

draft environmental impact statement
development concept plan

GRANT GROVE/REDWOOD MOUNTAIN
SEQUOIA-KINGS CANYON

NATIONAL PARKS/CALIFORNIA





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DRAFT ENVIRONMENTAL IMPACT STATEMENT
for the
DEVELOPMENT CONCEPT PLAN

GRANT GROVE/REDWOOD MOUNTAIN
SEQUOIA-KINGS CANYON NATIONAL PARKS
California

Four alternatives have been examined for future development and use at Grant Grove and Redwood Mountain, Sequoia-Kings Canyon National Parks. These alternatives focus on the overnight accommodations at Grant Grove Village and range from taking no action (health and safety measures only) to developing low-profile units or a hotel or a combination of a hotel and dispersed units. The proposed action and preferred alternative is alternative 1, which recommends rehabilitation of some existing units and construction of some one- and two-story structures that would incorporate amenities to meet the needs of winter visitors and tour groups. Other actions proposed under the three action alternatives include relocating commercial facilities out of Grant Grove Meadow; consolidating and upgrading employee housing; expanding administrative and maintenance space; and improving access, circulation, and visitor facilities at several critical sites in the study areas. The environmental consequences of the proposed action and alternatives, in particular the effects on soils, vegetation, hydrology and groundwater resources, and the character and values of the Grant Grove Village area, are documented in this report.

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The review period for this document ends November 7, 1986. All comments must be received by that time and should be forwarded to the above address.

U.S. Department of the Interior / National Park Service

SUMMARY

This Draft Environmental Impact Statement (DEIS) evaluates the impacts of several types and levels of development and related use in the Grant Grove and Redwood Mountain areas of Sequoia-Kings Canyon National Parks. Four alternatives, including a proposed action, have been analyzed: alternative 1/proposal - expanded facilities in a dispersed arrangement (preferred alternative); alternative 2 - no action (minimum health and safety requirements); alternative 3 - expanded facilities in a hotel; and alternative 4 - expanded facilities in a hotel and detached units.

The 1971 Master Plan for Sequoia-Kings Canyon identified Grant Grove as a site where overnight lodging facilities could be expanded within the parkwide ceiling of 2,000 pillows. Based on this objective, the 1983 Development Concept Plan/Environmental Assessment presented and evaluated three alternatives for providing overnight lodging at Grant Grove. Review of the 1983 document indicated that one or more of the alternatives had the potential for significant impacts on the human environment and that an environmental impact statement should be prepared. This DEIS is the result of that finding.

In developing the DEIS, several issues were identified that require resolution: the poor condition and arrangement of overnight lodging units and the intrusion of some commercial facilities on the natural setting of Grant Grove Village; congestion and safety hazards at the Big Stump entrance station, the Y intersection leading to Grant Grove Village, and in some areas of the village itself; the recent increases in winter use and the demand for related services; the interest in and potential for tour group use of lodging facilities at Grant Grove; the projected gradual, but steady increases in overall park visitation and the related demands for overnight accommodations; the dispersed arrangement and inadequate size of administrative and operational facilities; and the poor condition and arrangement of both NPS and concessioner housing. Redwood Mountain was included in the DEIS evaluation because it is close to the heavily used Grant Grove area and provides an alternative experience; the issue concerning this primitive sequoia forest is the extent to which it should be made known and available to the visiting public.

The alternatives focus on the design of overnight lodging facilities and related commercial services in Grant Grove Village. All of them would require phased implementation to ensure economic feasibility. Alternative 1 recommends expanding lodging units in the village from 52 to 91 to accommodate projected increases in overnight use. All of the new units would include private baths, winterizing features, and other amenities, and two-thirds of them would be in split-level or motel-type structures to allow for group use. The low-profile character of existing developments would be maintained. Commercial facilities in the village would be relocated to two sites north of Grant Grove Meadow to eliminate existing visual intrusions, reduce congestion in the visitor center area, and facilitate overall use. Other actions under this alternative would include

consolidation and upgrading of NPS and concessioner housing; expansion of NPS administrative and maintenance space; improved access and circulation at the Big Stump entrance station, the Y intersection with the Generals Highway, Grant Grove Village, and Panoramic Point; and improvement of the access road and facilities at Redwood Mountain.

Alternative 2, the no-action alternative, would involve only those actions necessary to correct unsafe conditions, meet basic health standards, and improve handicap-accessibility; no new construction or expansion of facilities would be undertaken. Alternatives 3 and 4 would include all of the actions recommended under alternative 1, except for the design of overnight lodging and commercial facilities in Grant Grove Village. Under alternative 3 all lodging would be consolidated in a 75-room, multistory hotel, which would also include a restaurant, gift shop, and ski-touring center; other commercial functions would be moved to a single facility on the knoll just north of Grant Grove Meadow, and a new road would be constructed to permit access to the hotel and stores. Alternative 4 would result in the greatest expansion of overnight lodging. In addition to the 75-room hotel, detached lodging units with a total of 76 rooms would be developed. Commercial facilities would be consolidated on the knoll, and a new access road would be built.

All of the action alternatives would involve soil and vegetation disturbance and the removal of some mature conifers during construction. The impacts would be greatest under alternative 4 and least under alternative 1. These effects, plus the expansion of overnight lodging, would alter the appearance of Grant Grove Village, but the existing rustic character of developments would be maintained through sensitive design and construction. Water consumption would increase with increased use of overnight accommodations. However, a new water storage system (approved in 1985) would be installed, which would be adequate to supply projected visitor and operational needs. Water for the storage tank would be taken from Round Meadow during the peak runoff period, and withdrawals would be spaced throughout the period to minimize effects on hydrology and natural resources. Passive water conservation features would be included in all existing and proposed facilities.

The other effects of the action alternatives would be generally beneficial and would include restoration of Grant Grove Meadow, improved access, and reduced congestion and safety hazards.

Following review of the DEIS, comments will be evaluated and incorporated as appropriate, an FEIS will be prepared, and a final proposal will be selected and approved.

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PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed action is to establish a design concept that will guide subsequent rehabilitation and construction of National Park Service and concession facilities in the Grant Grove and Redwood Mountain areas of Sequoia-Kings Canyon National Parks. The action is needed to alleviate problems related to poor building location and condition, hazardous circulation patterns, and inadequate services and to minimize impacts on the natural environment of the areas. The concept is based on the management objectives in the 1971 Master Plan and takes into consideration present and projected use. (The management objectives are included in appendix A.)

ISSUES AND CONCERNS

The Grant Grove and Redwood Mountain areas were originally set aside to preserve the setting and significant values of the giant sequoia groves, which contain "some of . . . the wonders of the world" (26 Stat. 478). Because of the naming of individual trees and the magnificence of the specimens, Grant Grove became a popular destination, attracting enough visitors to encourage the development of lodging accommodations and support facilities. Today Grant Grove is one of the most heavily used park areas during the summer months and is becoming increasingly popular for winter sports. Because of its relatively easy access from Fresno, it also has potential as a tour group destination. In contrast, Redwood Mountain has been the focus of research efforts over the years. It contains no major developments, is not well known, and receives relatively little visitor use. The following concerns related to the two study areas are addressed in this DEIS.

Deteriorated and Visually Intrusive Buildings

The major concerns relate to the usefulness, arrangement, and condition of facilities in Grant Grove Village (see the Existing Conditions - Grant Grove Village map). The village expanded over a number of years in response to changing visitor interests and needs, and it reflects a lack of planned development. It appears as a cluster of architecturally unrelated buildings separated by large areas of asphalt. Several buildings in the village complex are badly deteriorated or inconveniently located to serve visitors. The centerpiece of the village, Grant Grove Meadow, is a natural open space that is used for interpretive activities and is a favorite snow play area in the winter; however, it is currently encircled by roadways, and some of the buildings on the periphery obscure views of the meadow from key visitor use points.

The worst intrusions on the meadow are the buildings along the southwest edge. The cafe/gift shop sits between the visitor center and the meadow, blocking views and limiting the possibility of using this site as an interpretive area or gathering place. The gas station and post office to the north and east of the cafe/gift shop are in poor repair and are also intrusions on the natural landscape.

The 52 lodging units (tent frames and cabins) in the meadow camp and bowl areas are in varying states of disrepair, and many require major rehabilitation to continue to be functional. Forty-three of them do not include baths, and although showers are available at a central bathhouse, there are not enough to serve both cabin guests and area campers. Only half of the units are winterized. Because of the lack of amenities, some visitors are unwilling to stay overnight at Grant Grove Village.

Congestion and Safety Hazards

There are several points where poor signing and road and parking design contribute to traffic congestion and cause safety hazards. At the Big Stump entrance station, traffic during peak use periods is delayed because there are not enough lanes to handle the volume of cars (see the Existing Conditions - Grant Grove map). Northeast of the entrance station, at the Y intersection with the Generals Highway, directional signs are not clear, and motorists must pull onto the highway at a sharp angle, with inadequate advance direction. At the Grant Grove Village entrance, visitors must make an immediate decision to turn right or left to park, and many are confused because there is no indication of which parking area serves their destination.

A small market east of the visitor center serves campers and day visitors in the summer and cross-country skiers in the winter. However, because of its distance from the main road, it is hard to find, and motorists trying to locate it contribute to congestion at the visitor center.

Changing Use Patterns and Anticipated Visitation Increases

Winter use has increased dramatically in the Grant Grove area. People began using the Big Stump area for informal snow play a number of years ago, parking haphazardly along California 180. This practice still continues, and roads are now plowed into the Grant Grove campgrounds to provide additional snow play areas. Cross-country ski trails have also been designated and marked, and parking is provided at the visitor center. However, because of the increasing popularity of winter recreation, support facilities and services for these activities may need to be further expanded.

As indicated earlier, Grant Grove's easy access and convenient location make it an ideal destination for tour groups and others wishing to stay overnight. However, the existing accommodations do not lend themselves to group use because of their small size and dispersed arrangement. In addition, most of the cabins do not include the amenities normally expected by visitors. To realize the area's potential as a tour group destination and to respond to individual preferences for private baths and other amenities, modifications to existing lodging units would be required.

Although overall visitation at Sequoia-Kings Canyon is currently fairly stable, recreational projections indicate that there will be greater use of

CRYSTAL SPRINGS
CAMPGROUND

THE KNOLL

GRANT GROVE MEADOW

GAS STATION

RESTROOM

PARKING (35 SPACES)

RESTAURANT/GIFT SHOP/

REGISTRATION/BAR

POST OFFICE

PARKING (62 SPACES)

VISITOR CENTER/

DISTRICT OFFICES

AMPHITHEATER

NPS RESIDENTIAL AREA

PINE CAMP

NPS SEASONAL HOUSING

MAINTENANCE BUILDING

GRANT GROVE

CEDAR GROVE

TO FRESNO

GRANT
GROVE
VILLAGE

REDWOOD
MOUNTAIN

GIANT FOREST

MINERAL KING

TO VISALIA

MAJOR ROAD

MINOR ROAD

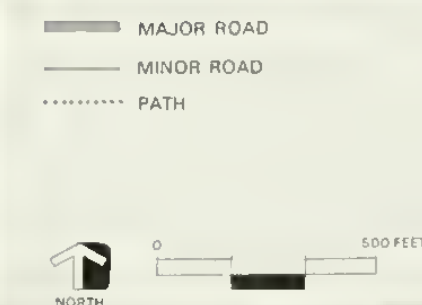
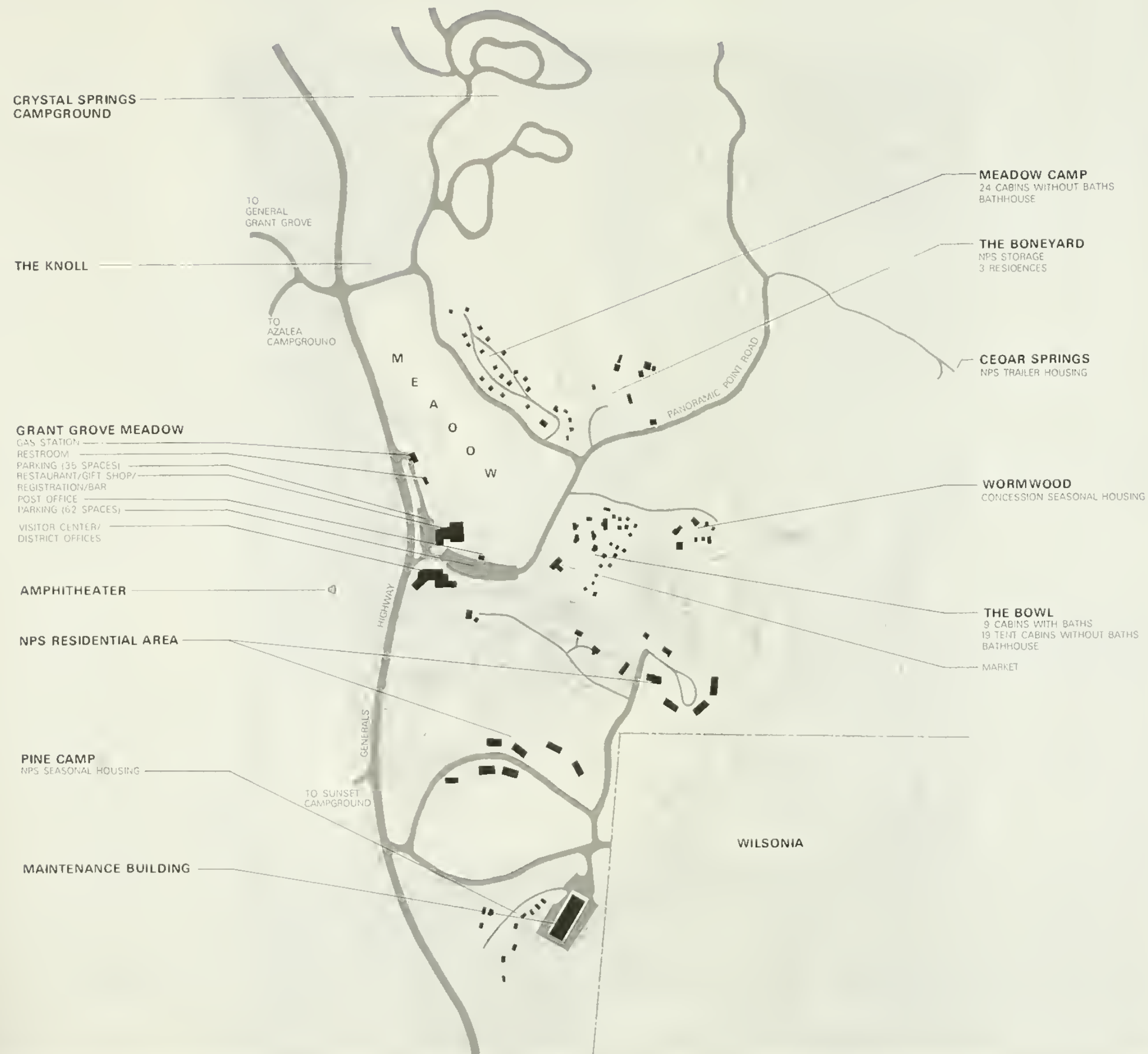
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EXISTING CONDITIONS GRANT GROVE VILLAGE

SEQUOIA-KINGS CANYON
NATIONAL PARKS/CALIFORNIA
United States Department of the Interior
National Park Service



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EXISTING CONDITIONS GRANT GROVE VILLAGE

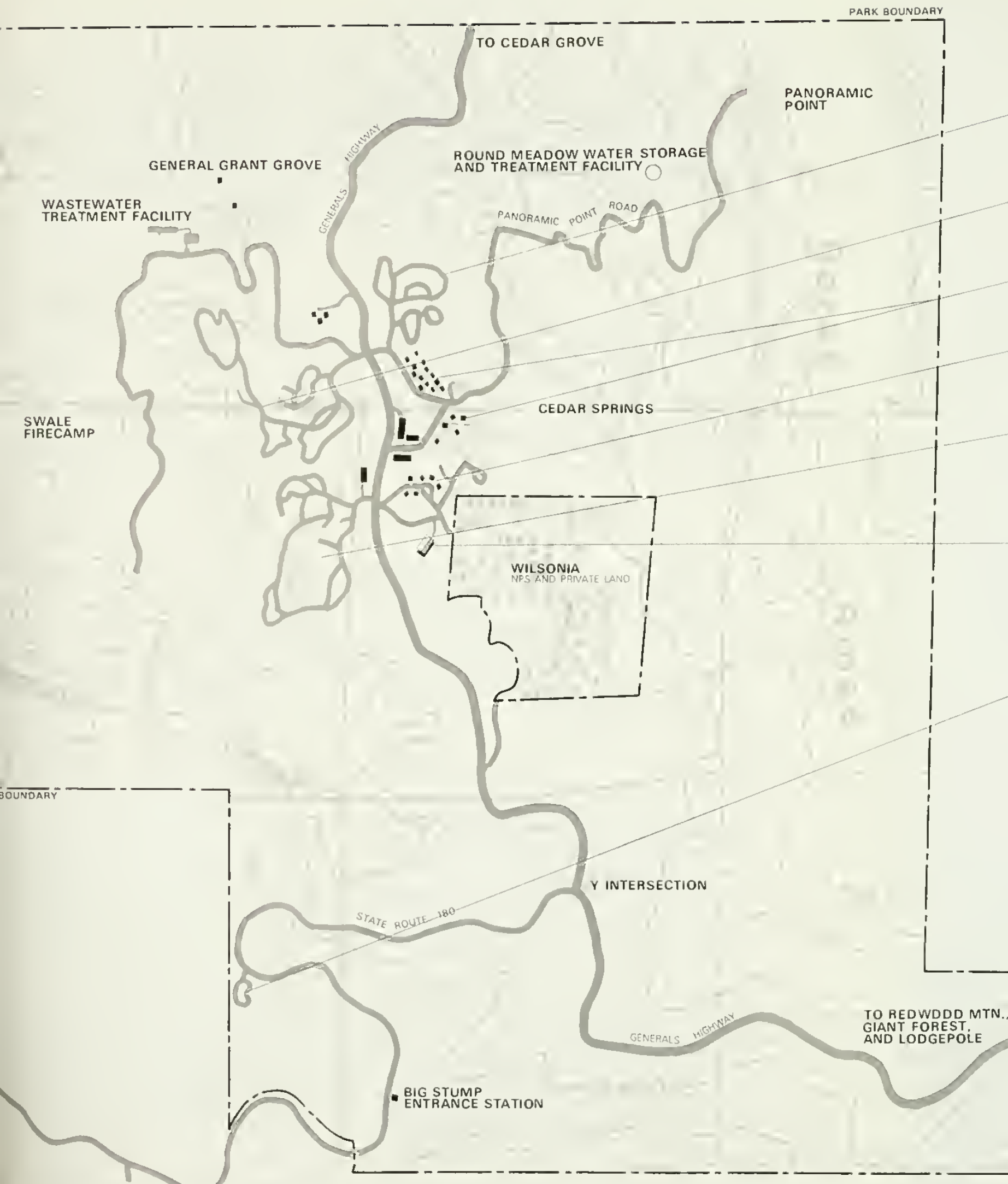
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EXISTING CONDITIONS GRANT GROVE

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- CRYSTAL SPRINGS CAMPGROUND
- AZALEA CAMPGROUND
- GRANT GROVE VILLAGE
- NPS RESIDENTIAL AREA
- SUNSET CAMPGROUND
- MAINTENANCE AREA
- PARKING FOR HIKING AND PICNICKING



EXISTING CONDITIONS GRANT GROVE

**SEQUOIA-KINGS CANYON
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the parks in the immediate future because more people will be vacationing by car and visiting attractions within the U.S. In light of these projections, a gradual but steady increase in visits to Grant Grove can be anticipated in the coming years, accompanied by an increased demand for overnight lodging. Because Grant Grove accommodations are already at or near capacity during the peak month of August, the existing number of lodging units is unlikely to meet demand at the time the Grant Grove proposal is implemented.

Operational Efficiency

Operational efficiency at Grant Grove is hampered by crowded conditions in the administrative offices, a lack of adequate covered maintenance space, and the decentralization of maintenance facilities (two separated boneyard areas). In addition, existing housing for seasonal NPS and concession employees is substandard, scattered, and inadequate to accommodate the present number of employees. The public portion of the visitor center and the nearby amphitheater are in good condition and provide adequate space.

Redwood Mountain Facilities

Redwood Mountain is a significant resource that remains unknown to most visitors. There is little information available on this large grove of sequoias in a wilderness setting, and the sign indicating the entrance is easy to overlook. The access road into the area varies in width and is fairly rough, and regular grading to maintain the surface may be harming the root systems of nearby sequoias. The comfort station at Redwood Saddle is not functioning, and the water and sewer systems are in poor repair.

SCOPE OF ANALYSIS

This Draft Environmental Impact Statement describes and evaluates the environmental consequences of four alternatives, including a proposed action, that could be implemented at Grant Grove and Redwood Mountain. The evaluation was prompted by the review of the 1983 Development Concept Plan/Environmental Assessment for the same areas, which indicated that one or more of the alternative plans had the potential for significant impacts on the quality of the human environment because of the style and increased size of proposed developments.

The alternatives discussed in this document vary somewhat from those in the Environmental Assessment: The no-action and minimum action (health and safety) alternatives are combined to reflect the actions that would be taken if no plan was implemented; and three, rather than two, alternatives are presented for the possible redesign of Grant Grove Village. However, the scope of the analysis remains the same as that of the Environmental Assessment: The study areas include the lands within

the Grant Grove and Redwood Mountain unit boundaries (see Existing Conditions maps); the focus of the study is the lodging accommodations and other facilities that support visitor use in these areas; and the possible number of lodging units in Grant Grove Village still ranges from the present 52 units up to a maximum of 150 units.

Analysis of public comment on the Environmental Assessment and subsequent management evaluations provided the information for determining significant impact topics to be addressed in this Draft Environmental Impact Statement. (A description of the scoping process that preceded preparation of this document is included in the "Consultation and Coordination" section.) The DEIS evaluates the direct and indirect environmental consequences of development alternatives and related visitor use on

- geology, topography, and soils
- climate and air quality
- hydrology and groundwater recharge capacity
- floodplains and wetlands, including meadows and meadow ecology
- sequoia groves
- other vegetation, including incense cedar, fir, and pine stands in
and near developed areas
- wildlife
- threatened or endangered species
- archeological and historic resources
- area characteristics and values
- visitor experiences, including aesthetic factors
- recreational use levels and demands

The document also examines the effects of projected use levels on the water storage system proposed in the 1985 Environmental Assessment for a Sewage Treatment Plant and Expanded Water Storage Facilities. It does not, however, provide a detailed statement of the effects of the proposed system on the environment of the study areas, as these effects were fully assessed in the 1985 report. The conclusions of that report are summarized in the "No-Action Alternative" and "Environmental Consequences" sections of this DEIS.

Park management has had a hazard tree removal program for a number of years. The current program is based on standards developed by the U.S. Forest Service (1984). The criteria for removing trees are included in appendix G; however, in general, trees to be removed fall into one of two categories: those actually in or immediately adjacent to existing or proposed developments; and those that would pose safety hazards now or in the immediate future if left standing. The hazard tree removal program is related to the current planning effort because the extent and pattern of required tree removal has been a determinant in the alternative designs for new developments. Although the exact number of trees that would have to be removed as a result of new construction has yet to be determined, the DEIS evaluates the generalized effects of tree removal on the character and natural values of the Grant Grove Village area.

