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Appendices A-J

Final Environmental Impact Statement

Land and Resource Management Plan

Olympic National Forest

Cover Photo: C.P. Cockrell, first woman employed by the Forest Service as a fire lookout. Finley Peak Lookout, Olympic National Forest. USDA Forest Service photo.

OLYMPIC NATIONAL FOREST
FINAL ENVIRONMENTAL IMPACT STATEMENT

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Appendix A

Public Issues, Management Concerns and Resource Opportunities

Olympic National Forest

APPENDIX A

PUBLIC ISSUES, MANAGEMENT CONCERNS AND RESOURCE OPPORTUNITIES

INTRODUCTION

This appendix discusses: 1) the process used to identify the public issues, management concerns, and resource opportunities (ICOs); 2) the selected ICOs addressed in the Draft Environmental Impact Statement (DEIS) and carried forward into the Final Environmental Impact Statement (FEIS); 3) the Forest's potential opportunities to resolve each ICO; and 4) consultation with other agencies, groups, and individuals.

Land and resource management planning, or forest planning, must be conducted on the basis of ICOs. Consequently, the identification of ICOs (often collectively referred to as issues) represent a key element in the process.

A public issue is any subject of widespread public interest relating to the management of Forest resources. A management concern, identified by the Forest itself, is an issue, problem, or condition that can potentially limit the way the Forest manages its resources. A resource opportunity is a proposal that is considered in developing alternative activities, projects, or programs where an option exists to invest profitably to improve or maintain a present condition.

The purpose of identifying ICOs is to determine the different preferences of individuals or groups for the goods, services, and environmental conditions that can be provided by the Forest.

Appendix A reviews the development of ICOs up to the time the DEIS was released (November 1986). Any changes to aspects of certain ICOs as a result of the public response to the DEIS, or other reasons, are discussed in Chapter I of the FEIS. The section "Consultations with Others" has been updated to include consultations and meetings since the DEIS was released. Reference should also be made to Appendix K, "Response to Public Comment," and to the planning records on file in the Forest Supervisor's Office concerning the public participation process.

ISSUES, CONCERNS AND OPPORTUNITIES IDENTIFICATION PROCESS

The process for identifying public issues, management concerns, and resource opportunities (ICOs) has evolved throughout the forest planning process. It was initiated in the fall of 1978 with preparation of a public involvement plan. Work began in earnest in December 1978, when a Citizens' Work Group convened to start the ICO process. This was followed by a news release announcing public meetings (workshops)

relative to the planning process and identification of ICOs. These meetings were held in Aberdeen, Port Angeles, Shelton, and Tacoma and were attended by a total of 66 people.

From oral comments recorded, as well as review of written responses, a preliminary list of ICOs was developed.

Responses were further examined utilizing a scoping procedure which involved a Citizens' Work Group, Forest Planners, and the District Rangers and Staff of the Olympic National Forest.

Forest Plan Reports were also prepared to inform interested groups and individuals of the scoping process being used. The Citizens' Work Group (see the section on Consultation with Others) provided valuable assistance throughout.

In March 1979, the Interdisciplinary Team's (ID Team) first version of the issues was sent to the Citizens' Work Group and Forest Management Team for review.

These preliminary issues were then presented to the Regional Forester in April 1979. This presentation resulted in some minor modifications and clarifications. Several concerns were added to the list to assure that certain regulations pertaining to the National Forest Management Act of 1976, would be addressed in the planning process.

As part of the process to identify ICOs to be considered in the planning process, Forest Planners used the following criteria:

- Is consideration of the issue required by existing laws and regulations? If consideration was required, scoping was initiated. If it was not required, the next steps were taken.

- Is the issue within the jurisdiction of the Forest Service to resolve? If the issue was not, it was screened out.

- Is the issue relative to land management or is it administrative, such as personnel and procedural policy? If it was administrative, it was screened out.

- Is the issue currently valid? If the issue was previously resolved and no different facets have emerged, it was not considered further.

- Can the issue be resolved by the Forest or should it be resolved at a higher level, such as the Regional or National level? If resolution was needed at a higher level, the issue was not considered further.

- Given the economic, biological, social, or political situation, can the issue be resolved? If it could not be resolved within these constraints, it was screened out.

- Would the resolution of the issue result in significant long-term effects? If resolution is likely to happen as a matter of normal management activities within a relatively short time, the issue was not considered in forest planning.

The issues were then sent to the public as Forest Plan Report No. 3. Over 400 interested citizens, organizations, groups, county, State and Federal agencies, and Olympic Peninsula American Indian Tribal organizations received this information.

Throughout the planning period, comments from numerous public and agency meetings, individual discussions and public correspondence were reviewed concerning the planning issues. Appendix K discusses the public involvement from the initial stage of ICO identification to issuance of the FEIS.

The Forest received nearly 4,000 responses to the DEIS and Supplement during the 90-day review periods. The normal 90-day public review period for the DEIS was extended 15 days at the request of several special interest groups who were concerned that adequate review of a lengthy and complex document could not be completed during the 90-day period which included the Christmas and New Year holidays.

As a result of comments received on the DEIS and Supplement, the original ICOs were reconfirmed and three additional issues were added. Some of the issues received new emphasis; aspects of others were clarified as the result of meetings with individuals and public interest groups, as described in Chapter I of the FEIS. The Planning Team made changes to keep the ICOs current and within the scope of the planning process.

SELECTED ISSUES, CONCERNS, AND OPPORTUNITIES ADDRESSED IN THE ENVIRONMENTAL IMPACT STATEMENT

All the ICOs are in the form of questions and contain the facets of the issue to be addressed and evaluated by alternatives. The resolutions of these issues varies by alternative and are of major interest to the public and land managers. These resolutions are a product of the capability of the land, the applications of selected management practices to produce or maintain effects, the timing of practices and a budget with which to implement them. Indicators of responsiveness are used to evaluate the alternatives and to subsequently select a preferred alternative for the Forest Plan.

Each planning question is discussed in two parts: 1) the evolution of the issue; and 2) the major ways in which the ICO is evaluated through the FEIS and Plan.

The ICOs have been stratified into three categories. The first category deals with the 13 key issues that drove the alternative development process and form the basis for comparison of alternatives. These ICOs are listed first. These form the focus of the FEIS and are discussed in more detail in Chapter I.

The second category addresses those ICOs which have been carried through the process as management concerns. In some cases these concerns will also be included in the 13 key issues.

The third category addresses those deferred for resolution outside the forest planning process. These ICOs were among those identified in the earlier part of the planning effort by the Planning Team and the public.

KEY ISSUES ADDRESSED DIFFERENTLY IN EACH ALTERNATIVE

1. *How should the scenic resource of the Forest be managed?*

Situation:

People expressed interest in management of the visual or scenic resource on the Forest. Since much of the Forest was originally covered by a solid canopy of coniferous vegetation, management activities such as timber harvest and road construction result in openings that are not perceived as natural openings.

Management of scenery includes a broad range of individual perceptions. Some perceive modification of natural vegetation as aesthetically displeasing, while others are concerned that reducing the visual impact will in turn lower the amount of timber available for harvest. Others have offered suggestions that include reducing visual impacts while harvesting timber and still provide for a visually satisfying forest experience. Comments received indicate a stronger concern for scenic quality on the east side of the Forest and along major road and trail corridors. The issue involves the degree of protection scenic values should receive and the cost and impacts of scenic management on other Forest activities such as reduction in the annual timber harvest and the resulting cost of implementing scenic management activities.

Interest in this issue is more pronounced in the Seattle metropolitan area than on the Peninsula. Population trends on the east side of the Peninsula do indicate a change in local interest toward more sensitivity for the scenic resource. Interest in this issue also includes comments from visitors from other parts of the Nation.

