environmental assessment

k&k road relocation

june 1981

REDWOOD

NATIONAL PARK / CALIFORNIA

K & K ROAD RELOCATION

ENVIRONMENTAL ASSESSMENT

REDWOOD NATIONAL PARK

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

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PURPOSE AND NEED

The 1978 expansion of Redwood National Park included approximately 7,600 acres of Simpson Timber Company lands and approximately 9 miles of the Klamath and Korbel (K&K) road, the mainline log haul road for the company's northern California logging operations. Based upon Simpson Timber Company maps, approximately 54,600 acres of lands east of the expanded park are still serviced by this road, with a projected total cut of more than 2.9 billion board feet of timber over the next 70 years. Previous logging operations on lands east of the Bald Hills Road (in the Klamath River drainage) used other haul routes in addition to the K&K road, including the Bald Hills Road itself. (Simpson Timber Company has the option of using alternative haul routes in the future.) Public Law 95-250, the legislation that expanded the park, permits Simpson Timber Company to continue to use the segment of the K&K road within the park at "the existing levels and extent of access and use . . . provided that such use is limited to forest and land management and protection purposes, including timber harvesting and road maintenance."

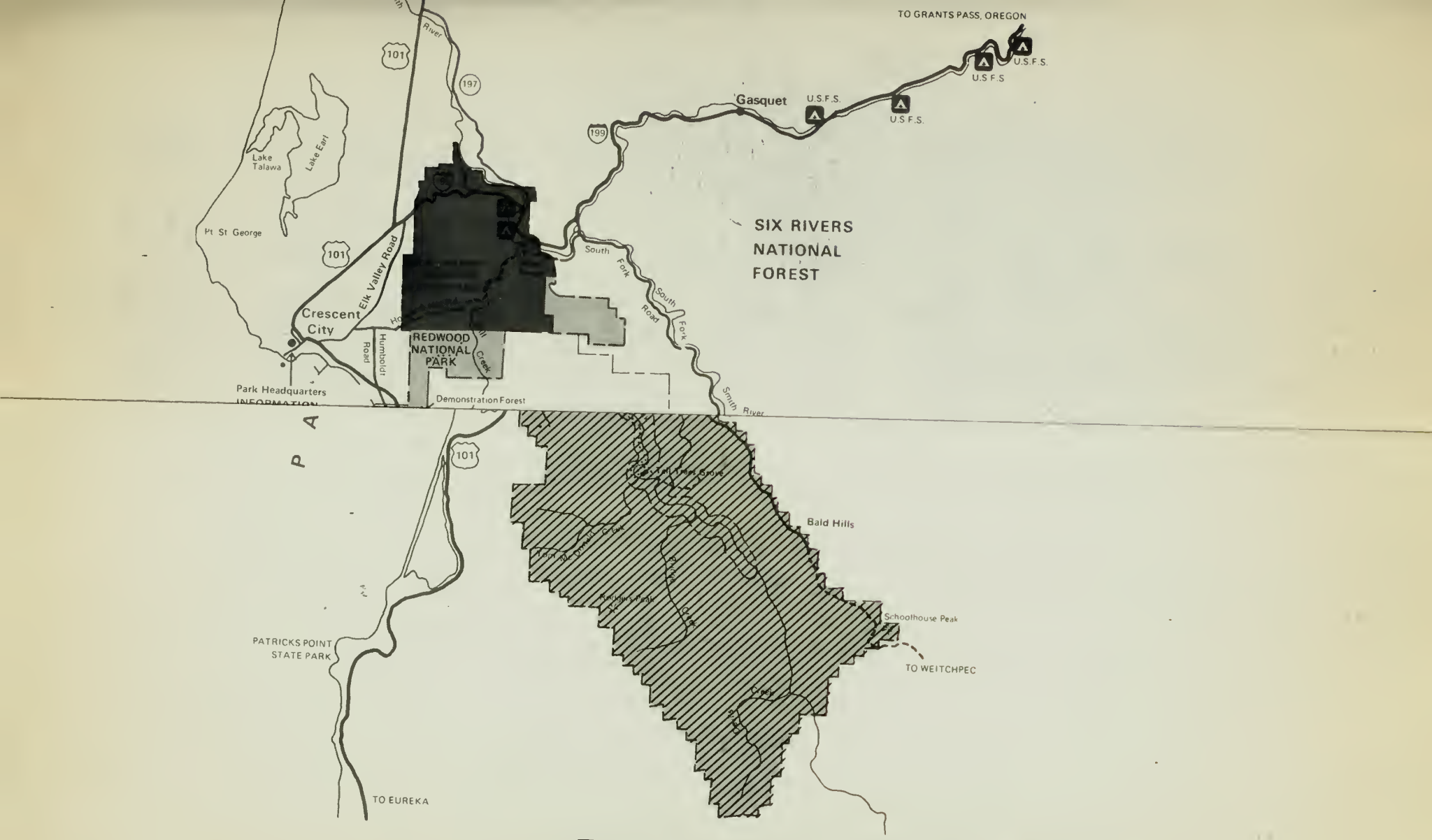
The portion of the K&K road within the park from Coyote Creek northward for approximately 3 miles to the Copper Creek bridge passes through some of the most erosive terrain in the Redwood Creek basin. Because the area is inherently unstable, some of the slopes would probably fail and deliver sediment to Redwood Creek even without a road. However, the general condition of the slopes has deteriorated markedly since the construction of the road and the beginning of logging in the late 1950s, and hillslopes adjoining this section of the K&K road constitute one of the most highly altered logged-over areas within the entire watershed. (A description of this area is included in appendix A.)

The restoration of such hillslopes to a facsimile of their natural condition is the major goal of the watershed rehabilitation program currently underway within Redwood National Park. The methods employed to achieve this goal are based on the premise that restoring a hillslope's hydrologic system to its natural configuration and mitigating the current erosion will allow the area to heal itself. Such a program is not possible as long as the K&K road remains open. The current road disrupts many of the area's drainages and concentrates runoff by means of culverts and an inboard ditch system. As a result, erosion of the roadbed, fills, and cutbanks has become a constant problem, elevating the area's already high level of sediment production. The presence of the road has also increased the potential for future gullying and slope failure. Heavy maintenance is constantly required to keep the road open, and this and the heavy traffic load ensure the persistence of these conditions.

Administrative problems resulting from use of the K&K road include controlling access from both the north and south ends of the road. Currently, access for private vehicles is seasonally restricted, and cars are more subject to accidents because the road was intended to be used as a logging haul road, not as a public access road, and it is not wide enough to accommodate both uses. Other administrative concerns include lack of control over poaching, removal or damage to vegetation and

cultural resources because of unauthorized off-road vehicle use, and damage to rehabilitated slopes or equipment.

Simpson Timber Company has proposed to relocate that portion of the K&K road within the park, but only if the company is compensated for the loss of the existing, legislatively authorized access through the park. This compensation is to include funding for new access road construction and for increased hauling and maintenance costs resulting from using an alternative road system. Simpson Timber Company would consider this as a partial settlement for all damage claims it has filed against the U.S. government relating to the 1978 park expansion.



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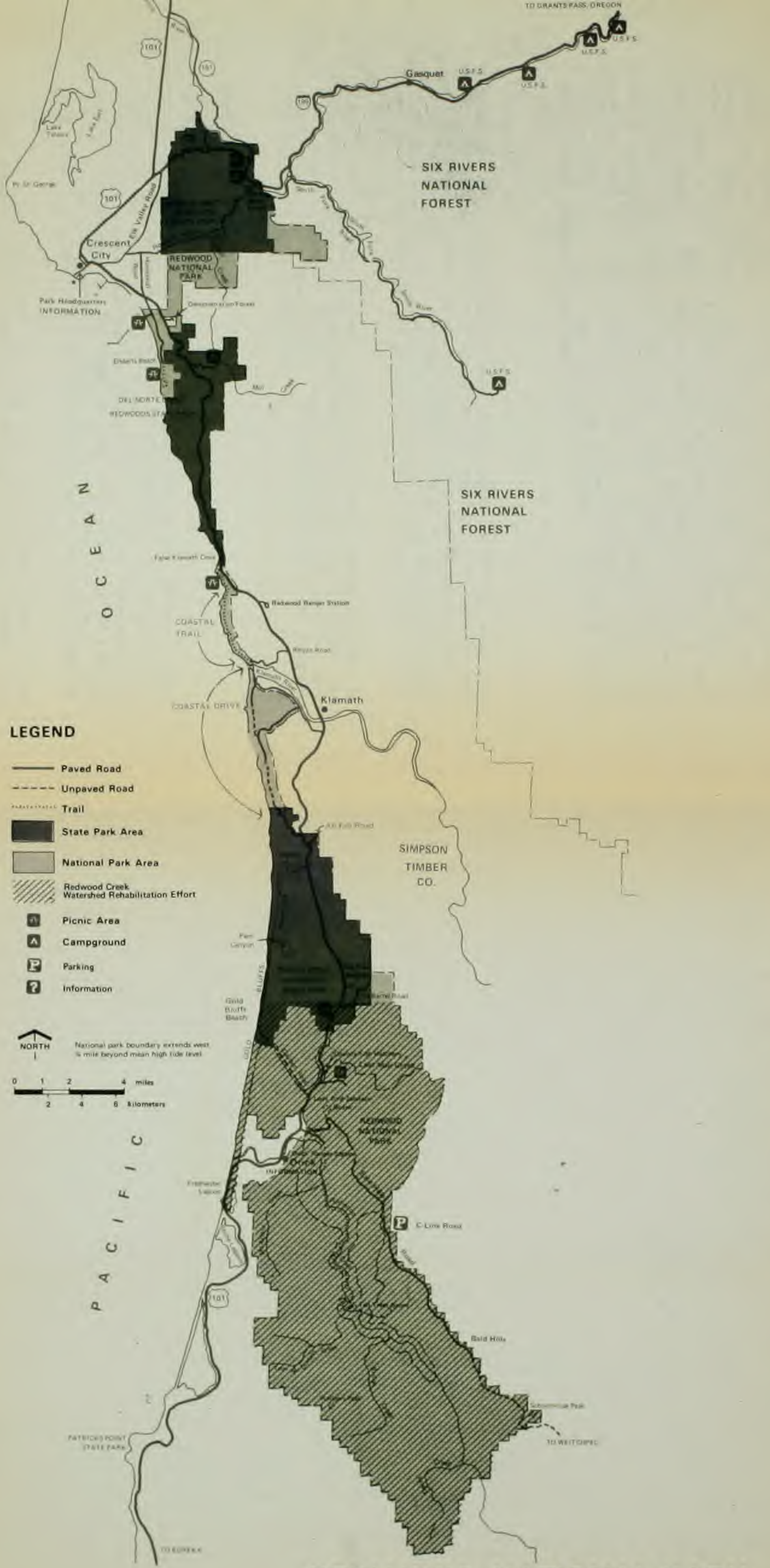

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ALTERNATIVES

There are two alternatives concerned with the K&K road alignment within Redwood National Park. The first is a no-action alternative: The K&K road would be retained in its present alignment, and access and use by Simpson Timber Company would continue. The second alternative is to establish a bypass route around the park. The bypass route is considered in two segments. The first segment would consist of a road up the Coyote Creek drainage with two options (A and B) for approximately the last 3 miles of the route; the second segment would consist of either using the Bald Hills Road (option 1) or one of two routes to the east of it (options 2 and 3). If a bypass route was selected, then the 3-mile segment of the K&K road between Coyote and Copper creeks within the park would be removed and restored as part of the Redwood Creek watershed rehabilitation program. The various routes are shown on the Alternative Routes map.