REDWOOD SADDLE

SEASONAL RESIDENCE

RESTROOM

PARKING

GRANT GROVE

OSCAR MOUNTAIN

TO FRESNO

GRANT GROVE VILLAGE

REDWOOD MOUNTAIN

SANTO FOREST

VINEYARD CANYON

LA SALA

MAJOR ROAD

MINOR ROAD

TRAIL



0 1000 2000 FEET



Scale

EXISTING CONDITIONS
REDWOOD MOUNTAIN

SEQUOIA-KINGS CANYON
NATIONAL PARKS/CALIFORNIA

United States Department of the Interior
National Park Service

OD SADDLE

NAL RESIDENCE

RESTROOM

PARKING

GENERALS
HIGHWAY

PARK BOUNDARY

GRANT GROVE

CEDAR GROVE

TO FRESNO

GRANT
GROVE
VILLAGE

REDWOOD
MOUNTAIN

GIANT FOREST

MINERAL KING

TO VISALIA

MAJOR ROAD
MINOR ROAD
TRAIL



0 1200 2400 FEET

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EXISTING CONDITIONS
REDWOOD MOUNTAIN

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National Park Service

This DEIS has been prepared in compliance with the National Environmental Policy Act of 1969. Other laws and regulations that require compliance during the review of the DEIS, the preparation of the FEIS, and the approval and implementation of the proposed action include the NEPA implementing regulations, the National Historic Preservation Act of 1966, as amended, the Endangered Species Act of 1973, Executive Order 11988 concerning floodplain management, Executive Order 11990 concerning protection of wetlands, the Rehabilitation Act of 1973, and the Concessions Policy Act of 1965. Specific compliance requirements are discussed in the "Alternatives" and "Environmental Consequences" sections.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The following sections describe alternative concepts for the redesign and rehabilitation of Grant Grove Village in Sequoia-Kings Canyon National Parks. The alternatives range from "no action" (taking only those actions necessary to ensure health and safety) to major expansion of overnight accommodations and related facilities. The action alternatives also propose minor improvements in other parts of Grant Grove and the Redwood Mountain area to facilitate use and reduce safety hazards. However, because of the parks' purpose to preserve the natural setting of the giant sequoias and because the Redwood Mountain area has been recommended for wilderness designation, no major development alternatives have been considered for areas outside Grant Grove Village.

Any proposals for overnight accommodations at Grant Grove must take into consideration the other park developments that currently serve visitors. The largest development, at Giant Forest, is going to be phased out because of environmental considerations and replaced with new facilities at Clover Creek, a site about 25 miles southeast of Grant Grove. (This phased relocation will precede any development at Grant Grove.) Clover Creek will contain the largest concentration and greatest variety of accommodations, including a lodge, motel units, tent-top cabins, a hostel, and cluster cabins. The site has a cool summer climate and snow in winter and will support all of the activities currently associated with Giant Forest. Cedar Grove, some 31 miles northeast of Grant Grove in the Kings Canyon vicinity, emphasizes summertime activities--hiking, biking, river fishing, and swimming--and serves as a wilderness threshold. It includes campsites and a small concession development with 18 modern motel units above a store and snack bar. The development sits on an open valley floor at a relatively low elevation and is generally hotter in summer than the other developed areas; it is closed in winter because the access road to it is frequently impassable. The Stony Creek development is next to the Generals Highway on national forest land between Grant Grove and Clover Creek. It provides 12 rooms in a modern motel with a restaurant and gift shop. There are no defined activity sites near the development, but because of its proximity to Giant Forest and Grant Grove, it serves visitors to both of these areas.

Together, the parks' developed areas provide a wide range of opportunities and experiences and can accommodate visitors with varying interests and needs. These factors, combined with the objective of restoring and preserving natural ecosystems and reducing human intrusions, set a clear direction in planning for the Grant Grove development. The 1971 Master Plan and 1980 "Parkwide Concession Study" have determined the parks' maximum acceptable levels of lodging accommodations (2,000 pillows) and campsites (1,700 sites) and have stressed the need to provide facilities that are appropriate to the setting, aesthetically pleasing, reasonably priced, and meet public health and safety standards (see appendix B for lodging capacity figures). With these objectives in mind, the following design alternatives for the Grant Grove and Redwood Mountain areas are proposed.

ALTERNATIVE 1/PROPOSAL: EXPANDED FACILITIES IN A DISPERSED ARRANGEMENT (PREFERRED ALTERNATIVE)

Under the proposal, the Grant Grove and Redwood Mountain areas would be managed to provide contrasting but complementary experiences within a fairly compact geographic area. Grant Grove, with its individually named trees, easy vehicular access, and adjacent support facilities, would continue to accommodate large numbers of visitors seeking structured activities and commercial amenities. Redwood Mountain would offer opportunities to experience the giant sequoia groves without the distraction of large numbers of people or major developments.

Grant Grove

To improve experiences, expand opportunities, and meet health and safety requirements in the Grant Grove area, deteriorated structures would be rehabilitated or replaced, lodging units would be increased to approximately 90 (half of which would be reasonably low cost), facilities for winter use would be expanded, utility systems would be upgraded, and safety hazards would be corrected. To the extent possible, the Park Service would also ensure that new and rehabilitated facilities were accessible to and usable by physically and mentally handicapped persons. Design details would be incorporated in conformance with applicable laws and regulations, in particular section 504 of the 1973 Rehabilitation Act, so that disabled visitors could participate in recreational activities and programs using the same facilities as able-bodied people. All existing and proposed developments would also include the passive water conservation features described in appendix C.

Village. Grant Grove Village is the activity hub of the Grant Grove area and the place most in need of rehabilitation and redesign. Proposals would focus on removal and replacement of facilities that are deteriorated, inappropriately located, or unsuited to their function and on restoration of a more natural setting, particularly in the vicinity of the large central meadow area (see the Alternative 1/Proposal - Grant Grove Village map).

To accomplish these goals, the gas station, market, and post office functions would be moved to a new facility west of the Crystal Springs campground and next to California 180. The new facility would also contain showers, a laundromat, a deli and gift shop, a ski-touring center, and parking for 45 cars and 10 buses/RVs. The existing cafe/gift shop and guest registration functions would be placed in a new building on a knoll just north of the meadow, and a 70-car/4-bus/RV parking lot would be included. The entrance to the Crystal Springs campground would be modified slightly to accommodate this facility, and six nearby campsites would be removed and replaced with new sites inside the campground (see the "Other Support Facilities" section for the campground discussion).

After all of the commercial functions were relocated, the existing structures within and south of the meadow would be removed, and the

meadow edge would be restored to its natural condition, providing a more pastoral setting for activities at the visitor center and nearby cabins. The site of the cafe/gift shop would then be used for outdoor gatherings, interpretive programs, and cultural demonstrations, and sitting areas would be established.

The visitor center and amphitheater, which are well-designed and in good condition, would remain in their present locations; a 240-square-foot addition would be built on the north side of the visitor center to provide needed office space. After the gas station, post office, and cafe/gift shop were removed, the existing parking lots would be redesigned to include one lot for recreation vehicles and buses and one for automobiles. The lots would have a shared entrance from the highway, but a turn lane and improved signing would be provided to eliminate the confusion and hazards associated with the existing entrance. The lot east of the visitor center would be reduced in size and would end at a cul-de-sac. The road segment between the cul-de-sac and the bowl area to the east would be gated.

Lodging would be expanded from 52 units to approximately 90, depending on final design requirements. This expansion is proposed because of Grant Grove's relatively easy access (for tour buses as well as cars), its attractive rustic setting, its central location in relation to significant park features, and its potential to accommodate winter use. Lodging units would be replaced or rehabilitated in the following manner:

Within the bowl area the nine cabins with baths would be rehabilitated, and the 19 tent-top cabins and central bath facility would be removed; a small (12-car) parking area would be provided.

The NPS boneyard area next to the meadow camp would provide space for five split-level structures with a total of 30 rooms (see below for other actions proposed in this area); these units would have a 32-space parking lot.

Of the 24 cabins in the meadow camp, 22 would be rehabilitated as low-cost lodging units with individual parking spaces; the other two would be removed.

The area just north of the meadow camp would be the site of two new 2-story motel units (30 rooms total); parking for 32 cars and 4 buses/RVs would be included.

Modern conveniences would be incorporated into all new lodging units (private baths, winterizing and energy-conserving features, motel-type amenities), but they would be designed to reflect the traditional rustic character of the village. Cleared sites and areas that had been disturbed by previous use would be revegetated and restored to their natural condition. When the rehabilitated cabins reached the end of their useful life, they would be replaced in kind.

COMMERCIAL CENTER

CONSTRUCT
MARKET/GAS STATION/DELI/GIFT SHOP/
POST OFFICE/LAUNDRY/SHOWERS/
SKI TOURING CENTER/PARKING
(45 AUTO/10 RV AND BUS)

THE KNOLL

CONSTRUCT
RESTAURANT/REGISTRATION/
PARKING (70 AUTO/10 RV AND BUS)

GRANT GROVE MEADOW

REMOVE
RESTAURANT/POST OFFICE/
GAS STATION/RESTROOM/
35 AUTO PARKING SPACES
CONSTRUCT
RV/TRAILER AND BUS PARKING (11 SPACES)
REDUCE
AUTO PARKING TO 45 SPACES
EXPAND
VISITOR CENTER (ADDITIONAL OFFICE SPACE)

NPS RESIDENTIAL AREA

CONSTRUCT
4 ADDITIONAL SINGLE-FAMILY RESIDENCES

PINE CAMP

CONSTRUCT
3-2-STORY APARTMENTS FOR 40 NPS
SEASONAL EMPLOYEES/PARKING AND
STORAGE UNDERNEATH AT GROUND LEVEL/
RECREATION FACILITY

REMOVE
EXISTING SEASONAL CABINS

MAINTENANCE BUILDING

ADD 3 BAYS AND OUTSIDE STORAGE



MAJOR ROAD

MINOR ROAD

PATH

EXISTING TO BE
REMOVED

EXISTING TO REMAIN

PROPOSED



0 500 FEET

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**ALTERNATIVE 1/
PROPOSAL
GRANT GROVE VILLAGE**

**SEQUOIA-KINGS CANYON
NATIONAL PARKS/CALIFORNIA**
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National Park Service

COMMERCIAL CENTER
CONSTRUCT
MARKET/GAS STATION/OELI/GIFT SHOP/
POST OFFICE/LAUNDRY/SHOWERS/
SKI TOLING CENTER/PARKING
(45 AUTO/10 RV AND BUS)

THE KNOLL
CONSTRUCT
RESTAURANT/REGISTRATION/
PARKING (70 AUTO/10 RV AND BUS)

GRANT GROVE MEADOW
REMOVE
RESTAURANT/POST OFFICE/
GAS STATION/RESTROOM/
35 AUTO PARKING SPACES
CONSTRUCT
RV/TRAILER AND BUS PARKING (11 SPACES)
RELOCATE
AUTO PARKING TO 45 SPACES
EXPAND
VISITOR CENTER (ADDITIONAL OFFICE SPACE)

NPS RESIDENTIAL AREA
CONSTRUCT
4 ADDITIONAL SINGLE FAMILY RESIDENCES

PINE CAMP
CONSTRUCT
3 2-STORY APARTMENTS FOR 40 NPS
SEASONAL EMPLOYEES/PARKING AND
STORAGE UNDERNEATH AT GROUND LEVEL/
RECREATION FACILITY
REMOVE
EXISTING SEASONAL CABINS

MAINTENANCE BUILDING
ADD 3 BAYS AND OUTSIDE STORAGE

**CRYSTAL SPRINGS
CAMPGROUND**
REDESIGN ENTRANCE
RELOCATE 6 SITES

MEADOW CAMP
CONSTRUCT
2 2-STORY MOTEL UNITS
130 ROOMS/PARKING
132 AUTO/4 RV AND BUS)
RETAIN
22 UNITS/BATHHOUSE
REMOVE
2 UNITS

THE BONEYARD
REMOVE
NPS STORAGE STRUCTURES/
3 RESIDENCES
CONSTRUCT
5 SPLIT LEVEL UNITS
6 ROOMS EACH (30 ROOMS/
PARKING (32 SPACES)

CEDAR SPRINGS
CONSTRUCT
4 16-BED DORMS (64 BEDS)/
2 8-UNIT APARTMENTS (16 UNITS)/
2 DUPLEX RESIDENCES/
3 SINGLE FAMILY RESIDENCES/
RECREATION FACILITY FOR
CONCESSION EMPLOYEES

WORMWODD
REMOVE
CONCESSION SEASONAL HOUSING

THE BOWL
RETAIN
9 UNITS WITH BATHS
REMOVE
19 TENT CABINS/BATHHOUSE
MARKET
CONSTRUCT
PARKING (13 SPACES)

WILSONIA



MAJOR ROAD
MINOR ROAD
PATH
EXISTING TO BE REMOVED
EXISTING TO REMAIN
PROPOSED



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ALTERNATIVE 1/ PROPOSAL GRANT GROVE VILLAGE

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Access into the lodging area from the Generals Highway would be just north of the meadow at the intersection with the road leading to General Grant Grove. This intersection would be widened and have turn lanes to accommodate the increased volume of traffic; directional signs would be improved. The road serving overnight guests would run along the north and east sides of the meadow and would dead-end at the parking lot in the bowl area. These actions would effectively separate traffic coming to the visitor center and the concession area and would reduce existing congestion and confusion about where to turn and park. Visitors would be encouraged to walk between the two areas using the new paths established along the meadow's edge.

New concession quarters for approximately 90 employees would be constructed in the Cedar Springs area. Because about two-thirds of these employees would be seasonal, housing would be in four dorms (64 beds), 16 apartments in two buildings, two duplexes, and three single-family residences; a recreation center would be incorporated. Access to the housing area would be from the Panoramic Point road. The existing housing area at Wormwood would be removed, and the area restored.

Four new single-family residences for permanent employees would be constructed within the main NPS housing area south of the village, and additional quarters for 40 seasonal employees (in three apartment-style winterized buildings) would be constructed in Pine Camp, adjacent to the existing seasonal cabins; the cabins would be removed. The interior layout of the new structures would allow use by families, couples, or single employees. A recreation center would be provided. The NPS residences in the boneyard and at Cedar Springs and Big Stump would be removed.

The maintenance yard northeast of Pine Camp would be expanded to add three bays on the south end of the existing building needed for winter storage of emergency vehicles and required work space and to relocate the maintenance/storage function from the meadow area to the southern portion of the site. The circular drive around the building would be realigned farther west to accommodate the building expansion.

Other Support Facilities. At the Big Stump entrance station an additional entrance lane would be constructed to reduce congestion problems; the new pavement would extend approximately 10 to 12 feet for a distance of 400 feet. The two existing residences at Big Stump would be removed, and the employees relocated to the main NPS housing area south of the village (see the Alternative 1/Proposal - Grant Grove map).

The Big Stump visitor use area would continue to support summer and winter recreation. The picnic sites and 75-car parking area would be redesigned at their existing capacity and landscaped to improve their function and appearance.

The Y intersection of California 180 and the Generals Highway northeast of Big Stump would be reconstructed as a T intersection to reduce safety

hazards and meet highway design standards. Signing would also be improved at the intersection.

The three campgrounds north and west of Grant Grove Village are in good condition and provide adequate space to meet existing and projected demands. (The Swale campground, shown on the map, is currently used as an interagency fire camp, leaving a total of 376 sites in the Crystal Springs, Azalea, and Sunset campgrounds for public use.) With the exception of the modifications to the Crystal Springs campground to permit development of the cafe/gift shop and guest registration facility, no actions are proposed for the campgrounds.

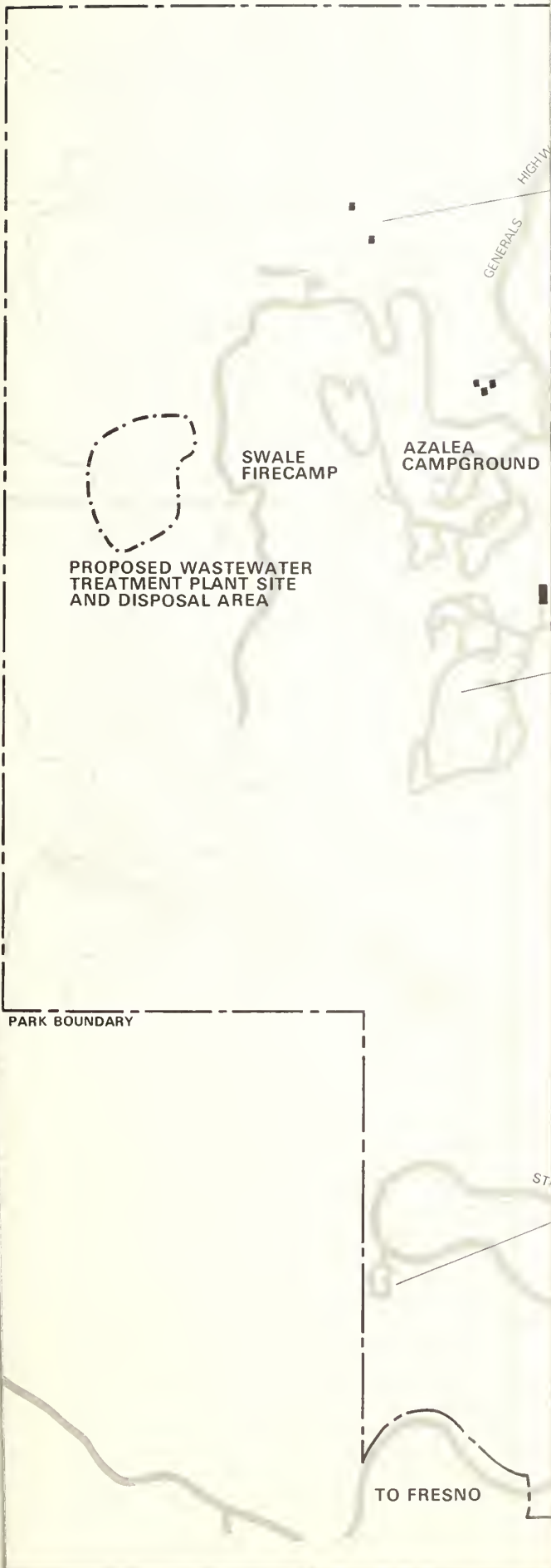
Minor improvements are recommended to reduce impacts and improve visitor use in the Panoramic Point area. The access road leading from the village to Panoramic Point would be repaved, and the signing upgraded. The parking area would be redesigned and paved, and a comfort station would be included.

All of the actions recommended in the 1985 environmental assessment for the wastewater treatment facility and the water storage system would be carried out (see "Alternative 2: No Action" for more details). These actions are reflected on the Grant Grove Proposed Development Concept Plan map. The potential impacts of increased overnight use on the water storage system are discussed in the "Environmental Consequences" section.

Redwood Mountain

The Redwood Mountain area provides opportunities to experience wilderness in a relatively accessible location. This area would be left in its primitive and relatively undisturbed state, with only minor improvements to facilitate visitor use.

The Grant Grove visitor center would provide information on the opportunities at Redwood Mountain, and a new directional sign on the Generals Highway would indicate the entrance to the area (see the Alternative 1/Proposal - Redwood Mountain map). The access road to Redwood Saddle would be paved, but not widened, along the existing roadbed (approximately 1.25 miles), and ditches would be developed on the upslope side. The parking area would be paved and designed for approximately 35 cars. The existing comfort station building and NPS seasonal residence would be renovated, and the water and sewer systems would be replaced.



MAJOR ROAD

MINOR ROAD

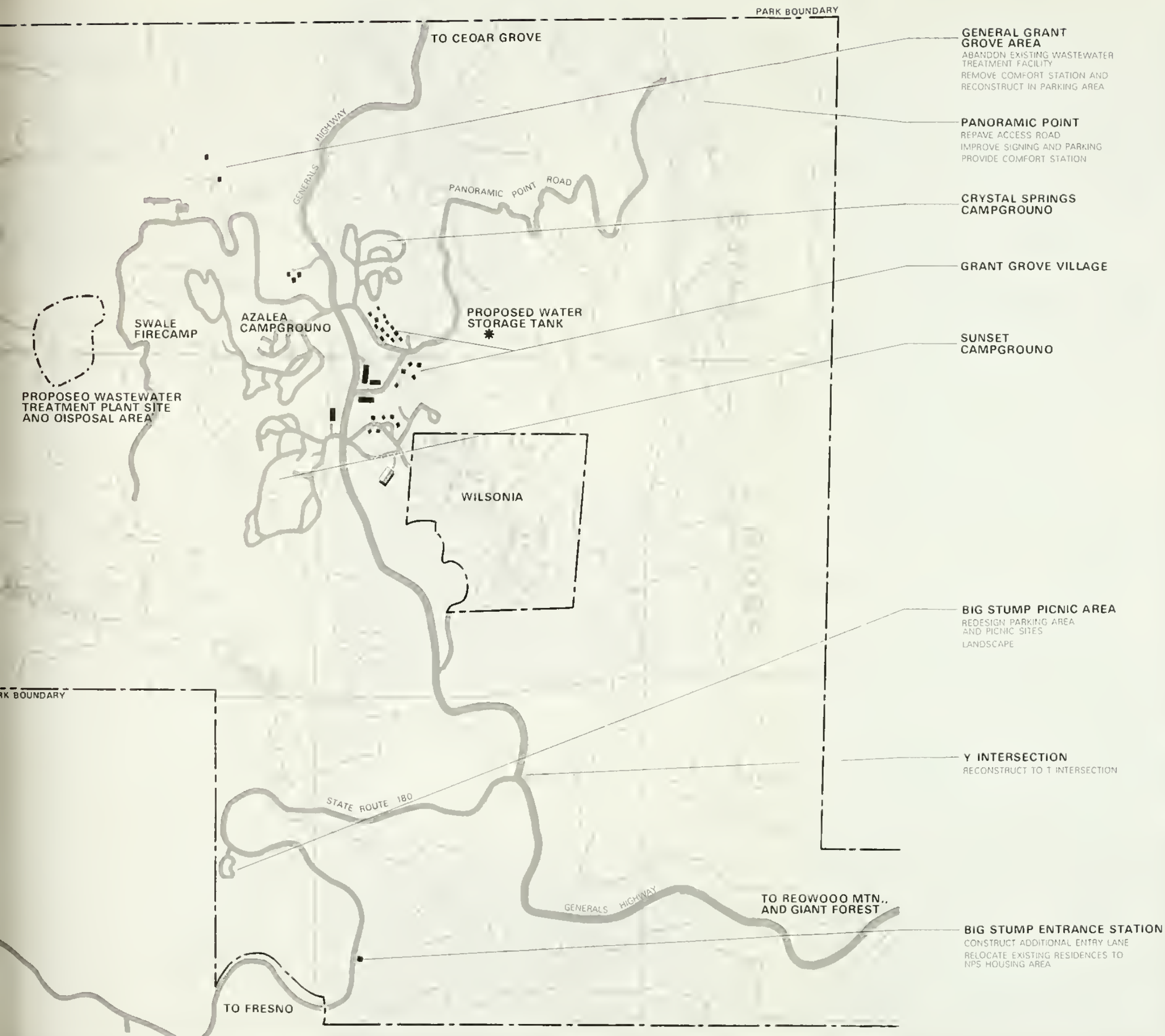


0 1000 FEET

102 40110A
DSC MAY 86

ALTERNATIVE 1/ PROPOSAL GRANT GROVE

SEQUOIA-KINGS CANYON
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GENERAL GRANT GROVE AREA
 ABANDON EXISTING WASTEWATER TREATMENT FACILITY
 REMOVE COMFORT STATION AND RECONSTRUCT IN PARKING AREA

PANORAMIC POINT
 REPAVE ACCESS ROAD
 IMPROVE SIGNING AND PARKING
 PROVIDE COMFORT STATION

CRYSTAL SPRINGS CAMPGROUND

GRANT GROVE VILLAGE

SUNSET CAMPGROUND

BIG STUMP PICNIC AREA
 REDESIGN PARKING AREA AND PICNIC SITES
 LANDSCAPE

Y INTERSECTION
 RECONSTRUCT TO T INTERSECTION

BIG STUMP ENTRANCE STATION
 CONSTRUCT ADDITIONAL ENTRY LANE
 RELOCATE EXISTING RESIDENCES TO NPS HOUSING AREA



MAJOR ROAD
 MINOR ROAD



0 1000 FEET

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**ALTERNATIVE 1/
 PROPOSAL
 GRANT GROVE**

