 ft to 715 ft at a gradient of 20 ft/mi. The channel here is basically one of wide gravel riffles dominated by instream gravel deposits. This segment is a Class II reach with occasional strong tailwater hydraulics in some riffles at some flows.

B. Use Characteristics:

Because of variable winter and early spring weather and characteristically cool temperatures, the river recreation "season" typically begins in March or April and extends to mid-June. Because suitable flows occur as early as late January there is limited kayaking and non-commercial rafting use in the winter season, however, this use is not part of the recreation management problems addressed in this study. In the main use season commercial and non-commercial rafting and kayaking activities are undertaken with most of the use occurring between the Colfax-Iowa Hill Bridge and the Ponderosa Road Bridge, mostly on weekends. Because of limited run length, limited camping locations, and difficult maneuvering for loaded dunnage rafts, there are no overnite or two day trips taken on this river.

To characterize use on the NF several terms are used that may require definition. Clients are those who have contracted with commercial operators to take them down the river for recreational reasons. Commercial users include both the clients and the boat guides or all those on the river associated with commercial operations. Non-commercial users are all those who used the river for non-commercial whitewater recreation. The counts in this section refer to presence of individuals and since all use on the NF was on one day trips, these are also user day counts. User days are the use of the river by individuals for any portion of a day. This count approach is used as opposed to various alternatives because even though only about 5 hours of the day are expended in whitewater recreation per se, literally the whole day is appropriated to whitewater recreation related activities.

1: Commercial Use.

There are 57 commercial companies with State Park permits to use the NF and from 15 to 25 companies actually use it on a recurrent basis through the season. Commercial use typically starts slowly in April with some training trips and a very small number of paying trips. April commercial use is held low because; 1) temperature and weather conditions are not typically amenable for commercial clients, 2) it is too early for commercial clients to consider water recreation, 3) it is difficult to schedule early season trips because of flow and weather uncertainties, and 4) untrained prospective guides. Once the weather and flow patterns are more accurately understood by the commercial operators and the temperatures and season become more conducive for commercial clients, commercial use picks up and stays at high levels through the end of the usable flows, most often in June.

Peak daily commercial use at the beginning of the season is from four to six trips per day on weekend days and about two trips per

week. In the 1985 season, commercial use increased steadily through mid-May when daily peaks of 12 trips occurred on the weekend and about nine trips per week. Because the 1984-1985 streamflow on the NF was about 52% of normal and lower flows occurred relatively early, commercial use dropped off sharply through the end of May and only a few trips occurred in June.

During the 1985 season the NF was surveyed for use and user patterns at the Colfax-Iowa Hill Bridge put-in, at the Ponderosa Road Bridge take-out, and at several constriction rapids on 18 days; 13 weekend days, and 5 mid-week days. Commercial group characteristics were recorded on these sample days and the totals are shown on Table 1 below. An effort was also made to extrapolate use estimates to the peak use season and to the full season as well. This was done on the basis of the differences in weekend vs. mid-week use characteristics and assumptions of the number of trips that may have occurred on unsurveyed days. The differences in per trip and per boat use characteristics between the 18 survey days and the estimated peak season use result from the considerably smaller trips that are run mid-week. Table 2 shows that mid-week trips have both fewer boats and fewer clients per boat which translates into group sizes that are about 8 users and 31% smaller than weekend trips. The full season estimates were made on the assumption that there were five trips made after May 27 on streamflows that were below suitable levels and that the use characteristics of these trips were the same as the peak season averages.

The general use pattern for commercial trips is to either; 1) arrive at the put-in early with the gear and most of the guides in a gear vehicle and to begin staging the rafts, and the clients are met at some off-site location and driven to the put-in in a separate passenger vehicle during or after staging (about 90% of the commercial trips), or 2) the clients are met off-site and are taken to the put-in with the gear and guides (about 8% of the commercial trips). There are also a few commercial operators who would meet the clients at the put-in (about 2% of the commercial trips); this pattern resulted in gear vehicles and many client vehicles at the put-in area.

The commercial put-in was designated to be on the river right (RR) at the new bridge and consists of a small off-road parking and staging area, a steep 8-foot wide trail which descends to a gravel bar, and a gravel bar put-in area with about 300 feet of frontage beneath and downstream of the bridge. Commercial gear vehicles arrived before 8 am (some guide/gear vehicles spent the proceeding night at the campground) to as late as 11:30 am. On trips when both the clients and gear arrived at the same time, the average time staging was 83 minutes between arrival and trip

Table 1.

NF Commercial Use, 1985 Season.

Use Characteristics	Count (18 days)	Estimated Peak Season	Estimated Full Season
Trips	94	130	135
Boats	356	480	499
Clients	1919	2483	2579
Users	2275	2963	3078
Boats/Trip	3.8	3.7	3.7
Clients/Trip	20.4	19.1	19.1
Clients/Boat	5.4	5.2	5.2
Users/Trip	24.2	22.8	22.8
Users/Boat	6.4	6.2	6.2

Table 2.

NF Weekend vs. Mid-Week Use
Commercial Use, 1985 Season.
(From 18 Survey Days)

Use Characteristics	Weekend Survey	Mid-Week Survey	Total Survey
Trips	83	11	94
Boats	321	35	356
Clients	1763	156	1919
Users	2084	191	2275
Boats/Trip	3.9	3.2	3.8
Clients/Trip	21.2	14.2	20.4
Clients/Boat	5.5	4.5	5.4
Users/Trip	25.1	17.4	24.2
Users/Boat	6.5	5.5	6.4

departure. On those trips which the gear arrived ahead of the clients, the clients arrived an average of 89 minutes after the gear and these trips started an average 45 minutes later. The average staging time for the first trip type was 1:29 and the average staging time for the second trip type was 2:14.

Due to limited space at the put-in, commercial operators often quickly unloaded gear in either the off-road turnout or along the edge of the road and moved the vehicles to temporary parking across the bridge. This effort to reduce time at the put-in increased with the number of groups at the site. After the trip actually departed, the gear and passenger vehicles left the put-in area and headed for the take-out at Ponderosa Road Bridge with various stops along Highway 80.

The commercial trips left the put-in between 9:30 am and 1:00 pm and moved through the first rock garden/gorge to Chamberlin Falls and through the steep portion of the run. They usually stopped for lunch somewhere between Chamberlin Falls at river mile 0.8 (RM 0.8) and Indian Creek at RM 3.5. The location of lunch stops were often a result of trip start time and amenable locations with shade and quiet water. The trips often spent time at the more severe rapids for scouting, waiting in line to run, and having lunch or simply allowing the clients to watch runs by other rafts and companies. The trips proceeded to the Ponderosa Road Bridge and arrived there between 2:00 and 7:00 pm; 43% of the arrivals were between 4:30 and 5:30 pm. Total trip times ranged from 2:35 to 7:35 and averaged 5:18.

The gear and passenger vehicles that were used at the put-in were driven to the take-out and parked along the road usually by 1:00 pm. Unlike the time taken to stage the trips at put-in, commercial trips took an average only 45 minutes to stage the gear and to depart the area. The clients were returned to their vehicles at the meeting area.

Early in the season those commercial operators who expected to run the NF frequently ran training trips and these training trips often took out at Shirttail Canyon, and sometimes two trips a day were made through the steep, technical reach. On rare occasion, a client trip would take-out at Shirttail; this occurs about once a weekend, or less.

Overall more than 95% of the commercial trips used the Colfax-Iowa Hill Bridge to Shirttail Canyon and Shirttail Canyon to Ponderosa Road Bridge segments together for the one day runs. Less than 5% used only the Colfax-Iowa Hill Bridge to Shirttail Canyon segment and no commercial operators were observed to use the Ponderosa Road Bridge to Lake Clementine segment.

2: Non-Commercial Use.

Both rafting and kayaking are major elements in the river recreation on the NF but differ in their user patterns and characteristics.

a) Non-Commercial Rafting: Non-commercial rafting basically occurs in the late fall, winter, spring, and early summer when suitable flows are available. In average water years suitable flows typically occur from late January through mid-June. Winter use occurs but is held at relatively low levels by weather and temperature conditions. By late March and early April (depending on weather) peak use season starts and relatively high use levels continue through the peak flow season then use sharply declines sooner and more sharply than commercial use.

During the 1985 season, non-commercial rafting use was at about 5-6 trips on weekend days and about one trip per week in early April. Through mid-May use was 6-9 trips on weekend days and about three trips per week. After mid-May use declined to near zero with only 4 trips on the weekend of May 18-19, and two more trips through to the end of May.

The results of the 18 survey days and the estimates of total peak season and full season use are shown on Table 3. The same methods used above are used here to extrapolate weekend and mid-week use to the unsurveyed days of the peak season and, because of unusually good weather, the peak season was assumed to have started four weeks before the commercial season and that there were 12 non-commercial raft trips in that time. It was also assumed that there were another 12 trips undertaken during the rest of the year and that these additional 24 trips had use characteristics similar to those of the peak season.

The use patterns of non-commercial raft trips were all about the same except for the order of the vehicle shuttle. About 20% of the groups dropped off the shuttle vehicles at the take-out at the Ponderosa Road Bridge on the way to the put-in at the Colfax-Iowa Hill Bridge, and the gear and passenger vehicles continued to the put-in. These groups staged the trip at the put-in, ran the river to the take-out, then ran a shuttle back to the put-in to get the larger vehicles and back to the take-out to pack the gear. The other groups went to the put-in first, dropped off the gear and most of the people and shuttled the larger vehicles to the take-out. Upon returning to the put-in these groups ran the river to the take-out, staged and packed the gear and people in the larger vehicles and returned to the put-in to get the shuttle vehicles. At the Ponderosa Road Bridge the vehicles were parked along the roadway.

Table 3.

NF Non-Commercial Rafting Use,
1985 Season.

Use Characteristics	Count (18 days)	Estimated Peak Season	Estimated Full Season
Trips	63	98	110
Boats	105	163	183
Users	427	661	737
Boats/Trip	1.7	1.7	1.7
Users/Trip	6.8	6.7	6.7
Users/Boat	4.1	4.1	4.1

Table 4.

NF Weekend vs. Mid-Week Use,
Non-Commercial Rafting, 1985 Season.
(From 18 Survey Days)

Use Characteristics	Weekend Survey	Mid-Week Survey	Total Survey
Trips	61	2	63
Boats	99	6	105
Users	396	31	427
Boats/Trip	1.6	3.0	1.7
Users/Trip	6.5	15.5	6.8
Users/Boat	4.0	5.2	4.1

Non-commercial rafters used the put-in designated for their use on the RL upstream of the bridge. This put-in consists of a fairly large parking area where most of the trips were staged as well; there is also some overflow parking closer to the bridge. There are two well designed pit toilets in the parking area and two nearby also used by the overnite campers using the campground. A closed-off road leads about 200 feet from the parking area to the river. There is about 150 feet of frontage along a bedrock bench at the put-in.

Non-commercial raft trip vehicles arrived mostly from 8:30 to 12:30 pm and the groups spent an average of 76 minutes staging; departures ranged from 10:00 to 1:00 pm. From the departure to the Ponderosa take-out, the non-commercial and commercial trips were run with basically the same format. They spent about 5:30 on the trip and arrived at the take-out between 3:30 and 5:30 pm.

At the take-out little difference in staging time was associated with the different shuttle approaches because the major time element was group behavior. Typically, for non-commercial raft trips, the time required to complete staging, and to pack and leave the area was about 65 minutes.

The take-out at Shirttail Canyon was rarely used by non-commercial raft trips, primarily because the carry from the water to the road is difficult with rolled rafts and frames, etc. and this results in a short run from the Colfax-Iowa Hill Bridge. There were no reported raft put-ins at this location. There also were no reported nor recorded non-commercial raft trips that put-in at Ponderosa Road Bridge for the run to Lake Clementine but there may have been some runs made in the winter during fair weather conditions. Most (>97%) of the NF use occurs on the Colfax-Iowa Hill Bridge to Shirttail Canyon and the Shirttail Canyon to Ponderosa Road Bridge segments together.

b) Kayaking: Kayak use on the NF is significantly different from either non-commercial or commercial rafting use. Kayak use occurs through the late fall, winter, and spring when suitable flows are available. The technical difficulty of the Colfax-Iowa Hill Bridge to Shirttail Canyon segment is a very attractive resource to advanced kayakers and is often used under worse weather conditions than rafting occurs. Use levels remain high through the peak flow season and well into the seasonal flow recession, typically in May and June.

During the 1985 season, kayak use was at near peak levels when the surveys began in early April with up to 33 users in 7 groups on weekend days. Use stayed at relatively high levels through early May when there were 23 users in 9 groups. Following the early May peak, kayak use apparently dropped off sharply,

however, there was probably a use pattern shift to later trip starts to avoid raft congestion and were missed by the survey.

Table 5.

NF Kayaking Use, 1985 Season.

Use Characteristic	Count (18 Days)	Estimated Peak Season	Estimated Total Season
Groups	44	86	106
Users	142	262	326

Table 6.

NF Weekend vs. Mid-Week Use, Kayaking Use, 1985 Season (From 18 Survey Days)

Use Characteristics	Weekend Survey	Mid-Week Survey	Total Survey
Groups	39	5	44
Users	129	13	142
Users/Group	3.3	2.6	3.2

The results of the 18 day survey and the estimates of total peak season and full season use are shown on Table 5. The results of weekend day and mid-week surveys were used to extrapolate to unsurveyed days in the peak season. It was also assumed that the peak season started two weeks before the surveys began in which there were eight trips and that there were 20 trips undertaken during the winter. Average peak season group sizes were used for this extrapolation.

Kayak trips on the NF used the Colfax-Iowa Hill Bridge to Ponderosa Road Bridge reach, the Colfax-Iowa Hill Bridge to Shirttail Canyon reach, and the Shirttail Canyon to Ponderosa Road Bridge reach. About 90% of the kayak use was on the Colfax-Iowa Hill Bridge to Shirttail Canyon reach and when used, put-ins were often later in the day than raft starts and they tended to catch up with some of the raft trips near Shirttail Canyon. This late start resulted from a combination of wanting to miss the raft crowd and having the luxury of having a short day. Some kayak trips (about 10%) did start earlier in the day and they were often using the Ponderosa Road Bridge take-out. The Shirttail Canyon to Ponderosa reach was infrequently used (< 5%) mostly by beginners who feel that this is a reach with difficulties appropriate for their skill levels. Because of use patterns, the relatively short time spent at the put-in or take-out, and the small number of vehicles required to support kayak trips (about 4/vehicle) kayak use does not represent a major problem element in the recreation management of the NF.

3: Summary Of Seasonal Whitewater Use.

Because of weather and flow regimes that typify the NF, the peak use season is relatively short, and with the weather parameter limiting use on the winter side of the peak season and unsuitable flows limiting use on the summer side of the peak use season, the use in the 2.5 month peak use season represents a major portion of the total use. The estimates generated in this study indicate that the peak season has about 92% of all the user types and about 90% of the trips. Commercial rafting is the most oriented to the peak season with 96% of the commercial trips and 96% of the commercial users in the this season. Non-commercial rafting is less oriented to the peak season with 89% of both trips and users in that portion of the year. Kayak use is even less concentrated with about 81% of the groups and 80% of the users in the peak season.

Since the peak season is limited to the spring season by weather and flow conditions, there is also a use distribution disparity between weekend days and mid-week days because of the tendency to engage in outdoor recreational activities during the mid-week mostly in the summer season. The main exception to this on the NF is the Easter week vacation which often occurs when peak season water and flow conditions exist. Despite these tendencies, commercial trips were distributed 70 - 30%, weekends vs. mid-week, and commercial use was distributed 77 - 23%, weekends vs. mid-week. Non-commercial raft trip distribution was 71 - 29%, and use distribution was 69 - 31% for weekends and mid-week respectively. Kayak group distribution was 60 - 40%, and

use distribution was 66 - 37% for weekends and mid-week respectively.

One of the busiest days during the 1985 season was Saturday, May 11. On that day a total of 22 groups ran the river with; 1) 12 commercial groups with 41 rafts and 251 users, 2) 7 non-commercial raft groups with 22 rafts and 85 users, and 3) 3 kayak groups with 1 raft, 11 kayaks, and 19 users. Mid-week days in the peak use season can have use as light as one or two trips or even zero use.

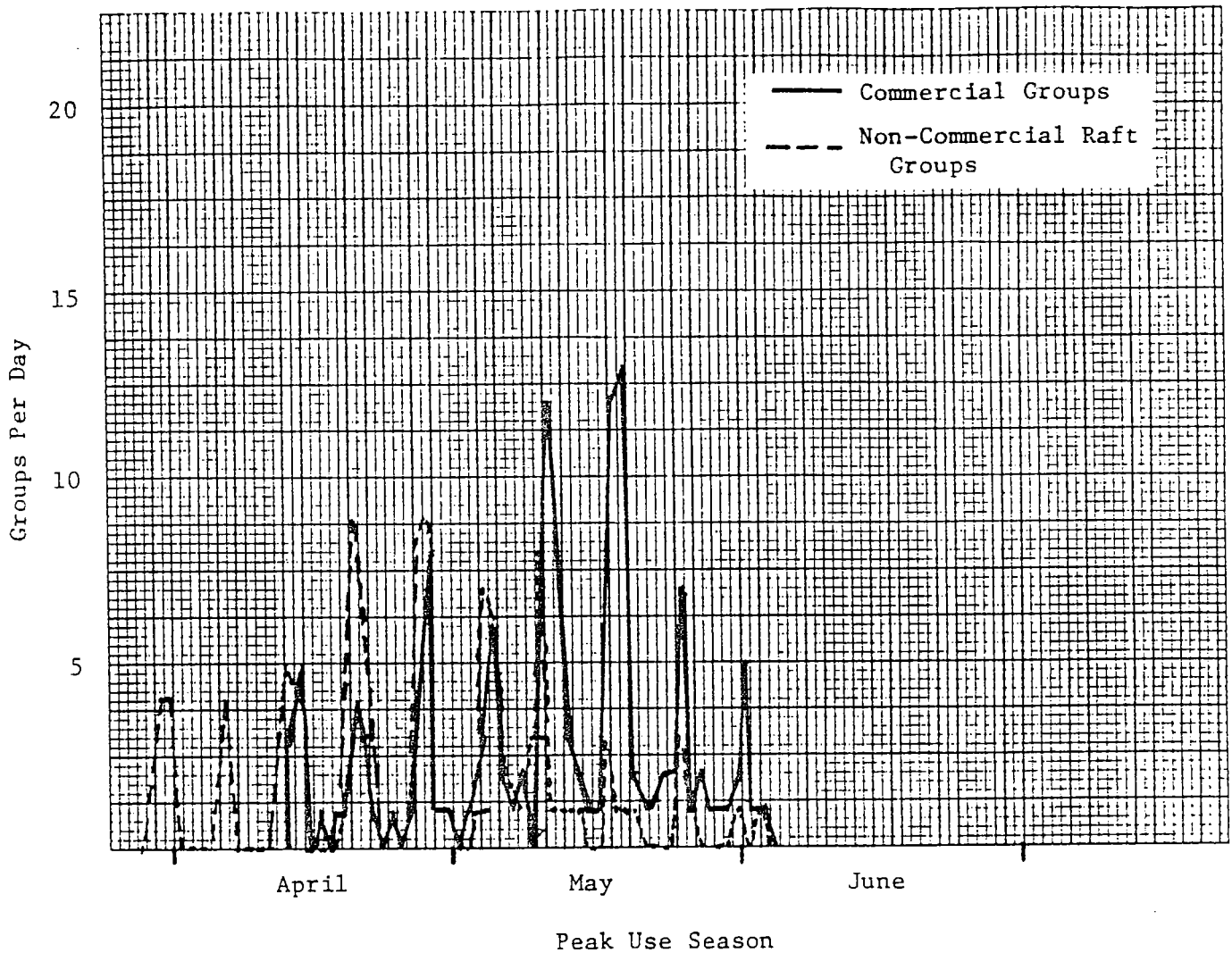

Figure 1: Estimated NF Peak Season Use Pattern, 1985 Season.

This is developed from 18 survey days of commercial and non-commercial use data and the extrapolation to the full peak season based on estimated use patterns.

Table 7.

Summary of NF Use, 1985 Season.

Use Type	Count (18 Days)	Estimated Peak Season	Estimated Full Season
Commercial			
Trips	94	130	135
Boats	356	480	499
Clients	1919	2483	2579
Users	2275	2963	3078
Non-Commercial			
Rafting			
Trips	63	98	110
Boats	105	163	183
Users	427	661	737
Kayaking			
Trips	44	86	106
Users	142	262	326
Non-Commercial Subtotal			
Trips	107	184	216
Boats			
Rafts	105	163	183
Kayaks	142	262	326
Users	569	923	1063
TOTAL USE			
Trips	203	314	351
Boats			
Rafts	561	643	682
Kayaks	142	262	326
Users	2844	3886	4141
(Recreational)	(2488)	(3406)	(3642)
(Employees)	(356)	(480)	(499)

4: Non-Whitewater Recreational Uses.

As used here "non-whitewater" recreational uses refers to recreational mining, swimming, river oriented day use, and camping. Recreational gold mining in the channel and along the banks occurred in the late spring and summer and took place in the first half mile below the Colfax-Iowa Hill Bridge, in spotted locations in the canyon from RM 1.3 to 2.5, and from about Indian Creek to Shirttail Canyon. Swimming and other river oriented day use activities occurred mainly in late spring and summer at the major access points, primarily, Shirttail Canyon and Ponderosa Road Bridge areas. Most of the overnite camping occurred at the Colfax-Iowa Hill Bridge campground operated and maintained by State Parks. There was some long term camping at Shirttail Canyon but it occurred in unimproved sites and was often associated with recreational gold mining.

C. Current Management:

1: Whitewater Recreation Management Authority.

The existing management and institutional arrangements on the NF are a result of the land ownership patterns and institutional agreements among the various agencies involved. The Colfax-Iowa Hill Bridge and the Ponderosa Road Bridge put-in and take-out areas are on lands owned by the U.S. Bureau of Reclamation (USBR) while the Shirttail Canyon put-in/take-out access area is on U.S. Bureau of Land Management (BLM) lands. Between the Colfax-Iowa Hill Bridge and Shirttail Canyon there are 2.4 river frontage miles of USBR lands, 6.4 river frontage miles of BLM lands, and 0.6 river frontage miles under private ownership. Between Shirttail Canyon and Ponderosa Road Bridge there are 2.2 river frontage miles of USBR lands, 0.6 river frontage miles of BLM lands, and 6.2 river frontage miles under private ownership. The access roads to the put-in and take-out areas are the maintenance responsibility of Placer County. There are no National Forest lands on this reach of the NF.

On lands owned by the USBR and on BLM lands, State Parks has recreation management responsibility and law enforcement authority in accordance with the interagency agreements discussed earlier and State law. Placer County has land use and law enforcement authority and responsibility on private lands. The recreational mining activities require a permit from the State Dept. of Fish and Game and that agency is responsible for the enforcement of the mining activities associated with that permit.

On the basis of USBR and BLM control of the three main access points and on the basis that this recreational reach is totally within the Auburn Project Area, State Parks has assumed management responsibility for whitewater recreational resources.

2: 1985 Whitewater Recreation Management.

The 1985 State Parks whitewater recreation permit, the current management tool, addressed only commercial operators: Non-commercial users were not addressed because of the difficulty of limiting the numbers and controlling the behavior patterns of these users.

The management approach recognized that daily use levels in the peak season were resulting in the loss of recreational resource values to the users and there were commercial/non-commercial users conflicts associated with the crowding. The level of on-river conflict was assumed to be related to the number of commercial trips on the river a day and the concentration of

commercial trip start times at the Colfax-Iowa Hill put-in. The permit issued to commercial operators;

- Was in effect from May 4, 1985 to July 7, 1985, the assumed peak use season.

- Assigned start times to operators on the basis of 2 starts for each half hour period from 9:00 am through 1:00 pm on Saturdays, Sundays, and Holidays.

- Established a daily start limit of 18 trips.

- Directed operators to coordinate use and schedules to conform to the daily trip number limit.

- Limited trip sizes to 4 rafts.

- Required the use of the put-in location on the RR downstream of the Colfax-Iowa Hill Bridge.

- Allowed for the presence of commercial vehicles at the Ponderosa Road take-out only during the staging and packing of the trip.

- Prohibited camping at the Colfax-Iowa Hill Campground but allowed on-river camping on "government lands".

D. Use and Management Problems:

The main use problems on the NF are associated with congestion at specific locations and reaches of the river which result from the concentration of use into weekend days and into narrow hour ranges of the day. These congestion problems are a function of facility and physical capacities and translated into; 1) on-river crowding in a wilderness/primitive river setting, 2) use conflicts between commercial and non-commercial river recreational users, and 3) some conflict between river recreational users and other recreational users.

1: Facility, Physical, and Social Capacities.

On many of the weekend days of the peak use season on-river use levels are so high that continuous lines of rafts develop in some of the constriction points. In some cases this could lead to very tight spacing between rafts and the intermingling of groups, while in other cases it forces waiting in line to run a particular rapid for periods of time upwards to a half hour. In other situations rafts can wrap on rocks and because of the narrow channel characteristics of the NF, all transit at this point is halted. While the occurrence of a wrapped raft is not necessarily related to levels of use, at greater use levels the degree of congestion above the wrap is much greater and once the cause of the congestion is resolved, more time and distance are necessary to smooth out the residual congestion as the groups travel downstream. The use levels are also high enough to lead to a high degree of contact with other groups and users even where there is little congestion. Because of the rate at which trips depart the put-in, more or less constant contact and adjustment of behavior occurs through the steep portion of the run. After the last major rapid, Staircase, use tends to spread out and the absence of narrow channels and technical water reduces bottlenecks and congestion.