Opportunities to Resolve:

(a) Opportunities exist to rehabilitate or reshape previously modified landscapes for improved scenic values.

(b) There are opportunities to complement other management goals through the application of the visual management system.

(c) Modification of management direction to meet Visual Quality Objectives could satisfy demand.

(d) Short of meeting all Visual Quality Objectives, there is opportunity for expanding the acreage for which management to achieve Visual Quality Objectives is required. Priority should be given to areas of relative high sensitivity.

(e) Opportunities also exist to maintain and enhance the scenic quality of the Forest's major travel corridors through scenic management area allocations.

Sensitive areas are protected to various degrees from modification depending upon the objectives of the alternative. The extent to which the alternatives are responsive to this issue can be evaluated by the degree to which assigned Visual Quality Objectives are met in each alternative. Visual Quality Objectives are described in Chapter III of the FEIS.

2. *How should the outdoor recreation resource be managed?*

Situation:

Outdoor recreation, both developed and undeveloped, is becoming more important to many residents both for the personal experience and as a means of income. Comments received indicate a stronger desire for undeveloped recreation opportunities from National Forest land than for developed recreation. The developed recreation opportunities are seen as the responsibility of private enterprise by many because of their income producing potential whereas the Federal Government, both the Forest and Olympic National Park, are viewed as the appropriate providers of undeveloped recreation opportunity.

The undeveloped recreation aspects of this issue are primarily concerned with the use and development of areas outside Wilderness that are as yet unroaded. Many people feel that the remaining unroaded areas should be retained in their present condition in recognition of the increasing interest in unroaded recreation and the shrinking land base capable of providing those experiences. Other people are concerned that allocating additional areas to uses that preclude timber harvesting will have significant long-term impacts on the local timber industry and community stability.

Interest in this issue extends beyond the local areas to the Seattle-Tacoma metropolitan area. It is also part of a National trend.

Opportunities to Resolve:

(a) There are opportunities to increase the amount of area allocated to dispersed (undeveloped) recreation throughout the Forest, especially on the east side.

(b) Road closures, where appropriate, can decrease the amount of motorized disturbance in certain areas thereby increasing areas that provide Semi-Primitive recreation opportunities.

(c) Additional trail construction in Wilderness and unroaded areas can result in a greater capacity for accommodating those wanting Primitive or Semi-Primitive experiences by dispersing users through more of the area currently available.

Projected demand indicates that existing capacity for Semi-Primitive recreational opportunities will no longer be adequate. However, if opportunities are realized as previously mentioned, then demand could be met for the next 50 years. The extent to which the alternatives are responsive to this issue can be evaluated by the number of acres that will provide Semi-Primitive opportunities, projected use measured in recreation visitor days, and the percent of future recreation demand met for Semi-Primitive (primarily Nonmotorized) uses.

3. *How should the old-growth resource of the Forest be managed?*

Situation:

Considerable interest was expressed regarding management of old-growth stands on the Forest. Old-growth forest has unique characteristics and frequently provides habitat for specific animal and plant communities. Management activities on timber producing lands are generally designed to convert old-growth forest to managed forest over rotations shorter than required to restore old-growth characteristics. The issue is primarily concerned with the reduction of old-growth acreage.

Interests cover a wide spectrum of concerns from both commodity and non-commodity forest users. To some, old-growth stands contain a large percentage of high quality, high volume raw material that should be harvested and replaced with new stands. Others stated they were opposed to harvesting old-growth and desired to maintain the forest in a near natural state. Several responses dealt with the relationship of old-growth to wildlife habitat and plant communities. Some individuals stressed the need to harvest old-growth to create more diverse habitat, while others indicated that harvesting was detrimental to plant communities and wildlife, such as habitat for the northern spotted owl. Some comments focused on reducing the size of clearcut areas and still providing for natural plant communities and animal habitats.

A related interest is focused primarily on the west and north sides of the Forest, and concerns the Forest's ability to provide old-growth cedar and other specific wood products. This includes cedar shakes, shingles, clear veneer and planking for wooden boats. Concern was expressed that the availability of cedar products would decrease if these stands were harvested soon after maturity, thus affecting mills and employment on the Peninsula that are dependent on old-growth.

Other facets of the issue include the need for gene pool and ecosystem diversity and the cultural and religious significance of old-growth (especially cedar) to American Indians. Traditionally, the cedar tree has many uses and is of importance culturally and spiritually to the tribes.

Interest in this issue appeared to be Forest-wide but most concerns dealt with the east side, including the Shelton CSYU. It was clearly stated by those responding that how much, what kind, and where old-growth is harvested may affect the economic well-being of some and environmental concerns of others.

Opportunities to Resolve:

(a) Opportunities exist for providing various amounts of old-growth.

(b) On timber producing lands, there is opportunity to retain old-growth acreage, provided timber harvest is reduced.

(c) Greatest opportunities for providing old-growth stands will occur in unroaded areas, Wildernesses, and areas dedicated to wildlife (e.g., spotted owl) habitat management.

(d) Considerable areas of the Forest are currently occupied by stands that have old-growth characteristics except for tree diameters (as described in the Regional Guide for the Pacific Northwest Region). These stands can provide old-growth for many uses.

(e) Areas of old-growth can be provided or maintained by managing selected stands on longer rotation schedules.

Levels of old-growth proposed in the alternatives range from retention of all existing old-growth to the level needed only to maintain viable populations of dependent species. The responsiveness of the alternatives to this issue can be evaluated by the amount of existing old-growth (acres) retained on the Forest.

4. *Where should timber be harvested and what is the appropriate harvest level?*

Situation:

More people expressed interest in timber management than any other resource activity occurring on the Olympic National Forest. Virtually all who responded were concerned not only with the harvest level for the Forest but also where harvest activities would take place.

Some Forest stands of merchantable trees occupy sites of comparatively low productivity. These stands meet the definition of commercial forest land and are currently included in the acreage used to determine the allowable sale quantity. Interest concerning this issue centers around the desirability of scheduling these stands for harvest and investing dollars in their management.

Comments included the concern that by withdrawing these stands from harvest, we would reduce the timber available for sale. This could have a negative impact on Olympic Peninsula jobs and economy. Other concerns are that these sites often have thin soils, steep slopes and high potential for environmental damage from logging and road construction. It was also suggested that an economic analysis of these stands might show that intensive management practices should be concentrated on more productive sites with a greater potential for return. Virtually all who responded were concerned with where these stands are located and the harvest schedule to be used for them.

Forest lands capable of producing crops of wood in excess of 20 cubic feet of annual growth per acre are generally available for timber harvest. This includes both roaded and unroaded areas that are harvestable with technology currently available. Growth from these lands is used to calculate the allowable sale quantity.

Responses from members of the timber industry stressed the need to maintain or increase the current harvest level; others perceive the current level to be excessive. Those concerned with maintaining or increasing the harvest level pointed out that harvesting, transporting and processing timber is the major source of employment on the Olympic Peninsula. To some who responded, other (non-timber) resource uses are perceived to be incompatible with or adversely affected by timber harvesting. The need for employment and economic stability of the Peninsula's communities was frequently cited. Others expressed concern that timber harvesting was overemphasized and more Wildernesses were needed.

This issue is Forest-wide with relatively widespread interest. It also covers a wide range of interest groups and individuals.

Opportunities to Resolve:

(a) Modification of current land allocations could lead to increases in the overall efficiency of the timber harvest program.

(b) The Forest has a large area of stagnated stands (doghair) occupying sites that have the capability of producing timber volume if a favorable economic climate develops.

(c) Fertilization of appropriate stands on the east side of the Forest during the first decade can increase future harvest levels.