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GENERALS

DIRECTIONAL SIGN
PROVIDE AT INTERSECTION
WITH GENERALS HIGHWAY

ACCESS ROAD
PAVE 1.25 MILES TO
REDWOOD SADDLE

REDWOOD SADDLE
RENOVATE EXISTING COMFORT
STATION AND SEASONAL RESIDENCE
DESIGN PAVED PARKING AREA
WITH 35 PARKING SPACES



MAJOR ROAD
MINOR ROAD
TRAIL

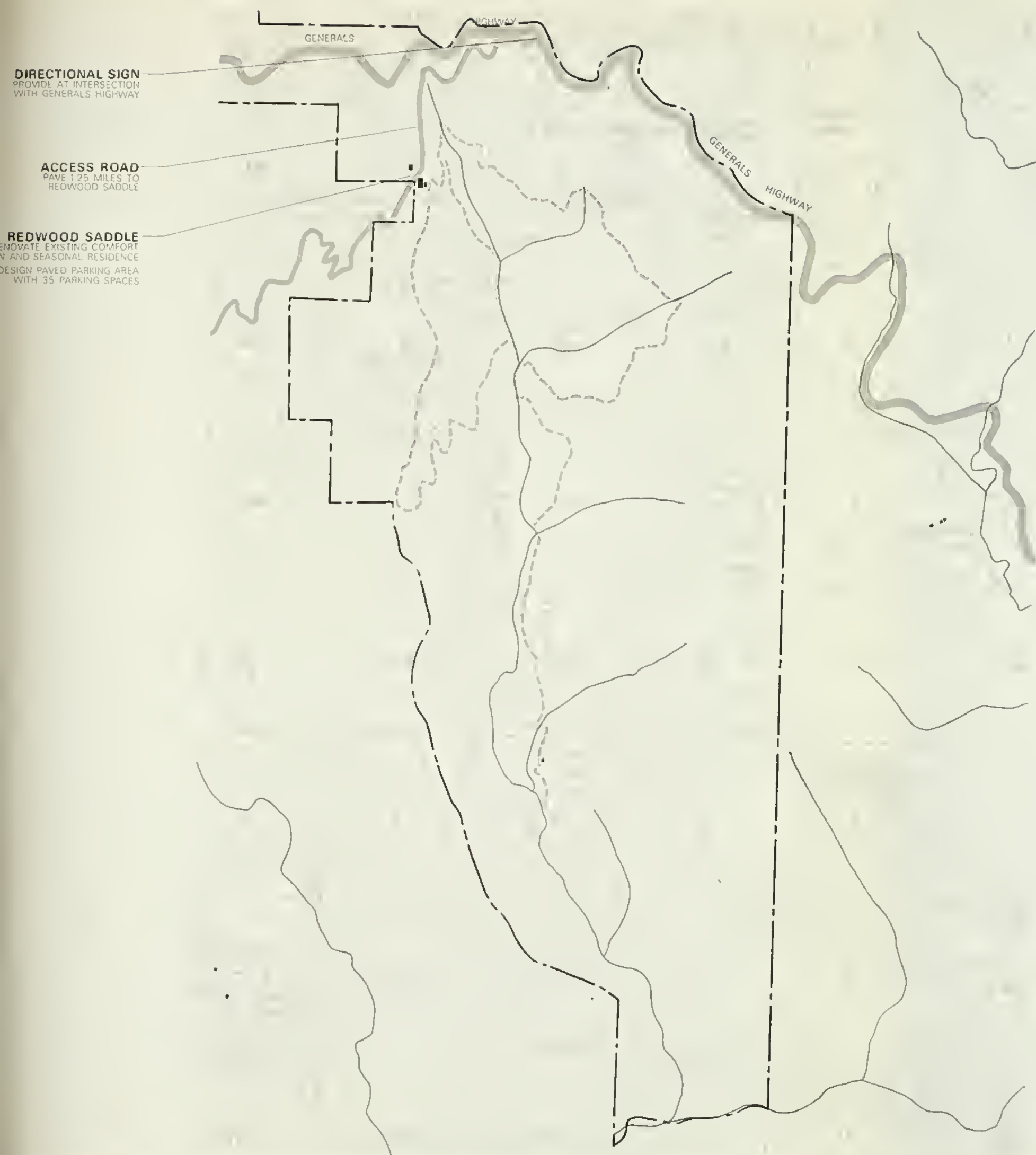


0 1200 2400 FEET

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ALTERNATIVE 1/ PROPOSAL REDWOOD MOUNTAIN

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ALTERNATIVE 1/ PROPOSAL **REDWOOD MOUNTAIN**

**SEQUOIA-KINGS CANYON
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ALTERNATIVE 2: NO ACTION (MINIMUM REQUIREMENTS FOR HEALTH AND SAFETY)

The Grant Grove area would continue to be managed as at present. The only actions taken would be those necessary to correct unsafe conditions, meet basic health standards, and improve handicap-accessibility. Resource protection and visitor use problems would be dealt with on a case-by-case basis.

Existing lodging units and other structures would be rehabilitated as necessary to eliminate health and safety problems, and minor improvements would be made if money and manpower permitted. However, buildings would continue to deteriorate, and those on the meadow edge would block views from the visitor center and intrude on the natural setting. There would be no expansion or winterizing of lodging facilities. Existing circulation patterns and signing would be maintained.

No expansion or consolidation of park administration and maintenance functions would be undertaken, and day-to-day operations would continue to be hampered because of the separation of maintenance facilities and inadequate space. Seasonal housing for both NPS and concession employees would be rehabilitated as necessary to meet health and safety standards, but employee accommodations would remain scattered and substandard.

For safety reasons, the additional lane at the Big Stump entrance station would be constructed, and the Y intersection northeast of the entrance would be reconstructed as a T intersection.

All of the actions recommended in the 1985 Environmental Assessment for the sewage treatment plant and the water storage system would be carried out to bring the systems into compliance with health, safety, and water quality standards. That assessment concluded that the existing sewage treatment plant is an environmental and health hazard, is located in a prime resource area, and is inadequate to meet existing needs, and it recommended that the plant be abandoned and a new, larger facility be constructed on an environmentally acceptable site south of Mill Flat Creek and west of the Swale campground access road. The treatment plant recommendations have been approved by NPS management, and construction is planned for 1986. The recommended actions are reflected on the Alternative 1/Proposal - Grant Grove map.

The 1985 assessment also evaluated the condition of the water storage system at Grant Grove and determined that a new facility was required to correct existing leakage problems and ensure dependable water supplies and pressure during periods of severe drought. This recommendation has also been approved by management, and the project is currently under contract. The new 1.2-million-gallon storage facility will be built at Cedar Springs in an area that is not visible from visitor activity areas (see the Alternative 1/Proposal - Grant Grove map). The impacts of visitor use on this facility are summarized in the "Environmental Consequences" section.

Under the no-action alternative, Redwood Mountain would continue to be managed as a primitive area. No improvements would be made to the road, parking area, and support facilities.

ALTERNATIVE 3: EXPANDED FACILITIES IN A HOTEL

This alternative would involve all of the actions recommended under the proposal, with the exception of the design for overnight accommodations and other concession facilities in Grant Grove Village. Instead of dispersed cabins and lodging units, all accommodations would be consolidated in a centrally located hotel that would operate year-round. The hotel would be built on the approximate site of the existing NPS boneyard area and would contain 75 rooms and a restaurant, gift shop, and ski-touring center. It would be designed to blend into the natural setting and to reflect the rustic character of existing developments. All of the other concession functions--the market, gas station, deli, gift shop, post office, laundry, and showers--would be moved to a single facility on the knoll just north of the meadow. A new road would be constructed from the General Grant Grove intersection to serve visitors going to the hotel and concession facility; because of gradient requirements, this construction would involve substantial landscape alteration along the 1,200-linear-foot alignment. Parking would be provided for 102 cars and 9 buses/RVs at the hotel, and for 45 cars and 10 buses/RVs at the concession facility. The existing cabins, lodging units, and concessions structures would be removed, and their sites restored to a natural condition. All new facilities would be designed to be fully accessible to handicapped visitors in conformance with applicable laws and regulations. All existing and proposed developments would include the passive water conservation features described in appendix C.

This alternative would not require as many concession employees as the preferred alternative. New quarters at Cedar Springs would house approximately 85 employees in four dorms (56 beds), two 8-unit apartments, two duplexes, and three single-family residences; a recreation center would be included.

The other actions that would be taken under alternative 3 in the Grant Grove and Redwood Mountain areas are described in the proposal.

ALTERNATIVE 4: EXPANDED FACILITIES IN A HOTEL AND DETACHED UNITS

Alternative 4 would involve a significant expansion of overnight accommodations in Grant Grove Village. In addition to the 75-room hotel (as proposed in alternative 3), detached lodging units would be developed in the surrounding bowl and meadow camp areas. To accomplish this, the existing cabins and tent frames would be removed and replaced with four 1-story housekeeping units (16 rooms) in the bowl area and six 2-story motel units (60 rooms) in the meadow camp. Parking would be provided in three lots with a total of 187 spaces. A new road would be developed

CRYSTAL SPRINGS CAMPGROUND

REDESIGN ENTRANCE
RELOCATE 6 SITES

THE KNOLL

CONSTRUCT
MARKET GARDEN (200)
GIFT SHOP (100) (200)
LAUNDRY SHED (100) (200)
(45 AUTO/10 RV AND BUS)

GRANT GROVE MEADOW

REMOVE ---
RESTAURANT POST OFFICE
GAS STATION/RESTROOM/
PARKING 35 SPACES
CONSTRUCT ---
RV TRAILER AND BUS PARKING
(11 SPACES)
REDUCE ---
AUTO PARKING TO 45 SPACES
EXPAND ---
VISITOR CENTER
(ADDITIONAL OFFICE SPACE)

NPS RESIDENTIAL AREA

CONSTRUCT
4 ADDITIONAL GUEST HOUSE
RESIDENCES

PINE CAMP

CONSTRUCT
3 2-STORY APARTMENT HOMES
40 NPS SEASONAL EMPLOYEES
PARKING AND STORAGE UNDERNEATH
AT GROUND LEVEL/RECREATION FACILITY
REMOVE
EXISTING SEASONAL CABINS

MAINTENANCE BUILDING

ADD 3 BAYS AND OUTSIDE STORAGE



MAJOR ROAD
MINOR ROAD
PATH
EXISTING TO BE REMOVED
EXISTING TO REMAIN
PROPOSED



0 500 FEET

102 | 40114A
DSC | MAY 86

ALTERNATIVE 3 GRANT GROVE VILLAGE

SEQUOIA-KINGS CANYON
NATIONAL PARKS/CALIFORNIA
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National Park Service

**CRYSTAL SPRINGS
CAMPGROUND**
REDESIGN ENTRANCE
RELOCATE 6 SITES

THE KNOLL
CONSTRUCT
MARKET/GAS STATION/DELI/
GIFT SHOP/POST OFFICE/
LAUNDRY/SHOWERS/PARKING
(45 AUTO/10 RV AND BUS)

GRANT GROVE MEADOW
REMOVE
RESTAURANT/POST OFFICE/
GAS STATION/RESTROOM/
PARKING (35 SPACES)
CONSTRUCT
RV/TRAILER AND BUS PARKING
(11 SPACES)
REDUCE
AUTO PARKING TO 45 SPACES
EXPAND
VISITOR CENTER
(ADDITIONAL OFFICE SPACE)

NPS RESIDENTIAL AREA
CONSTRUCT
4 ADDITIONAL SINGLE-FAMILY
RESIDENCES

PINE CAMP
CONSTRUCT
3 2-STORY APARTMENTS FOR
40 NPS SEASONAL EMPLOYEES/
PARKING AND STORAGE UNDERNEATH
AT GROUND LEVEL/RECREATION FACILITY
REMOVE
EXISTING SEASONAL CABINS

MAINTENANCE BUILDING
ADD 3 BAYS AND OUTSIDE STORAGE

MEADOW CAMP
REMOVE
24 CABINS /BATHHOUSE

THE BONEYARD
REMOVE
NPS STORAGE STRUCTURES/
3 RESIDENCES
CONSTRUCT
75-ROOM HOTEL/RESTAURANT/
GIFT SHOP/SKI TOURING CENTER/
PARKING (111 SPACES)

CEDAR SPRINGS
CONSTRUCT
4 14-BED DORMS (56 BEDS)/
2 8-UNIT APTS (16 UNITS)/
2 DUPLEX RESIDENCES/
3 SINGLE FAMILY RESIDENCES/
RECREATION FACILITY FOR
CONCESSION EMPLOYEES

WORMWOOD
REMOVE
CONCESSION SEASONAL HOUSING

THE BOWL
REMOVE
28 CABINS/BATHHOUSE/MARKET

WIDEN AND IMPROVE
EXISTING ROADS

WILSONIA



MAJOR ROAD
MINOR ROAD
PATH
EXISTING TO BE REMOVED
EXISTING TO REMAIN
PROPOSED



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ALTERNATIVE 3 GRANT GROVE VILLAGE

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into the lodging area, involving substantial landscape alteration along a 2,000-linear-foot alignment. All other concession functions would be housed in a single facility on the knoll north of the meadow, as described in alternative 3. All facilities would be designed to be handicap-accessible and would include the passive water conservation features described in appendix C.

Designs for concession quarters would be expanded to accommodate the approximately 110 employees required to support increased use in the village. These quarters, which would be built in the Cedar Springs area and extending down the ridge toward Wormwood, would be in six dorms (84 beds), two 8-unit apartments, two duplexes, and three single-family residences; the complex would include a recreation center.

All other actions would be the same as those described in the proposal.

ECONOMIC FEASIBILITY OF CONCESSIONER DEVELOPMENT

Alternatives 1, 3, and 4 have been analyzed to determine the economic feasibility of the concessioner development, taking into consideration the cost of construction, potential income for the summer and winter seasons, anticipated operational expenses, and concessioner overhead expenses. These analyses indicate that there would be a heavy debt service, and because of the seasonality of the operation, economic success could not be guaranteed. Alternatives 1 and 4 would probably be more feasible than alternative 3 because the proposed individual units could be phased in over an extended period at an acceptable investment cost, providing profit-making interim improvements until the balance of the alternative could be implemented.

As indicated earlier, no new concession development would take place at Grant Grove until the Clover Creek development was completed (with the possible exception of interim health and safety measures). Before implementation of the Grant Grove development concept plan, an economic feasibility study (including a market study) would be prepared, which would project the cost of construction (including investment costs) at that future time.

SUMMARY OF ACTIONS, IMPACTS, AND COSTS

Tables 1-3 summarize the actions, impacts, and costs of the four alternatives. Because of the extent of new development proposed, alternative 4 would involve substantially greater impacts and higher costs than the other two action alternatives. Hotel and new access road construction would result in somewhat greater visual impacts and higher costs under alternative 3 than under the proposal.

ALTERNATIVES CONSIDERED BUT REJECTED FROM FURTHER STUDY

Elimination of overnight accommodations from Grant Grove was considered but rejected for a number of reasons. First, lodging in the area predates the parks and offers overnight experiences not found elsewhere in the parks or the adjacent national forest (Clover Creek, when developed, will be a large, modern recreational complex; Stony Creek, on national forest land, provides only 12 motel units and is not suitable for expansion). Second, the area is easily accessible, serves as a gateway to several significant park features, is in an attractive setting, and is becoming an increasingly popular destination for winter use. Finally, all previous plans, including the 1971 Master Plan, have identified Grant Grove as an appropriate overnight area that can serve portions of the park not otherwise served.

Replacing the existing units with the same number of new units was also considered but rejected for several reasons. First, the no-action alternative provides for maintenance of the existing 52 units, with improvements to ensure health and safety--and other improvements as funding permits. Second, the Master Plan identifies Grant Grove as a location where overnight accommodations can be expanded within the parkwide ceiling. Finally, because a gradual increase in the number of visitors seeking overnight accommodations is anticipated and the existing cabin units are already at or near capacity in August (see the "Affected Environment" section), it was determined that 52 units would not be adequate to meet peak-season demand in the near future.

**CRYSTAL SPRINGS -
CAMPGROUND**
REDESIGN ENTRANCE
RELOCATE 6 SITES

THE KNOLL
CONSTRUCT
MARKET/GAS STATION/DELI,
GIFT SHOP/POST OFFICE/
LAUNDRY/SHOWERS/PARKING
(45 AUTOS/10 RV AND BUSES)

GRANT GROVE MEADOW
REMOVE
RESTAURANT/POST OFFICE/
GAS STATION/RESTROOM/
AUTO PARKING (35 SPACES)
CONSTRUCT
RV/TRAILER AND BUS PARKING
(11 SPACES)
REDUCE
AUTO PARKING
TO 45 SPACES
EXPAND
VISITOR CENTER
(ADDITIONAL OFFICE SPACE)

NPS RESIDENTIAL AREA
CONSTRUCT
4 ADDITIONAL SINGLE FAMILY RESIDENCES

PINE CAMP
CONSTRUCT
3 2-STORY APARTMENTS FOR 40
NPS SEASONAL EMPLOYEES/PARKING
AND STORAGE UNDERNEATH AT
GROUND LEVEL/RECREATION FACILITY
REMOVE
EXISTING SEASONAL CABINS

MAINTENANCE BUILDING
ADD 3 BAYS AND OUTSIDE STORAGE



MAJOR ROAD
MINOR ROAD
PATH
EXISTING TO BE REMOVED
EXISTING TO REMAIN
PROPOSED



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ALTERNATIVE 4 GRANT GROVE VILLAGE

SEQUOIA-KINGS CANYON
NATIONAL PARKS/CALIFORNIA
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CRYSTAL SPRINGS CAMPGROUND
REDESIGN ENTRANCE
RELOCATE 6 SITES

THE KNOLL
CONSTRUCT
MARKET/GAS STATION/OELI/
GIFT SHOP/POST OFFICE/
LAUNDRY/SHOWERS/PARKING
(45 AUTOS/10 RV AND BUSES)

GRANT GROVE MEADOW
REMOVE
RESTAURANT/POST OFFICE/
GAS STATION/RESTROOM/
AUTO PARKING (35 SPACES)
CONSTRUCT
RV/TRAILER AND BUS PARKING
(11 SPACES)
REDUCE
AUTO PARKING
TO 45 SPACES
EXPAND
VISITOR CENTER
(ADDITIONAL OFFICE SPACE)

NPS RESIDENTIAL AREA
CONSTRUCT
4 ADDITIONAL SINGLE FAMILY RESIDENCES

PINE CAMP
CONSTRUCT
3 2-STORY APARTMENTS FOR 40
NPS SEASONAL EMPLOYEES/PARKING
AND STORAGE UNDERNEATH AT
GROUND LEVEL/RECREATION FACILITY
REMOVE
EXISTING SEASONAL CABINS

MAINTENANCE BUILDING
ADD 3 BAYS AND OUTSIDE STORAGE

MEADOW CAMP
REMOVE
24 CABINS/BATHHOUSE
CONSTRUCT
6 2-STORY MOTEL
UNITS (10 ROOMS EACH-
60 ROOMS TOTAL/
PARKING (60 SPACES)

THE BONEYARD
REMOVE
NPS STORAGE STRUCTURES/
3 RESIDENCES
CONSTRUCT
75 ROOM HOTEL/RESTAURANT/
COFFEE SHOP/GIFT SHOP/
SKI TOURING CENTER/
PARKING (111 SPACES)

CEDAR SPRINGS
CONSTRUCT
6 14-BED ROOMS (84 BEDS)/
2 8-UNIT APARTMENTS (16 UNITS)/
2 DUPLEX RESIDENCES/
RECREATION FACILITY FOR
3 SINGLE-FAMILY RESIDENCES/
CONCESSION EMPLOYEES

WORMWOOD
REMOVE
CONCESSION SEASONAL HOUSING

THE BOWL
REMOVE
28 CABINS/BATHHOUSE/MARKET
CONSTRUCT
4 ONE-STORY 4-ROOM
HOUSEKEEPING UNITS
(16 ROOMS TOTAL)
PARKING (16 SPACES)

WIDEN AND IMPROVE
EXISTING ROADS

WILSONIA



MAJOR ROAD
MINOR ROAD
PATH
EXISTING TO BE REMOVED
EXISTING TO REMAIN
PROPOSED



1021 40115A
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ALTERNATIVE 4 GRANT GROVE VILLAGE

**SEQUOIA-KINGS CANYON
NATIONAL PARKS/CALIFORNIA**
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Table 1: Summary of Major Actions

	Alternatives			
	1 (Proposal)	2 (No Action)	3	4
<u>Overnight Accommodations</u>				
Lodging units - total	91	52	75	151
cabins (rehabilitate)	31	52*	--	--
motel units	60	--	--	76
(7 structures)				(10 structures)
hotel	--	--	75	75
Campground spaces	376	376	376	376
(relocate 6)			(relocate 6)	(relocate 6)
<u>Commercial Facilities</u>				
	Relocate to two complexes north of meadow	Retain	Relocate to one complex north of meadow	Relocate to one complex north of meadow
<u>Visitor Center</u>				
	Expand administrative space	No change	Expand administrative space	Expand administrative space
<u>Employee Housing</u>				
NPS				
single-family residences	20	16	20	20
apartment buildings	3	--	3	3
cabins/trailers	--	18	--	--
recreation center	1	--	1	1
Concession				
dorms	4	2	4	6
cabins	--	16	--	--
apartment buildings	2	--	2	2
duplexes	2	--	2	2
single-family residences	3	--	3	3
recreation center	1	--	1	1
<u>Access and Parking -</u>				
<u>Grant Grove Village</u>				
Auto spaces	236	97	201	277
Bus/RV spaces	35	--	21	21
New access road	--	--	1,200 If	2,000 If
<u>Maintenance Areas</u>				
	Consolidate and expand	No change	Consolidate and expand	Consolidate and expand
<u>Eg Stump</u>				
	Widen entrance; redesign day use area; modify Y intersection	Widen entrance; modify Y intersection	Widen entrance; redesign day use area; modify Y intersection	Widen entrance; redesign day use area; modify Y intersection
<u>Panoramic Point</u>				
	Pave access and parking; add comfort station	No change	Pave access and parking; add comfort station	Pave access and parking; add comfort station
<u>Rdwood Mountain</u>				
	Pave access and parking; add comfort station	No change	Pave access and parking; add comfort station	Pave access and parking; add comfort station

*Rehabilitation for health and safety purposes only

Table 2: Summary of Impacts

	Alternatives			
	1 (Proposal)	2 (No Action)	3	4
Net acreage disturbance (soils and vegetation)	6.5	5.1 (no change)	7.9	11.4
Required tree removal ¹	124±12	--	209±21	312±31
Average daily water consumption ² increases - peak season	52,840 gpd (30% increase)	33,500 gpd (no change)	49,240 gpd (25% increase)	64,990 gpd (50% increase)
Water draw increases peak season peak runoff period ³	None 10%	None 10%	None 10%	None 10%
Effects on floodplains and wetlands	None	None	None	None
Effects on wildlife	Minor habitat loss	No change	Minor habitat loss	Minor habitat loss
Effects on endangered species	None	None	None	None
Effects on archeological and historic resources	None	None	None	None
Effects on area characteristics	2-story motel units and new commercial complexes added; otherwise low-profile rustic architecture maintained; some clearing involved; 3.2 acres restored	No change	Multistory hotel and new commercial complex added; low-profile setting altered; substantial clearing involved; 2.3 acres restored	Multistory hotel, 2-story motel units, and commercial complex added; low-profile setting altered; significant clearing involved; 1.1 acres restored
Recreational use level increases				
overnight lodging	75%	No change	45%	190%
camping	No change	No change	No change	No change
day use	No change	No change	No change	No change

1. Mature conifers generally 70-120 feet in height; no sequoias affected

2. Excluding day users and NPS employees

3. To fill supplemental storage tank for use during peak season

Table 3: Summary of Estimated Costs

NPS Cost*	Alternative			
	1 (Proposal)	2 (No Action)	3	4
Construct or modify roads/parking	\$ 315,000	\$ 315,000	\$ 500,000	\$ 600,000
Construct turn lanes	600,000	300,000	600,000	600,000
Demolish structures	50,000	--	80,000	80,000
Relocate campsites	6,000	--	6,000	6,000
Add headquarters space	36,000	--	36,000	36,000
Expand maintenance yard	290,000	--	290,000	290,000
Construct employee housing				
single-family residences (\$90,000 ea)	360,000	--	360,000	360,000
apartments (\$233,000 ea)	700,000	--	700,000	700,000
recreation center	90,000	--	90,000	90,000
Upgrade Panoramic Point road and parking area	400,000	--	400,000	400,000
Construct restroom	80,000	--	80,000	80,000
Pave Redwood Mountain road	200,000	--	200,000	200,000
Renovate restroom/replace utilities	40,000	--	40,000	40,000
Rehabilitate house	5,000	--	5,000	5,000
Total	\$ 3,172,000	\$ 615,000	\$ 3,387,000	\$ 3,487,000
<u>Concession Cost</u>				
Construct employee housing				
dorms	\$ 640,000	--	\$ 590,000	\$ 860,000
apartments	420,000	--	420,000	420,000
duplexes	130,000	--	130,000	130,000
residences	230,000	--	230,000	230,000
recreation center	90,000	--	90,000	90,000
furnishings/equipment	150,000	--	150,000	180,000
Construct visitor facilities				
market/deli/gas/etc.	550,000	--	530,000	530,000
cafe/registration	630,000	--	--	--
hotel	--	--	2,360,000	2,770,000
new detached lodging	1,480,000	--	--	1,650,000
Rehabilitate cabins	270,000	--	--	--
Total	\$ 4,590,000	--	\$ 4,500,000	\$ 6,860,000

*Does not include cost to government to buy concessioner's possessory interest in facilities caused to be abandoned by the requirement to relocate.