Many of the on-river points of congestion are strongly flow dependent. Chamberlin Falls (RM 0.8) and the 0.4 mile long boulder gorge above it, have channel/hydraulic conditions that are very flow sensitive. At flows greater than about 1800-2000 cfs most groups stop to scout and congestion develops in the eddy immediately above the Falls and in several eddies in the gorge further upstream. At flows below about 1100-1200 the increased exposure of rocks in the gorge above causes many raft pins, broaches, and wraps which result in long delays to other raft groups. Throughout the remainder of the steep portion of the run, flows below 1100-1200 cfs expose many difficult areas which result in congestion due to crowding and bottlenecks when problems occur. The rapid Bogus Thunder (RM 2.2) creates no congestion at all above 1200 cfs, however, below that flow it becomes a major bottleneck. Conversely, Staircase (RM 2.8) does

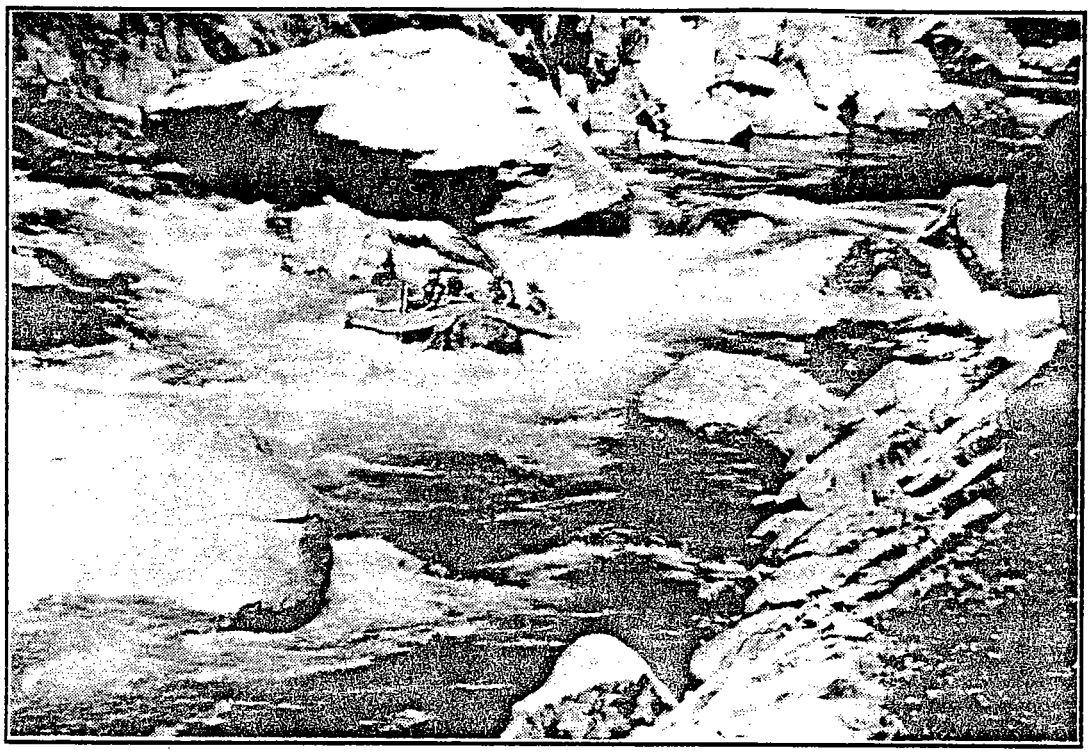

PLATE III: Channel Configuration of tne NF.

This picture shows the typical complex and tecnnicaliy difficult nature of the NF. A paddle raft is shown broached and about to wrap on a mid-channel rock at a flow of about 1200 cfs.

not have congestion conditions dependent on flows. All raft groups stop here to scout and to observe other groups. The run and the rate at which the rapid is run does not seem to vary with the flow, therefore, any congestion at this location is related to the level of use and use patterns. The capacity of the Staircase is most affected by commercial use of the scout eddy area for a lunch stop. If this area is not used by commercial groups for lunch, little undue congestion occurs. The late starting kayak groups tend to reach Staircase about the same time as the peak raft presence, but this seems to have little effect on congestion.

The narrow and technical aspect of the NF channel and the lines required for incident-free runs leads to a situation where levels of congestion as high or higher than are found on other regional rivers, can be created on the NF with far fewer rafts. The observed levels of accommodation required by rafting groups to deal with congestion and bottlenecks, the length of delays imposed, and the degree of contact with other groups that occurs on the NF on weekend days during the peak use season would indicate that this is a "High Contact" river recreation resource under the 1985 use patterns.

Other elements of the NF where capacity problems have been noted are the access/put-in/take-out points. In past years and for the first half of the 1985 season commercial operators were allowed to use the RL put-in upstream of the Colfax-Iowa Hill Bridge; now they use the RR access below the bridge. Under the pervious situation the commercial operators would arrive before the clients to stage the rafts. After rigging the rafts they would put them in the water and wait for the clients to arrive. It required only two or three companies to completely block off river frontage and prevent convenient access for other companies or for non-commercial users. This issue has been resolved with the move of the commercial access to the downstream RR location where there is room for 25 or 30 rafts to be in the water at once without undue conflict. The non-commercial use of the original put-in is now fairly heavy during the mornings of weekend days and there has been some level of conflict with the campers.

The access at Shirttail Canyon was also observed to be a point of congestion, primarily between commercial operators and non-river recreation users. The point of this problem is the limited parking capacity available at that location. All parking space available along the narrow roadway and reasonable capacity is only about 7 to 10 vehicles of normal size. Because this location is a popular recreation access point for the local population for mining, swimming and other day use activities, parking capacity can be quickly filled.

At the Ponderosa Road Bridge take-out parking is also limited, however, the capacity is greater than at Shirttail Canyon.

Parking associated with commercial and non-commercial trips, as well as other day use activities occurring at the site, is accommodated along the narrow roadway on both sides of the bridge; no off-road parking is available except for some four-wheel access to the river downstream of the bridge. There is also limited space for the staging of raft trips at this location and it is sensitive to congestion on heavy use days when arrivals are concentrated in a narrow time frame.

The 1985 State Park commercial permit had several elements that were intended to increase the daily capacity of various sites and facilities by directing certain aspects of commercial use patterns. The use pattern directives that were designed to reduce conflicts and to increase daily use capacity levels included; 1) a designated commercial put-in area; 2) assigned trip start times; and 3) parking limitations at the take-out. Without consistent on-river management presence, State Parks relied on the commercial operators to voluntarily assume these use patterns.

The observations of user patterns through the peak use season conducted for this study conclude that the use patterns of commercial trips did not voluntarily conform to the suggested patterns in the permit. Only when there were State Park personnel at the Colfax-Iowa Hill Bridge on weekend days did the commercial operators use the designated put-in location. Although it is impossible to determine which operators used their trip start times through the season, we observed no occurrences where a commercial operator modified put-in staging behavior on a particular trip to meet an assigned put-in time. In addition we observed several weekend days when up to 9 commercial trips started in the same hour. At the Ponderosa Road Bridge we observed only a few commercial operators that consistently brought the vehicles to the staging area only during the staging and packing phase of the trip.

2: Commercial/Non-Commercial Use Conflict.

Because of the congestion characteristics of the NF and the use patterns and group characteristics of the raft trips, there appears to be a strong element of conflict between commercial and non-commercial use. As the commercial use increases about mid-season, the level of non-commercial use drops to near zero; this has happened in both the 1984 and 1985 seasons. The reasons for the non-commercial use decline could result from a number of causes, including the relative water conditions of other regional rivers. However, on-river observations indicate that the presence of commercial groups is overwhelming on high use days during the peak season. This is particularly true when flows are in the less than 1200 cfs range when greater levels of congestion develop.

There appear to be several elements in the conflict between commercial and non-commercial use. These elements include; 1) simply the number of rafts on the river that commercial operations can generate (up to 58/day) and the resulting general congestion, 2) the number of rafts per commercial group (3-5) create additional on-river congestion by "filling up" considerable lengths of the narrow channel in blocks requiring unusual accommodation by the smaller non-commercial groups, and 3) the number of rafts and users (15-25) per group on commercial trips are visually out of scale on this narrow channel and create an impression of "High Contact" and crowding to the smaller non-commercial groups. Compared to other rivers in the region, these conflict elements occur with lower commercial activity because of the narrow and technical characteristics of the NF channel.

There have been several comments received during the season from kayakers that indicate that the continuous transit of rafts past specific points on the river has resulted in a noticeable decline in resource values and has lead to a "High Contact" recreational resource for this group. To reduce this conflict these users have adopted a use pattern of a shorter trip length and a later put-in time. We estimate that those kayakers who adopt that use pattern should be able to reduce raft/kayak on-river conflict by about 60%.

3: Whitewater/Other Recreation Conflicts.

The conflicts observed between whitewater users and other recreational users have been mainly associated with the use activities and parking at the access/put-in/take-out points. A secondary conflict has been the aesthetic impact of mining activities on whitewater users.

The Colfax-Iowa Hill Bridge non-commercial put-in is located in the campground and the level of whitewater activity during the mornings of peak season weekend days tends to create a sense of crowding for the campground users. To date, the problems have not been the capacity of the facility, but rather a basic conflict between the recreational expectations of the campers and the level of activity (and in some cases behavior patterns) of the non-commercial users. This conflict exists for four to five hours on Saturday and Sunday mornings. With a continued growth in the non-commercial use of the NF, the parking capacity of this put-in may soon be a problem; the degree of conflict between non-commercial users and campers may become more pronounced. Fortunately, the cause of the conflict is usually gone by early June at the start of the summer season.

At Shirttail Canyon the nature of the conflict between whitewater users and other recreational users is in the capacity of the limited parking along the roadway. Although not commonly used by

raft groups, kayak trips often use this take-out and their vehicles often contribute to the lack of available parking for the local day use recreationalists.

Ponderosa Road Bridge take-out area also has limited parking, however, in the 1985 season the parking capacity was not observed to be a problem to the day users. The main beach area at this location is used for the take-out and the rate of raft trip arrivals on Saturday and Sunday afternoons in the peak season are such that day users choose to leave. In addition, the level of staging and traffic activity, on and along the roadway at the bridge, often creates traffic congestion for all users. Once again, the cause of this conflict is often removed by mid-June and does not exist during most of the summer day use recreational season.

The major conflict element in which the whitewater use is impacted is the affect of recreational mining on the isolated, primitive character of the run. Although recreational mining occurs throughout most of the year, the level of activity increases with warming weather, warming water, and reduced streamflow toward summer. The conflict constitutes an adverse impact on the whitewater recreation resource, however, our on-river surveys indicate that the level of impact during the peak use season is not unduly severe and the greatest potential for conflict occurs after the whitewater use season.

4: Safety/Search and Rescue.

Whitewater recreational activities on the NF have resulted in many instances where rafts have flipped, become lodged on mid-channel rocks, filled with water and wrapped around mid-channel rocks, and where users have been disassociated from rafts in any number of alternative ways. Kayakers with intermediate skills (and some times those with greater skill levels) have spent their share of time floating short portions of the NF in pursuit of their kayaks. Sometimes, albeit infrequently, these occurrences result in damaged or lost equipment and in minor injuries to users such as cuts or bruises. For the most part adequately equipped and experienced user groups quickly rectify these problems through self or group supported rescue and in more difficult situations other user groups typically assist. These problems and solutions are considered as normal on whitewater resources and expected on whitewater trips.

On the NF these problems are mainly associated with rafting and kayaking on the Colfax-Iowa Hill to Shirttail Canyon run at high and low flows. At flows greater than 3000 cfs long rapids with very intense hydraulics develop which can result in raft flips and users being washed out of the rafts by waves. Under these conditions swimmers can be easily and quickly separated by long

distances from the rafts and other users by the swift and somewhat eddyless current. This can lead to the need of outside assistance particularly if there are few other groups on the river. At flows less than 1200 cfs the routes through rapids become very narrow and there are may exposed mid-channel rocks and short near vertical drops. These conditions result in frequent raft wraps and users being thrown from the rafts. Although these problems cause delays for the group and other groups upstream, they are easily resolved by self or group supported rescue.

The vast majority of any injury and equipment damage situations have been adequately dealt with by the on-river users at the scene. Over the past several years there have been several instances on the NF where the help of local emergency response organizations were required. As far as is known, assistance has only been required occasionally in the early season when rafts and users were completely separated and ground personnel were needed.

E. Management Objectives:

Because of various resource elements and characteristics of the NF, it is a unique whitewater recreational resource in the region. This river reach has a small, steep, and complex channel with a decidedly technical aspect best used by advanced rafters. The run has a isolated and wilderness/primitive character, is relatively close to users populations, and is runnable in the spring season. When considering raft use, season of use, trip length, channel characteristics, and technical difficulty, only the Cal Salmon and the NF Yuba are roughly comparable. The normally rafted portion of the NF Yuba, however, is not in a wilderness/primitive situation, does not have the same continuous rapid characteristic, and is significantly more removed from the user population. The Cal Salmon is so far removed from the user population that it may not even be considered as part of the NF's region.

There are other rivers in the region with wilderness/primitive and technical characteristics similar to those of the NF, however, they tend to be larger west slope Sierran rivers which, when flows on the NF are ideal, have high spring streamflows that are often too high for the majority of potential users. The sum of all these parameters make the NF a very important whitewater recreational resource element in the region.

Demand in the region for whitewater recreational resources will increase for both the commercial and non-commercial sectors. Non-commercial demand for spring season, technical, and isolated whitewater resources should increase at relatively high rates in the future as the number of skilled non-commercial rafters grows and these resources become more rare. Commercial and non-commercial demand on the NF is therefore expected to grow in the future. Because of the tendency of commercial operations to adversely affect non-commercial use and reduce resource values for this group, and to even displace non-commercial users due to a strong sense of crowding, the future use pattern on the NF will probably be one of increased commercial use and decreased non-commercial use.

Issues of resource characteristics and values, user group characteristics and use patterns, future demand, and user group conflicts, as presented above, and the management options available to State Parks leads to the following management objectives:

1) The resource should be managed to maintain its wilderness/primitive character, to the degree possible, by maintaining a "Moderate Contact" recreational resource opportunity.

2) Non-commercial use should be the whitewater recreational focus of the NF and levels of commercial use should be managed

such that a "Moderate Contact" recreational resource opportunity is maintained for all whitewater user groups.

3) The management plan should rely on the natural use patterns of the user groups and employ use level management rather than use pattern or behavior management to meet contact level objectives; it should be as self-enforcing as possible

4) There should be accommodation for changes in future demand for the NF resource.

5) Whitewater/non-whitewater recreational conflicts should be reduced where possible by altering facility capacities and whitewater use patterns.

To develop a management plan that addresses these objectives the analysis should:

1) Use the capacity of access points and on-river constriction points to establish the appropriate use level that maintain "Moderate Contact" levels.

2) Use the existing use patterns of the user groups as the basis for capacity evaluations.

F. Capacity Evaluation:

The various access/put-in/take-out points and areas of on-river congestion were evaluated for physical capacity based on the use patterns of whitewater groups in the 1985 season. The capacity criteria used are related to the degree of accommodation and delay experienced by user groups as a result of general use levels and characteristic use patterns. Capacity threshold categories used are "Low Contact", "Moderate Contact", and "High Contact" as defined in Chapter II.

1: Colfax-Iowa Hill Bridge Put-In.

a) Observations: At this location there are two put-in areas; there is a designated commercial area downstream of the bridge on RR, and a non-commercial put-in area upstream of the bridge on RL. During the 1985 season these separate put-in locations were not enforced by State Parks until about half way through the peak use season. Before the separation was enforced about 90% of both commercial and non-commercial groups used the put-in located on RL in the campground area. This area is the preferred put-in because of the larger staging area available, the shorter distance to the river from the staging area, and the more convenient parking area. With both commercial and non-commercial groups using this put-in, congestion occurred creating conflict both between commercial and non-commercial groups and between whitewater user groups and campers using the campground. Campers utilizing the campground are generally miners and recreational campers, many of whom remain at the campground for several weeks or the entire season. They use both the main area upstream of the raft staging/parking area and the large flat beside the Colfax-Iowa Hill Road. There also has been limited camping associated with commercial and non-commercial whitewater use. This camping usually occurs with the late night arrival of people who sleep near their vehicles rather than formal camping.

For about 90% of the commercial operations, guides and gear vehicles arrived at the campground either the night before a scheduled trip or early that morning. While most groups were using the main put-in area, staging of these trips occurred in the early morning hours in the parking/staging area. The concurrent staging of these larger commercial trips with the non-commercial trips and with larger vehicles and numbers of people created conflict between the commercial and non-commercial groups in this area. Since much of the staging activity took place in the morning hour of weekend days, this created noise and congestion that lead to conflict with the campers of the site. In addition, because about half of the commercial operators staging rafts before the clients arrive would put the rafts in the water while waiting for clients, the access to the water was blocked off by only a few commercial groups and this blockage

could last for several hours with additional commercial put-ins. This created a conflict between commercial and non-commercial groups. Although the main put-in area is fairly large, it does not have the capacity to serve the needs of both commercial and non-commercial user groups during the peak season.

At about mid-season State Parks began enforcing the designated put-in locations. By this point in the season, non-commercial use had declined substantially, and it was difficult to determine the efficiency of the campground put-in for non-commercial use only. Observations of peak season non-commercial use patterns and use levels indicate that there may be ample area for maintaining "Low Contact" or "Moderate Contact" levels and reduced conflict with campers during the peak non-commercial use season.

The designated commercial put-in site has very limited off-road parking and can only accommodate vehicles when there are two or three groups staging at a time. When staging is carried out without parking in the staging area there is room for four groups to stage at a time. When rates of staging exceeded four groups, commercial operators tended to unload gear vehicles along the side of the roadway, then move the vehicles to the RL side of the bridge to the parking area, and begin staging the rafts on the road. Staging time for commercial operations usually was 30-45 minutes. During periods of heavy commercial activity, there was a continuous rotation of unloading, staging, and carrying rafts to the water. Because the designated commercial put-in location has a more confined staging area and a larger river access area than the main put-in, at about mid-season companies tended to arrive earlier in the morning to avoid staging during the high activity period. This in effect increased the length of time that staging activities were occurring at the site and extended the amount of time commercial rafts are on the gravel bar waiting for the clients to arrive.

Rafts were inflated at the main staging area just off the road, and carried down the to the gravel bar put-in area where there is considerable room for rafts along the shore. Rafts were generally in the water for about 1.5 hours before departure. Clients usually arrived by bus and were unloaded on the RL side of the bridge and walked across the bridge and down to the rafts. The trail that descends from the road to the gravel bar is fairly steep and the surface is loose dirt and fine gravel that caused many falls gracefully executed by clients and guides alike. Some improvements to this trail could provide for safer conditions.

b) Instantaneous Capacity:

"Low Contact" instantaneous capacity at the commercial put-in is considered to be 3 groups. At this level of use all the groups can use the staging area and the gravel bar without

waiting and can park the gear vehicle in the off-road staging area. Behavior is not altered because there is only limited waiting time required at any stage of the put-in process.

"Moderate Contact" instantaneous capacity is 4 groups. At this level of use there is no waiting time involved in the staging process and 4 groups can use the off-road staging area if no vehicles are parked. With more than 4 groups involved in staging the roadway is used and accommodation is required by all the groups. If all of the groups have staged the rafts and are at the water, there is room for about 5 groups of rafts without undue crowding or a sense of congestion. This is a much greater instantaneous capacity than the non-commercial put-in.

"High Contact" instantaneous capacity is 12 groups. This is based on a upper limit of 5 groups staging at one time under very crowded conditions, and another 7 groups staging on the roadway. There is also room for about 12 groups on the gravel bar at one time. At these use levels the degree of waiting and accommodation by both clients and guides would result in a sense of crowding and marked degradation in the recreational quality of the experience.

c) Daily Capacity: To convert the instantaneous capacities for the contact levels to daily capacities, hourly capacities were calculated based on the average staging time of 40 minutes for commercial groups. The peak hourly capacities were then applied to the arrival and departure time pattern of commercial operations at the put-in through the 1985 season to develop daily capacity.

"Low Contact" daily capacity is 14 groups. At an instantaneous capacity of 3 groups at "Low Capacity", 4.5 groups could use the staging area in an hour and, if this were the peak hourly use, the typical daily capacity would be 14 groups.

"Moderate Contact" daily capacity is 19 groups. At an instantaneous capacity of 4 groups at "Moderate Contact", 6 groups could use the staging area in an hour and, if this were the peak hourly use, the typical daily capacity would be 19 groups. Based on the average of 50 minutes waiting at the water before trip departure, this level of use would result in a typical maximum of 8 groups on the gravel bar at any one time.

"High Contact" daily capacity is 38 groups. At an instantaneous capacity of 12 groups at "High Contact", 18 groups could use the staging area in an hour and, if this were the peak hourly use, the typical daily capacity would be 38 groups. If these groups also wait 50 minutes after staging to depart, there could be periods when 24 groups would be on the gravel bar.

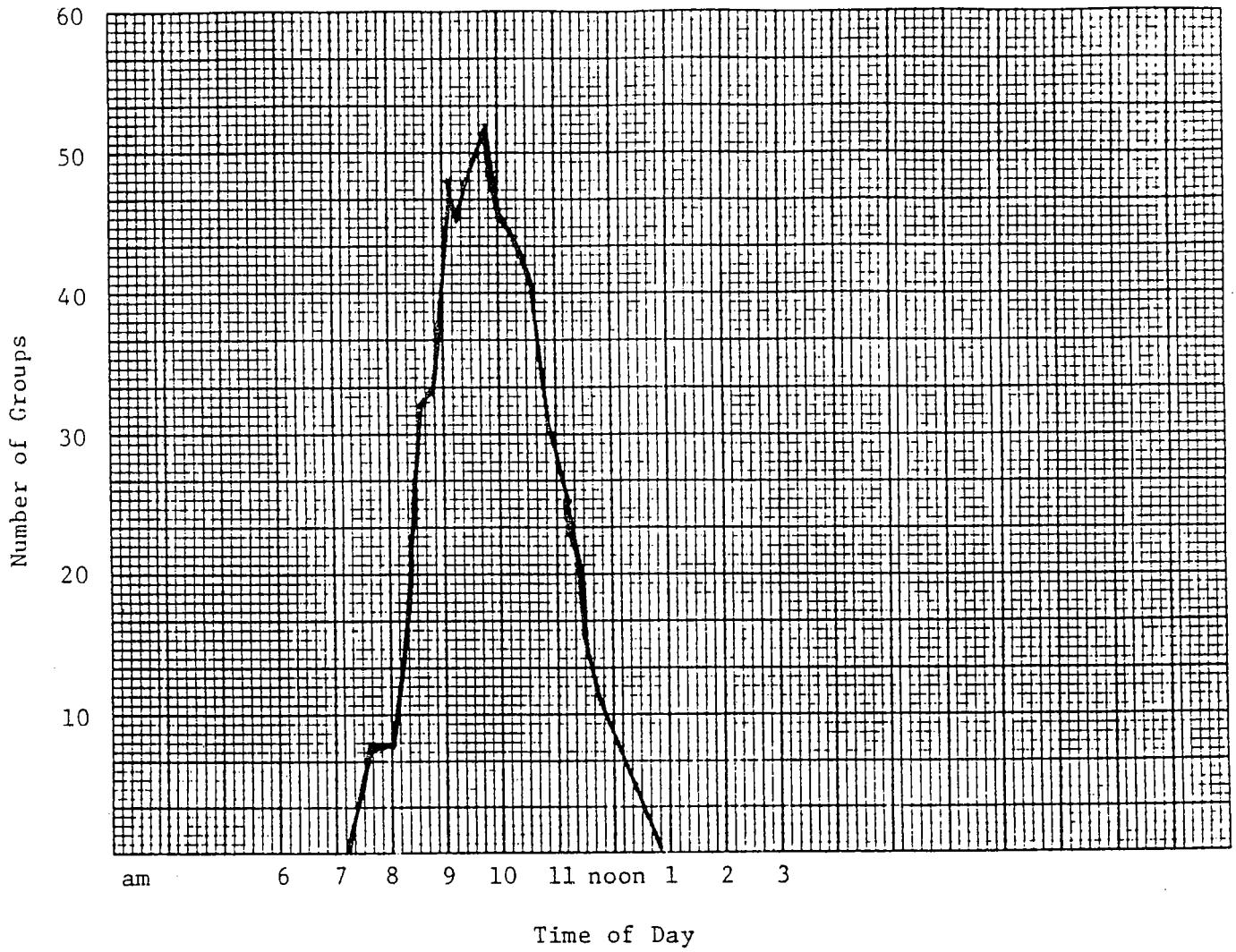

Figure 2: Cumulative Time of Occupation of the Commercial Put-In, Colfax-Iowa Hill Bridge, 1985 Season.

This is developed by accumulating the time of equipment/guides arrival and the time of trip departures for the 18 survey days.

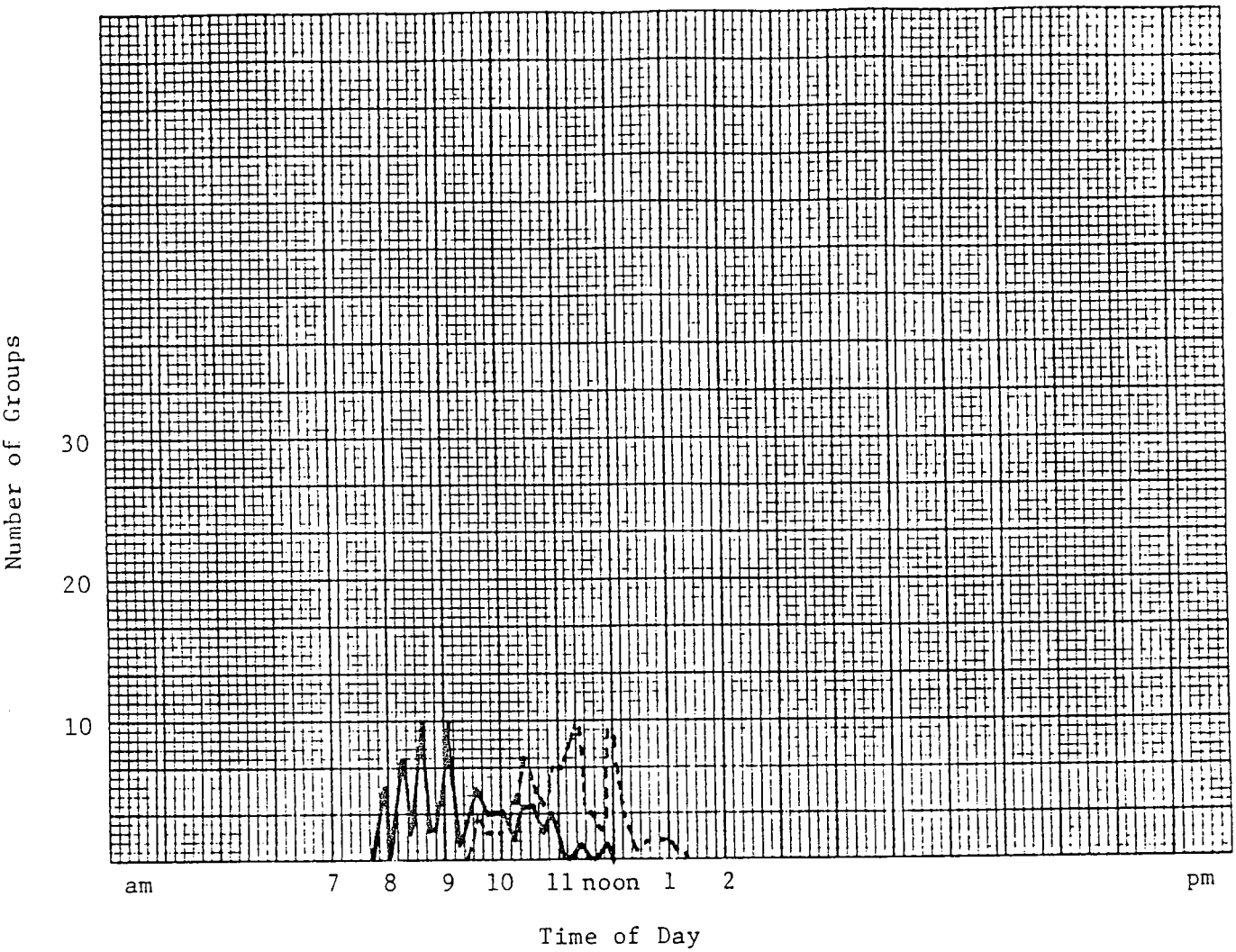

Figure 3: Time Pattern of Commercial Group Arrival and Departure At the Colfax-Iowa Hill Put-In, 1985 Season.