(d) Expansion of the current genetic tree program can increase harvest levels in later decades.

(e) There are opportunities to allocate the most suitable productive timber lands to timber management emphasis where management activities are most cost effective.

(f) There are opportunities to benefit other Forest resources by timber harvest design such as the improvement of big game habitat, temporary forage for wildlife, selective timber removal to improve the scenic condition of travel corridors, opening views of surrounding landscapes and providing for vegetative diversity.

(g) Significant volumes of currently unmarketable material are a potential energy source. The main source is from cull material not utilized for sawlogs and small round wood from logging residues, precommercial thinnings, disease and insect mortality, and stagnated stands.

The amount of wood that can be offered for sale each year is based upon the amount of land suitable for timber production, the amount of volume that the land is physically capable of producing, and the other resource objectives that must be met.

Alternatives were developed that explored different ways of producing high volumes of timber. One approach was to allow harvesting on the maximum amount of suitable land while meeting NFMA management requirements for wildlife, fish and water.

Another approach was to increase annual timber offerings by departing from a non-declining even-flow level of harvest. This would increase sell levels for a period of time after which the levels would fall below the even-flow level.

The extent to which the alternatives are responsive to this issue can be evaluated by the following:

- Number of acres suitable for timber production.
- Allowable sale quantity (ASQ).
- Number of acres managed at various rotation lengths.
- Long-term sustained-yield capacity of the Forest.

5. *How should the existing transportation system be managed and where should new roads and trails be constructed?*

Situation:

Management of the transportation system is largely determined by the management direction for the various resource programs. An adequate transportation system is essential for protecting and managing National Forest lands.

People expressed interest specifically in regard to road construction costs, standards, and environmental effects. A wide range of concerns were expressed on this issue. Several comments stressed the belief that Forest roads are public roads and should be open to full public use. Others felt some existing roads have been built to standards too high for the traffic they receive. Access to areas not yet roaded will generally be more expensive and the potential for resource impacts will increase, which is also a concern.

It is evident from the comments received that the public is concerned about cost efficiency in both the maintenance and construction of the Forest road and trail system, including location and total number of miles. The public wants to keep more trails open and maintained.

Furthermore, road and trail access by various types of vehicles entering the Forest is a specific concern which some feel should be restricted under certain conditions, while others object to restrictions of any kind. Concerns were expressed by commodity and non-commodity users on a Forest-wide basis. Many non-commodity user groups perceive adverse direct and secondary effects.

This issue is Forest-wide with relatively widespread interest. Construction of additional roads, especially in areas not yet developed, is of particular interest.

Opportunities to Resolve:

(a) Although most Forest road systems are now in place, opportunities remain to match future road planning with the goals of a specific management area so they complement each other.

(b) The same opportunity exists for trails, i.e., trail standards and densities should be planned to meet the management goals of the area they will be serving.

(c) Opportunities also exist to coordinate road and trail locations, including standards and objectives with intermingled or neighboring private and public landowners to best serve the interests of all parties.

Management of the Forest transportation system will vary depending upon the objectives of the alternatives. The extent to which alternatives are responsive to this issue can be evaluated by the following:

- Average annual miles of road/trail constructed in first and second decade.
- Miles of road/trail constructed in unroaded areas.
- Public access miles open/closed.

6. *How should the soil and water resources (including riparian areas, hydropower potential, and municipal watersheds) be managed?*

Situation:

People originally expressed interest in management of the Forest's soil and water resources with specific concern for water quality and streamside protection. Later in the planning process, a concern for the increasing demand and proliferation of hydropower sites developed. Most major watersheds on the Olympic Peninsula include significant areas managed by the Forest Service. When Forest activities are considered with those of other landowners downstream, there is potential for significant cumulative effects.

Responses to this issue dealt with the continuing need to protect streams and rivers from adverse effects of management activities, including proposed hydropower use. Some expressed concern that timber harvesting and related road building were causing increased runoff and flooding, which in turn was resulting in increased stream sedimentation and a reduction in stream life. These concerns dealt with the major rivers and streams located within or passing through the Forest and were primarily related to anadromous fish streams and watersheds serving domestic and industrial users. Maintenance of clean water for human use as well as for fish and wildlife needs is a fundamental concern.

Interest in this issue is primarily local and concerned with specific Forest watersheds.

Opportunities to Resolve:

(a) Streamside/river management offers the opportunity to enhance wildlife, recreation, and scenic quality by providing protection that serves to minimize disturbance over extended timeframes.

(b) There are also opportunities to enhance the condition of some of the Forest watersheds and major drainages where past activities have changed water runoff timing and amount.

All alternatives meet the water quality standards established by the Clean Water Act and meet or exceed the standards for the State of Washington through application of best management practices (BMPs). This is accomplished by limiting the amount of timber harvest in a watershed during any 10-year period, by limiting the amount of harvest along streams, and by assuring that sensitive, unstable slopes are not logged. Some alternatives provide additional protection for watersheds by restricting public access to municipal watersheds or by excluding harvest from larger areas along streams or unstable slopes. In general, watersheds are protected by reducing the number of acres available for timber production. This is reflected in the amount of sediment produced and the condition of fish habitat. Water quality will also vary between alternatives due to efforts to provide different levels of anadromous fish habitat (see Issue 7).

The extent to which the alternatives are responsive to this issue can be evaluated by the following:

- The amount of sediment produced (estimated).
- The percent of riparian areas harvested.
- Amount of protection afforded municipal watersheds.

7. *How should fish and wildlife habitat be managed?*

Situation:

The Forest includes significant amounts of habitat for both fish and wildlife. Management implemented for these resources has a direct bearing on the quantity and quality of associated animal species. Many of these animals, particularly anadromous fish, have social, economic, and cultural significance.

Responses regarding this issue dealt with concerns involving conflicts between timber harvesting and the need to retain habitat for both fish and wildlife resources. Comments included the need to avoid introducing sediment into spawning beds. Habitat maintenance and enhancement was mentioned for both big game and non-game species. Desirable vegetative diversity and threatened and endangered species habitat were mentioned by the public, though not widely. A principal concern focused upon protection and enhancement of habitat for the Forest's anadromous fish streams and their importance to the many Indian tribes on the Olympic Peninsula.

Management activities that affect fish and wildlife habitat are recreation, timber harvest, related road construction, and fire management. Hydropower projects may also have an impact on available fish habitat. Another concern stressed the need to examine timber harvest schedules and rotations to avoid or lessen the impact on streams and improve big game habitat distribution patterns.

A related and important concern under this issue stresses the responsibilities of the Forest to ensure Indian treaty fishing and hunting rights are recognized.

This issue is widespread for the Forest and extends beyond the local area to include the Puget Sound Basin.

Opportunities to Resolve:

(a) There are opportunities to manage key habitat for wildlife (e.g., winter range, old-growth, fawning and calving areas) and for fish (streamside management units) through management area designations.

(b) Significant increases in projected habitat quality can be achieved by modification of harvest levels and harvest scheduling.

(c) There are opportunities to work closely with Peninsula Indian Tribes and the Washington State Departments of Wildlife and Fisheries to improve management of fish and wildlife habitat on the Forest.

(d) Application of specialized timber management practices aimed at habitat improvement could increase habitat quality to some extent. Examples are harvest before culmination mean annual increment and modified commercial thinning regimes, both of which could be useful in improving forage conditions.

(e) Increased attention to harvest patterns within individual drainages, particularly in winter range, could substantially improve habitat balance.

(f) Implementation of road closure and traffic management programs, with emphasis on critical time period in key habitat areas, could enhance existing habitat conditions.

(g) Increased funding of wildlife habitat improvement projects would serve to help mitigate negative effects of other activities.

(h) Fish habitat availability can be increased through implementation of habitat access projects.