AFFECTED ENVIRONMENT

REGIONAL SETTING

The region under consideration includes Fresno and Tulare counties in California. The boundary between these two counties cuts east/west through the middle of Grant Grove Meadow. Fresno County extends from the central Coast Range across the San Joaquin Valley to the crest of the Sierra Nevada and contains some of the state's most productive agricultural land; two-fifths of the land is federally owned. Tulare County, at the southeast end of the San Joaquin Valley, also contains productive agricultural lands; the federal government owns half of this county, the majority in Sequoia-Kings Canyon National Parks and Sequoia National Forest.

The population of Fresno and Tulare counties was estimated to be 760,300 persons in 1980, an increase of 27 percent from 1970. This percentage compares to a state increase of 18 percent during the same period. In both counties, population per square mile was less than half that in the state as a whole. In Fresno County, over three-fourths of the people lived in urbanized areas (defined as places with 2,500 residents or more). Nearly 20 percent were rural nonfarm residents, and about 6 percent were rural farm residents. In Tulare County, over 60 percent of the inhabitants lived in urbanized areas, while over 30 percent were rural nonfarm and 8 percent rural farm residents. Median income was \$18,396 in Fresno County and \$16,166 in Tulare County, as compared with \$21,537 for the state.

Fresno is the largest city in the region and had a 1980 population of 218,200 persons (an increase of 32 percent from 1970). Visalia, on California 198, is the largest city in Tulare County; its 1980 population was slightly less than 50,000 persons. Three Rivers (population 2,000) is 7 miles to the southwest on California 198 and provides food and lodging for a large number of park vacationers.

In 1980 the economies of Fresno and Tulare counties were fairly diverse and evenly distributed among employment sectors. The employment distribution included wholesale trade, retail trade, and professional services (over 40 percent); manufacturing (12 percent); and agriculture (12 percent). The remainder were either government workers or self-employed. The relatively large number of people employed in retail trade (over 20 percent) indicates that the recreation industry plays a significant role in the economy of both counties.

STUDY AREAS

Natural Resources

Geology/Topography/Soils. The geologic conditions in the Grant Grove and Redwood Mountain study areas are typical of the Sierra Nevada.



This range, composed of metamorphic rock with intrusions of granite, has been uplifted and tilted to the west through time. Much of the older metamorphic rock has eroded away, leaving a largely granitic area exposed. In the study areas granitic exposures are less dramatic and other igneous rock predominates.

No faults have been mapped in the study areas; the closest active fault is the Kern Canyon Fault, approximately 30 miles east of Grant Grove. Tremors centering along the Kern Canyon, Owens Valley, and San Andreas faults do, however, affect the Grant Grove vicinity, and although the magnitude of the quakes is significantly less than at the center, the area is considered to have a moderate seismic hazard. The Grant Grove staff has reported waterline breaks due to tremors in the past, and this condition is expected to continue (personal communication 1984). Site-specific information is not available concerning the consistency of the subsurface bedrock formations in terms of jointing, fracturing, and depth of overburden, but it is assumed these occurrences are widespread. The seismic hazards in the vicinity of the park require that structures be able to withstand a seismic loading of 4 feet/second² (personal communication, Jon Haman 1985).

The highest point in Grant Grove is on Park Ridge (7,800 feet), the lowest at Sequoia Creek (5,400 feet). The Grant Grove Village area varies only 50 feet in elevation (from 6,600 to 6,650 feet). Nearly half of the Grant Grove area is on slopes of 25 percent or greater. Most of the terrain with slopes of less than 10 percent is in an area 1½ miles long by ½ mile wide that includes Wilsonia, Grant Grove Village, and the Sunset, Azalea, and Crystal Springs campgrounds.

The soils in the Grant Grove study area are classified as Toiyabe-Corbett-Granite Rockland association. These soils consist of shallow to moderately deep loamy sands and sandy loams that have developed on granite rock. Corbett soils are 35 to 50 inches deep; weathered granodiorite and Toiyabe soils are less than 22 inches deep. Toiyabe soils are intermingled with granite outcroppings and are generally on steep slopes or within areas of hard bedrock.

Alluvial meadow soils occur in poorly drained areas. The soil surface is high in organic matter and the subsoil consists of stratified deposits of sandy material of largely granite origin. Soil depths commonly exceed 10 feet.

Granite Rockland soils occur within and adjacent to the Grant Grove Village development. These are large areas of exposed granitic rock, although some random thin soil profiles may be present. The jointing pattern of the bedrock has hydrologic significance because the joints can be important conduits for transporting subsurface water in the otherwise impervious rock. This land type is excessively drained. Runoff is rapid to very rapid depending on the amount of soil cover. Shallow soil profiles and hard bedrock present major constraints for most types of land uses. Soils surrounding structures and pathways have a high erosion hazard if vegetation is removed (Osmundson 1976).

The elevations in the Redwood Mountain study area range from approximately 7,000 feet at the entrance to about 6,200 feet at the parking area. About 0.8 mile of the road traverses soils of the Toiyabe-Corbett-Granite Rockland association; the remaining 0.4 mile (including the comfort station) is on Holland-Shaver soils (Osmundson 1976).

Climate/Air Quality. Climatic conditions in the Grant Grove and Redwood Mountain areas are typical of the western Sierra Nevada slope. Summers are dominated by warm sunny days, with occasional high-intensity afternoon thunderstorms. Summer temperatures are usually in the low 70s at Grant Grove and in the 80s at Redwood Mountain. Winter temperatures average in the low 30s at Grant Grove and the low 40s at Redwood Mountain. Both areas occasionally have temperatures below freezing. At Grant Grove Village more than 90 percent of the precipitation occurs as snow from November through April, yearly snow depth averages approximately 200 inches, and the mean annual precipitation is 42 inches. Because Redwood Mountain is at a lower elevation, the daily temperatures are slightly higher and the annual precipitation is slightly lower than at Grant Grove Village.

Sequoia-Kings Canyon National Parks have been designated class 1 under the Clean Air Act as amended (1977). As such, their air quality related values are important attributes. A class 1 area is subject to the most stringent regulations. Such areas must not exceed the maximum allowable incremental increases over baseline concentrations of sulfur dioxide and particulate matter as specified in section 163 of the act. Air pollutants at the parks primarily originate from populated areas outside, but vehicular traffic on the Generals Highway and in visitor use areas contributes a slight amount of hydrocarbons, nitrates, etc. Campfires also add carbon monoxides and particulate matter, which slightly decrease air quality.

Because of the parks' high altitude, they receive a large amount of ultraviolet light. The wave length of this light induces photochemical reactions that yield the more harmful pollutant compounds--nitrates and ozone. Mature giant sequoias are considered to have a high tolerance to ozone and other oxidants that are the primary pollutants damaging to vegetation, but sequoia seedlings may be more sensitive (Miller et al. 1985). In addition, ozone injury is common in ponderosa and Jeffrey pines and black oak at low to mid elevations in the parks (personal communication, Bennett 1986.)

Poor air quality produces acid rain that, depending on the concentrations, can be detrimental to the entire ecosystem. The magnitude and extent of the problem is not known, but the parks' research and resource management staff is currently studying the problem.

Water Resources. The study areas do not contain any major watercourses, but several small streams flow through or near them. The Grant Grove study area includes three small streams that carry runoff from the Park Ridge area--Abbott, Mill Flat, and Sequoia creeks.

Abbott Creek follows a drainage path immediately north of the Grant Grove developed area. This intermittent creek is supplied mainly from surface and subsurface waters that flow through Round Meadow. In recent years it has dried up and ceased to flow during late summer (correspondence, resource staff, Grant Grove 1984). At present there is insufficient information to verify a groundwater connection between Abbott Creek and the Mill Flat and Sequoia creek drainage systems. If there are rock fractures that function as underground conduits, then water from the Round Meadow may affect groundwater in the sequoia groves in the Mill Flat and Sequoia creek drainages.

Mill Flat Creek is a relatively small, perennial creek that is supplied with water from the Winter Spring/Grant Grove Meadow complex and unnamed meadows in the Crystal Springs campground area. This creek flows through the General Grant Grove and is important in maintaining the grove because of the groundwater/surface water interchange.

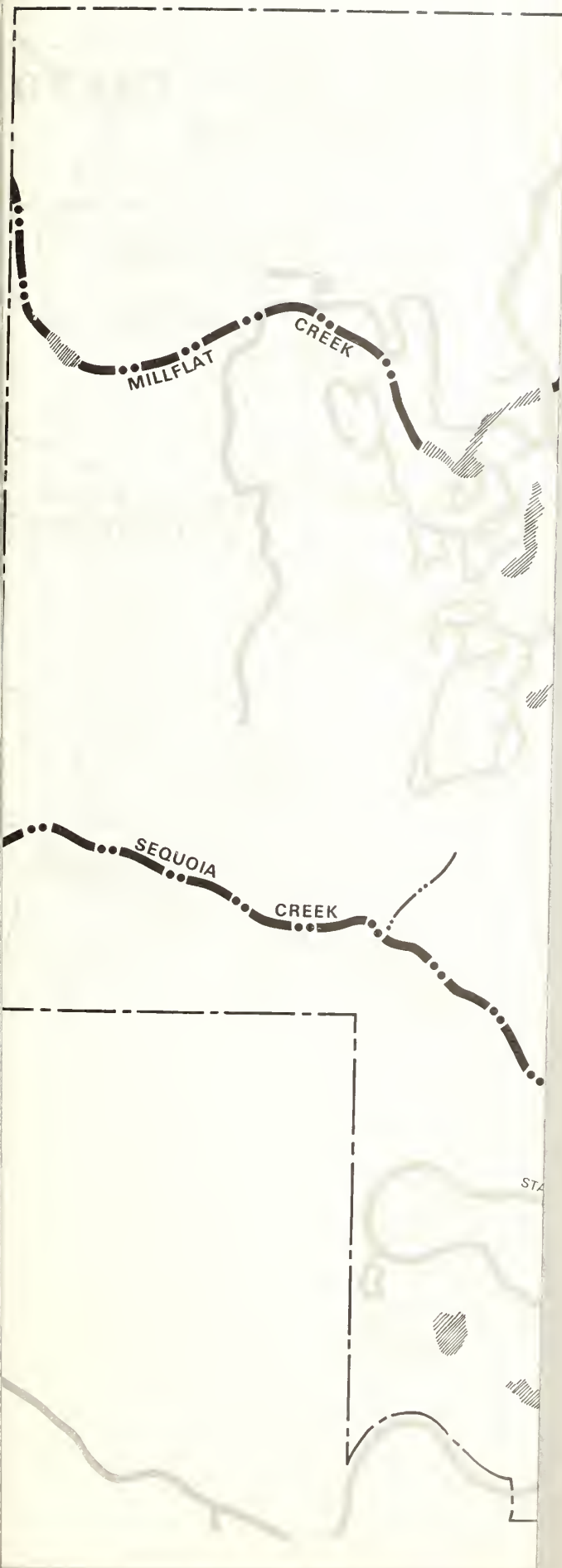
Sequoia Creek is a small, perennial creek that traverses a path immediately south of the Grant Grove developed area. A major supply source for this creek originates in the Merritt Spring and Wilsonia meadow area. This creek is also significant to the groundwater/surface water interchange in sequoia groves south of the Grant Grove area.

Groundwater is common in alluvial deposits in meadow areas and wherever decomposed or fractured granite is suitable to form an aquifer. Precipitation appears adequate to recharge the groundwater, but the actual quantity of stored water in aquifers is unpredictable. The groundwater storage capacity of all the meadows in the study areas is estimated to be 500 acre-feet. Neither storage nor yield can be predicted in the fractured rocks (Walter Long and Associates 1973). Rainfall and melting snow tend to infiltrate weathered and fractured rock rapidly. Even in areas of relatively solid rock, runoff tends to channel into the nearest fractures and crevices. These characteristics mean that much of the streamflow is a result of interflow, or shallow groundwater movement, rather than direct surface runoff.

The amount of precipitation in the study areas typically increases with elevation. Because of the higher precipitation rates at higher elevations and the fairly common occurrence of fractured or weathered rock, ridges and high plateaus are important in the groundwater recharge process. Groundwater, in turn, supplies many meadows, seeps, springs, creeks, and perennial streams.

Wet meadows provide a source of water, but the rate of dependable yield during the critical late summer and fall periods is highly variable, depending on the nature of the groundwater system on the slopes above the meadows. If too heavy a draw is placed on a meadow, the surface will dry up and the vegetation will be destroyed or radically changed (Osmundson 1976).

In the Grant Grove area the concession and National Park Service facilities are served by an artesian well in Round Meadow that is used as



MAJOR ROAD

MINOR ROAD

● SPRING

* WELL

WET MEADOW

● PERENNIAL STREAM

● INTERMITTENT STREAM



NORTH

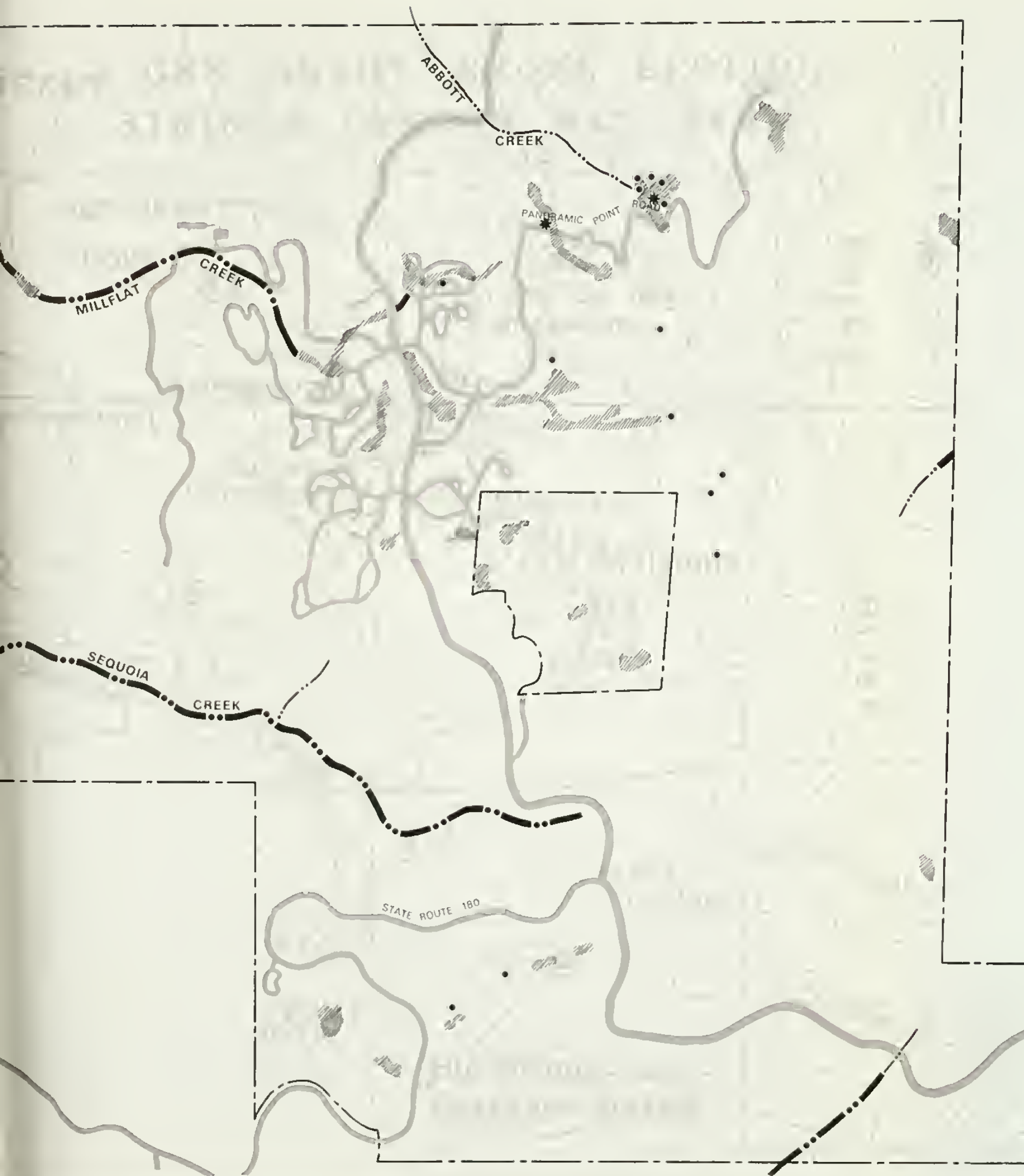
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HYDROLOGY GRANT GROVE

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a year-round water source; Merritt and Winter springs have only been used in late summer or during dry years as a supplemental source of water. These springs have a flow rate of approximately 9 gpm each, and the combined flow rate of the springs at Round Meadow averages 36 to 50 gpm. Following the 1976 and 1977 drought winters, the flow rate in Round Meadow was recorded at 17 gpm. During those low flow periods, water was trucked in from Lodgepole to meet the demand at Grant Grove (personal correspondence, Ken Bachmeyer, chief of maintenance 1984). However, because of increasing water requirements at Lodgepole and the limited available supply from Silliman Creek, this supplemental water source for Grant Grove will not be available in the future.

The water distribution system consists of a network of pipelines up to 8 inches in diameter, a 50,000-gallon storage tank near Winter Spring, which leaks severely, and a 200,000-gallon storage tank below Round Meadow. Chlorination facilities exist at both storage sites. The existing intake structure has a 4-inch iron pipe extending from the 200,000-gallon storage tank to an impounding dam at Round Meadow. This water system serves the entire Grant Grove Village/campground facilities, entrance station, nearby residences, and Big Stump area.

The water supply for Redwood Mountain facilities is Redwood Mountain Spring. This source is reported to supply an adequate quantity of water to meet present and projected needs (personal communication, Ken Bachmeyer 1985).

Chemical analysis of water supplies at Round Meadow, Winter Spring, Merritt Spring, and Redwood Mountain Spring were provided by Brown and Caldwell, Consulting Engineers, Emeryville, California, and by Environmental Consultants, Inc., Clarksville, Indiana (appendix D). In all cases, the quality of the water exceeded existing drinking water standards. In general, the springs and wells of the Grant Grove area produce a water supply with a quality typical of waters of a snowmelt origin (Walter Long and Associates 1973).

Hydrologic Influences on Giant Sequoias. A study of hydrologic influences on the Giant Forest sequoia grove was conducted during the summer of 1968, a year of unusually dry conditions (Rundel 1972). Both soil moisture stress (indication of water in soil) and plant water stress (indication of water in plant xylem) were determined. The results showed that throughout the summer the soil moisture levels in all parts of the soil profile inside the groves remained well above those outside the grove. The plants outside the grove exhibited a greater water stress (higher stress with less water) that extended to a later date. The conclusion of the study indicated that moisture, more than any other factor, determines the occurrence and extent of giant sequoias within their range.

The higher soil moisture within the Giant Forest grove during the summer of 1968 was probably due to subsurface percolation of groundwater from higher elevations, although hydrologic information on the source and consistency of these hypothesized groundwater supplies is not available. Precipitation in Giant Forest was too little and scattered to account for

the sharp increase in soil moisture, and the drainage areas above the study transects were too small for surface runoff to greatly affect soil moisture. Such groundwater sources are of critical ecological importance to giant sequoias, particularly during late summer. During drought stress, sequoia seedlings that have germinated in spring along margins of groves may die, and crown foliage of mature trees may brown. High mortality rates of first-year seedlings can be attributed to dessication during summer months, even inside sequoia groves. Outside grove margins, surface soil moisture levels are generally too low to allow for the survival of seedlings.

Floodplains/Wetlands. The floodplains of the drainage creeks in the study areas have not been mapped, but the small size of the drainage basins and their distance from developments indicate that a rare flood would not threaten structures in the area. It is also unlikely that visitors would be threatened in the event of a flood because access roads to high-water areas like Mill Flat Creek bridge at Grant Grove would immediately be closed.

The meadows in the Grant Grove and Redwood Mountain areas are considered wetlands as defined in EO 11990, "Protection of Wetlands." In compliance with this order the meadows are to be protected. A more detailed description of meadow ecology is included in appendix E.

Vegetation and Wildlife. Most of the Grant Grove area contains mixed coniferous forest. Large conifers, including Jeffrey pine, sugar pine, white fir, and incense cedar, are its principal constituents. These species are found in varying degrees of density and dominance depending on elevation (mostly between 4,000 and 8,000 feet) and local microclimatic conditions. White fir is usually the dominant species in the community at all elevations, and this is true in the vicinity of Grant Grove Village. Ponderosa pine, incense cedar, and black oak are subdominants at lower elevations due to the drier conditions; red fir and Jeffrey pine are the distinguishing species at higher elevations. Osmundson (1976) reported that the Grant Grove area was historically vegetated with significantly more black oaks but that since the 1920s it has been free of fire, which has allowed the firs and pines to outcompete the oaks.

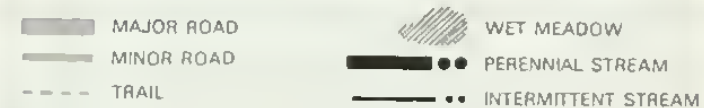
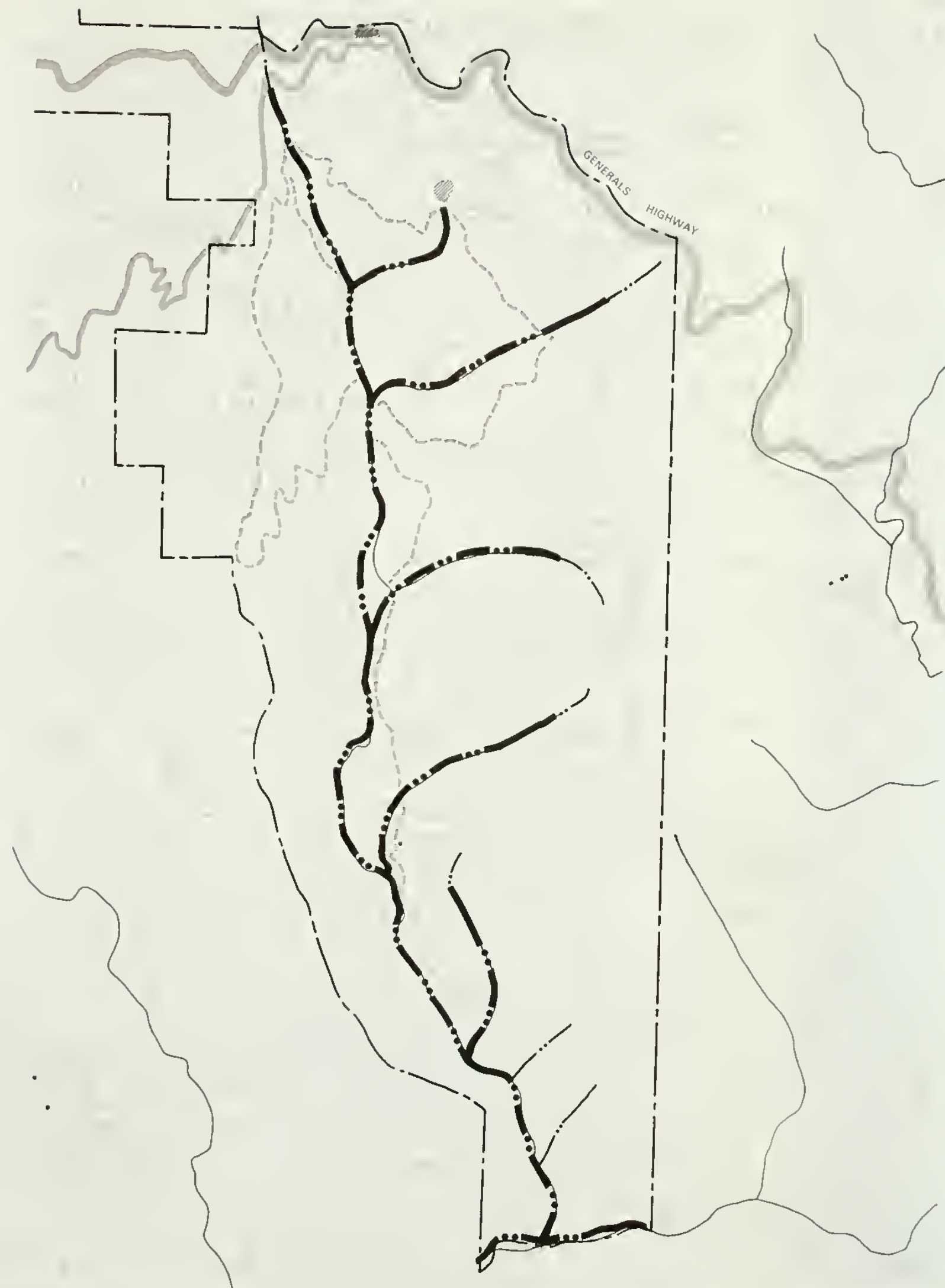
Within the study areas, 23 mammal and 15 amphibian and reptile species are closely associated with the mixed conifer forest. The upper canopy pine seeds along with numerous tree-dwelling insects provide food sources for the lodgepole chipmunk, chickaree, gray squirrel, and other small mammals and birds. The forest also provides roosting and nesting habitat for the pygmy owl, spotted owl, great horned owl, and other raptors. Rodent species in the understory provide prey for larger mammals, such as fisher, marten, and long-tailed weasel.