NO ACTION

Under the no-action alternative, existing use levels on the K&K road from the park boundary at Coyote Creek to the intersection of the K&K road and the Bald Hills Road would be retained. The restrictions as stated in PL 95-250 would apply to Simpson Timber Company in regards to existing types and levels of use. Little road improvement would be required other than the periodic maintenance required at various locations along unstable slopes.

If the K&K road was retained, some actions would have to be taken to rehabilitate already disturbed sites along the road corridor within the park, including stream channel clearing, drainage improvements, haul road removal, and revegetation. A detailed description of required actions is contained in appendix B.

COYOTE CREEK OPTIONS

Option A

For the first segment of a bypass around the park, Simpson Timber Company would use an 8.3-mile route from Redwood Creek up the Coyote Creek drainage to the Bald Hills Road. Existing roads would be utilized, which would require moderate reconstruction and minor upgrading (see table 1 for definitions of the types of road construction). The roadbed would be 18 to 20 feet wide, similar to the existing K&K route. The route would be outside the park boundary but within the park protection zone.

The route would leave the K&K road just north of the Panther Creek bridge across Redwood Creek and climb north and east to Arbor Camp Ridge. From that point it would follow the adjoining ridge north, pass Coyote Peak on the east side, and intersect the Bald Hills Road. The entire route would follow a major haul road system (1400 series)

Table 1: Road Construction Required for Alternative Routes

Coyote Creek Options	A--New Construction	B--Substantial Reconstruction	C--Major Reconstruction	D--Moderate Reconstruction	E--Minor Upgrading	Total
Option A	0.0	0.0	0.1	2.2	6.0	8.3
Option B	0.3	0.6	0.9	0.0	5.8	7.6
Bald Hills Options*						
Option 1	0.0	0.0	0.0	0.0	8.4	8.4
Option 2	4.5	1.8	1.9	1.8	3.5	13.5
Option 3	6.5	1.5	0.4	0.7	2.2	11.3

* The mileage for option 1 would be 8.9 miles if Coyote Creek option A was selected. Mileages for options 2 and 3 are figured from the end of the Coyote Creek option B route.

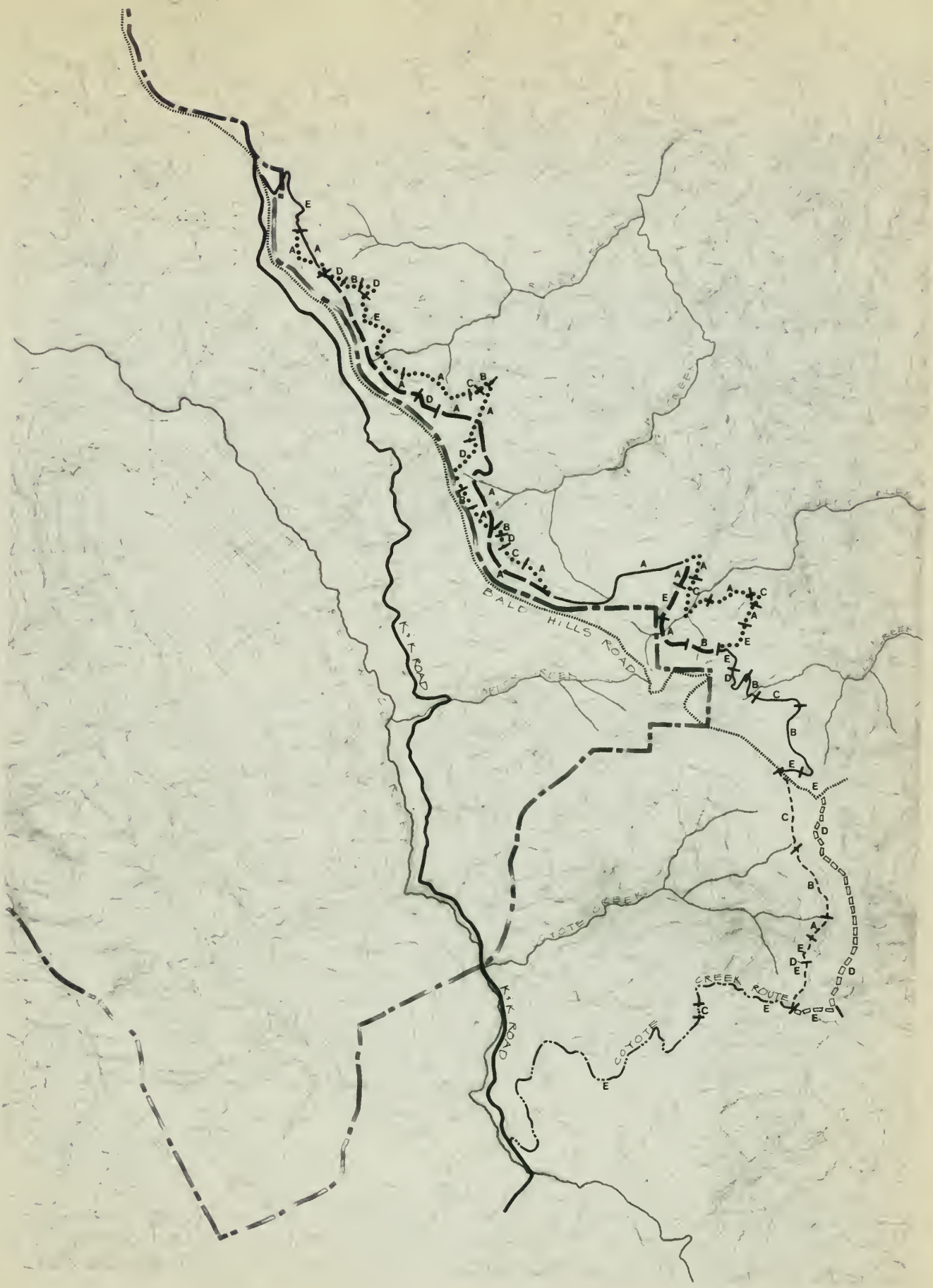
New Construction--No road of any kind exists.

Substantial Reconstruction--Route would follow existing minor roads or skid trails, but widening and upgrading to bring them up to mainline standards would require a major construction effort.

Major Reconstruction--Right-of-way is well established, and either is, or at one time was, a major road. However roadbed deterioration, or lack of compliance with mainline standards, would necessitate a considerable amount of widening, roadbed repair, drainage improvement, crossing reconstruction, etc.

Moderate Reconstruction--Portions of the road may be drivable; however widening, surfacing, drainage improvements, etc., must be completed before standards could be met. Most of the stream crossings would need to be reconstructed.

Minor Upgrading--The existing road is in good condition and drivable. Some culvert upgrading, inboard ditch maintenance, etc., could be necessary, but in general very little work would be needed to meet standards.



ALTERNATIVE ROUTES

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established in the early 1960s, and elevations would range from 400 to 3,000 feet. Except for one short segment, the haul roads are still in good condition, and the entire route is drivable.

Option B

Option B would be a 7.6-mile route through the Coyote Creek drainage to the Bald Hills Road. It would follow the same alignment as option A for approximately the first 5 miles. From Arbor Camp Ridge, the route would be about 0.25 mile west of and downslope from option A, and it would skirt Coyote Peak on the west. This route would intersect Bald Hills Road about 0.5 mile northwest of the option A intersection.

Most of the route would consist of existing roads that would require only minor upgrading. Approximately 0.3 mile of the last portion of the route, however, would require new construction, and 1.5 miles would require substantial or major reconstruction, consisting of extensive widening, grading, installation of culverts, and rocking.

BALD HILLS OPTIONS

Option 1

Bald Hills Road follows a north-northwest alignment along the ridge separating the Redwood Creek drainage from the Klamath River drainage. From the Holter Ridge Road intersection, the road turns westward to join U.S. 101. Existing use patterns include hauling of logs, access to private lands, random visitor use, and shuttle bus tours from Orick along the C-line road to the vicinity of the Tall Trees Grove.

The segment of Bald Hills Road that would be used as the second part of the bypass would be 8.9 miles long if option A in the Coyote Creek basin was selected or 8.4 miles long if option B was selected. Use of the county road to the intersection of the present K&K road would require a transportation permit and a cooperative agreement between Humboldt County and Simpson Timber Company for road maintenance and/or repair. The county's major concerns about road use revolve around the overweight and oversized hauling trucks used by Simpson. (Normal-sized logging trucks now use existing county and state roads with no apparent problems.) If the Bald Hills Road was used, widening might be required to accommodate oversized logging trucks.

Option 2

This 13.5-mile route east of the Bald Hills Road would require approximately 9 miles of existing roads or skid trails to be connected by some 4.5 miles of new road. The route would leave the Bald Hills Road at the intersection of the Coyote Creek option B route. (If the option A route was selected, 0.5 mile of the Bald Hills Road would be used to the turnoff.) Option 2 would head south from the Bald Hills Road, then turn north. It would pass Schoolhouse Peak on the east and cross the

headwaters of Tully Creek, a tributary of the Klamath River. The route would then cross Williams Ridge, traverse Cagle Ridge, and join Johnson Road about 1.4 road miles south of the existing K&K road. Approximately the last 0.1 mile of the route would be on the Bald Hills Road. In addition to the new construction, 3.7 miles of existing roads would require substantial or major reconstruction, including extensive widening, roadbed repair, drainage improvements, and crossing reconstruction. Approximately 1.8 miles would require moderate reconstruction, and about 3.5 miles of the route would require minor upgrading.

Option 3

This 11.3-mile road would generally lie between the Bald Hills Road and option 2. Although some segments of this route would follow the same alignment as option 2 (the beginning, the end, and a 1.3 mile segment on Cagle Ridge), most of the route would be upslope and to the west of option 2. Approximately 6.5 miles would be new construction; 1.9 miles, substantial or major reconstruction; 0.7 mile, moderate reconstruction; and 2.2 miles, minor upgrading.

NATURAL RESOURCES

Geology and Soils

The southern portion of Redwood National Park lies within the drainages of the Klamath River and Redwood Creek, which are separated by the Bald Hills ridge. The Klamath River originates in Oregon and flows into the Pacific Ocean near Klamath, California. It has an approximate drainage area of 15,500 square miles. Soils along the river are generally more stable than those along Redwood Creek, and there is less suspended sediment in the river.