2. Chamberlin Falls Bottleneck:

a) Observations: Behavior patterns at Chamberlin Falls changed through the season which affected the degree of congestion and rates of transit through this bottleneck. Typically in the early season and at higher streamflows most groups stopped in the eddy immediately above the drop to scout the rapid. In mid-season and at moderate streamflows few groups stop to scout Chamberlin. In late season and at low streamflows few scouted the drop but the rate of transit through the boulder gorge above Chamberlin became slow and highly dependent on the degree of success of each raft. Frequent raft wraps and pins delayed transit for extended periods of time and generated congestion.

At the higher flows, >1700 cfs, groups stopped to scout the main drop, often a throw line was set up at the strong eddy below the drop and one of the rafts would run. After this raft sets up a throw line the rest of the rafts in the group ran the falls. Average transit rates of 6.4 minutes per raft were observed with groups averaging 24 minutes to scout and run Chamberlin Falls. At lower flows, 1700-1300 cfs, the strength of this rapid declined to the point where few groups stop to scout and little congestion resulted.

At even lower flows, <1300 cfs, although congestion remained low at Chamberlin and no waiting time was experienced, the boulder gorge above became very congested. This stretch of technical water became difficult to run in rafts as lines became very narrow with declining flows and there were typically several mishaps a day. On the average it took about 20 minutes to run this stretch, but this varied greatly depending on conditions and boater skill of other rafts on the run. Groups tended to stagger themselves in eddies throughout this section while waiting for the next short section to clear and the eddy below the section to become available. When flows were low, nearly every group had at least one incident which delayed those groups behind them. Because of the narrowness of the channel if a raft becomes stuck it blocks the entire route and all transit stops until the problem is resolved. These delays lasted from 20 minutes to 2 hours with the net effect of extreme delays by the time groups reached Chamberlin Falls. Under these conditions non-commercial rafting and kayaking appeared to be driven off the river by congestion generated by the large commercial groups.

b) Instantaneous Capacity: The instantaneous capacity of Chamberlin Falls is related to the capacity of the eddy above the drop, the capacity of the eddies in the gorge above Chamberlin Falls and the rate at which groups transit the main drop.

"Low Contact" instantaneous capacity is about 8 rafts and 2-3 groups. At this use level there is room in the eddy for all

the rafts in most flow conditions and allows for the groups to follow their own preferred use pattern.

"Moderate Contact" instantaneous capacity is 15 rafts and 3-4 groups. With the eddy immediately above the falls filled by the first two groups, the third group either crowds the main eddy by double parking, waiting in an eddy in the gorge above the falls for space to be made available in the main eddy, and running the falls without scouting.

"High Contact" instantaneous capacity is 25 rafts and 6 groups. Under high use pressure the capacity of the eddy can increase to 3 groups and there is room for 3 more groups in the eddies of the gorge above. These groups tend to slowly move through the sequence of eddies as these eddies are vacated by proceeding groups. High levels of accommodation and waiting are required to get through Chamberlin Falls.

c) Daily Capacity: To deal with the issue of daily capacity of Chamberlin Falls it is necessary to consider peak rates of raft and group arrival to the area and rates of raft and group transit through the bottleneck. Because groups running the rapid without scouting was a significant element of the use pattern the hourly capacity was increased to levels greater than simply the average transit rate. Because peak rates of arrival to the Chamberlin Falls area determine the rate at which available space is filled and because the rates of arrival are a result of departure rates at the put-in, it is the departure pattern that determines the daily capacity of Chamberlin Falls under different contact levels. Assumed non-commercial use levels for the 1985 peak use season are subtracted from the daily capacities in order to determine the appropriate daily commercial capacity. With time the levels of non-commercial should increase which would decrease the daily capacity for commercial use if the same contact levels are to be maintained.

"Low Contact" daily capacity is 1-2 commercial groups and 11 commercial rafts. This was developed by assuming a capacity of 8 rafts and that 3 rafts do not stop; with a through-transit rate of 6.4 minutes/raft an arrival rate of 4.7 minutes/raft would fill the available space in an hour; a peak departure rate of 4.7 minutes/raft is a peak hourly departure of 12.75 rafts; at a seasonal average of 3.4 rafts/group this is an hourly peak departure of 3.75 groups. Based on the time distribution of trip departures through the day, these hourly peaks convert to 29 rafts and 8-9 groups per day. Assuming a typical peak season weekend day non-commercial raft use level of 7 groups and 19 rafts, there is available daily capacity for 1-2 commercial groups and 11 rafts.

"Moderate Contact" daily capacity is 5-6 commercial groups and 24 commercial rafts. This was developed by assuming a capacity of 15 rafts and that 4 rafts do not stop; with a through-transit rate of 6.4 minutes/raft, an arrival rate of 3.2 minutes/raft would fill the available space in an hour; a peak departure rate of 3.2 minutes/raft is a peak hourly departure of 18.75 rafts; at a seasonal average of 3.4 rafts/group this is an hourly peak departure of 5.5 groups. Based on the time distribution of trip departures through the day, these hourly peaks convert to 43 rafts and 12-13 groups per day. Assuming a typical peak season weekend day non-commercial raft use level of 7 groups and 19 rafts, there is available daily capacity for 5-6 commercial groups and 24 rafts.

"High Contact" daily capacity is 14-15 commercial groups and 53 commercial rafts. This was developed by assuming a capacity of 25 rafts and that 6 rafts do not stop; with a through-transit rate of 6.4 minutes/raft, an arrival rate of 1.9 minutes/raft would fill the available space in an hour; a peak departure rate of 1.9 minutes/raft is a peak hourly departure of 31.58 rafts; at a seasonal average of 3.4 rafts/group this is an hourly peak departure of 9.3 groups. Based on the time distribution of trip departures through the day, these hourly peaks convert to 72 rafts and 21-22 groups per day. Assuming a typical peak season weekend day non-commercial use level of 7 groups and 19 rafts, there is available daily capacity for 14-15 commercial groups and 53 rafts.

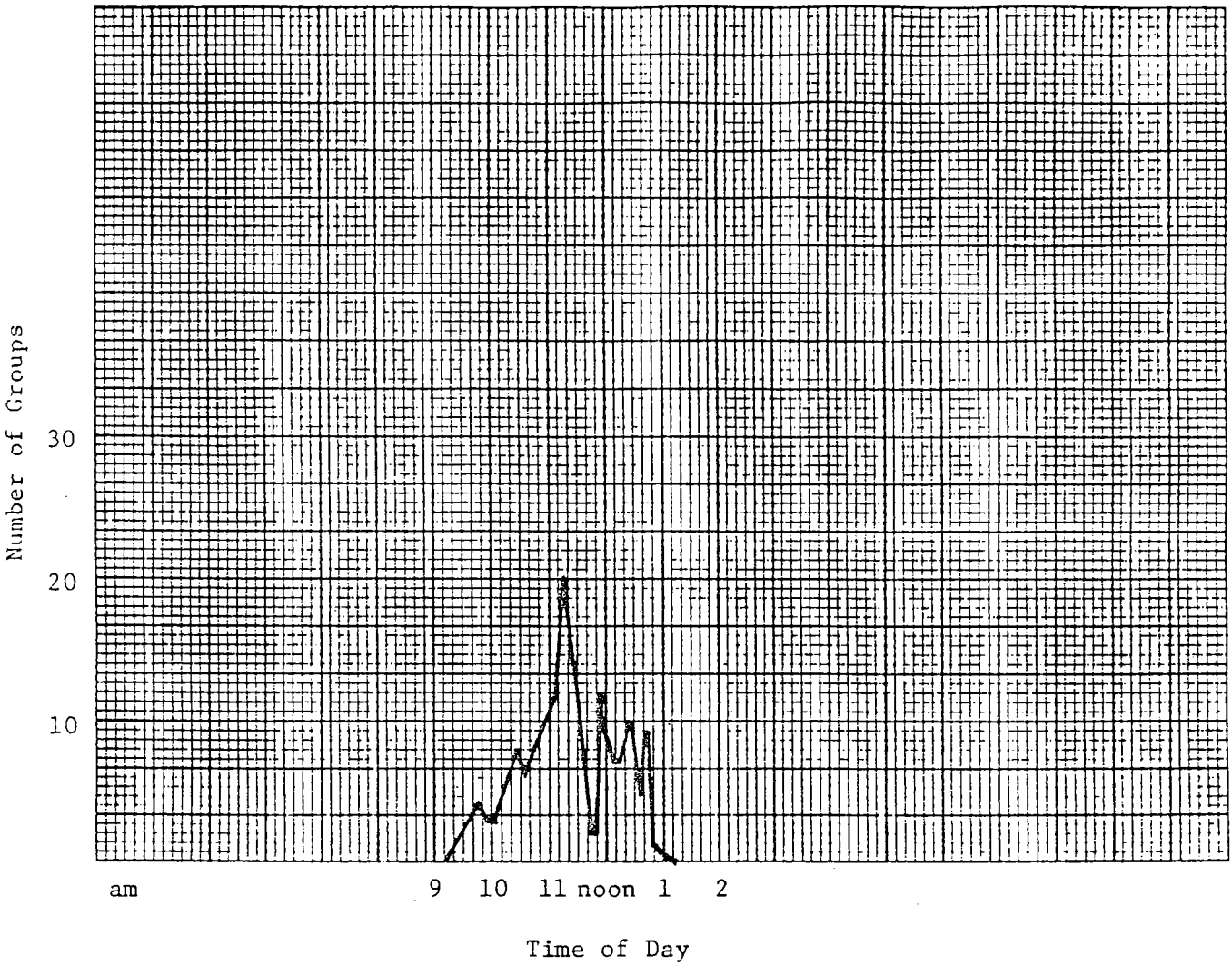

Figure 4: Cumulative Commercial/Non-Commercial Trip Departure Times, Colfax-Iowa Hill Put-In, 1985 Season.

This is developed accumulating the time of the recorded trip departure times on the 18 survey days.

3: Ponderosa Road Bridge Take-Out.

a) Observations: The Ponderosa take-out area consists of a fairly large beach immediately downstream of the bridge on RR. Leading to the beach from a small turn-out on Ponderosa Road, is a short, steep road safely negotiated only by four-wheel vehicles. The turn-out at the north abutment of the bridge is the preferred raft staging area for the groups, however, when conditions are crowded some staging occurs on the beach and along the road itself. Parking for all users at the take-out occurs along both sides of Ponderosa Road mainly on the RR side and some parking occurs along the road on the RL side and on the beach. Further south on Ponderosa Road 1.3 miles, is a large turn-out/turn-around/parking area occasionally used by commercial operators.

Typically non-commercial and day use vehicles began arriving at the take-out area at about 9:00 am. Non-commercial rafting vehicles parked along Ponderosa Road while day users tended to park there as well as in the turn-out at the bridge and on the take-out beach. Commercial vehicles tended to begin arriving at about noon and arrivals continued until about 3:00 pm typically parking along Ponderosa Road on the RR side.

Raft groups began arriving at about 2:00 pm, and continued until about 6:00 pm. with a peak arrival in the 4:30 to 5:30 pm period when 43% of all arrivals occurred. The main staging procedure was to carry the rafts and gear from the beach to the turn-out at the bridge where the gear is broken down; the gear was either carried to the vehicles or the vehicles were moved to the turn-out for packing. After packing the groups left the area. Nearly all non-commercial trips operated this way as did about 5% of the commercial trips. About 95% of the commercial trips carried the gear to their vehicles, loaded the rafts on top of busses and deflated them as they were stacked. These staging patterns generally required about 1:06 to complete and used about 1.5 vehicles for non-commercial groups; about 1:05 to complete and 2 vehicles for those commercial groups that completely rolled and packed gear; about 0:45 to complete and 1 vehicle for those commercial groups that loaded on top of the busses. The overall average staging time for all groups was 1:15 in the 1985 season. After loading, most often the large commercial vehicles had to turn around in the area of the bridge to exit the take-out toward Highway 80.

Because of the concentration of take-out arrivals and staging activity, limited staging area, and the movement of large vehicles, congestion at this location increased quickly in the afternoons of weekend days during the peak season. This level of activity resulted in conflicts between day users and raft groups, conflicts between commercial and non-commercial groups, and conflicts between commercial groups.

Day use activity was often occurring at the take-out beach from late morning into the afternoon and their vehicles were often parked at the beach or in the turn-out/staging area near the bridge. When the raft groups began arriving at the take-out beach they tended to drive the day users off but by that time the day use vehicles were often blocked at Ponderosa Road by raft staging activities and vehicles.

Conflicts between commercial and non-commercial groups occurred as room in the staging area became scarce in the peak activity hours. Commercial groups had more rafts, people, and larger vehicles at the take-out. They therefore tended to dominate the area imparting a strong sense of congestion to the smaller non-commercial groups. Conflict between commercial groups may also occur with this congestion level but commercial groups appear more tolerant of the situation.

The necessity of turning vehicles around to exit the area toward Highway 80 created another element of congestion. Busses, after loading gear and clients, crossed the bridge, turned around and crossed back through the staging area a second time. Non-commercial vehicles generally turned around without crossing the bridge, temporarily blocking all through traffic. Frequently, commercial groups moved their vehicle on to the bridge to load gear and clients. This blocked all traffic for short periods of time. This behavior also caused a conflict between rafters and day users as this second group generated considerable traffic in the afternoon at this location.

b) Instantaneous Capacity: The instantaneous capacity of the Ponderosa Road take-out is related to the space available for staging and the level of vehicular movement.

"Low Contact" instantaneous capacity is 2 groups, or 8 rafts. At this level of use there is room in the preferred staging area, the turn-out, for both groups to break down the gear, dry rafts and load equipment without undue crowding or accommodation to other users. Also at this level there would be little conflict with the day users.

"Moderate Contact" instantaneous capacity is 4 groups, or about 16 rafts. At this use level 2 or 3 groups can occupy the preferred staging area, while the fourth group can stage either between cars, on the bridge, or on top of the take-out vehicle (commercial busses/vans).

"High Contact" instantaneous capacity is 8 groups and about 32 rafts. At use levels between 5 and 8 groups staging is occurring at the preferred location with up to 3 groups and other groups staging between vehicles, on vehicles, on the roadway, and

on the beach. At these levels groups often elect to wait on the beach for staging space at more convenient locations. At this use level, congestion is such that all users groups are severely affected by the presence of equipment and activity.

c) Daily Capacity: To convert the above instantaneous capacity of the take-out to total daily capacity and the to commercial capacity it is necessary to consider peak hourly non-commercial and commercial group arrival rates and the expected levels of non-commercial use on weekend days of the peak use season.

"Low Contact" daily commercial capacity is 1 group. An instantaneous "Low Contact" peak of 2 groups allows for 8 groups per day based on the 1985 arrival and use pattern characteristics at the take-out, and the characteristic non-commercial use level for weekend days in 1985 of 7 groups and 19 rafts. This level of commercial use would allow for "Low Contact" conditions for whitewater users and day users at Ponderosa Road Bridge.

"Moderate Contact" daily commercial capacity is 8 groups. An instantaneous "Moderate Contact" peak of 4 groups allows for 15 groups per day based on the 1985 arrival and use pattern characteristics at the take-out, and the characteristic non-commercial use level for weekend days in 1985 of 7 groups and 19 rafts. This level of commercial use would allow for "Moderate Contact" conditions for whitewater users and day users at Ponderosa Road Bridge.

"High Contact" daily commercial capacity is 19 groups. An instantaneous "High Contact" peak of 8 groups allows for 26 groups per day based on the 1985 arrival and use pattern characteristics at the take-out, and the characteristic non-commercial use level for weekend days in the 1985 of 7 groups and 19 rafts. This level of commercial use would create "High Contact" conditions for whitewater users and day users at Ponderosa Road Bridge.

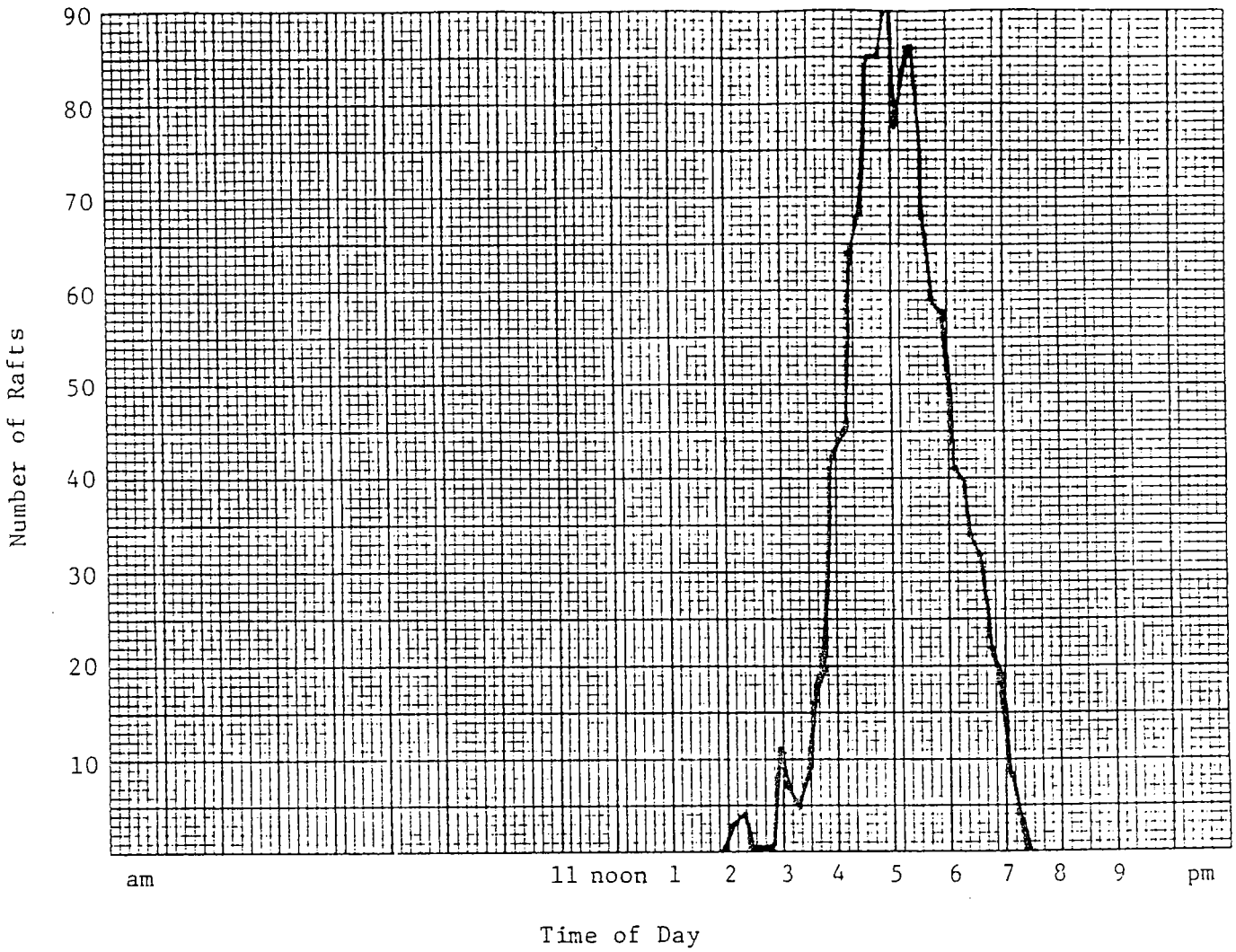

Figure 5: Cumulative Commercial/Non-Commercial Occupation At the Ponderosa Road Take-Out, 1985 Season.

This is developed by accumulating the recorded times of groups arrivals at the take-out and the times the groups departed the area after staging for the 18 survey days.

8: Summary of Capacities:

In preceding sections each of the major access and on-river points of congestion were analyzed for instantaneous capacities at various contact threshold levels. Also the instantaneous capacities were extended to daily capacities, at the various contact threshold levels, by applying observed use and behavior patterns. The "Moderate Contact" level is the desired management goal and the instantaneous and daily capacities at "Moderate Contact" levels for the features of the NF are summarized in Table 8 below.

Table 8.

Summary of Site Capacities for Commercial Operations at "Moderate Contact" Use Levels, NF.

Site	Instantaneous Capacity	Daily Capacity
Weekend Days		
1. Colfax-Iowa Hill Put-In	4 groups	19 groups
2. Chamberlin Falls	3-4 groups	5-6 groups
3. Ponderosa Road Take-Out	4 groups	8 groups
Mid-Week days		
1. Colfax-Iowa Hill Put-In	4 groups	19 groups
2. Chamberlin Falls	3-4 groups	12-13 groups
3. Ponderosa Road Take-Out	4 groups	15 groups

The "Moderate Contact" daily capacities for the various features on the NF are combined into an overall daily capacity by virtue of the most limiting factor. The Chamberlin Falls area has the most restrictive daily capacity and sets the overall daily

"Moderate Contact" level capacity for the NF. The Chamberlin Falls conditions apply to almost the same degree to other narrow, steep gradient gorge reaches of the NF that experience significantly increased congestion with relatively small increases in use levels. Because there is a management focus for non-commercial whitewater recreation on the NF, typical weekend day non-commercial daily use, in the 1985 season, is subtracted from the overall daily capacities on weekend days to obtain the weekend daily capacities for commercial activity; weekend daily commercial capacity is 6 groups. On mid-week days the level of non-commercial use is very low and commercial activity can use the full daily capacities; mid-week daily commercial capacity 13 groups. As non-commercial use patterns and use levels change in the future, the daily capacities for commercial use should also change.

G. NF Findings and Management Recommendations:

1: Findings.

Field surveys conducted in the 1985 peak use season, observations of access point and on-river use patterns and conflicts, a review of the resource characteristics of the NF, and regional resource characteristics have lead to several findings that have directed the management recommendations. These findings include:

- Because of the season of suitable flows and resource characteristics, the NF is a significant regional resource and deserves careful management.

- Because of the isolated nature of the NF and the speed at which "High Contact" conditions occur with increased use due to channel/hydraulic characteristics, the NF should be managed for "Moderate Contact" levels.

- Because of the degree of commercial/non-commercial conflict induced by user pattern and channel/hydraulic characteristics, the demand for the NF by non-commercial users, and the difficulty of State Parks to limit non-commercial use, the management of the NF should give priority to non-commercial use.

- Because observed commercial use patterns indicate that required changes in use pattern (intended to reduce congestion) will not be followed without strict enforcement, the management plan should emphasize daily commercial use limits to reduce conflicts rather than use pattern and behavior requirements.

- Because of the heavy weekend day non-commercial use, commercial daily use limits can be different for weekend days and week days.

2: Management Recommendations.

a) Whitewater Use Permit: The permit for whitewater recreation on the NF should apply to commercial operators only and should include:

- A time limit that includes the full season, probably from April 1 through July 1 of each year.

- A requirement that commercial operators meet their clients off-site, and transport the clients to the put-in with a commercial vehicle.

- A requirement that all commercial trips use the RR downstream put-in location at the Colfax-Iowa Hill Bridge.

- A limitation of 6 commercial trips per weekend day and holiday.

- A limitation of 12 commercial trips per normal week day.

- A limitation of 4 rafts per commercial trip.

- A prohibition on commercial overnight trips using dunnage support rafts.

- A provision that commercial training trips are considered as a commercial trip.

- A limitation of commercial take-outs at Shirttail Canyon to early season non-client, training trips.

- A commercial parking restriction at the Ponderosa Road take-out that requires all commercial vehicles to use the large turn-out/turn-around area 1.3 miles south of the bridge and to occupy the bridge/take-out area only when loading is occurring.

b) Other Management Actions: The above permit requirements should be as self-enforcing as is possible, however, there are some actions that can be taken by State Parks to affect enforcement and to improve conditions. These actions include:

- An pre-season commercial allocation system that assigns commercial starts for weekend days (until commercial or non-commercial demand increases on week days) so that a daily use limit can be assured, commercial operators can develop schedules, and State Park field personnel can enforce the management plan.

- Occasional patrols of the put-in and take-out areas on random days through the use season to enforce commercial put-in and take-out restrictions.

- Occasional user surveys at the put-in on weekend days in the peak season to record commercial and non-commercial use patterns.

- Seasonal adjustments of the commercial daily use limits based on trends of non-commercial use.

- The steep trail between the commercial staging area and the gravel bar at the put-in should be improved with the construction of firm steps using set logs or other suitable material.

- Construction of a vehicle barrier across the turn-out at the Ponderosa Road Bridge and a "No Parking" zone in front the barrier.

IV. MIDDLE FORK AMERICAN RIVER

A. Resource Characteristics:

The Middle Fork American River (MF) is typically a low gradient whitewater resource interrupted by four major rapids over the 24 mile reach. This creates a whitewater resource some what unique among west slope Sierran rivers. The long low gradient sections impart a character of very gentle whitewater conditions with subdued hydraulic intensity, while of the four major drops only one (Kanaka Gulch) could be considered as a legitimate and runnable whitewater rapid; Tunnel Chute is man-made and should be run advisedly, Ruck-A-Chucky is a mandatory portage, and Murderer's Bar gorge is runnable only under the most appropriate conditions, by familiar experts. The river could be classified as a Class III run with isolated Class IV and V rapids and portages, or, more generally, as a Class IV run with portages. Because of the difficulty of dealing with either the running or the portaging of the Tunnel Chute, the reasonable upper end of recreational streamflows are in the 4000 cfs range; above about 2500 cfs the running of the Tunnel Chute should be considered as imprudent. The lower end of recreational flows is about 900 cfs due to the shallow wide channel characteristics of the reach.

The broad channel characteristics of the river along with the lack of complex rapids combine to provide a run that does not become congested with greater use levels, however, because of the open channel characteristic, many rafts and groups can be viewed at once. With increased use levels, congestion does tend to occur at specific locations, particularly at the put-in, Tunnel Chute, the Ruck-A-Chucky take-out, and the Ruck-A-Chucky portage. The river also has many good camping sites on public lands, and with the length of the runs, it is a good two day trip resource.

On this portion of the MF there are several areas where historical or current activities have an impact on whitewater resources. In the first 2.5 miles there are several large gravel bars that have been disturbed during gold mining operations, and there is currently a large commercial operation at RM 2.3; near the mouth of Volcano Creek there are several recreational gold dredging operations and camping through the summer from RM 3.3 to RM 3.7; at Cash Bar at RM 5.0 there are several recreational gold dredging operations and camping through the summer; the same is true from RM 14.5 through RM 15.1; from RM 20 through RM 22 there is scattered off-road vehicle use. Despite this degree of activity, the Oxbow to Oregon Bar portion of the MF has a very isolated character, high scenic quality, and imparts a wilderness/primitive experience to users.