In general, a mature forest provides less desirable habitat for most forest-dwelling wildlife than a young forest with interspersed open areas, or glades. Additionally, a forest dominated by pines rather than fir generally supports a higher density and number of species because of a general preference for pine seeds. This community can withstand human



HYDROLOGY REDWOOD MOUNTAIN

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intrusion to a higher degree than most other habitat types because the buffer effect of heavy growth mutes noise and disturbances.

Fomes annosus, a root disease, is infesting some mature white fir, Jeffrey pine, and sugar pine in the existing and proposed development areas of Grant Grove. This disease attacks and kills the roots of these trees. As the infection progresses, the tree's vigor is progressively reduced and death is inevitable. However, before death occurs, a diseased tree is more likely to fall because of a reduction in its root system. Therefore, trees infected with F. annosus are considered to be potentially hazardous. The U.S. Forest Service (1984) has mapped and evaluated this problem in Grant Grove. Their results and recommendations have been considered in locating proposed developments.

Mountain chaparral species occur in patches in the Grant Grove area but outside the planning project boundaries. This community type has a 90 percent brush ground cover. The sites are relatively dry, with shallow rocky soils. The dominant plant species include manzanita, ceanothus, and bush chinquapin. These species are also found in lesser density in the understory of the mixed coniferous forest.

The chaparral community provides suitable habitat for at least 32 mammal and 12 amphibian and reptile species within the study areas. Wildlife includes the California ground squirrel, golden-mantled ground squirrel, white-footed mouse, and various reptiles. The tender shoots of manzanita and various species of ceanothus provide excellent browse for mule deer. Birds common to this habitat include the spotted towhee, fox sparrow, and white-crowned sparrow. Reptiles and small rodents within the chaparral community are relatively tolerant of human activity or disturbance. Revegetation in these relatively xeric areas is slow.

Larger mammals, including black bear, cougar, and coyote, range throughout most of the park habitats.

Wet Meadows. Because of their limited area and their importance in maintaining a variety of wildlife, meadows are of critical concern in preserving the biotic associations, natural balance, and integrity of park ecosystems. Grant Grove Meadow is also the central aesthetic feature in the immediate village area. A discussion of the wet meadow ecology, dynamics, and associated plant and animal species can be found in appendix E.

Giant Sequoia Groves. Giant sequoias (Sequoiadendron giganteum) are the best known and largest trees, in terms of volume, in the world. They are also significant because of their limited range and life span of over 2,000 years (Harvey et al. 1980). Giant sequoias grow in more or less isolated groves on the western slopes of the Sierra Nevada in central California from Placer County southward to Tulare County. Redwood Mountain was once the focus of pioneering research in sequoia ecology. Sequoia ecology and associated plant and animal species are discussed in appendix F.

Threatened or Endangered Species. There are no known or reported threatened or endangered plant or animal species in the study areas. There is a population of California pinyon (Pityopus californicus) in the Redwood Mountain vicinity but not in the immediate study area. This species is not listed as a candidate for federal threatened or endangered status, but it is listed as rare by the California Native Plant Society (1980) and is managed as a sensitive species in the parks.

The wolverine (Gulo gulo) and the California condor (Gymnogyps californicus) are the only reported wildlife species that may infrequently range into the Grant Grove vicinity. The wolverine is listed as rare by the state of California (1980), and the condor is listed in the Federal Register (1984) and by the state of California (1980) as an endangered species.

Cultural Resources

Archeology/Ethnohistory. The Sequoia-Kings Canyon region was prehistorically used by the western Mono, Yokut, and Owens Valley Paiute (Steward 1935). Subsistence was based primarily on hunting and gathering, which entailed seasonal migrations from permanent base camps at lower elevations to temporary camps at higher elevations. This area was also used as a trade route by the Owens Valley Paiute.

An archeological survey was conducted in October 1974 in Kings Canyon National Park, headed by Professor L. Kyle Napton and A.D. Albee, California State College. The party surveyed approximately 700 acres north and west of Wilsonia that included the entire Grant Grove development area. No surface evidence of archeological resources was found on any proposed development site, and clearance to proceed with the concession facility developments on these sites was provided by the Western Archeological Center (143-78-SEKI, October 26, 1978).

For the purpose of ascertaining and fulfilling responsibilities to native Americans based on any religious and traditional use rights as required by the American Indian Religious Freedom Act (Public Law 95-341), it is recognized that one group of people (Mono) originally occupied the area and that two other groups seasonally made use of park lands (the Owens Paiute and Yokut). Many of the descendants of these three groups are still in the park's vicinity and reside throughout Fresno, Inyo, and Tulare counties and on the nine reservations and rancherias in those counties. However, not all descendants are necessarily affiliated with any reservation or rancheria.

History. The large grove of sequoias about 30 miles north of the Giant Forest area was first known as the Fresno-Tulare Grove; it later became known as the General Grant Grove, named after the grove's largest tree. After a road was built to the area, many of the sequoias fell prey to lumbermen. The first sawmill in the area opened in 1862, and additional mills followed. Many of the larger trees were harvested for shingles or fence posts. Following the introduction of flumes, which allowed the



- MAJOR ROAD
- MINOR ROAD
- SEQUOIA
- MEADOW

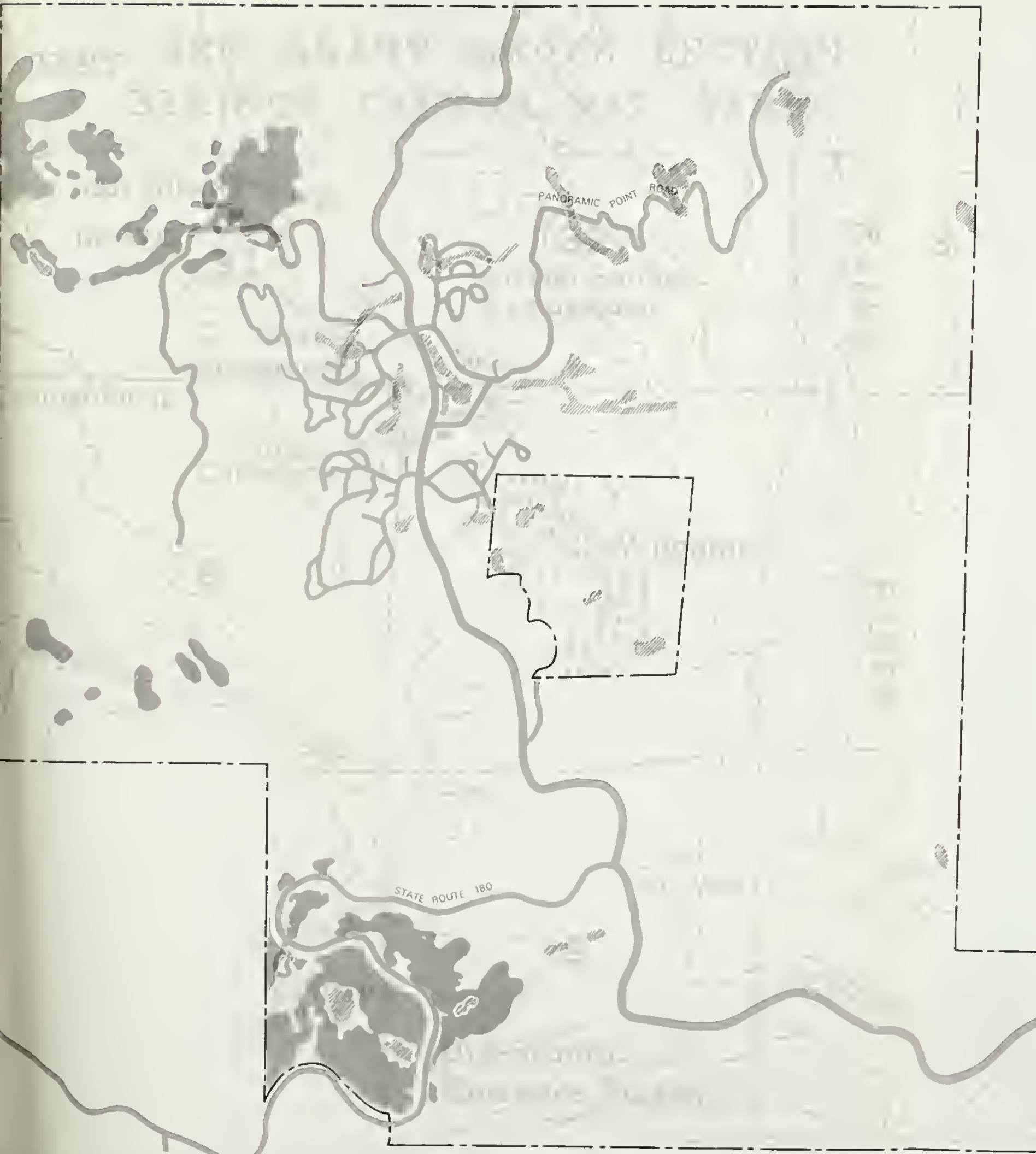


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VEGETATION GRANT GROVE

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MAJOR ROAD
MINOR ROAD
SEQUOIA
MEADOW



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VEGETATION GRANT GROVE

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MAJOR ROAD
MINOR ROAD
TRAIL

SEQUOIA
MEADOW



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VEGETATION REDWOOD MOUNTAIN

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National Park Service



MAJOR ROAD
 MINOR ROAD
 TRAIL
 SEQUOIA
 MEADOW



0 1200 2400 FEET

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DSC MAY 88

VEGETATION REDWOOD MOUNTAIN

SEQUOIA-KINGS CANYON
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 United States Department of the Interior
 National Park Service

economical export of cut lumber from the mills, an area north of General Grant Grove known as Converse Basin was so ravaged that only six large sequoias remain today in what was once the largest grove.

Danger to General Grant Grove stimulated interest in the preservation of the giant sequoias in the Kings and Kern river watersheds. Joseph H. Thomas, who discovered the General Grant tree, first entered the grove in 1862. Thomas was soon operating a small sawmill nearby with the help of two brothers, Israel and Thomas Gamlin. The Gamlins visited the grove and established a squatter's claim there. Thomas married in 1872 and moved from the area. Israel remained, but a government survey disclosed the remarkable quality of General Grant Grove, and Israel was persuaded to give up his claim so the area could be preserved.

In spite of preservation efforts, a 300-foot sequoia was cut down in 1875, and a cross section was shipped to Philadelphia for a centennial exhibition the following year. The General Grant Grove area was finally protected by legislation in 1890 when Congress established General Grant National Park. Finally, in 1940, Congress established Kings Canyon National Park, and General Grant National Park was absorbed into it.

National Register Properties. Pursuant to Executive Order 11593, "Protection and Enhancement of the Cultural Environment" (1971), the Grant Grove study area was surveyed for archeological, architectural, and historical resources. Three properties were determined to merit nomination to the National Register of Historic Places: Big Stump historic district, just inside the entrance to General Grant Grove; General Grant historic district; and the Gamlin cabin, in General Grant Grove near Fallen Monarch (also on the National Register). The General Grant historic district includes the chief ranger's and superintendent's old residences (buildings 108 and 112).

Visitor Use

Visitors to Grant Grove are primarily attracted by the giant sequoia trees, the mountain environment, and the opportunity to enjoy an overnight stay at a campground or a cabin accommodation. A significant number of people come for day visits, and many attend the interpretive programs at the visitor center, amphitheater, and on walks among the giant trees. During winter San Joaquin Valley residents come to the area for snow play or cross-country skiing.

Visitation figures for Grant Grove reflect use levels and patterns throughout Sequoia-Kings Canyon. During the years 1975-1985 total park visitation remained fairly stable, ranging from approximately 1½ million to 2 million (see table 4). Over 70 percent of these visits took place from June through September. Tables 5 and 6 show use statistics at Grant Grove accommodations during the years 1981-1985. These tables indicate similarly stable annual use levels, with summertime visits predominating. Day use in the area exceeded overnight use by a ratio of about 4 to 1 during the summer; average daily visitation included about 800 people at

the campgrounds, 120 at the cabins, and 4,000 who visited just for the day. During the peak month of August, occupancy rates in the lodging units ranged from 91 to 99 percent during the five-year period.

According to the Grant Grove cabin user survey for the 1984 season, about 50 percent of the respondents were repeat visitors and 26 percent had been to the park three or more times during the past five years. About half were in parties of two; another third came in groups of 3 or 4, 11 percent in groups of 4 or larger, and 7 percent alone. Forty-two percent of the adult cabin users were accompanied by children. Three-fourths of the respondents were between the ages of 26-54, 19 percent were over age 55, and 6 percent were under 25. Most people (67 percent) stayed one or two nights, 14 percent stayed three nights, and 19 percent stayed four nights or longer.

Table 4: Annual Park Visitation - 1975-1985

<u>Year</u>	<u>Sequoia</u>	<u>Kings Canyon</u>	<u>Total</u>
1975	957,386	1,035,294	1,992,680
1976	1,040,575	1,127,902	2,168,477
1977	978,600	1,046,600	2,025,200
1978	973,400	869,900	1,843,300
1979	799,600	804,200	1,603,800
1980	862,800	823,800	1,686,600
1981	1,095,000	782,500	1,877,500
1982	1,020,500	831,044	1,851,544
1983	854,233	765,755	1,619,988
1984	979,632	937,262	1,916,894
1985	938,860	877,336	1,816,196

Table 5: 1981-1985 Monthly Overnight Stays at Grant Grove
Concession Facilities

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
January		537	380	374	563
February		584	641	464	667
March		439	578	545	588
April		413	443	775	753
May	1,089	1,392	969	1,414	1,728
June	4,273	2,886	2,371	2,364	2,556
July	4,347	4,105	3,359	3,273	3,686
August	4,556	4,524	4,178	3,798	4,520
September	2,899	2,509	2,270	2,121	2,315
October	1,577	1,377	1,257	1,375	1,368
November	515	468	596	627	771
December	<u>695</u>	<u>466</u>	<u>702</u>	<u>765</u>	<u>864</u>
Total	19,941	19,700	17,684	17,895	20,379

Table 6: 1981-1985 Camper Use at Sunset,
Azalea, and Crystal Springs Campgrounds (376 Sites)

<u>Monthly Total</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
May	5,217	6,739	3,202	8,606	7,920
June	--	14,635	17,911	14,418	15,695
July	14,029	26,347	26,250	23,281	24,239
August	15,327	31,035	25,225	25,595	28,181
September	7,738*	15,360	15,085	12,635	8,743
<u>Daily Average</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
May	171	217	103	279	255
June	--	488	597	481	523
July	452	847	855	751	785
August	494	1,001	810	825	909
September	515	510	503	421	291

Note: Azalea campground is open all year, but use decreases dramatically during the off-season.

* $\frac{1}{2}$ month

No visitor use figures are available for Redwood Mountain. However, observations indicate that most use occurs during the spring and fall because of high summer temperatures.

Facilities Analysis

Description. Grant Grove and Redwood Mountain are quite different in character. Grant Grove provides a wide range of visitor facilities and activities; Redwood Mountain, which is managed as a primitive area, has few developments.

Centrally located in Grant Grove is Grant Grove Village, which includes a visitor center, cabins, a 104-seat restaurant with a gift shop, a small market, a post office, a service station, and an NPS maintenance/storage area. The visitor center (2,300 square feet) also contains NPS staff offices and a county library facility. The overnight facilities are concessioner operated and total 52 units; winter operation of the cabins began in 1981.

South of Grant Grove Village is the NPS housing area, which includes 16 single-family homes and 10 summer cabins for seasonal employees. In addition, there are two permanent residences and one seasonal residence in the boneyard near the meadow, three seasonal residences at Cedar Springs, and two at Big Stump. Concessioner employee quarters include 16 cabins and two 4-room dorms in Wormwood, on the upper level of the bowl area. Three additional employee rooms are under the restaurant.

Other developments in the Grant Grove area include Wilsonia, a largely private enclave covering 100 acres, three campgrounds with 376 sites, a maintenance building (11,060 square feet) and service yard, an amphitheater, and an entrance station and picnic area. Parking is provided at the Big Stump picnic area (75 spaces), the visitor center (100 spaces), and the General Grant tree (127 spaces). Approximately 14 miles of paved roads, 7 miles of unpaved roads, and 17 miles of trails serve the area. In addition, the ridges to the east of the village can be reached by traversing a paved road from the village to a point a short distance from Panoramic Point, where an unsurfaced parking area is provided.

Redwood Mountain, southeast of Grant Grove and accessible from the Generals Highway, is undeveloped except for a graded (unpaved) road extending from the highway to Redwood Saddle and a well-constructed but nonfunctioning restroom building, seasonal employee cabin, and unpaved 60-car parking area at Redwood Saddle. A portion of the road continues through the area to provide access for park personnel during fire control operations, and several miles of trails have been established for visitor use.

Character of the Development. The Grant Grove developed area has a rustic, "cabin in the woods" atmosphere that recalls earlier times. Structures blend into the landscape; roads, cabins, and rooms are at a

human scale. The distribution of the cabins allows guests to experience solitude or participate in community activities as desired. People can speak across porches and children can use the common areas between buildings for play. The evenings are quiet. There is a relaxed, comfortable feeling and an intimate association with the surroundings.

In the spring of 1985 a visitor use survey was sent to 1,462 people who had stayed overnight at the Grant Grove cabins during 1984. Fifty-four percent of those surveyed responded to the questionnaire (a copy is included in appendix J), providing the following statistics. Approximately 85 percent stated a preference for small scattered accommodations (cabins), and 11 percent indicated that they would prefer a lodge or hotel. Concerning the appearance of the existing development, 62 percent found it "attractive," 31 percent listed it as "OK," and 2 percent said that it "detracted from the experience." Lodging was rated excellent by 20 percent, good by 41 percent, average by 17 percent, fair by 14 percent, and poor by 6 percent. (The above percentages do not add up to 100 because some forms were only partially filled out.) When asked which types of accommodations they would prefer at Grant Grove, 137 of the respondents chose cabins without baths, 103 housekeeping units without baths, 232 housekeeping units with baths, 352 cabins with baths, and 85 a hotel (some respondents indicated more than one choice).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1: EXPANDED FACILITIES IN A DISPERSED ARRANGEMENT

Natural Environment

Impacts on Geology, Topography, and Soils. There would be no impacts on the geology of the study areas as a result of proposals in this alternative. Slight topographical modifications would be required to level sites for facility construction.

Approximately 10 acres of surface soils would be disturbed during construction of new facilities in the Grant Grove area. Exposed soils would be susceptible to erosion from wind and water until the sites were surfaced or stabilized through revegetation.

As part of the hazard tree removal program, a yet-to-be-determined number of trees adjacent to existing and proposed structures would have to be removed. (The criteria to be used in tree removal are outlined in appendix G). Soils in these areas would be disturbed during tree removal, and erosion hazards would temporarily increase, particularly if there were not enough understory plants to intercept falling rain and stabilize soils. However, subsequent revegetation of the areas where trees were removed would minimize these hazards.

Soil compaction, primarily from foot traffic, would continue in areas where developments were retained and would increase near new lodging facilities and commercial establishments, in visitor activity areas, and on trails and pathways, thus reducing the ability of plant roots to penetrate soils and increasing runoff in the vicinity. These adverse impacts would be reduced by delineating the activity sites and pathways and encouraging visitors to avoid cross-country travel. However, the areas that received repeated foot traffic would remain denuded and susceptible to soil erosion. If this condition persisted, measures such as surface paving, applying soil binders, or closing pathways would be considered.

The projected increases in winter use at Grant Grove would not cause any additional impacts on soils because the area would be frozen and covered with snow, which would provide adequate protection from erosion and compaction.

The soil types at the Panoramic Point and Redwood Mountain comfort station sites are suitable for use as leachfields (NPS 1979). However, as these facilities began to be used, the microorganism composition near the leachfields would change as a result of the modified nutrient content of soils filtering the effluent.

Impacts on Climate and Air Quality. Alternative 1 would have no impact on the overall climatic conditions in the area. The microclimate in areas where new developments were constructed would be modified slightly

because vegetation removal and paving would reduce the filtering effect on sunlight and permit faster surface heating for a longer duration than in the surrounding vegetated areas. Also, heat radiation in these areas would occur at a faster rate than in vegetated areas, so the paved or covered areas would be slightly warmer during the daylight hours and slightly colder at night.

Construction activities would cause temporary decreases in the air quality in the immediate area because of the production of dust, particulate matter, and construction machinery emissions.

Impacts on Surface and Groundwater Hydrology. Implementation of alternative 1 would result in a projected water consumption increase of approximately 19,000 gallons per day (from 33,500 to 52,840; see table 10) during the peak visitor use season. This is a worst-case projection based on full occupancy and maximum water consumption at new facilities; it is, however, calculated to include the implementation of all proposed passive water conservation measures (see appendix C). With the addition of the new 1.2-million-gallon storage tank, the existing water draws from Round Meadow and the supplemental stored water should be sufficient to meet increased demands and to provide a fire protection reserve of 200,000 gallons, even during drought years. Based on projected use, the water level in the storage tank should be at or near empty on Labor Day.

The water used to fill the new storage tank would be taken from the Round Meadow well during the peak runoff period (January to April), which corresponds to the lowest visitor use period; withdrawals would be spaced throughout the high flow period to minimize any effects on park resources. Based on the total estimated area draining into the meadow and the average volume of precipitation during the peak runoff period, this action would result in a reduction of less than 10 percent in the volume of water flowing through the meadow and into Abbott Creek. Because excess surface runoff rather than groundwater would be collected, no appreciable changes in the saturation levels in the meadow are anticipated.

Although the above actions would minimize impacts on the area's hydrology, the possibility of subtle and far-reaching effects would still exist. Park resource specialists would continue to monitor conditions and would recommend any system modifications or mitigating measures to reduce or eliminate such effects.

Discontinuing the use of Merritt and Winter springs as a supplemental water supply source during drought years would restore the natural surface and groundwater drainage patterns of Sequoia Creek and Mill Flat Creek, respectively.

The Redwood Mountain Spring would be used to meet any increases in water consumption in this area. It provides a surface water source, and the parks' maintenance staff reports that the supply would be adequate for both present and future needs.

Impacts on Floodplains and Wetlands. Although the floodplains have not been mapped, alternative 1 is not expected to have any adverse effects on the drainage systems of the Grant Grove and Redwood Mountain study areas. The water conservation objective at Grant Grove during the peak visitor use season would be to maintain the existing water draw from Round Meadow and to use stored water to supplement this supply. Therefore, the impacts of withdrawal on the meadows and other wetlands of the area would be minimal. No visitor use structures would be located in the probable floodplain of any drainage system, and no trails would be developed within the meadows.

The proposed turn lanes on the Generals Highway at the north end of Grant Grove Meadow would require careful design to avoid any adverse impacts on meadow ecology. Proper culvert placement is particularly critical because if the culvert was improperly sited, it could effectively drain the meadow. In addition, if it was determined necessary to place fill material in the meadow to widen the roadway, a statement of findings would be required to quantify the degree of impact and to identify mitigating measures.

The nonfunctioning comfort station at Redwood Mountain is approximately 100 feet upslope from a small meadow, and its leachfield is 50 feet downslope. Because of the soil type in the area (Holland-Shaver) and the fact that a main sewer line connects the comfort station and leachfield, use of this facility is not expected to have any impacts on the meadow.

Impacts on Sequoia Trees. Alternative 1 would have no impacts on the sequoia trees in the General Grant Grove area. In fact, discontinuing the use of Winter Spring would reduce potential groundwater stress following a drought year because the reduced water draw from the spring would increase the water flows in the Mill Flat Creek drainage, thereby increasing bank storage and decreasing groundwater contributions (as baseflow) to Mill Flat Creek in the General Grant Grove area.