Redwood Creek begins near an elevation of 5,000 feet and flows northwest for 66 miles until it empties into the Pacific Ocean near Orick, California. The creek drains a 280-square-mile watershed, which is characterized by high relief, steep unstable slopes, and narrow valley bottoms. Average hillslope gradients range from 31 to 34 percent, with many streamside slopes being over 70 percent. Over a third of the basin shows evidence of past or present mass movement (U.S. Department of the Interior, Geological Survey 1976b).

Redwood Creek and its tributary streams are subject to frequent flooding from winter storms, and basin soils are naturally unstable and highly erodible. Landslides and earthflows are widespread, and even under natural conditions streams swelled by winter rains transport large volumes of sediment (Anderson 1979). Mean annual erosion rates for the north coast area in general result in sediment yields in excess of 4,000 tons per square mile per year (Janda and Nolan 1979). For Redwood Creek, with over 90 percent of the forests in the basin harvested, the sediment yields are in excess of 8,000 tons per square mile per year (U.S. Congress, House, Committee on Government Operations 1976).

The existence of over 300 miles of truck roads and 3,500 miles of tractor trails has created the greatest erosion problems in the watershed. The cutting of logging roads into steep slopes has often resulted in massive slope failures, causing sediment to be delivered directly into perennial and intermittent stream channels. Surface runoff is intercepted and concentrated by inboard ditches along these roads, and it is diverted onto slopes that have no natural drainage channels. In addition, culverts often become blocked, diverting water onto road surfaces and across unchanneled hillslopes. These diversions result in both roadbed and hillslope gullying, and they also initiate or accelerate failures in the roadfill and underlying hillslopes.

The Grogan fault is a major structural feature that lies near the present K&K road, from the south park boundary to Copper Creek. Movement along this fault has left the adjacent rocks highly fractured and faulted, and nearby hillslopes tend to be very unstable. This situation has been aggravated in the vicinity of the K&K by logging, a recent series of large storms, and disturbances accompanying the construction, use, and maintenance of the road.

Many natural deep-seated mass movements in the prairies in the Redwood Creek watershed have also been aggravated by logging (appendix A). Road construction across unstable prairie grasslands has altered the natural drainage patterns, resulting in deep gullies and slumping as the prairie slopes adjust to changing hydrologic conditions.

Vegetation

Historically, the Redwood Creek basin supported a mosaic of forest, prairie, and woodland. Forest types ranged from Sitka spruce on slopes and valleys adjacent to the ocean, to the redwood/Douglas-fir associations in the more upland areas approximately 10 miles from the coast. Redwoods dominate alluvial forests, where they reach their greatest height. California laurel and bigleaf maple are common associated species on alluvial flats. Elsewhere associated species of importance include hemlock, grand fir, madrone, tanoak, and red alder. In the upper basin, redwoods are absent or are confined to valley bottoms. At higher elevations, true firs replace Douglas-firs.

Approximately 65 percent of the basin within the park has been cutover or otherwise disturbed by activities associated with logging (i.e., construction of roads, skid trails, and landings). Only 29 percent remains in old-growth and/or advanced second-growth stands, while the remaining 6 percent consists of prairies, woodlands, valleys, and riparian bottomlands.

Wildlife

Wildlife habitats for a variety of species are found in Redwood National Park, the three state parks, and surrounding areas. The species associated with these various habitat types are listed in appendix F-7 of the Draft Environmental Statement for the General Management Plan (DES 79-55; see USDI, NPS, Denver Service Center 1979).

Common mammals within the Redwood Creek basin include the Roosevelt elk, black-tailed deer, black bear, and various small mammals. Bobcat, gray fox, coyote, and mountain lion also occur in the area. Mink, otter, and beaver are more closely associated with Redwood Creek and its tributaries.

Birds in the watershed include larger species such as hawks, waterfowl, woodpeckers, and turkey vultures, as well as smaller species such as sparrows and warblers. Occasionally, eagles, falcons, and osprey are observed, but only the osprey is known to nest in the immediate area.

Aquatic Resources

The streams that would be directly affected by the road relocation alternatives include Copper Creek and Coyote Creek within the Redwood Creek basin, and Tully Creek and Roach Creek within the Klamath River drainage.

Copper Creek and Coyote Creek were electrofished during the summer of 1980 as a part of a basinwide nursery area study (Anderson and Brown 1980). The survey revealed substantial numbers of steelhead trout in both creeks and a single juvenile coho salmon present in the lower portion of Coyote Creek.

Only 500 yards of Copper Creek is available for use by anadromous salmonids because the stream gradient is a natural barrier to migration. In Coyote Creek 1.4 miles of suitable habitat exists for anadromous salmonids. Increased sediments are visually apparent within both Copper Creek and Coyote Creek, the result of past logging and related practices.

Fisheries resource information on the lower reaches of Roach and Tully creeks is included in a 1979 U.S. Fish and Wildlife Service report. This study was centered within the Hoopa Valley Indian Reservation, approximately 6-8 miles downstream of the alternative Bald Hills alignments.

Unlike the aquatic resources of many streams in the Klamath River drainage that have been acutely impacted as a result of logging, the aquatic resources of Tully Creek and Roach Creek have not been severely affected. Stream conditions in both drainages were found to be suitable for the spawning and rearing of salmonids, and hence they have a good potential for producing steelhead and some salmon. The stream substrate of Roach Creek contains very low levels of silt, and Tully Creek is relatively free of silt.

CULTURAL RESOURCES

Ethnography and History

Archeological sites identified in the Redwood Creek basin are within the ethnographic territory of the Chilula peoples, also known as the Redwood Creek or Bald Hills Indians. Chilula territory included the Redwood Creek drainage from a few miles above the mouth of the creek to a few miles above Redwood Creek valley and probably to the crests of the ridge systems on either side of the creek. Since settlement patterns and subsistence strategies determine the distribution of archeological resources, a brief outline of these aspects of Chilula culture follows.

The Chilula were inland oriented, since they had no direct access to the ocean without going through the territory of the Coast Yurok, their traditional enemies. Because coastal and riverine resources were less abundant or accessible for the Chilula than for their Yurok and Wiyot neighbors, the Chilula likely placed greater emphasis on vegetable foods and game than on fish. In addition, their subsistence effort was probably more mobile and not necessarily oriented around Redwood Creek itself, except during the limited period of the creek's yearly salmon run.

Within their territory, the Chilula could use the creek for salmon and eel, the forests for acorns, the prairies for bulbs, grasses, elk, and other game, and the forest/prairie ecotone for the diversity of plant species it offered. During the year, various resources would be used at the

appropriate season, and temporary camps or procurement sites would be occupied away from permanent villages.

The lower 45 miles of the Klamath River were occupied by the Yurok Indians. Since the Yurok utilized upland as well as riverine resources, the ridges between the Klamath River and Redwood Creek may have been used by both the Chilula and the Yuroks.

Initial exploration of the Redwood Creek watershed by white men occurred in the early 1800s by traders and miners. Subsequently, homesteads and pack trails were established in both the Bald Hills and Redwood Valley. The Trinidad Trail, a primary pack trail from the coast to the Trinity River goldfields, crossed Redwood Creek at the Tall Trees and then ascended the Bald Hills ridge. During this period, approximately 1850-1875, the Chilula people resisted the incursions of white settlers, but in the process the Chilula population was nearly decimated.

Early homesteading efforts were concerned with vegetable farming and mule raising, and later sheep ranches were established. By the 1940s, there were 15,000 or 20,000 sheep in Redwood Valley alone (Salzman and Bickel 1979). From the 1940s through the 1970s, lumber activities predominated in the Redwood Creek basin. Although a few substantial ranches still exist, the large numbers of coyotes have made sheep ranching unfeasible. Timber companies bought and subsequently harvested the redwood and fir forests along Redwood Creek and constructed roads throughout the basin and mills on the creekside flats of Redwood Valley. By 1978, when Congress expanded Redwood National Park, little virgin timber remained in the Redwood Creek basin. Today some cattle are run in the Bald Hills, a few ranches exist in Redwood Valley, and the park is implementing a watershed rehabilitation program on the park lands.

Cultural Resource Surveys and Consultations

Pursuant to Executive Order 11593, cultural resources of a sample of park lands in the Redwood Creek basin were inventoried by Bickel (1979). Subsequently, three studies were completed during the watershed rehabilitation planning process (Bickel and King 1980, King and Bickel 1980, and Hayes and others 1980). Finally, in conjunction with proposed watershed rehabilitation projects in the basin, archeological reconnaissances have been undertaken (Salzman and Bickel 1979, King 1980, and Baker 1981) and archeological excavations were contracted (King 1980).

Approximately 15 percent of the lands within the Redwood Creek basin have been surveyed for cultural resources. Thirty-three archeological sites have been recorded, and 19 of the prehistoric sites have been determined to be eligible for nomination to the National Register of Historic Places as the Bald Hills archeological district. Three prehistoric sites have been test excavated, and artifacts have been analyzed.

The cultural resources of the project area clearly have the potential to yield information about prehistoric and historic lifeways. This information

is valuable not only to anthropological research in northwestern California but also to local descendants and to the interpretation of events and changes in the area.

Three surveys have been initiated within the Redwood Creek basin to ascertain sites and structures of historic and architectural significance (USDI, NPS 1969; USDI, NPS, DSC 1978 and 1980b). The Lyons ranch homestead site and remnants of the Trinidad Trail were identified as possessing intrinsic historic importance and are being nominated to the National Register of Historic Places. Two other properties, the Lane barn at Elk Camp and the Dolason barn in Dolason Prairie, possess exemplary architectural significance and are recognized for their local value, although they are not of National Register caliber. Ongoing archeological surveys and a proposed oral history program may identify additional historic sites, which would be added to the cultural resources data base for the park. Their significance would be evaluated against the criteria for inclusion on the National Register of Historic Places (36 CFR 1202). Actions specific to the management of the Lyons ranch site, the Dolason barn, and the Lane barn are found in the cultural resources management portion of the General Management Plan (USDI, NPS, DSC 1980a).

Pursuant to PL 95-341 (American Indian Religious Freedom Act), consultations with Native Americans were held before most of the above studies were undertaken. There are Indians now residing at Hoopa who either themselves or their families lived in villages in the Redwood Creek basin. Native Americans in the area use a ceremonial site in the Bald Hills, and the park will develop a policy for local Indians to use traditional resources in the park.

THE REGIONAL ECONOMY

Until the 1980 census results become available, current socioeconomic data on Humboldt County will not be known. The following discussion is based primarily on projections and observations published in the Socio-Economic Base Study on Six Rivers National Forest (TerraScan 1979). Additional economic information may be found in DES 79-55 and in the 1980 report to Congress on the status of the implementation of the park expansion act (USDI, NPS 1980).

The population of Humboldt County has increased slightly since 1970. In 1976 Humboldt County's population was estimated by the state to be 106,000, reflecting a growth rate of 6.5 percent between 1970 and 1976. The 1980 census is likely to reveal an additional net migratory inflow.