(i) Fisheries habitat quality can be improved through modification of timber harvest levels and schedules (timber harvest generates the bulk of road construction and use).

(j) Increased funding of mitigation and enhancement projects could lead to improved fish habitat quality.

(k) Modification of timber harvest levels within water influence zones and on highly erosive soils could reduce potential adverse effects on fish habitat.

Resolution of this issue ranges from not allowing timber harvest on all unstable areas, riparian areas and areas adjacent to intermittent streams, to maintaining minimum viable populations of fish and wildlife.

The extent to which the alternatives are responsive to this issue can be evaluated by the following:

- The amount of protection afforded unstable areas and riparian zones.
- The amount and condition of anadromous fish habitat.
- The amount and size of spotted owl habitat areas (SOHAs).

8. *How should the unroaded areas of the Forest be managed?*

Situation:

This issue developed later in the planning process and did not receive the number of written public comments that other issues did. This was primarily the result of the regulations in effect at the time of the initial issue identification in 1979. Nonetheless, interest in this issue is high.

Over 85,800 acres of the Forest outside of established Wildernesses are presently unroaded. These could continue to be managed in an unroaded and undeveloped condition, or they could be roaded to provide access for the enjoyment of scenic and recreational values and for the use and development of other resources. Areas which can provide unroaded types of recreation (both motorized and non-motorized) are becoming short in supply. People remain concerned about how much of these areas should be managed for timber as opposed to management for unroaded and undeveloped recreation and wildlife habitat. Others would like to see these areas roaded to provide scenic drives or campgrounds. There is also a concern regarding how soon these areas should be entered and the effect roading and management activities would have on soils, water quality, and wildlife habitat and plant species dependent on old-growth forests.

Interest in the issue is strong locally and in the Puget Sound area. It is also part of a National concern with the future of the remaining unroaded areas on public lands managed by Federal agencies.

Opportunities to Resolve:

(a) There is opportunity to provide a range of options for uses in these currently unroaded areas. Options might include unroaded or roaded recreation, commodity production or special area classification. The selected use would determine which lands would (or would not) be roaded and when roading might (or might not) occur.

(b) There is also opportunity to use unroaded areas to help meet management goals for research natural areas, endangered or threatened wildlife and sensitive plants. They might also be appropriate for wildlife habitat and provide old-growth stands for dependent species such as spotted owls. These land allocations can also be made in established Wilderness, existing research natural areas, or unroaded recreation areas rather than in timber management areas when appropriate.

The extent to which the alternatives are responsive to this issue can be evaluated by the number and size of areas (acres) assigned to undeveloped management.

9. *How should the corridors adjacent to potential Wild, Scenic or Recreation Rivers be managed?*

Situation:

This issue relates to determining the eligibility for classification of inventoried rivers in or adjacent to the Forest and the management activities to be implemented within the river corridors.

Of the seventeen rivers studied for eligibility, fourteen have been determined to be eligible as Wild and Scenic. A segment of the public supports designation of all or many of these rivers. Others feel that such designation is overly restrictive on land management activities and may infringe on private property rights.

Interest in this issue is strong locally (there is strong opposition to wild and scenic rivers especially in many Peninsula communities). The issue extends beyond the local area to the region and nation and is strongly correlated to the anadromous fishery and the desire to limit construction of dams and other impoundments and diversions.

Opportunities to Resolve:

(a) There is an opportunity to work closely with the National Park Service to determine the suitability of inventoried potential Wild and Scenic Rivers and develop recommendations.

(b) A opportunity exists to examine other rivers not previously considered in the Nationwide Rivers inventory and make recommendations.

(c) Opportunities exist to modify management practices in these river drainages and corridors to meet both inventory criteria and management objectives.

The extent to which the alternatives are responsive to this issue can be evaluated by the number and miles of rivers to be recommended for inclusion in the National Wild and Scenic Rivers System and the number and miles of rivers allocated to the River Corridor management area.

10. *How should the Forest's native plant species and communities be managed?*

Situation:

Interest in this issue increased between the release of the DEIS and development of the Final planning documents. It has therefore been added to the list of key issues. The Forest provides habitat for several rare plants and sensitive or unusual plant communities. A considerable amount of interest in studying, as well as protecting these sites (from disturbance that might result from road construction, timber harvest or mining) developed during the response period to the DEIS. Those responding felt that these unique areas contribute to overall Forest diversity and that concentrations of rare plants or unique ecosystems should be designated as Botanical or Research Natural Areas (RNAs). Activities that could disturb plants or sites would be precluded including, where appropriate, protection from plant collecting. Others commented that the plant populations should be managed by on-the-ground project location and design without removing or greatly restricting lands for timber management or mineral development.

Opportunities to Resolve:

(a) Opportunities exist to develop management prescriptions that provide protection for sensitive plant communities.

(b) In addition to using unroaded areas to meet management goals for sensitive plants, allocations can also be made in established wildernesses and other areas that prohibit timber harvest.

(c) Standards and Guidelines provide additional protection for plant species and communities.

The extent to which the alternatives are responsive to this issue can be evaluated by the number of sites and acres allocated to Botanical or Research Natural Areas.

11. *How will management of Forest resources affect local communities?*

Situation:

Forest management affects the jobs, incomes, and lifestyles of local residents and nearby communities through economic as well as aesthetic and recreational ties. Forest outputs have traditionally provided a base for several local industries, including lumber and wood products, commercial fishing, and tourism. A portion of receipts from the sale of Forest outputs is paid to counties. The Forest Service spends money locally on supplies, services and salaries. In addition, the Forest provides resources that are important to local residents even though there is no direct economic tie. Local residents place a high value on amenities such as clean water, open space and scenery, and on personal uses such as firewood cutting, hunting, fishing, and camping.

Even though Forest outputs and expenditures contribute only an estimated 10 percent of the jobs in the four Peninsula counties where the Forest is located, the lifestyles of some residents and structure of certain communities are directly dependent on them. Small communities near the Forest, that have economies based on lumber and wood products, are most dependent. There has always been a desire that the Forest supply timber for local industries to sustain jobs and lifestyles.

On the other hand, intense timber harvest may conflict with other resources which influence other jobs, lifestyles and communities. This concern includes how changing recreational opportunities, wildlife and fish habitat, and visual quality will affect personal uses of the Forest as well as local commercial fishing and tourist industries. It is becoming greater as more people with values which are different from the values of people who have traditionally depended on the Forest move into the area. These newcomers include second-home owners and retired people, people working in cities and urban people moving to rural communities.

Opportunities to Resolve:

Alternatives explore the effect on local communities of different mixes of Forest output activities. Some alternatives provide high levels of timber to support jobs and lifestyles dependent on the lumber and wood products industries and payments to counties. Some alternatives provide high levels of recreation, visual quality, and wildlife and fish habitat to support jobs and lifestyles dependent on tourism, commercial fishing, aesthetics and recreational use of the Forest.

The extent to which the alternatives are responsive to this issue can be evaluated by:

- Payments to counties.
- Changes in jobs and income.
- Changes in lifestyle and community structure.

12. *How should the Shelton Cooperative Sustained Yield Unit (CSYU) be managed?*

Situation:

The Shelton CSYU, created under authority of the Sustained Yield Forest Management Act of 1944, was established in 1946 and is the only one of its kind in the United States. Management is guided by the terms of a 100-year Cooperative Agreement between Simpson Timber Company and the Forest Service. Included within the Shelton CSYU are about 111,300 acres of the Olympic National Forest and 220,400 acres owned by Simpson. More information is provided in Chapter III.

The focus of management activity within the Shelton CSYU is now shifting from National Forest to Simpson Timber Company ownership.