As stated earlier, there is a possibility that widespread jointed and fractured bedrock provides groundwater conduits from the Round Meadow water source to General Grant Grove. Groundwater testing similar to that conducted by the U.S. Geological Survey for the Wolverton/General Sherman tree area would be completed in the Grant Grove study area to ensure that proposed water draws from Round Meadow would not affect groundwater in General Grant Grove.

The paving of the Redwood Mountain roadway along its existing alignment would not alter present conditions. The existing roadbed is so compacted that it is impervious to water; paving the surface would not change this condition and, in the long term, would reduce potential threats to sequoia trees adjacent to the road because less road maintenance would be required. Currently, the most significant threat to these trees is from road grading, which can damage root systems and allow disease organisms to infect healthy trees.

If roadway improvements and additional signing stimulated increases in visitor use at Redwood Mountain, some type of protective barrier would be placed around sequoia trees at the more heavily used sites to prevent trampling and damage to the shallow feeder roots. In some cases, better trail delineation or even rerouting might be required.

Impacts on Other Tree Stands. The proposed installation of new lodging units, relocation of existing developments, and construction of new roads and parking areas would require the removal of about 10 acres of mixed conifer forest. It is estimated that approximately 124 ± 12 mature trees would have to be removed. Table 7 in the "Comparative Summary of Cumulative Impacts" section indicates the extent of impact by predominant species. Approximately 3 acres in the village would be restored to natural conditions; however, it would take 50 to 100 years for mature tree species to become reestablished on these sites.

The hazard tree removal program would also entail the removal of some mature conifers, particularly in the Grant Grove Village area. The definition of what constitutes a hazard tree is outlined in appendix G, but the precise numbers and species of trees that would have to be removed requires further on-site analysis (no sequoia trees would be affected). The removal of mature conifers would stimulate understory growth and increase the susceptibility of adjacent trees to windfall hazard because of increased exposure to wind stress.

Measures have been developed for the treatment of trees infected with Fomes annosus and the protection of remaining trees; these measures are described in appendixes H and I.

Snowplowing during the winter months might result in the scraping and scarring of trees next to the plowed roadways.

Impacts on Understory Vegetation. In Grant Grove Village approximately 10 acres of vegetation would be removed, and the areas surfaced or covered and removed from biological productivity. The understory in these areas varies from sparse to dense and is primarily composed of white fir seedlings and saplings and patches of chinquapin in more open areas. About 3 acres in the village would be restored to natural conditions; however, it would take 5 to 10 years for mature understory species to become reestablished on this acreage.

Trampling of understory vegetation surrounding visitor use areas would continue and would increase in extent. The limits of disturbance would be minimized by delineating and marking trails and educating visitors about the importance of avoiding cross-country routes.

Because understory vegetation would generally be covered by snow, no additional impacts would be expected to occur as a result of winter use at Grant Grove.

Impacts on Wildlife. Despite the increased water consumption at new facilities in Grant Grove Village, no adverse impacts on meadow habitats

are anticipated because the existing water draw from Round Meadow would not be exceeded and stored water would be used to supplement the supply. Limited habitat (about 10 acres of mixed conifer forest) would be lost because of tree removal and vegetation clearing in and near the village, and some wildlife would be forced into adjacent areas to continue feeding and nesting. If the remaining vegetation did not respond to the increased sunlight by producing adequate food sources (primarily pine seeds), intraspecific and interspecific competition could lead to a slight reduction in the overall population levels of the species involved. Based on Storer and Usinger (1974), the species most likely to be displaced or reduced in numbers include the western gray squirrel, flying squirrel, lodgepole chipmunk, mountain chickadee, plain titmouse, common flicker, white-headed woodpecker, golden-crowned kinglet, ruby-crowned kinglet, and black-headed grosbeak. A small portion of the home range of large mammals such as black bear and deer would be altered.

Riparian habitat is considered to be a critical habitat type in the study areas, and it supports one of the most important wildlife communities. Although it occurs along most drainages, the total acreage is quite low in comparison to that of that of other habitat types. Implementation of alternative 1 is not expected to have any significant impacts on this habitat.

Riparian habitats are dependent on the natural flow of high quality water. Although a maximum 10 percent reduction in the volume of water flowing into Abbott Creek could occur during the storage tank collection period at Grant Grove, it is not expected to significantly affect wildlife values by reducing forage, shelter, or water supply.

Impacts on Endangered and Threatened Species. No endangered or threatened plant or animal species are believed to exist in the study areas; however, surveys and consultations with the Fish and Wildlife Service are being undertaken to ensure compliance with law and policy. Documentation of this consultation, along with any avoidance or mitigation measures that might be required should a candidate species be in the area, will be included in the FEIS.

Archeological and Historical Resources

An archeological survey has been conducted in the Grant Grove study area, and a clearance has been granted on the concession facility developments (see the "Affected Environment" section). Proposed developments would not have any effect on known archeological resources in the area.

The General Grant historic district, consisting of the chief ranger's and superintendent's old residences, is within Grant Grove Village. However, no new developments would take place near these structures or the boundaries of the district, and the qualities that resulted in the listing of these properties on the National Register would not be affected.

Visitor Use

Impacts on Area Characteristics and Values. Alternative 1 would generally preserve the existing character of Grant Grove Village but would increase the total number of lodging units and consolidate commercial services in two development nodes north of Grant Grove Meadow. The construction of two 2-story motel units would somewhat modify the character and profile of the meadow camp area, and the relocation of commercial services would expand development into previously undisturbed areas. However, the overall design and scale of new structures would be in keeping with the rustic character of existing developments, and the village ambience would be retained.

Additional vegetation, including some mature trees, would have to be removed to accommodate proposed facilities in and near Grant Grove Village (see the impacts on the natural environment). The removal of these trees would have some effects on the natural setting, but the canopy surrounding lodging units and other facilities would remain fairly dense.

Certain proposals would increase natural values and enhance the aesthetic qualities of the village. Removal of the deteriorated structures in the bowl and restoration of their sites would expand open space and improve the appearance of this area. Removal of the boneyard structures would eliminate this intrusion in the meadow camp area. Finally, removal of all commercial structures within and south of Grant Grove Meadow would greatly enhance the character and values of this natural feature and permit restoration of the area to a more natural condition.

The character of other visitor developments in the Grant Grove study area (the Big Stump picnic area, campgrounds, General Grant Grove, and Panoramic Point) would remain the same or would improve as a result of redesign and removal of intrusive structures. A 2½-acre forested site west of Cedar Springs would be altered to accommodate the new concession housing area; a 1-acre site containing the existing housing area would be returned to its natural condition.

No natural values or characteristics would be altered or diminished outside the developed areas of Grant Grove. The Redwood Mountain area would remain in an essentially undeveloped condition, with only minor improvements to permit visitor access and low-impact dispersed uses.

Impacts on Visitor Experiences. Because of the type and scale of new developments in Grant Grove Village, the "cabin in the woods" experiences would generally be maintained. The proposed two-story units in the meadow camp area might be viewed by some visitors as intrusive in this setting, but they would also serve the needs of those seeking group accommodations and everyday comforts. The increased number of units with private baths would offer an alternative for visitors who do not enjoy roughing it, and the large number of winterized accommodations would meet the needs of this growing clientele. Finally, because some of the older units would be retained and rehabilitated, a wide range of

accommodations, including those at reasonably low cost, would be available to meet varying needs, interests, and price requirements.

The removal of all commercial facilities within and south of Grant Grove Meadow would improve views from the visitor center and permit use of the southern portion of the meadow as a gathering and display area for interpretive activities. This relocation would also reduce congestion in the vicinity of the visitor center, enhancing experiences there. The consolidation of most commercial facilities in a single complex west of Crystal Springs would make these services more accessible and easier to find, and the showers and laundry within this complex would be more convenient for campers. Better signing along the entrance road would reduce confusion about where to go to obtain certain services.

Additional congestion might occur at the commercial complex and at the new restaurant/registration facility north of the meadow because of the large numbers of visitors seeking these services. Day visitors might feel inconvenienced because they would have to stop twice to go to the visitor center and obtain services. The increased activity in and around the restaurant/registration facility might make access into the Crystal Springs campground more difficult at times. The noise and visual distractions associated with both of these developments might diminish the experiences of nearby campground users, and the alteration of previously undisturbed sites might be viewed as intrusive by some people.

Various proposals, including removal of deteriorated or intrusive structures, landscaping and redesign, road and parking improvements, and additional signing, would reduce safety hazards and generally enhance visitor experiences in the Grant Grove and Redwood Mountain areas. Opportunities for picnicking, ski touring, and snow play would be enhanced.

Temporary visitor inconveniences would occur during the construction of new facilities because of associated noise, dust, and unsightliness, possible detours, and disruption or interruption of services.

Impacts on Recreational Use Levels and Demands. The rehabilitation of existing cabins and construction of new units would increase the overnight lodging capacity by 75 percent (from 52 to 91 units). However, because the vast majority of visitors to Grant Grove are day users, the increase in lodging units would generate only slight increases in overall visitation. Further, overnight use in existing units represents only 15 percent of the total overnight use at Grant Grove during the peak season (May-September; see 1985 statistics in tables 5 and 6). Assuming the same approximate occupancy rate in the new facilities and a 75 percent increase in lodging capacity, overnight lodging stays during this period would increase from 14,800 to 25,900, which would represent an 11 percent increase in the total overnight use of the Grant Grove area. The major effects of this visitation increase would be greater water consumption, as discussed in the "Impacts on Surface and Groundwater Hydrology" section, and more demands for commercial services such as restaurants, recreational sales outlets, and gas stations. The new water

storage tank would be installed in Round Meadow before construction of any additional water-consuming facilities at Grant Grove Village, and this storage supply would be adequate to meet the projected increases in water consumption.

Grant Grove is becoming an increasingly popular destination for winter sports. Because additional winterized accommodations and recreational services would be provided under this alternative, winter use levels in and near Grant Grove Village could be expected to increase to an unquantifiable extent.

No actions are proposed under this alternative that would encourage increased camping or day use; therefore, other use levels in the Grant Grove area would probably increase gradually in keeping with nationwide recreation trends. Although use in the Redwood Mountain area is expected to increase, the extent of this increase cannot be quantified at this time and would depend on how much use of the area was encouraged through park literature and locational and directional signing. However, use would be maintained at levels that left the resources unimpaired and maintained the area's wilderness qualities.

Conclusion

There would be minor increases in the impacts on the natural environment as a result of proposals in alternative 1. However, activities would continue to be concentrated in previously developed areas (Grant Grove Village, the three public campgrounds, Big Stump, General Grant Grove, Panoramic Point, and Redwood Saddle), and use would not increase significantly over present levels. The construction of new lodging units, commercial facilities, and employee housing in Grant Grove Village would involve soil, vegetation, and habitat disturbance on about 10 acres, and the subsequent 75 percent increase in overnight lodging stays would result in some additional disturbance. To the extent possible, the adverse effects of visitor use would be reduced by delineating activity sites and trails or temporarily closing areas to allow revegetation. Water consumption would also increase; however, use of the new 1.2-million-gallon storage tank as a supplemental water source (to be filled during the peak runoff period) would minimize the effects on surface and groundwater hydrology and eliminate the need to exceed existing water draws during the peak season.

The Grant Grove Village setting would not change measurably under this alternative. A greater variety of accommodations would be provided, but the rustic character of developments would be retained. A yet-to-be-determined number of mature conifers would have to be removed to complete construction and implement the hazard tree program, but the forest canopy surrounding lodging units would remain fairly dense. Other proposals for the study area would enhance the scenic qualities of Grant Grove Meadow, eliminate safety hazards, improve access and circulation, and provide additional visitor amenities.

Paving the access road into the Redwood Mountain study area would likely cause increases in visitation; however, use of this area is so light that no impacts on the natural environment are anticipated in the foreseeable future. If use resulted in excessive trampling near sequoia trees, protection measures would be implemented.

ALTERNATIVE 2: NO ACTION/MINIMAL REQUIREMENTS

Natural Environment

Impacts on Geology, Topography, and Soils. No additional impacts on the geology or topography of the study areas would take place under this alternative. Slight to moderate soil compaction would continue in areas surrounding activity sites and lodging units, mainly as a result of foot traffic. No additional erosion hazards would occur, but trails and pathways would remain susceptible to erosion during runoff. The effects of soil compaction and erosion would be minimized by delineating and marking trails, emphasizing the importance of avoiding cross-country routes, and possibly paving or applying soil binders to the surface.

The effects of the hazard tree removal program on soils in Grant Grove Village would be somewhat less than those of alternative 1.

Impacts on Climate and Air Quality. There would be no additional impacts on the climatic conditions or air quality of the study areas.

Impacts on Surface and Groundwater Hydrology. Use of water from Round Meadow is not expected to increase under this alternative. In fact, because of the capacity of the storage tank, during most years the amount of water withdrawn from the meadow during the low-flow periods should actually decrease, resulting in favorable environmental impacts on the meadow ecology. Even following drought years, the existing water withdrawals from Round Meadow would not be exceeded. By Labor Day the storage tank water level would be nearly empty.

Discontinuing use of Merritt and Winter springs would improve the groundwater/surface water relationship in the General Grant Grove area.

Impacts on Floodplains and Wetlands. There would be no additional impacts on the floodplains and wetlands of the Grant Grove and Redwood Mountain areas.

Impacts on Sequoias. There would be no additional impacts on sequoia trees under this alternative. Hydrologic improvements, as described under alternative 1, would restore natural drainage patterns in the Grant Grove area by allowing groundwater reserves to return to more natural levels. A study would be undertaken to determine whether natural underground conduits connect Round Meadow and General Grant Grove and, if so, whether existing water draws have any major effects on groundwater in the grove.

Impacts on Other Tree Stands. The most immediate impact on the mixed conifer stands would result from implementing the hazard tree program. The determination of which trees are potentially hazardous requires further field analysis; the criteria to be used in this determination are included in appendix G.

Impacts on Understory Vegetation. Although no additional development or relocation of structures would take place, there would be continuing effects on vegetation because of visitor use and related disturbances. At present, about 3 acres are covered by buildings, roads, and other structures, and an additional 2 acres are severely disturbed and lack the normal understory layer.

Impacts on Wildlife. There would be continuing effects on wildlife because of visitor use and related disturbances. About 5 acres would remain developed or disturbed and lacking natural habitat, and an additional, as yet unquantified amount of habitat would be altered as a result of hazard tree removal.

Impacts on Endangered and Threatened Species. There are no known endangered or threatened species within the study areas.

Archeological and Historic Resources

There would be no impacts on known archeological or historic resources in the study areas.

Visitor Use

Impacts on Area Characteristics and Values. Under alternative 2 the existing character of Grant Grove Village would be maintained. The removal of hazard trees would modify the setting to a limited degree, but the "cabin in the woods" ambience would not be greatly altered because most of the trees surrounding the cabin units would be retained. The commercial facilities, in particular the restaurant/gift shop, would continue to block or interrupt views of the meadow from the visitor center, and deteriorated or intrusive structures would detract from the overall appearance of the village. All other areas in Grant Grove and Redwood Mountain would retain their existing character, and no natural values would be altered.

Impacts on Visitor Experiences. Experiences in Grant Grove Village would not change markedly from those at present. Rehabilitation of existing lodging units, as funding permitted, would reduce safety hazards, provide for visitor comfort, and improve handicap-accessibility; however, many units would remain run-down, and few amenities (private baths, winterized cabins, group accommodations) would be available. Because of inadequate signing and poor circulation patterns, visitors would continue to be inconvenienced and confused about where to go to reach specific destinations; these problems would be particularly apparent at the restaurant/visitor center parking areas and the market.

The modifications to the Big Stump entrance station and the Y intersection at the Generals Highway would reduce safety hazards and improve traffic circulation in these areas. The remainder of the Grant Grove and Redwood Mountain areas would continue to be managed to support existing uses.

Impacts on Recreational Use Levels and Demands. Gradual increases in use are anticipated under this alternative in keeping with projected nationwide trends. Minor increases in winter use could be expected in and near Grant Grove Village.

Conclusion

Alternative 2 would have the least impact on the natural environment of the Grant Grove and Redwood Mountain areas because no new construction or relocation of facilities would be undertaken and no increases in visitor use would be likely. The hazard tree removal program would effect minor changes in the Grant Grove Village setting, soil and vegetation disturbance would continue at present levels, and existing intrusions in the meadow and meadow camp areas would remain. The improvements at Big Stump and the Y intersection would reduce safety hazards.

ALTERNATIVE 3: EXPANDED FACILITIES IN A HOTEL

Natural Environment

Impacts on Geology, Topography, and Soils. There would be no impacts on the geology of the area as a result of the proposals in this alternative. Slight topographical modifications would be required to level sites for the installation of new buildings. In addition, construction of the proposed 1,200-foot-long, 20-foot-wide roadway (including shoulders) leading to the new hotel complex would affect approximately 1 acre and would include cuts, fills, and possibly some blasting of underlying granite, thus modifying the topography to an undetermined extent. (A preliminary design has been completed for the proposed roadway, but the current evaluation is based mainly on surface indicators--slopes, exposed granite, etc.)

Approximately 10 additional acres of surface soils would be disturbed in implementing this alternative. As in alternative 1, the affected soils would be susceptible to wind and water erosion until the sites were surfaced or stabilized through revegetation.

The impacts on soils resulting from visitor use would be similar to those described in alternative 1; however, because of the consolidation of lodging in a single facility, they would be less widespread. If foot traffic resulted in severe soil erosion, management would consider paving, applying soil binders, or closing pathways to mitigate this problem.

The soil erosion hazards related to hazard tree removal would be somewhat less than those of alternative 1. The impacts of winter use would be minimal because of snow cover and frozen conditions.

Impacts on Climate and Air Quality. There would be minor impacts related to construction activities and increased heat radiation, as described in alternative 1.

Impacts on Surface and Groundwater Hydrology. The impacts on the hydrology of the Grant Grove area would be similar to those of alternative 1, except that the projected water consumption increases would be smaller (approximately 16,000 gpd--from 33,500 to 49,240; see table 10) because fewer new lodging units would be provided. The impacts on the hydrology of the Redwood Mountain area would be the same as those of alternative 1.

Impacts on Floodplains and Wetlands. There would be no significant impacts on floodplains and wetlands, as explained in alternative 1. The same requirements would apply in designing the turn lanes adjacent to Grant Grove Meadow.

Impacts on Sequoia Trees. The impacts on sequoia trees would be the same as those described in alternative 1. A study would be undertaken to determine whether natural underground conduits connect Round Meadow and General Grant Grove and, if so, whether proposed water draws would have any major effects on groundwater in the grove.

Impacts on Other Tree Stands. The construction of a 75-room hotel to replace the existing dispersed cabin units, the consolidation of commercial services north of the meadow, and the construction of a new roadway would require the removal of approximately 209±21 mature conifers on about 10 acres (see table 7). The impacts of other actions, including site restoration on 2 acres, hazard tree removal, and winter snowplowing, would be similar to those described in alternative 1.

Impacts on Understory Vegetation. Approximately 10 acres of understory vegetation (primarily pine and fir seedlings) would be removed from biological productivity as a result of construction activities. Vegetation trampling would increase near new facilities, as described in alternative 1. The impacts of site restoration and winter use would be similar to those of alternative 1.

Impacts on Wildlife. Habitat on about 10 acres of mixed conifer forest would be lost because of construction, and resident species would be forced to relocate. Overall population densities might decrease slightly if the remaining vegetation did not produce adequate food sources. Other impacts would be minimal, as described in alternative 1.

Impacts on Threatened and Endangered Species. No such species are believed to exist in the study areas; however, surveys and consultations with the Fish and Wildlife Service are being undertaken to ensure compliance with law and policy and the results will be included in the final EIS.

Archeological and Historic Resources

No impacts on known cultural resources would result from implementation of this alternative.

Visitor Use

Impacts on Area Characteristics and Values. Alternative 3 would alter the appearance of Grant Grove Village by replacing the low-profile cabin units with a multistory hotel complex and relocating commercial services to a previously undisturbed area. There would be less relationship in scale between the buildings and their surroundings, but the rustic character of developments would be retained through sensitive design and use of appropriate construction materials. Additional vegetation would have to be removed to allow construction of proposed facilities (see the impacts on the natural environment). The new road would be a visible scar in the natural setting; however, the existing roads on the northeast side of Grant Grove Meadow and in front of the bowl area would be removed and the sites restored, enhancing the natural characteristics of those areas.

The removal of the cabins and commercial facilities from the bowl, the meadow camp, and the meadow itself would expand open space and enhance the natural values of these areas. Views of the meadow from the visitor center and the hotel would be unobstructed.

The characteristics of other areas in Grant Grove and Redwood Mountain would stay the same or would improve, as described in alternative 1.

Impacts on Visitor Experiences. "Cabin in the woods" experiences would no longer be available, and there would be little variety in the types of accommodations provided and the price structure. Separation from other overnight guests would not be possible. No housekeeping units or small cabins would be available for families or other visitors who could not afford or would not feel comfortable in a large hotel. However, the hotel would provide additional amenities for guests (private baths, fully winterized accommodations, and a convenient restaurant) and would be better suited to accommodate large tour groups than the existing cabin units.

Redesigning the Crystal Springs campground entrance would effectively separate campers from visitors to the commercial complex and hotel, reducing the possibility of congestion and confusion in that area; however, the noise from the commercial facilities might penetrate to the campground and disturb some visitors there. Removing the roads in front of the meadow camp and bowl would eliminate through traffic and automobile-related noise in those areas. Noise and congestion would increase on the new road to the hotel.

Other visitor impacts in Grant Grove Village would be similar to those of alternative 1, as would the impacts of proposals for other portions of the Grant Grove and Redwood Mountain study areas.

Impacts on Recreational Use Levels and Demands. The construction of a 75-room hotel to replace the existing cabin units would increase the total available overnight space by 45 percent (from 52 to 75 units). Assuming the same approximate occupancy rate as in the existing facilities and a 45 percent increase in lodging capacity, overnight lodging stays during the peak season would increase from 14,800 to 21,460--a 7 percent increase in the total overnight stays in the Grant Grove area. The impacts of this use in terms of water consumption and demands for recreational services would be similar to but slightly less than those of alternative 1. Other impacts would be the same as those of alternative 1.

Conclusion

Although the built portion of Grant Grove Village would be reduced in extent and the areas where buildings were removed would be restored to their natural condition, the overall impacts on the natural environment of the Grant Grove and Redwood Mountain areas would be similar to those of alternative 1. The construction of the hotel, commercial facilities, and employee housing would involve soil, vegetation, and habitat disturbance on about 10 acres, and the subsequent 45 percent increase in overnight lodging stays would result in additional disturbance, which would be partially mitigated through routine maintenance and temporary closures in specific areas. Water consumption would increase to a slightly lesser degree than under alternative 1 and would not be expected to affect surface and groundwater hydrology or existing water draws during the peak season because of the capacity of the new supplemental water storage tank.

Removal of the cabins and construction of a multistory hotel complex would alter the character and setting of Grant Grove Village and would reduce the variety of available accommodations. The new road and commercial facilities would be visual intrusions in previously disturbed areas. An undetermined number of mature conifers would have to be removed to complete construction and implement the hazard tree program, but the forest canopy would remain fairly dense. Other impacts would be similar to those of alternative 1.

ALTERNATIVE 4: EXPANDED FACILITIES IN A HOTEL AND DETACHED UNITS

Natural Environment

Impacts on Geology, Topography, and Soils. There would be no impacts on the geology of the study areas. Topographical modifications would be required to level building sites and construct the new 20-foot-wide, 2,000-foot-long roadway, as described in alternative 3.

Approximately 12 additional acres of surface soils would be disturbed in implementing this alternative. As in alternative 1, the affected soils would be susceptible to wind and water erosion until the sites were surfaced or stabilized through revegetation.

The impacts on soils resulting from visitor use would be similar to those described in alternative 1; however, because both a hotel and dispersed lodging units would be constructed, substantially increasing the overnight capacity of the village, impacts would be much more widespread. If foot traffic resulted in severe soil erosion, management would consider paving, applying soil binders, or closing pathways to mitigate this problem.

The soil erosion hazards related to hazard tree removal would be similar to but slightly more extensive than those of alternative 1. The impacts of winter use would be minimal because of snow cover and frozen conditions.

Impacts on Climate and Air Quality. The impacts related to construction activities and increased heat radiation would be similar to but greater than those of alternative 1.