Employment in forest products industries has declined, while agriculture, commercial fishing, tourism, and government have all expanded. The decline in forest products has been accompanied by a substantial increase in unemployment rates. Between 1970 and 1980, the unemployment rate for Humboldt County has increased from 10.1 percent to an estimated 12.9 percent (USDI, NPS 1980). Concurrently, taxable transactions, personal income, and residentiary employment have increased. The total Humboldt County income in 1980 was estimated at $523,800,000 and residentiary

employment was approximately 19,100 (personal communication with Frank I. Jewett, Humboldt State University). These increases may be partially due to the Redwood Employment Protection Program, which was set up to maintain the incomes of those persons who lost jobs because of the Redwood National Park expansion. The increases may also partially result from an increase in professional and white collar occupations, as well as in unskilled and semiskilled positions. In addition, the decrease in forest products manufacturing has resulted in an increase in the cost of wood products, a leveling of productivity, and possibly the adoption of more labor-intensive methods (TerraScan 1979).

NATURAL RESOURCES

Geology and Soils

No Action. Retention of the K&K road would continue to aggravate the instability of the adjacent hillslopes in the vicinity of Grogan fault. Unstable areas and earthflows would continue to move, producing widespread slumping, disrupted surface drainage, road failures, and continued gullying. These problems would have to be addressed if the K&K road was retained. Numerous culverts would have to be replaced or rerouted, and waterflow dissipators would have to be installed. Drainage disruptions on the adjacent slopes would have to be treated, fill would have to be removed from several locations, and failing cutbanks would have to be stabilized. Trash and other material would also be removed. The stabilization of sites adjoining the road would lower sediment yield, but not to the extent possible if the road was removed.

Rehabilitation of the K&K Road. With an alternate road alignment, immediate extensive rehabilitation efforts would be undertaken along the portion of the K&K road between Coyote and Copper creeks within the park. These efforts would affect approximately 500 acres of impacted hillside and would help restore the terrain to a relatively natural condition. (A detailed description of the proposed rehabilitation measures for this area is contained in appendix B.) In addition, rehabilitative efforts north of Copper Creek could be completed in the most cost-effective manner. Complete rehabilitation would prevent substantial erosion.

Coyote Creek--Option A. Problems with the option A route would be minimal. Major reconstruction of the existing road would be necessary near an old landslide scar (denoted as construction type C on the Alternative Routes map). Special care would have to be taken just after this route separated from the option B route, where the crown of an old, stabilized earthflow would be crossed. Overall, the route is in a generally good condition, as indicated by the amount of work that would be required (see table 1). An overview of the types of erosion impacts that would result from construction is contained in appendix C.

Coyote Creek--Option B. Unlike option A, option B would cause major erosional problems. In addition to the new construction, four sections of the proposed road system have the potential to become major sources of road-related erosion.

The least serious hazard would occur where a short section has experienced major failures in the roadfill (category D on the Alternative Routes map). To use the road, the slope would have to be stabilized.

More serious problems would occur at the base of Coyote Peak, where a major spring occurs along the proposed right-of-way. The existing road has been relocated and raised, and it is currently backing up water to

depths of 3 or more feet between it and the hillside. The resulting pond measures approximately 300 feet by 30 feet, and as of April 1981 it was discharging about 300 cubic feet of water per hour into a nearby stream channel. Drainage problems in the subgrade would make this portion of the road a year-round maintenance problem.

The most serious of all the erosional problems along this route (in fact, along the entire bypass) is the hillslope immediately south of Coyote Peak, only a few hundred feet from the spring mentioned above. This hillslope exhibits widespread minor slumping (1 to 2 foot scarps are common, some are larger), saturated soil conditions, and poorly integrated drainage. These are apparently long-term conditions, judging from the anaerobic, organic-rich nature of the soils and the widespread distribution of wet-area vegetation (coltsfoot and rushes). The area is about 520 feet long and 240 feet wide, and the presence of overturned cattle troughs in its upper portions indicates that the slumping is expanding up the slope. The average slope gradient is 30 percent, and a major tributary of Coyote Creek lies along its lower boundary. The slumping extends less than halfway to the ridgetop, and the area is contributing only minor amounts of sediment to the channel system. However, constructing, maintaining, and using a road the capacity of the K&K would have adverse effects upon the hillslope's stability. It is possible that an earthflow comparable in size to those along the present K&K would be initiated. The U.S. Geological Survey has mapped the entire Coyote Creek prairie system, including this slope, as a series of previously active earthflows (USDI, GS 1976a).

The last section that would have potential erosional problems lies north of Coyote Peak, where option B would cross prairies and old earthflows sensitive to gully erosion. Such gully erosion is a major concern of the Redwood National Park rehabilitation program (USDI, NPS, RNP 1978 and 1981). Careful construction and maintenance procedures would have to be followed to avoid serious erosional problems here.

Bald Hills--Option 1. Use of the existing Bald Hills Road would not result in any significant erosional impacts.

Bald Hills--Options 2 and 3. Except for numerous gullies, the rights-of-way for options 2 and 3 would not cross any major erosional features. Because the potential for landsliding along either route would probably be about the same, the differences in erosional impacts would depend on the expected responses to construction.

Option 3 would require an additional 1.7 miles of new construction and substantial reconstruction (categories A and B) compared to option 2, but option 2 would require an additional 2.6 miles of major and moderate reconstruction (categories C and D). Major and moderate reconstruction would not result in as much alteration. Because option 2 would follow more existing roads, this route would likely be a much less serious source of initial sediment than option 3.

Long-term differences between the options would depend on the residual erosion rates. Option 2 would be 2.2 miles longer and contain steeper

segments; however, option 3 would cross an additional 1.4 miles of erosionally sensitive prairie. Consequently, it is likely that differences in long-term sediment production would be minimal.

Vegetation

No Action. Of the 3 miles of the K&K road between Copper and Coyote creeks within the park, 0.5 mile passes through prairie and oak woodland and the remaining 2.5 miles pass through second-growth redwood/Douglas-fir forest. Introduced annual grasses (dogtail, soft chess, and annual fescue) and native annual and perennial forbs (plantain, hairy cats ear, and sheep sorrel dock) dominate the grassland (see appendix D for scientific names of plant species). Scattered stands of Oregon white oak occupy the ecotone between grassland and redwood/Douglas-fir forest. Second-growth redwood and Douglas-fir dominate most of the lower elevations of the drainage. Tanoak, blue blossom, and coyote brush are common. No plant species listed by the state or federal government as rare, threatened, or endangered has been found in or is known to exist in the vicinity of the K&K road.

Limited rehabilitation efforts that would be taken on the slopes adjacent to the K&K road would restore some vegetation. Stabilization of slopes and drainage channels would limit adverse impacts on adjacent vegetation.

Rehabilitation of the K&K Road. Rerouting the K&K road along any of the alternative alignments would allow the restoration of vegetation along the K&K road between Copper and Coyote creeks. Assuming revegetation of a 3-mile-long, 50-foot swath, then some 3 acres of grassland and oak woodland and 15 acres of second-growth redwood/Douglas-fir forest would be restored. (These and later quantifications represent the minimum areas that would be affected. Exceptionally steep slopes would require more extensive rehabilitation efforts, and the affected acreages would be substantially greater.)

Rehabilitation of adjoining slopes and roads would affect approximately 500 acres of prairies and second-growth forest between the Bald Hills Road and Redwood Creek, and between Copper Creek and the park boundary.

Revegetation treatments that would be used on both roads and slopes are described in the Watershed Rehabilitation Plan (USDI, NPS, DSC 1981).

Coyote Creek--Option A. Approximately 2.5 miles of this alignment would pass through prairies and 5.8 miles through a second-growth Douglas-fir/redwood forest. Most of the grassland is located along the ridgetops between the Redwood Creek and Klamath River drainages, within the Redwood Creek watershed, and on the ridgetops between Coyote and Garrett creeks. Introduced annual grasses (dogtail, soft chess, and annual fescue) and native annual and perennial forbs (sheep sorrel dock, hairy cats ear, and bracken fern) are most abundant. Blue wild rye and California oatgrass, both native perennial grasses, are present in small amounts.

Remnants of oak woodland from which most of the Douglas-fir has been removed line the prairie margins. Tanoak, Oregon white oak, canyon oak, chinquapin, bigleaf maple, hazel, oceanspray, gooseberry, and blackberry dominate.

A second-growth Douglas-fir/redwood forest dominates the lower portions of the drainage. Douglas-fir and tanoak are common throughout, with redwood being more common at elevations below 2,000 feet. Blue blossom and coyote brush are common understory shrubs. Grass and bracken fern have invaded portions of second-growth forests adjacent to prairies. Bracken fern, rush, and blue wild rye occupy several small swales along this alignment.

If the existing haul road was widened by 10 feet, approximately 3 acres of prairie and 6.7 acres of second-growth forest would be lost. No rare, threatened, or endangered plant species recognized by the state or federal government has been found in the vicinity of this route.

Coyote Creek--Option B. This 7.6-mile route would pass through prairie for approximately 1 mile, oak woodland for 0.6 mile, and second-growth Douglas fir/redwood forest for 6.0 miles. The first 5 miles of the route would pass through the same vegetation as option A, primarily the Douglas-fir/redwood forest. The grasslands along the upper portion of the route are also similar in species composition to option A, with introduced annual grasses and native annual and perennial forbs dominating.

The oak woodland along the upper portion of the route is dominated by tanoak and Oregon white oak. Bigleaf maple and California bay are common near springs and streams. Hazel, oceanspray, and blackberry are common understory shrubs. Grasses and forbs from the adjacent prairies are patchily distributed as understory vegetation.

If the existing road was widened by 10 feet, approximately 1.2 acres of prairies, 6.9 acres of second-growth forest, and 0.7 acre of oak woodland would be removed. An additional 0.5 acre of prairie, 0.4 acre of oak woodland, and 0.7 acre of second-growth forest would be destroyed by new construction, estimating a 35-foot-wide strip. No rare, threatened, or endangered plant species has been found in the vicinity of this route.

Bald Hills--Option 1. That portion of the existing Bald Hills Road that would be used under option 1 (either 8.4 or 8.9 miles, depending on which Coyote Creek route was selected) would pass through approximately 6.8 to 7.0 miles of prairie, 1.2 to 1.5 miles of second-growth redwood/Douglas-fir forest, and 0.4 mile of oak woodland.

Most of the grassland to be affected would be on the tops of Williams and Cagle ridges in the Klamath River drainage. Species composition is similar to that found in grassland areas along other alternative routes, with introduced annual grasses (dogtail, soft chess, and annual fescue) and native annual and perennial forbs (sheep sorrel dock, hairy cats ear, and plantain) dominating. Native perennial grasses (oatgrass and wild blue rye) are patchily dominant on ridgetops.

Scattered open stands of oak woodlands occupy the ecotone between prairie and Douglas-fir/redwood forest. Oregon white oak and tanoak dominate the overstory, with annual and perennial grasses common to adjacent prairies dominating the understory.

Second-growth Douglas-fir and redwood forest dominates much of the proposed route. Douglas-firs and tanoak are common throughout, with redwood increasingly common nearer the ocean.