Specific concerns were raised by Simpson Timber Company and the Forest Service. These are related to: 1) the need for changes in land classification on National Forest land to respond to requirements of NFMA and subsequent direction; 2) the intensity of timber management activity in relation to the cost of the activities; and 3) the current terms of the Cooperative Agreement in relation to recent changes in market conditions which affect timber management.

Opportunity to Resolve:

All alternatives provide for continuation of the CSYU. However, the intensity of management may vary among the alternatives. It may be necessary to implement the Forest Plan on the non-CSYU portion of the Forest. This would occur if agreement between Simpson Timber Company and the Forest cannot be reached on a final alternative for the CSYU. The Forest Plan would then be amended at a future time once agreement for management of the CSYU has been reached with Simpson.

13. *American Indian concerns, values, and treaty rights.*

Situation:

The primary focus of the Peninsula Indian tribes' concerns center on the identification and protection of areas of religious significance and management of fish and wildlife resources. They want to assure the planning process adequately evaluates the fishery resource in relation to their economy and culture. Several Olympic Peninsula tribes would like to see management activities (primarily timber harvest) displayed for each drainage so specific impacts could be assessed for each (tribal) area. Some tribes have stated that planning has not adequately recognized tribal archaeological and cultural resources, and they feel that protection measures for these resources will be inadequate. Finally, the Squaxin Island Tribe is concerned about adequate resource protection as per their treaty rights. Specifically, they maintain that Simpson Timber Company lands located within the Shelton Cooperative Sustained Yield Unit (CSYU) should be managed under the requirements of the National Forest Management Act (NFMA).

Opportunities to Resolve:

(a) In 1978, the Joint Resolution on American Indian Religious Freedom was enacted. The Act states it shall be the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express and exercise their traditional religions. In addition, the 1976 Federal Land Management and Policy Act requires that Forest Service land management plans be coordinated with the land use planning and management programs of Indian tribes.

(b) The opportunity exists to provide drainage-specific impacts for projected fish outputs as requested by the tribes.

(c) Opportunities exist for management area allocations to address American Indian concerns such as use of the River Corridor Prescription (A4B), and the Wild and Scenic River Prescription (A4A). These allocations could provide substantial protection for anadromous fisheries.

(d) Additions to the Botanical Area Allocation (J3) could provide opportunities to protect areas utilized by Peninsula tribes for traditional purposes such as plant gathering.

(e) Opportunities exist to substantially strengthen the planning documents, including the final alternative to more adequately address American Indian concerns.

(f) During Plan implementation, opportunities exist to continue to coordinate with the American Indian community, ensuring that concerns regarding protection of ancestral sites and freedom to continue religious uses of the Forest land and resources are resolved.

MANAGEMENT CONCERNS TO BE ADDRESSED

Management concerns originally developed by Forest managers that have been displayed and discussed with the public throughout the planning process are also carried through the analysis process. As you would expect, these concerns often parallel the public issues. Management concerns are stated in the form of basic planning problems needing resolution in the Forest Plan. They include the following:

1. *How will demands for outdoor recreation be met and conflicts between user groups resolved or minimized?*

   There are several facets to this concern. One related to developed recreation opportunities and the cost of providing facilities versus the revenue derived from user fees. Another facet relates to conflicts on trails between hikers, horseback riders, and off-road vehicles. Concerns are also expressed relative to the amount and locations of areas to remain undeveloped for their potential to provide Primitive/Semi-Primitive recreation opportunities.

2. *How will the Forest manage lands now within inventoried potential wild and scenic river corridors?*

   This concern involves management of forest resources for a variety of uses within the corridors of eligible wild and scenic rivers. It is related to the designation of a specific corridor as wild, scenic, or recreation and the intensity of management associated with that designation.

3. *What protection will be given to cultural, historical, and archaeological resources?*

   The primary concern is for identification and management of areas important for cultural and historical values to Native American communities as well as other people. Certain rights have been granted to Indian tribes through various treaties, but very little is known about the location of religious sites.

4. *How should the Forest timber resource be managed to help meet local, regional and national demands?*

   There is growing concern about the role National Forests should play in the local, regional, and national scope of the forest products industry. Past uses of the Forest have emphasized the timber resource but public attitudes are calling for change in that traditional role.

5. *How will fuelwood opportunities be provided and administered?*

   The last several years have shown an increased use of the Forest as a source of fuelwood as an alternative energy source. There is concern as to how the public can continue to have access to this material as less is left in the woods after commercial timber sales and road access is limited because of changing management emphasis. There is also concern with utilization of all woody biomass as a means of generating additional revenue through the development of new markets. There is a changing attitude toward fuelwood from viewing it as "residual slash" to be disposed of toward "biomass resource" to be managed for many uses.

6. *To what extent should objectives of different interest groups be considered in managing the Forest?*

   The concern in this case is with increasingly demanding desires of different interest groups for the same piece of ground or facility. Examples include: timber harvest versus primitive recreation, hiking in solitude versus trail bike riding, and driving roads for pleasure versus road closures to reduce pressures on wildlife. There is also concern for desires that are complementary but the perceptions of individuals do not agree. An example is the complementary use of the timber resource while providing high scenic quality.

7. *How will economic analysis, especially with regard to changes in costs and values, be used during implementation of the Forest Plan?*

   Costs of management and values of products change. Many of the decisions being made in the planning process are based on economic information from 1983 or earlier. There is concern with the possibility of making decisions in the planning process that unnecessarily restrict future management activity because of outdated economic data or assumptions.

8. *How should the Forest resolve the sometimes differing objectives of timber and wildlife habitat management?*

   Management of the timber and wildlife resources usually have compatible objectives; however, there are areas where both resource objectives cannot be served on the same piece of ground. Examples include: old-growth habitat dependent wildlife species and, to a lesser extent, mature forest dependent wildlife and big game winter range. The concern is with the tradeoffs associated with vegetative treatments that reduce economic returns from highly productive timberlands for the benefit of unquantified wildlife values.

9. *How much land area should be managed for the Primitive and Semi-Primitive recreation opportunities it now provides?*

   Much of this concern is related to providing Primitive and Semi-Primitive recreation opportunities in areas where the potential revenues from timber production would exceed management costs. It is also related to the relationship between the National Park and National Forest and the different management responsibilities of the two agencies. Should the National Forest continue to provide this kind of recreation opportunity, considering that there are almost 1,000,000 acres of the same opportunity available in the Park?

10. *How will the Forest protect resources from diseases, insect and animal pests, and other natural threats?*

    The primary concerns here are related to recent bans on the use of chemicals in the control of diseases, insects, and animal pests, and the current lack of suitable alternative means of control. There are also concerns with the practicality of partial-cutting silvicultural practices in light of frequent severe wind storms and resulting tree blow-down.

11. *Can the Forest continue to use prescribed burning to manage logging residue, reduce wildfire hazard, and prepare sites for reforestation, and still meet air quality standards for South Puget Sound?*

    There is growing concern that the use of prescribed burning as an efficient means for disposing of "unwanted or unmerchantable woody residue" will be severely restricted. Concerns are oriented toward the role the Forest Service should play in relation to other forest land owners and their use of prescribed burning. How should the Forest Service use prescribed burning as a tool in managing the woody biomass resource and for site preparation?

12. *How should Forest lands be managed for energy resources, both renewable and non-renewable?*

    The renewable energy facet of this concern is related to the fuelwood concern expressed earlier, but is directed toward commercial enterprise. This concern also includes development of the hydropower resource and potential conflicts with the fishery resource.

    The non-renewable energy facet relates to the amount of Forest land open for oil and gas leasing and prospecting, and potential differing objectives associated with management for unroaded recreation, scenic quality, and wildlife habitat.