The watershed of the MF is highly controlled by water resources reservoirs that store water in the winter and spring for hydro-

electric releases in the summer. The average monthly flows in the winter are in the 1400-1900 cfs range, in May it is 1290 cfs and in the June through December period the average monthly streamflow is in the 600-800 cfs range. The Oxbow Powerhouse as well as other hydroelectric facilities in the basin are operated as peak capacity resources with daily peak releases; the Oxbow release and the natural flow on the North Fork of the Middle Fork American River control the flow on the recreational reach of the MF. The powerhouse has a capacity of 900 cfs and the timing, duration, and magnitude of daily releases strongly affect the recreational use downstream and can result in daily peak recreational flows in the 1000 cfs range while average monthly flows may be in the 600-700 cfs range. The hourly, daily, weekly, and monthly pattern of releases can be quite variable but in the 1985 season boatable releases on weekend days usually began before 8:00 am, while the latest time boatable flows occurred was 10:30 am. With the normal early releases the boatable flow reached the Ruck-A-Chucky take-out (RM 13.0) at about 2:00 pm, Oregon Bar access (RM 51.1) at about 3:00 pm, Mammoth Bar access (RM 21.8) at about 6:30 pm, and the confluence (RM 24.0) at about 7:30 pm. On week days the releases at the Oxbow Powerhouse were often slightly later in the day. There were two occasions when the water did not come up at all in order to provide low flows downstream for special events.

The recreational section of the MF considered here is a 24.0 mile reach with multiple put-ins and take-outs, used in a variety of combinations. For the purposes of description, this reach is considered in three segments.

The first segment extends from Oxbow Powerhouse, 13.0 miles to Canyon Creek and the river drops from an elevation of about 1090 ft to 765 ft with a gradient of 25 ft/mi. This reach has two distinct characteristics. The first 4.1 miles from the Oxbow put-in to the bottom of Kanaka Gulch rapid is a steeper reach, with a gradient of 46 ft/mi. It generally has a broad and shallow channel with some Class III rapids, mostly formed by gravel bars and scattered larger boulders. It has two of the four major rapids on the whole river; the Tunnel Chute and Kanaka Gulch. The Tunnel Chute, a major attraction for commercial clients, is a steep chute blasted in bedrock that drops the river about 15 feet over a distance of about 160 ft into a wide, flat gradient 200 ft long tunnel through a low bedrock ridge. The Tunnel Chute could be considered a Class IV or V rapid. This tunnel, constructed in the 1890's, cut-off a 1.25 mile long meander loop of the original channel which was then mined. Kanaka Gulch (this rapid is known by a variety of names; Mushroom, Sidewinder, Cartwheel and possibly others) is a Class IV rapid controlled by bedrock with a large scale boulder gravel bar superimposed on it. It is located in the Melones Fault zone. In this portion of the segment there are several large gravel bars and terraces that can serve as camps.

The second portion of this segment extends from the bottom of Kanaka Gulch rapid (RM 4.1), 8.9 miles to Canyon Creek (RM 13.0) that has a gradient of 15 ft/mi, is characterized by a very wide and shallow channel, and typically has Class II riffles. There are many broad gravel bars and elevated terraces that provide for most of the campsites on this river.

From Canyon Creek (RM 13.0), 2.1 miles to Oregon Bar (RM 15.1) is the second segment. This segment has the unrunnable Ruck-A-Chucky rapid that drops about 25 ft and is portaged by all users using the suspended cable system. Below this initial rapid of this segment, the river is in a bedrock gorge and has a gradient of 27 ft/mi over the 1.6 miles to Oregon Bar. There are several Class III/IV rapids in the upper end of the gorge but the gradient soon flattens out.

The third segment is from Oregon Bar (RM 15.1) at elevation 692 ft, to the confluence with the NF (RM 24.0) at elevation 520 ft. This segment is 8.9 miles long, has a gradient of 19 ft/mi, has a broad channel characteristic with typically gravel bar riffle Class II rapids, and has many elevated terraces along the channel. There are a few bedrock and boulder dominated rapids that could be Class III rapids. The most prominent rapid is the Class V Murder's Bar Gorge at RM 22.0, runnable only at specific streamflows.

B. Use Characteristics:

Because of the concurrence of controlled boatable flows and good summer season weather, most of the whitewater use on the MF occurs in the May-June through September period. Because of the multiple access points, variable trip options, variable portions of the recreational reach used, and the availability of campsites, there are a wide range of use patterns on the MF. Of all the trips contacted during the 1985 season, approximately 49% were one-day, 50% were two-day, and 1% were three-day: 80% used the 13.0 mile Oxbow to Ruck-A-Chucky reach, 17% used the 15.1 mile Oxbow to Oregon Bar reach, and 3% used the 21.8 mile Oxbow to Mammoth Bar reach. There were other minor trip options that included putting in at Volcano Creek (RM 3.4) and taking-out at the confluence with the NF (RM 24.0). About 90% of the total whitewater trips on the MF were conducted by commercial operators.

The user definitions used here are similar to those used in the NF section, however, since there is considerable over night use some additional terms are used and should be defined. In the section on the summary of use, the client and user terms are extended to estimate user day and user day unit information. Commercial clients and non-commercial users are combined into `visitors´ (all those who use the river for recreational purposes) and the commercial guides are added to visitors to formulate `users´ (all those on the river associated with recreation). `Visitor/user days´ are individuals spending any portion of a day on the river engaged in whitewater recreation. `Visitor/user day units´ are the visitor/user days plus the nights spent camping during the trip.

1: Commercial Use.

There are 57 companies with State Park permits to use the MF, and from 20 to 35 companies actually use it on a recurrent basis through the use season. Commercial use typically initiates on the MF in late spring or very early summer when boatable flows and reasonable weather for commercial clients begin to coincide. Use picks up quickly and within two weeks commercial use is at peak levels (approximately 25 trips per weekend) and stays at peak levels through Labor Day. After Labor Day use drops to low levels very quickly. Through the main use season, peak weekend days had about 22 commercial trip starts and another 5 commercial trip starts through the week. There were observed shifts in daily use patterns through the season.

During the 1985 season the MF was surveyed for use and user patterns at the Oxbow put-in, the Tunnel Chute, the Ruck-A-Chucky take-out, the Ruck-A-Chucky portage, and the Greenwood Bridge/Or-

egon Bar take-out areas on 16 weekend days and 11 week days. Commercial group characteristics were recorded on these sample days and the totals are shown on Table 9 below. An effort was also made to extrapolate use estimates to the peak use season and to the full season as well. This was done on the basis of both the differences in characteristics between weekend vs. mid-week use and one-day vs. multi-day trips and assumptions of the number of trips that may have occurred on unsurveyed days. The differences in use characteristics on the basis of these two factors are shown in Table 10 and indicate a tendency for larger multi-day trips and a tendency for larger weekend day trips in terms of both rafts and users.

Table 9.

MF Commercial Use, 1985 Season.

Use Characteristics	Count (27 days)	Estimated Peak Season	Estimated Full Season
Trips	180	303	312
Boats	728	1226	1248
Clients	4086	6435	6614
Users	4814	7661	7862
Boats/Trip	4.0	4.0	4.0
Clients/Trip	23.0	21.2	21.2
Clients/Boat	5.6	5.2	5.2
Users/Trip	26.7	25.3	25.3
Users/Boats	6.6	6.2	6.2

The estimated peak season use was based on the assumption that 60 weekend trips were missed during the peak season; 28 in the first two weeks of the season, 18 trips during the season, and 14 trips at the end of the season. The estimated weekday trips on unsurveyed days was 60 based on the number of unsurveyed days with an

Table 10.

MF Commercial Weekend vs. Mid-Week Use,
One-Day vs. Multi-Day Use, 1985 Season.
(From 27 Survey Days)

Use Charact.	Weekend Survey		Mid-Week Survey		Total Survey		
	1-day	Multi-day	1-day	Multi-day	1-day	Multi-day	TOTAL
Trips	86	83	6	5	92	88	180
Boats	280	404	21	23	301	427	728
Clients	1858	2002	112	114	1970	2116	4086
Users	2138	2406	133	137	2271	2543	4814
Boats/Trip	3.3	4.9	3.5	4.6	3.3	4.8	4.0
Clients/Trip	21.6	24.1	18.6	22.8	21.4	24.0	23.0
Clients/Boat	6.6	5.0	5.3	5.0	6.6	5.3	5.0
Users/Trip	24.8	29.0	22.0	25.8	24.7	28.9	26.7
Users/Boat	7.6	6.0	6.3	6.0	7.5	6.0	6.6

assumed average use of 6 commercial trips a week. The full season use estimates were made on the assumption that there were 9 weekend day trips after the peak season (after Labor Day) and no mid-week trips and that the use characteristics of these trips were the same as those of the peak season.

These estimates of missed trips in the survey period and in the use season include both the trips that used the surveyed Oxbow put-in and the unsurveyed Volcano Creek put-in.

The general use pattern for commercial operations is to meet their clients off-site on the morning of the trip and to either 1) have gear and some guides arrive at the Oxbow put-in the night before the trip and begin staging the trip early the next day (about 40% of the trips), 2) have gear and some guides arrive at the put-in before the clients the morning of the trip and begin staging the trip (about 40% of the trips), and 3) have gear, guides and clients arrive together and staging is initiated (about 20% of the trips). The later approach usually only occurs with one-day trips. The operators meet the clients in the community of Foresthill, at commercial operation centers in Coloma, or in other locations. Once met the clients are transported to the put-in in commercial vehicles.

For those 80% of the commercial trips where the gear and guides arrived before their clients, the gear vehicles arrived mostly before 9:00 am but some arrived as late as 11:00. There was generally such competition for put-in spots in the put-in eddy that staging usually started as early in the morning as possible and rafts were placed in the water to reserve space. Often the water was filled to capacity with rafts and additional rafts were stacked on the shoreline or even in the staging/parking area waiting for room on the water. The separate passenger vehicles arrived between 8:30 and 11:30 with 60% arriving between 9:30 and 10:30 am. After preparing the clients and client's gear for the trip, the trips departed the area about 0:40 after the passenger vehicles arrived. The time required for the full process from gear arrival through staging to final trip departure ranged from 1:30 to 3:30 and there were often many rafts in the put-in eddy and on the shoreline waiting for extended periods of time for both the clients to arrive and for space in the water.

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10:30 am. After preparing the clients and client's gear for the trip, the trips departed the area about 0:40 after the passenger vehicles arrived. The time required for the full process from gear arrival through staging to final trip departure ranged from 1:30 to 3:30 and there were often many rafts in the put-in eddy and on the shoreline waiting for extended periods of time for both the clients to arrive and for space in the water.

For those 20% of the commercial trips where the gear, guides, and clients arrived at the same time, the vehicles arrived typically between 9:00 and 10:00 am and usually required about 0:40 to stage these trips and to depart the put-in area.

About 49% of the trips were one-day trips; they typically used up to 5 paddle rafts and averaged 3.3 paddle rafts/trip. About 51% of the trips starting from the Oxbow put-in were two or three-day trips, and about 80% of these use a dunnage/oar raft to support the trip and had up to 4 paddle rafts, while the remaining 20% use no dunnage rafts and have up to 5 paddle rafts. Multi-day trips averaged 4.8 rafts/trip. Those multi-day groups that did not use a dunnage/oar raft had the gear driven to the Fords Bar area by 4-wheel drive vehicle that can access 6 or 7 camps between RM 10.0 and RM 10.7.

About 90% of all commercial trips leave the put-in between 9:30 and 12:30 pm, peaking with 51% of the departures between 10:30 and 11:30 am. The groups progress downstream to the Tunnel Chute at RM 1.5 where 95% of the groups spend an average of 0:45 scouting and observing other groups before running the drop. About 5 % of the groups did not run the chute and take from 1 to 2 hours to portage the drop along the left shore. After running the tunnel the groups continued on and had lunch at various locations anywhere between the lower end of the tunnel and Cash Bar at RM 5.0.

A second put-in location is used by two companies both owned by the same operator. This is at the mouth of Volcano Creek at RM 3.4 and although on Tahoe National Forest lands, access is via a private road, use of which is leased to the operator.

One-day trips proceeded to the Ruck-A-Chucky take-out arriving between 2:00 pm and 6:30 pm but most arrived between 3:30 and 4:30. Two-day and three-day trips camped in any number of camping sites from RM 5.6 through RM 11.2. The following day the two-day trips arrived at Ruck-A-Chucky between 12:00 and 5:00 pm with the progression of the boatable flow releases. Depending on the number of groups to portage Ruck-A-Chucky, the time of day, and the flow, two-day trips either take-out at Ruck-A-Chucky (about 60%) or make the portage and run to Oregon Bar for a take-out and have the dunnage/oar raft staged at the Ruck-A-Chucky take-out (about 40%); the portage usually takes from 0:45 to 1:10

when waiting is not required. The three-day trips spend two nights above Ruck-A-Chucky before portaging and continuing to Mammoth Bar for a take-out.

Commercial groups typically are met at the take-out by the same vehicles that were at the put-in. The vehicles tended to arrive between 1:00 and 3:30 pm, and anytime from 0:40 to 2:00 before the raft trips arrive, and park waiting for their groups to arrive at the take-out. At the beginning of the season both gear and passenger vehicles were driven down the steep hill to the lower parking areas and the beach area. As the road conditions degraded through the season, the passenger vehicles began to use the upper parking and only those gear vehicles suited to rough, steep roads went to the beach. Under those conditions the clients walked to the passenger vehicles. After the trips arrived at the take-out it generally required about 1 hour to stage the equipment and to depart the area.

About 35% of the two-day trips, mostly those that started at Oxbow, used the Greenwood Bridge site (RM 14.9) or Oregon Bar (RM 15.1) take-out areas. About 5% of the trips, nearly all two-day trips that started at Volcano Creek and the three-day trips, continued to Mammoth Bar at RM 21.8 for the take-out. Only very rarely did a trip pass through Murderer's Bar Gorge to take-out at the confluence at RM 24.0.

At the Greenwood Bridge site and the Oregon Bar area, trips were met by the support vehicles and the staging of the trip occurred on the roadway and in small turnout areas. The staging only took from 0:30 to 0:45 and the groups usually left the site immediately. The arrival pattern of trips at these take-outs was spread out by the time element of the Ruck-A-Chucky portage.

At the Mammoth Bar take-out area there is extensive area for parking and staging. Due to the typically heavy off-road vehicle use of this area on summer weekend days, raft trip take-out operations were often very fast and basically the same as at Oregon Bar and Greenwood Bridge sites.

After the clients were in commercial vehicles they were transported from the take-out locations back to the original meeting locations, often back to the community of Foresthill.

Overall the location of a commercial operation and/or its client/market base tends to lead toward a general operational approach to the use of the MF. When the major emphasis of a commercial operation is centered in southern California, the operators tend to concentrate on two-day weekend oriented experiences for their clients, with a secondary emphasis on two-day or three-day week day trips. To create a more efficient and profitable operation there is a trend for southern California operators to operate two "companies", on separate permits, in

tandem so that 40 to 50 clients can be transported from southern California by bus. When the major emphasis of an operation is in northern California or more generalized, the operators tend to run a mix of one and two-day trips. Back-to-back one-day trips are often run by these operators on the weekends with different groups of clients and some times the same operator will start both a one-day and two-day trip on the same day.

2: Non-Commercial Use.

Non-commercial use on the MF is low and only amounts to about 10% of the trips and 2% of the total users. Non-commercial trips typically begin use in the late spring or very early summer when boatable flows occur. Through the main use season peak there were about 3 non-commercial trip starts on weekend days and about 1 non-commercial trip start per mid-week period. Use was evenly distributed between Saturdays and Sundays and there were no observed shifts in daily use patterns through the season. Use remained at consistently low levels throughout the 1985 peak use season.

As with the evaluation of commercial use, during the 1985 season the MF was surveyed for use and user patterns at the Oxbow put-in, the Tunnel Chute, the Ruck-A-Chucky take-out, the Ruck-A-Chucky portage, and the Greenwood Bridge/Oregon Bar take-out areas on 16 weekend days and 11 week days. Non-commercial group characteristics were recorded on these sample days and the totals are shown on Table 11 below. An effort was also made to extrapolate use estimates to the peak use season and to the full season as well. This was done on the basis of both the differences in characteristics between weekend vs. mid-week use and one-day vs. multi-day trips and assumptions of the number of trips that may have occurred on unsurveyed days. The differences in non-commercial use characteristics on the basis of these two factors are shown in Table 11 and indicate a tendency for 1-day, weekend trips. These trips are generally 33% the size of multi-day trips. There were no observations of multi-day non-commercial mid-week trips.

Also as with the estimates of commercial use, the estimated peak season use for non-commercial activity was based on the assumption that 4 weekend trips were missed during the peak season; 2 in the first two weeks of the season and 2 trips at the end of the season. The estimated weekday trips on unsurveyed days was 5 based on the number of unsurveyed days with an assumed average use of one non-commercial trip per mid-week period. The full season use estimates were made on the assumption that there were 2 weekend day trips after the peak season (after Labor Day) and no mid-week trips and that the use characteristics of these trips were the same as those of the peak season.

Table 11.

MF Non-Commercial Use, 1985 Season.

Use Characteristics	Count (27 days)	Estimated Peak Season	Estimated Full Season
Trips	20	29	31
Boats	29	40	43
Users	138	188	201
Boats/Trip	1.5	1.4	1.4
User/Trip	6.9	6.5	6.5
Users/Boat	4.8	4.7	4.7

The general use pattern for non-commercial trips was to first drive to Ruck-A-Chucky take-out where a shuttle vehicle was left for post-trip staging; the remaining vehicles were taken to the put-in. This shuttle was generally run early in the morning before the trip. A small portion of the trips ran the shuttle the night before the trip and camped at the put-in area.

For those trips where the shuttle was run in the morning on the way to the put-in, the groups generally arrived at the put-in between 9:00 am and 12:30 pm; most arrived between 10:30 and 11:30 am. Staging began immediately and took an average of 1:35 to complete. Trip departures were generally between 12:00 am and 1:00 pm. For groups where shuttle has been run the night before, staging typically began between 8:00 and 9:00 am and departure usually occurred between 8:30 and 9:30 am.

About 85% of the non-commercial trips were 1-day and typically use only one paddle raft. The remaining 15% were multi-day trips occurring on weekends having an average of 3 rafts and 13 users.

The groups progress downstream to the Tunnel Chute at RM 1.5 where all non-commercial groups stop to scout. Approximately 50% of the groups portaged the rafts around the Tunnel Chute while the rest ran the drop after spending about 1:00 scouting and observing. After running or portaging Tunnel Chute, the groups continue on and had lunch at various locations anywhere between the lower end of the tunnel and the Ruck-A-Chucky.

Table 12.

MF Non-Commercial Weekend vs. Mid-Week Use,
One-Day vs. Multi-Day Use, 1985 Season.
(From 27 Survey Days)

Use Charact.	Weekend Survey		Mid-Week Survey		Total Survey		
	1-Day	Multi-Day	1-Day	Multi-Day	1-Day	Multi-Day	TOTAL
Trips	16	3	1	0	17	3	20
Boats	18	10	1	0	19	10	29
Users	95	39	4	0	99	39	138
Boats/Trip	1.1	3.3	1.0	0	1.1	3.3	1.5
Users/Trip	5.9	13.0	4.0	0	5.8	13.0	6.9
Users/Boat	5.3	3.9	4.0	0	5.2	3.9	4.8

One-day trips proceeded to Ruck-A-Chucky take-out, arriving between 4:00 and 5:30 pm. Two-day trips camp in any number of sites from RM 5.6 through RM 10.9. The following day, the two-day trips arrive at the Ruck-A-Chucky take-out between 12:00 and 5:00 pm with the progression of boatable flow releases. Most of the non-commercial two-day trips (<90%) took out at Ruck-A-Chucky while the remaining portage Ruck-A-Chucky and took out at Oregon Bar.

The shuttle vehicles were usually parked at either the upper or middle parking areas. At the take-out non-commercial groups took about 1:30 to stage the equipment. The vehicles were moved to the lower parking area or the beach for loading. The groups left the area as soon as the vehicles were loaded and returned to the put-in for the rest of the vehicles.

The majority of the non-commercial users contacted on the MF were from the Reno-Auburn-Sacramento area. The observed behavior patterns indicated that they attempted to avoid the congestion generated by commercial operations; departure times were usually much earlier or later than the morning commercial peak.

3: Summary Of Seasonal Whitewater Use.

Because of dependable weather and flow regimes, the MF peak season starts in early June and continues through Labor Day. After that use drops off very quickly. The estimates generated in this study indicate that about 97% of the commercial use, and 93% of the non-commercial use occurs in this time period.

There is a high distribution disparity between weekend days and mid-week days. Even though the mid-summer use season on the MF would allow for a greater use of mid-week opportunities by vacationers, this was not the case. About 75% of the commercial use was on the weekend days and about 25% was in mid-week. For non-commercial use the estimated distribution was about 70% on weekend days and 30% on mid-week days.

One of the busiest days during the 1985 season was Saturday, June 22, when 22 commercial trips started with 98 rafts, 515 clients and 98 employees, and 1 non-commercial trip started with 4 rafts and 16 users.

Table 13.

Summary of MF Use, 1985 Season.

Use Type	Count (27 Days)	Estimated Peak Season	Estimated Full Season
Commercial			
Trips	180	303	312
Boats	728	1226	1248
Clients	4086	6435	6614
Users	4814	7661	7862
Non-Commercial			
Trips	20	29	31
Boats	29	40	43
Users	138	188	201
TOTAL USE			
Trips	200	332	343
Boats	757	266	1291
Users	4952	7849	8063
(Recreational)	4224	6623	6815
(Employees)	728	1126	1248

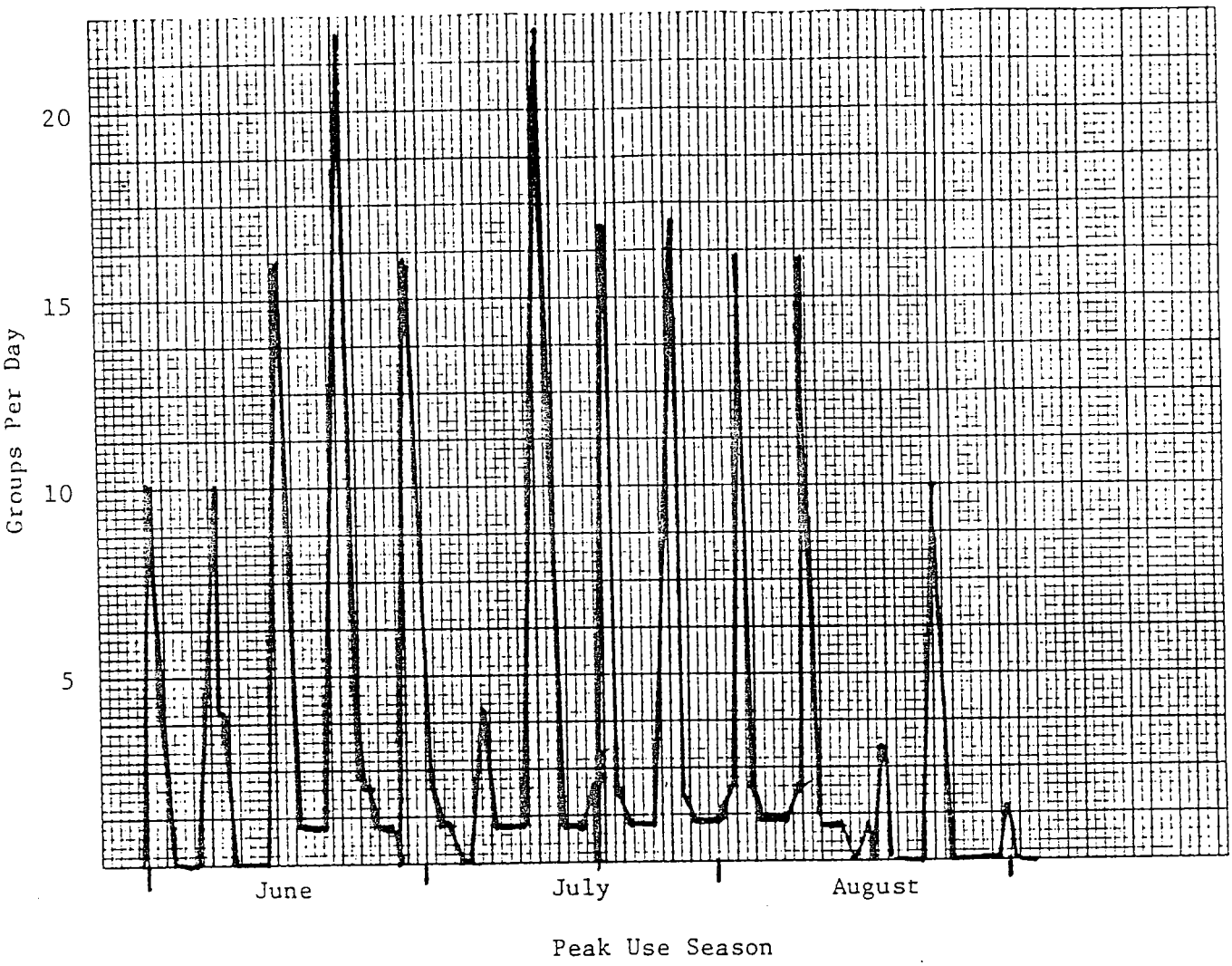

Figure 6: Estimated Commercial Use In The Peak Use Season, 1985 MF Season.

This is developed from the recorded use observed on the 27 survey days and extrapolated to the full peak use season based on assumptions of use patterns.

Total seasonal use on the MF was calculated in terms of users/-visitors, user/visitor days, and user/visitor day units. "Visitors" are considered those who use the river as clients of the commercial operators and the non-commercial users: these are the individuals who use the river resource for recreational purposes. "Users" are the visitors plus the employees of the commercial operators: these are all of the individuals on the river in association with recreational use.

"Visitor/user days" is a use parameter that considers the number of visitors/users in conjunction with the number of days spent (whole or in part) on the river on recreational trips; a 3-day trip would result in 3 visitor/user days per individual in the group. This is one of a number of "count" parameters normally used in recreation. Another is one that considers the recreation day as an 8 or 12 hour period and recreational activities are counted in incremental units of time; a full visitor/user day results when 8 or 12 hours are accumulated. We have used the former method because, for whitewater recreation, typically all activities undertaken during a normal day are associated, directly or indirectly, with the whitewater activity.

Another use parameter used here is the "visitor/user day unit" that considers the overnight camping element of the recreational activity; a 3-day trip would result in 5 visitor/user day units per individual in the group. This method of use counting integrates the time spent on the river camping along with the days, and accumulates in such a way as to weigh the recreational use on multi-day trips more heavily than one-day trips; while a 3-day trip would result in 5 user days units per individual, a three 1-day trips would result in 3 user day units per individual.

The use of the various use parameters results in the use levels shown in Table 13. There were an estimated 6614 commercial clients, 1248 commercial employees, and 201 non-commercial users on the MF in 1985. Commercial activity, while having 90% of the trips on the MF in 1985 had 97.5% of the users, 98% of the user days , and 98.4% of the user day units. The data shows an estimate of 12185 user days; the number of user days expended by all those associated with whitewater recreation, of which 1898 user days were derived from commercial company employees. There were also an estimated 4122 user/nights on the MF this season; 3439 by commercial clients (83%), 650 by commercial company employees (16%), and 33 by non-commercial users (>1%).

Table 14.