The only impacts on vegetation under option 1 would be associated with possible widening of the road to accommodate oversized haul trucks; otherwise there would be no additional impacts on vegetation. No rare, threatened, or endangered plant species would be affected.

Bald Hills--Option 2. The option 2 route would pass through approximately 1.2 miles of prairie, 0.5 mile of oak woodland, and 11.8 miles of second-growth Douglas-fir/redwood forest. The species composition would be similar to that of the associations along Bald Hills Road.

Widening existing roads an additional 10 feet would remove approximately 0.1 acre of prairie and 4.0 acres of second-growth forest. New construction or substantial reconstruction would remove an additional 3.4 acres of prairies, 1.7 acres of oak woodland, and 21.2 acres of second-growth forest. No rare, threatened, or endangered plant species would be affected.

Bald Hills--Option 3. The option 3 route would pass through approximately 1.4 miles of prairie, 1.3 miles of oak woodland, and 8.6 miles of second-growth Douglas-fir/redwood forest. Species composition of the three major vegetation types would be the same as that along option 2.

Widening existing roads an additional 10 feet would remove approximately 4.2 acres of second-growth forest. New construction would remove an additional 5.5 acres of prairies, 0.8 acre of oak woodland, and 27.6 acres of second-growth forest. No rare, threatened, or endangered plant species would be affected.

Aquatic Resources

In general, the major impacts that have occurred to streams throughout the Redwood Creek basin are due to sediment input as a result of logging activities. Effects of sedimentation on aquatic organisms range from complete suffocation of eggs, juveniles, or adults to a reduction of food organisms or loss of rearing area because of aggradation. This range of effects is evident in streams near the existing K&K road and the alignment in the Coyote Creek drainage.

No Action. Continued use of the K&K road would not result in appreciable changes in present impacts on area streams. Slope stabilization activities and limited rehabilitation would somewhat lower sediment yields to streams.

Rehabilitation of the K&K Road. Relocation of the K&K road would make rehabilitation treatment feasible along the existing route. This would help to eliminate the continual input of sediment to area streams, and stream recovery would be enhanced. Immediately after rehabilitation work there would be a slight, short-term increase in erosion; however, this increase would be insignificant when compared to long-term increases in overall rates of recovery.

The impacts on Redwood Creek itself as a result of rehabilitating the K&K road would be unquantifiable, although the stream bedload in general would be reduced.

Coyote Creek--Option A. Because a roadway already exists along the option A route, there would be no significant problems to Coyote Creek or other streams in terms of sediment input. The long-term impacts to aquatic resources resulting from rerouting commercial traffic off the existing K&K and up the Coyote Creek watershed would probably be beneficial to aquatic resources, although the limited new construction and maintenance activities would cause some instream sediment increases. However, given the distance from the creek and the stability of most of the route, the impacts would be more than offset by the long-term stabilization of slopes and the rehabilitation of the existing K&K route.

Coyote Creek--Option B. New road construction along the option B route would increase sediment input to nearby streams because of possible mass movement and gullying.

Bald Hills--Option 1. Use of the Bald Hills Road would not create additional impacts on aquatic resources.

Bald Hills--Options 2 and 3. With regard to options 2 and 3, no quantitative data have been collected on the aquatic system for this specific area, nor have any studies been conducted near the headwaters adjacent to these proposed roads. The two drainages that would be intersected by options 2 and 3 would be Tully Creek and Roach Creek (see table 2).

About 4.4 miles of the option 2 route would intersect the Tully Creek watershed, and 9.1 miles would intersect the Roach Creek watershed. For the most part, this route would transect stable slopes, and the existing roads pose minimal erosion problems. Approximately 3.9 miles of the option 3 route would intersect the Tully Creek watershed, and 7.5 miles would intersect the Roach Creek watershed. A large portion of the road would transect prairies, which could result in a greater input of sediment to Tully and Roach creeks due to the sensitivity of the prairies to erosion.

Keeping the sediment input to an aquatic system to a minimum is extremely important for maintaining optimum conditions for aquatic organisms. Temporary damage to the aquatic ecosystem could arise from the potential sediment input to the streams because of road construction. Most sediment enters the aquatic system during and immediately following road construction. After revegetation of the surrounding areas, the sediment input lessens and the area stabilizes. If the sediment input is

Table 2: Miles of Watershed Affected by Bald Hills Options

Tully Creek	Road Construction Categories*					
	A	B	C	D	E	Total
Option 2	0.7	1.1	1.2	0.4	1.0	4.4
Option 3	0.7	1.5	0.4	0.4	0.9	3.9
Roach Creek						
Option 2	3.8	0.7	0.6	1.4	2.5	9.0
Option 3	5.9	0.0	0.0	0.3	1.2	7.5

* See table 1 for a description of categories.

kept to a minimum and does not extend over long periods of time, the aquatic resources may recover. If the area recovers, the damage to aquatic life becomes minimal. If the area remains unstable and sediment load entering the streams remains high, the aquatic system will remain permanently depressed.

Under option 2, there would be an initial sediment input to the aquatic system as a result of road construction. The input would be greater along the segments where new construction was required, and less where pre-existing roads were located. Due to the overall stability of the proposed route, and the use of pre-existing roads, the impact upon the aquatic resources should be minimal.

Under option 3, there would be the same general problems for road construction as under option 2. But considering that over half of the proposed road would be new construction, the impact would be much greater. As a result of this new construction, greater amounts of sediment would enter the aquatic system, having a much greater effect on the aquatic resources.

Wildlife

If the K&K road was rerouted and the existing roadbed rehabilitated, wildlife populations would benefit because habitat would be restored in this area. Actions to improve slope stability would increase the potential for long-term productivity. Disturbance of wildlife populations because of poaching or off-road vehicle use would be eliminated along the restored portion of the K&K. Disturbance of wildlife populations would be reduced along the upper portions of the K&K road because of lower traffic levels. Most of the adverse impacts on wildlife associated with use of the existing

K&K road would be transferred to areas along alternative routes. No endangered or threatened wildlife species occur along any of the alternative routes.

CULTURAL RESOURCES

Overview of Potential Impacts

Based on the area's ethnography and history, and on previous archeological studies and consultations, the types of cultural resources likely to be located within the project area can be predicted. Prehistoric archeological sites might consist of trail scatters on ridgelines that were travel routes, villages on prairies and prairie margins, and seasonal or temporary camps, or special use sites, in specific resource areas. Historic resources might also be located in prairies and could consist of equipment and structures associated with homesteads or ranches. Some of the lands in the project area were within the historic Lyons ranch (USDI, NPS, DSC 1980b). Remnants of historic trails might also be noted. Although previous consultations with Native Americans did not result in the location of any contemporary cultural resources within the project area, such resources may exist.

Before a field reconnaissance was conducted, base maps and records maintained at Redwood National Park were consulted, with the following results:

> That portion of the K&K road between the park boundary at Coyote Creek and Copper Creek to the north was included in previous archeological studies. The prairies above this portion of the K&K road were also previously surveyed (Bickel 1979; Salzman and Bickel 1979; USDI, NPS, RNP 1980; Baker 1981). No cultural resources were recorded immediately adjacent to the road; however, a number of prehistoric and historic sites are located in the prairies and prairie margins above the road.
>
> None of the proposed Coyote Creek routes had been previously surveyed. Salzman and Bickel (1979) surveyed a portion of the ridge immediately south of the Coyote Creek route and recorded a prehistoric archeological site on land belonging to the Stover family.
>
> The portion of the Bald Hills Road within Redwood National Park was included in a survey by Bickel (1979), and a number of prehistoric and historic sites were recorded in the vicinity of the road. However, neither of the proposed routes east of the Bald Hills Road (options 2 and 3) had been previously surveyed.

Field surveys utilizing a general reconnaissance strategy were conducted in March and April 1981 by Redwood National Park archeologists. Both the Coyote Creek route options were inspected, and also likely adjoining areas; ground visibility was adequate. Portions of both of the options east of the Bald Hills Road were also surveyed, with close attention given to likely areas such as ridgetops and prairie margins. No historic sites were encountered during the field survey. However, three prehistoric

sites (two previously unrecorded) are along the optional routes and are discussed below.

The prehistoric archeological sites within Redwood National Park on the east side of the Redwood Creek basin are in the process of being nominated to the National Register of Historic Places as the Bald Hills archeological district. The three prehistoric sites discussed below, although not on park lands, have the same significance in terms of cultural resources as those sites within the park. Although the three sites outside the park have already been impacted, they are all large cultural resources with a dense concentration of a variety of artifacts representing either villages or major activity areas.

No Action

Continued use of the K&K road would not result in any additional adverse impacts on cultural resources.

Rehabilitation of the K&K Road

Removal of a portion of the K&K road within Redwood National Park, and of roads in the prairie above the K&K, would require the use of heavy equipment. No cultural resources are adjacent to the K&K road; however, one of the prairie roads that would be pulled is in the immediate vicinity of three prehistoric and one historic archeological sites.

These cultural resources are protected under Executive Order 11593 and the programmatic memorandum of agreement between the National Park Service, the California Historic Preservation Office, and the Advisory Council on Historic Preservation. Consequently, any erosion control projects affecting the K&K road within the park would be preceded by consultations with the park archeologist. Cultural resources would be avoided if possible, otherwise adverse impacts would be mitigated through measures such as surface collection and archeological test excavations.

Coyote Creek--Option A

One archeological site, designated CA-HUM-621, has been located in the prairie along the ridge portion of this route. A spring and vegetal resources are in the vicinity and one can see the upper reaches of both Coyote Creek and Little Pine Creek from this site. CA-HUM-621 is a large resource, measuring 1,300 by 325 feet, and it appears to be a village or intensively used seasonal site. A great variety of densely distributed artifacts were noted, including chert and obsidian tools, a point, cores, and ground stone.

Upgrading the existing haul road would require widening roads, installing culverts, and depositing rock and/or fill. Areas adjacent to roads might also be upgraded for use as pulloffs or storage decks. CA-HUM-621 would be adversely affected by any of these construction activities. Because this cultural resource is on private land and is not now protected

by federal or state legislation, it is hoped that adverse impacts would be avoided or mitigated through cooperation between the National Park Service and Simpson Timber Company. Adverse impacts to CA-HUM-621 could be avoided if an alternate route was used or if the least road improvement necessary in the area of the archeological site was undertaken and areas adjacent to the road were avoided. With the company's cooperation, the park would mitigate adverse impacts to the prehistoric archeological site. Mitigation might involve surface collection and archeological test excavations. Initial test excavations would cost approximately $10,000 for each archeological site. The cost of subsequent excavations would depend on the results of the initial tests.

Promptly initiating consultations between Simpson Timber Company and Redwood National Park would avoid delays in the construction of the option A route.

