Skagit River Project

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Prepared by:
Parametrix, Inc.

Seattle City Light

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Volume A:

Ross Lake
Early-Season
Recreational Activity
and Visual Quality
Assessment

FERC No. 553

ROSS LAKE EARLY-SEASON RECREATIONAL ACTIVITY AND VISUAL QUALITY ASSESSMENT FERC NO. 553

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1. INTRODUCTION

1.1 BACKGROUND

The City of Seattle, City Light Department, owns and operates the Skagit Hydroelectric Project under a license from the Federal Energy Regulatory Commission (FERC). The project includes the Gorge, Diablo, and Ross dams and their associated reservoirs, structures, and facilities. The original 50-year license for the project expired in 1977 and an application for relicensing was filed at that time. Since then the City has conducted a number of studies of the fish, wildlife, and other resources of the area. In consultation with intervening organizations and at the direction of FERC, the City has identified several additional evaluations necessary to the relicensing application. This study addresses recreational activity and visual quality on Ross Lake and has been prepared in support of this relicensing effort.

Ross Lake and its surroundings provide recreational opportunities of national importance. The area is visited by motorists, anglers, boaters, hikers, horseriders, and others. Some visitors pass by the lake on SR20, the North Cascades Highway, briefly viewing it from a distance; whereas other users spend longer periods on or near the lake. The lake is a destination or major feature for many recreational users. The lake provides a strong visual focus for many nearby viewpoints.

In the spring, at the beginning of the early recreational season, Ross Lake levels are low. As the weather becomes warmer, lake levels rise in response to snowmelt from the surrounding high country. Lower lake levels expose unvegetated areas on the shoreline, altering the lake's visual quality and making boat access more difficult. Thus, different lake levels vary in their impact on visitor experience, either by altering the visual quality of the lake, or by causing changes in visitor activities.

1.2 PURPOSE

The purpose of this study is to describe recreational activity in the Ross Lake area and to evaluate the visual quality of the lake at a series of lake levels. The following subjects are addressed:

1. Existing recreation management programs
2. Existing recreational facilities and opportunities at Ross Lake
3. Current patterns of recreational use
4. Effects of lake levels on recreational use
5. Visual quality of the lake at different lake levels

The study was undertaken independently of other research efforts because of the need to gather data during the spring and early summer. Other reports will be submitted to FERC by October 31, 1989, in response to an additional information request of October 31, 1988. Two of these reports, which cover similar subjects, are:

1. Supplemental Environmental Information, Envirosphere Company--draft

2. Transmission Rights-of-Way Vegetation Management Plan: Aesthetic Impact Evaluation, Compliance Services International

2. RECREATION

2.1 MANAGEMENT PROGRAMS

2.1.1 North Cascades National Park Complex General Management Plan (1988)

In 1988, the National Park Service revised their management plan for the North Cascades National Park Complex. This document outlines a program for managing North Cascades National Park, and the Ross Lake and Lake Chelan National Recreation Areas within the Park Complex. Management of the National Park emphasizes preservation of natural ecosystems with minimal human influence; whereas management of the National Recreation Areas emphasizes providing recreational opportunities within a natural setting that has been altered by human-influenced development.

The Management Plan includes numerous broad guidelines for managing the Park. These guidelines include the following:

- "The Park Service will preserve the wild character of the national park and recreation areas and will help visitors gain inspiration, knowledge, and recreation from their visits to the mountains.

- Management of the Park Complex will be coordinated with the management of lands under the jurisdiction of the U.S. Forest Service, Seattle City Light, and others to provide visitors with a comprehensive overview of the region, to offer a variety of interrelated visitor experiences, and to maximize the ability to sustain a representative and ecologically healthy sample of this unique ecosystem for the future.

- The National Park Service will cooperate with other land managers to find mutually beneficial ways of managing the North Cascades ecosystem for a variety of uses while minimizing disruptions to the ecological systems that sustain the region's invaluable natural resources.

- No extensive facilities are needed or even desirable to help visitors take advantage of the abundant recreational opportunities in the park and recreation areas. However, the National Park Service will strive to afford more people the opportunity to become aware of their surroundings and the wide range of available activities."

The Management Plan states that the Ross Lake National Recreation Area will be managed to "provide a variety of resource-based recreational opportunities for visitors with a broad range of outdoor interests and skills." Because other lakes in northern Washington such as Diablo, Baker, and Chelan have easy road and boat access, Ross Lake presents a different recreational opportunity emphasizing greater solitude and wildness. The National Park Service will manage Ross Lake to retain its character as the only large, wild lake in the region offering opportunities for canoeing and fishing.

The focus of human development on Ross Lake is at the Hozomeen campground on the United States-Canadian border. The Management Plan states that Hozomeen will be managed as a semi-primitive area to "retain the feeling of a simpler time and place." Boat launches will be maintained at Hozomeen, but no new facilities or road access will be developed at the south end of the lake. In addition, a new visitor center is being planned on the Canadian side of the border to be jointly operated with British Columbia Parks. The Park Service plans to establish new lakeshore trails from Hozomeen to Lightning Creek, and from the new visitor center to the lower campground units.

Interpretive panels will be installed at the Ross Lake overlook on SR 20 to introduce visitors to the outstanding resources of the North Cascades. Other development in the Ross Lake area mentioned in the Management Plan includes a trail connecting Ross Dam to the Thunder Creek trail and an expansion of the Ross Lake Resort from 14 to 18 units.

2.1.2 North Cascades National Park Complex Wilderness Management Plan (1989)

The Stephen Mather Wilderness area within the North Cascades National Park Complex was established in November, 1988. Table 2.1 shows the relative amount of acreage designated as wilderness within each component of the Park Complex.

Excluding the immediate area around Hozomeen at the north end of Ross Lake, the Wilderness area boundary starts at the 550 m elevation on the east side of Ross Lake and extends to the National Recreation Area boundary with the Pasayten Wilderness. On the west side of the lake north of Big Beaver, the Wilderness boundary also starts at the 550 m elevation and extends west into the National Park. The Wilderness area boundary near Ross Dam and Ruby Arm varies from 700 to 750 m.

Established and maintained trails in the Mather Wilderness that provide visitors with a view of Ross Lake include the trails to Sourdough and Desolation Lookouts, and the trail to Little Jack Mountain above Ruby Arm. Backcountry camps in the Wilderness that have a view of Ross Lake include the Pierce Mountain camp near Sourdough Lookout, Desolation Camp, and Jack Mountain Camp.

- Some of the broad management goals that provide the framework for decision-making in the Wilderness Area include:

- "To manage the Wilderness environment so as to conserve, maintain, enhance, or restore the wilderness natural resources and those ecological relationships and processes that would prevail were it not for human influences.

- To meet the challenges and spirit of the 1916 Park Service organic act and the 1988 Washington National Parks Wilderness Act.

- To insure maximum freedom of use without sacrificing the quality of the wilderness natural resources.

- To pass the wilderness natural resources and spirit of the North Cascades on to the next generation unimpaired."

The Management Plan classifies Wilderness Areas in the Park Complex into 4 groups (Day Use, Trails/Established Camps, Crosscountry I, and Crosscountry II) based upon the following criteria:

- Type and amount of use
- Accessibility and challenge
- Opportunity for solitude
- Current resource conditions
- Management uses.

The Plan evaluated wilderness conditions within the park complex and established specific standards for group size, wood fires, sanitation, power tool use, stock use, signs, and other factors. Most of the Wilderness area in the Ross Lake Basin above the 550 m elevation is categorized as a Crosscountry II area. This category is characterized as the most pristine type of area with little evidence of human presence. It does not receive much day use, travel routes are minimally visible or non-existent and require route-finding skills, opportunity of solitude is high, presence of park staff is low, human impact is not acceptable for camps or routes, and size of parties travelling in this area is limited to a maximum of six people.

Because dense vegetation and steep slopes surround a majority of Ross Lake, most of the use in the Wilderness area above the Lake is confined to areas with maintained trails. Trails to Desolation and Sourdough Lookouts, the Little Beaver Trail, the trail to Little Jack Mountain, the Devils Dome trail, and parts of the East Bank trail are all in the Trailed/Established camp area designation. This area category receives moderate day and camping use. Camping is restricted to designated sites and party size is limited to 12. The standards in Trailed/Established Camp areas are more lenient than the Crosscountry areas.

All of the standards are based on-site. Specific standards for each category address type and amount of use, opportunity for solitude, condition of camps, wildlife, trail conditions, water quality, and other factors. None of the four area classifications has a visual quality standard that addresses potential impacts of activity that can be seen in the distance. Therefore, while a hiker may be bushwhacking up the rugged west slopes of Ross Lake between Big and Little Beaver Creeks in the area classification characterized as most pristine, the hiker may be able to look down on Ross Lake and see considerable human activity.

2.1.3 Pasayten Wilderness Management Plan (1979), Okanogan Nat'l Forest

The Pasayten Wilderness Area is located along the eastern border of the Ross Lake National Recreation Area. The Pasayten Wilderness is a large and remote area with a history of relatively light total recreational use. The Pasayten is divided into numerous management subunits. The west side of the Pasayten Wilderness is divided into two subunits, Freezeout and McMillan. Both units have the Ross Lake NRA as the western boundary.

The Pasayten Wilderness Management Plan creates three management categories for the lands within the Wilderness area. These categories (Situation 1, 2, and 3) are based upon different land capabilities, attractions, and management direction.

The McMillan subunit includes an area surrounding Jack Mountain that is managed as a Situation 1 (pristine) area. This area will be managed so that visitors can expect a rugged and primitive experience with an outstanding degree of solitude. No new construction of trails or structures, and no new signs will be allowed in this area. Access to this area will remain primitive.

The rest of the McMillan subunit and the whole Freezeout subunit are managed as a Situation 2 area. Situation 2 is the management scenario used for the bulk of the lands in the Pasayten Wilderness and is characterized by a wilderness environment largely unmodified by human influence. Trails will be developed and maintained to manage and disperse use. Campsites will be managed to encourage use in areas with hardy vegetation and to protect fragile areas. Campsites will also be managed to avoid the impacts of overuse at popular areas.

Recreational use of the Pasayten is rapidly evolving. Previously, the Pasayten was used primarily by local residents, but it is now being used more frequently by recreationalists outside of the area. The U.S. Forest Service believes the increase in visitors is a result of increased mobility, increased leisure time, interest created by North Cascades National Park, and the development of SR20. The Wilderness Management Plan recognizes that recreational use will continue to increase in the Pasayten until restrictions on the number of visitors become necessary.

2.1.4 Mt. Baker-Snoqualmie Nat'l Forest Land and Resource Management Plan (1987)

The Mt. Baker-Snoqualmie National Forest (the Forest) contains 1.7 million acres of land on the west side of the Cascade Mountains from the Canadian border to a point southeast of Tacoma. The Forest borders the North Cascades National Park Complex on the west and south, but is not contiguous to the Ross Lake area.

In December 1987, the U.S. Forest Service issued a proposed management plan to provide management direction for the next 10 years. Because the Forest is not visible from Ross Lake, none of the guidelines in the forest are directly relevant. Out of almost 12,000 responses from the public on the draft management plan, only 71 mentioned areas adjacent to North Cascades National Park.

2.1.5 Statewide Comprehensive Outdoor Recreation Plan (1985)

The Statewide Comprehensive Outdoor Recreation Plan (SCORP) takes a broad look at recreational opportunities and needs in the state of Washington. The State is divided into 13 districts. Whatcom County, where Ross Lake is located, is included with Skagit County to form District #3.

The SCORP compared recreational needs within each district to the existing opportunities to determine overall recreation satisfaction. Table 2.2 shows the percent satisfaction for relevant recreational pursuits in District #3.

2.1.6 Scenic and Recreational Highway Program

State Route 20 from near the town of Lyman in Skagit County east over the Cascades to the town of Twisp in Okanogan County was designated a state Scenic and Recreational Highway in 1967. This portion of State Route 20 includes the segment that traverses the Ross Lake National Recreation Area. The Scenic and Recreational Highway program establishes a system in which motor vehicle funds are used for:

1. Acquisition of right-of-way necessary for highway operations.
2. Construction of the portion of the highway designed for vehicle use.
3. Exit and entrance roadways providing access to scenic observation points.
4. Safety rest areas.
5. Roadside landscaping.
6. Uniform signs designating features of the scenic highway.
7. Any additional costs of constructing and developing the scenic highways.

The Scenic and Recreational Highway designation allows the Washington Department of Transportation (DOT) more flexibility in designing highway pullouts. It also provides a means for controlling utilities in the DOT right-of-way; such as requiring telephone and power lines to be placed underground. Dot has the right to purchase scenic easements to protect the scenic values of the highway, but because of the high costs, this is rarely done. The primary method DOT uses to protect scenic values near Scenic and Recreational Highways is through the environmental review process embodied in the State Environmental Policy Act (Lund 1989 personal communication).

A portion of State Route 20 was also designated as the North Cascades Scenic Highway by Congress in 1984. The segment of SR 20 designated as a Scenic Highway is from the boundary of the Okanogan National Forest and the Ross Lake National Recreation Area east to the community of Early Winters. The area of influence for this designation extends up to the ridgetop on both sides of the highway. This designation requires the

U.S. Forest Service to manage the lands within the Scenic Highway boundaries to provide for recreational needs and maintain the scenic values for which the highway was designated. The Okanogan National Forest has included a specific section on Scenic Highway standards in its Proposed Land and Resource Management Plan for the Forest (USFS 1989). Scheduled timber sales and livestock grazing will be prohibited. Two new campgrounds, four new trails, a new visitor facility at Washington Pass, and other recreational improvements are planned for the future along this section of SR 20. Ross Lake is not visible from any portion of the North Cascades Scenic Highway.

2.2 EXISTING ROSS LAKE RECREATIONAL FACILITIES AND OPPORTUNITIES

2.2.1 Highway Overlooks

There are two highway overlooks on State Route 20 with a view of Ross Lake. The overlooks are within a quarter of a mile of each other on the westbound side of SR 20, and are just a few miles east of the Happy Flats parking area above Ross Dam. The total capacity of both overlooks is about 7 to 8 vehicles at any one time. Both sites provide visitors with a view of Ross Lake over Ruby Arm and have small signs interpreting the vista.

2.2.2 Ross Lake Resort

Ross Lake Resort is a series of 14 floating cabins tied together about one-half mile from Ross Dam. There are two commonly used means of access to the Resort. Visitors can hike down from the Happy Flats trailhead to the Dam with their belongings. From the Dam they can either continue up the Big Beaver trail to the Resort junction, or they can be picked up by boat and ferried over to the Resort. The other option for getting to the Resort is to be taken by boat up Diablo Lake to the Ross Powerhouse and be taken by truck to the Dam and then loaded on a boat.

Visitors to the Resort can rent canoes, kayaks, or power boats to explore Ross Lake. In addition, a ramp allows resort visitors to use the Ross Dam-Big Beaver trail for day hikes. Reservations for overnight visits to the Resort are required and the Resort is usually booked up from Memorial Day through Labor Day. The National Park Service has authorized expansion of the Resort from 14 to 18 units in the future.

2.2.3 Campgrounds

The four categories of campgrounds on Ross Lake are: car boat, horse, and hiker. Hozomeen campground at the north end of the lake is the only car campground. Boat, horse, and hiker camps are spread around the lake on both east and west shorelines (See Figure A). Some boat camps such as Ten-Mile Island and Cougar Island are only accessible by boat; whereas other boat camps such as Little and Big Beaver share available camping sites with hikers.

2.2.3.1 Hozomeen

Hozomeen campground on the U.S.-Canadian border at the north end of Ross Lake is the only campground on the lake accessible by automobile, and offers the only spot on Ross Lake where a visitor can launch a power boat. Car counts taken near the border from 1984 through 1988 show that an average of over 5,400 vehicles enter the Hozomeen area between May and October (See Table 2.3). Hozomeen campground is the focus for most of the activity on Ross Lake. Many visitors to Ross Lake start their trip at Hozomeen and then boat down the lake to other campsites.

There are few visitor amenities at Hozomeen. Individual camp sites have picnic tables and fire pits, but no power hookups or individual water sources and there are no showers at Hozomeen. Communal water spigots are available and must be shared by all campers.

2.2.3.2 Boat campgrounds

There are presently 17 boat campgrounds on Ross Lake. Ponderosa, Dry Creek, Ten-Mile Island, and Roland Point camps do not have boat docks. The number of sites available for camping at each individual camp varies from 1 to 7, and some boat camps such as Little and Big Beaver, Lightning Creek, and Green Point share campsites with hikers (See Table 2.5). Most camps have picnic tables, outhouses, and flat, cleared areas for tents.

2.2.3.3 Hiker campgrounds

There are seven campgrounds near water level and three camps up in the mountains surrounding Ross Lake for hikers. As mentioned previously, four of the hiker camps share available space with boaters. Backcountry hiker camps such as those at Desolation and Sourdough are more primitive than camps at lake level. Individual tent sites are typically hidden from other sites and a simple, "throne-like" toilet known as a Wallowa toilet replaces the outhouse structure found at camps near the lake.

2.2.3.4 Horse campgrounds

There are six established horse campgrounds near Ross Lake. Except for the Big Beaver Horse camp, all sites are on the east side of the lake. With the exception of the Jack Mountain horse camp above Ruby Arm, all horse camps on the east side are distributed along the East Bank trail. In addition to tent sites, horse camps provide hitch rails to tie up horses. Because of horse use, more of the natural forest understory in the camps is trampled leaving relatively large denuded areas.

2.2.4 Trails

There are over 60 miles of trail in the Ross Lake National Recreation Area. Table 2.4 shows the mileage between destination points.

The trail experience in the Ross Lake National Recreation Area varies from an intimate walk through the forest, to the exposed paths through the subalpine meadows of the upper mountains. Both the Big Beaver and East Bank trails are predominantly level; whereas the trails up to Sourdough and Desolation Lookouts are considered by most hikers as relatively steep. In addition to the trails around Ross Lake, the Little and Big Beaver trails continue away from the lake into the National Park, and three trails lead from the East Bank trail into the Pasayten Wilderness.

Trails are grouped into four major categories based on grade, clearance, tread bench dimensions, radius of switchbacks, and other factors. The East Bank and Big Beaver trails are categorized as all-purpose trails which are developed to accommodate horse use. The Desolation and Sourdough trails are classified as foot trails because they are steeper, have less clearance around the trail tread, and have tighter switchbacks. The use of stock is limited to the East Bank and Big Beaver trails.

2.3 LEVELS AND PATTERNS OF RECREATIONAL USE

All data for the following section were provided by the National Park Service.

2.3.1 National Park Complex

The pattern of use in the North Cascades National Park and Ross Lake National Recreation Area on an annual basis is largely governed by the accessibility of the area. During the winter months, the North Cascades Highway is closed to through traffic, usually at Thunder Arm on Diablo Lake immediately past the entrance to the Colonial Creek Campground. The highway normally closes in November and opens in April. The actual dates vary each year with the severity of the winter.

Recreational activity is concentrated during the summer months of June, July, and August, with virtually all recreation occurring in the May through October period. Tables 2.6, 2.7, and 2.8 show the total number of backcountry users in the Park Complex and the percentage distribution of use by month and selected periods. Ross Lake campgrounds, except Hozomeen, are included in these tables with other backcountry campgrounds.

The average size of backcountry parties in the park complex is about three persons, and the average length of stay is between two and one-half and three nights. Tables 2.9, 2.10, and 2.11 show the overall park complex backcountry use, size of backcountry parties, and the length of stay in the backcountry.

The majority of backcountry users in the Park (over two-thirds) originate in the Puget Sound area of Washington state. Other major sources of Park users are eastern Washington and other states on the west coast. Table 2.12 shows the origin of backcountry users as a percentage of total backcountry use.