MF Summary of User Days, 1985 Season,

Use Characteristics		Visitors			Users		
Type	Trip Length	Visitors	Visitor Days	Visitor Day Units	Users	User Days	User Day Units
Comm.	1-day	3241	3241	3241	3852	3852	3852
	2-day	3307	6614	9921	3931	7862	11793
	3-day	66	198	330	79	237	395
Subtotal		6614	10053	13492	7862	11951	16040
N-Comm.	1-day	168	168	168	168	168	168
	2-day	33	66	99	33	66	99
	3-day	-	-	-	-	-	-
Subtotal		201	234	267	201	234	267
TOTAL		6815	10287	13759	8063	12185	16307

4: Non-Whitewater Recreational Use.

As used here, non-whitewater recreational users and activities refer to recreational gold mining, swimming, and other river oriented day uses as well as longer-term camping. Swimming and other river oriented day use activities occur at major access points during the MF peak use season from late spring to Labor Day. The primary areas of activity are the Ruck-A-Chucky take-out beach and the take-out beach at Oregon Bar. This day use has very low use levels, presumably due to poor access compared to other potential locations in the recreation area. There is extensive, non-river oriented, recreational day use of off-road vehicles in the Mammoth Bar area; this area appears to be the main use location for these users in the Auburn Project area.

Recreational gold mining is the major non-whitewater recreational activity occurring along the MF in the reach under consideration. The main areas of recreational mining activity are in the reach from RM 3.3 to RM 3.7 near the mouth of Volcano Creek, from RM 4.8 to RM 5.3 at Cash Bar, and from RM 14.4 to RM 15.1 in the Greenwood/Oregon Bar area. There is often long-term camping associated with the recreational mining.

Long-term recreational camping also occurs in some areas of the MF. In portions of the Oxbow put-in camping is occurring however due to a lack of facilities the levels of use are very low at this location. At Oregon Bar, at RM 15.1, there are several camping spots that are occupied through the summer season by recreational campers and recreational miners. Also there is summer season camping occurring on Cherokee Bar from RM 15.5 to RM 15.9 on river left and accessed from the south side of the river canyon.

C. Current Management:

1: Whitewater Recreation Management Authority.

The existing management and institutional arrangements on the MF are a result of the land ownership patterns and institutional agreements among the various agencies involved. The Oxbow put-in area is on Tahoe National Forest lands as is the put-in at the mouth of Volcano Creek (RM 3.4) but access to this second site is via a privately controlled road. The Ruck-A-Chucky take-out at Canyon Creek (RM 13.0) is on BLM lands and the Oregon Bar put-in/take-out area (RM 15.1) is on a mix of both USBR and BLM lands. Between the Oxbow and the Oregon Bar access point there are about 2.0 river frontage miles of USBR lands, 11.7 river frontage miles of BLM lands, 1.2 river frontage miles of Tahoe National Forest lands, 7.7 river frontage miles of Eldorado National Forest lands, 3.9 river frontage miles of private lands in Placer County, and 3.7 river frontage miles of private lands in El Dorado County.

On the lower portion of the MF, the Oregon Bar, Mammoth Bar, and the confluence access points are on USBR and BLM lands, and along the river there are 15.6 river frontage miles of USBR lands, 1.4 river frontage miles of BLM lands, 0.5 river frontage miles of private lands in Placer County, and 0.5 river frontage miles of private lands in El Dorado County.

On lands owned by USBR and on BLM lands within the Auburn Project area, State Parks has recreation management responsibility and law enforcement authority in accordance with the interagency agreements and State law as discussed earlier. In a 1983 letter Tahoe National Forest transferred whitewater recreation management authority of the put-in area at Oxbow to State Parks because this area and a very short reach of the MF is outside of the Auburn Project boundary. This transfer was designed to eliminate the need for two permits and the letter contained specific stipulations that State Parks was to require of commercial operators on this portion of Tahoe National Forest lands. On the remaining 8.9 river frontage miles of National Forest lands the Tahoe (1.2 miles) and the Eldorado (7.7 miles) National Forests retain land management authority pending the construction of the Auburn Project. The Volcano Creek put-in is on Tahoe National Forest lands but is controlled by access via a private road and is accessible to commercial raft operators through a road lease arrangement. The commercial operators who use this site are subject to the whitewater permit process of State Parks. On the Eldorado National Forest lands on the south side of the river, the Forest issues camping permits to commercial operators for overnight use. About 3.9 river frontage miles of private lands on the north side of the river are subject to the ordinances of Placer County, and 3.7 river frontage miles on the south side are

subject to the ordinances of El Dorado County. The rest of the frontage miles and the access points are either on USBR and BLM lands and are subject to State Parks management.

The recreational dredge gold mining activities in the MF require a permit from the State Dept. of Fish and Game and that agency is responsible for the enforcement of the mining activities associated with the permit.

2: 1985 Whitewater Recreation Management:

The whitewater recreation management on the MF involves: 1) the transfer of management responsibility at the Oxbow put-in from Tahoe National Forest to State Parks, 2) the issuance of camping permits to commercial operators for the use of Eldorado National Forest lands, and 3) the issuance of use permits to commercial operators by State Parks.

The transfer of whitewater recreation management responsibility from Tahoe National Forest to State Parks in the Oxbow area carried the requirement that the State Park permit to commercial operators include a requirement for the operation and maintenance of temporary toilets. Although the management authority at the Oxbow put-in was transferred to State Parks in a 1983 letter, State Parks felt that the formality of this letter was not sufficient to officially make the transfer final. In addition there has not been sufficient funds to allow for a management presence at the Oxbow put-in which is many miles from the normal area of coverage for State Park personnel. In 1985 there was no effective management at the Oxbow put-in area.

Overnight use of Eldorado National Forest lands requires that commercial operators have a special use permit for the commercial use of Forest lands. The permit, among other things, 1) designated campsite locations based on a field survey and specifically excluded camping on 1.1 miles of river frontage in the Cash Bar area, 2) required the use of firepans for open fires, and 3) required the export all refuse materials. Campsites were not assigned to specific commercial operators nor were the operators required to report either the amount of camping use in the season or the location of the use. Without these data, fees for the overnight commercial use of Forest lands were based on a flat amount for the special use permit.

The 1985 State Parks commercial whitewater permit was the main management tool on the MF. Non-commercial users were not addressed because of the difficulty of limiting the numbers and controlling the behavior patterns of these users.

The management approach recognized that daily use levels in the peak season were resulting in the loss of recreational resource

values to the users due to crowding and congestion. The level of on-river conflict was assumed to be related to the number of commercial trips on the river a day and the concentration of commercial trip start times at the Oxbow put-in which translated congestion downstream. The permit issued to commercial operators on the MF ;

- Was in effect from May 4, 1985 to Sept. 15, 1985, the assumed peak use season.

- Assigned start times to operators on the basis of 2 starts for each half hour period from 9:00 am through 1:00 pm on Saturdays , Sundays, and Holidays.

- Established a daily start limit of 14 trips.

- Directed operators to coordinate use and schedules to conform to the daily group number limit.

- Limited trip sizes to 5 rafts.

- Limited camping on USBR and BLM lands to the Cherokee Bar area (RM 16) unless specific arrangements are made with private land owners or a special use permit is obtained from the US Forest Service.

- Required camping activities to include the proper food preparation, the use of portable toilet facilities, the removal and proper disposition of all solid waste from the canyon, and the use of a portable camp stove, fire pan or fire ring.

- Prohibited commercial dunnage rafts from the Ruck-A-Chucky portage.

- Allowed for the presence of commercial vehicles at the beach and lower parking areas of the Ruck-A-Chucky take-out only during the staging and packing of the trip.

- Directed the commercial use of the Drivers Flat Road to Ruck-A-Chucky rather than the McKeon-Ponderosa Road.

D. Use and Management Problems:

The main use problems on the MF are associated with congestion at specific locations on the river which result from the concentration of use into weekend days and into narrow hour ranges of the day. The areas of congestion include: 1) the traffic and parking problems in the community of Foresthill, 2) put-in, take-out, and other on-river congestion points, and 3) campsites. These congestion problems are a function of facility and physical capacities and the use patterns. There is also a sanitary health problem at the put-in associated with the seasonal use levels. These congestion and related problems translate into: 1) on-river crowding in a wilderness/primitive river setting which degrades the experiential values to users, 2) use conflicts between commercial operations, 3) conflicts between on-river recreational users and the residents of Foresthill, and 4) reduced environmental quality of the trip which reduces the experiential values to the users.

1: Facility, Physical, and Social Capacities.

On many of the weekend days, use levels are so high and so concentrated in time that congestion created at access points and at on-river locations causes time delays, alterations of itinerary, and shifts in use patterns. Because of the rate at which groups arrive and depart the put-in, more or less constant contact and adjustments of behavior occurs through the first portion of the run; from put-in through the Tunnel Chute (RM 1.5). The general lack of technical rapids and potential bottlenecks after the Tunnel Chute tends to spread out the use pattern. The distribution of lunch sites, stops of interest, and camping sites in the middle portion of the run also tends to spread out the groups so that there are only rare occurrences of on-river congestion provided that adequate flows are present.

Although there appears to be abundant campsites on the MF, the concentration of campsites between RM 7 and RM 11 and the low number of medium and high quality sites with capacities great enough to accommodate typical overnight commercial trips combined to generate a certain amount of competition among the operators for sites on a daily basis and the tendency for operators to leave camp equipment in sites - in a sense reserving and permanently occupying the sites. This resulted in a reduction in the possible campsites for those operators who did not leave equipment in camps.

The release pattern of the Oxbow Powerhouse is typically such that boatable flows reach the Ruck-A-Chucky area (RM 13.0) around 2:00 pm and the overnight trips tend to arrive from that time on. They either take-out there or portage Ruck-A-Chucky and take-out further downstream. The one-day trips tend to arrive

slightly later in the day. The flow and general trip patterns are such that both groups tend to arrive in the area in very narrow time limits and congestion can develop at both the portage and the take-out areas. Waiting times for groups to start the portage can be up to 3 hours which can result in conflict between commercial groups as they compete to get to the portage time delays can be great enough that some groups change itinerary and use the Ruck-A-Chucky take-out rather than waiting to portage.

Those groups that portage Ruck-A-Chucky take-out at either the Greenwood Bridge site (RM 14.9), Oregon Bar (RM 15.1), or Mammoth Bar (RM 21.8). Because of use patterns and the tendency of the portage to spread out use downstream, there was rarely congestion at these site. However because of limited space at the Greenwood Bridge site traffic on the roadway was often impeded during staging.

The 1985 State Park commercial permit had several elements that were intended to decrease congestion and to increase the daily capacity of various sites and facilities by directing certain aspects of commercial use patterns. The use pattern directives that were designed to reduce conflicts include; 1) a designated operator trip start time, and 2) parking restrictions at the Ruck-A-Chucky take-out area. Without consistent on-river management presence, State Parks relied on the commercial operators to voluntarily assume these use patterns.

Observations of use patterns at several of the points of congestion through the use season conclude that the commercial operators did not voluntarily conform to the suggested patterns in the permit. Apparently the operators did not coordinate trip scheduling as the limit of 14 trip start a day was regularly exceeded with a season average of greater than 15 commercial starts on Saturdays and as many as 22 in one day. About 35% of the trips had more rafts than the 5 raft limit. Several of the operators on the river held two permits under the names of two companies and often operators would run two groups simultaneously. Typically these trips have the same itinerary and would operate as a single group with up to 10 rafts and 80 users. Put-in use patterns were also much different than the permit directs. Commercial trip starts were concentrated in the hour 10:30 to 11:30 am. with 51% of all the departures through the season; in this hour the trip starts had an average separation of 6 minutes. On a typical Saturday morning there are usually 10 to 14 commercial trip starts in this hour.

2: Commercial/Non-Commercial Use Conflicts.

Because non-commercial use on the MF is low (approximately 10% of the trips and 2% of the users) conflict between commercial and non-commercial users is minimal. However, due to the high

commercial use levels, non-commercial users are severely affected by the use levels and use patterns. They typically modify their put-in patterns to either depart before or after the main commercial departures. They are also more sensitive to the congestion and crowding at the Tunnel Chute than are commercial users as they are usually one small non-commercial group among many larger commercial groups. There are few conflicts on other portions of the river unless they elect to undertake the portage with other commercial operations. There appears to be abundant smaller capacity campsites on the river so that conflicts with camping are very limited.

Our observations on the MF indicate that the recreational resource base of the MF is not conducive to non-commercial use and that any conflicts between commercial and non-commercial use should not be considered as significant.

3: Whitewater/Other Recreational Use Conflicts.

Other recreational activities on the MF occur at restricted locations and in low levels; there appears to be little conflict between these groups. There is some recreational mining and camping in the reach from RM 3.3 to RM 3.7 near the mouth of Volcano Creek, from RM 4.8 to RM 5.3 at Cash Bar, and from RM 14.4 to RM 15.1 in the Greenwood/Oregon Bar area. These activities were not observed to cause any unexpected problems of use or resource values to either group. There is also some limited day activity at the Ruck-A-Chucky take-out beach and the Oregon Bar take-out beach but use has been so low compared to the resource base that problems were not observed.

4: Whitewater/Foresthill Conflicts.

Most of the commercial operators met their clients in the community of Foresthill. This lead to situations where there was significant congestion along the highway on Saturday mornings from about 7 to 10 am. Between congestion created by general traffic, very dense parking patterns, random and often illegal parking, and pedestrians wandering across the highway the local population often felt severely impacted by the commercial whitewater operations despite the increased sales and profits by local business. Several of the companies operate such that camping facilities are needed in the Foresthill area. There have been issues raised over the lack of adequate parking, camping and other facilities used by the whitewater users.

5: Safety/Search and Rescue.

Whitewater recreational activities on the MF have resulted in instances where rafts have flipped, become lodged on mid-channel rocks, filled with water and wrapped around mid-channel rocks, and where users have been disassociated from rafts in any number of alternative ways. Sometimes these occurrences result in damaged or lost equipment and in minor injuries to users such as cuts or bruises. For the most part adequately equipped and experienced user groups quickly rectify these problems through self or group supported rescue and in more difficult situations other user groups typically assist. By enlarge, these problems and solutions are considered as quit normal on whitewater resources and expected on whitewater trips. At the Tunnel Chute, however, more serious injuries and equipment damage have occurred.

On the MF safety problems are typically a result of congestion at the put-in, runs through the Tunnel Chute, runs through Chunder Rapid on the approach to Ruck-A-Chucky, and the Ruck-A-Chucky portage. Injuries have occurred at the put-in when crowded on-river conditions resulted in rafts being tied to marginal and insecure anchors which have broken free under the pressure of the swift water and impact from other departing rafts. There have been several reported injuries and severely damaged rafts resulting from runs through the Tunnel Chute. These injuries have been varied and mostly minor but some have been deep cuts, broken bones, and trauma associated with impact on the rocks of the chute after a raft flip or being washed out of the raft. The more serious of these injuries have required emergency evacuation to hospitals by vehicle or helicopter. Most commercial trip vehicles stay at an overlooking turnout on Mosquito Ridge Road until their group has completed the Tunnel Chute and reported successful runs to the shuttle driver by radio. In the effort to start the portage of Ruck-A-Chucky as early as possible some commercial operations run Chunder Rapid, immediately upstream, at marginal low flows and several injuries have occurred as clients were thrown from rafts when the rafts hit exposed rocks. On the Ruck-A-Chucky portage there have been a few injuries associated with walking on the rocks and handling the rafts. Injuries that occur on the banks and shore as users are simply walking about are typically the most common on whitewater river trips.

The vast majority of these injury and equipment damage situations have been adequately dealt with by the on-river users at the scene. However, over the past several years there have been several instances where the help of local emergency response organizations were required. The most common situation appears to be at the Tunnel Chute on the MF where some injuries have required emergency evacuations. There have been some injuries at Chunder Rapid on the MF that were responded to, however, with the

road access and the number of raft operations usually found at this location, it is questionable as to how frequently emergency help will be required.

E. Management Objectives:

The recreational resource characteristics of the MF are such that it is an important whitewater resource in the region. Three factors combine make the MF significant: 1) reliable summer season boatable flows, 2) an isolated environment with high visual quality, and 3) a reach length that offers 1-day to 3-day trip options. Only three whitewater resources in the region have reliable summer season flows; the Tuolumne, the South Fork American, and the Middle Fork American. The Tuolumne is managed as a very "Low Contact"/wilderness/primitive experience by the National Forest with only two commercial starts a day and a total daily limit of 140 users; it is a National Wild and Scenic River and has very high visual, amenity, and "whitewater" resource values; it is an 18 mile run and offers 1-3 day trip options. The South Fork American is managed as a very "High Contact"/rural experience by El Dorado County with a daily limit of 4440 commercial users on weekends; it has good visual, amenity, and "whitewater" resource values; it is a 20 mile resource and offers 1 and 2 day trip options.

The MF in contrast, has high visual and amenity values and moderate to low "whitewater" resource values. Under present conditions, use levels are such that "Low Contact", "Moderate Contact", and "High Contact"/wilderness/primitive experiences occur. Therefore, with the exception of "whitewater" resource values, the MF has resources intermediate between the Tuolumne and South Fork American. For commercial operations the MF is a very valuable summer resource that offers 1-3 day trips in a high quality setting. Although lacking significant "whitewater" resource values, the MF offers important options to the South Fork American crowded conditions as well as to the very high value, but very limited use opportunities, of the Tuolumne.

Some of the characteristics that make the MF a very valuable commercial recreational resource serve to reduce potential resource values to non-commercial users. While the isolated, high visual and amenity aspects of the MF are highly regarded resource values by non-commercial users, the lack of significant "whitewater" resources and difficult logistics of the MF combine to make this resource one that will probably never be significant for non-commercial use. The 13 mile run to the Ruck-A-Chucky take-out is a long day, particularly when only the first 4 miles have Class III/IV rapids with the normally higher velocities. From RM 4.1 to 13.0 the rapids are Class II riffles and wide shallow channel reaches and velocities are generally lower than typical for whitewater rivers. The Tunnel Chute makes the MF a difficult multi-day river trip in that the dunnage/oar rafts have to be either run through the chute or they must be portaged. A run through the chute is not preferred because this is hard on equipment and because the non-commercial trips are smaller and have less support than commercial trips. The Tunnel Chute

portage is also more difficult for non-commercial trips because they usually have more gear per user and makes the carry more time and energy consuming. The portage at Ruck-A-Chucky is also more difficult for non-commercial multi-day trips in that they must typically deal with oar rafts and dunnage. The difficulties that non-commercial users encounter on the MF are typically greater than the resource values realized.

Given the expected increases in regional demand for general whitewater recreational resources and the resource characteristics of the MF, it appears that the MF should be managed as an important commercial recreational resource that should offer "Moderate Contact", isolated, and high amenity values.

Issues of resource characteristics and values, user group characteristics and use patterns, and future demand, as presented above, and the management options available to State Parks leads to the following management objectives:

1) The resource should be managed to maintain its wilderness/primitive character, to the degree possible, by maintaining a "Moderate Contact" recreational resource opportunity.

2) Commercial use should be the whitewater recreational focus of the MF and the levels of commercial use should be managed such that a "Moderate Contact" recreational resource opportunity is maintained.

3) The management plan should rely on the natural use patterns of the commercial operators and employ use level management rather than use pattern or behavior management to meet contact level objectives; it should be as self-enforcing as possible.

4) Whitewater/non-whitewater recreational conflicts should be reduced where possible by altering facility capacities and whitewater use patterns.

5) State Parks should consolidate management authority to include the area of the Oxbow put-in and deal with the human waste problems of this location.

6) Off-site problems generated in Foresthill resulting from the issuance of whitewater permits should be approached from the perspective of reduced daily use limits.

To develop a management plan that addresses these objectives the analysis should:

1) Use the capacity of access points, on-river constriction points, and campsites to establish the appropriate use level that maintain "Moderate Contact" levels.

2) Use the existing use patterns of the commercial groups as the basis for capacity evaluations.

F. Capacity Evaluation:

The various access/put-in/take-out points and areas of on-river congestion were evaluated for physical capacity based on the use patterns of whitewater groups in the 1985 season. The capacity criteria used are related to the degree of accommodation and delay experienced by user groups as a result of general use levels and characteristic use patterns. Capacity threshold categories used are "Low Contact", "Moderate Contact", and "High Contact" as defined in Chapter II.

1: Oxbow Put-In.

a) Observations: The MF put-in consists of an eddy and channel section in the immediate tailwater of the Oxbow Powerhouse. The eddy is used to hold rafts before trip departure as are several small locations downstream about 150 ft along the RL side. Above the pool/eddy is the very large parking/staging area. A steep slope leads from the staging area to the water. Along the RL, the bank is composed of a gravel bar of large sized material, and is accessible by a rough gravel road from the main staging/parking area.

Behavior patterns at the put-in were such that it quickly became an area with high levels of congestion and conflict between groups. The main problems associated with congestion are a result of both use levels and use patterns.

Through the 1985 season the average commercial trip size was 3.7 rafts and an average Saturday consisted of about 15 trip starts with 70 rafts, 390 clients, and a total of 460 users. Typically 75% of these are multi-day trips but there was a trend from nearly exclusive one-day trips early in the season to mostly multi-day trips later in the season. These use levels combined with behavior patterns caused consistent congestion problems throughout the season. Sunday use levels were substantially less averaging 6 trips, 22 rafts, 123 clients, and 145 users. Mid-week day only had an average of 1 commercial trip start per day.

Behavior patterns are centered around the commercial operator's process of meeting clients off-site and their transportation to the put-in, and the limited space available in the water for the rafts of the groups.

Actual space on the water is limited while parking/staging space is very large. Because of the limited on-water area guides stage as early as possible to make sure that they have their rafts in the water when their group was ready to depart. Groups that arrive later and have the rafts staged after the water is full must stack rafts on the shore and eventually in the parking/staging area waiting for space on the water. In an attempt to insure

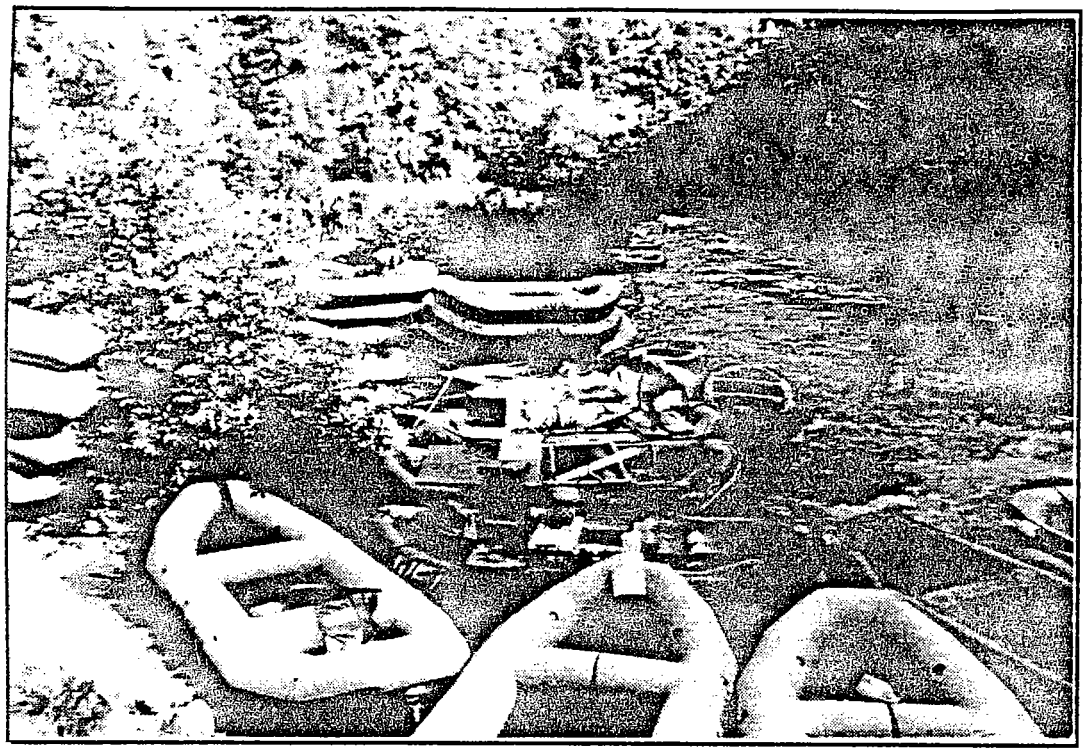

PLATE IV: Oxbow Put-In on the MF.

This picture shows the level of congestion typical on Saturday mornings in the peak use season and the user response of stacking rafts on the shore waiting to get into the water.

water space for rafts, guides, with equipment, either camp at the put-in the night before the trip (37%), or arrive early the next morning. They inflate rafts and begin to put them in the water or to stack them on the shore depending on space availability. As more groups arrive, they are forced to stack boats in various available locations, and often the stacked rafts create considerable congestion on the shore.

By about 10:00 am 86% of all the departing groups have the rafts ready and in or near the water. Typically the commercial clients are met off-site (typically in Foresthill) and after time for general preparation and breakfast etc. they are driven to the put-in. They arrive by bus between 8:30 and 11:30 and after safety talks and personal equipment checks they were ready to depart. Departure was an average of 40 minutes after the clients arrived but ranged to 1.5 hours. Most of the clients (60%) arrived between 9:30 and 10:30 and this patterns caused short periods of very congested conditions. After the rafts were ready there was an average of a 1:30 waiting period to the actual departure. Some groups spent most of this time in the water causing congestion for subsequent groups while other groups put rafts in the water, filled them with clients, and departed within minutes.

Another staging procedure is for a group to arrive with gear, guides, and clients at the same time in the same vehicles. The clients are met off-site by the guides with the gear and after arriving at the put-in they generally help with the staging of the rafts. This operation generally only requires 30 minutes from arrival to departure by sliding the rafts one at a time into the crowded eddy and departing. About 20% of the trips used this staging process.

These put-in operations result in short periods of very intense activity and congestion with nearly all groups of the day in an around the staging and put-in eddy at once. They also result in very condensed departure intervals with 90% of all the commercial groups departing between 9:30 and 12:30, but 51% departing between 10:30 and 11:30 with a season long departure interval in this hour of 6 minutes.

These use patterns condense large amounts of rafts and users into a small time frame and cause conflicts among commercial groups and between commercial operations and non-commercial groups. Conflicts between commercial groups is a direct result of limited water space and high use levels. As many as 23 groups have occupied the put-in area at once, some of which have had up to 10 rafts. When an arriving commercial group cannot find water space to rig the gear raft because the water is full of ideal rafts and some groups have many more than 5 rafts in the water, tension can result. This is particularly true when the excluded group has clients ready to depart.

Conflict between commercial and non-commercial groups occurs because of the same congestion issues, however, non-commercial trips are only about 10% of the total. While between the number of commercial groups and their typical sizes can create the environment for highly congested conditions for the smaller non-commercial groups, they tend to avoid it by either starting earlier or later than the main pattern of the commercial operations. This amount of accommodation by the non-commercial groups seemed to resolve the issues.

Most mornings the release of water at the Oxbow Powerhouse was at boatable levels at the time staging was underway and typically the timing of the release was not a factor. However if the release of boatable flows should start later than about 9:30 it becomes a major factor in increased congestion at the put-in and would also serve to further concentrate the departures and translate congestion downstream.

b) Instantaneous Capacity: The instantaneous capacity of the put-in area is primarily a result of the area available for rafts in the main put-in eddy, in secondary areas, and along the shoreline rather than parking or staging area factors.