13. *What priority should future transportation and utility corridors receive?*

    This concern is related to the previous concern on development of energy resources. However, in this case, the concern extends to energy developments on lands outside the Forest boundary, and is related to the need for rights-of-way across National Forest land for power transmission lines, etc. There is potential for increasing costs of development in these corridors when management objectives for scenic quality, unroaded recreation, and other resources are met.

14. *Can the Forest help meet identified Research Natural Area needs?*

    The Forest Service, through its research branch and other agencies, designates lands on which various features are preserved in an undisturbed state solely for research and educational purposes. Although many areas have already been designated, there are still many needs to be filled. This concern deals with identifying areas on the Forest that can be used to meet some of these needs.

15. *How will the Forest coordinate its management objectives and practices with those of intermingled or adjacent ownerships?*

    The Forest Service and its neighbors often have different objectives for managing land. This concern is related to the need to identify management objectives, where they are compatible, and where they are not. The biggest concern is when adjacent lands are managed for objectives that are not compatible.

16. *How should the social and economic effects of management activities, as related to the people and communities of the Olympic Peninsula, be used in the decisionmaking process?*

    This concern is related to the effects of management decisions on local communities. Many people view National Forests as a resource that needs to be managed for the good

of the entire country. These National desires are often different than those of the local communities.

17. *How should the Shelton Cooperative Sustained Yield Unit be managed?*

    The intensity of management activity within the Shelton CSYU is now shifting from National Forest to Simpson Timber Company ownership. Concerns have been raised as to the most efficient way to manage the CSYU in light of recent changes in the forest products economy. The need to change management direction on the Shelton CSYU to incorporate requirements of the NFMA has also been questioned. Included in this concern are questions as to the need for modification of the existing Agreement and the possible effects of discontinuing the Shelton CSYU.

18. *How should the Forest manage lands for which the costs of timber management exceed projected returns?*

    The timber harvest base associated with current management plans includes several areas in which the per-acre costs of timber harvest and management are likely to exceed potential returns under current market conditions. Management is concerned with the possible tradeoffs involved in either retaining such lands in the harvest base or removing them. The allocation of these areas could affect employment, cash flows to counties and the U.S. Treasury, and present net value.

The following table displays how each of the management concerns has been addressed. As with public issues, additional information is included in Chapters II and IV. The quantitative measures used to compare alternatives and resource management levels for those concerns addressed by the planning questions in Chapter I are presented at the end of this appendix.

Table A-1. Treatment of Management Concerns

Concern Number	How Treated
1.	Addressed directly in alternatives as part of planning question 2.
2.	Addressed directly in alternatives as part of planning question 9.
3.	Addressed directly in alternatives as part of planning question 13. Also addressed through standards and guidelines. See Chapter IV of the Forest Plan.
4.	Addressed directly in alternatives as part of planning questions 4 and 12.
5.	Addressed indirectly through planning questions 4 and 5. Fuelwood is generally a byproduct of the timber sale program. Therefore, it is related to the amount of timber offered for sale. The availability of fuelwood is also affected by the transportation system and road mileage open and closed.
6.	This concern is addressed through the decisionmaking process. The objectives of different interest groups are considered in the formulation of alternatives, with the extent of the consideration reflected in the selection of the preferred alternative.
7.	Addressed directly in alternatives as part of planning questions 4 and 12.
8.	Addressed directly in alternatives as part of planning questions 4 and 7.
9.	Addressed directly in alternatives as part of planning questions 2 and 8.
10.	Addressed through standards and guidelines. See Chapter IV of the Forest Plan.
11.	The effects of air quality have been displayed in Chapter IV and standards and guidelines have been prepared. This concern will also require additional coordination at the State level.
12.	This concern is indirectly addressed in alternatives, through planning questions 6 and 9, and in the standards and guidelines. The land allocation for each alternative will present varying degrees of difficulty for energy development exploration.
13.	Addressed indirectly through planning questions 1, 5 and 8. The Forest is not expecting any significant expansion of the county, State, or Federal highway systems near the Forest. Additional utility corridors may be necessary, should energy development occur within or near the Forest boundary. This part of the concern is addressed directly through the land allocation and standards and guidelines associated with each alternative.
14.	Addressed through planning question 10 and through further study during Plan implementation.
15.	Addressed through standards and guidelines. See Chapter IV of the Forest Plan.
16.	This concern is addressed through planning question 11. The likely consequences of each alternative have been displayed in Chapter IV. The emphasis placed on local social and economic effects is reflected in the preferred alternative.
17.	Addressed directly in alternatives as part of planning question 12.
18.	Addressed directly in alternatives as part of planning questions 4 and 12.

ICOs DEFERRED FOR RESOLUTION OUTSIDE THE FOREST PLANNING PROCESS

During the scoping process several ICOs were deferred for resolution outside the forest planning process. They included:

1. **Law Enforcement** - Some members of the public believe the Forest should hire law enforcement people. This is a personnel and administrative issue not addressed in a land and natural resource management planning process.

2. **Planning Procedures** - Some members of the public believe that the methods of analysis used in the planning process--such as identification of land suitable for timber production, determining the allowable harvest, and identification of minimum habitat requirements for viability of wildlife--should be issues analyzed in the Forest planning process. These methods are part of the overall analysis used to identify environmental effects of the various alternatives. These processes were defined by federal regulations developed to implement the National Forest Management Act (36 CFR Part 219) and could not be resolved at the Forest level.

3. **Interagency Coordination** - Some members of the public believe that the need for more and better interagency coordination should be resolved in forest planning. Forest planning analyzes the variety of land and resource management strategies that could be applied to the National Forest and not the level of coordination required to manage the Forest. However, coordination with other agencies occurs frequently as part of the planning process to seek advice and resolve planning issues.

CONSULTATION WITH OTHERS

Consultation with other agencies, local government, interest groups, and individuals has been constant throughout the planning process. The consultation described in this section covers the initiation of the Forest planning effort in 1978 to issuance of the DEIS and proposed Forest Plan in 1986, the Supplement to the DEIS in 1988, and subsequently, the consultations made between release of the documents and issuance of the FEIS.

Numerous meetings and individual contacts were made with various agencies and groups. The purpose of the contacts was to: 1) discuss the Forest planning process; 2) identify issues that should be recognized; 3) identify any existing or ongoing plans of other agencies; 4) establish any necessary coordination plans; and 5) consult on specific problems. A description of public involvement effort is provided in Appendix K of the FEIS. In addition, documentation of these meetings, including issues discussed is on file at the Supervisor's Office, Olympia, Washington, as part of the planning records.

The following list highlights contacts made with other agencies, Indian Tribes and interest groups and indicates the topics discussed.