Coyote Creek--Option B

One archeological site, CA-HUM-625, was located on the Bald Hills Ridge, near the option B route. Vegetation is prairie grasses and forbs, plus a stand of oak along a spring-fed drainage on the site. The Bald Hills Road and two skid roads cut through this intensively used prehistoric settlement. Chert and obsidian artifacts are densely distributed over an area approximately 420 by 325 feet. Based on the artifacts observed, this site has the potential for yielding excellent comparative data pertinent to the Bald Hills archeological district. This site could be affected by construction activities, including widening of roads, installation of culverts, and depositing of rock and/or fill. Adjacent areas might also be upgraded. Actions for mitigating potential adverse effects would be the same as those discussed under option A.

Bald Hills--Option 1

Previously recorded archeological sites are located adjacent to the Bald Hills Road, on Cagle and Williams ridges, and in the vicinity of Schoolhouse Peak. None of these sites would be affected by use of the existing Bald Hills Road by standard-sized logging trucks. Upgrading the Bald Hills Road to allow for use of oversized trucks, however, could result in adverse impacts to cultural resources adjacent to the road. It is not now known if or where such upgrading might occur. If this option was selected, Simpson Timber Company should contact Redwood National Park in advance of construction activities so that cultural resources and sites could be surveyed and protected.

Bald Hills--Options 2 and 3

One prehistoric site, CA-HUM-441, is adjacent to Johnson Road and was previously recorded by Bickel (1979). The site, a village or seasonal campsite, is on an open, prairie-covered knoll and is marked by a dense scatter of chert debitage, flakes and tools, fire-cracked rock, and waterworn cobble manuports. No ground stone is apparent, but the

present landowner reported that he has removed many ground stone slabs from the site surface. Dark-colored soil, apparently midden, can be seen in some traces of tractor grading on parts of the site. Artifacts and midden extend down fir-covered slopes around the knoll top. The entire site surface has been disturbed in its upper 10 to 20 inches by previous uses (a sawmill, a log deck, and a campsite for firefighters). Several roads bound the site, and vehicle tracks cross its central portion. Despite past collecting from the site and surface disturbances, it appears that useful information could be recovered through surface collection and excavation. Because of the site's location on the divide between the Redwood Creek and Klamath River drainages, Yurok and Chilula affinities are equally likely; the artifact assemblage may contain some elements that could be interpreted as ethnic markers.

Selection of either option 2 or 3 could affect this site because of upgrading, which could consist of widening the road, installing culverts, and depositing rock and/or fill. Areas adjacent to the road might also be upgraded for use as pulloffs or storage decks. Actions for mitigating potential adverse effects would be the same as those described under the Coyote Creek option A route.

Because the density of cultural resources is quite high in the Bald Hills area, changes in the routes through this area could result in adverse impacts to prehistoric and historic sites.

SOCIOECONOMIC IMPACTS

Visitor Use

Visitor use statistics are not available for this portion of the park because no visitor use facilities exist, and no records are kept for cross-country use of the park. The 1980 General Management Plan for Redwood National Park proposed the development of low-key hiking and horseback-riding trails in the Redwood Creek basin. The development of these trails will be influenced by the watershed rehabilitation program that is now underway and by the decision about the K&K road. The General Management Plan calls for construction of a hiking trail from Tall Trees Grove to the vicinity of Schoolhouse Peak. Although the specific route has not been identified, the trail would have to cross the K&K road, perhaps in the vicinity of Slide Creek. The park is undertaking a trail study to identify additional possible trail routes in the Redwood Creek basin. Two potential routes that could cross the K&K road alignment have been identified. One trail might be from the Schoolhouse Peak area down to Redwood Creek by way of Copper Creek, and it would cross the K&K near the 1800 road intersection. The second trail might be from Bald Hills Road down through the watersheds of Dolason and Emerald creeks to Redwood Creek, and it would cross the K&K near its intersection with the Bald Hills Road. Other routes may be proposed that would cross the K&K road.

Continued use of the K&K road over the short term would have little or no effect on visitor use because few visitors use the lower hillslopes on the east side of Redwood Creek, and trails would not be developed for

some time. Over the long term, increased visitation and continued use of the K&K road would significantly impair the visitor experience in this portion of the park. Visitors would have to cross a 20-foot roadway and would be subject to dust, noise, and potential danger from logging truck traffic. Noise from trucks in the basin can be heard up to a mile away and dust settles several hundred feet from the road. As more and more trails were developed and visitors were encouraged to use the area, these types of conflicts would increase.

Park Operations

The K&K road provides access for park patrols and wildfire control. However, the road also provides unauthorized access to anyone with a gate key from Simpson Timber Company or the park. Cattle and elk poaching is reportedly a problem on the Bald Hills. Up to 12 cattle are shot each year (D. Lane, personal communication). Although most poaching occurs off the Bald Hills Road, the K&K road could also provide access to poachers. As cattle are removed and elk invade the prairies, poaching can be expected to continue. This situation would likely continue if use of the K&K road was continued.

Annual road maintenance along the lower stretches of the K&K road within the park has been undertaken by Simpson Timber Company to alleviate problems caused by existing earthflows. Road maintenance problems would persist for a long time if major steps were not undertaken to address the causes of earthflow activity.

If the road was not removed, proper approaches to correcting existing road stability problems would have to be developed. Corrective actions might include diversion of water off earthflows (from above the earthflow as well as from the earthflow itself); cribbing or rip-rap of cutbanks; removal of rock fill; retaining of walls, trenches, pilings, and water barriers; and implementation of a wide variety of other theoretically applicable techniques or proposed solutions. One question that must be resolved is the responsibility for correcting existing road problems.

Apart from the cost of pulling the K&K road within the park, no significant impacts on park operations would occur if a portion of the K&K was relocated. Access to the area would be inconvenient once the road was removed.

Continued use of the Bald Hills Road (option 1) could require the park to grant Simpson Timber Company additional access across park lands into the Klamath watershed for forest and land management, resource protection, and timber harvesting. This issue has been previously discussed by the park and Simpson, and it has not been resolved.

Construction and/or upgrading roads outside Redwood National Park and within the park protection zone would be accomplished by Simpson Timber Company, so park operations would not be affected.

Private Landowners

Acreages lost by private landowners as a result of right-of-way purchases would be minimal. However, impacts on private landowners as a result of road construction would include removal of agricultural/timber lands from production, disruption of grazing patterns, and bisection of whole tracts of land. Table 3 illustrates amounts of land that could potentially be purchased or utilized under each option.

Table 3: Estimated Road Mileages and Private Landownership

	Miles of Right-of-Way				
Landowner	Coyote Creek Options		Bald Hills Options		
	A	B	1*	2	3
Simpson	3.8	3.8	0	10.0	12.9
Lyons	1.4	1.6	0	0.6	0.6
Champion	0.6	0.2	0	0	0
Stover	2.5	2.0	0	0	0
Graves	0	0	0	0.7	0
TOTAL	8.3	7.6	0	11.3	13.5

* Use of the Bald Hills Road could require widening to accommodate oversized trucks, which might affect landowners along the county road.

Local Economy

The impact on the federal government would depend on the amount of the final settlement. Current severance damage claims by Simpson Timber Company are estimated in excess of $25 million as a result of the 1978 park expansion. Settlement of a severance claim associated with the K&K road relocation could result in a savings to the U.S. government, and ultimately to U.S. taxpayers. Estimates for rehabilitating park lands and removing the lower K&K road are about $500,000.

Hammon, Jensen, Wallen & Associates, a private firm retained by the U.S. Department of Justice to evaluate the costs and feasibility of relocating the porton of the K&K road within the park, has estimated that increased haul costs and road maintenance associated with developing options B and 2 would amount to $127,000 per year. If capitalized at 10 percent, present worth, this would amount to $1,270,000. Reconstruction of existing roads and new construction along this route would cost $1,940,000, and purchases of rights-of-way would cost $40,000. Estimated total costs for a road along this alignment would amount to $3,250,000. (These costs are based on data developed by Simpson Timber Company.) Costs for the other options have not been calculated.

Impacts on the local economy or local employment levels from implementation of any of the options would be insignificant. For comparison, the 1981 watershed rehabilitation program allocated $2.3 million per year for operations, which would have resulted in a net increase in total county income of 0.43 percent. Distribution of road construction costs is unknown, but construction would most likely occur over more than one season and might be accomplished by Simpson Timber Company road maintenance crews. Effects on local employment figures would amount to less than 0.1 percent of the county employment levels.

SUMMARY OF IMPACTS

Table 4 summarizes impacts associated with the no-action and relocation alternatives for the K&K road. The major environmental impacts of all the road options revolve around the degree of erosion impacts, which in turn affect vegetation, wildlife, and aquatic resources.

The Coyote Creek option B and the Bald Hills option 3 routes would result in more erosion because of more unstable soils and new road construction.

The alignment that would result in the least environmental deterioration is the combination of Coyote Creek option A and Bald Hills option 1. This alignment would traverse more favorable soil conditions and utilize existing roads to the maximum extent possible, thus lessening new disturbance of natural and cultural resources.

Impacts On	No Action	Bald Hills Options 2	3
Geology/Soils	Sediment input to R Creek would be red depending on the ex rehabilitation work.	Variable impacts would depend on the requirements for reconstruction. Erosional impacts would be greater than option 1 but probably less than option 3.	Extensive new construction would probably make this the most erosive action.
Vegetation	No impact	Widening existing roads by 10 feet would remove 0.1 acre of prairie and 4.0 acres of second-growth forest. New construction or major reconstruction would remove an additional 3.4 acres of prairies, 1.7 acres of oak woodland, and 21.2 acres of second-growth forest.	Widening existing roads by 10 feet would remove 4.2 acres of second-growth forest. New construction or major reconstruction would remove an additional 5.5 acres of prairies, 0.8 acre of oak woodland, and 27.6 acres of second-growth forest.
Aquatic Resources	Present impacts on streams would not c appreciably. Slope tion and limited reh would somewhat low ment yields to the s	Impacts upon aquatic resources would be minimal. Sediment input associated with road construction would likely be temporary.	Impacts on aquatic resources would be greater because of more new road construction and prairie bisection than under option 2.
Wildlife	Potential for poachi park land would co Existing levels of d bance on park land continue.	Same as option A	Same as option A
Cultural Resources	No impact	CA-HUM-441 could be adversely impacted.	CA-HUM-441 could be adversely impacted.
Visitor Use	Increased visitation tinued use of the K significantly impair experience in this p the park.	No impact	No impact
Park Operations	Potential for poachi resource damage wo tinue. Existing adm tive problems would resolved.	No impact	No impact
Private Landowners	No impact	Same as option A	Same as option A
Regional/Local Economy	No impact	Minor	Minor