"Low Contact" instantaneous capacity is about 20 rafts or 4 groups at once. At this, or lesser levels of use, all rafts and groups can occupy the main pool and groups can be fairly separated and little accommodation is necessary; the carrying of equipment and loading of rafts would not be impeded.

"Moderate Contact" instantaneous capacity is 30 rafts or 6 groups. Up to this level of use, all rafts and groups can be accommodated in the main pool and other reasonably adequate put-in locations along the left shore. While all rafts and groups are in the water, essentially all the usable water surface is occupied and there is little separation between groups. Any additional rafts above this level are usually left on shore until space is created by a group departure. At these levels of use groups experience levels of accommodation usually associated with put-ins.

"High Contact" instantaneous capacity is considered to be about 95 rafts and 19 groups. As use levels increase above the "Moderate Contact" levels, rafts are stacked along the shore and in the staging areas waiting for space in the water to develop with group departures. Since the area available for staging and stacking rafts is essentially unlimited, the "High Contact" capacity is calculated by assuming a constant capacity of 6 groups in the water and a turn over rate of 1.5 hrs./group over an eight hour period. As the "High Contact" capacity level is approached, rafts are stacked along most of the shoreline where

conditions permit waiting to get into the water, and in the staging area waiting to get to the shoreline. Under "High Contact" conditions crowding is a major element of the put-in experience for guides and clients alike.

c) Daily Capacity: To convert the instantaneous capacities to daily capacities, the typical put-in patterns and times observed in the 1985 season were applied. The instantaneous capacity for the put-in was converted to hourly capacity by assuming an average of 90 minutes spent in the water before departure. This hourly capacity was used to determine daily capacity based on the time of day occupation of the put-in in the 1985 season. The calculated daily capacities are very close to the instantaneous capacity because behavior patterns are such that extreme concentrations of groups at the put-in occur: Often all groups of the day will be at the put-in at once.

"Low Contact" daily capacity is 5 groups. An instantaneous capacity of 4 groups and 20 rafts, an average of 1.5 hours in the water results in a daily capacity of 5 groups or 25 rafts when the daily distribution of use is applied. At this level there is adequate room in the water to hold the rafts and ample room in the parking/staging area. No congestion occurs on the shoreline.

"Moderate Contact" daily capacity is 7 groups. An instantaneous capacity of 6 groups and 30 rafts, an average of 1.5 hours in the water results in a daily capacity of 7 groups and 35 rafts when the daily distribution of use is applied. At this level of use the water area of the put-in is full for about 1.5 hours when additional groups would have to stack rafts and wait for access to the water.

"High Contact" daily capacity is 32 groups. This is a bit artificial in that it assumes very high "High Contact" instantaneous capacity through the full put-in activity period. Levels of use in the "High Contact" capacity category result in various levels of waiting and congestion in the water, along the shoreline, and in the parking/staging area.

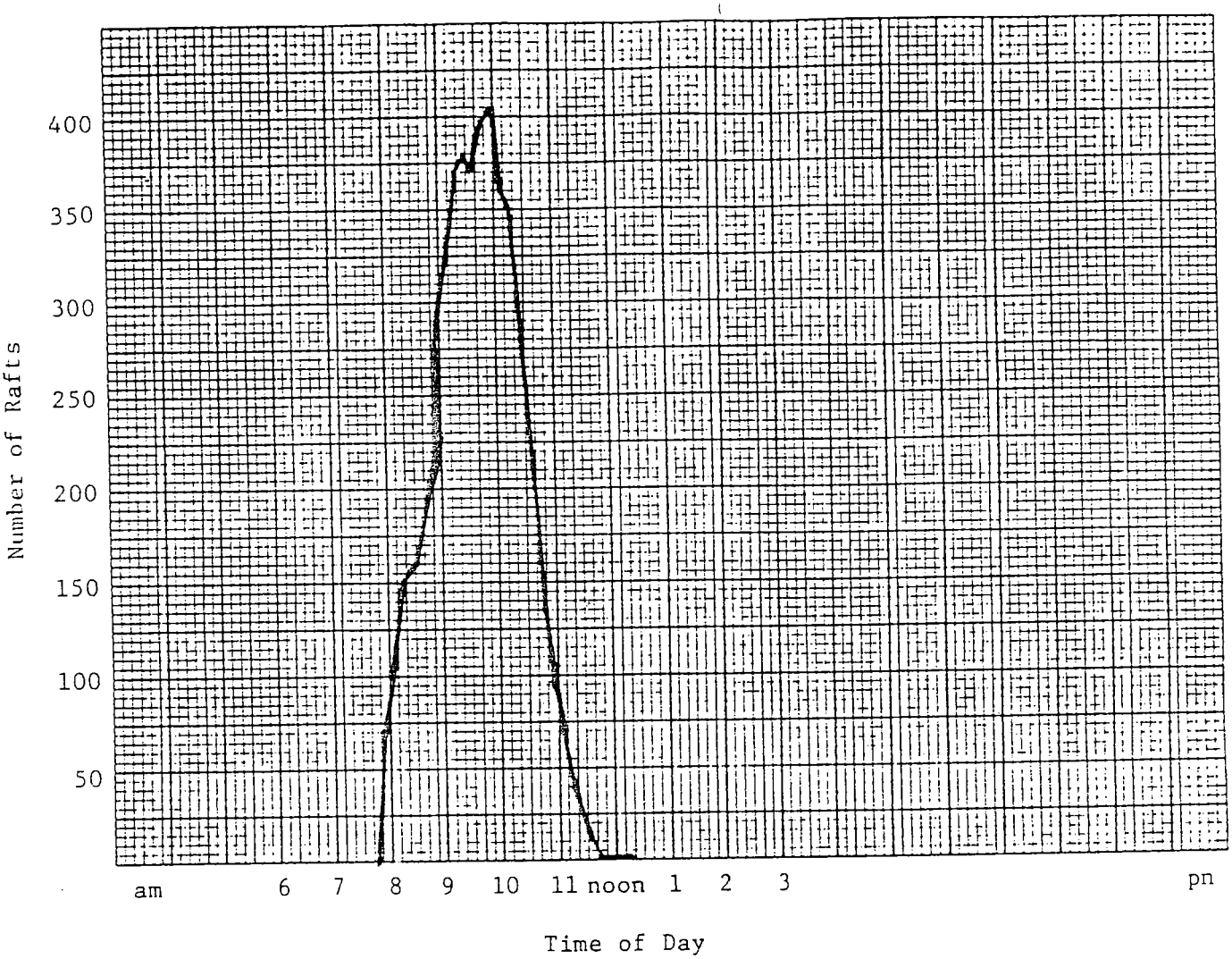

Figure 7: Cumulative Commercial Time of Occupation At the Oxbow Put-In, 1985 MF Season.

This is developed by accumulating the recorded times of arrival of guides/equipment and the initiation staging and group departure at the main put-in on the 27 survey days.

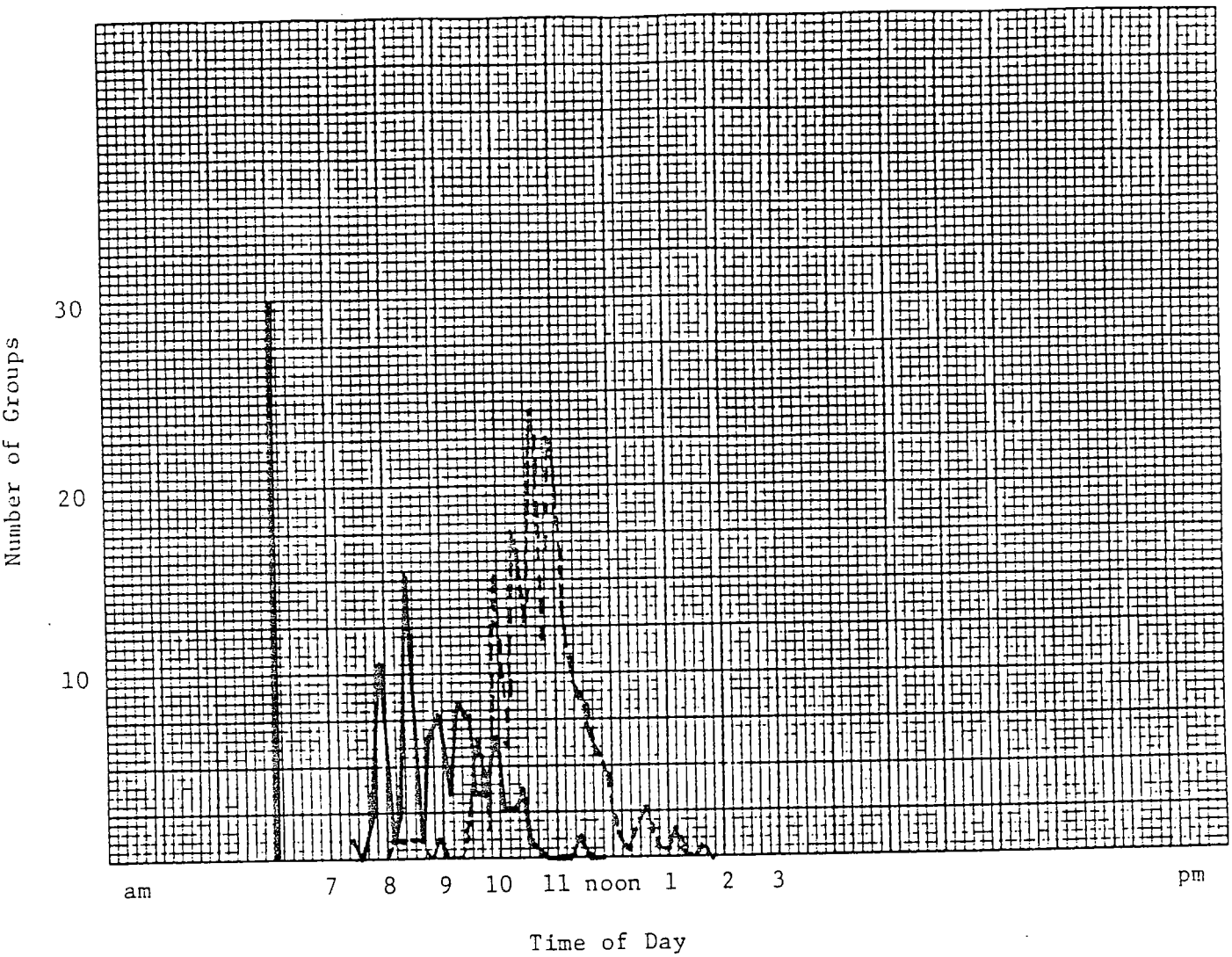

Figure 8: Time of Commercial Group Arrival and Departure at the Oxbow Put-In, 1985 MF Season.

This is a recording of the arrivals of commercial equipment/guides and departures of commercial groups on the 27 survey days. The vertical bar at the left indicates that 30 trips had gear/guides arrive the night before the trip start.

2: Tunnel Chute Bottleneck.

a) Observations: Typically groups began arriving at the Tunnel Chute at about 10:45 and continued at an interval rate of about 10 minutes per group through about 12:45 pm. The peak arrival time was between 11:15 and 12:30 pm.

Approximately 90% of the commercial groups and all of the non-commercial groups stopped to both scout and to observe other rafts run the chute. The groups stopped in the fairly large and quiet eddy on the RL above the entrance to the Chute and immediately below a strong Class III rapid. During the peak activity hour a raft was running the Chute on the average of every 4.3 minutes while rafts were arriving in the area every 2.8 minutes. This created a continually increasing number of groups and rafts in this eddy during the peak use period.

A typical group was at the Tunnel Chute for about 45 minutes. This amount of time stayed very consistent and did not increase with congestion nor decline when there were only a few other users present. The time spent at the Tunnel Chute appears to be related to preference for watching other rafts rather than waiting for an opportunity to run.

About 25% of the commercial groups and 50% of the non-commercial groups portaged the Chute on RL. The process took about 20 minutes per raft and was usually a casual process which included stopping to watch other rafts as they ran. Because of the relatively small number of groups that portaged, there were only minor occurrences of congestion with short waits. In the future, if portaging becomes more common this could be a serious congestion problem considering that peak raft arrival rate is 2.8 minute intervals and a portage requires about 20 minutes.

On a typical Saturday there were as many as 8 groups in the eddy at once. This could result in about 33 rafts in the eddy and about 215 users in and around the Chute. Congestion associated with this use level occurred mainly in the eddy as rafts could be tied to shore 3 deep from the bank and there was a constant process of jockeying arriving and departing rafts, constant crawling over rafts by users and conflicts between arriving and departing rafts at the eddy fence. This last issue is potentially very important as conflicts at this point can result in arriving rafts being forced to run the Chute without scouting.

b) Instantaneous Capacity: The instantaneous capacity of Tunnel Chute is a function of the upper eddy and the congestion generated by the rafts.

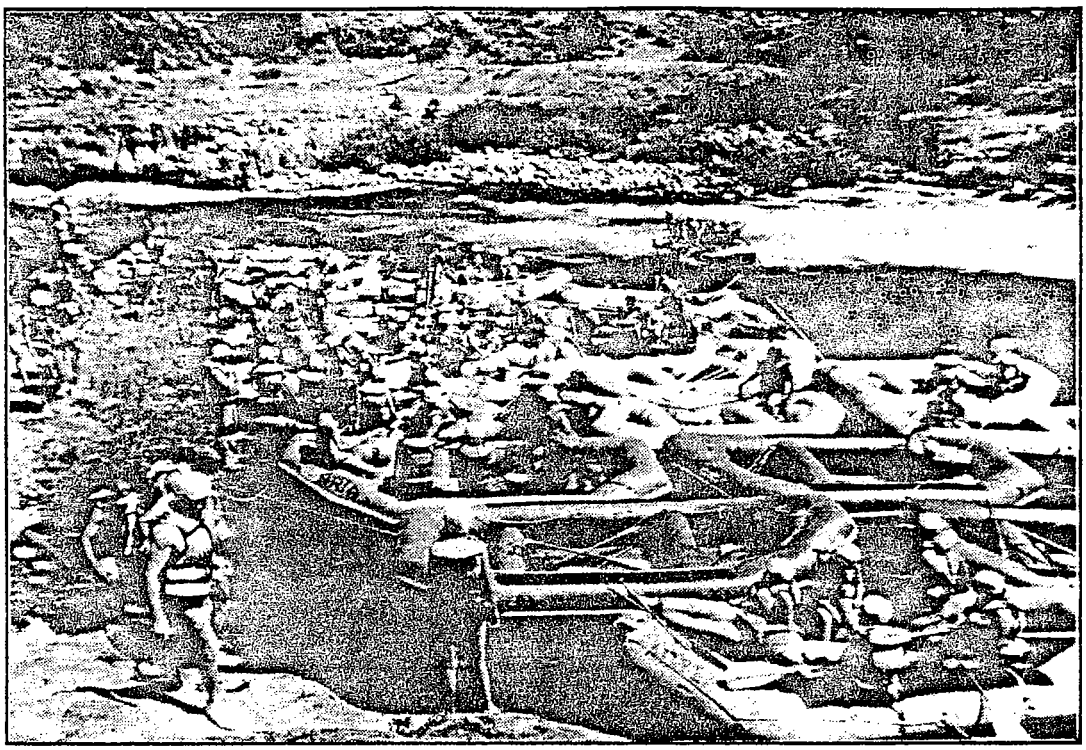

PLATE V: The Scout Eddy at the Tunnel Chute.

This picture shows the congestion at the shore and the limited space available. A raft is shown crossing the eddy fence from the runout of the upstream rapid (PLATE II) into the scout eddy before the entry into the Tunnel Chute shown on the extreme left.

"Low Contact" instantaneous capacity is 12 rafts or 2 to 3 groups. At this level rafts can arrive, tie up to the shore, scout, and depart without undue congestion, accommodation to other groups, or delay. This level of use results in about 72 users in the Tunnel Chute area.

"Moderate Contact" instantaneous capacity is 25 rafts or 5 groups. Through this contact level, altered user patterns and accommodation is required, double parking is required because of limited shoreline space and users have to walk over other rafts to get to shore, and constant reshuffling of rafts at the shore in required. This level of use results in about 140 users in the Tunnel Chute area.

"High Contact" instantaneous capacity is 35 rafts or 7 groups. Through this contact level, while some rafts are floating in the eddy preparing to run the Tunnel Chute, most are tied to shore three deep resulting in the constant climbing of users over numerous rafts and the constant and difficult reshuffling of tied rafts as a group elects to depart. This congestion causes conflict as rafts leaving the eddy for the Tunnel Chute interfere with rafts trying to get to the eddy. This level of use results in about 210 users in the Tunnel Chute area.

c) Daily Capacity: To convert instantaneous capacities to daily capacities for each contact level, instantaneous capacity was converted to peak hourly capacity based on the average of 45 minutes per group spent at the Tunnel Chute entry area. The daily capacity was calculated by considering the hourly distribution of use of this area through the season.

"Low Contact" daily capacity is 54 rafts or 11 groups. An instantaneous capacity of 12 rafts and an average transit of 45 minutes results in a peak hourly capacity of 16 rafts and based on the daily distribution, a daily capacity of 54 rafts.

"Moderate Contact" daily capacity is 111 rafts or 22 groups. An instantaneous capacity of 25 rafts and an average transit of 45 minutes results in a peak hourly capacity of 33 rafts, and based on the daily distribution, a daily capacity of 111 rafts.

"High Contact" daily capacity is 158 rafts or 32 groups. An instantaneous capacity of 35 rafts and an average transit of 45 minutes results in a peak hourly capacity of 47 rafts, and based on the daily distribution, a daily capacity of 158 rafts.

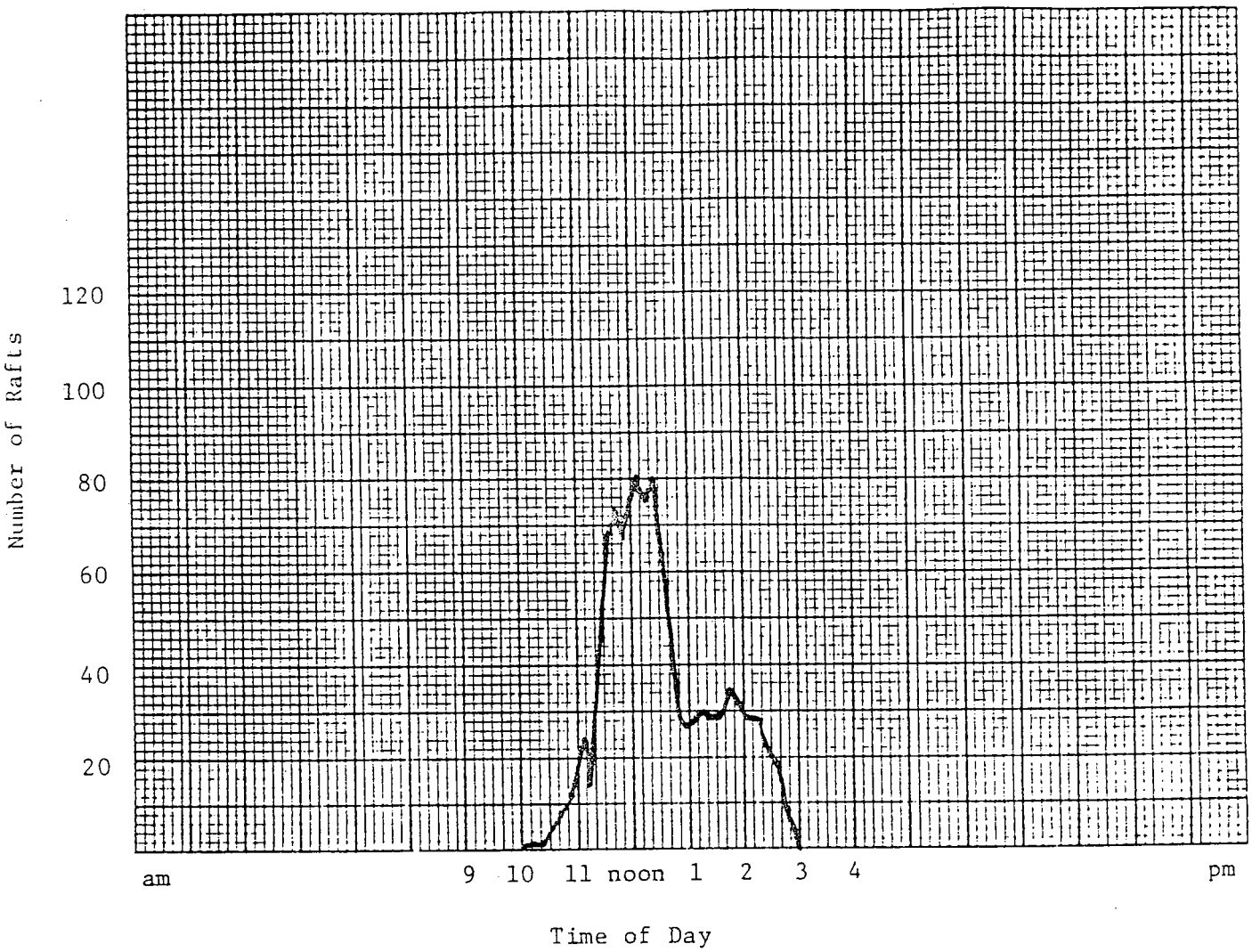

Figure 9: Cumulative Time of Occupation of the Tunnel Chute Area, 1985 MF Season.

This is developed by accumulating the recorded times of group (and converted to raft numbers) arrivals and departures at the Tunnel Chute entry eddy over the 27 survey days.

3: Camping.

a) Observations: There are many potential camps on the Oxbow to Ruck-A-Chucky segment of the MF and there is substantial overnight use. About 20 to 30 of the commercial operators run overnight trips on the MF with 20 operators using it regularly. A September campsite survey was conducted in which every campsite discovered was inventoried for capacity and quality at varying assumed contact levels. Campsite locations on the MF are mostly elevated bars along the channel margins and on lower more active gravel bars. There are 9 camps above Kanaka Gulch Rapid that are on private lands and Tahoe and Eldorado National Forest lands but these are too close to the put-in to be used for camping; they often are used for lunch stops. Campsites 6 through 9 are most often occupied by recreational miners during the summer season.

From RM 4.3 to 5.4 on the RL, or south side, Eldorado National Forest has restricted commercial camping because of the recreational gold mining and related camping activity around Cash Bar. Because of the level of impact to camps in this area and their generally poor quality, what sites were found were not surveyed. They would be suited for off-season use only.

Campsites 10 and 11 are the furthest upstream used with any regularity. By far the greatest concentration of campsites is between RM 7.0 and 10.9 with a total of 22 sites. The greatest concentration of use of sites is in the Fords Bar area where between RM 10.0 and 10.9 there are 9 sites, 6 or 7 of which are on the RR, or north side and are accessible by 4-wheel vehicle. On a typical Saturday night there are as many as 7 of the 9 sites occupied in this 0.9 mile reach. A local resident contracts with commercial operators to haul overnight gear and dunnage to the RR sites on BLM lands at Fords Bar which relieves these companies of having to have a dunnage/oar raft for support. Often the operators use a fifth paddle raft to fill the five raft limit which generally increases the number of users on these trips to 35 or 40. When operators use a dunnage/oar raft to support overnight trips there can be about 29 to 33 users per trip.

Group size and raft operations are fairly important when the estimates of camping capacity are calculated. If overnight trips are composed of 4 paddle rafts and a dunnage/oar support raft there may be 24 clients and 5 guides in the group. If overnight trips are composed of 5 paddle rafts there may be 30 clients and 5 guides in the group. Of the overnight trips in the 1985 season 28% had less that 20 users, 42% had from 20 to 29 users, and 30% had more than 30 users. The groups in the less than 20 size category typically had between 12 and 18 users, while those in the greater than 30 size category typically had 35 to 40 users with several trips between 45 and 49. These larger trips used up to 8 paddle rafts.

Table 15.

MF Campsite Inventory.

Site/ Location	Land Own.	Low Contact			Moderate Contact			High Contact		
		Grp#	Usr#	Qual	Grp#	Usr#	Qual	Grp#	Usr#	Qual
1/ 2.3R	Pvt.	1	15	H	1	20	M	2	70	L
2/ 2.4R	Pvt.	1	8	H	1	12	M	2	30	L
3/ 2.5R	Pvt.	1	10	L	1	15	L	2	25	L
4/ 2.8L	Pvt.	2	40	H	2	50	M	3	90	L
5/ 3.0R	Pvt.	1	8	H	1	12	M	2	18	L
6/ 3.5R	TNF	not surveyed/occupied by miners								
7/ 3.6L	ElNF	1	12	H	1	18	M	2	30	L
8/ 3.7L	ElNF	1	14	H	1	20	M	2	45	L
9/ 3.7L	ElNF	1	20	H	1	25	M	2	100	L
10/ 5.6R	BLM	1	20	M	1	25	M	2	90	L
11/ 5.6R	BLM	1	15	H	1	25	M	2	50	L
12/ 7.0R	BLM	1	15	L	1	25	L	2	20	L
13/ 7.1R	BLM	1	12	H	1	15	L	2	30	L
14/ 7.3L	ElNF	1	15	H	1	22	H	2	45	L
15/ 7.6R	BLM	1	15	M	1	30	L	2	50	L
16/ 7.8R	BLM	1	20	H	1	30	M	2	50	L
17/ 8.0R	BLM	1	15	M	1	25	L	2	50	L
18/ 8.1R	BLM	1	25	H	2	40	H	3	75	L
19/ 8.2L	ElNF	1	15	H	1	20	H	2	35	L
20/ 8.3L	ElNF	1	20	H	1	30	H	2	50	L
21/ 8.4R	BLM	1	8	M	1	12	L	2	40	L
22/ 8.7L	ElNF	1	4	H	1	6	H	1	20	L
23/ 9.0L	USBR	1	18	H	1	25	H	2	40	M
24/ 9.7L	ElNF	1	10	H	1	12	H	1	25	L
25/10.0R	BLM	1	18	H	1	25	M	2	60	L
26/10.1R	BLM	2	50	H	3	90	M	5	150	L
27/10.2R	BLM	1	12	M	1	20	M	2	35	L

MF Campsite Inventory (cont).