2.3.2 Highway Overlooks

Traffic on the North Cascades Highway is highly seasonal and generally follows the pattern of use for the entire park complex. Table 2.13 shows traffic counts for the highway nearest Ross Lake. Counts for traffic using the two Ross Lake overlooks are not available. Limited observations made at the overlooks suggest that the average length of stay for motorists who stop is between five and ten minutes, and that approximately 6% of passing cars stop.

2.3.3 Ross Lake Resort

Use of the Ross Lake Resort is concentrated during the summer months of July, August, and September. Table 2.15 shows total visitation at the resort in visitor nights for 1984 to 1988. Much of the resort use is oriented towards fishing on the lake. Presently the resort is open for the same period as the fishing season on the lake; about June 16th to October 31st. Resort operators indicated that opening day is their busiest time, for both lodging and boat rentals.

Boating activity on Ross Lake occurs mainly in the June through September period. Table 2.16 shows boating use by type on Ross Lake May to October for 1984 through 1985. Boating activity is approximately two-thirds power boats and one-third non-power boats. Non-power boating is heaviest in August, while power boating is more evenly distributed through the summer months.

Although numerical data are not available, observations and anecdotal accounts indicate that a very large portion of the boat activity is related to fishing. The opening day of fishing season, normally the third Saturday in June, is typically very busy. Non-power boating appears less related to fishing than does power boating.

2.3.4 Ross Lake Campgrounds

As with other areas in the park complex, Hozomeen campground is used primarily in the summer months of June, July, and August. The campground is open throughout the year, but in winter, access is restricted to snowmobiles or four-wheel-drive vehicles. Tables 2.17 and 2.18 show recreational vehicle and tent use at the Hozomeen campground in visitor nights from 1984 to 1988.

Tables 2.19, 2.20, and 2.21 show average, total, and percent distribution of backcountry campsite use by user type and month for 1981 through 1988. Activity at backcountry campgrounds on Ross Lake is also concentrated during the same three summer months for all user types (hikers, horse-packers, and boaters). Of the three types of backcountry users, boaters are clearly dominant with over 75% of the total persons and nearly 80% of the total visitor nights. Hikers are the other type of user present in substantial numbers, accounting for approximately 20% of the total use. Horse packers account for less than 2% of total persons or visitor nights.

A comparison of the percent distribution of persons and visitor nights (Table 2.21.) reveals that in June there are relatively more visitor nights than persons, indicating a longer than normal length of stay. Conversely, in August there are relatively more persons than visitor nights, showing shorter trips during this month. During other months the percent distribution of persons and visitor nights is relatively balanced.

Backcountry campsite use at Ross Lake is heaviest at Little Beaver, Big Beaver, Lightning Creek and Cat Island campgrounds. In keeping with the general distribution of activity, boaters are the principal user type at these campgrounds (Cat Island can only be reached by boat). Campgrounds with the least amount of use are Sourdough, Ruby Point (horse use only), Pumpkin Mountain, Jack Mountain, and Desolation. Use of the other campgrounds is relatively evenly distributed. Tables 2.22, 2.23 and 2.24 show recreational use at Ross Lake backcountry campgrounds.

2.4 EFFECTS OF LAKE LEVELS ON RECREATIONAL USE

Due to Seattle City Light operations at Ross Dam, the surface elevation of Ross Lake annually rises and falls. The highest annual elevation of 1602.5 ft above sea level (termed "full pool") occurs in the summer months. The surface elevation drops in the fall and winter reaching the lowest annual level in late March or April, after which the lake rises back to full pool. The lowest annual surface elevation is typically between 70 and 125 ft below full pool. The level of Ross Lake can affect recreational use in two ways; directly, by altering the ease-of-use or availability of a recreational facility or opportunity, or indirectly, by altering the desirability of the area for recreational use. Because recreational use is normally seasonal, as are the lake levels, direct evaluation of their influence on recreational use from existing patterns of use is problematic.

Existing patterns of recreational use and lake levels provide some evidence that can be examined for potential interaction. During July and August Ross Lake is essentially at full pool in any year and varies in average elevation by less than 2 ft. However, recreational use (as shown in Tables 2.15 through 2.26) varies considerably. This difference between the two months in recreational activity is statistically significant (difference in mean visitor nights yields $P0 < 0.02$), and shows that in this period use varies independently of lake levels.

During May, June, and September recreational activity is present and Ross Lake varies in elevation. In May and September, there is no association or significant correlation between lake levels and visitor nights at Ross Lake campgrounds. In June, there is a statistically significant ($P0 < 0.09$) inverse association. In other words, there were fewer visitor nights in June at Ross Lake campgrounds during years when the lake was filling more rapidly. Association, however, does not necessarily imply causation. The most likely explanation for this relationship between lake levels and recreation is that the lake would be higher during years with higher rainfall, when backcountry use would be less attractive.

Boating on Ross Lake is essentially the only recreational activity directly affected by lake levels. Hiking is affected only to the extent that low lake levels inhibit access to trailheads like Little Beaver. At 1,567 ft, the government landing south of Hozomeen campground becomes usable. Below this elevation, no public boat access to the lake is available.

Boat ramps for campgrounds on Ross Lake become useable at varying lake levels. In general, most ramps are floating at 10 ft below full pool, 1592. Below this elevation boats are beached below the docks. This makes use of the campgrounds more difficult, since supplies and equipment must be carried over the often rough and rocky shoreline. However, an examination of lake elevation and backcountry visitor nights on opening day of the fishing season for 1981 through 1987 shows no significant correlation between the level of the lake and the amount of recreational activity.

Indirect effects on recreational activity result from changes in the desirability of the lake. These changes are primarily aesthetic in nature, and are due to drawdown area decreasing the visual quality of the area. A complete discussion of the effects of lake levels on visual quality is contained in Section 3 of this study. Lower lake levels and correspondingly lower visual quality could influence recreational users' location choice, resulting in less activity in late spring and early summer than might otherwise occur. Existing patterns of activity and lake levels show that the large majority of recreational users are on or near the lake at close to full pool conditions. Table 2.25 shows the percent of backcountry users present at different lake levels, and Figures 2.1, 2.2, 2.3, and 2.4 show the relationship between average use and lake levels. Over 90% of the users see or use the lake within 7.5 ft of full pool. Less than 8% of the users are present when the lake is more than 10 ft below full pool and the floating docks are not useable.

Table 2.1. Designated and potential wilderness acreage of the North Cascades National Park Complex.

Areas	Gross Acres	Wilderness	Percent Wilderness	Potential Wilderness[a]
North Cascades NP	505,000	504,614	99%	226
Lake Chelan NRA	62,000	56,000	90%	0
Ross Lake NRA	117,000	74,000	63%	5,000
Total	684,000	634,614	93%	5,226

Source: National Park Service 1989.
[a]Additional area that could be designated and managed as wilderness as determined by the National Park Service.

Table 2.2. Percent satisfaction by recreational activity in District #3.

Activity	% Satisfaction[a]
Backpacking	91
Boating	93
Camping	100
Day Hiking	65
Picnicking	100

Source: Statewide Comprehensive Outdoor Recreation Plan 1985.

[a]% Satisfaction = (opportunities/need)*100.

Table 2.3. Road counts at the U.S. - Canada border at Hozomeen, May to October, 1984 - 1988.

Month	1984	1985	1986	1987	1988
May	15	0	47	80	0
June	672	1,247	1,074	1,008	1,275
July	1,531	1,737	1,674	1,762	1,477
August	1,055	986	1,611	1,364	1,072
September	1,286	339	1,020	1,113	1,051
October	651	630	750	719	81
Total	**5,210**	**4,939**	**6,176**	**6,046**	**4,956**

Source: Data supplied by National Park Service 1989.

Table 2.4. Approximate trail mileage between destination points within the Ross Lake National Recreation Area.

From	To	Mileage	Trail Type
Ross Dam	Big Beaver Camp	6	Foot, horse
Big Beaver Trail	Sourdough	7	Foot
East Bank Trail	Jack Mountain Camp	6	Foot, horse
East Bank Trail	Lightning Creek Camp	15	Foot, horse
Lightning Creek Camp	Desolation Camp	7	Foot
Lightning Creek Camp	Hozomeen Camp	15	Foot, horse

Table 2.5. Number of camping sites available at specific hiker, horse, and boat campgrounds on Ross Lake.

Campground	Sites	Campground	Sites
Hiker		**Boat**	
Little Beaver	6	Silver Creek	4
Big Beaver	7	Boundary Bay	3
Pumpkin Mountain	2	Little Beaver	*
Green Point	7	Cat Island	6
East Bank Zone	9	Lightning Creek	*
Jack Mountain	3	Ponderosa	2
Lightning Creek	6	Dry Creek	4
Desolation	2	Ten-Mile Island	3
Hozomeen Lake	5	Devils	1
Pierce Mountain	2	Rainbow Point	3
		May Creek	1
Horse		Spencer's	2
Big Beaver	1	McMillan	3
Ruby Pasture	1	Roland Point	1
May Creek	1	Big Beaver	*
Devils	2	Cougar Island	3
Lightning Creek	3	Green Point	*
Jack Mountain	1		

*Number of camping sites included in the hiker camp total.

Table 2.6. Number of backcountry users in North Cascades National Park Complex by month, May through October, 1981 - 1988.

Month	1981	1982	1983	1984	1985	1986	1987	1988
May	607	515	432	341	224	345	297	319
June	1143	1507	1276	1098	1060	1256	1229	1079
July	3242	3025	3230	2736	3006	2769	2881	3138
August	3870	4475	3918	4101	3681	4164	4199	4027
Sept.	1768	1976	1184	1191	742	863	1240	1577
October	87	186	80	64	81	267	0	253

Table 2.7. Backcountry use (number of people) in North Cascades National Park Complex as a percentage of annual backcountry use by month, May through October, 1981 - 1988.

Month	1981	1982	1983	1984	1985	1986	1987	1988
May	5.5	4.4	4.3	3.5	2.5	3.5	3.0	3.1
June	10.4	12.8	12.6	11.3	12.0	12.7	12.3	10.3
July	29.4	25.7	31.8	28.3	33.9	28.2	28.9	30.0
August	35.1	38.0	38.5	42.4	41.6	42.4	42.1	38.5
Sept.	16.0	16.8	11.6	12.3	8.4	8.8	12.4	15.1
October	0.8	1.6	0.8	0.7	0.9	2.7	0.0	2.4
Total	97.2	99.3	99.6	98.5	99.3	98.4	98.8	99.4

Table 2.8. Percentage of annual backcountry use (number of persons) occurring during selected monthly periods, 1981 - 1988.

Year	May - October	June - September	June, July August
1981	97.2	93.6	77.1
1982	99.3	95.3	77.7
1983	99.6	96.3	84.4
1984	98.5	95.9	83.8
1985	99.3	96.9	87.1
1986	98.4	92.1	83.3
1987	98.8	95.8	83.3
1988	99.4	93.9	78.8

Table 2.9. Annual backcountry use in North Cascades National Park Complex, 1981 - 1988.

Year	# of Parties	# of People	Average Size	Average Stay	Visitors Nights
1981	3,731	11,032	3.0	2.7	31,467
1982	3,906	11,771	3.0	2.6	32,574
1983	3,390	10,164	3.0	2.7	29,362
1984	3,331	9,679	2.9	2.5	25,975
1985	3,076	8,858	2.9	2.5	23,798
1986	3,393	9,815	2.9	2.6	27,094
1987	3,452	9,969	2.9	2.6	28,090
1988	3,628	10,459	2.9	2.6	29,711

Table 2.10. Size of parties using backcountry camps in the North Cascades National Park Complex as a percentage of total backcountry use, 1981 - 1988.

# of People	1981	1982	1983	1984	1985	1986	1987	1988
1	12.6	12.5	12.5	12.9	12.9	13.1	14.1	14.3
2	50.4	47.5	49.5	50.1	50.9	51.8	49.6	50.5
3	12.8	14.0	13.8	13.1	13.4	12.3	13.9	12.3
4	10.7	11.6	11.3	11.0	10.3	10.3	10.1	10.1
5	3.5	4.0	3.5	3.8	3.3	3.4	3.4	3.9
Over 5	9.8	10.9	9.2	7.7	9.1	8.9	8.8	8.7
Not given	0.3	0.3	0.1	0.2	0.1	0.1	0.1	0.0

Table 2.11. Length of stay in backcountry camps for the North Cascades National Park Complex as a percentage of total backcountry use, 1981 - 1988.

# of Nights	1981	1982	1983	1984	1985	1986	1987	1988
1	29.7	32.0	29.7	34.6	32.5	31.5	28.4	21.1
2	28.8	27.0	28.7	29.2	27.7	29.3	28.8	26.7
3	14.1	15.0	13.2	13.6	16.6	14.3	15.7	15.9
4	9.0	9.3	9.5	7.2	8.3	8.2	9.5	9.2
5	6.4	6.0	6.6	5.0	5.9	5.1	5.5	4.5
6	5.1	4.3	5.2	3.9	3.5	4.0	3.7	4.0
7	3.3	2.5	3.1	2.6	2.1	2.8	3.4	2.9
Over 7	3.3	3.8	3.8	3.9	3.3	4.3	3.9	4.7
Not given	0.3	0.1	0.0	0.0	0.1	0.6	1.1	0.0

Table 2.12. Origin of backcountry users as a percentage of total backcountry use, 1981 - 1988.

Location	1981	1982	1983	1984	1985	1986	1987	1988
City of Seattle	25.3	25.0	22.0	23.7	23.9	26.0	23.2	25.4
Other King Cty/Edmonds	17.4	17.9	18.6	18.1	18.9	17.6	18.1	17.0
City of Tacoma	2.2	2.0	2.7	2.1	2.1	2.4	2.0	1.5
Snoho./Skagit/Whatcom	19.9	19.4	16.8	20.5	20.3	20.5	21.4	20.9
Oly.Pen./Thurston/Pierce	5.2	4.6	6.7	5.0	5.1	4.6	6.1	4.8
Yakima/Ellensburg	0.7	1.0	1.3	0.7	0.7	0.9	0.6	0.8
Chelan/Okanogan/Grant	7.0	5.3	7.2	5.8	5.5	5.8	6.1	8.2
City of Vancouver, WA	1.3	1.0	0.8	0.9	0.9	0.8	0.8	0.8
City of Spokane	1.3	1.4	1.2	0.9	1.3	1.3	1.2	1.0
Other Spokane area	0.3	0.3	0.3	0.2	0.3	0.4	0.3	0.4
Tri-Cities	1.6	1.7	0.9	1.1	0.8	1.2	1.1	0.7
Other eastern Washington	0.5	0.7	0.5	0.5	0.8	0.6	0.5	0.4
Oregon	3.3	4.3	5.0	3.8	3.7	3.9	3.5	3.3
California	3.3	3.1	3.2	4.1	2.7	2.9	3.0	2.9
Other states	6.3	6.2	6.4	5.9	7.3	6.7	7.3	7.3
Canada	2.5	1.6	3.6	4.2	3.7	0.0	0.0	0.1
Other foreign	0.4	0.2	0.2	0.2	0.0	0.6	0.4	0.4
Not Given	1.5	4.3	2.7	2.3	2.0	3.7	4.5	4.4

Table 2.13. Traffic counts and estimated passengers on North Cascades Highway, 1987.

	Vehicles		Passengers	
	Eastbound	Westbount	Eastbound	Westbound
April	5,625	1,473	14,063	3,683
May	21,628	12,912	54,070	3,2280
June	21,288	17,565	68,122	5,6208
July	31,084	21,323	99,469	6,8234
August	37,151	26,152	118,883	8,3686
September	29,600	20,731	94,720	6,6339
October	22,840	16,918	47,964	3,5528
November	11,337	8,225	23,808	1,7237

Traffic counters are located at approximately the western and eastern boundaries of the Ross Lake National Recreation Area.

Table 2.14. SR20 opening and closing dates at Colonial Creek and Early Winters.

Year	Opening	Closing
1989	April 21	
1988	April 20	Nov. 19
1987	April 15	Dec. 1
1986	April 11	Nov. 26
1985	April 12	Nov. 15
1984	April 04	Nov. 16
1983	April 20	Dec. 05
1982	May 06	Dec. 02
1981	April 24	Dec. 08
1980	April 18	Dec. 02
1979	April 10	Dec. 28
1978	April 21	Dec. 11
1977	no closure	Nov. 23
1976	May 21	no closure
1975	May 16	Nov. 24
1974	June 14	Nov. 22
1973	April 27	Nov. 21
1972		Nov. 26

Source: Brent Olson, Public Affairs, WSDOT

Table 2.15. Total visitation at Ross Lake Resort, May to October, 1984-1988, in visitor nights.

Month	1984	1985	1986	1987	1988
May	0	0	0	0	0
June	446	514	535	338	377
July	1,433	1,283	1,271	1,297	1,355
August	1,182	1,547	1,378	1,423	1,433
September	1,380	1,034	1,225	1,309	1,338
October	791	697	742	856	867
Other Months	105	116	91	93	90
Yearly Total	5,337	5,191	5,242	5,316	5,460

National Park Service 1989.

Table 2.16. Power and non-power boat use on Ross Lake, May to October, 1984-1988.

	1984		1985		1986		1987		1988	
Month	NP[a]	P[b]	NP	P	NP	P	NP	P	NP	P
May	0	0	0	0	12	0	52	18	5	12
June	168	854	93	732	211	1,203	321	1,258	109	1,069
July	504	1,779	1,155	936	857	2,857	385	2,004	967	1,574
August	929	2,932	1,054	1,033	2,101	745	922	2,014	1,865	1,613
Sept.	590	2,024	198	272	315	1,404	738	1,872	730	1,850
Oct.	27	744	11	392	16	723	61	1,112	8	752
Yearly Total	2,218	8,414	2,556	3,516	3,512	7,059	2,494	8,430	3,698	6,938

[a] Total non-power boats per month
[b] Total power boats per month

Table 2.17. Recreational vehicle use at Hozomeen campground between May and October, 1984 - 1988, in visitor nights.

Month	1984	1985	1986	1987	1988
May	31	0	20	62	0
June	2,976	5,405	2,166	2,118	2,117
July	4,342	6,262	2,970	3,722	1,907
August	3,232	2,838	2,381	3,187	1,742
September	2,301	1,869	1,256	1,541	1,336
October	972	726	1,027	1,035	865
Other Months	267	130	128	166	108
Yearly Total	14,121	17,230	9,948	11,831	8,075

Table 2.18. Tent use at Hozomeen campground between May and October, 1984 - 1988, in visitor nights.

Month	1984	1985	1986	1987	1988
May	23	0	44	34	0
June	1,226	1,120	768	790	666
July	1,738	1,603	1,334	1,117	876
August	1,635	1,386	1,690	2,138	1,061
September	541	450	629	552	439
October	104	114	185	158	145
Other Months	21	48	20	13	11
Yearly Total	5,288	4,721	4,670	4,802	3,198

Table 2.19. Average Ross Lake backcountry use per campsite by user type and month, 1981 - 1988.

	Hike		Horse		Boat	
	Persons	Visitor Nights	Persons	Visitor Nights	Persons	Visitor Nights
May	86	148	1	2	51	85
June	171	285	18	36	587	1,422
July	369	523	17	22	1,465	2,501
August	524	649	37	45	2,119	2,981
Sept.	145	194	10	20	18	28
October	13	18	0	0	18	28

Table 2.20. Total Ross Lake backcountry use by user type and month, 1981 - 1988.