Impacts On	No Action	Rehabilitation of the K&K Road	Coyote Creek Options		Bald Hills Options		
			A	B	1	2	3
Geology/Soils	Sediment input to Redwood Creek would be reduced, depending on the extent of rehabilitation work.	Extensive rehabilitation efforts on approximately 500 acres of impacted hillside adjoining the lower K&K road would help restore terrain to a relatively natural condition. Substantial erosion would be prevented.	Erosional impacts of construction, including those resulting from possible reactivation of a slide above the lower portion of the route, would be more than offset by the reduction resulting from a thorough rehabilitation program along the present K&K road.	Potential reduction in sediment input to Redwood Creek achieved by the rehabilitation program could be offset by mass movement and gully erosion triggered by upgrading this route.	No additional impact	Variable impacts would depend on the requirements for reconstruction. Erosional impacts would be greater than option 1 but probably less than option 3.	Extensive new construction would probably make this the most erosive action.
Vegetation	No impact	Revegetation of the lower K&K would restore some 3 acres of prairie and oak woodland and 15 acres of second-growth redwood/Douglas-fir forest. Rehabilitation of adjoining slopes would restore about 500 acres of prairies and second-growth forest.	3 acres of prairie, and 6.7 acres of second-growth Douglas-fir/redwood forest would be removed by widening the existing road 10 feet.	1.2 acres of prairies, 6.9 acres of second-growth forest, and 0.7 acre of oak woodland would be removed by widening the existing road 10 feet. An additional 0.5 acre of prairie, 0.4 acre of oak woodland, and 0.7 acre of second-growth forest would be removed by new construction	No impact An undetermined amount of vegetation could be removed if the existing road was widened.	Widening existing roads by 10 feet would remove 0.1 acre of prairie and 4.0 acres of second-growth forest. New construction or major reconstruction would remove an additional 3.4 acres of prairies, 1.7 acres of oak woodland, and 21.2 acres of second-growth forest.	Widening existing roads by 10 feet would remove 4.2 acres of second-growth forest. New construction or major reconstruction would remove an additional 5.5 acres of prairies, 0.8 acre of oak woodland, and 27.6 acres of second-growth forest.
Aquatic Resources	Present impacts on area streams would not change appreciably. Slope stabilization and limited rehabilitation would somewhat lower sediment yields to the streams.	Rehabilitation would help eliminate the continual input of sediment to area streams, and stream recovery in the area would be enhanced.	No significant problems to streams in terms of sediment input would arise.	Sediment input to nearby streams would increase because of possible mass movement and gullying as a result of road construction.	No impact	Impacts upon aquatic resources would be minimal. Sediment input associated with road construction would likely be temporary.	Impacts on aquatic resources would be greater because of more new road construction and prairie bisection than under option 2.
Wildlife	Potential for poaching on park land would continue. Existing levels of disturbance on park lands would continue.	Wildlife habitat would be restored. Actions to improve slope stability would increase the potential for long-term productivity. Disturbance of wildlife populations due to traffic, off-road vehicle use, and poaching would be reduced or eliminated along the rehabilitated portion of the road.	Potential for poaching on park land would decrease. Restoration of habitat would benefit populations in adjacent areas of existing K&K. Adverse impacts on wildlife associated with K&K road would be transferred to areas along alternative routes outside the park.	Same as option A	Same as option A	Same as option A	Same as option A
Cultural Resources	No impact	No cultural resources are adjacent to the K&K road; but roads in the prairie above the K&K are near three prehistoric and one historic archeological sites. Rehabilitation efforts could adversely affect these sites.	CA-HUM-621 would be adversely impacted.	CA-HUM-625 would be adversely impacted.	If Bald Hills Road was upgraded, archeological sites might be adversely impacted.	CA-HUM-441 could be adversely impacted.	CA-HUM-441 could be adversely impacted.
Visitor Use	Increased visitation and continued use of the K&K would significantly impair the visitor experience in this portion of the park.	Rehabilitation efforts would restore a more natural element to the visitor experience. Hikers would not be subject to dust, noise, and potential danger from logging truck traffic.	No impact	No impact	No impact	No impact	No impact
Park Operations	Potential for poaching and resource damage would continue. Existing administrative problems would not be resolved.	Potential for poaching and resource damage would be reduced or eliminated. Cost of pulling the lower K&K would be about $500,000.	Complete rehabilitation of existing K&K road and slopes would improve long-term quality of visitor experience.	Same as option A	Simpson could require access across park lands for operations near Bald Hills Road.	No impact	No impact
Private Landowners	No impact	No impact	Agricultural/timber lands would be removed from production, grazing patterns would be disrupted, and whole tracts of land would be bisected.	Same as option A	Same as option A	Same as option A	Same as option A
Regional/Local Economy	No impact	Minor	Minor	Minor	No impact	Minor	Minor

Simpson Timber Company--Redwood National Park has requested road maintenance data for the K&K road within the park from Simpson Timber Company (letter dated April 9, 1981).

Public Coordination--Local citizens have been briefed on at least three separate occasions about the status of the K&K road. During meetings held in autumn 1979 and autumn 1980 problems with the K&K road were discussed.

U.S. Geological Survey--Verification of earthflow data for lower K&K road was requested from Mike Nolan, Menlo Park, California (April 1981).

Division of Public Works, Humboldt County--Feasibility of Simpson Timber Company utilizing portions of Bald Hills Road was discussed with Chuck Alexander during April 1981. It was concluded that standard-sized vehicles would continue to be allowed. Any decision regarding oversized vehicles would have to be made following more specific discussions and data on frequency of use.

Hammon, Jensen, Wallen and Associates--This private firm is associated with forestry, aerial mapping, and environmental services. The firm has supplied data to the National Park Service upon request. The principal contact has been with Paul Kevin, Jr.

APPENDIX A: DESCRIPTION OF HILLSLOPES ADJACENT TO THE LOWER K&K ROAD

The present K&K road between the south park boundary and Copper Creek is near the Grogan fault, which separates schist to the west of Redwood Creek from slightly metamorphosed sandstones and siltstones to the east (all rock types belong to the Franciscan formation). The fractured rocks along the fault and the highly unstable hillsopes have been aggravated in the vicinity of the K&K by logging, a recent series of large storms, and disturbances accompanying the construction, use, and maintenance of the road. The cumulative impacts have resulted in the earthflows and unstable areas shown on the Erosional Features map.

Earthflows are large-scale, slow-moving features, and along Redwood Creek they move by the slow, unpredictable sliding of large interactive blocks of hillside, at least in their upper portions (Swanston 1981 and personal communication with Mike Nolan, U.S. Geological Survey, 1981). Unstable areas (features 1, 9, and 12) are similar to earthflows--the soils are generally the same, there is widespread slumping and surficial instability, and disrupted surface drainage--but the blocks have not yet assumed a comparable degree of mechanical continuity and instability. The level of instability of area 1, however, is approaching that of an earthflow, and movement there is already occurring.

The histories of mass movement features are summarized in table A-1. Although the unstable nature of this area has been apparent for many years, in only one case was activity noted prior to 1958 (feature 2); most of the movement seems to have occurred since the early 1970s. In general, features 1 through 6 have been the most active.

The U.S. Geological Survey has maintained an active monitoring program on five earthflows within the Redwood Creek basin since 1973 (USDI, GS 1978). Inspection of data from all five sites, as well as information contained in Swanston (1981), suggests that movement rates ranging from 8 to 24 inches per year are adequate definitions of the expected streamside maximums during the initial observation period (1973-1976). Rates since then have been comparable (personal communication with Mike Nolan, U.S. Geological Survey).

The current level of sediment input (by sliding) from all the earthflows is estimated to average about 20,000 cubic feet per year. Although the amount of gully erosion has not been measured, studies in other areas have shown that the fluvial portion of earthflow erosion may be as important as the translational component (Kelsey 1978). Consequently, the actual sediment yield of these areas may be much larger than the 20,000 cubic feet estimate. Future erosion rates cannot be predicted. However, with a sustained period of above-average precipitation, they could easily become much larger than the values suggested here.

The land use history of the area has been mapped. From 1958 to 1962, the activity was limited primarily to road construction and scattered selective cut logging. No logging appears to have occurred from 1962 to 1966. The heaviest impacts occurred between 1966 and 1973, and large

areas were clearcut by 1971, including those that previously had only been selectively cut. Almost all the remaining forest between the K&K road and Redwood Creek was removed at this time. The question of whether this activity caused or triggered the present instabilities has not been directly examined. However, the timing of the movements (see table A-1), and the results of recent studies concerning root strength and soil creep/earthflow rates (Ziemer 1981, Swanston 1981) strongly suggest that is the case.

Table A-1: Mass Movement History

Feature	History 1936 - 1973*	Remarks, 1973 - 1978
1	Not noted by Coleman	Logged after 1973
2	Visible in 1936; stayed about the same size until 1972; enlarged in 1972 and 1973	Extent about the same in 1978 as 1973; some brush revegetation
3	Not visible until 1966; no change until 1972; enlarged in 1972	Significant increase in size since 1973
4	Not active but obviously unstable slope from 1936 to 1958; visible in 1966; stayed the same until 1972; enlarged in 1972	Increase in size since 1973
5	Not visible until 1966; increase in size from 1970 to 1972	Small increase in size since 1973; still active enough to disrupt road
6	Not active but obviously an unstable slope from 1936 to 1958; visible in 1966; increase in size from 1970 to 1972	Active since 1973
7	Uncertain whether streamside areas were unstable prior to 1973	Not much change since 1973; some revegetation
8	Not active but obviously an unstable slope from 1936 to 1958; visible in 1966; enlarged from 1970 to 1972	Not much change since 1973
9	Uncertain whether streamside areas were unstable prior to 1973	Some revegetation since 1973, but appears to be about as unstable now as it was then
10	Uncertain whether streamside areas were unstable prior to 1973	Revegetated after logging to same degree as the stable slope between here and feature 11 (10, 11, and the intervening slope were equally bare in 1973)
11	Uncertain whether streamside areas were unstable prior to 1973	Appearance about the same as in 1973; a USGS rain gauge installed in 1974 has not shifted perceptibly, implying stability on the northern half of the toe.
12	Not noted by Coleman	Looks about the same as in 1973

* Based on information from S.M. Coleman, "The History of Mass Movement Processes in the Redwood Creek Basin, Humboldt County, California," M.S. thesis, Pennsylvania State University, 1973.

MAJOR LANDSLIDE
GROGAN FAULT
STREAM
MAJOR ROAD
SECONDARY ROAD
EARTHFLOW
HIGHLY UNSTABLE HILLSLOPE
NATIONAL PARK BOUNDARY

NORTH

0 1000 2000 3000 4000
FEET

EROSIONAL FEATURES

LOWER K & K ROAD

REDWOOD NATIONAL PARK / CALIFORNIA
UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

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APPENDIX B: REHABILITATION WORK FOR K&K ROAD

This appendix describes the rehabilitation work that will be required for either retaining or removing the K&K road. In either case, rehabilitation work on the adjoining slopes will have to be completed prior to, or concurrent with, work on the K&K itself. The timing and rehabilitation work on these adjoining sites are briefly described, and the benefits of the work are discussed in terms of decreased erosion and sediment yield.

REHABILITATION SITES ADJOINING THE K & K

The three main rehabilitation sites adjoining the K&K are site A--slopes above the K&K, site B--the unstable earthflow areas just south of Copper Creek, and site C--the 1800 road and adjacent hillslopes. The sequencing of work for the sites should be as listed, although the first two sites could be treated simultaneously.