OTHER AGENCIES

FEDERAL AGENCIES

1. U.S. Department of Agriculture, Forest Service, Mt. Baker-Snoqualmie National Forest

   - Coordination of management practices
   - Coordination with American Indian Tribes

2. U.S. Department of Agriculture, Forest Service, PNW Forest and Range Experiment Station

   - Research Natural Areas - S. Greene
   - Old-growth Management - J. Franklin
   - Spotted Owl Inventory

3. U.S. Environmental Protection Agency

   - Development of Standards and Guidelines
   - Documentation of planning process and analyses
   - Monitoring Plans

4. U.S. Department of Interior, Fish and Wildlife Service

   - Threatened and Endangered Species
   - Informal and formal consultations on T&E and sensitive species

5. U.S. Department of Interior, Bureau of Indian Affairs (Olympic Peninsula Agency)

   - Planning Process
   - Tribal contacts

6. U.S. Department of the Interior, National Park Service (Olympic National Park)

   - Coordination of management practices
   - Olympic National Park Master Plan
   - Shared facilities

STATE AGENCIES

1. Washington State Department of Ecology

   - Planning process and document coordination
   - Planning Liaison for Governor's Office (SEPA)
   - Smoke Management Implementation Plan

2. Washington State Department of Fisheries

   - Fish population trends
   - Fish Habitat Index Model review

3. State of Washington, Governor's Office

    - Planning Process and Planning Document Overview
    - Timber Supply
    - Community Stability
    - Recreational potential for Olympic Peninsula

4. Washington State Historic Preservation Officer

    - Cultural Resource Management
    - Natural Heritage Plan

5. Washington State Department of Natural Resources

    - Olympic Peninsula timber harvest levels
    - Olympic Peninsula timber industry characteristics
    - Forest land management program

6. Washington State Department of Parks and Recreation

    - Recreation statistics and demand projections
    - Funding opportunities for future trail construction
    - Coordination with Interagency Commission for Outdoor Recreation

7. Washington State Department of Wildlife

    - Wildlife habitat quantity and quality
    - Management indicator species

COUNTY AND LOCAL AGENCIES

County Board of Commissioners for:

Mason County
Clallam County
Grays Harbor County
Jefferson County

- Coordination with county land use plans
- Timber sale planning and county receipts
- Transportation System
- Recreation planning
- Other areas of concern

PENINSULA AMERICAN INDIANS

Hoh Indian Tribe
Jamestown Klallam Tribal Council
Lower Elwha Tribal Community Council
Makah Indian Tribal Council
Northwest Indian Fisheries Commission
Point No Point Treaty Council
Port Gamble Community Council
Quileutte Tribal Council
Quinault Fisheries Division
Quinault Indian Nation
Quinault Tribal Forestry
Skokomish Tribal Council
Squaxin Island Tribe

- Tribal forest management plans
- Anadromous fish
- Sites of religious significance
- Wildlife resources
- Cumulative effects
- Treaty rights
- Funding for enhancement and mitigation
- Management of the Shelton CSYU

OTHER INTEREST GROUPS

1. Northwest Rivers Council

   - Wild and scenic rivers
   - River corridors

2. Olympic Park Associates
   Sierra Club
   National Audubon Society
   The Wilderness Society

   - Old-growth management
   - Resource maps in FEIS
   - Unroaded areas
   - Wildlife habitat management
   - Botanical Areas
   - Transportation system: roads and trails
   - Wild and scenic rivers

3. Olympic Resource Council
   Northwest Forestry Association
   Western Forest Industries Association
   Northwest Independent Forest Manufacturers
   Simpson Timber Company

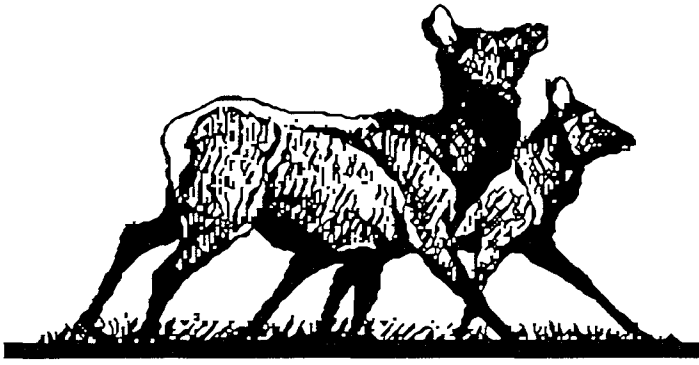
   - Timber yield tables and prescriptions
   - Board-foot cubic-foot conversion ratios
   - Snag management
   - Unsuitable timber lands
   - Riparian area management
   - Fish and wildlife management allocations
   - Timber harvest level
   - Land allocations
   - Management of Shelton CSYU

4. Washington Natural Heritage Program
   Washington Native Plant Society

   - Research Natural Areas
   - Botanical Areas
   - Standards and Guidelines
   - Monitoring Plan
   - Protection of Native Plants and Plant Communities

Appendix B

Description of the Analysis Process



Olympic National Forest

APPENDIX B

DESCRIPTION OF THE ANALYSIS PROCESS

INTRODUCTION

THE PLANNING PROBLEM

The Forest Service is responsible for determining how to best manage National Forest lands, based on consideration of both public desires and production capabilities. Arriving at this determination is an extremely complex process. A wide range of public desires and concerns must be interfaced with limited resource production capabilities in order to develop possible answers to land management questions. Public desires are widely varied, and often compete with each other. For example, one segment of the public may wish to have maximum timber harvest opportunity, while another may desire that old-growth timber stands be preserved as wildlife habitat. Production capabilities are also complicated, and are often mutually exclusive--a given land area can provide timber for harvest or old-growth habitat, but not simultaneously. Because of the complexity of both desires and production possibilities, the number of potential solutions to the land management problem is virtually infinite.

The principal public desires relating to management of the Olympic National Forest are embodied in the issues and concerns discussed in Chapter I and Appendix A of this document. Scenic quality, unroaded recreation opportunity, old-growth, timber harvest level, fish and wildlife habitat, and Wild and Scenic River corridors are the resource outputs most closely associated with these issues. Concerns regarding transportation system management, unroaded area management, water quality, treatment of streamside zones, the social and economic effects of management, effects on American Indian rights and values, and management of the Shelton Cooperative Sustained Yield Unit are also key considerations in assessing management options.

The Forest has the physical capacity to respond to each of the issues and concerns in a wide variety of ways. It cannot, however, provide a mix of outputs and management strategies which resolves all of them at once. The mutual exclusivity of some of the outputs involved precludes such an ideal solution. Hence the need to examine a wide range of output mixes and management regimes, with the goal of finding an operating strategy which comes as close as possible to simultaneously resolving all of the issues and concerns.

The variety of public desires and the complexity of resource production interrelationships combine to make the problem of developing a comprehensive management strategy exceedingly complicated. Fortunately, the means necessary to reduce the problem to reasonably manageable size are available. Advances in mathematical modeling, particularly linear programming, have made it possible to represent extremely complex problems in a relatively straightforward and understandable form. This can be accomplished without excessive sacrifice of analytical precision. The primary purpose of this appendix is to describe how the Forest used the available tools to develop and analyze alternative land management strategies.

CHANGES BETWEEN DRAFT AND FINAL EIS

Numerous changes in data, analysis methodology, and the framework within which the analysis of alternatives was conducted have occurred since the Olympic's DEIS was released in November, 1986. These are outlined below.

GENERAL CHANGES

- Alternative NC-No Change has been added as an alternative considered in detail. The supplement to Appendix B (issued in September, 1988), which describes Alternative NC and the process used to analyze it, has been incorporated into this appendix.

- DEIS Alternatives C-Departure, D-Departure, E, F, and G have not been considered in detail in FEIS analysis. DEIS Alternatives B-Departure (RPA), C-Preferred, and H have been modified in response to public comments. They are now referred to as Alternatives B-Departure (Modified), C-Preferred (Modified), and H (Modified) respectively.

- Much of the Forest's original data has been updated to reflect current conditions. Examples are land base changes, updating of timber yield information to reflect recent harvest and projected growth through the midpoint of the first decade, restratification of timberland suitability, and reassessment of the potential productivity of fish habitat.

- There have been numerous changes in the specifications and/or strategies for meeting the management requirements (MRs) derived from the National Forest Management Act and its implementing regulations. The acreage of old-growth considered necessary to assure maintaining viable populations of the northern spotted owl has increased substantially. Both the modeling technique for and the means of meeting the dead and defective tree habitat MR have changed, and the method for representing the riparian zone/fish habitat MR in FORPLAN has been revised. Finally, changes in distribution specifications have reduced the number of pileated woodpecker and pine marten habitat areas needed to meet the objectives of the mature conifer habitat MR.