Impacts on Surface and Groundwater Hydrology. Water consumption in Grant Grove Village would be substantially greater than under alternative 1 (an increase of approximately 31,500 gpd--from 33,500 to 65,040; see table 10) because of the number of new lodging units. During years with normal precipitation, if the existing wells maintained their average yields throughout the peak season (36 gpm for Round Meadow), the water supply and supplemental storage tank would be adequate to meet required needs (at the conclusion of the season, the storage tank would be empty). However, with the projected increases in visitor use, during drought years the groundwater supply and supplemental stored water might not be sufficient to meet demands. In such a drought event, active conservation measures would be required to avoid exceeding existing water draws and at the same time ensure an adequate water supply. These measures, including closing the public laundry and public shower, are discussed in more detail in appendix C.

Other impacts on the hydrology of the Grant Grove and Redwood Mountain areas would be similar to those of alternative 1.

Impacts on Floodplains and Wetlands. There would be no significant impacts on floodplains and wetlands, as explained in alternative 1. The same requirements would apply in designing the turn lanes adjacent to Grant Grove Meadow.

Impacts on Sequoia Trees. The impacts on sequoia trees would be the same as those described in alternative 1. A study would be completed to determine whether underground conduits connect Round Meadow and General Grant Grove and, if so, whether proposed water draws would have any major effects on groundwater in the grove.

Impacts on Other Tree Stands. The construction of a 75-room hotel plus detached units with an additional 76-room capacity, the consolidation of commercial services north of the meadow, and the construction of a new roadway would require the removal of 312 ± 31 mature conifers on about 12 acres (see table 7). The impacts of other actions, including site restoration on 1 acre, hazard tree removal, and winter snowplowing, would be similar to those of alternative 1.

Impacts on Understory Vegetation. Approximately 12 acres of understory vegetation (primarily pine and fir seedlings) would be removed from biological productivity as a result of construction activities. Vegetation trampling would increase near new facilities, as described in alternative 1. The impacts of site restoration and winter use would be similar to those of alternative 1.

Impacts on Wildlife. Habitat on about 12 acres of mixed conifer forest would be lost because of construction activities, and resident species would be forced to relocate. If the remaining vegetation did not produce adequate food sources, overall population densities might decrease slightly. Other impacts would be minimal, as described in alternative 1.

Impacts on Threatened and Endangered Species. No such species are believed to exist in the study areas; however, surveys and consultations with the Fish and Wildlife Service are being completed to ensure compliance with law and policy, and the results will be included in the final EIS.

Archeological and Historic Resources

No impacts on known cultural resources would result from implementation of this alternative.

Visitor Use

Impacts on Area Characteristics and Values. Alternative 4 would substantially alter the appearance of Grant Grove Village because of the inclusion of a multistory hotel complex and additional detached units. The impacts of new development on the values of the area would be similar to but more extensive than those of alternative 3 because there would be less available open space and more intrusions in the meadow camp and bowl areas. The new road providing access to overnight accommodations would extend into the bowl area.

The relocation of all commercial facilities would have the same beneficial impacts on Grant Grove Meadow as described in alternative 3. The characteristics of other areas in Grant Grove and Redwood Mountain would stay the same or would improve, as described in alternative 1.

Impacts on Visitor Experiences. This alternative would offer visitors the greatest variety in the types of available accommodations. Group accommodations and hotel amenities as well as housekeeping and motel units would be provided. However, because of the extent of lodging development, the village ambience would be substantially altered.

Other impacts in the Grant Grove Village area would be similar to those of alternative 3, except that the bowl area would be developed for lodging rather than restored to open space. Impacts in other portions of the study areas would be similar to those of alternative 1.

Impacts of Recreational Use Levels and Demands. The construction of a 75-room hotel and additional detached units with a 76-room capacity would increase the total available overnight space by 190 percent (from 52 to 151 units). Assuming the same approximate occupancy rate as in the existing facilities and a 190 percent increase in lodging capacity, overnight lodging stays during the peak season would increase from 14,800 to 42,920--a 28 percent increase in the total overnight stays in the Grant Grove area. The impacts of this use in terms of water consumption and demands for recreational services would be similar to but substantially greater than those of alternative 1. During drought years, projected water consumption in the peak season might require active measures to ensure an adequate water supply (see the "Impacts on Hydrology" section). Other impacts would be the same as those of alternative 1.

Conclusion

The extent of new development (triple the number of existing lodging accommodations) and related visitor use would result in substantially greater impacts on the natural environment than under alternatives 1, 2, and 3. The construction of a hotel, detached units, commercial facilities, and employee housing would involve soil, vegetation, and habitat disturbance on about 12 acres, and the subsequent 190 percent increase in overnight lodging stays would result in significant additional disturbance (these effects would be mitigated to the extent possible through routine maintenance or temporary closures). Water consumption during the peak period would nearly double under this alternative. The existing water draws and supplemental stored water would be adequate to meet these additional requirements under normal circumstances; however, during a drought event, active conservation measures, including the closure of some facilities, might be required.

The construction of a multistory hotel complex as well as new detached units would substantially alter the character and setting of Grant Grove Village, and although a wider variety of accommodations would be available, the "cabin in the woods" ambience would be lost. The new road and commercial facilities would be intrusions in previously undisturbed areas, although limited acreage, including the southern edge of Grant Grove Meadow, would be restored to natural conditions. An undetermined, but considerably greater, number of mature conifers would have to be removed to complete construction and implement the hazard tree program, which could alter the appearance of the forest canopy. Other impacts would be similar to those of alternative 1.

COMPARATIVE SUMMARY OF CUMULATIVE IMPACTS

This section includes a summary comparison of cumulative impacts on the primary environmental issues.

Vegetation and Soil Disturbance

The following tables provide a quantitative evaluation of the amount of disturbance associated with the alternatives. Table 7 indicates the total number of trees to be removed as a result of construction.

Table 7: Required Tree Removal as a Result of Construction under Each Alternative

Location	Tree Type	Alternative			
		1 (Proposal)	2 (No Action)	3	4
Meadow camp - dispersed cabins/ motel units with parking	WF	28	None	None	44
	SP	8			13
	JP	5			1
	IC	--			8
Boneyard and meadow camp - motel units or hotel/road	WF	5	None	29/80	29/80
	SP	2		--/ 5	--/ 5
	JP	15		9/10	9/10
	IC	--		3/35	3/35
Bowl - dispersed units (includes road and parking)	WF	None	None	None	27
	SP				2
	JP				4
	IC				5
Knoll - restaurant site or market complex (includes parking)	WF	26	None	26	26
	SP	6		6	6
	JP	--		--	--
	IC	6		6	6
West of campground - market site	WF	14	None	None	None
	SP	7			
	JP	2			
	IC	--			
Total	WF	73		135	206
	SP	23		11	26
	JP	22		19	23
	IC	<u>6</u>		<u>44</u>	<u>57</u>
All trees removed		124±12		209±21	312±31

Note: A 10 percent margin of error is included to reflect variations in final field locations of proposed developments. The trees designated for removal are generally between 70 and 120 feet in height.

WF = white fir
 SP = sugar pine
 JP = Jeffrey pine
 IC = incense cedar

Conclusion: The no-action alternative would result in no trees removed. Of the action alternatives, the proposal would result in the least number of trees removed.

Table 8 quantifies the amount of additional surface area disturbance resulting from each action alternative. This table is to be used for comparative purposes and does not reflect the total acreage currently altered.

Table 8: Surface Area Disturbed or Covered under Each Alternative

Action	Alternatives			
	1 (Proposal)	2 (No Action)	3	4
Overnight lodging areas, including boneyard	2.5	3.2	4.5	5.9
(restoration)	(2.1)	--	(1.2)	(0.1)
Market/gas station/cafe complex	3.1	1.0	1.6	1.6
(restoration)	(0.2)	--	(0.2)	(0.2)
Employee housing				
Park Service	1.6	--*	1.6	1.6
Concession	2.45	0.9	2.45	3.45
(restoration)	(0.9)	--	(0.9)	(0.9)
Total disturbed area	9.65	5.1	10.15	12.55
Restoration	(3.2)	--	(2.3)	(1.2)
Net disturbed area	6.45	5.1	7.85	11.35

*The existing Park Service housing and maintenance areas were not measured because they will remain the same under all alternatives.

Conclusion: Alternative 1 would result in the least amount of additional surface area disturbance.

Water Consumption

The 1971 Sequoia-Kings Canyon Master Plan states that "no development should be undertaken in the parks which would provide human habitation until it is shown that adequate water supply and waste disposal systems are available and that such development will not cause undue deterioration of the natural environment." These requirements will be met through the construction of a new sewage treatment plant to replace the existing inadequate system and the construction of a new 1.2-million-gallon water storage tank to replace the existing marginal tank, with an additional fire protection reserve of 200,000 gallons.

The environmental impacts of the proposed sewage treatment plant and water storage tank project were analyzed thoroughly in the 1985 Environmental Assessment. The following tables analyze the current and projected water requirements under the four alternatives and their probable impacts on hydrology and water supply. Conservation measures that will be required to ensure adequate water supplies are described in appendix C.

Table 9: Average Daily Water Consumption
Recorded at Grant Grove
(in gallons per day)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>
June	--	27,500	27,700	27,400
July	--	41,700	54,500*	43,700
August	33,000	46,100	46,100	--
September	23,800	24,200	34,400	--

*Inaccurate reading - This figure was reported for July 1983, but the Grant Grove maintenance staff (October 1984) found the meter to be faulty and replaced it at that time. A more reliable peak figure would be 46,100 gallons per day in August 1982 and 1983.

Table 10 projects the water consumption increases as a result of overnight developments and related visitor use at Grant Grove.

Table 10: Projected Peak Season Water Consumption
at Grant Grove under Each Alternative
(in gallons per day)

Water Use by Function ¹	Alternatives			
	1	2	3	4
Lodging ² (number of units)	13,500 (91)	7,800 (52)	10,650 (75)	22,650 (151)
Camping ³	23,100	23,100	23,100	23,100
Showers ⁴	9,240	-- ⁵	9,240	9,240
Laundromat ⁶	2,500	--	2,500	2,500
Concession housing ⁷ (number of employees)	4,500 (90)	2,600 (52)	3,750 (75)	7,500 (150)
Total	52,840	33,500 ⁸	49,240	64,990
Increase over existing	19,340	--	15,740	31,490

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1. Based on July/August 1982 figures and EPA 1982 estimates.
 2. Water use at 50 gallons/person/day at 3 persons per room.
 3. Water use at 25 gallons/person/day at maximum daily recorded average of 924 campers.
 4. Water use at 10 gallons/person/day at 924 campers.
 5. The current intermittent availability and use of showers is reflected in the lodging and camping consumption.
 6. Water use at 50 gallons/wash and 50 washes/day.
 7. Water use at 50 gallons/person/day.
 8. Total does not include NPS employee or day use.

Table 11: Summary of Major Environmental Consequences
(Cumulative Impacts)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Geology	No additional impacts (new structures would be constructed to withstand a seismic loading of 4 ft/sec ²)	No additional impacts (seismic loading of 4 ft/sec ² has contributed to the deterioration of the existing structures)	Same as alternative 1	Same as alternative 1
Topography	Slight topographical modifications to install new facilities	No additional impacts	Moderate topographical modifications to install new facilities and construct road	Slightly more modifications than under alternative 3
Soils	A total of 10 acres of soil surface disturbance; increased erosion susceptibility due to vegetation removal; increased soil compaction due to construction vehicle and foot traffic	No additional soil disturbance; continued soil compaction due to foot traffic	A total of 10 acres of soil surface disturbance; other impacts same as alternative 1	A total of 12 acres of soil surface disturbance; other impacts same as alternative 1
Climate/air quality	Slight microclimatic changes due to increases in covered surface area; slight but temporary decreases in air quality due to construction activities	No additional impacts	Same as alternative 1	Same as alternative 1
Surface and groundwater hydrology	No additional impacts on the Round Meadow groundwater system; during the high-flow period, slight reductions in water quantity reaching Abbott Creek because of water draws to fill storage tank, improved surface and groundwater hydrology in Sequoia and Mill Flat creeks due to discontinued use of Merritt and Winter springs	Increased surface water flows to Abbott Creek during low-flow periods because of dispersed water draws from Round Meadow throughout the year	Similar to alternative 1	Substantially more demands than under alternative 1; active conservation methods likely
Vegetation	A total of 10 acres of understory vegetation and 124 mature trees removed to construct new facilities; 3 acres restored	No additional disturbance; continued effects from visitor use	A total of 10 acres of understory vegetation and 209 mature trees removed to construct new facilities; 2 acres restored	A total of 12 acres of understory vegetation and 312 mature trees removed to construct new facilities; 1 acre restored
Wildlife	A total of 10 acres of wildlife habitat lost; 3 acres restored	No additional disturbance; continued effects from visitor use	A total of 10 acres of wildlife habitat lost; 2 acres restored	A total of 12 acres of wildlife habitat lost; 1 acre restored
Threatened or endangered species	No impacts (there are no known threatened or endangered species in the study areas)	Same as alternative 1	Same as alternative 1	Same as alternative 1
Study area character	Slight modification (additional low-profile structures)	No change	Some modification (additional multistory development)	Significant modification (additional low-profile and multistory development)

CONSULTATION AND COORDINATION

SCOPING

Consultation and coordination efforts were undertaken during the scoping process for the Grant Grove/Redwood Mountain Draft Environmental Impact Statement to determine the range of actions and significant issues to be addressed and analyzed. Scoping began in July of 1984 with a series of interagency meetings to determine the range of planning and environmental issues. A notice of intent (NOI) to prepare an EIS was published in the Federal Register on February 11, 1985. Contacts as a result of the published NOI included the Friends of the Earth and National Parks and Conservation Association.

VISITOR QUESTIONNAIRE

During February 1985 a questionnaire was sent to visitors who had previously used the overnight accommodations at Grant Grove Village (see appendix I). Out of a total of 1,367 questionnaires, 793 (58 percent) were returned. The results of the survey are summarized in the "Affected Environment" section.

AGENCIES AND GROUPS THAT COMMENTED ON THE DEVELOPMENT CONCEPT PLAN/ENVIRONMENTAL ASSESSMENT OR WERE CONSULTED DURING PREPARATION OF THE DEVELOPMENT CONCEPT PLAN/DRAFT ENVIRONMENTAL IMPACT STATEMENT

Sequoia National Forest
Guest Services, Inc.
YMCA
Montecito Sequoia
Sierra Club
National Parks and Conservation Association
Ecology Center of Southern California
Building and Planning Department, Tulare County
Public Works Department, Tulare County
John Sieberling, Chairman, Public Lands Committee, U.S. House
of Representatives
California Historical Parks Office
Assistant Secretary for Resources, State of California

AGENCIES AND ORGANIZATIONS TO WHOM COPIES OF THIS DRAFT
ENVIRONMENTAL IMPACT STATEMENT ARE BEING SENT

Federal Agencies

Advisory Council on Historic Preservation
Department of the Army
 Corps of Engineers, Sacramento
Department of Agriculture
 Forest Service
 Inyo National Forest
 Sequoia National Forest
 Sierra National Forest
 Office of Information, San Francisco
Department of Health and Human Services
 Public Health Service
Department of the Interior
 Fish and Wildlife Service
Environmental Protection Agency

State Agencies

Department of Fish and Game
Department of Parks and Recreation
Department of Transportation
Division of Forestry, Region IV
Historic Preservation Officer
State Resources Agency
Water Quality Control Board

Regional, County, and Municipal Agencies

Exeter Chamber of Commerce
Fresno County Board of Supervisors
Fresno County Chamber of Commerce
Fresno County Parks and Wildlife Department
Kern County Fire Department
Lindsay City Planning Department
Merced County Association of Governments
Three Rivers Chamber of Commerce
Tulare City Planning Department
Tulare County Building and Planning Department
Tulare County Chamber of Commerce
Tulare County Road Commissioners

Organizations

Audubon Society
Boy Scouts of America
Friends of the Earth
Guest Services, Inc.
National Parks and Conservation Association
Outward Bound
Sierra Club
 Angeles Chapter
 Kern-Kaweah Chapter
 Tehipite Chapter
Southern California Edison
Trust for Public Lands
Tulare County Sportsmen's Council
Wilderness Institute
Wilderness Society
Wilsonia Cabin Owners

APPENDIXES

- A: Management Objectives
- B: Parkwide Concessions Lodging Distribution
- C: Water Conservation Measures
- D: Water Quality Data
- E: Wet Meadow Ecology
- F: Giant Sequoia Ecology
- G: Marking Guidelines for Tree Removal
- H: Protection of Residual Stands
- I: Recommendations for Trees Infested with Fomes Annosus
- J: Visitor Questionnaire

A: MANAGEMENT OBJECTIVES FROM 1971 MASTER PLAN

General Management

Coordinate research and management efforts to identify and apply actions necessary to restore and/or perpetuate desirable environmental conditions as contemplated in the policies for management of natural areas.

Adjust seasonal levels of operations to provide optimum protection of natural resources and service to park visitors.

At Ash Mountain, Giant Forest, and Grant Grove, personnel and facilities should be provided to operate on a 7-day-week, 24-hour basis from May 20 to September 15. The Ash Mountain and Big Stump entrances are considered to be parts of the above installations.

The Generals Highway and access roads in the above developed areas should be maintained for year-round traffic.

Operations during the September 15 to May 20 period must be keyed to the requirements of visitor use, which can vary greatly with weather and snow conditions. From December 20 through March 15, services should be maintained on a 24-hour basis during holidays and weekends at the foregoing developed areas and entrances.

For the foreseeable future, Cedar Grove should be operated on a seasonal basis, May 1 through October 31; but all buildings and improvements placed there should be constructed for year-round operation because visitor demand may well require year-round operation of Cedar Grove within five to ten years.

Existing travel patterns--involving heavy visitation on weekends, holidays, and school vacations--are resulting in overcrowding of facilities and are detrimental to park resources. Concentrated effort should be made to encourage visitation during midweek and the periods of October to November and March through May, in an effort to level off the existing peaks in this travel pattern.

The existing primary road system throughout the two parks generally provides access consistent with required resource protection. Relocations may be necessary to relieve congestion in developed areas or to provide for improved resource protection or visitor use and enjoyment.

Concession visitor overnight accommodations should not be expanded beyond a capacity of 2,000 pillows, and accommodations at Giant Forest should not exceed the existing pillow capacity of 1,240.

Overnight public use and support facilities provided by the concessioner will be confined to the Giant Forest-Lodgepole, Grant Grove, and Cedar Grove areas, except where simple camps or huts may be required in the backcountry.

The primary interpretive themes are the sequoia groves and the High Sierra. The objective is to encourage visitors to absorb the inspiring atmosphere of the sequoia groves and to relate the survival of the sequoias--through the preservation of the trees' required living conditions--with our own survival and welfare--through the protection of the quality of our environment. A parallel purpose is to impart an awareness of the unique recreational quality of alpine wilderness and a realization of the fragility and vulnerability of that quality.

The essential visitor-experience opportunities are:

Walking in a quiet and unspoiled grove of sequoias to experience the magnificence of the trees in an atmosphere of tranquility.

Seeing and feeling the rugged wilderness of the High Sierra, being in it under primitive and undisturbed conditions, and traveling into it beyond the influence and distractions of urban life.

Most of the backcountry in both parks is outstanding wilderness and should be so managed. Visitor use is heavy on some trails leading into the backcountry, to Mount Whitney, and the John Muir Trail. The last will ultimately be included in the Pacific Crest Trail. Visitor use can be expected to increase. Facilities such as campgrounds or primitive trailside accommodations of the High-Sierra-Camp type may be required in areas of trail-visitor concentration to make available the wilderness experience to park visitors, to protect the resource from overuse, and to provide proper sanitation. Enclaves or corridors along heavily used trails may have to be excluded from wilderness classification where the need for facilities is imperative. The alternative to designated developed facilities would be an enforceable system of rationed visitor use in the backcountry if the quality of the natural environment is to be maintained.

Two large developments on Forest Service lands immediately adjacent to Sequoia National Park--the Mineral King and Trail Peak developments--will, in effect, provide two additional and relatively easy access routes for visitors into the parks' backcountry on a year-round basis. To avoid detrimental impact on the parks, these two proposed developments will require close study by this Service and a high degree of joint planning in cooperation with the Forest Service and developers.

Resource Management

No further development of any kind should be placed in any sequoia grove except the minimum required for trail access by visitors on foot and minimal interpretive devices. This does not preclude upgrading accommodations and food services within the presently developed Giant Forest area.

Natural science research is and will continue to be an important activity in these parks and will be encouraged. It is fundamental to good resource management. However, problems exist now and will increase as

time goes on because of the lack of housing and basic facilities for research activities. To protect the resource, every effort should be made to arrange for as many as possible of the research facilities to be located outside of the park but in reasonably close proximity to them. Mobile facilities offer one solution where research requires residence onsite.

No development should be undertaken in the parks which will provide human habitation, until it is shown that adequate water-supply and waste-disposal systems are available and that such development will not cause undue deterioration of the natural environment.

Private land inholdings, particularly subdivisions, are becoming increasingly detrimental to the park environment. Priority should be given to acquisition of these holdings. Pending acquisition, suitable regulations should be formulated to minimize adverse uses.

Fire and other natural agents must be skillfully restored to the park ecosystems. Restoration of natural environmental processes is particularly essential in the sequoia groves, high mountain meadows, and some lakes and streams.

Measures must be taken in the immediate future to provide more adequate protection of the environment in the vicinity of the General Sherman and General Grant Trees. Improved management of visitor use in these highly popular areas is imperative to better protect these great trees.

Visitor Use

In congested areas or areas where automobile traffic is undesirable, other systems of transportation should be utilized to provide appropriate use, consistent with quality experience and resource protection.

Additional opportunities should be developed to enable park visitors to view the High Sierra. More ready access to overlooks such as Big Baldy and Panorama Point offer opportunities to develop new viewing possibilities. Trams and lifts should be considered for developing overlooks of the Sierra Crest, since they may be more practical and less damaging to the environment than roads.

Visitor contact facilities for information and orientation, located at trailhead entrances into the parks, should be developed, especially on the east side.

Encourage development of trailer courts, campgrounds, and overnight accommodations outside of the parks but in close proximity to them.

Motor nature trails which provide a quality park experience for visitors will be developed from existing administrative roads where feasible and practical.

Winter sports and snow activities at Giant Forest, Lodgepole, Wolverton, and Grant Grove should be maintained at a simple family-participation level. This will not preclude the upgrading of existing facilities at Wolverton.

Campground capacity in the parks should be maintained at existing levels. Campgrounds in Giant Forest should be removed from the sequoia groves to the Clover Creek-Willow Meadow area. All campgrounds require improvement and rehabilitation to properly regulate camping activity and protect the environment.

The entire trail system should be evaluated in terms of existing and projected needs and the altered pattern of use, arising from increasing numbers of foot travelers compared to horse and packtrain use.

Because of the damage resulting from livestock foraging for food and resultant trampling of soils, possible pollution of water, and conflict with foot travelers, use of livestock in the higher elevations for any purpose should be phased out as conditions permit. Search and rescue, fire suppression, resource-management activities, and maintenance and supply functions should be serviced by helicopter instead of livestock. Livestock may be used in the lower elevations and around developed areas where it can be stabled and fed without open grazing on park lands.

Touring by ski and snowshoe is increasingly popular with visitors. Proposed year-round developments adjacent to the parks at higher elevations will, undoubtedly, greatly stimulate winter touring of the snow country available in the parks. Any back-country shelters or camps installed in the parks should consider the potential of this type of winter use.

APPENDIX B: PARKWIDE CONCESSIONS LODGING DISTRIBUTION

Existing Overnight Lodging Count by Area:

Giant Forest - 249 units
Grant Grove - 52 units
Cedar Grove - 18 units

Future lodging distribution will be based on the following planning assumptions:

Lodging within the park will be confined to three principal locations: Clover Creek in the Giant Forest area, Grant Grove, and Cedar Grove.

The existing concession development in Giant Forest will be removed.

Lodging at Cedar Grove will not be expanded.

Assuming a multiplier of four pillows per unit and 319 available units, based on the 2,000-pillow ceiling established in the 1971 Master Plan, 181 additional units can be developed and located at Clover Creek or Grant Grove.

C: WATER CONSERVATION MEASURES

Passive Measures

One of the major water-consuming activities in national park system areas is the flushing of toilets, which accounts for up to 45 percent of indoor water consumption (NPS 1981). To reduce this consumption at Grant Grove, low-volume flushing units should be installed in all facilities with flushing toilets. This does not mean that the existing toilets need to be replaced; instead, a 1- to 1.5-gallon water displacement device should be placed in each flush tank. The usual flush tank holds approximately 5 gallons, and displacing 1.5 gallons has not shown to reduce its efficiency or impair the proper functioning of the sewage collection system. This measure would conserve 30 percent of the water used for flushing.