Site A - Upper Slopes

This triangular site is bounded on the north by the ridge from Lyons ranch to Redwood Creek, on the south by the park boundary, and on the west by the K&K road. The two main elements of this site will be the removal of the 1552 and 1551 roads within the park boundary. The main work on the 1552 road will be the clearing of a perennial stream channel at the end of the road, constructing crossroad drains through the forested reach, and outsloping and constructing crossroad drains across the prairie reach. Additionally, a culvert crossing just outside the park boundary should be removed to prevent vehicular access to the park lands. Also, a ranch road extending from Lyons ranch to the 1552 road should be waterbarred and closed to vehicular access. Additional work on skid trails above and below the road may also become necessary upon assessment of the detailed geomorphic mapping.

The main work on the 1551 road will be the stabilization of a large gullied stream channel that contributes to large-scale slope failures above the K&K road near feature 9. Also, several skid trail crossings of the 1551 road will be excavated. The remainder of the road will require crawler tractor outsloping and crossroad drainage. Additionally, some outsloping may be required on the cable-yarder landing on the park boundary. Some additional work on skid trails may also become necessary following assessment of the results of detailed geomorphic mapping.

Work on this site is contingent upon obtaining permission from Simpson Timber Company to use the Coyote Creek road network.

Site B - Earthflows

This site encompasses the area below the K&K road from the mouth of Copper Creek to the old 1800 road bridge. The main elements of the

work are associated with the four haul roads that traverse the site and with slope work below the K&K road.

The lowest road along the creek is fairly stabilized and revegetated. Some drainage clearance and outsloping may be necessary if the disturbance can be minimized. The uppermost road will also require drainage clearance in association with the gully system draining the small prairie. Some additional work across the slumping portion of the prairie may also be possible.

The intermediate road, which joins the lowermost road to the south, will be the most complicated road to rehabilitate. It has been dissected into six isolated segments by several earthflows, slumps, and a large gully. Access to these individual segments is extremely limited, and to some it may be impossible. (The road would not be reconstructed to obtain access, as this would entail excavation across the toes of several earthflows and slumps.) Several streams and gullies will need to be cleared, and road outsloping will be required at several locations. Crossroad drains should be constructed to minimize fill failures into Redwood Creek. Measures to stabilize failures and erosion at the toes of the unstable area may be attempted.

The Camp Road, which switchbacks to the mouth of Copper Creek, will require some outsloping along its lowest portion. The rest of the road will require the construction of numerous crossroad drains.

Slope work at this site will entail stabilizing the beds and banks of the gullied stream channels. Drainage definition on several earthflows and slumps may also be required. Access to this portion of the site is extremely limited. Use of existing skid trail systems will be made, although some crawler tractor trails may be constructed.

Site C - 1800 Road

This site encompasses the 1800 road to Redwood Creek and the slopes north of the Devils Creek earthflow (feature 6 on the Erosional Features map). The segment to the old bridge abutment will require outsloping and extensive log removal, and the abutment itself should be removed. Additionally, the stream-center pier should be removed to alleviate streamflow diversion. This will require blasting. The remainder of the 1800 road will require culvert removal, extensive crossroad draining, and some outsloping.

The main slope work above the 1800 road will entail stabilizing the gully/perennial stream channel adjacent to the Devils Creek earthflow. The remainder of the slope could require additional work based on the results of the detailed geomorphic mapping.

REHABILITATION OF THE K & K ROAD

The lower K&K road, which would be rehabilitated if a bypass route was selected, starts where the road enters the Copper Creek drainage on the

north and runs south about 3 miles to the south park boundary. This section can be divided into three segments: the southern portion from the park boundary to the 1800 road intersection (K-1), the central portion from the 1800 road to the camp road (K-2), and the northern portion from the camp road to the Copper Creek ridge (K-3). The K-1 and K-2 segments are the most unstable. The northern segment is fairly stable and could be maintained with minimal work and low erosional potential.

Complete removal of the K&K road would require removal of 29 culverts and excavation of 36 stream and gully crossings. Outsloping along the road would vary from slight to extensive. Some of the extensive outsloping areas would require end-hauling material to stable dumpsites.

The most critical portion of the road for rehabilitation would be the segment traversing the earthflow and slump areas (K-2). Some of these stretches could require extensive roadfill removal and end-hauling to decrease the loading at the crowns of earthflows or slump areas. In some areas, however, it could be necessary to leave all or portions of the fill as a stabilizing measure. Tractor contouring would be advisable at these locations.

The road as a whole would require extensive crossroad drain construction. If the road was removed, the surface would be ripped (decompacted), which might be more difficult than usual because it is a well-established, major haul road.

Additionally, some work on the immediately adjacent slopes would be required. This includes gully/stream stabilization along the Devils Creek earthflow, drainage definition and corrections at features 4 and 5, and gully stabilization on the small prairie above feature 1 and at numerous other sites of lesser importance. The older failed segment of the K&K road just south of the small prairie would require tractor contouring, drainage clearing, and possibly extensive fill removal. Most of this work lies within the K-2 segment.

Removal of the Copper Creek bridge, if undertaken, would include extensive outsloping and end-hauling.

Removal of discarded culvert pipe, logging debris, logs, and other trash would also be necessary. Removal of the water and oil tanks would be considered as well.

APPENDIX C: OVERVIEW OF EROSION IMPACTS

The following material summarizes the type of road-related erosional impacts that could be expected as a result of constructing and using an alternative haul road. All of these impacts have occurred and can be observed along the present K&K road. If a bypass was constructed, these problems along the K&K would be treated during the course of the area's rehabilitation.

Road-related erosion following construction can generally be broken into two major classes: that which occurs on the roadbed, cutbanks, and adjoining right-of-way, and that which is accelerated or initiated on the underlying hillslopes. These classes are outlined as follows:

Right-of-Way Erosion

Post-Construction Erosion	Residual Erosion
Surficial erosion of disturbed soils adjacent to roadway	Cutbank and roadfill failure
Surficial erosion of roadbed, fills, and cutbanks	Surficial erosion
Initial cutbank and fill failures	
Stream-crossing adjustments	

Initiation or Acceleration of Slope Erosion

Mass Movement	Gullying (caused by)
Slides	Drainage disruptions at culverts and stream crossings
Earthflows	Concentration of excess runoff in existing channels
	Blockages or diversions of inboard ditches

The distinction between the two types of right-of-way erosion is largely one of timing. Initial post-construction erosion rates (per unit area) can be very high, but they decline exponentially following construction and are much lower after a few years. (Over 90 percent of the total erosion of a road has been measured within two years of construction, with initial sediment production exceeding the natural rate by 1,500 times; see USDA, Agricultural Research Service 1975.) The initial period of high rates is followed by a residual phase. Erosion during this period, although still very high, decreases in importance, and after a point remains relatively constant. This level of constant sediment production is called the post-disturbance norm (USDA, ARS 1975). Failures of roadfill, although relatively infrequent, can significantly increase these stable rates for short periods of time. This is true even for well designed and maintained

road systems (USDA, Forest Service, Pacific Northwest Forest and Range Experiment Station [PNW] 1979; Brown and Krygier 1971). Continuing use of the road maintains a residual rate substantially higher than the post-disturbance norm (Reid 1981). The absolute values of the rates vary, depending on the type of terrain crossed. For example, prairie slopes can be expected to be more erosionally sensitive than those underlain by competent sandstone.

Of the two types of road-induced slope erosion, mass movements (for example, landsliding, slumps, and earthflow movements) are initiated or accelerated by roads through a variety of different mechanisms. For example, a slide along the lower portion of the Coyote Creek route (segment C on the Alternative Routes map) appears to have been triggered by a ponding of runoff that was concentrated by means of an inboard ditch system. (Histories of earthflows in response to road and logging impacts are contained in appendix A.) In general, steeper slopes are more susceptible to these impacts than shallow ones (for example, see USDA, FS, PNW 1979). The second type of slope erosion, road-related gully systems, is a common phenomenon on logged-over lands and is routinely dealt with during the park's watershed rehabilitation program. Their initiation and consequences are best illustrated by the post-logging condition of the Copper Creek watershed. Gullying related to haul roads in the southern half of the watershed alone has resulted in over 2.3 million cubic feet of sediment entering the channel system (USDI, NPS, Redwood National Park, in preparation).

The general types of construction that would be needed to open an alternative K&K road are summarized in table 1 and are shown on the Alternative Routes map. New construction and substantial reconstruction (categories A and B) would be needed where an alternative route crossed a hillslope that had either no roads or minimal roads. Major reconstruction (category C) would be needed on deteriorated roads or on existing roads built for use levels substantially below those projected for the alternative routes. Moderate reconstruction (category D) would primarily involve widening the present road and improving its drainage. Well-established major roads would require only minor upgrading (category E).

The initial erosion rates on hillslopes where new construction and substantial reconstruction were undertaken would likely be much higher than for any other categories of work because of the major new hillslope disturbances. The magnitude of rates associated with major reconstruction would depend on the amount and type of work needed to bring the existing roads up to standard. Initial erosion associated with moderate reconstruction would also vary, but would be substantially less than for new construction or substantial reconstruction. Minor upgrading would result in minimal initial erosional impacts.

The erosional decay characteristics (the behavior of erosion rates as they drop from the high immediately after construction) associated with the various types of construction are not known. However, it seems reasonable that smaller construction impacts would result in shorter recovery times. Thus, hillslopes where there was new construction and substantial reconstruction would recover slower than slopes with moderate

reconstruction or minor upgrading. The eventual levels of residual erosion would depend on a number of factors, including local conditions of slope, rock types, susceptibility to landsliding, traffic conditions, and maintenance procedures.

APPENDIX D: COMMON AND SCIENTIFIC PLANT NAMES

Common Name	Scientific Name
annual fescue	*Festuca megalura* and *Vulpia bromoides*
bigleaf maple	*Acer macrophyllum*
blackberry	*Rubus vitifolius*
blue wild rye	*Elymus glaucus*
blue blossom	*Ceanothus thrysiflorus* and *C. velutinous*
bracken fern	*Pteridium aquilinum* var. *pubescens*
California bay	*Umbellularia californica*
California oatgrass	*Danthonia californica*
canyon oak	*Quercus chrysolepis*
chinquapin	*Chrysolepis chrysophylla*
coltsfoot	*Petasites palmatus*
coyote brush	*Baccharis pilularis* var. *consanguinea*
dogtail	*Cynosurus echinatus*
Douglas-fir	*Pseudotsuga menziesii*
gooseberry	*Ribes menziesii* and *R. sanguineum*
hairy cats ear	*Hypochoeris radicata*
hazel	*Corylus cornuta* var. *californica*
oceanspray	*Holodiscus discolor*
Oregon white oak	*Quercus garreyana*
plantain	*Plantago lanceolata*
redwood	*Sequoia sempervirens*
rushes	*Juncus effusus*
sheep sorrel dock	*Rumex acetosella*
soft chess	*Bromus mollis*
tanoak	*Lithocarpus densiflorus*

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