	Hike		Horse		Boat		Total	
	Persons	Visitor Nights	Persons	Visitor Nights	Persons	Visitor Nights	Persons	Visitor Nights
May	689	1,182	10	18	408	678	1,107	1,182
June	1,370	2,276	144	291	4,698	11,379	6,212	13,946
July	2,948	4,184	139	177	11,720	20,011	14,807	24,372
August	4,194	5,189	295	358	16,948	23,845	21,437	29,392
September	1,163	1,550	81	160	1,163	5,190	4,146	6,900
October	105	144	1	2	146	224	252	370
Total	10,469	14,525	670	1,006	35,083	61,327	47,961	76,162

Table 2.21. Percent of Ross Lake backcountry use by user type and month, 1981 - 1988.

	Hike		Horse		Boat		Total	
	Persons	Visitor Nights	Persons	Visitor Nights	Persons	Visitor Nights	Persons	Visitor Nights
May	1.44	1.54	0.02	0.02	0.85	0.88	2.31	2.44
June	2.86	2.96	0.30	0.38	9.80	14.81	12.95	18.15
July	6.15	5.44	0.29	0.23	24.44	26.04	30.87	31.71
August	8.74	6.75	0.62	0.47	35.34	31.02	44.70	38.24
September	2.42	2.02	0.17	0.21	6.05	6.75	8.64	8.98
October	0.22	0.19	0.00	0.00	0.30	0.29	0.53	0.48
Total	21.83	18.90	1.40	1.31	76.78	79.79	100.00	100.00

Table 2.22. Average persons and visitor nights per month (May - October) by user type and campground, 1981 - 1988.

	Hiker		Horse		Boat	
	Persons	Nights	Persons	Nights	Persons	Nights
Big Beaver	389	504	16	23	469	742
Boundary Bay					223	351
Cat Island					438	918
Cougar Island					305	419
Devils			14	18	132	200
Desolation	14	19				
Dry Creek					192	392
East Bank[a]	325	483				
Green Point	28	33			275	328
Hozmeen Lake	135	232				
Jack Mountain	15	32	3	6		
Lightning Creek	89	128	19	32	404	755
Little Beaver	217	269			449	816
May Creek			6	10	136	252
McMillan					260	384
Ponderosa					210	295
Pumpkin Mnt	69	87				
Rainbow Point					252	394
Roland Point					128	188
Ruby Point			6	9		
Silver Creek					237	346
Sourdough	51	67				
Spencers					210	433
Ten Mile Island					282	434

[a] Includes use of the following camps by hikers: Ruby Pasture, Hidden Hand, Roland Creek, Devils Creek, May Creek (horse), Devils Creek (horse).

Table 2.23. Average persons in Ross Lake backcountry campgrounds by location and month, 1981-1988.

	May	June	July	August	September	October
Big Beaver	29	105	257	374	101	6
Boundary Bay	1	28	69	118	7	0
Cat Island	3	61	146	186	45	2
Cougar Island	5	35	102	132	30	1
Devils	2	21	53	58	14	0
Desolation	0	1	3	7	2	0
Dry Creek	1	29	45	92	12	0
East Bank[a]	25	52	91	119	31	5
Green Point	4	28	83	169	13	2
Hozomeen Lake	22	32	39	33	10	0
Jack Mountain	1	2	5	5	5	0
Lightning Creek	10	58	157	240	39	2
Little Beaver	8	88	201	308	61	5
May Creek	2	18	50	51	17	2
McMillan	4	39	75	129	14	0
Ponderosa	0	20	75	113	2	0
Pumpkin Mnt	4	8	20	27	9	0
Rainbow Point	3	32	82	109	28	1
Roland Point	1	17	42	54	13	1
Ruby Point	0	2	1	3	0	0
Silver Creek	4	28	81	112	10	0
Sourdough	2	5	12	20	11	1
Spencers	5	29	65	92	18	3
Ten Mile Island	4	30	98	124	26	1

[a] Includes use of the following camps by hikers: Ruby Pasture, Hidden Hand, Roland Creek, Devils Creek, May Creek (horse), Devils Creek (horse).

Table 2.24. Average persons in Ross Lake backcountry campgrounds by location and month, 1981-1988.

	May	June	July	August	September	October
Big Beaver	43	200	392	477	148	8
Boundary Bay	1	61	138	138	12	0
Cat Island	5	174	298	354	89	3
Cougar Island	7	71	137	162	42	1
Devils	3	41	73	81	23	0
Desolation	1	2	3	7	5	1
Dry Creek	1	128	111	131	32	1
East Bank[a]	47	96	135	151	44	7
Green Point	6	45	102	186	16	2
Hozomeen Lake	44	54	64	56	14	0
Jack Mountain	2	2	9	8	12	1
Lightning Creek	18	163	309	344	85	3
Little Beaver	9	214	322	438	100	8
May Creek	0	2	2	7	4	0
McMillan	6	77	112	141	23	0
Ponderosa	0	29	108	148	3	1
Pumpkin Mnt	4	10	29	32	11	0
Rainbow Point	4	49	135	165	42	1
Roland Point	2	28	59	78	19	1
Ruby Point	0	4	1	3	0	0
Silver Creek	8	66	116	137	15	0
Sourdough	3	6	17	247	278	87
Spencers	14	101	139	153	36	5
Ten Mile Island	6	74	146	172	40	1

[a] Includes use of the following camps by hikers: Ruby Pasture, Hidden Hand, Roland Creek, Devils Creek, May Creek (horse), Devils Creek (horse).

Table 2.25. Percent of Ross Lake backcountry users by lake level.[a]

Feet Below Full Pool	Percent of Backcountry Users
0.0 - 2.5	75.04
2.5 - 7.5	14.97
7.5 - 12.5	3.92
12.5 - 17.5	2.10
17.5 - 22.5	0.72
22.5 - 27.5	0.34
27.5 - 32.5	0.36
32.5 - 37.5	0.61
37.5 - 42.5	0.75
42.5 - 47.5	0.68
47.5 - 52.5	0.09
52.5 - 57.5	0.14
57.5 - 62.5	0.16
62.5 - 67.5	0.12
67.5 - 72.5	0.0

[a]Lake elevations are based on the 1978 - 1988 average. Backcountry use is average monthly visitor nights at backcountry campgrounds for 1981 through 1988.

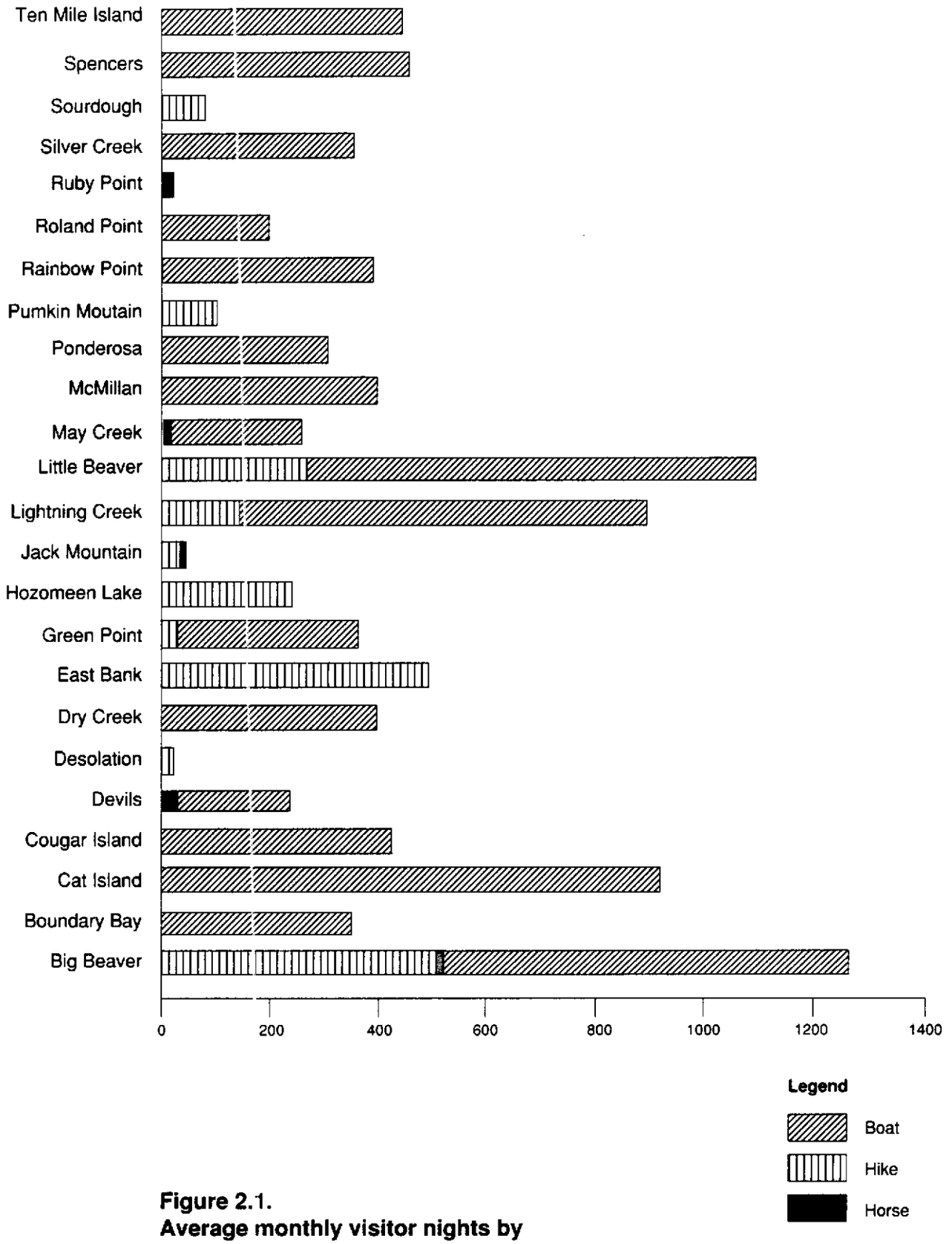


Figure 2.1.
Average monthly visitor nights by location and user type.

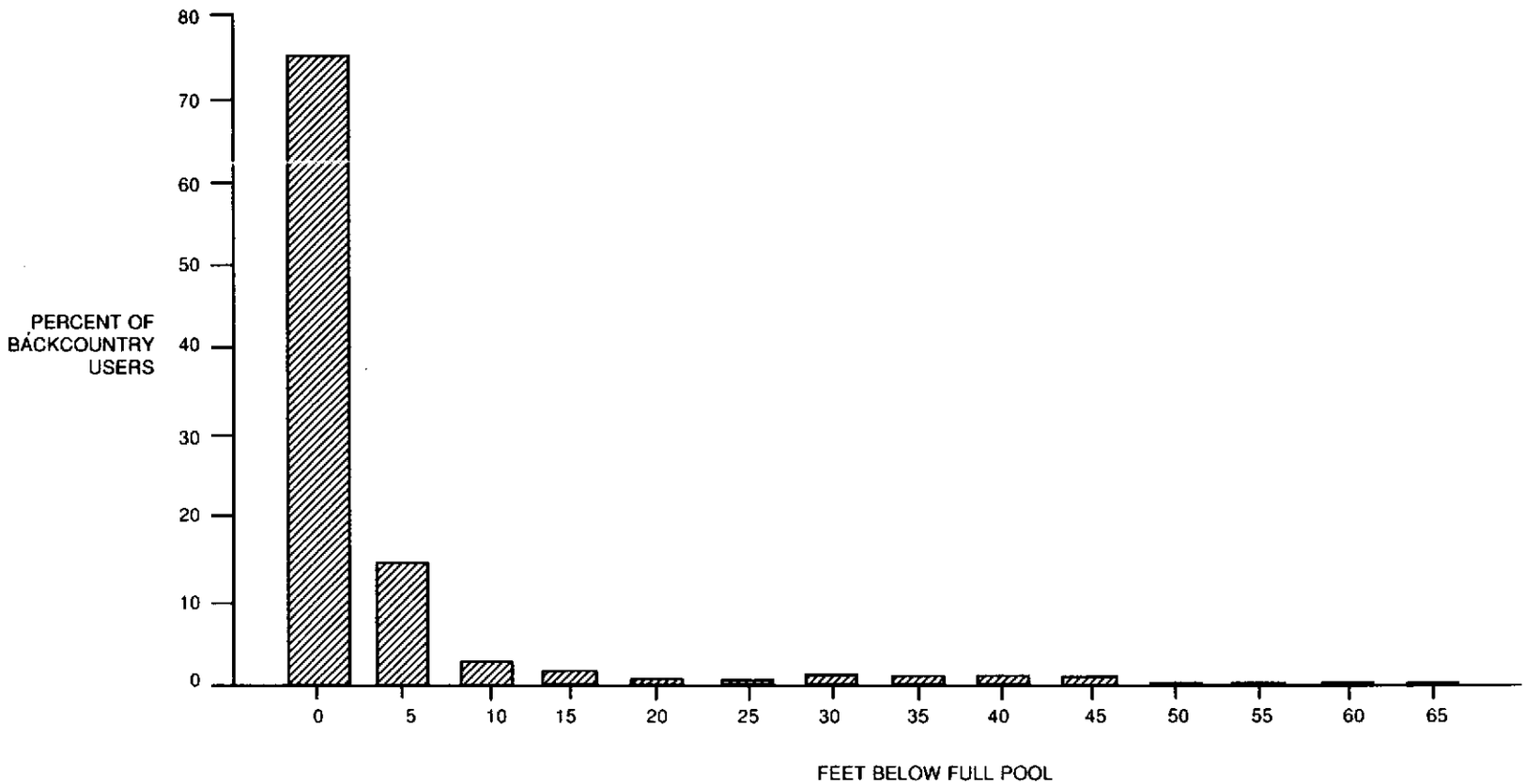
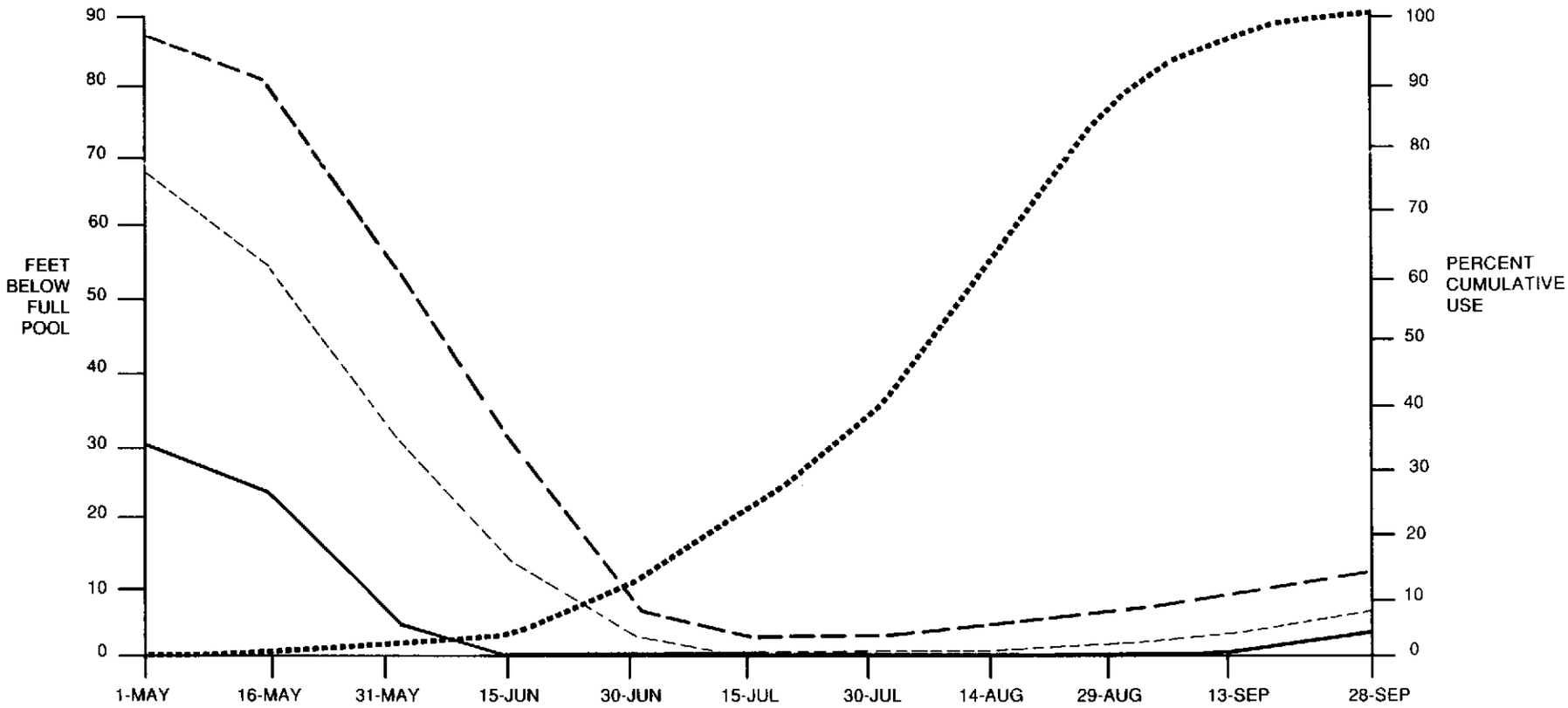


Figure 2.2.
Percent of National Park Backcountry Users by Feet Below Full Pool



NOTE: May through September data - represents 99.5% of entire use

Legend

- Backcountry Use (1981-1988)
- Minimum Lake Level (1978-1986)
- Average Lake Level (1978-1986)
- Maximum Lake Level (1978-1986)

Figure 2.3.
Feet below full pool and cumulative National Park backcountry use by date.

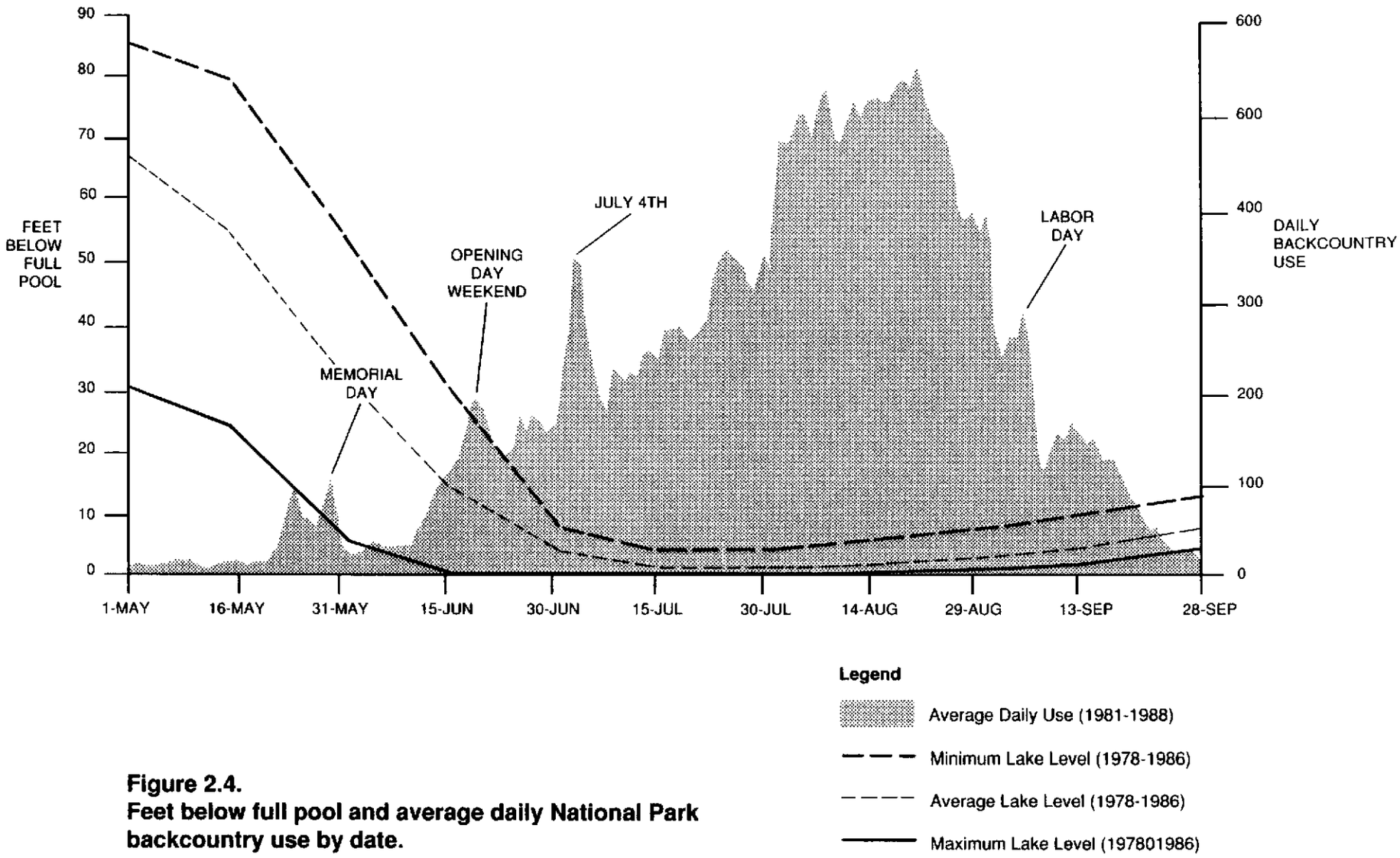


Figure 2.4.
Feet below full pool and average daily National Park backcountry use by date.