For the proposed new General Grant Grove comfort station, very low flow toilet fixtures have been included in the design because of the comfort station's location and elevation in relation to the new sewage treatment plant. This would conserve an additional amount of water, up to 1 gallon more than the low-flow measure mentioned above.

The second highest use of water is for bathing and personal use, more than half of which is for showering (30 percent of total indoor use; NPS 1981). Assuming this is the case at Grant Grove, all showers should be fitted with flow restrictors and shutoff valves at the shower heads and all sinks in comfort stations with spring or pressure closure devices, along with faucet aerators and spray taps on each faucet. These measures would conserve water, but the overall reduction might be offset by increased individual use.

About 14 percent of the overall indoor consumption is for laundry and dishwashing (NPS 1981). It is recommended that 8-pound washer loaders with a low fill capacity of 38 gallons per wash be installed at the public laundry facility to conserve water. Again, this measure might be offset by increased numbers of washes.

Active Measures During a Severe Drought Year

Two major active water-conserving measures would be to close the public laundry and the public shower for the season. These actions would result in a savings of approximately 2,500 gallons per day (77,500 gallons per month) and 10,010 gallons per day (310,310 gallons per month), respectively. Using these measures in the appropriate circumstances, the existing water supply and 1.2-million gallon storage tank should meet the water consumption requirements even at the maximum proposed level of development without using pumped wells in wet meadows. However, during a drought year, additional measures might be required during July and August based on a weekly water yield and consumption evaluation, using the following equation:

artesian well flow rate x number of days through Labor Day
+ gallons in storage tank - gallons consumed per day
x number of days through Labor Day = +/-0

if the weekly supply-demand calculation resulted in a negative figure and the active measures previously mentioned had been implemented, the park would haul in water to supplement the Grant Grove supply as needed--probably from the Wolverton Creek water source.

D. WATER QUALITY DATA--GRANT GROVE/REDWOOD MOUNTAIN

<u>Determination</u> <u>(mg/l unless otherwise noted)</u>	<u>Round Meadow</u> <u>Feb. 2, 1980</u>	<u>Winter Spring</u> <u>July 2, 1979</u>	<u>Merritt Spring</u> <u>July 2, 1979</u>	<u>Redwood</u> <u>Mountain Spring</u> <u>March 25, 1976</u>
Chloride	.5	.2	.4	.95
Sulfate (SO ₄)	1	.5	.5	.5
(HCO ₃)	41	12	9.4	
Carbonate (CO ₃)	0	0	0	
Sodium	3.8	2.4	2	
Potassium	.99	.53	.5	
Calcium	8.8	1.6	1.2	
Magnesium	.7	.3	.3	
Hydroxide Alkalinity (CaCO ₃)	0	0	0	
Carbonate Alkalinity (CaCO ₃)	0	0	0	
Bicarbonate Alkalinity (CaCO ₃)	34	10	7.7	
Calcium Hardness (CaCO ₃)	22	4	2.9	
Magnesium Hardness (CaCO ₃)	3	1.2	1.1	
Total Hardness (CaCO ₃)	25	5.2	4	
Iron	.07	.05	.05	.01
Manganese	.01	.01	.01	.008
Copper	.037	.001	.003	.005
Zinc	.01	.02	.05	.003
Fluouride	.05	.05	.05	.1
Arsenic	.0005	.0005	.0005	.002
Barium	.1	.1	.1	.03
Cadmium	.001	.001	.001	.002
Chromium	.01	.01	.01	.008
Lead	.001	.001	.001	.025
Mercury	.0002	.0001	.0001	.001
Selenium	.0005	.0005	.0005	.005
Silver	.001	.001	.001	.002
Cyanide				.003
Nitrate	.16	.21	.13	.04
Nitrite				.001
Phenols				.001
Total Dissolved Solids	79	28	14	64
Turbidity (J.T.U.)				4
Foaming Agents (MBAS)	.02	.025	.025	
Specific Conductance micromhos at 25°C	69	24	19	
Gross Alpha pCi/liter		2.1		
Gross Beta pCi/liter		4.5		
pH	5.8	5		

E: WET MEADOW ECOLOGY

As defined in Executive Order 11990 (May 24, 1977), the wet meadows in the Grant Grove area are designated as follows: "Those areas that are inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetative or aquatic life that requires moist soil conditions for growth and reproduction. Wetlands generally include . . . wet meadows." Merritt Spring, Winter Spring, Round Meadow, and Grant Grove Meadow are all considered wet meadows and are to be protected under this executive order.

The meadows in the Grant Grove area have poorly drained alluvial soils and are on slopes ranging from 3 to 30 percent. The soil surface is high in organic matter, and the subsoil consists of stratified deposits of sandy material of largely granitic origin; soil depths commonly exceed 10 feet. These alluvial soils present flooding hazards during snow-melt periods and are subject to compaction from foot traffic, deterioration of the soil structure, and direct damage to vegetation. Footpaths through meadows may act as conduits for surface water, diverting it away and leading to changes in the natural characteristics of the meadows.

The Grant Grove meadows occur from 4,500 to 8,000 feet in elevation and are interspersed in the mixed conifer forest. Representative data on species composition are hard to obtain because the meadow is an intricate complex of many small assemblages of organisms associated with slightly differing soil moisture regimes in different areas. Willows are abundant along stream courses, and Jeffrey pine may encroach on drier areas. Perennial sedges, grasses, and rushes, including Nebraska sedge, ovalhead sedge, wire rush, wheatgrass, brome, tufted hairgrass, ryegrass, fescue, melic grass, muhly, squirreltail, needlegrass, redtop, mannagrass, timothy, bluegrass, and trisetum, dominate in most meadow areas. Characteristic wildflowers include shootingstar, elephanthead, spiked mallow, rein orchid, corn-lily, cowparsnip, Bigelow sneezeweed, California coneflower, red columbine, leopard lily, aster, meadow lotus, owlclover, wild onion, yarrow, and pearly everlasting. There are no known threatened or endangered plant species in the meadows.

The meadow environment provides suitable habitat for an abundance of wildlife. Mammals commonly found include several species of shrew, meadow mouse, mole, long-tailed weasel, and deer. The rodent species provide prey for raptors, including the great-horned owl, red-tailed hawk, and American kestrel. Salamanders and frogs are also common (Osmundson 1976). Grant Grove is near the southern end of the known range of mountain beaver (Aplodontia rufa californica). Aplodontia, although not officially listed as threatened or endangered, is rare in the park. No other officially listed threatened or endangered wildlife species are known to inhabit the meadows.

The ecotone between meadows and adjacent forest communities is important to the wildlife ecology in the area. Meadows are the major sources of food for many species that seek cover in the adjacent forests. The

ecotone often contains denser populations and greater numbers of species than the communities flanking it. The meadow/forest edge is important to the more secretive species, such as the long-tailed weasel and mule deer, that feed on rodents and vegetation in the meadow but require the security of a nearby forest for a quick retreat to shelter.

The acreage of natural meadow/forest edge has declined in the Grant Grove area, as well as in other parts of the park, because of the development of campgrounds and other visitor facilities. Development of facilities along meadow perimeters has been a common practice for many years. This type of development upsets the forest ecosystem balance by eliminating habitats that are crucial to secretive predators and escaping prey (NPS 1979). Species that use the meadows as fawning grounds or nesting sites are often sensitive to concentrated human activities. Although deer are moderately tolerant of humans, they will not use meadows as fawning habitat if there is any activity nearby.

Several meadows in the area have significant springs and seeps issuing a fairly continuous water supply. Meadow areas provide large and predictable groundwater stores, but the rate of dependable yield during the critical late summer and fall periods is highly variable. During the period of snow cover and snowmelt, meadow soils are saturated, and the water table is at ground surface until the end of June. By early July, direct runoff and seepage from melting snow has ceased. From this time until September, meadow water tables may decline to a depth of 2 to 4 feet due to evapotranspiration by the plant community, and plants must obtain water from the soil through root capillary action. Groundwater removal during this period can cause an additional lowering of the water table beyond 4 feet, and under these conditions plant root capillary action may not be adequate to obtain moisture. Generally, the water table begins to rise again in late September and is at the surface by late October. This condition is not directly related to rainfall but to groundwater storage coupled with reduced transpiration as plants reach senescence (Halpern 1985).

The vegetation of a meadow is highly dependent upon the local drainage pattern. Any substantial change in moisture availability can radically affect species composition and the integrity of the meadow. Water table depths control the position of the ecotone between meadow and forest. Alteration of local drainage patterns by increased water drawdown allows encroachment of species tolerating more xeric conditions and reduces the total wetland area (Halpern 1985).

With establishment of the parks in 1890, a period of active fire suppression was begun. No natural fire has occurred in any meadow since 1920, and no definite record exists of any fire occurring since establishment. Grant Grove Meadow was prescription-burned in December of 1980 and 1981. The frequency of naturally ignited fires entering the meadow is probably less than 80 or 90 years; therefore, fire appears to have been excluded from playing a role in the modern ecology of meadows in the Grant Grove area. Plants that reproduce vegetatively have probably been favored with the absence of fire. Woody plants, such as

willow, might be expected to increase in stature and become less available and palatable to wildlife. This has occurred at Grant Grove Meadow but is not attributable solely to fire suppression. Cover quality increases as the willows become larger and more abundant, increasing the attractiveness of the meadow for fawning grounds. Conifers and woody species might be expected to become established at a greater rate along the meadow periphery with the absence of fire. Although few young conifers are present along the meadow's edge, several clumps of woody plants (especially azaleas) are present. Fire is involved in nutrient cycling in the meadow ecosystem on a macrolevel.

Development adjacent to Grant Grove Meadow is extensive. Roads or pavement completely surround the meadow and are rarely more than 100 feet from it. Structures ranging from large concession facilities to small rental cabins circumscribe all but the northwest third of the meadow perimeter. Water is drawn from the drainage that feeds the meadow. Sewer and water lines are buried along a portion of the meadow's edge. It is possible that gasoline leaking from the gas station's storage tanks is entering the meadow drainage; however, no evidence of leaks has been observed at the surface. The proposed relocation of the gas station adjacent to the meadow would not solve this potential problem because this site also drains into Mill Flat Creek. If a leak occurred, gasoline draining into this creek would pose a threat to the health of sequoias in the creek's immediate vicinity because their extensive root systems are directly beneath the creek.

Aside from the meadows' sensitivity to human activity, they are also highly sensitive to any alteration of surface or subsurface water flow. Poor drainage conditions and flooding hazards during snowmelt periods place major constraints on intensive use of most meadow areas. Meadows are also significant recharge areas for groundwater that travels to lower elevations and may feed other meadows and possibly sequoia groves. Meadow vegetation may be adversely affected by activities that raise or lower the water table. The need to maintain the natural vegetation associated with meadow soils also places constraints on any activities near a meadow that could generate increased traffic in or through it.

Additional wells or pumped wells in Round Meadow may be the most dependable water source, but wells and other works in meadow areas must be very carefully designed and operated to avoid disturbing the meadow vegetation and the wildlife dependent on it. With regard to this hazard, Osmundson (1976) states that "to avoid possible risk of this kind, the present wells at Round Meadow should not be operated at significantly higher rates than shown in the past to be safe with respect to shallow marsh saturation level." Also, it is recommended that development of any additional meadow sources utilize gravity "excess flows" rather than pumping from the substrate. Pumping risks do not seem justified in view of the other source possibilities. Pumping wells in Round Meadow would also pose a potential threat to the continued gravity flow of the artesian well. The risk of this occurring does not justify the use of pumps in that area (personal communication, Dan Kimball and Mike Whittington, water resource specialists, WASO, NPS 1984).

F: GIANT SEQUOIA ECOLOGY

The giant sequoia is restricted to about 75 disjunct groves along the western slope of the central and southern Sierra Nevada. Although at one time more extensively distributed, the giant sequoia's range has been largely reduced by changing climatic conditions. Although present grove boundaries seem stable, a majority of areas are undergoing a gradual decrease in density because of low levels of regeneration. This decline in density began long before man's influence on the groves. However, at this time Grant Grove seems to be a mature, steady-state grove.

Several factors within the ecosystem control giant sequoia grove boundaries. Availability of soil moisture at the seedling stage is the single most critical factor for maintenance of groves (Rundel 1972). Other environmental conditions, such as temperature and physiographic factors, are of secondary importance. Giant sequoias are associated with conifers, such as white fir, sugar pine, and incense cedar. The white fir is especially tolerant of shade, and unless white fir reproduction is controlled by fire, there is a tendency for it to eliminate successful seedling establishment, with mature sequoias lingering as successional relicts.

Fire is an important component of the giant sequoia ecosystem. In addition to controlling ground cover and understory to provide room for germination of sequoia seeds, hot fires cause the serotinous sequoia cones to open and release their seeds in tremendous numbers (Harvey et al 1980). Larger sequoias are insulated from the effects of fires by their thick, relatively fire-resistant bark. Lower branches are sloughed off early in the life cycle, reducing the probability of crown fires. As a result, the giant sequoias are well adapted to withstand fire, and in fact they require it for long-term survival (Harvey et al. 1980).

Reproduction of giant sequoias is not restricted to conditions produced by fire, although an altered substrate and open forest floor enable more seedlings to survive. Root pits of fallen trees, terraces of rivers, small streams and creeks, and other minor disturbances provide a receptive seedbed for sequoias. Seeds for these intermittent and randomly occurring seedbeds come mainly from the activities of two animals, a minute beetle and the chickaree. The most significant seed release is due to the cone-mining activity of the beetle, which mainly attacks green cones 5 to 8 years old. The chickaree feeds on 2- to 5-year-old cones, and the fleshy green cone scales appear to be its major food source in sequoia groves.

Giant sequoia seeds will germinate in almost any natural medium in the forest if there is sufficient moisture. However, if they are to survive, the rooting medium must remain moist and allow for rapid root penetration. Nearly 90 percent of the mortality rate reported in the parks was attributed to lack of soil moisture (Rundel 1970). Seedlings adjacent to rocks, limbs, and other objects that help retain soil moisture show a high survival rate (Rundel 1970). Few insects attack young seedlings, but heat canker may kill exposed seedlings, and pathogens and falling debris also take their toll on seedlings (Harvey et al. 1980).

Although relatively brief in the life cycle, the seedling stage of giant sequoias is critical, and the mortality of seedlings in their first year of growth is high. Harvey et al. (1980) found a mortality rate of nearly 75 percent between July 15 and October 30, 1966, in a study of over 2,000 seedlings in fire-manipulated plots in Redwood Mountain Grove.

Once seedlings have most of their roots located in a zone of relatively permanent soil moisture, growth is extremely rapid. They may reach over 10 feet in height in 10 years, and a few may grow 2 feet vertically per year. This rapid growth, including development of bark and quick loss of lower branches, enables the sequoia to better withstand fire.

Giant sequoia seedlings are better adapted to full sunlight and moderate shade than white fir seedlings. Sequoia seedlings grow best with a litter cover that reduces heat damage to the stem and lowers soil temperatures; they also survive or endure in areas of dense shade, but they grow poorly. Sequoia seedlings are better able to endure drought than white fir, apparently because of their extensive root system. The presence of dry, dense litter layers adjacent to groves may inhibit seed germination and establishment in many areas.

In mature groves such as General Grant Grove the mortality rate remains high until the trees are about 4 feet in diameter, which generally means they are about 400 years old. Beyond this age, there are only slight distinctions in mortality rates between age classes. Factors seemingly involved in the deaths of older trees include toppling because of fungus-weakened roots, undercutting by streams, excessive strain due to snow or wind, and water-logged soils. However, many trees live to be over 2,000 years old (Harvey et al. 1980).

Mature sequoia trees have extensive root systems that may extend outward from the trunk up to 200 feet. The root systems are within 4 to 5 feet of the soil surface (Engbeck 1976) and consist of large roots up to 3 feet in diameter and tiny threadlike feeders that spread out from larger roots near the base of the tree. In groves where there is heavy visitation, both direct effects and alteration of key environmental conditions appear to affect the vigor of mature trees and regeneration of the species. Giant sequoias are subject to direct injury from construction and use of existing facilities. Buildings, parking areas, and compacted soils alter the soil moisture regime. Heavy foot traffic can damage the shallow feeder roots, which are essential to sequoia survival (Meinecke 1926). Fire suppression in developed areas increases the competition against the giant sequoia and reduces its reproduction. When developments are located in a sequoia grove, management techniques for the best protection of the prime resource are not possible, and the ability of the grove to perpetuate itself is hampered.

G: MARKING GUIDELINES FOR TREE REMOVAL

Following are the general criteria to be used for marking trees to be removed from existing or planned developments.

Trees, regardless of size, species, defect, or vigor, that are located within the staked perimeter of road prisims, buildings, trails, or parking areas. Realignment of roads and other staked developments because of the presence of particular trees will be reserved primarily for especially large, old, high-value specimen trees, vigorous mature trees, or patches of vigorous young growth.

Potential high-priority hazard trees based on a combination of high probability of failure and high probability of target impact. In true firs, important indicators of defect include basal scars, nearby occurrence of Fomes annosus, and conks of Echinodontium tinctorium.

Old-growth trees within and adjacent to identified root-rot centers and in areas of shallow rooting because of a high water table or thin soil mantle.

Old-growth trees that are identified as "high risk" in terms of reduced vigor and expected longevity because of the effects of overmaturity and/or disease (dwarf mistletoe) infection.

Severely suppressed or intermediate crown class trees that would not respond to release.

Residual trees, regardless of size, that are prone to windthrow because of management-related or existing openings (wind tunnels) in the stand.

Trees that will unavoidably be or already have been severely damaged by tree removal or construction activities.

Size (dbh or height) class generalizations will not be utilized solely to decide which trees to remove; trees will be marked on a case-by-case basis. However, trees over a yet-to-be-determined size (based on tree failure records) will be considered more strongly for removal based on above criteria. Marking will encompass all trees within a horizontal distance equal to the height of the residual trees. Marking in accordance with these guidelines should ensure protection of both resource values and public safety. Marking guidelines will be reviewed and implementation evaluated in the field by the U.S. Forest Service (R-5 Forest Pest Management, San Francisco). Actual marking will be under direct supervision of the forestry foreman and park forester (park resource staff 1985).

H: PROTECTION OF RESIDUAL STANDS DURING TREE REMOVAL AND CONSTRUCTION

Overstory removal and construction activities in mature tree stands can severely injure the leave (remaining) trees, leading to unsightly wounds, substantial decay, and sometimes tree death. Although these guidelines were developed for commercial logging operations in young-growth true fir stands (Forest Service 1983), they are also applicable to park development and should greatly reduce damage to residual stands.

Restrict the construction and logging season. Do not allow entry during the spring and early summer when the bark is loose.

Restrict the size and type of equipment. Match the logging equipment to the type and size of material being removed.

Mark the leave trees. When leave trees rather than cut trees are marked, the operator becomes more aware of which trees are to be protected.

Lay out skid roads in advance of logging. Skid trails should not be cleared wider than skidding vehicles. Use straight-line skid trails, and follow the routes of proposed roads and paths.

Leave buffer or bump trees. When possible, leave logs and bump trees along the margins of skid trails. Remove bump trees during the last stand entry. Limb, top, and buck trees before skidding. Avoid whole tree logging, and cut limbs flush with the tree bole.

Limit the log length. Skidding long logs increases the likelihood of damage to leave trees. Adjust log lengths to the spacing of the residual stand.

Log the skid trails first. To keep the skidder from veering into leave trees, cut the stumps in the skid rails as low as possible, no more than three-to-four inches high.

Use directional felling. Fall trees toward or away from the skid trails to reduce skidder maneuvering. Back the skidder toward the direction of the fall.

Do not thin stands too heavily. Sudden exposure to sunlight can cause considerable sunscald to thin-barked species.

Prevent new annosus root disease centers. Treat all conifer stumps with granular borax according to label instructions.

Gain the contractor's cooperation. Through training and close supervision, convince operators that damage to leave trees is unnecessary and will not be tolerated.

I: RECOMMENDATIONS FOR TREES INFESTED WITH FOMES ANNOSUS (Forest Service 1984)

Trees diseased with Fomes annosus that could fall on existing or proposed developments will be removed. These trees are considered disease centers and should be treated as follows.

If the diseased tree to be removed is a white fir, then adjacent white firs should also be removed. Pines can be left in place and additional pines can be planted because white fir Fomes centers have a very low probability of infecting pines.

If the diseased tree to be removed is a pine, then adjacent pines should be removed. White firs adjacent to this center should also be removed because Fomes from pines readily infects firs. Plantings in these areas should consist of shrubs or hardwoods (black oaks) and resistant conifers, depending on the recommendations of the park resource staff.

For all tree removal activities, the stumps should be treated with borax, because this will prevent the initiation of new disease centers, although it will not stop the spread of infection outward from existing centers. This recommendation should, however, be carefully evaluated based on the ecological conditions of the Grant Grove area, the intended recreational purposes, and the biological effects of borax in the environment. This statement is based on objectives of the Park Service and on the specifics of borax as an herbicide (Thomson 1979).



United States Department of the Interior

NATIONAL PARK SERVICE

SEQUOIA AND KINGS CANYON NATIONAL PARKS

THREE RIVERS, CALIFORNIA 93271

IN REPLY REFER TO:

Your name was randomly selected to assist the National Park Service in a major planning effort for Grant Grove at Kings Canyon National Park. This questionnaire specifically addresses overnight accommodations and other services at Grant Grove.

Would you please take a minute to help us in this endeavor by removing and answering the attached questionnaire? This questionnaire then may be folded and fastened with one or two staples or tape, and returned to the address indicated. No postage is necessary. Please return the questionnaire as soon as possible.

If you wish some information on Sequoia and Kings Canyon National Parks, please send your request to me at the above address.

Thank you very much for your interest and help.

Boyd Evison

Park Superintendent

Sequoia and Kings Canyon National Parks

QUESTIONNAIRE

1. How many times have you visited Kings Canyon National Park in the last 5 years? _____ times _____ never
 2. How many times have you visited this park during the last 12 months?
summer: _____ times winter: _____ times
 3. How many nights did you spend in overnight accommodations at Grant Grove this year? _____ nights
 4. Why did you choose to stay at Grant Grove? _____

 5. Which type of overnight accommodation *did you use* at Grant Grove? _____
Cabin without bath _____
Housekeeping (cooking facilities; no bath) _____
Cabin with bath _____
 - Which type of overnight accommodation *would you prefer* to stay in at Grant Grove? _____
Cabin without bath _____
Housekeeping (cooking facilities; no bath) _____
Housekeeping (cooking facilities; with bath) _____
Cabin with bath _____
Hotel room with bath _____
 6. If Grant Grove had offered the overnight facilities of your choice, would you have stayed longer? _____ yes _____ no
 7. What would be your preference if new lodging was constructed at Grant Grove:
() small scattered accommodations (i.e., cabins), or
() consolidated accommodations (i.e., hotel or lodge)
 8. What do you like best about the Grant Grove developed area? _____

 9. Please provide your reactions to the following items. For example, how would you evaluate your lodging? Did the visitor center contribute to your experience? Is the distance to nearby cities a positive factor in your selection of Grant Grove as a destination?
- | | | | | | |
|-----------------------------------|---------------------|------------------|------------------------------------|----------|----------|
| Lodging | () excellent | () good | () average | () fair | () poor |
| Food Service | () excellent | () good | () average | () fair | () poor |
| Store | () excellent | () good | () average | () fair | () poor |
| Gift Shop | () excellent | () good | () average | () fair | () poor |
| Visitor Center | () excellent | () good | () average | () fair | () poor |
| Interpretive Programs | () excellent | () good | () average | () fair | () poor |
| Amount of Development | () too much | () about right | () not enough facilities/services | | |
| Character of the Development Area | () attractive | () OK | () detracted from experience | | |
| Distance from Nearby Cities | () positive factor | () not a factor | | | |
| Comments | _____ | | | | |
| _____ | | | | | |
| _____ | | | | | |
10. How many people were in your party (including yourself)? _____
Did you party include children? _____
 11. Your age: under 25 _____ ; 26-40 _____ ; 41-54 _____ ; over 55 _____
 12. Your zip code _____

PLEASE FOLD AND TAPE THE QUESTIONNAIRE WITH THE RETURN ADDRESS ON THE OUTSIDE. Thank you.

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As the nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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Sagunbas