Site/ Location	Land Own.	Low Contact			Moderate Contact			High Contact		
		Grp#	Usr#	Qual	Grp#	Usr#	Qual	Grp#	Usr#	Qual
28/10.2L	ElNF	1	25	H	1	35	M	2	50	M
29/10.5L	ElNF	1	25	H	1	35	H	2	50	M
30/10.7R	BLM	1	30	H	2	45	M	3	70	L
31/10.8R	BLM	1	12	H	1	18	M	2	35	L
32/10.9R	BLM	1	15	H	1	20	H	2	40	M
33/10.9L	ElNF	1	20	H	1	27	H	2	50	M
34/11.2R	Pvt.	1	20	M	1	30	M	2	50	L
35/12.6L	USBR	1	30	H	2	40	H	2	60	M

Notes: Site/Location indicates the campsites in numerical order downstream, river miles from the Oxbow put-in, and either river right (R) or river left (L). The numbers of groups and users indicated are the upper end of the capacities for the indicated contact thresholds. Site quality refers to the estimated overall quality condition of the site under differing use levels and degrees of contact. ElNF=Eldorado National Forest, TNF=Tahoe National Forest, USBR=US Bureau of Reclamation, BLM=Bureau of Land Management, Pvt.=private lands.

b) Instantaneous Capacity: The camping capacities on the MF under the contact level thresholds were derived from the campsite inventory which considered the number of groups and users that could be accommodated within the defined levels of site crowding and the resulting campsite quality. Because 70% of the overnight trips in 1985 had more than 20 users, only sites with a capacity of >20 were considered. Because the MF is intended to be a "quality" resource, only sites with Medium and High site quality were considered. Because of the management arrangements on the MF, only sites on public lands were considered. Because of typical use patterns, only those sites below Kanaka Gulch Rapid (RM 4.1) were considered. Since it is fully reasonable that typical MF overnight trips can have between 30 and 40 users, those sites with capacities greater than 30 are considered along with all of the other criteria.

"Low Contact" instantaneous camping capacity of the MF is 11 groups and 265 users in sites with capacities >20 users, and 3 groups and 110 users in sites with capacities >30 users. This level of use provides for low levels of on-site crowding and congestion in medium and high quality sites.

"Moderate Contact" instantaneous camping capacity of the MF is 22 groups and 554 users in site with capacities of >20 users, and 10 groups and 335 users in sites with capacities of >30 users. This level of use provides for camping conditions where there is sense of on-site contact that is an identifiable element of the experience but where no marginal facilities are required, and the use of only those sites with medium and high quality characteristics.

"High Contact" instantaneous camping capacity of the MF is 51 groups and 1445 users in low, medium, and high quality sites with capacities of >20 user, and 34 groups and 1380 users with capacities of >30 users. This level of use requires use of all sites with capacities greater than 20 or 30 users and creates on-site conditions of crowding and congestion and the use of marginal facilities. If only medium and high quality sites are considered the capacity is 12 groups and 290 users in sites with capacities of >20 users and 7 groups and 290 users in sites with capacities of >30 users..

c) Daily Capacity: Because of the nature of camping capacity, instantaneous and daily capacities are the same.

4: Ruck-A-Chucky Take-out.

a) Observations: The Ruck-A-Chucky take-out area consists of a large beach area across from the mouth of Canyon Creek and several parking areas for vehicles. A very large parking area is located at the top of the steep hill where the road descends to the take-out; this is about 0.4 mile from the beach. A second large parking area is located about half way to the beach and has a single hole outhouse. Immediately adjacent to the beach are three or four small turn-out areas that can accommodate parking and staging. The beach itself can accommodate only 4-wheel drive vehicles. The road from the upper to the middle parking area is very steep and in poor condition requiring either very low geared or 4-wheel drive vehicles.

Typically non-commercial and day-use vehicles arrived at the take-out between 9:30 and 10:30 am and parked either at the beach, if vehicle and road conditions permit, or in either the upper or middle parking areas. Commercial vehicles usually began arriving at about 1:00 pm and continued until 5:30; they tended to arrive between 40 minutes and 2 hours before the raft trips. Early in the season, when road conditions permitted, most of the commercial vehicles parked in either the middle parking area or in the lower parking areas near the beach. Later in the season, as road conditions degraded, the commercial busses parked in the upper parking area and the clients walked to the vehicles from the beach, while the gear vehicles were parked either in the middle parking area or in the spots near the beach.

Because of typical on-river trip itineraries and the progression of boatable flows from Oxbow Powerhouse, multi-day trips began arriving at the take-out area at about 12:00 and continued until about 5:00 pm, while the 1-day trips arrived between 2:00 and 6:30 pm but most arrived between 3:30 and 4:30 pm. During the peak hour of activity commercial groups arrived at an interval of about 12 minutes. Because of the conditions at the beach and the easy of loading gear vehicles, the take-out staging only required about 50 minutes.

Although there were times when the number of groups at the take-out area reached fairly high levels, the congestion problems at this location were associated with the manner in which the commercial operators dealt with the passenger vehicles. When these vehicles were parked in the middle and lower parking areas and brought to the beach area when trip staging and loading was underway, congestion levels were very high due to the limited parking and turn around areas and the degree of acitivity associated with staging. When the passenger vehicles were parked and left at the upper parking area there was a marked reduction in the levels of congestion and conflict at the take-out.

If the commercial passenger vehicles are allowed to operate as they did in early season, the degree of congestion generated by the concentrated trip arrival pattern and the limited space available near the beach for vehicles could limit instantaneous capacities if the contact parameters are applied. If the commercial passenger vehicles are required to stay in the upper parking area the same use levels and arrival patterns result in less congestion and conflict. Under this condition the capacity of the take-out would be a function of both the contact parameter at the beach and the parking capacity of the upper parking area along with the commercial passenger vehicle use pattern. The current instantaneous capacity of the upper parking area is estimated at about 10 busses of the size used on the MF by commercial operators.

b) Instantaneous Capacity: The instantaneous capacities are based on the available space on the beach for activity and the parking capacity of the upper parking area on the assumption that commercial passenger vehicles will not be allowed below that point. It also assumes that there will be one gear boat from a portaging multi-day trip staging at the same time as the peak instantaneous arrival and take-out activity of 1 and 2-day trips.

"Low Contact" instantaneous capacity is 3 groups. At this level all 3 groups will have ample room so as not to feel impacted by other groups.

"Moderate Contact" instantaneous capacity is 6 groups. At this level the number of users in the area and number of rafts and gear vehicles at the take-out begins to impart a sense of crowding. Depending on the staging behavior of these groups, available beach parking and day use activity, this sense of congestion ranges from slight to high.

"High Contact" instantaneous capacity is 10 groups. At this level of use there could be up to 200 users, 50 rafts, and 10 gear vehicles. Behavior patterns are altered as groups either wait for available beach or staging parking, or simply postpone the staging process until the congestion level is reduced. The upper limit of "High Contact" capacity is a function of the instantaneous capacity for passenger bus parking in the upper parking areas.

c) Daily Capacity: The daily capacities were derived by converting the instantaneous capacities of the different contact levels to peak hourly capacity and applying that use level to the time distribution of use at the take-out through the 1985 season.

"Low Contact" daily capacity is 8 groups. An instantaneous capacity of 3 groups, an average staging time of 1 hour, and the

time distribution of occupation through the season result in 8 groups.

"Moderate Contact" daily capacity is 17 groups. An instantaneous capacity of 6 groups, an average staging time of 1 hour, and the time distribution of occupation through the season results in 17 groups.

"High Contact" daily capacity is 28 groups. In this case the factor of beach crowding at "High Contact" instantaneous capacity resulted in very large numbers and the capacity for bus parking is exceeded before "High Contact" daily capacity is reached. Given the bus parking space capacity of 10 busses and an average occupation of the take-out parking facilities of 1:45, and the time distribution of bus occupation through the season, a capacity of 28 trips results.

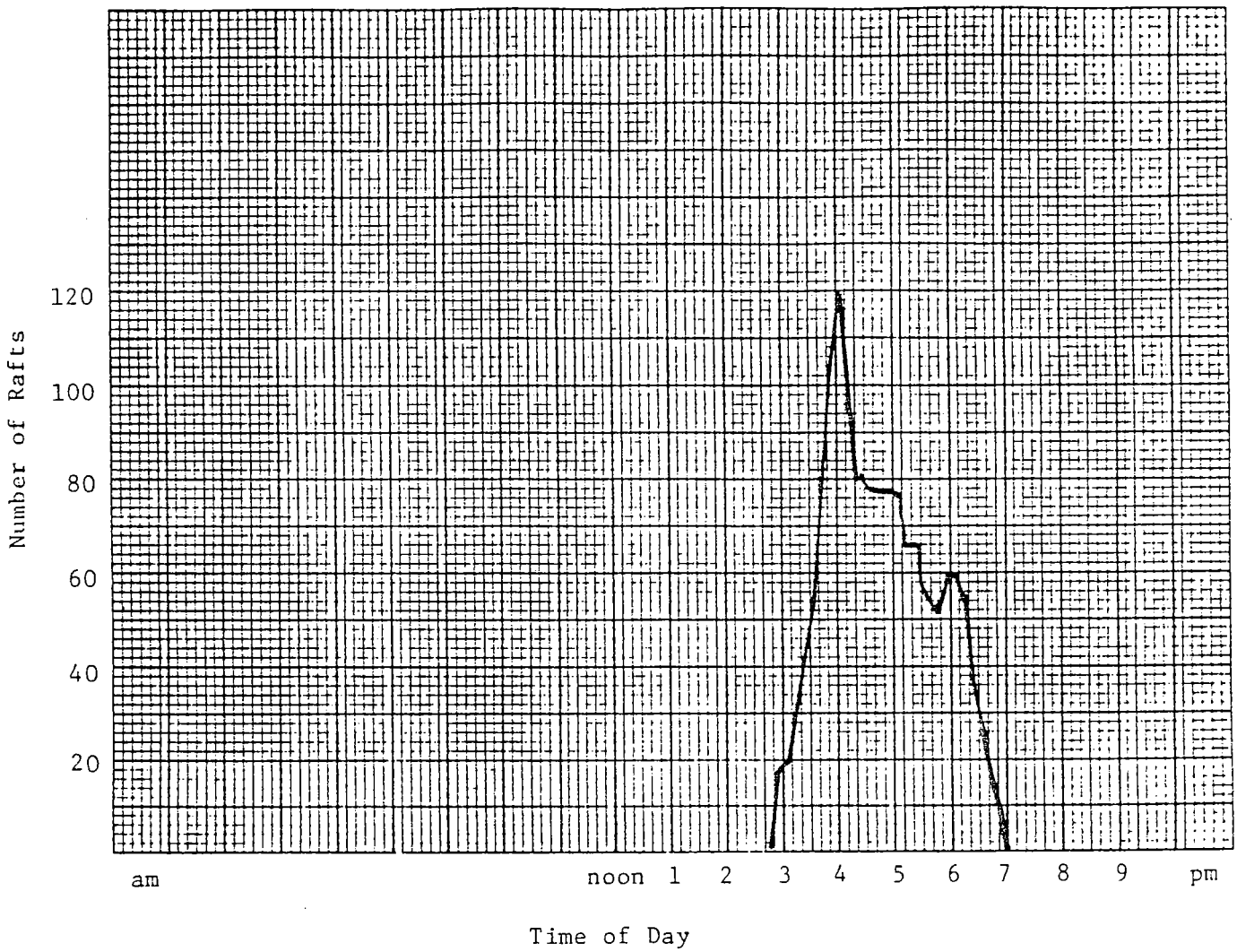

Figure 10: Cumulative Commercial Time of Occupation of the Ruck-A-Chucky Take-Out, 1985 MF Season.

This is developed by accumulating the recorded times of commercial group arrival and departure after the staging and loading of the gear on the 27 survey days.

5: Ruck-A-Chucky Portage.

a) Observation: In the 1985 season about 40% of all multi-day trips portaged Ruck-A-Chucky to take-out at downstream sites. Based on the progression of boatable flow releases from Oxbow Powerhouse which often arrived in the Ruck-A-Chucky area about 2:00 pm. Most of the groups would arrive between 2:30 and 4:30, however, when there was competition for the portage, many groups moved downstream ahead of the boatable flows in order to establish their place in line. Early arrivals often started arriving from 11:30 to 12:00.

The portage is a time consuming process requiring an average of 15 minute per raft. The average group size at the portage was 4.6 rafts which meant that portage times for groups were in the 1:10 range. Because of the arrival patterns and the rates at which the portage could be handled, congestion built up quickly and dissipated slowly. There have been observations at peak activity times when one group is on the portage cable, 2 groups or about 10 rafts in the eddy waiting to start the portage, 2 groups around Chunder Rapid waiting to move to the eddy at the portage, 2 groups at the mouth of Canyon Creek waiting to move further downstream, and 1 group at the take-out beach discussing the options. Under these and even less congested conditions the wait to start the portage can be up to 3 hours and there were many instances of groups arguing over places in line and "line cutting" as groups float past other groups on the bank waiting to move farther downstream. These congestion and conflict conditions were often intensified when one operator had two full groups running on one itinerary. To the other groups and users in the area these groups appeared as one with up to 10 rafts and 80 users. This created a greater sense of waiting time and congestion. It was typical that at least 1 group altered their intended itinerary and take-out at Ruck-A-Chucky when wait lines developed.

This congestion situation also induced two other itinerary or behavior pattern shifts. One was for commercial groups to move to Canyon Creek before the arrival of boatable flows and wait there until there was enough water to run Chunder Rapid at to start the portage. This was an effort to be first in line at the portage when the rest of the commercial groups arrived with the boatable flows around 2:00 pm. This pattern often resulted in up to 4 groups at the mouth of Canyon Creek for about 1.5 hours having lunch and on hikes. The other accommodation of use pattern was to arrive before the boatable flows and to run, line, or carry Chunder before boatable flows and to undertake the portage. They would have lunch below Ruck-A-Chucky waiting for boatable flows. Despite these shifts in behavior patterns, there were often up to 6 groups waiting at and around the portage area simultaneously.

Regardless of how the section was run by the groups, the intense competition for the portage created the need to run Chunder Rapid as early as possible in order to get to the start of the portage. This often led to running Chunder before the rapid had fully boatable flows and there were several instances of perched rafts and injuries when clients were thrown from the rafts by sudden stops associated with perching, both of which served to create greater congestion.

b) Instantaneous Capacity: The instantaneous capacity of the Ruck-A-Chucky portage is based on the assumption of 1 group being on the line, the number of groups waiting to begin the portage, the perceived length of time of the wait, and the affect of that perception on contact congestion.

"Low Contact" instantaneous capacity is 1 group. At this level of use there is no waiting by users not associated with the group on the portage even though there could be waiting by these users of up to an hour.

"Moderate Contact" instantaneous capacity is 3 groups. At this level there is assumed to be 1 group on the line, 1 group next in line, and the third group waiting for the full time required by the second group to complete the portage plus what time is necessary for the first group to finish the portage.

"High Contact" instantaneous capacity is 8 groups. Although there is enough space at the portage and around the take-out beach for tens of groups to wait to begin the portage, given that the time required to complete the portage, there is only time for 8 groups the whole day.

c) Daily Capacity: The daily capacities for the portage at the contact levels are calculated from the instantaneous capacities, and converted to hourly peak capacity rates of use. This is then converted to daily capacity based on the characteristic group occupation of the portage, including the wait in the eddy directly above the portage.

"Low Contact" daily capacity is 3 groups. An instantaneous capacity of 1 group, an average transit of 1:07 per group, and the time distribution of group occupation through the season results in a daily capacity of 3 groups. At this level of use there would be no waiting by users of groups and no need for accommodation.

"Moderate Contact" daily capacity is 5 groups. An instantaneous capacity of 3 groups, an average transit of 1:07 per group, and the time distribution of group occupation through the season results in a daily capacity of 5 groups. This assumes

that there are 5 hours of adequate flow available to complete trips to Oregon Bar. This use level creates congestion and necessitates accommodation of users and groups that includes waiting for periods from 1 to 2 hours to start the portage process. These conditions can exist at the portage for periods greater than half of the entire period of daily portage activity.

"High Contact" daily capacity is 8 groups. This level of use is considered the maximum use possible based on an average transit of 1:07 per group and the potential availability of 8 hours of adequate streamflow when groups are ready to use the portage and to continue to Oregon Bar. This level of use creates congestion that begins soon after the second group arrives and continues through the full period of activity at the portage.

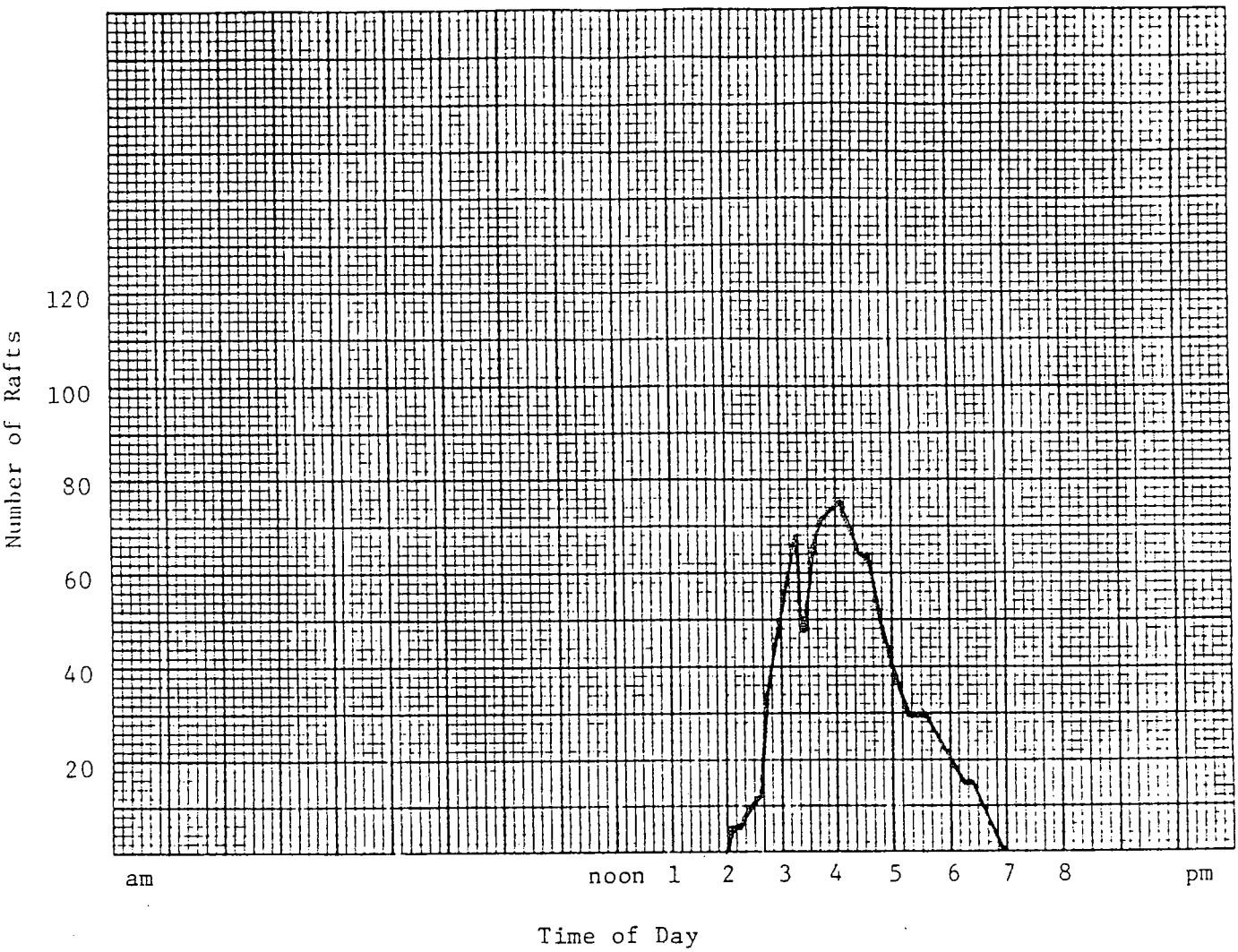

Figure 11: Cumulative Commercial Time of Occupation at the Ruck-A-Chucky Portage, 1985 MF Season.

This is developed by accumulating the recorded times of commercial group arrival in the portage eddy and the departure of groups from the base of the portage on the 27 survey days.

6: Greenwood Bridge Take-out.

a) Observations: This take-out consists of a small, rocky shoreline area with an old (no longer used), steep ford road leading to the Driver's Flat Road. At the main road there are several small off-road clearings and one that is large to accommodate a vehicle.

Because of the location (RM 14.9), boatable flows reach the Greenwood Bridge site in mid-afternoon and groups tended to arrive in the area between 3:00 and 6:00 pm. Because of the tendency for the portage at Ruck-A-Chucky to spread out the groups, the rate of group arrival was always low. Early in the season 3 or 4 companies used this as a take-out, but by mid-season only two companies (2 companies with a single operator) were using it. The rest started using the Oregon Bar site just downstream.

Because of the limited space for parking and the staging of equipment, one group at the take-out created high contact situations. Gear and passenger vehicles were forced to park at Oregon Bar until their trip was staging. While these vehicles were parked at the staging area the presence of rafts, users, and vehicles partially or completely blocked the roadway. This often created congestion and conflict with other users of the road during the mid to late afternoon hours.

b) Capacities: The instantaneous capacity for this site is one group and as a result of staging times and arrival rates, the daily capacity could be about 4 groups. However, due to the congestion generated by just one group, any use at all results in "High Contact" use levels. The use of this site as a commercial take-out should be prohibited.

7: Oregon Bar Take-Out.

a) Observations: This take-out consists of a small beach area with about 20 feet of river frontage and a wide, steep sandy area leading to Driver's Flat Road where there is a moderately sized parking and staging area that can accommodate about 5 commercial vehicles. There are also pit outhouses.

Because of the location (RM 15.1), boatable flows reach the Oregon Bar area in mid-afternoon and groups tended to arrive between 3:30 and 6:30 pm with a peak arrival between 4:30 and 5:30 pm. Because of the tendency for the portage at Ruck-A-Chucky to spread out the groups, they tended to arrive at Oregon Bar at intervals of about 30 minutes. Staging and loading of trips at this site required an average of 37 minutes and the groups usually left soon after loading. Little congestion was ever observed.

There was some day-use and long-term camping activity at Oregon Bar, mainly associated with recreational gold mining. Because rafting activity was mainly in the mid and late afternoon hours and generally only involved one group at a time there was no apparent conflict between users.

b) Instantaneous Capacity: Instantaneous capacity of the Oregon Bar take-out area is a function of the off-road space available for parking vehicles and to accommodate users.

"Low Contact" instantaneous capacity is 1 group. At this level there is adequate room at the beach and in the off-road parking area to accommodate users, vehicles and staging of equipment. Those long-term campers at the site are not unduly impacted by this use.

"Moderate Contact" instantaneous capacity is 2 groups. At this level of use there is adequate room in the staging/parking area to accommodate use, however, activities between groups would have to be coordinated and the users would experience some sense of crowding. The long-term campers at the site would have a strong sense of congestion and noise.

"High Contact" instantaneous capacity 4 groups. At this level of use most available space in the staging/parking area is in use; the groups have to make extreme accommodations to each other, the users have a strong sense of congestion and crowding, and the beach area could be used by only two groups at a time. The long-term campers would feel intense levels of congestion and crowding.

c) Daily Capacity: The daily capacity of this site results from the instantaneous capacities at the contact levels, the average staging time of 37 minutes, and the observed seasonal arrival pattern of groups that result from the Ruck-A-Chucky portage.

"Low Contact" daily capacity is 12 groups. An instantaneous capacity of 1 group, a staging time of 37 minutes, an arrival of 1 group per half hour, and a potential daily take-out time of 6 hours results in a daily capacity of 12 groups.

"Moderate Contact" daily capacity is 24 groups. An instantaneous capacity of 2 groups, a staging time of 37 minutes, and a potential daily take-out time of 6 hours results in a daily capacity of 24 groups. The Ruck-A-Chucky portage, however enforces a spread out arrival rate of about 1 group/half hour which would not allow "Moderate Contact" daily capacities to be reached.

"High Contact" daily capacity is 48 groups. An instantaneous capacity of 4 groups, a staging time of 37 minutes, and a potential daily take-out time of 6 hours results in a daily capacity of 48 groups. The Ruck-A-Chucky portage, however enforces a spread-out arrival rate of about 1 group/half hour which would not allow "High Contact" daily capacities to be reached.

8: Summary of Capacities:

In preceding sections each of the major access and on-river points on congestion were analyzed for instantaneous capacities at various contact threshold levels. Also the instantaneous capacities were extended to daily capacities, at the various contact threshold levels, by applying observed use and behavior patterns. The "Moderate Contact" level is the desired management goal and the instantaneous and daily capacities at "Moderate Contact" levels for the features of the MF are summarized in Table 16 below.

Table 16.

Summary of Site Capacities
at "Moderate Contact" Use Levels, MF.

Site	Instantaneous Capacity	Daily Capacity
1. Oxbow Put-In	6 groups	7 groups
2. Tunnel Chute	5 groups	22 groups
3. Campsites	10 groups	10 groups
4. Ruck-A-Chucky Take-Out	6 groups	17 groups
5. Ruck-A-Chucky Portage	3 groups	5 groups
6. Oregon Bar Take-Out	2 groups	24 groups
7. Total Take-Out (4+5+6 above)	9 groups	22 groups

The "Moderate Contact" daily capacities for the various features on the MF are combined into an overall daily capacity by virtue of the most limiting factor. The put-in has a daily capacity of 7 groups and the take-outs have a daily capacity of 22 groups.

The total take-out capacity is a combination of the daily capacity at Ruck-A-Chucky of 17 groups and the daily capacity of 5 groups on the Ruck-A-Chucky portage. The daily capacity of the Oregon Bar take-out downstream is not significant in the take-out capacity in that only 5 groups can reach this take-out based on the 5 group daily capacity of the Ruck-A-Chucky portage. The other major on-river congestion point, Tunnel Chute, is not a factor in that it has a daily capacity of 22 groups. In terms of the access points and the points of on-river congestion, the daily capacity for "Moderate Contact" use levels is 7 groups; the limitation is the capacity of the put-in.

The campsite capacity factor is also a necessary element of the overall daily capacity of the MF. There are 10 sites on public lands that have medium or high quality conditions under "Moderate Contact" use levels, and have capacities of greater than 30 users. Although, of the multi-day trips in 1985, 28% had less than 20 users, 42% had 20 to 29 users, and 30% had over 30 users, a typical 5 paddle raft multi-day trip have full capacities 30 to 35 users. Under the influence of the potential for reduced daily group number limits it is likely that a greater proportion of multi-day trips will be at capacity in the future.

Taken together the capacities of the various features would seem to imply that the daily "Moderate Contact" capacity is 7 groups based on the most limiting daily capacity feature; in this case the Oxbow put-in. However, because the daily capacities are somewhat greater for other features on the MF it may be reasonable to increase the daily group start numbers to levels that more closely conform to other capacity limits; in this case, campsites. This could bring the daily starts to a 10 trip limit which would also result in the Ruck-A-Chucky take-out capacity if all trips should use that facility instead of the portage. An increase in the daily trip start limits may result in contact levels greater than "Moderate Contact" at the put-in, however, due to the use patterns at the put-in, these greater contact levels will be brief compared with the full trip. The greater contact levels may also be more acceptable at the put-in by users in that crowding here may be expected. Also, it should be remembered that the daily trip start limits that will follow from the analysis of daily capacities at the put-in, among other features, applies to total daily trip starts. The put-in activity at Volcano Creek was not considered when put-in daily capacities were calculated but will be affected by trip start limitations. Therefore with a 10 trip start limit there may be one or two trips starting at Volcano Creek and would not contribute to congestion at the Oxbow put-in.