3. VISUAL QUALITY

3.1 GOAL AND METHODOLOGY

The goal of this study was to assess the effect of different Ross Lake reservoir levels on the visual quality of the lake and its surroundings. Ross Lake is located in a deep valley amid the Cascade Mountains in northern Washington State. The surrounding terrain is rugged, with steep-forested slopes rising to alpine meadows and glaciers topped by rocky peaks. The lake and adjacent area comprise the Ross Lake National Recreation Area, which the National Park Service manages as part of the North Cascades National Park Complex. Recreational use of the lake and surrounding areas includes boating, fishing, camping, hiking, and horse packing. State Route 20, a major east-west road through the Cascades, runs along the south side of the lake. Here, motorists view the lake and surroundings from their cars and from overlooks along the road. The largely unmodified, natural appearance of the area contributes to its high scenic quality and recreational value.

Due to Seattle City Light operations at Ross Dam, the surface elevation of Ross Lake annually rises and falls. The highest annual elevation of 1602.5 ft above sea level (termed "full pool") occurs in the summer months. The surface elevation drops in the fall and winter reaching the lowest annual level in late March or April, after which the lake rises back to full pool. The lowest annual surface elevation is typically between 70 and 125 ft below full pool. Falling lake levels expose an unvegetated shoreline that can contrast visually with the surrounding terrain. Where this contrast exists, it diminishes the visual quality of the lake and surroundings. As part of the Federal Energy Regulatory Commission (FERC) relicensing process for the Skagit Project, Seattle City Light is investigating the feasibility and effects of varying Ross Dam operations to modify the annual cycle of Ross Lake levels. As a first step in this investigation, this study documents the effect of different lake levels on the visual quality of the lake and its surroundings.

This study analyzed visual quality through a four-step process:

- Identification of viewsheds and viewpoints surrounding Ross Lake
- Selection of ten representative viewpoints for analysis
- Photographic and video documentation of four different lake levels from the ten viewpoints
- Visual quality rating of the lake and surroundings using various indices (see Section 3.2.6.4 for a description of these indices).

3.2 ANALYSIS AND RESULTS

3.2.1 Viewsheds

The overall viewshed of Ross Lake is the area containing all points from which a person could see the lake. Accordingly, the viewshed is where potential visual quality impacts may occur due to changing lake levels. The Ross Lake viewshed generally extends from the lake to the high ridges surrounding the lake.

This report includes two viewshed maps. The first, Figure B, shows the overall or "theoretical" viewshed. Mapping of the overall viewshed does not take account of vegetation, minor irregularities in topography, and, most importantly, the fact that most of the area within the overall viewshed is very rarely visited by humans.

The second viewshed map, Figure C, takes into account the actual distribution of human visitation in relation to seasonal change in lake levels. This map of the "actual" viewshed shows areas that are commonly visited when lake levels are below full pool. These areas include campgrounds and portions of trails and roads where visitors have views of Ross Lake.

3.2.2 Landscape Subdivisions

The fundamental subdivisions of the landscape around Ross Lake are: lake, forest, alpine area, and sky. Each has its characteristic lines, colors, and textures, and each contributes to the broad forms that dominate most views.

Each fundamental landscape subdivision can be further divided. For example, the lake can be divided into coves (east of Roland Point, east of Dry Creek), arms (Ruby Arm, Lightning Creek mouth), and the main body of the lake. Each of these lake divisions has a separate visual character. Coves offer viewers highly textured intimacy, arms are linear, steep-sided, and typically dark, and broad forms and distant vistas dominate in views over the main lake.

Similarly, forests can be divided into those that are predominantly deciduous and those that are coniferous. Deciduous forest areas, typically developed in riparian area and on avalanche slopes, are light green in the spring and summer and yellow and red in the fall. Coniferous forest areas are a somber green. Alpine areas contain meadows, snow, and rock divisions.

Weather, time of day, and season affect the visual character of each of these areas, which together create the overall visual character of the Ross Lake area that is described in Section 3.2.5.

3.2.3 Viewpoints

Views of Ross Lake are available from State Route 20, trails in the vicinity of the lake, and at campgrounds around the lake. Viewpoints are shown on the second viewshed map, Figure C. Other viewpoints exist in the vicinity of Ross Lake, but are rarely visited. These include the higher areas on the peaks surrounding the lake and other areas lacking established access.

Boaters, hikers, and horse riders visit campgrounds around the lake. Hikers and horse riders travel along trails. Carcampers use Hozomeen, the only campground with vehicle access to the lake. Motorists are the primary visitors to viewpoints along State Route 20.

By far, the viewpoints that receive the highest number of visitors are Hozomeen Campground and viewpoints along State Route 20. These viewpoints receive several hundred to several thousand visitors per week during the summer. The numbers of visitors to Hozomeen Campground and the State Route 20 viewpoints are typically twenty or more times the number of visitors to other viewpoints around the lake, which do not have vehicle access. Because of severe weather state Route 20 is closed from about November through March of most years and those viewpoints of Ross Lake on this road are inaccessible to motorists during those months. Hozomeen Campground is open all year. However, use decreases significantly in winter.

3.2.4 Scenic Attractions and Scenic Background

Ross Lake is located in the North Cascades National Park Complex and adjacent to the Pasayten Wilderness, areas providing abundant recreational opportunities in a landscape unique in the 48 states. Within these mountainous areas, glaciers and rocky peaks stand above alpine meadows and forested valley sides providing a dramatic setting for the lake.

Ross Lake itself is a prime scenic attraction in the region. Fjord-like, it extends from Ross Dam sinuously northward for about twenty-five miles to just north of the International Boundary with Canada. Framed by green, forested slopes, the lake dominates most views in its vicinity. The broad expanse of the lake guides the viewer's gaze outward to the shoreline and surrounding peaks.

At and near full pool, the mouths of Lightning and Devils creeks, frames by narrow walls and arched by bridges of the East Bank Trail, are scenic attractions for boaters, hikers, and horse riders. Ruby Arm, a large scale version of lower Lightning and Devils creeks, attracts the attention of boaters and motorists along State Route 20. Several streams between Little Beaver and Big Beaver creeks flow into the west side of the lake as hanging waterfalls or steep cascades. These streams are visible from the East Bank Trail as well as the lake itself.

Jack Mountain rises 7,400 ft from the east side of the lower end of the lake and is the tallest peak in the area. The south and west sides of the mountain, visible from the lower end of the lake, are a mosaic of green forest and brown and reddish rock typical

of the relatively dry eastern side of the lake. By contrast, the north side of the mountain contains a high cirque (bowl-shaped hollow) and glacier visible from the upper end of the lake. This side of Jack Mountain is more typical of peaks west of the lake.

Just south of the International Boundary, the steep rock walls of multi-summitted Hozomeen Mountain stand close above the east side of the lake. The jagged, brown crags of Hozomeen are visible from many points along the lake and form a focal point for views from as far south as State Route 20.

Ruby Mountain, while not as distinctive as Jack or Hozomeen Mountains, rises from the south end of the lake and forms an important element of many southerly views. The north side of Sourdough Mountain, snow covered with striking cornices in spring and early summer, attracts the eye from Tenmile Island to Roland Point.

The Colonial Peak Group, a striking assemblage of pyramidal peaks set amongst glaciers, can be seen from the lower east side of the lake, and, more prominently, from the Ross Lake Resort in views over Ross Dam. The Picket Range, the jagged centerpiece of the north unit of North Cascades National Park, forms the distant background for views of the lake from high points on the east side of the lake, such as Desolation Peak.

3.2.5 Visual Character

3.2.5.1 General

The mountainous nature of the landscape and the generally dense, dominantly coniferous vegetation determines the visual character of Ross Lake and its surroundings. The level, even surface of the lake typically provides a visually placid counterpoint to the drama of the surrounding terrain. During storms and high winds, however, waves create movement accentuating the visual excitement of the mountains.

From most viewpoints around Ross Lake, the character of views is determined by natural elements. The lake and the surrounding mountains form broad, irregular masses that dominate the viewer's attention. Strong lines are formed at sky-land and land-lake boundaries. These lines are commonly irregular and horizontal overall, although the sky-land boundary has strong vertical components where steep slopes form the horizon.

From some viewpoints, the lake and lake trough form a lineal axis that draws the viewer's eye toward a distant focal point. A good example is the view north from the State Route 20 Overlook, where the lake and lake trough draw the eye toward Hozomeen Mountain standing near the International Boundary.

Colors are dominated by greens of coniferous and deciduous trees, dark grays to blacks of rock outcrops, blues of the sky, whites and light grays of clouds, snow, and cascading creeks, and various greens to gunmetal grays of the lake waters. Textures typically are coarse due to the dominance of broad masses. From some viewpoints, vegetation is visually significant and provides fine-scale texture. This is particularly the case for viewpoints at lake level.

At some locations, for example Ross Dam and Hozomeen Campground, existing man-made structures are important visual elements. These structures tend to be geometric in form with straight lines and, typically, add new colors to the landscape. Other views contains manmade elements, for example tables and docks. However, in these other views these elements are visually insubstantial.

3.2.5.2 Exposed Shoreline

When lake levels are below full pool, an unvegetated strip of shoreline is exposed around the lake. The exposed shoreline typically contrasts with the lake and its surroundings, although the degree of contrast varies. Where the exposed shoreline is covered by silt and stumps, the contrast is evident. Where the exposed shoreline is covered by rock outcrops or loose cobbles or boulders, the exposed shoreline typically appears as a natural continuation of the slopes above, and little contrast exists.

Where the exposed shoreline is covered with clay, silt, or sand, it is light tan in color. In these areas, minor shelves on the exposed shoreline slope create horizontal lines. The tan coloration and strong horizontal lines combine to make the exposed shoreline a dominant visual element at low pool levels.

At the upper end of the lake, where a large expanse of stump-covered mudflat is visible at low pool levels, the exposed shoreline forms a dominating element in views from Hozomeen Campground, other areas at the head of the lake, and Desolation Peak. Due to the shallow nature of the upper end of the lake, several hundred to several thousand acres of mudflat are exposed when the lake level falls more than about 15 ft below full pool.

Increasing distance diminishes the contrast of the exposed shoreline with the surrounding terrain. As the distance between the viewer and the shoreline increases, details that contribute to the contrast of the exposed shoreline (for example, stumps) become less apparent and the exposed shoreline itself becomes a smaller portion of the scene. In addition, as distance increases, intervening haze reduces color contrasts. The effect of distance is evident in the northwest view from Desolation Peak. At low lake levels, the exposed mudflat at the upper end of the lake is visible as a tan area that includes the meandering Skagit River. The exposed area is a small portion of the overall view, however, and the stumps, which command the viewer's attention from Hozomeen Campground, are not visible from this distance. Distance also ameliorates contrast as seen from Sourdough and, to a lesser extent, the SR20 overlook.

Some of the most dramatic changes in contrast occur over a day's time. When a stretch of exposed shoreline is in full sun, the contrast may be evident from a great distance. The contrast of that same stretch of shoreline with the surrounding slopes may be minimal in the early morning or late afternoon when the shoreline is in shadow.

In general, the exposed shoreline tends to contrast less in views that include significant manmade structures. The geometric form and straight lines of the exposed shoreline typically mimic the form and line of manmade structures. This relationship is especially evident in the vicinity of Ross Dam.

3.2.6 Visual Quality Assessment at Four Lake Levels

3.2.6.1 Lake Levels

The study analyzed four lake levels: a lowest feasible lake level, 1567 ft above sea level, 1592 above sea level, and full pool (1602.5 above sea level). The lowest feasible lake level was 1523-1528, when weather and logistics first allowed field work. The 1567 level is the level when the lake becomes accessible to boaters at Hozomeen Campground. However, weather and a rapidly rising lake level forced the postponement of field work until the lake level was 1577-1580. The level of 1592 was chosen because the majority of docks along the lake become usable at approximately that lake level. Full pool was chosen as the baseline against which the study would analyze other lake levels. At full pool, there is no contrasting exposed shoreline and the lake appears at its visually most "natural" condition.

3.2.6.2 User Groups

The Ross Lake area primarily supports recreational activities. The number of users of the Ross Lake area that are not directly engaged in recreational activities (for example, City Light or National Park employees) is comparatively insignificant. There are no permanent residents in the area. This report does not consider these non-recreational users and assumes that visual quality user groups are identical to recreational user groups.

The study identified five primary user groups: boaters, hikers, horse riders, carcampers, and motorists along State Route 20. The study combined powered and non-powered boaters into one category, because use data were only available for the combined category. This report does not consider a sixth user group, bicyclists along State Route 20, because use data for this group are not available. Study team observation indicates that the number of bicyclists is comparatively small, however, so the exclusion of this group was not considered significant.

3.2.6.3 Viewpoints

Ten viewpoints around Ross Lake were chosen as locations from which to photographically document changing lake levels. The study documented two separate vistas from five of the ten viewpoints, for a total of fifteen separate views around the lake. Figure D shows the viewpoints that were studied, as well as the direction and angle for the documentary photographs. Documentary photographs and analysis of the visual elements of each view are contained in Volume B.

The viewpoints provide a well-distributed and representative sample of the range of views of the lake. Motorists along SR-20 and carcampers each primarily view the lake from one viewpoint; the SR-20 overlook in the case of motorists and Hozomeen in the case of carcampers. The other eight viewpoints represent views seen by the other principal user groups - boaters, horse riders, and hikers. Table 3.1 gives the viewpoints and the groups that use them. The ten viewpoints also encompass the range of landscape types found in the Ross Lake area. Table 3.2 gives the viewpoints and landscape types seen from them.

3.2.6.4 Visual Quality Indices

Methodology

Factors that affect visual quality impacts include baseline visual quality (full pool conditions), contrast (of the exposed shoreline with the remainder of the scene in this case), duration of views, sensitivity of viewers, and number of viewers. The visual quality of the landscape as seen from different viewpoints varies throughout the Ross Lake area, although it is uniformly high.

The "natural" qualities of the Ross Lake area define its visual character. Therefore, viewers typically are aware that the exposed shoreline is the result of human activities. They commonly perceive the exposed shoreline as "unnatural" and thus as an inharmonious element in the Ross Lake setting. As the contrast of the exposed shoreline increases, the visual coherence of the total scene generally decreases. In the language of Ady et al. (1979), the exposed shoreline diminishes the "intactness" and "unity" of the landscape.

As the view duration increases, the visual quality impact on the viewer increases. Viewer habituation with time, however, tempers the extent to which impacts increase with increasing duration. In other words, viewers rapidly become accustomed to a view after the initial impressions.

Different types of viewers vary in their sensitivity to visual quality impacts. Some viewers are primarily involved in aesthetic appreciation. That is, much of their attention is focused on the landscape and its visual character. Other viewers are primarily involved in other activities in which aesthetic appreciation plays less of a role. Finally, regardless of the visual quality, visual quality impacts only exist if there are viewers. The more viewers there are, the greater the cumulative impact of a given view.

The five factors accounted for in these indices - baseline visual quality, contrast, duration of view, viewer sensitivity, and number of viewers - were all scaled similarly to minimize the potential for weighting one factor more than the others. The scaling, 0 to 4, was arbitrarily chosen. Choosing another scaling, say 0 to 10, would not have changed the comparative relation between calculated values and thus would not have changed the study's conclusions. Each factor was scaled independently by two study team members and reviewed by a third member. In each case, the final factor used for analysis is the average of the two independent ratings.

Taking account of these five factors, the study developed six indices, as a means of comparing the visual quality impacts of different lake levels.

Table 3.3 summarizes characteristics of the factors and indices, and the following paragraphs briefly discuss them. In each case, indices were scaled to span the scaling range. A particular index of zero therefore means that the score was the lowest for the ten viewpoints studied.

The study rated the baseline (full pool) visual quality of the landscape seen from the ten viewpoints. The study used variety as a measure of visual quality. This is similar to the variety class rating used by the Forest Service (Bacon 1979) in which three degrees of variety are recognized - "distinctive," "common," and "minimal." The baseline visual quality rating in this study used a scale of 0 to 4. The viewpoint with the lowest variety of landscape received a score of 0 and the viewpoint with the highest variety received a score of 4. Table 3.4 gives the baseline ratings.

This study analyzed the contrast of the shoreline area exposed by low lake levels using a rating mechanism developed by the Bureau of Land Management. The results of this analysis are expressed through a "contrast index." An increase in the contrast index indicates that the exposed shoreline is more obvious to the viewer. As the contrast index increased, the visual quality was considered to decrease for reasons previously discussed. For viewpoints where visually significant structures exist (Ross Dam and Hozomeen), the contrast index incorporates the degree of contrast of the exposed shoreline with these structures. Table 3.5 gives the contrast ratings. Contrast ratings for full pool conditions are zero at all viewpoints (no exposed shoreline) and are not shown in the table.

Landscapes vary in their capacity to absorb manmade modifications. This capacity, similar to what is termed "visual absorption capacity" in Forest Service terminology, is accounted for in the contrast ratings determined in this study. If a landscape has a high capacity to visually absorb a particular manmade modification, the modification will not contrast much with the remainder of the landscape. In other words, the manmade modification would have similar visual characteristics of form, line, color, and texture and would not comprise a large portion of the landscape. In general, homogeneous landscapes have a lower visual absorption capacity, while varied landscapes have a higher absorption capacity and, usually, a higher visual quality. However, each situation must be evaluated separately.

Average view duration for each type of user was based on Park Service data (including NPS data for vehicle traffic on State Route 20), study team observation, and professional judgement. The average duration in minutes was adjusted by taking the natural logarithm of the average duration to take account of viewer habituation. Viewer habituation is described in the first paragraph of this subsection. Tables 3.6a and 3.6b show the average durations and adjusted durations used in the analysis.