Within the context of the above considerations it appears that the appropriate daily start limit should be 10 trips. With this limit the river can accommodate the use levels and provide for "Moderate Contact" conditions throughout with the possible

exception of short-term congestion at the Oxbow put-in. There will be room for all multi-day groups to have large medium and high quality camp sites and would allow for acceptable contact levels at the take-outs even if a day with 10 2-day trip starts is followed by a day with 10 1-day trip starts. Up to 22 trips can be accommodated at the take-outs if 5 groups portage Ruck-A-Chucky and take-out at Oregon Bar or below.

A daily start limit of 10 trips allows for those trips to exercise full flexibility of trip itinerary, behavior pattern, and trip length while maintaining "Moderate Contact" levels. Desired contact levels could be maintained with greater use levels but it would require regulation of use and behavior patterns, trip length and other aspects that have proven to be essentially unattainable and/or difficult to enforce.

G. MF Findings and Management Recommendations:

1: Findings.

Field surveys conducted in the 1985 peak use season, observations of access point and on-river use patterns and conflicts, discussions with commercial operators and non-commercial users, a review of resource characteristics of the MF, and regional resource characteristics have led to several findings that have directed the management recommendations. These findings include:

- Because of the season of suitable flows and resource characteristics, the MF is a significant regional resource and deserves careful management.

- Because of the isolated nature of the MF and the general lack of "whitewater" rapids, the MF should be managed for "Moderate Contact" use levels to maintain a "wilderness/primitive" character.

- Because of general lack of non-commercial interest in the MF due to relatively difficult logistics and low whitewater intensity, and relatively high demand for commercial use, the management of the MF should give priority to commercial use.

- Because observed commercial use patterns indicate that required changes in use pattern (intended to reduce congestion) will not be followed without strict enforcement, the management plan should emphasize daily commercial use limits to reduce conflicts rather than use pattern and behavior requirements.

2: Management Recommendations.

a) Whitewater Use Permit: The permit for whitewater recreation on the MF should apply to commercial operators only and should include:

- A time limit that includes the full potential use season, probably May 1 through Sept. 15 of each year.

- A daily trip start limit that applies to both the Oxbow and Volcano Creek put-ins.

- A limitation of 10 commercial starts per day.

- A provision that commercial training trips are considered as a commercial trip.

- A limitation of 5 commercial two day trip starts per day allowed to portage Ruck-A-Chucky.

- A limitation of 5 rafts for one day trips and 6 for two day trips if 2 oar/dunnage rafts are used.

- A provision that campsite use should be on a first come first serve basis daily; they should not be "reserved" or "designated" for certain companies.

- A requirement that all equipment associated with camping is removed with each trip.

- A requirement that camping activities include proper food preparation, all solid waste removed from the canyon and properly disposed of, appropriate portable toilet facilities, a fire pan for all wood and charcoal fires and ashes carried out of the canyon (no fire rings).

- A requirement that all commercial passenger vehicles must stay in the main parking area at the top of the steep hill at the Ruck-A-Chucky take-out and clients will walk.

- A Requirement that all commercial gear vehicles can only use the lower parking areas or the beach when in the process of staging a trip at the Ruck-A-Chucky take-out.

- A prohibition on take-outs at the Greenwood Bridge site.

b) Other Management Action: The above permit requirements should be as self-enforcing as is possible, however, there are some actions that can be taken by State Parks to affect enforcement and to improve conditions. These actions include:

- The development of a pre-season commercial allocation system that assigns daily trip starts to commercial operators and designates which two-day trips can use the portage so that daily use limits can be assured, commercial operators can develop schedules, and State Park field personnel can enforce the management plan.

- Occasional patrols of the put-in and take-out areas on random days through the use season to enforce commercial put-in and take-out restrictions.

- Occasional user surveys at the put-in on weekend days in the peak season to record commercial and non-commercial use patterns.

- If use pattern changes warrant, modify the daily commercial trip start limits and the allocation system.

- Two pit or vault toilets are needed at the Oxbow put-in area.

- The steep trail between the commercial staging area and the water at the put-in should be improved with the construction of firm steps using set logs or other suitable material.

- A one time effort should be made to clean the put-in area of various pieces of metal which represent a potential safety hazard to users.

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APPENDICES

A. Summary of Activities and Authorities of Agencies Concerned With Recreational Rafting on Middle and North Fork, American River.

B. Example Observational and Use Pattern Forms Used on the NF/MF Study.

C. International Scale of River Difficulty.

APPENDIX A.

Activities and Authorities of Agencies Concerned With Recreational Rafting on Middle and North Fork, American River

Prepared by Taylor O. Miller

for Chuck Watson, Environmental Consultants

October, 1985

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Summary

An analysis was undertaken of agency activities and jurisdiction concerning management of white water recreation in the North and Middle Forks of the American River. This area lies within the authorized boundaries of the federal Auburn Dam and Reservoir project to be built and managed by the Bureau of Reclamation. Reclamation has contracted with the state Department of Recreation for the management and protection of Auburn Project lands as part of the State Park System pending construction of the dam. For the past several years, the Department of Parks has issued permits to commercial rafting companies interested in running trips on the North or Middle Fork.

The activities, authorities and interagency agreements of the Bureau of Reclamation, the Department of Recreation, the El Dorado National Forest, the Tahoe National Forest, Placer County and the Bureau of Land Management were reviewed and the following conclusions reached:

1. Since the State does not directly own any of the lands in the area in which rafting is occurring, State Parks' jurisdiction is derivative to authority of other agencies, particularly Reclamation. However, once State Parks does properly have administrative jurisdiction, state law gives Parks broad authority to manage and regulate the lands as part of the State Parks System.

2. Reclamation may have jurisdiction within the project area through outright ownership, through proposed or final withdrawals of federal lands managed by other agencies or by interagency agreement. Most of the river corridor lands appear to have either been proposed or finally withdrawn, though no definitive survey was done as part of this review. Some lands remain within private ownership; however, none of the principal put-in, take-outs and camping areas appear to be within privately owned areas.

3. The jurisdictional situation varies for BLM and USFS lands.

a. Pursuant to an interagency agreement signed in 1980, BLM has authorized Reclamation to manage, through it s contract with State Parks, BLM lands proposed for withdrawal within the Auburn Project area.

b. Reclamation's authority to manage USFS lands is presently much more limited. The two agencies have agreed that until lands are finally withdrawn by Reclamation, the Forest Service retains exclusive jurisdiction over their management. Even for lands which are finally withdrawn, the lands remain part of the National Forest system with Reclamation having primary jurisdiction only for "reclamation purposes". Previous memoranda of agreement suggest that such primary jurisdiction will cover (in addition to water development works) the surface of the reservoir and 300 feet horizontally from the water surface. No written policy was located concerning the geographical scope of "reclamation purposes" before completion of construction and reservoir filling.

The Forest Service position is that Reclamation does not have authority to contract with Parks for management of national forest lands within the project area. However, the agency does acknowledge that it has the authority to transfer management authority over national forest lands by agreement.

4. The net effect of this mix of statutory provisions and agency understandings is to give State Parks jurisdiction over BLM and Reclamation acquired lands within the project area, but little or no jurisdiction over Forest Service lands.

a. In the North Fork corridor, the put-in, take out and most of the riparian areas are either Reclamation acquired or BLM.

b. In the Middle Fork, the put-in is within the Tahoe National Forest, but the Tahoe has agreed by letter that Parks can manage this area. The south side of the river is largely within the El Dorado National Forest, and camping permits for commercial rafters have been issued by this Forest. The take-out and most camping areas on the north side of the river appear to be BLM lands and thus subject to Parks' jurisdiction.

5. If it is desired to consolidate permitting and management authority and responsibility for all commercial rafting related activities in the Auburn Project area under State Parks, an additional interagency agreement between the Forest Service, Parks and, probably, Reclamation is necessary.

6. To the extent that some management problems outside the Project area require regulation and expenditure by Placer County (e.g., Forest Hill parking, emergency service expense), regulation by Parks might be supplemented by additional county regulation. Rafting companies might be required to obtain a county permit in addition to the Parks permit. However, unlike the county permit system for the Truckee River, the county might leave permit allocation and operational regulation up to Parks and merely require that a Parks permit is a prerequisite to obtaining a county permit. A fee could be charged for the county permit sufficient to cover county expenses for emergency services or parking facilities and regulation.

7. State Parks has expressed concern that additional management of rafting activities will require additional budget, and that even if additional fees are charged for rafting permits, these monies may not in fact be be available to the department. This problem might be avoided through careful structuring of agreements with Reclamation or the Forest Service for management of the Auburn Project area.

Monies that now come to the department through the Reclamation contract may only be expended on management activities under the contract. Should fees be increased for rafting permits issued by State Parks, some component of such fees (possibly all of them) could be applied by the federal agency against amounts due Parks under an agreement with the agency for managing the area. Public Resource Code Section 5080.30, which gives Parks the authority to enter into agreements with other agencies for the management of lands as part of the State Parks System, states that the expenses of such management can come from the contracting agency or from revenues generated on the lands subject to the agreement. Section 5080.32 then provides that any revenues received from lands subject to an interagency agreement shall only be expended for the management of such lands.

Agency and Principal Contacts

Bureau of Reclamation	Larry Boll	988-1707
2600 Cottage Way	Mike Petrinovich	978-5048
W 2211	Gary Boyenton	885-0661
Sacramento, CA 95825		

Current Activities

Contracts for management of Auburn and Folsom Dam Project areas with California Department of Parks and Recreation. General oversight of management of area. Contracted with Charles Watson, Environmental Consulting, for study of problems concerning whitewater recreation in Middle and North Fork, American River.

Authorities

P.L. 89-161 (authorizing Auburn Dam; outdoor recreation and fish and wildlife enhancement are included among project purposes); 43 U.S.C. Sec. 416 (withdrawals of entry for public lands needed for irrigation works); 43 U.S.C. Sec. 417 (reservations of easements or right of ways over public land when needed for reclamation project); 43 U.S.C. Sec. 421 (condemnation authority).

Geographical Jurisdiction

Potential jurisdiction to manage for reclamation purposes all lands within the "take line" for the Auburn portion of the Auburn-Folsom South Project. Current jurisdiction includes private lands acquired by Reclamation and BLM. USFS retains exclusive jurisdiction over lands prior to final withdrawal and primary jurisdiction thereafter, subject to prior needs for reclamation purposes (see agreements noted in El Dorado NF description). BLM has authorized Reclamation, under its contract with Parks, to assume recreational management responsibility for BLM lands within the Auburn Project take line (see agreement noted in BLM description).

Regulations

None noted concerning river recreation management

Management Guidelines; Planning Documents

Auburn-Folsom Recreation Plan, prepared by Auburn-Folsom Interagency Task Force, October 1966

Interagency Agreements

Contract No. 14-06-200-3193A with California Department of Parks and Recreation executed in 1966 provides for the construction and operation of recreational facilities at the Auburn-Folsom South Unit of the Central Valley Project and eventual transfer of possession and control of the area to the state to be operated at its own expense.

Contract No. 14-06-200-8532A with Parks and Recreation executed in 1977

provides for the interim management for the recreational use and protection of Auburn Dam project lands until they are turned over to the state under the 1966 agreement and provides financial support for state salaries and equipment. Agreement amended annually to adjust budget support. FY 84-85 provides $ 355,000.

Memorandum of Understanding executed September 30, 1980 provides for Reclamation management (through Parks contract) of BLM lands which have been proposed for withdrawal within the take line.

Exchange of letters in 1982-1983 between Reclamation and USFS establishes USFS jurisdiction over even withdrawn lands subject to prior right of use by Reclamation for "reclamation purposes." Agencies appear to agree that Reclamation will have primary jurisdiction over first 300 feet horizontally from high water mark of Auburn Reservoir.

Draft MOU in 1982 between Relamation/USFS/State would have transferred lands within the Auburn Reservoir Area, and within either the Tahoe or El Dorado NF, to the USFS for administration as National Forest land. USFS would permit the State to administer for recreation and resource protection lands within this area that are within 300 feet horizontally from the high water mark of the Auburn Reservoir.

Agency and Principal Contacts

California Department of Parks and Recreation
Folsom Lake State Recreation Area
7806 Folsom-Auburn Road
Folsom, CA 95630

Dick Johnson - Area Mgr.
Mike Van Hook 1-885-4527
Shelley Spindler 988-0205

Current Activities

Issue and enforce permits for commercial rafting operations in the Middle Fork American and North Fork American (below Iowa Hill Bridge). General responsibility for recreation management in the Auburn Recreation Area.

Authorities

Contract with Bureau of Reclamation (see Reclamation description). Contract gives Parks the right to use, protect and manage Project lands within the Auburn Dam and Reservoir Area, as defined in Reclamation contract, in a manner necessary to administer these lands as part of the State Park System.

General state statutory authorities -- Public Resources Code sections: 5001 (control of state park system); 5002 (areas acquired or under the control of the state constitute State Park System); 5003 (department may establish rules and regulations for the government and administration of property under its jurisdiction); 5006.6 (authority to contract with federal government for operation of Auburn-Folsom South recreation facilities and to administer unit lands for recreation); 5010 (authority to collect fees for the use of any state park system area); 5010.1 (authority to contract with other entities for the collection of fees); 5080.30/.32 (agreements with other public agencies).

Geographical Jurisdiction

Coincident with Reclamation jurisdiction of Auburn project "take line" under P.L. 89-161 to the extent such jurisdiction exists either by acquistion, by virtue of withdrawal from other federal agency jurisdiction, or pursuant to interagency agreement for Reclamation to manage the area.

All of Middle Fork corridor immediately adjacent to river appears to be either acquired, withdrawn or proposed for withdrawal by Reclamation. USFS and Reclamation agree that National Forest areas withdrawn are still subject to USFS jurisdiction other than for "reclamation purposes". Without an additional interagency agreement, USFS lands within the take line do not appear to be subject to Parks jurisdiction under the Reclamation/Parks management contract. Middle Fork put-in area is just outside of take line but subject to 1983 letter agreement between DPR and Tahoe NF giving Parks authority to manage.

North Fork involves only BLM, Reclamation and private lands. BLM has agreed to permit Parks, through its Reclamation contract, to manage lands proposed for withdrawal within the take line.

Regulations

Order No. 3-5-85, dated June 20, 1985, permitting enforcement of permit system. No other regulation noted.

Management Guidelines; Planning Documents

Preliminary General Plan for Auburn Recreation Area and Folsom Lake (1978); Interim Management Plan (apparently dealt primarily with facilities after dam completed)

Interagency Agreements

Contract with Reclamation (see Reclamation listing). Agreement with Tahoe N.F. concerning management of put-in area. No other agreement with county or other entity noted.

Agency and Principal Contacts

El Dorado National Forest
7600 Wentworth Springs Rd.
Georgetown, CA 95634

Kirby W. Schwinck - District Ranger
Art Allen 333-4312

Current Activities

Issues special use permits for camping by commercial rafting companies on south side of Middle Fork. Permits issued annually for the period of May 1-October 30.

Authorities

U.S. Forest Service Organic Act (16 U.S.C. secs. 471 et seq.); National Forest Management Act (16 U.S.C. sec. 1604)

Geographical Jurisdiction

Areas on south side of Middle Fork are within the El Dorado National Forest. Areas adjacent to river and within the Auburn Reservoir "take line" are subject to withdrawal by Reclamation; however, National Forest areas withdrawn are still under USFS jurisdiction other than for "reclamation purposes" for which Reclamation has "primary jurisdiction". Areas that have not yet been formally withdrawn, but are only proposed for withdrawal, are under exclusive Forest Service jurisidction even if within the take line.

The Auburn project authorizing legislation does include recreation and wildlife enhancement among project purposes, but does not specify the geographic scope of this purpose. Previous memoranda of understanding between the agencies (see below) suggest that this "purpose" only gives Reclamation jusrisdiction over the water surface and 300 feet horizontally from the high water mark of the reservoir. There is little written policy guidance concerning the extent of recreation as a project purpose before the project is built.

Regulations

36 CFR secs. 251.1, 261.1, 261.15. Forest Service Manual secs. 1531.51 (Bureau of Reclamation 1948 Memorandum of Understanding); 2710 (Special uses); 2721.53 (outfitters)

Management Guidelines; Planning Documents

Volcanoville Unit Plan (1978); Area classified "semi-primitive motorized" for purposes of land management planning under NFMA

Interagency Agreements

Draft MOU between USFS, Reclamation and DPR to establish management authorities and responsibilities noted; dropped when construction of Auburn project delayed. The agreement would have transferred lands acquired or withdrawn by Reclamation to the Forest Service to be administered as National Forest

Lands subject to their use for project purposes. State management would be limited to the first 300 feet beyond the high water mark of the reservoir.

Reclamation agreed in a letter dated March 1, 1983 with the position outlined in a November 9, 1982 letter from Tom Schmidt, El Dorado National Forest, concerning Forest Service jurisdiction (this position is summarized above). Mr. Schmidt's letter references a 1948 memorandum of understanding between the Forest Service and Reclamation and a 1957 interpretive letter from the Secretary of Agriculture (see Forest Service Manual sec. 1531.51) which generally establish the relative jurisdictions of the agencies where project authorizations include National Forest land.

Included in Mr. Schmidt's outline of the situation is the statement that "the Bureau does not have the authority to include the National Forest land in their contract (agreement) with the State for administration of project lands." The letter does agree that the Forest Service could transfer management of National Forest lands by agreement. The 1957 letter suggests that this may be particularly appropriate where a reclamation project lies partly within and partly outside a national forest, as it does for the Auburn Project.

No other written agreement noted. Informal policy gives Placer County Sheriff lead in search and rescue activities within the National Forest unless USFS is in a better position to immediately respond to the emergency.

Agency and Principal Contacts

Tahoe National Forest
Foresthill District
Foresthill, CA 95631

Harlan Hamburger 367-2224
Bob McChesney (Road issues) 367-2224

Current Activities

Issues permits for commercial use of Mosquito Ridge Road which provides access to principal put-in on Middle Fork. Fees based on proportion of commercial rafter use to total use (quite small proportion: $ 979 of $ 68,779 collected in 1984). No permits issued for camping since no camping thought to be occurring on Tahoe NF land. Camping is allowed at put-in only for employees of rafting companies.

Authorities

Forest Service Organic Act (16 U.S.C. secs. 498, 572, 530, 532-538); National Forest Management Act (16 U.S.C. sec. 1604)

Geographical Jurisdiction

North side of Middle Fork including principal put-in (to be managed by DPR - see below)

Regulations

36 CFR sec. 2615 (enforcement of road permit requirement); Forest Service Manual sec. 7770 (road use permit)

Management Guidelines; Planning Documents

Tahoe Forest National Forest Management Plan now being developed. North side Middle Fork within Queens management area. No specific provisions regarding river management other than continuing to participate with the state in river management. Areas is classified as "primitive motorized".

Interagency Agreements

Letter agreement dated February 7, 1983 gives DPR permission to manage "that portion of the Middle Fork of the American River for white water rafting from the put-in point down to the [Auburn Dam] project boundary." Letter requires DPR permits to include insurance requirements, to operate and maintain temporary toilets at the put-in point, and to meet all applicable state, county or municipal code requirements.

Agency and Principal Contacts

Placer County Planning Department
11414 "B" Ave.
Auburn, CA 95603

Fred Yaeger - Zoning Administrator
Kathy Spence-Wells 823-4721

Current Activities

No specific regulation of commercial rafting on Middle Fork or North Fork.

Placer County adopted a commercial rafting ordinance for the Truckee River. Truckee ordinance provides that commercial rafting company must obtain business license and "raft tags" for all rafts used. License application requires plan for rafting operation including safety, sanitation, parking, and clean-up. Total of 200 rafting tags are authorized. If applications for more than 200 tags are received, the zoning administrator is to apportion according to criteria relating to parking, safety, past performance and measures to improve traffic congestion in Tahoe City. License requirements include sanitation and trash collection facilities at put-in and take-out and requirement for one off-street parking place for every one and one-half rafting tags. Cost of each raft tag equals pro rata share of net county clean up and enforcement costs plus an additional $ 125 per tag for traffic mitigation. Latter is to be put in trust fund to provide parking improvements.

Authorities

General police power authorities to protect public health and welfare.

Local regulation is permitted under Harbors and Navigation Code sec. 660 provided it does not effectively prohibit use of the river.

Geographical Jurisdiction

Within limits of the county. Pollution control laws specifically applicable on federal lands under Clean Water Act. State and local criminal law also applicable. Business activity can probably be licensed whether or not it is undertaken within federal lands.

Regulations

None noted

Management Guidelines; Planning Documents

None noted

Interagency Agreements

None noted

Agency and Principal Contacts

Bureau of Land Management
63 Natoma
Folsom, CA 95630

Dave Harris 985-4474

Current Activities

Generally consult with Reclamation and DPR concerning river recreation matters. No specific permitting or management activities undertaken.

Authorities

Federal Land Policy and Management Act (43 U.S.C. 1701 et seq.)

Geographical Jurisdiction

Lands in both Middle and North Fork corridors. Lands withdrawn to be managed by Reclamation (see below).

Regulations

43 CFR Part 8300

Management Guidelines; Planning Documents

Management Framework Plan for Auburn Area (1983). No specific reference to MF or NF river recreation management. Iowa Hill area to be managed for dispersed recreation.

Interagency Agreements

Memorandum dated September 30, 1980 between Bureau BLM and Reclamation authorizing Reclamation, through its contract with State Parks, to manage BLM lands proposed for withdrawal within the Auburn Project area pending a final agreement between the agencies as to which lands will be included in the project.

APPENDIX B.

NORTH FORK AMERICAN RIVER PUT-IN SCHEDULE

Date _____

GROUP #														
COMM/N-COMM.														
T ARRIVED (gear)														
(pass.)														
STAGING AREA														
# BOATS (rafts)														
(Kayaks)														
# CARS DURING STAGING														
T STARTED STAGING														
# PEOPLE														
PUT-IN AREA														
T TOOK OFF														
COMMENTS														

Staging areas A-lower park.
B- Upper park
C-Bridg. RL
D-Bridg. RR
E-@ put-ins (ABC)

Put-ins A-Normal
B- Bridg. RL
C- Bridg. RR

NORTH FORK AMERICAN: LOCATION ____________________ DATE ____________

GROUP/RAFT	RAFT DESCRIP.	STOP. UP.ED.	TIME ARRV.	TIME LEFT		COMMENTS

MIDDLE FORK AMERICAN RIVER TAKE-OUT SCHEDULE Date;_____

GROUP														
# RAFTS														
# KAYAKS														
# PEOPLE														
T ARRIVED														
T OUT OF WATER														
# ,OAY TRIP														
STAGING AREA														
T PACKED														
T LEFT PASS./GEAR														
# VEH. IN GROUP PARKED cars/vans-trks./busses / PARKING AREA BEFORE STAGING														
# VEH. PARKED AT STAGING / PARKING LOT USED DURING STAGING														
TIME ARRIVED R.C.														
T.STARTED PORTAGE / T.FINISHED PORTAGE														
PARKING AREAS- 1- ABOVE R.C. 2- NEXT P.L. DOWN 3- P.L. ABOVE BEACH ON LEFT														

MIDDLE FORK AMERICAN

CAMP-SITE INVENTORY

Site_____ Site location_____

_____

SITE SIZE _____
Camp Area:

Number of sleeping sites (range);
Low contact_____
Mod. contact_____
High contact_____

Size of kitchen area;
Small_____
Med._____
Larg._____

Appro. group size (range);
Low contact_____
Mod. contact_____
High contact_____

Multiple group use?:
Number of groups;
Low contact____
Mod contact____
High contact____

Group sizes;
Low contact_____
Mod contact_____
High contact_____

Boat Area:

Number of boat spots (range);
Low contact_____
Mod. contact_____
High contact_____

SITE QUALITY
Camp Area:

On-site shading; low____, med____, high____
Morning shading; low____, med____, high____
Evening shading; low____, med____, high____
Screening from river; low____, med____, high____
Screening from other camps; low____, med ____, high____
Internal screening; low____, med____, high____
Head location quality; poor____, mod____, good____
Kitchen area quality; poor____, mod____, good____
Ground condition; sand____%, gravel____%, bedrock____%, other %
Envirn. impact sensitivity; high____, med____, low____
Impact factor;_____

Boat Area:

Ease of boat/camp access; poor____, mod____, good____
Distance of carry to camp; long____, mod____, short____
Shore material; sand____, rocks____, thick brush____, trees____
Negative effect of drawdown; high____, mod____, low____

GENERAL SITE CAPACITY/QUALITY

	Group #	People #	Boat #	Quality (H,M,L)
Low contact	_____	_____	_____	_____
Mod contact	_____	_____	_____	_____
High contact	_____	_____	_____	_____

Definition of terms;

Low Contact: Level of use that does not impart any sense of crowding or excessive contact with other people or groups. Users and groups need not make any itinerary or use pattern compromises to others. A low contact, wilderness experience is possible; no sense of on-site crowding among users. Ranges from no user/group contact to a sense of contact.

Moderate Contact: Level of use that imparts a sense of user/-group contact as an obvious element in the experience and may require some accommodation of itinerary or use patterns, but is not great enough to make contact a major element of the experience; on-site use levels not great enough to require the use of marginal sleeping sites or to impart a loss of `space´ to users. Ranges from sense of user/group contact to accommodation.

High Contact: Level of use that requires accommodation of other users and groups by itinerary and use pattern changes to the degree that the experience is degraded; contact is a major element. On-site use levels impart sense of dense-pack and the use of marginal sleeping sites. Ranges from user/group accommodation to absolute physical capacity.

SITE SKETCH

APPENDIX C.

INTERNATIONAL SCALE OF RIVER DIFFICULTY

This rating system was developed in Europe to standardize the terminology used in describing the difficulty of rapids. Although the wording was intended to be very precise, the definitions for the Classes and the application of the system have evolved and there is now significnat regional variation.

CLASS I Moving water with a few riffles and small waves. Few or no obstructions. */**/

CLASS II Easy rapids with waves up to 3 feet, and wide, clear channels that are obvious without scouting. Some maneuvering is necessary. */**/

CLASS III Rapids with high, irregular waves often capable of swamping an open canoe. Narrow passages that often require complex maneuvering. May require scouting from shore. */**/***/

CLASS IV Long, difficult rapids with constricted passages that often require precise maneuvering in very turbulent waters. Scouting from shore is often necessary, and conditions make rescue difficult. Generally not possible for open canoes. Boaters in covered canoes and kayaks should be able to Eskimo roll. */**/

CLASS V Extremely difficult, long, and very violent rapids with highly congested routs which nearly always must be scouted from shore. Rescue conditions are difficult and there is significant hazard to life in event of a mishaps. Ability to Eskimo roll is esstntial for kayaks and canoes. */**/****/

CLASS VI Difficulties of Class V carried to the extreme of navigability. Nearly impossible and very dangerous. For teams of experts only, after close study and with all precautions taken. */**/****/

System Modification:

*/ Often applied to full runs of rivers if these rapid characteristics predominate. Additionally, the most difficult river in a region is often considered as Class IV or V and other rivers of the region are gauged accordingly; Classifications are therefore often not equatable between regions.

**/ If the water is cold or the river or run is isolated, the Class may be increased by one.

***/ A reliable roll is considered essential, Class III and up.

****/ In the western U.S., Class V has been commonly considered the limit of reasonable navigability and Class VI has been considered unrunnable. Alternatively, sometimes a seventh classification has been added for unrunnable conditions.