Viewer sensitivity is reflected in an "expectation index." This takes account of the fact that different types of users have differing desires for an "unmodified" landscape (represented by full pool conditions) and hence differing sensitivities to manmade changes in the landscape. Several studies have acknowledged variations in viewer sensitivity (Banerjee 1977; Hendee et al. 1968; Ady et al. 1979). The expectation indices reflect the professional judgement of several study team members and represent an average sensitivity level within each user group. The expectation indices take account of several factors, such as a user's typical level of dependence on manmade equipment and the extent of a user's activities that are not directly involved with aesthetic appreciation. For example, the study team concluded that the more a particular user depended on mechanized equipment the lower their sensitivity would be to modifications in the landscape. These conclusions are supported by the work of Hendee et al. (1968) in which they found that an attitude of "antiartifactualism" was the strongest indicator of a pro-wilderness versus urban point of view. Table 3.7 gives the expectation indices used in the analysis. These indices are averages of three independent ratings by study team members.

For the three low lake levels studied, the average date that each lake level was reached in the past ten years was obtained from City Light records. The average dates for the three low lake levels are:

1523-1528: April 28 - May 9

1577-1580: June 3 - June 8

1592-1593: June 18 - June 19

For backcountry campgrounds used as viewpoints, the average number of viewers for the weekly period straddling the average date was derived from the most recent Park Service data available (1981 through 1988). For Hozomeen Campground, Park Service data for 1984-1988 was used to derive overnight use, while data from 1985-1988 was used to derive day use. National Park Service data for 1988 provided the basis for estimates of motorists on State Route 20. Study team observation indicated that about 6% of all motorists stopped at one of the two adjacent Ross Lake overlooks. For the April 28th date, Park Service data for the week May 1-7 was used due to lack of data for April. Table 3.8 shows the average weekly viewer numbers, which were scaled and then used in the analysis.

Interpretation of Indices

The visual quality indices measure visual quality at various lake levels without reference to the number or type of viewers at particular viewpoints. Table 3.9 gives the visual quality indices from this study. The low visual quality indices at Hozomeen East Bank Trail and Ross Dam reflect not only a reduction in visual quality due to lake drawdown but a relatively low baseline (full pool) visual quality.

The single user impact potential indices compare the impact potential of different types of users at different locations. Table 3.10 lists these impact potential indices. The highest potential for impact occurs with users having the highest expectations at locations when their average stay is the longest: hikers at Lightning Creek, Little Beaver, and Big Beaver. Conversely, motorists along State Route 20 have the lowest expectations and durations and consequently, the lowest impact potential per individual.

Viewpoint importance indices compare the significance of the ten viewpoints at full pool. Viewpoints with the highest importance are those that are visited by large numbers of users or those that are visited by viewers who typically stay at least overnight. Table 3.11 gives these indices, which indicate that Hozomeen, the SR20 Overlook, Big Beaver, Little Beaver, and Lightning Creek are the most important of the ten viewpoints studied.

Both the single user impact and overall impact indices provide comparative ratings. These indices clarify when the greatest visual impacts occur, and aid in the analysis of alternative operating regimes for Ross Dam. A single user impact index can be compared to another single user impact index, and an overall impact index can be compared to another overall impact index. On the other hand, a single user impact index cannot be compared to an overall impact index; they take account of a different set of factors. Table 3.12 gives single user impact indices and Table 3.13 gives overall impact indices.

As described earlier, the single user impact index indicates the visual quality impact experienced by a single specific type of user at a given viewpoint and lake level. On the other hand, the overall impact index takes account of the number of viewers. Also, the overall impact index sums the impacts on different user types at a particular viewpoint and so provides a comparison of the total visual quality impact at the given viewpoints and lake levels.

The calculated single user impact indices (SUIIs) indicate at least some diminishment of visual quality at all viewpoints at each of the lower reservoir levels studied. As would be expected, SUIIs (and impacts on individual users) increase as pool levels fall because the exposed shoreline increases in size and visibility. Changes in visual quality, however, do not directly correlate with changes in lake elevation. For example, at Little Beaver, comparatively little shoreline is exposed as the lake level drops from full pool to 1,577 ft. Subsequent lake level drops of 25 ft, however, expose a comparatively larger area of shoreline, because a substantial delta built into the lake by Little Beaver Creek is revealed as the lake level drops from 1,577 to 1,527 ft. Changes in visual quality, therefore, correlate most closely with changes in the area of the exposed shoreline.

The relatively low SUIIs (which indicate little impact on an individual user for the SR-20 Overlook) are due to comparatively short view durations and comparatively low sensitivities (expectation index) of the user group (motorists) at that viewpoint. Similarly, the relatively low SUIIs for Ross Dam, Desolation, and Sourdough are due to low contrast and, in the case of Ross Dam, relatively short view durations. These low SUIIs occur despite the high expectation indices associated with the user groups (hikers and horse riders) at these viewpoints. In the case of Ross Dam, the comparatively low

contrast of the exposed shoreline is primarily due to the presence of the dam structure, which has form, line, and color elements similar to the exposed shoreline. For the Desolation and Sourdough viewpoints, the low contrast is primarily due to the large distance from the lake, which makes the exposed shoreline less obvious to the viewer.

Conversely, relatively high SUIIs for Lightning Creek, Big Beaver, and Little Beaver indicate that a more substantial diminishment of visual quality occurs at these viewpoints at low pool levels. These high SUIIs are due to the relatively high contrast of the exposed shoreline and relatively long view durations (a result of overnight activity at these locations). The strong shoreline contrast is a result of viewer proximity to the lake and, the extensive exposure of shoreline at these locations at low pool levels. Each of these three viewpoints is located at the mouth of a significant creek which has built a substantial delta into the lake. At very low lake levels, these deltas are exposed, and the shoreline becomes visually dominating.

Overall impact indices (OIIs) show a different pattern than the SUIIs. For most viewpoints, rather than increase as the lake level lowers, the OIIs tend to increase as lake levels increase (although at full pool, where there is no exposed shoreline, the contrast would be zero, and the OIIs would decrease to zero indicating no visual quality impact at full pool). The pattern exhibited by the OIIs is largely a result of the seasonal pattern of recreational use in the Ross Lake area. In the spring, when lake levels are lowest and the SUIIs indicate substantial diminishment of visual quality for several viewpoints, user numbers are very low so little visual quality impact is experienced by users. In late spring and early summer the visual quality (as expressed in the SUIIs) improves as lake levels rise, but the OIIs increase (meaning the visual quality impacts increase) because (relatively) so many more users visit the viewpoints studied. The OIIs for Hozomeen and the State Route 20 Overlook show a somewhat different pattern. For these two viewpoints, the greatest overall impact occurs at mid-drawdown levels, when a moderate level of use and diminishment of visual quality combine to produce a greater impact than the impacts that occurs at lower or higher pool levels. In a comparative sense, Hozomeen and the SR-20 Overlook have much higher use levels (see Table 3.8) than the other viewpoints and so are the only viewpoints that have substantial SUIIs.

3.3 SUMMARY

The most important conclusion to be drawn from this study is that the greatest visual quality impacts do not occur at the lowest lake levels. Because there are very low numbers of viewers early in the recreational season, minimal visual quality impacts are actually experienced during that period. Changing the lake level regime of Ross Lake prior to Memorial Day would probably have minimal beneficial effect on the visual quality impacts experienced.

More visual quality benefit would be achieved if the lake level regime were changed in the June/early July period, when the area supports substantial recreational use. Higher lake levels during this period would reduce the visual quality impacts experienced by viewers.

Figure 3.1 illustrates these conclusions. It shows the average seasonal pattern of National Park backcountry use (daily figures are available for the National Park as a whole) and the average seasonal pattern of exposed shoreline area. For the National Park as a whole, approximately 95% of the annual backcountry use occurs during June through September. Tables 3.14a through 3.14g give monthly data for the Ross Lake area (daily figures are not available) and demonstrates that a similar seasonal pattern exists in the Ross Lake area. Figures 3.2a through 3.2g illustrate the data given in these tables. The study estimates that as many as 6% of motorists along State Route 20 stop at one of the two viewpoints overlooking Ross Lake. The amount of exposed shoreline is a good indication of the relative visual quality experienced by a single viewer; the greater the area of exposed shoreline, the lower the visual quality. As shown by these data, the great majority of the annual use of the Ross Lake area occurs at the higher lake levels.

Table 3.1. User groups visiting viewpoints chosen for study.

Viewpoint	User Groups
Hozomeen	Carcampers[a]
Little Beaver	Boaters[b] Hikers
Desolation Lookout	Hikers
Lightning Creek	Boaters Horse Riders Hikers
Ten-mile Island	Boaters
East Bank Trail	Horse Riders Hikers
Big Beaver	Boaters Horse Riders Hikers
Sourdough Lookout	Hikers
SR-20 Overlook	Motorists
Ross Dam	Horse Riders Hikers

[a] Many individuals within this group also boat and hike
[b] Includes both power and non-power boat users

Table 3.2. Landscape types seen from viewpoints chosen for study.[a]

Landscape Type	Hozomeen	Little Beaver	Desolation	Lightning Creek	Ten-mile Island	East Bank Trail	Big Beaver	Sourdough	SR20 Overlook	Ross Dam
snowfield/glacier	o[b]	x	x	x	o	o	x	x	x	o
rock slope/peak	o	x	x	o	o	o	x	x	x	x
alpine meadow	o	o	x	o	x	x	o	x	x	/
forest	x	x	x	x	x	x	x	x	x	x
avalanche slope	x	/	/	o	o	o	x	x	x	x
stream cascade	o	/	/	x	x	x	/	/	/	/
creek delta	/	x	o	x	/	/	x	/	/	/
alluvial fan	/	/	o	/	/	/	/	/	/	/
lakeside bluff	/	/	o	x	o	x	o	/	o	/
talus/scree slope	/	/	o	/	/	/	o	o	o	/
island	/	o	/	o	x	/	/	o	o	/
lake	x	x	x	x	x	x	x	x	x	x
man-made structures	x	/	/	o	/	o	/	/	o	x

[a]Table indicates landscape components seen when viewer looking toward Ross Lake.
[b] x - evident or prominent from viewpoint
o - minor component as seen from viewpoint
/ - insubstantial or absent from viewpoint

Table 3.3. Summary of indices.

Factor or Index	Characteristics
Visual quality rating	Rated by assessing the variety of the landscape; the greater the variety of landscape components the higher the rating; for Hoxomeen and Ross Dame viewpoints the rating took account of whether man-made structures added or detracted from the unity of views.
Contrast index	Rated using Bureau of Land Management (BLM) method; the greater the index the higher the contrast.
Visual quality index	baseline (fullpool) visual rating minus the appropriate contrast rating; the higher the index the higher the visual quality.
Duration	Average time spent by an individual type of user at a particular viewpoint; calculated as average visitor nights divided by average visitors for 1981-1985; multiplied by two-thirds to adjust for daylight viewing and scaled to account for viewer habituation.
Expectation index	An estimate of the average sensitivity of an individual user to man-made modifications to the landscape.
Single user impact potential index	A measure of the potential that a particular type of user could be impacted by lake drawdowns; calculated as duration times expectation and scaled from 0 to 100; the greater the index the higher the impact potential.
Single user impact index	A measure of the visual quality impact on a single user; calculated as the difference in visual quality at fullpool and a lower lake level times duration times expectations; scaled from 0 to 100 with higher scores indicating greater impact.
Viewer number	The number of viewers in the week straddling the historically average date that a particular lake level was reached; based on National Park Service data.
Viewpoint importance index	A measure of the importance of a particular viewpoint (all fullpool); calculated as fullpool visual quality times duration times expectation times viewer number at fullpool and summed over all user groups; scaled from 0 to 100 with higher scores indicating greater importance at fullpool.
Overall impact index	A measure of the overall visual quality impact at a particular lake level; calculated as the difference in visual quality at fullpool and a lower lake level times duration times expectation times viewer number at the lower lake level and summed over all user group's scaled from 0 to 100 with higher scores indicating greater impact.

Table 3.4. Baseline (full pool) rating of visual quality from different Ross Lake viewing locations.

Location	Rating[a] (scale of 0 to 4)
Hozomeen	0.0
Litle Beaver	1.3
Desolation	4.0
Lightning Creek	3.9
Ten-Mile Island	1.8
East Bank Trail	0.6
Big Beaver	2.4
Sourdough	2.5
SR-20 Overlook	3.4
Ross Dam	0.3

[a]Visual quality rating: Rated by assessing the variety of the landscape; the greater the variety of landscape components the higher the rating; for Hozomeen and Ross Dam viewpoints the rating took account of whether man-made structures added or detracted from the unity of views.

Table 3.5. Contrast indices for different Ross Lake viewing locations for different Ross lake pool elevations.[a]

Location	1523-1528[b]	1577-1580	1592-1593
Hozomeen	2.2	1.6	0.0
Little Beaver	2.7	0.7	0.4
Desolation	1.3	0.4	NA
Lightning Creek	4.0	2.7	1.3
Ten-mile Island	3.3	3.3	1.3
East Bank Trail	4.0	2.2	0.0
Big Beaver	4.0	2.9	0.7
Sourdough	1.3	0.2	NA
SR20 Overlook	3.3	2.4	1.3
Ross Dam	2.0	0.9	0.0

[a]Contrast index: Rated using Bureau of Land Management (BLM) method; the greater the index the higher the contrast between the exposed shoreline and the overall view.
[b]Surface elevation above mean sea level.
[c]NA-not analyzed due to inclement weather conditions.

Table 3.6a. Average duration (in minutes) spent at different Ross Lake viewing locations by user type.[a]

Location	Hikers	Horse Riders	Boaters	Hozomeen Visitors	Motorists At SR-20 Overlook
Hozomeen	0	0	0	1475	0
Little Beaver	1263	0	1785	0	0
Desolation	120	0	0	0	0
Lightning Creek	1399	1709	1784	0	0
Ten-Mile Island	0	0	1392	0	0
East Bank Trail	60	60	0	0	0
Big Beaver	1318	1377	1539	0	0
Sourdough	120	0	0	0	0
SR-20 Overlook	0	0	0	0	9
Ross Dam	30	10	0	0	0

[a]Duration: Average time spent by an individual type of user at a perticular viewpoint; calculated as average visitor nights divided by average visitors for 1981-1985; multiplied by two-thirds to adjust for daylight viewing and scaled to account for viewer habituation.

Table 3.6b. Adjusted duration.[a]

Location	Hikers	Horse Riders	Boaters	Hozomeen Visitors	Motorists At SR-20 Overlook
Hozomeen	0.00	0.00	0.00	3.90	0.00
Little Beaver	3.82	0.00	4.00	0.00	0.00
Desolation	2.56	0.00	0.00	0.00	0.00
Lightning Creek	3.87	3.98	4.00	0.00	0.00
Ten-Mile Island	0.00	0.00	3.87	0.00	0.00
East Bank Trail	2.19	2.19	0.00	0.00	0.00
Big Beaver	3.84	3.49	3.92	0.00	0.00
Sourdough	2.56	0.00	0.00	0.00	0.00
SR-20 Overlook	0.00	0.00	0.00	0.00	1.17
Ross Dam	1.82	1.23	0.00	0.00	0.00

[a]Adjusted duration: 1_n (duration in minutes) x 4/7.92

Table 3.7. Expectation indices by user type.[a]

User Type	Expectation Index
Hiker	4.0
Horse Rider	3.0
Boater	1.9
Carcamper	1.0
Motorist along SR-20	0.0

[a]Expectation index: An estimate of the average sensitivity of an individual user to man-made modifications to the landscape. Scale of 0 to 4.

Table 3.8. Average weekly number of viewers at different Ross Lake viewing locations by type, for different Ross Lake pool elevations.

Lake Level	Viewpoint	Hikers	Horse Riders	Boaters	Hozomee Visitors	Motorists At SR-20 Overlook	Total
	Hozomeen	0.00	0.00	0.00	5.10	0.00	5.10
	Little Beaver	0.33	0.00	0.23	0.00	0.00	0.56
	Desolation	0.02	0.00	0.00	0.00	0.00	0.02
	Lightning Creek	0.51	0.02	0.22	0.00	0.00	0.75
1523-	Ten-Mile Island	0.00	0.00	0.31	0.00	0.00	0.31
1528[a]	East Bank Trail	1.85	0.00	0.00	0.00	0.00	1.85
	Big Beaver	1.45	0.00	0.64	0.00	0.00	2.09
	Sourdough	0.12	0.00	0.00	0.00	0.00	0.12
	SR-20 Overlook	0.00	0.00	0.00	0.00	1209.00	1209.00
	Ross Dam	2.91	0.00	0.00	0.00	0.00	2.91
	Hozomeen	0.00	0.00	0.00	134.90	0.00	134.90
	Little Beaver	1.23	0.00	5.20	0.00	0.00	6.43
	Desolation	0.08	0.00	0.00	0.00	0.00	0.08
	Lightning Creek	0.74	0.58	3.50	0.00	0.00	4.82
1577-	Ten-Mile Island	0.00	0.00	2.21	0.00	0.00	2.21
1580	East Bank Trail	3.79	0.24	0.00	0.00	0.00	4.03
	Big Beaver	3.00	0.37	4.30	0.00	0.00	7.67
	Sourdough	0.30	0.00	0.00	0.00	0.00	0.30
	SR-20 Overlook	0.00	0.00	0.00	0.00	1706.00	1706.00
	Ross Dam	6.00	0.37	0.00	0.00	0.00	6.37
	Hozomeen	0.00	0.00	0.00	832.24	0.00	832.24
	Little Beaver	6.15	0.00	25.95	0.00	0.00	32.10
	Desolation	NA	NA	NA	NA	NA	NA
	Lightning Creek	3.68	2.88	17.44	0.00	0.00	24.00
1592-	Ten-Mile Island	0.00	0.00	11.03	0.00	0.00	11.03
1593	East Bank Trail	18.89	1.20	0.00	0.00	0.00	20.09
	Big Beaver	14.96	1.86	21.44	0.00	0.00	38.26
	Sourdough	NA	NA	NA	NA	NA	NA
	SR-20 Overlook	0.00	0.00	0.00	0.00	1706.00	1706.00
	Ross Dam	29.92	1.86	0.00	0.00	0.00	31.78

Table 3.8. Average weekly number of viewers at different Ross Lake viewing locations by type, for different Ross Lake pool elevations (continued).

Lake Level	Viewpoint	Hikers	Horse Riders	Boaters	Hozomee Visitors	Motorists At SR-20 Overlook	Total
	Hozomeen	0.00	0.00	0.00	910.32	0.00	910.32
	Little Beaver	24.49	0.00	43.85	0.00	0.00	68.34
	Desolation	1.47	0.00	0.00	0.00	0.00	1.47
	Lightning Creek	6.44	2.84	43.91	0.00	0.00	53.19
Full-	Ten-Mile Island	0.00	0.00	27.59	0.00	0.00	27.59
Pool	East Bank Trail	26.51	1.95	0.00	0.00	0.00	28.46
	Big Beaver	36.36	1.55	45.13	0.00	0.00	83.04
	Sourdough	4.35	0.00	0.00	0.00	0.00	0.00
	SR-20 Overlook	0.00	0.00	0.00	0.00	2744.00	2744.00
	Ross Dam	72.73	1.55	0.00	0.00	0.00	74.28

[a]Surface elevation above mean sea level.

Table 3.9. Visual quality indices for different Ross Lake viewing locations for different Ross Lake pool elevations.[a]

Location	1523-1528	1577-1580	1592-1593	Full Pool
Hozomeen	0.6	1.0	1.8	1.8
Little Beaver	1.1	2.2	2.3	2.6
Desolation	3.2	3.7	NA	4.0
Lightning Creek	1.8	2.5	3.2	3.9
Ten-mile Island	1.0	1.0	2.0	2.8
East Bank Trail	0.0	0.9	2.1	2.2
Big Beaver	1.0	1.5	2.7	3.1
Sourdough	2.4	3.0	NA	3.2
SR20 Overlook	1.9	2.3	2.9	3.7
Ross Dam	0.9	1.5	1.9	2.0

[a]Visual quality index: Baseline using Bureau of Land Management (BLM) method; the greater the index the higher the contrast between the exposed shoreline and the averall view. Scale of 0 to 4.
[b]Surface elevation above mean sea level.
[c]NA - not analyzed due to inclement weather conditions

Table 3.10. Single user impact potential indices at different Ross Lake viewing locations by user type.[a]

Location	Hikers	Horse Riders	Boaters	Hozomeen Visitors	Motorists on SR20
Hozomeen	-	-	-	37	-
Little Beaver	98	-	58	-	-
Desolation	64	-	-	-	-
Lightning Creek	100	80	58	-	-
Ten-mile Island	-	-	56	-	-
East Bank Trail	54	41	-	-	-
Big Beaver	99	78	56	-	-
Sourdough	64	-	-	-	-
SR20 Overlook	-	-	-	-	0
Ross Dam	44	20	-	-	-

[a]Single user impact potential index: A measure of the potential that a particular type of user could be impacted by lake drawdowns; calculated as duration times expectation and scaled from 0 to 100; the greater the index the higher the impact potential.

Table 3.11. Viewpoint importance indices for different Ross Lake viewing locations at full pool.[a]

Location	Full Pool
Hozomeen	100
Little Beaver	17
Desolation	0
Lightning Creek	16
Ten-mile Island	5
East Bank Trail	4
Big Beaver	24
Sourdough	1
SR20 Overlook	73
Ross Dam	9

[a]Viewpoint importance index: A measure of the importance of a particular viewpoint (all full pool); calculated as full pool visual quality times furation times expectiation times viewer number at full pool and summed over all user groups; scaled from 0 to 100 with higher scores indicating greater importance at full pool.

Table 3.12. Single user impact indices for differet Ross Lake viewing locations for different Ross Lake pool elevations.

Pool Level	Location	Hikers	Horse Riders	Boaters	Hozomeen Visitors	Motorists on SR20
	Hozomen	-	-	-	23	-
	Little Beaver	66	-	40	-	-
	Desolation	23	-	-	-	-
	Lightning Creek	100	81	60	-	-
1523-1528	Ten-mile Island	-	-	48	-	-
	East Bank Trail	56	44	-	-	-
	Big Beaver	99	79	59	-	-
	Sourdough	23	-	-	-	-
	SR20 Overlook	-	-	-	-	4
	Ross Dam	24	12	-	-	-
	Hozomeen	-	-	-	16	-
	Little Beaver	18	11	-	-	-
	Desolation	8	-	-	-	-
	Lightning Creek	67	55	40	-	-
1577-1580	Ten-mile Island	-	-	48	-	-
	East Bank Trail	32	25	-	-	-
	Big Beaver	72	57	43	-	-
	Sourdough	5	-	-	-	-
	SR20 Overlook	-	-	-	-	3
	Ross Dam	11	5	-	-	-
	Hozomeen	-	-	-	0	-
	Little Beaver	13	-	7	-	-
	Desolation	NA	NA	NA	NA	NA
	Lightning Creek	35	28	21	-	-
1592-1593	Ten-mile Island	-	-	20	-	-
	East Bank Trail	1	0	-	-	-
	Big Beaver	18	14	11	-	-
	Sourdough	NA	NA	NA	NA	NA
	SR20 Overlook	-	-	-	-	2
	Ross Dam	1	0	-	-	-

[a]Single user impact index: A measure of the visual quality impact on a single user; calculated as the difference in visual quality at full pool and a lower lake level times duration times expectations; scaled from 0 to 100 with higher scores indicating greater impact.
[b]Surface elevation above mean sea leve.
[c]NA - not analyzed due to inclement weather conditions.

Table 3.13. Overall impact indices for different Ross Lake viewing locations for different Ross Lake pool elevqations.[a]

Location	1523-1528[b]	1577-1580	1592-1593
Hozomeen	2	35	13
Little Beaver	0	1	4
Desolation	0	0	NA
Lightning Creek	1	3	9
Ten-mile Island	0	2	3
East Bank Trail	2	2	0
Big Beaver	3	7	8
Sourdough	0	0	NA
SR20 Overlook	96	100	56
Ross Dam	1	1	1

[a]Overall impact index: A measure of the overall visual quality impact at a particular lake level; calculated as the difference in visual quality at full pool and a lower lake level times duration times expectation times viewer number at the lower lake level and summed over all user groups; scaled from 0 to 100 with higher scores indicating greater impact.
[b]Surface elevations above mean sea level.
[c]NA - not analyzed due to inclement weather conditions.

Table 3.14a. Total backcountry visitor nights by user type and month, 81-85.

	May	June	July	Aug	Sept	Oct	May-Oct	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
Avg. hike	158.6	361.6	482.4	566.2	207	21.8	1797.6	***	***	***	***
Avg. horse	3.6	32.2	18.2	44.6	24.2	0	122.8	***	***	***	***
Avg. boat	73	1478.2	2633	2815.2	632.6	21.6	7653.6	***	***		***

Note: for avg. total, May-October use estimated at 98.78% of total annual use based on NCNP figures.
Note: data for months other than May-October not tallied for individual user types.

Table 3.14b. Total visitor nights at Ross Lake Resort, 84-88.

	May	June	July	Aug	Sept	Oct	Nov-Apr	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
1984	0	446	1433	1182	1380	791	105	5337	83	75	49
1985	0	514	1283	1547	1034	697	116	5191	84	74	55
1986	0	535	1271	1378	1225	742	91	5242	84	74	51
1987	0	338	1297	1423	1309	856	93	5316	82	76	51
1988	0	377	1355	1433	1338	867	90	5460	82	76	51
Avg.	0	442	1328	1393	1257	791	99	5309	83	75	51

Table 3.14c. Estimated day use at Hozomeen (exclusive for overnight campers), 85-88.

	May	June	July	Aug	Sept	Oct	Nov-Apr	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
1985	0	1268	7939	4667	151	150	333	14508	97	88	87
1986	60	1103	1053	3383	767	738	167	7271	87	72	61
1987	99	1135	775	1210	267	347	328	4161	81	54	48
1988	50	647	1477	1649	260	758	270	5111	79	66	61
Avg.	52	1038	2811	2727	361	498	275	7763	89	76	71

Table 3.14d. Visitor nights at Hozomeen Campground, 84-88.

	May	June	July	Aug	Sept	Oct	Nov-Apr	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
1984	54	4202	6080	4867	2842	1076	288	19409	93	71	56
1985	0	6525	7865	4224	2319	840	178	21951	95	66	55
1986	64	2934	***	4071	1885	1212	***	***	***	***	***
1987	96	2908	4389	5325	2093	1193	179	16633	91	74	61
1988	0	2783	2783	2803	1775	1010	179	11333	90	65	49
Avg.	43	3870	5392	4258	2183	1066	206	17018	92	70	57

Table 3.14e. Estimated hiker day use at Ross Dam, 81-85.

	May	June	July	Aug	Sept	Oct	May-Oct	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
Avg.	96	460	778	880	314	16	2544	2575	94	77	64

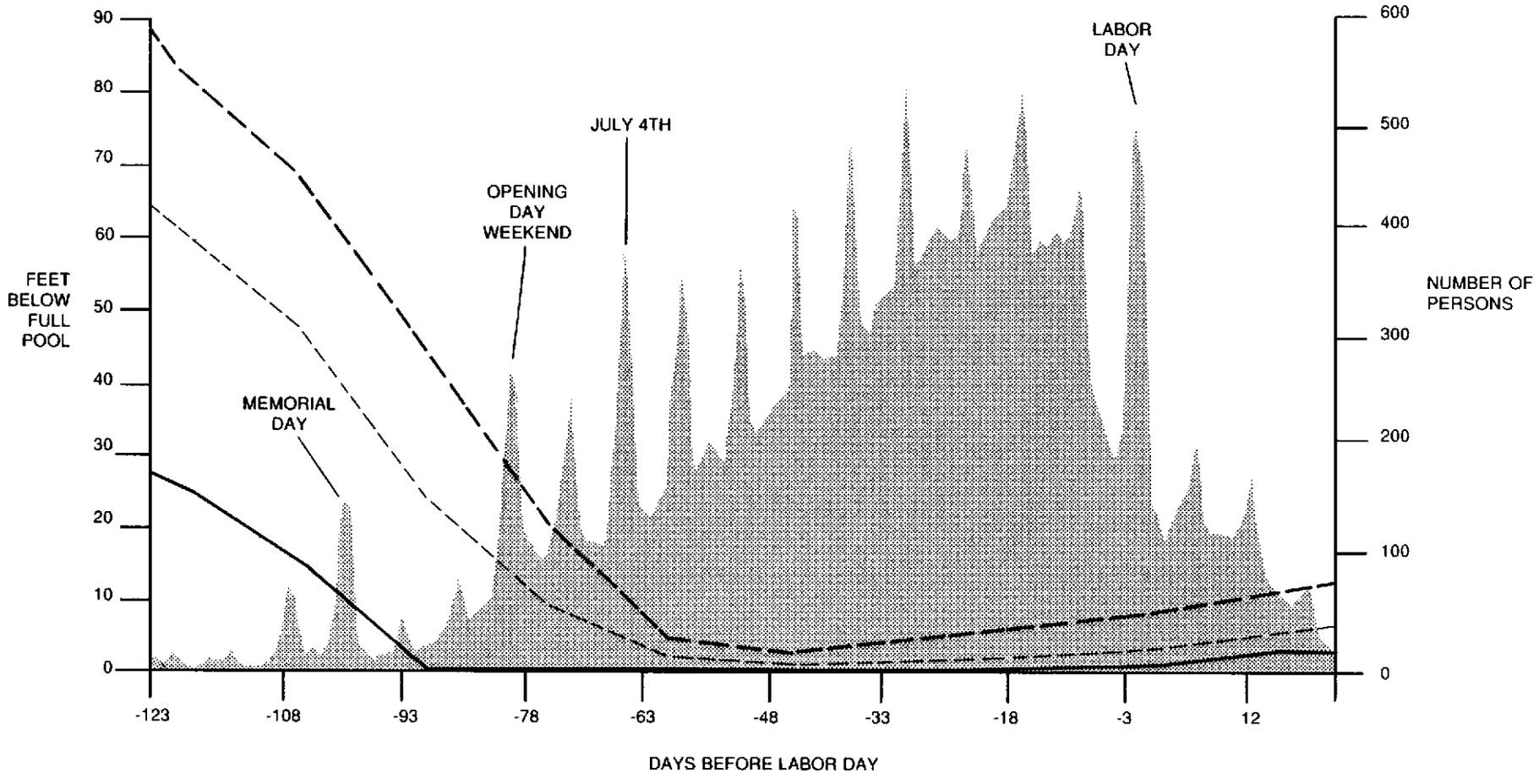
Note: May-October use estimated at 98.78% of total annual use based on NCNP figures
Note: day hiker use estimated at twice the overnight use level at Big Beaver.

Table 3.14f. Maximum number of motorists past Ross Lake on SR20, 86-87.

	May	June	July	Aug	Sept	Oct	Nov-Apr	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
1986	60343	140310	171840	210253	157897	103160	52461	896264	76	60	43
1987	86350	124330	167703	202569	161059	83492	58827	884330	74	60	42
Avg.	73347	132320	169772	206411	159478	93326	55644	890297	75	60	42

Table 3.14g. Estimated total recreational visitors in Ross Lake Area, various yearly data.

	May	June	July	Aug	Sept	Oct	May-Oct	Est. Ann. Total	% of ann. total June-Sept	July-Sept	July-Aug
All groups	73773	140003	183214	219095	164457	95740	56373	932655	76	61	43
Minus SR20	426	7683	13442	12684	4979	2414	729	42358	92	73	62

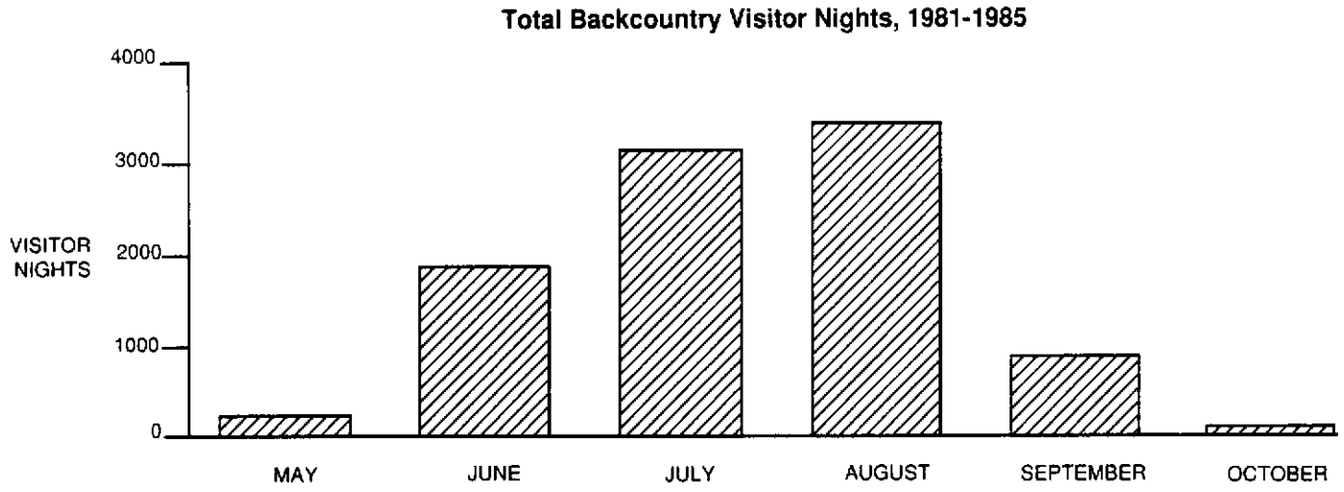


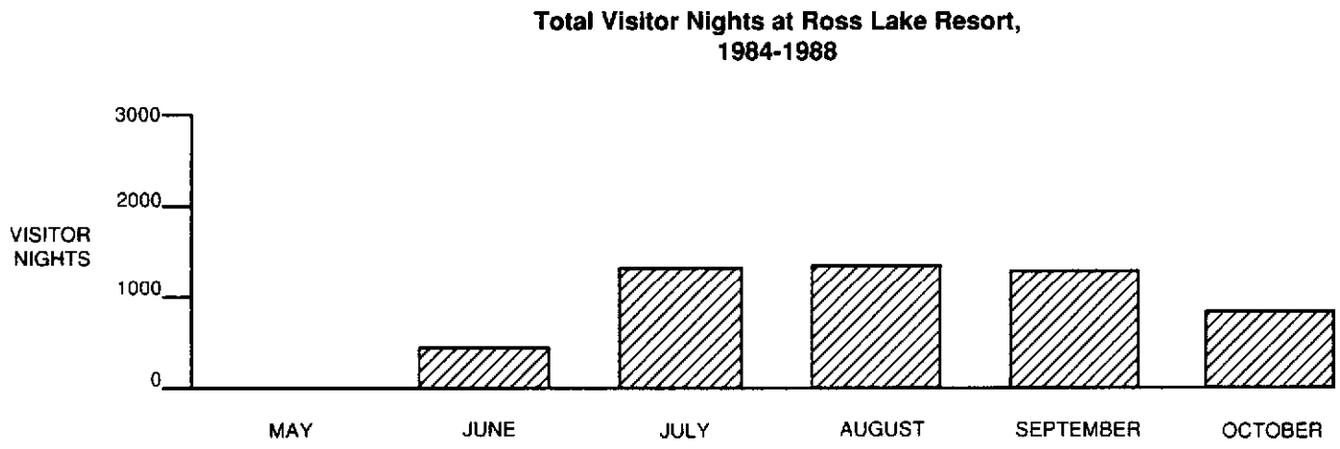
NOTE: Weekend data for each year aligned.

Legend

- Seasonal Use (1981-1988)
- Minimum Lake Level (1978-1986)
- Average Lake Level (1978-1986)
- Maximum Lake Level (1978-1986)

Figure 3.1.
Seasonal National Park backcountry use and seasonal lake level patterns.





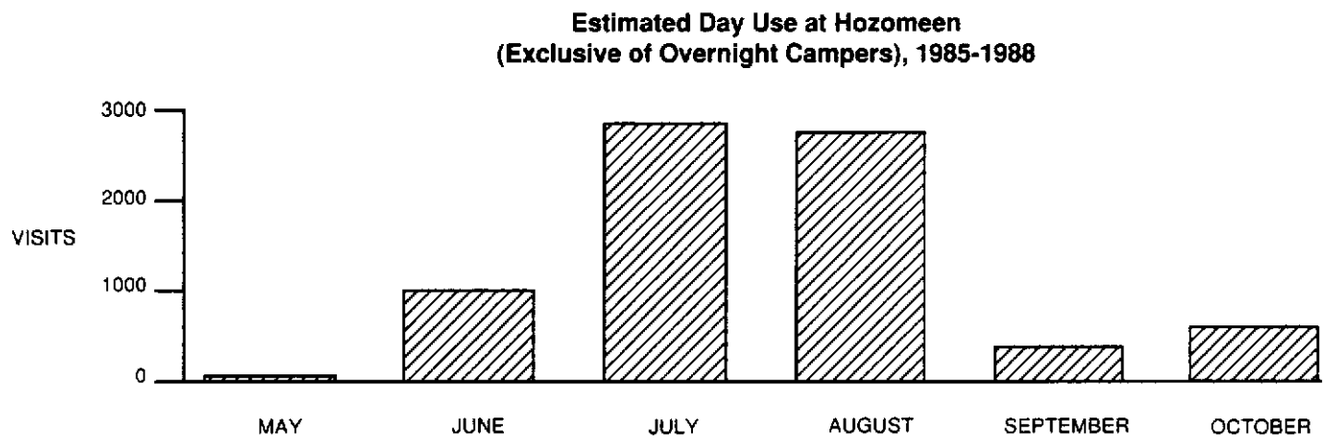
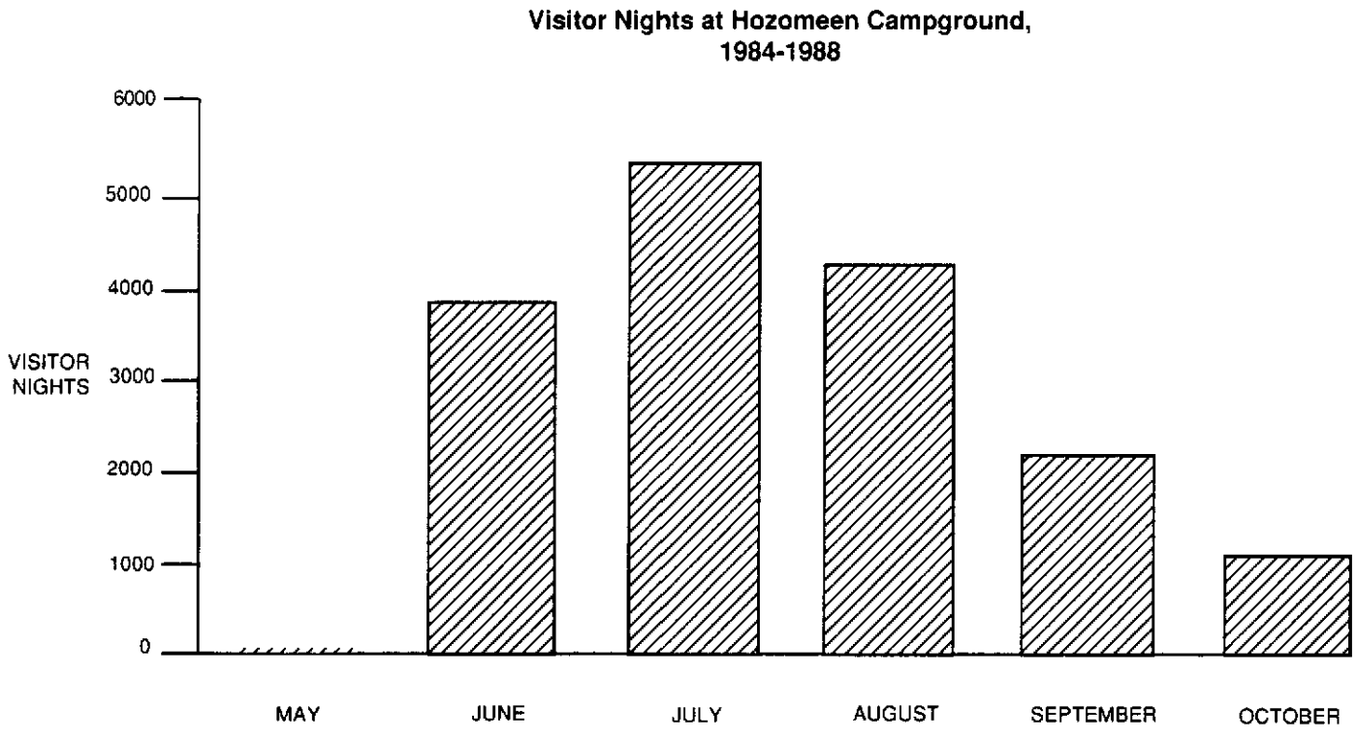


Figure 3.2, a - c.
Summary of Ross Lake recreational use.



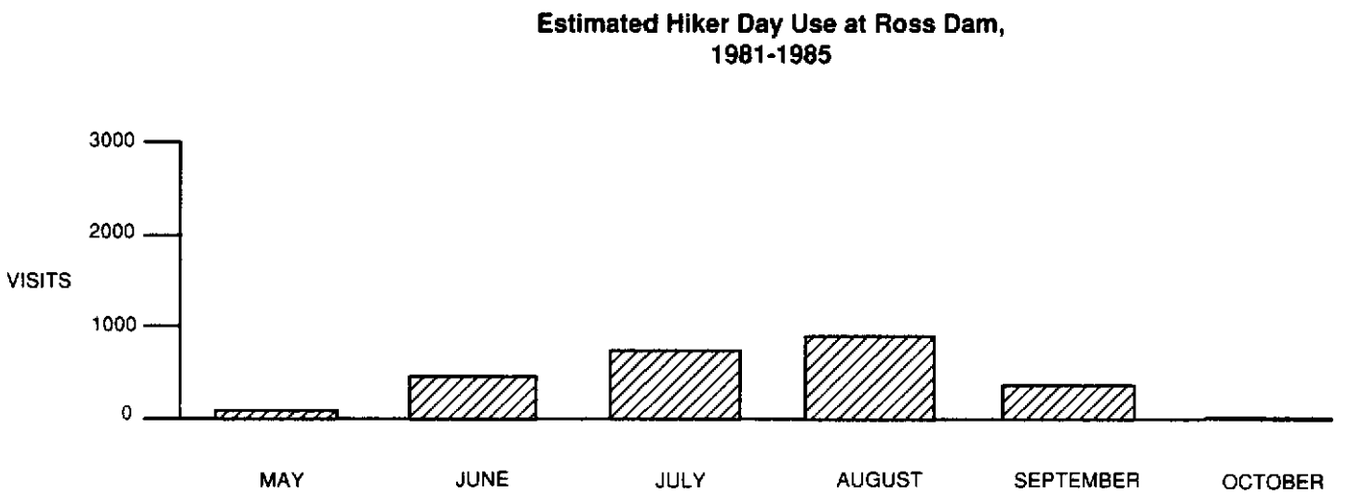
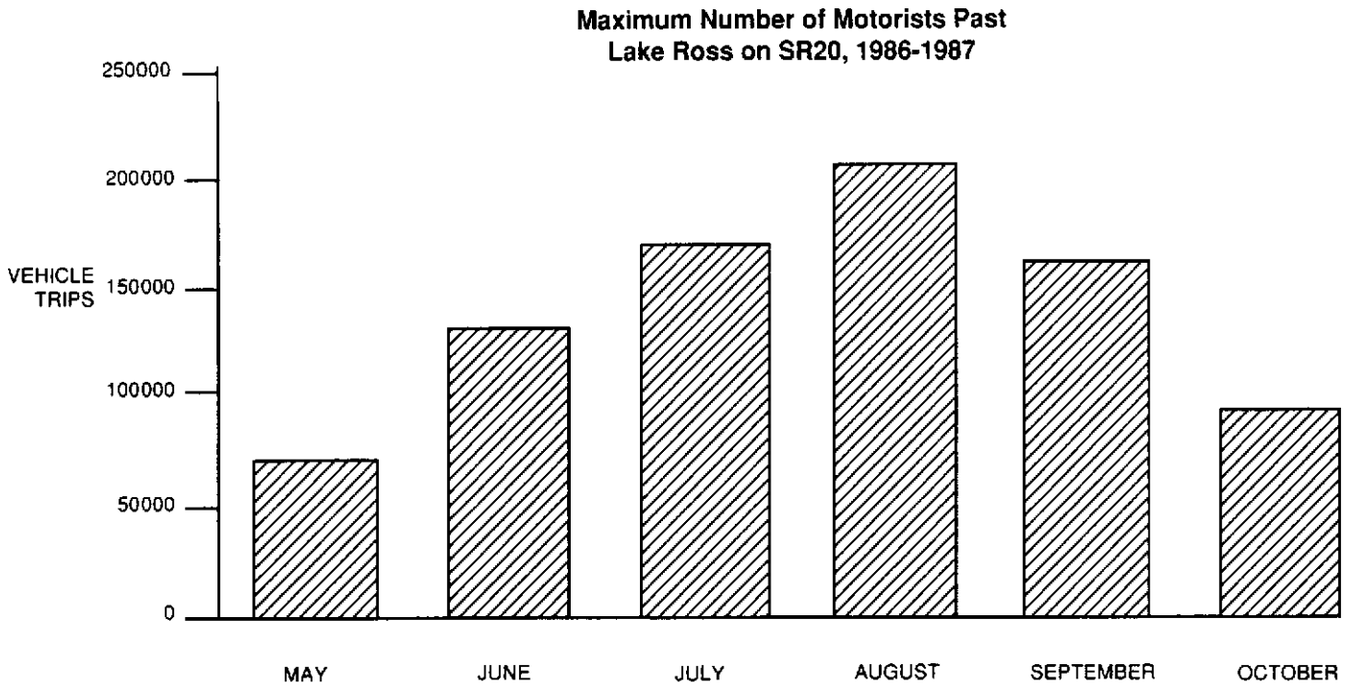
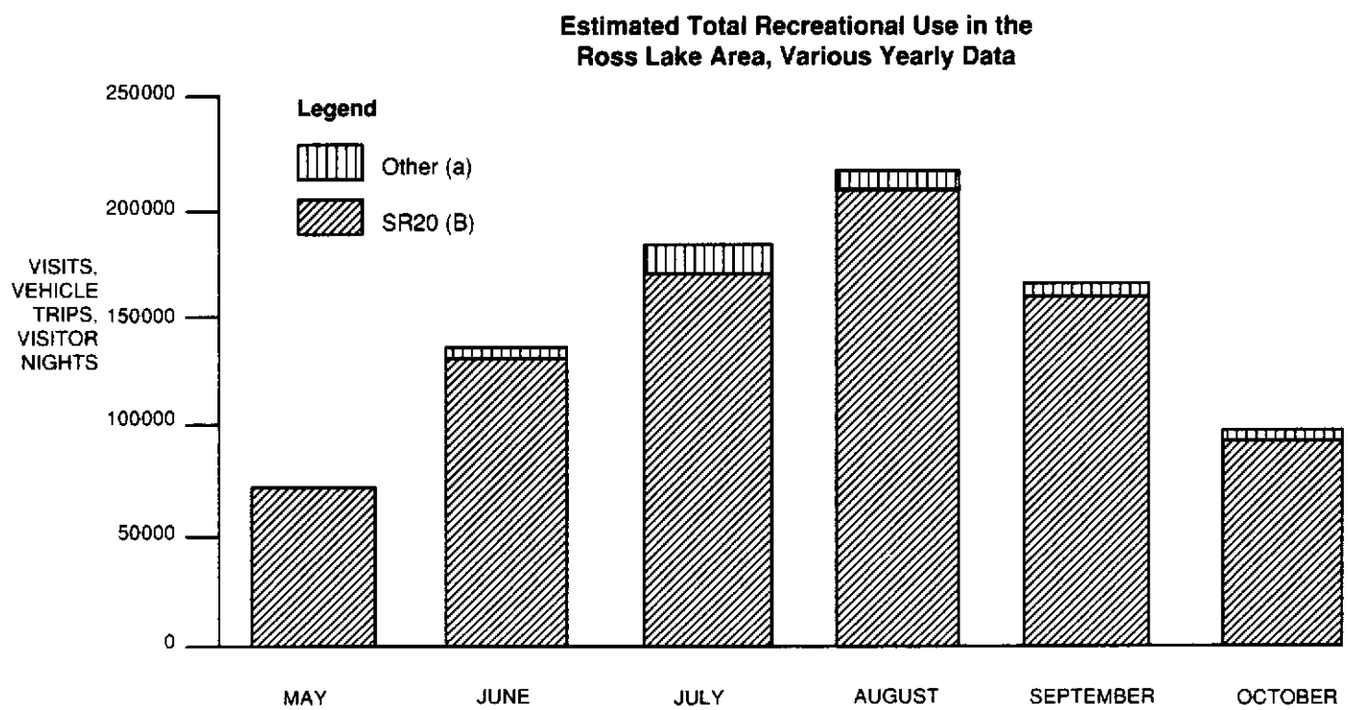


Figure 3.2, d - e.
Summary of Ross Lake recreational use.





NOTE:
(a). Hiker day use at Ross Dam in visits.
Day use at Hozomeen in visits.
Overnight use at Hozomeen, backcountry use, and Ross Lake Resort in visitor nights.
(b). SR20 use in vehicle trips.

Figure 3.2, f - g.
Summary of Ross Lake recreational use.

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INTERVENOR COMMENTS

and

SEATTLE CITY LIGHT RESPONSES

NCCC Comment on

Ross Lake Early-Season Recreational Activity and Visual Quality Assessment

General Comment

Recreation

Why is there no analysis of road visitation as a recreational activity at Ross Lake SR 20 overlooks? It would seem that these users of the lake are important too? Are they only to be treated under visual quality? (1)

This study presents lots of data but very little of it documents impacts of low lake levels on visitation. Its main aim seems to be to show that most visitation is present when the lake is highest. It seems more realistic to go back through the records and analyse which years were slow in reaching full pool or years when drawdown started in the recreation season and then discussing the impacts on recreation. The study really skims over the question that all want to know the answers too -- what happens to recreation when there is a low lake level. Comparison between years/time of full pool/number of visitors would be helpful. There is scant information here to assist in dealing with the use question. (2) (3) (4) (5)

Visual Quality

It seems unfair to ask persons to comment on a document with important tables and figures absolutely missing, e.g., viewshed maps. (6)

Editorial Comment

Recreation

p. 3 Ross Lake is not the only large wild lake on which people can canoe and fish. (7)

What about Ross Lake resort as a focus for human development? (8)

What visitor center? (9)

Expand on the Canadian developments. (10)

p. 11 Mention the level below which boats cannot be launched in Canada. (11)

The big question is "Do visitors stay away from the lake at lower levels or would they arrive earlier and stay (12)

later than they now do if they were assured of high lake levels?" Alternatively, "How do visitor use patterns here compare with visitor use patterns at other lakes (Gorge, Diablo or other west side lakes in Washington and B.C.?" How do use patterns correspond to weather/vacation schedules in the PNW? (13)

What time series data are used to show lake levels on figures? Should show average and probabalistic high/low range of variation. (14)

p. 12 What is meant by satisfaction in table 2.2? (15)

Visual Quality

p. 1 The contrast between the unvegetated shoreline and the surrounding terrain "does" diminish the visual quality. NCCC is not aware of any studies that indicate otherwise. (16)

Will the photographic documentation of the four lake levels be available in the final report? (17)

p. 2 NCCC rejects the approach that eliminates viewpoints during the season when use is low (and lake levels are low). This results in an evaluation only at high pool - which misses the point. The idea behind trying to characterize the visual quality impacts is to identify them and their magnitude. This information can be modified by viewer information later on but viewer numbers should not automatically eliminate views. (18)

Why is there no shoreline landscape subdivision? (19)

p. 3 There should be a table of dates of opening and closing of SR 20 since it came into use. This can then be shown against traffic by month and by lake levels. This would be a more effective means of investicating visual impacts than that done hitherto. (20)

Note that some cross country skiers/showshoers and snowmobilers use this corridor - what they see is devastating. Are there no data on winter use? (21)

There are no supporting data to identify Ross Lake as a "prime scenic attraction". It may be one but how does it compare with the other prime attraction. Would people miss it if it were not there? (22)

Second to last paragraph needs editing work. What is the basis for these statements - interviews with boaters? (23)

p. 4 What about the Colonial Peak Group and the Pickets? (24)

The listing of views on and above the lake has to be more systematic than this. (25)

p. 5 The sand flats are also highly visible from the Canadian CG and Hozomeen CG as well as the road. (26)

p. 6 Are there no "historic" photographs in SCL archives that document the reservoir at previous low pools of -117 feet? It seems that there should be at least some record of a worst case scenario. (27)

<u>NCCC does not accept the assertion that at full pool the lake looks natural. The basis for rejection is the evidence from the erosion study. This would indicate that for significant portions of the lake there are major, obvious bank erosion problems that affect the visual quality of the shoreline.</u> (28)

Table 2.15 of the recreation portion of this report clearly shows a breakdown between power and non-power boaters for the period 1984-88. What is the basis for treating the boating category as one user type and not differentiating between viewer sensitivities? (29)

Table 3.1 indicates that only one viewpoint is from the lake surface (Ten Mile Island). This is hardly adequate for a 25 mile long reservoir. (30)

p. 8 Note the description of the lakeshore here and contrast it with "may" statement on p. 1. (31)

What is the length of time that it takes a viewer to become habituated to a lake drawdown? NCCC questions whether this is "rapid" as is the contention here? (32)

NCCC can appreciate the utility for some purposes of trying to get an aggregate impact figure. However, it seems that identification of the visual quality of areas is a necessary precursor. (33)

To say that a scalar was selected to minimize overweighting and then to say that the scalar was arbitrarily chosen is directly contradictory. (34)

Is there some way to indicate the professional competence of the study team members involved in the ratings. (35)

p. 9 NCCC considers it odd that a visual quality baseline rating that is oriented to identifying Ross Lake visual quality would be skewed so that the highest rating is achieved by the point farthest away from the shore (Desolation Pk). It is possible to understand that rating for views in the Cascades but readers have already been (36)

informed that the Ross lake shoreline from this viewpoint is subject to haze, visual distortion and a distance factor that minimizes negative influences.

Similarly a contrast rating index that seems barely capable (0-1.3 our of 4) of discerning a 7-8 foot drawdown is strange. While this level is less distracting than an 80 foot drawdown (and viewed by more persons) may be true it doesn't seem to get at the real issues of contrast. Especially when a 0 value is assigned to full pool there seems to be something off. There is contrast at full pool between the lake and the shore, particularly where there is an unstable bank and erosion taking place. 37 38

How is "visual absorption capacity" defined for this study? 39

Is there any supporting literature to justify the technique used to adjust duration in the manner done here? This seems highly prejudicial to rating by all but motorists. NCCC has not previously seen any discussions of duration, habituation and adjustments to duration for habituation in the outdoor recreation literature. NCCC requests further justification and clarification of the method. This would seem to negate any differences in sensibilities among viewers. (Re: Table 3.6 Is there no way to document boat use, i.e., by length of rental from concessionaire for the Ross Dam area. This is a popular resort area with substantial boat/canoe use). 40 41 42 43 44

What are the professional qualifications of the study team members to assign sensitivities? 45

It seems odd that any category of viewer could be assigned an expectation index of 0. If such were the case what would justify that person stopping at a viewpoint? When a hiker travels by car under this arrangement he/she doesn't count but if he/she wanders toward Roland Point he/she becomes a 4. How can this be the case? 46

p. 10 Are these really average dates or are they a range of dates? earliest and latest during the period? If they are some kind of an average, the earliest and latest dates of fill should be provided to help show the variability in fill regime. 47

HOw does study team observation data match with NPS data on number of vehicles stopping? Is there a difference in percentage stopping at various times of the year -- transit only early and late and higher stop rates during tourist season? 48 49

How do viewer numbers get scaled for analysis? 50

NCCC copy of the report is missing Table 3-9 showing the visual quality indices. (51)

The single user impact potential, especially for motorists seems unfortunate. For someone who has only one stop to take in all of Ross Lake from an overlook on SR 20 not to expect something is certainly counterintuitive. (52)

Last full sentence is unclear. (53)

p. 11 The SUIIs discussion at mid-page seems reasonable despite the complaints about methods above. However the continuation in the next paragraph gives some cause for concern. Early in this visual quality section is the statement that the indices are chosen to avoid giving disproportionate weight to any factor. Yet, in this paragraph, explanations show that a low or high rating in single categories apparently are accorded enormous influence in a rating. (54) (55)

p. 13 It would be alot easier and alot more intuitively correct to simply state that at low lake levels the visual quality is low but at this time there are relatively few people who are affected. This is understandable in plain English. The contortions that have to be made to accommodate visual quality analysis jargon are not worth the effort. Unfortunately, the analysis has not been performed in a way to support a defensible decision on when, according to visual quality criteria, should be target dates for lake level to reach full pool. A target date of late May to coincide with fishing season openings is apparently not justified by the combination of number of visitors and degree of impact according to the study. Instead, the study recommends a June/early July period for this purpose. Yet this would be fully a month to a month and a half after one significant use of the lake currently begins. Can't there be a more defensible answer about how to determine a reasonable target date for full pool. The conclusions of this study would indicate that a date much later than those indicated on p. 10 would be appropriate to handle visual quality concerns. NCCC seriously disputes this conclusion. (56) (57) (58)

Where are the studies that help to analyse tradeoffs among different conclusions of studies? (59)

MEMORANDUM

to: Toby Thaler — October 24, 1989

from: David Mattern — 55-1810-01

re: Responses to comments from NCCC on Ross Lake Early-season draft reports

1 Road visitation and use of the SR 20 overlook is discussed on the top of page 10.

2 The purpose of this study was to evaluate existing patterns of recreational activity, not necessarily to focus on periods of low lake levels. That most recreational activity occurs when the lake is high is a statement of fact, not a bias in the study.

3 The effects of lake levels on recreational use are discussed on page 11. In addition, data on recreational activity (visitor nights at Ross Lake backcountry campgrounds) and average lake levels for May, June, and September in the years 1981 to 1986 have been gathered and analyzed further for possible relationships between lake levels and recreational use.

4 In May and September, there is no association or significant correlation between lake levels and recreational use. In June, there is a statistically significant inverse association. In other words, during the period studied, backcountry recreation at Ross Lake was lower in June during years when the lake was filling more rapidly. Association, however, does not necessarily imply causation. The most likely explanation for this relationship between lake levels and recreational activity is that the lake would be higher during years with higher rainfall, when backcountry use would be less attractive. The text on page 13 of the report has been revised to include this analysis.

5 During July and August Ross Lake is essentially at full pool in any year and varies in average elevation by less than 2 feet. However, recreational use (as shown on Tables 2.14 through 2.20) varies considerably. This difference between the two months in recreational activity is statistically significant and shows that use varies independently of lake levels. The text on page 13 of the report has been revised to include this analysis.

6 Due to the complexity of the viewshed maps they could not be completed in time for preliminary review. All materials will be made available to interested parties as soon as possible.

7 This statement refers to the Park Service's policy contained in their General Management Plan (NPS 1988). The statement is important to this study because it will direct how the Park Service will manage the area.

8 This statement is also directly from the Park Service's management policy.

9 The Park Service is planning a visitor center to be jointly operated with British Columbia Parks to be located on the Canadian side of the border (see NCNP General Management Plan, page 25).

10 Further information on Canadian developments is not immediately available and is beyond the scope of this study. See also the response to your comment No. 9 to supplemental Environmental Information, Envirosphere, 1989.

11 This information is not yet available. Seattle City Light is conducting a study this year which will provide the requested information.

12 As discussed above in response to comments 3 - 5, data show no association between lake levels in May and September and backcountry use. In June, higher lake levels are associated with lower backcountry use. We do not conclude, however, that the lower use is a result of the higher lake levels. Instead, weather is considered the most probable cause of the observed association.

13 Recreational use patterns do vary considerably with vacation schedules. Figures 2.6 and 2.7 show peaks in backcountry use on Memorial Day, the opening of fishing, July 4th, and Labor Day. Weekend peaks in use are evident in Figure 3.7.

14 Lake levels are averages at 15 day intervals from 1978 through 1986. Highest and lowest lake levels have been added to the figures.

15 "Satisfaction" is as defined by the Statewide Outdoor Recreation Plan (SCORP). It is defined as:

$$(\text{Opportunities}/\text{Need})*100$$

Where Need equals supply minus demand, and Opportunities refers to the facilities and other opportunities available within an area.

16. The sentence "This contrast may diminish the visual quality of the lake and surroundings" has been changed to: "Where this contrast exists, it diminishes the visual quality of the lake and surroundings."

17. Yes, the photographic documentation will be presented in an 11 x 17 booklet available with the final report.

18. The ten viewpoints chosen (at meetings attended by NCCC) at the outset of the study represent a variety of locations, the range of user groups, and the range of landscape types around the lake. Each of those viewpoints was studied at all four lake levels. A viewpoint from the Devils Dome Trail was not studied because the Sourdough and Desolation Peak viewpoints were judged to adequately represent the types of views seen from the high country surrounding the lake. Figure C was developed specifically to indicate the areas within the "theoretical" viewshed where visitors actually viewed lower lake levels. This figure was not the basis for choosing representative viewpoints for study.

19. Shoreline landscape subdivisions are not mapped in this study. However, Section 3.2.5.2 of the report describes different shoreline types depending on substrate, slope angle, and presence or absence of such features as the minor benches that are evident in many areas.

20. A table of opening and closing dates for SR20 has been provided and is included along with the bar graph showing monthly SR20 use.

21. Little data are available on winter use in the Ross Lake area. Apparently very little backcountry use occurs in the Ross Lake area in the winter months. The North Cascades Highway normally closes in late November at Colonial Creek and Early Winters and opens in April. Use of the highway in the winter months in very limited. Hozomeen Campground is open all year, but use in the winter months is known to be very low although numbers are not available on a per month basis.

    If ski, snowshoe, or snowmobile use occurs on SR20 or the road into Hozomeen Campground, the exposed shoreline would probably be snow-covered. A covering of snow would substantially alter the appearance of the exposed shoreline. The color would be the same as other snow covered areas above the shoreline, however, the snow-covered shoreline would probably contrast strongly with the adjacent water and dark-colored forest.

22. There are no direct data on the question of whether Ross Lake itself is a prime scenic attraction, although there has been testimony suggesting this in the past. That

the Ross Lake area is a prime scenic attraction is supported by National Park use data, which indicates that approximately 50 percent of the total backcountry use occurs in the vicinity of Ross Lake. Part of the reason for this high use level is comparatively easy access and the attraction for boaters. In any case, it is well documented from use data in the North Cascades and elsewhere that lakes in mountainous areas attract visitors in part because of their scenic quality.

23. The basis for these statements are observations made by the study team.

24. Although these areas are generally either not visible or are not prominent in views that include Ross Lake, Section 3.2.4 has been modified to include these areas.

25. The presentation of views and of the information obtained from them has been handled objectively and systematically in this study. The study was not intended to document every conceivable location where Ross Lake is visible.

26. This discussion has been modified to note the visibility of the sand flats from other areas at the head of the lake.

27. Some oblique aerial photographs were taken during the drought in 1977-78. Besides the disadvantage of being aerial shots, there is no documentation of date, location, or conditions.

28. In certain areas, when the viewer is close to the shoreline, erosion is evident where there is a steep shoreline. This erosion is difficult to detect when the viewer is more than several hundred yards from these steep shorelines. For the large majority of viewers, those at SR20 and Hozomeen Campground, this erosion cannot be seen and the lake looks "natural" at full pool. To acknowledge the visibility of erosion in some views, the sentence - "At full pool, there is no contrasting exposed shoreline and the lake is visually 'natural'." - has been changed to - "At full pool, there is no contrasting exposed shoreline and the lake appears at its visually most 'natural' condition."

    A full evaluation of erosion conditions has been completed for Ross Lake. Most erosion consists of recession of the edges of the reservoir. Most of this is not visible at full pool. What is visible at full pool are erosional areas that have migrated above the full pool level and instances of slope failure above full pool elevation. These are being addressed in the erosion plan. It is not correct to state that "significant portions" have visually obvious bank erosion problems at full pool.

29. The data for non-power versus power boaters is not comparable to the data for boaters, hikers, and horse riders. Data on number of visitors and visitor nights are

necessary to determine average duration. These data were not available for non-power versus power boaters.

30. All viewpoints chosen (see also response to comment #18) were on land to allow accurate location so that photographic documentation at one lake level could be repeated precisely at other lake levels. Six of the ten viewpoints are at the shoreline (within 5 to 10 vertical feet of the water surface at full pool) and thus are essentially from the lake surface. A seventh viewpoint, Ross Dam, is only slightly higher than these six. One of the viewpoints that is located high above the lake, the SR20 overlook, was specifically chosen for two reasons. It is the viewpoint that is most frequently visited in the Ross Lake area and it is the only viewpoint where motorists along SR20 can stop and have a clear view of the lake. The last two viewpoints, Sourdough and Desolation, were chosen to represent high country views.

31. The statement on page 1 has been changed as stated above (see response to comment #16).

32. Viewer habituation has an effect on visual quality impacts in the experience and judgement of study team members, but the study team is unaware of specific research on this factor that would be applicable to this study. The choice of an appropriate factor (here the natural logarithm) to account for habituation was made based on the study team's judgement that in a given visit, the initial impression of a given view primarily determines a person's reaction to that view. Choosing a factor that reflected less rapid habituation would result in attributing comparatively less impact on individual viewers on SR20 from lower pool levels and comparatively more impact on individual viewers at backcountry camps such as Lightning Creek from lower pool levels. Whatever reasonable habituation factor is chosen, the basic conclusions of this study would remain the same largely because use levels vary so strongly by season and location that these two factors are the primary determinants of visual quality impacts.

33. The visual quality of views from the viewpoints studied (which varied from view to view) was assessed at full pool (Table 3-4). The diminishment of visual quality at lower lake levels was also rated. The visual quality assessed at a given lower lake level took into account both the extent that visual quality was lowered at that lake level and the visual quality of the view at full pool.

34. The scaling chosen (0-4) was arbitrary, but the scalar, which is the scaling factor, was determined by the scaling. For example, the weekly number of viewers ranged from 0 to 2744 for the ten viewpoints and different lake levels studied. This range of 0 to 2744 was scaled to a range of 0 to 4 by multiplying the weekly number of viewers by the scaling factor = 4/2744. Other factors used in calculating indices were also scaled from 0 to 4, which required different scaling factors.

35. The principal author of the visual quality study is a planner with an educational background in environmental studies and ten years experience working for government and the private sector. Research in environmental studies included a study of recreational use, recreational impacts, and possible mitigation in a subalpine area in the North Cascades. As a planner, the principal author has been involved in a variety of aesthetic issues and studies. Most recently, he was prepared an assessment of the aesthetic impacts associated with salmon fish culture in Puget Sound.

    The other study team member that played a prominent role in the visual quality assessment is a planner with eight years experience. His background includes several years as a backcountry ranger in the North Cascades National Park in the 1970's. As a planner he has been involved in several recreational and aesthetic studies.

    The individuals involved with this study have benefitted from discussions with study team members who have a landscape architecture background. The methodology for the visual quality analysis was specifically reviewed and critiqued by a study team member having a landscape architecture background.

36. Views studied in this report vary in their baseline visual quality, that is, there visual quality when there is no exposed shoreline. The study team concluded that it was necessary to account for this variability and then account for the effect of contrast. The baseline visual quality assessed the visual quality of views and not the visual quality of Ross Lake isolated from the view context. There is no inherent reason that a view of the lake from a viewpoint near the lake would have a higher visual quality than a view of the lake from a viewpoint farther from the lake. Other elements in the view besides the lake also contribute to the visual quality of a particular view. Considering the visual quality of Ross Lake in isolation from its surroundings would remove one of the prime reasons for assessing visual quality in the relicensing process.

    The haze, visual distortion, and distance would reduce the contrast of the exposed shoreline with the remainder of the view. The view from Desolation Peak, which has a relatively high visual quality at full pool is not diminished much at lower pool levels because of these three mitigating factors. Therefore, at lower pool levels, the view from Desolation Peak would tend to have a higher visual quality than other views which either have a higher visual quality at full pool or in which the exposed shoreline has a higher contrast.

37,38 To assess the effect of lower lake levels on visual quality required establishing a baseline against which to measure changes in visual quality. The baseline chosen was full pool conditions. While there may be visual changes to be seen because of erosion, attempting to account for the visual quality changes caused by erosion is

difficult because of the lack of a documentable baseline - a shoreline at full pool without erosion.

39. Visual absorption capacity as used in this study is defined as the relative capacity of a landscape to visually absorb modification. The higher the visual absorption capacity, the less a given modification will diminish visual quality.

40. The study team is unaware of any literature that supports the specific method (taking the natural logarithm) used to adjust duration.

41. Taking the natural logarithm of the average duration in minutes does give more weight to short durations in proportion to longer durations. This was done intentionally because of the study team's judgement that habituation was a real factor influencing visual quality impacts. The table below indicates the effect of scaling the duration in a linear manner (no accounting of habituation) versus scaling duration in the manner done here.

USE	DURATION in MINUTES	NATURAL LOG SCALING	LINEAL SCALING
boaters at Little Beaver	1785	4.00	4.00
hikers at Little Beaver	1263	3.82	2.83
hikers at Sourdough	120	2.56	0.27
horse riders at East Bank Trail	60	2.19	0.13
motorists on SR20	9	1.17	0.02

This table indicates that the natural log scaling done for this study weighted all but the longest durations, with the heaviest weighting on the shortest durations. A lineal scaling would reduce the scaled value of all durations (except the longest) relative to natural log scaled values.

42. The conclusion that habituation is a factor influencing visual quality reflects the experience and judgement of study team members. The discussion of comment #32 above provides additional explanation of the study team's method.

43. Boat use at Ross Dam itself is limited to City Light and Park Service use. For this reason, no boater use is shown for the Ross Dam viewpoints. Considerable boat use does occur in the vicinity of the dam at Ross Lake Resort. No data are available on duration of boat use in the vicinity of the resort. Length of rental would not be an accurate indicator of duration or numbers of boaters in the resort area.

44. The resort is a popular area with substantial boat and canoe use.

45. In addition to the qualifications given in the response to comment #45, study team members that rated sensitivities have practical experience in recreation in the Northwest, having hiked, boated, packed, and driven throughout the North Cascades and the Ross Lake area in particular. Study team members are familiar with visual quality and outdoor recreation literature.

46. The expectation index of 0 does not mean that motorists on SR20 are judged to have no sensitivity. Rather it means that their sensitivity is judged to be the lowest of any of the types of users in the Ross Lake area. The expectation index attempts to express an average sensitivity of users within a user group. User groups, particularly a group as large as motorists, would probably contain people with a wide range of sensitivities. However, there is no data that would allow a breakdown of this group into smaller groups having more common sensitivities. For this reason, this study assessed an average expectation.

47. The dates given on page 10 are average dates. April 28 is the average date for the 1523 level and May 9 is the average for the 1528 level. The other average dates follow the same pattern on page 10. Maximum, minimum, and average lake levels for May through September dates based on records of the last nine years are shown on Figures 2.4 and 2.5.

48. The National Park Service does not have any data on the number of vehicles stopping at the SR20 overlook.

49. Observations of stopping rates were not conducted throughout the season to determine whether significant differences in stop rates exist. Differences in stop rates may exist. If higher stop rates exist during the principal tourist months, those viewers in the tourist months would be viewing higher lake levels.

50. Viewer numbers range from 0 to 2744 per week. These numbers are scaled to a range of 0 to 4 by multiplying by the factor of 4/2744.

51. The table missing from the NCCC copy of the report was provided to them.

52. This index is scaled from 0 to 4. An index of 0 does not mean that there is no impact potential, only that the impact potential for a viewer at the SR20 overlook is the lowest potential of any viewer at any viewpoint. Viewers at the SR20 overlook certainly do have the potential to be impacted. To place this impact potential on an absolute scale is outside the possible range of this study.

53. This sentence has been revised to read - "Viewpoints with the highest importance are those that are visited by large numbers of users or those that are visited by viewers who typically stay at least overnight."

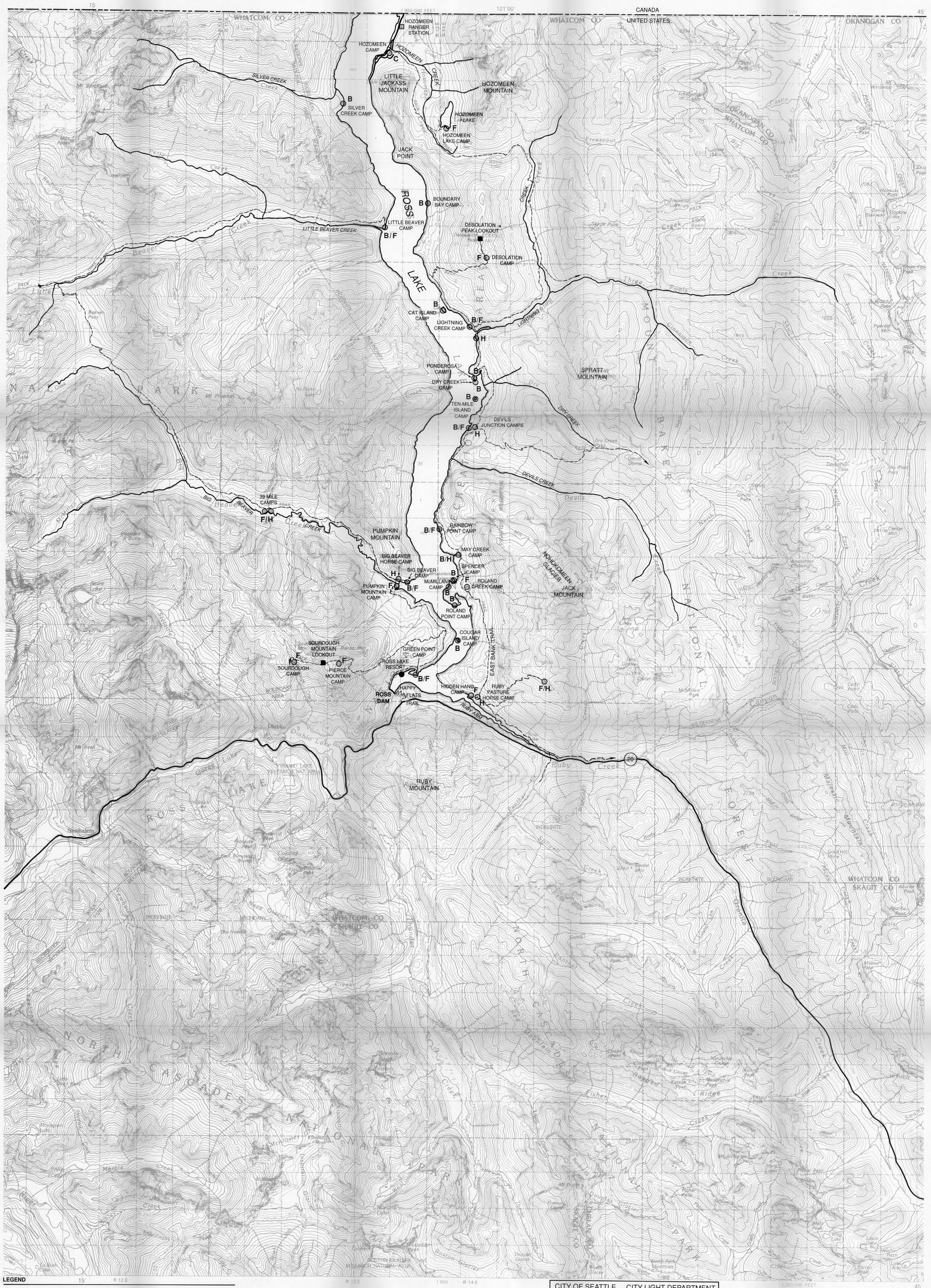
54,55. Each factor that contributed to the various indices was scaled similarly to reduce the likelihood that one factor would be given disproportionate weight. Indices derived from these factors were also scaled similarly, not because of a concern about weighting, but rather to provide for ease in comparison. Weighting is not a concern for the indices because they are not used in further calculations of other indices. Indices reveal patterns of visual quality effects or impacts - where in the Ross Lake area these impacts occur to the greatest degree, when the greatest impacts occur, and so on. The explanations that focus on high and low ratings are simply meant to elucidate these patterns and not to give disproportionate weight to one index or location over another.

56. Although several of the conclusions to this report seem intuitive, the decision was made to use a specific methodology for two reasons. The first reason was to introduce consistency in the comparisons between viewpoints. The second reason is that adopting a formal methodology provides a better basis upon which to draw conclusions and allow review of those conclusions. A more intuitive approach to describing visual quality would have been subject to more questions about its validity. Visual quality assessments are inherently based on subjective judgments and the study team's approach was to provide data and indicate patterns that are supported by that data and reasonable judgments. Elucidating these patterns should help decisionmakers in the relicensing process to understand when and where impacts occur and to arrive at conclusions regarding the significance of these impacts.

57,58. Opening day of fishing season on Ross Lake occurred on June 19 of this year and has occurred on the third Saturday in June for a number of years. The June/early July time period mentioned in the report runs effectively from Memorial Day through June. The small peak of use on Memorial Day weekend is the first significant pulse

of recreational activity that occurs in the Ross Lake area. It is followed by relatively low use levels for the first half of June, after which the use levels increase substantially.

59. Studies analyzing tradeoffs are being conducted by Seattle City Light and will be submitted to the FERC.



LEGEND

B	Boat Campground	H	Horse Campground
F	Hiker Campground	C	Car Campground (Hozomeen Only)

---- Trail

N

SCALE 1:50,000

0 1 2 3

MILES

CITY OF SEATTLE CITY LIGHT DEPARTMENT
SKAGIT RIVER PROJECT FERC NO. 553
EARLY SEASON RECREATIONAL/VISUAL STUDY

ROSS LAKE RECREATIONAL FACILITIES

FIGURE

A