- Alternatives considered in detail have been reanalyzed using updated data and changes in management assumptions, objectives, and specifications. The reanalysis was conducted using a PC-adapted version of FORPLAN known as RMS FORPLAN.

- The analysis of benchmarks has been updated to determine changes in present net value (PNV) and allowable sale quantity resulting from changes in data and analysis parameters. Benchmarks 3, 7, 7T, and 11 (the principal PNV and timber benchmarks) were reanalyzed with the Forest's revised FORPLAN model.

- The Forest's primary computerized data base for storing, analyzing, and aggregating planning data has switched from Mt. Hood Map to the Geographic Information System (GIS). This has greatly increased the ID team's ability to analyze, manipulate, and map basic planning information.

CHANGES IN TECHNICAL ANALYSIS

- The identifiers used in delineating FORPLAN analysis areas have been revised. Elevation zones have been removed as an identifier level, and the seral stage identifiers used in DEIS analysis have been

replaced with a more detailed set of age class identifiers. The productivity class identifiers used in DEIS analysis have been broken down by species. This improves the precision of timber yield modeling.

- The original FORPLAN analysis included use of allocation zones to model spatial relationships. For FEIS analysis, allocation zones have been removed from the model. Their function has been replaced by use of prescription controls (developed from GIS-generated map data) as the means of assuring the spatial integrity of management allocations.

- For FEIS analysis, Arney's Stand Projection System (SPS) was used to project timber yields from managed Western hemlock and silver fir stands. In the original analysis, DFSIM was used to generate managed timber yield tables for all species.

- The assumption regarding timber yield increases associated with use of genetically improved stock has been revised. In DEIS analysis, it was projected that such stock would increase yields by fifteen percent. The estimated gain has been changed to five percent for FEIS analysis.

- The assessment of employment and personal income effects by alternative has been expanded to include all forms of recreation in the analysis. This provides a more complete development of potential changes affecting the local economy.

- Employment and income effects are now projected for the first decade only. In the original analysis, such projections spanned the 50-year planning horizon. The high degree of uncertainty associated with long-term employment estimates makes such 50-year projections extremely speculative.

- The modeling of recreation outputs which did not vary by alternative in DEIS analysis has been changed. Yields of developed, roaded dispersed, and Wilderness recreation are now modelled as a function of timber harvest activity, and vary by alternative in FEIS analysis.

- The treatment of recreation values in the calculation of present net value (PNV) has been modified. In FEIS analysis, *all* Forest recreation outputs have been included in the computation of PNV. Roaded dispersed recreation values have been added to the developed, Wilderness, and unroaded dispersed recreation values used in DEIS analysis.

- The effects of Forest activities on off-Forest fish habitat quality have been removed as a factor in the calculation of PNV. While these effects have still been estimated to facilitate comparison of alternatives, it is felt that including them in the economic calculations is inappropriate. Both the procedures used to estimate such effects and the degree to which available off-Forest habitat will actually be utilized (which determines actual output level as opposed to theoretical output level) are highly speculative. As a result, monetary values for these effects are no longer included in the PNV analysis.

- The conversion factors used to translate cubic foot outputs into estimates of board foot production have been updated. Conversion factors are now species-specific and diameter-specific, as opposed to the Forest-wide average used in DEIS analysis.

- Timber management costs based on the conversion of board foot information into cubic foot costs have been revised to reflect the range of updated board foot to cubic foot ratios employed in FEIS analysis. Other management costs have been retained as in DEIS analysis.

- Timber values used for National Forest harvest from the Shelton CSYU have been adjusted to reflect the effect of noncompetitive bidding on prices. The remaining National Forest timber values and all

other resource values have been retained as in DEIS analysis. Timber values expressed in cubic foot terms, however, have been adjusted to reflect revised board foot to cubic foot conversion factors.

- Eventual termination of the Shelton CSYU Cooperative Agreement has been included in the FORPLAN analysis of Alternatives C-Preferred (Modified), H (Modified), and I.

THE PLANNING PROCESS

The Forest's principal planning goal is to provide the information needed by decisionmakers in their selection of the combination of outputs, services, and land uses which most closely approaches maximum net public benefits (see "Economic Analysis" for discussion of this concept). The National Forest Management Act (NFMA) and its accompanying regulations (36 CFR 219) provide the analytical framework for addressing this objective. They also specify that the requirements of the National Environmental Policy Act (NEPA) and its regulations (40 CFR 1500-1508) be applied in the analysis process.

The regulations developed in response to NFMA specify a ten-step process for the development and implementation of Forest Plans. These steps cover the entire flow of plan-related activities, from the initial definition of the planning problem through the evaluation of the results of plan implementation. The individual planning steps are described in the following paragraphs.

1. *Identification of Issues, Concerns, and Opportunities*: This initial step involves the determination of the factors that will form the focus of plan development. The Forest interdisciplinary team identifies relevant public issues, management concerns, and resource use opportunities (ICOs) on the basis of public involvement and coordination with other Federal agencies, State and local governments, and American Indian tribes. Those which lend themselves to resolution through the planning process are then identified by the Forest Supervisor. This set of ICOs then becomes the foundation upon which the remainder of the planning process is constructed. The ICOs upon which Olympic National Forest plan development is based are presented in Chapter I and Appendix A of this FEIS.

2. *Development of Planning Criteria*: This step involves the establishment of the "rules of the game." Guidelines are developed to cover data collection and use, analysis of the management situation, and the design, formulation, and evaluation of alternatives. The purpose of this step is to develop the framework within which analysis is to be conducted, in order to assure that the analysis is both sufficiently comprehensive in addressing the planning problem and as objective as possible. These criteria are designed to assure that the effect of each alternative on net public benefits can be adequately assessed. The criteria governing the Olympic National Forest planning effort are on file in the Forest Supervisor's Office.

3. *Inventory Data and Information Collection*: This step involves the development of the data base to be used in analyzing the management situation, developing and assessing alternatives, and monitoring the implementation of the selected alternative. Data needs are determined by the interdisciplinary team, based on its assessment of the information needs associated with addressing ICOs. Data is required regarding resource capabilities, existing supply and demand, expected outputs, and benefits and costs. Existing data are to be used to the extent possible, but expansion or supplementation of this is often necessary in order to fully address ICOs. The Olympic's data base is on file in the Forest Supervisor's Office. Much of the basic information developed as a result of this step is presented in Chapter III of this FEIS.

4. *Analysis of the Management Situation*: This analysis is an assessment of resource production capabilities and existing market conditions, with the purpose of identifying the opportunities for (and

limitations on) issue resolution. A land use allocation and scheduling model (FORPLAN) is used in conjunction with other analyses to make a number of specific determinations regarding capability. These include: a) the projected effects of the Forest's current management program, b) the effects associated with management at the custodial level only (often referred to as "minimum level"), c) maximum potential production levels of key goods and services, d) the outputs and effects associated with maximizing present net value, and e) the effects of modifying key management principles (e.g. nondeclining flow). From this analysis comes a delineation of the decision space within which the Forest can operate in attempting to resolve ICOs. The Analysis of the Management Situation is summarized in Chapter II of the proposed Olympic Forest Plan.

5. *Formulation of Alternatives*: The purpose of this step is to develop alternative land and resource management strategies, each of which is designed to address ICOs in a different way. The information gathered and insights gained as a result of the first four planning steps serve as the basis for alternative development. The principal goal of the process is to develop a wide range of feasible, issue-oriented management patterns and output mixes which, when analyzed, will provide an adequate basis for identifying the alternative that most nearly maximizes net public benefits. Each alternative is to be designed so that the management prescriptions and practices associated with it represent the most cost-efficient way of meeting that alternative's objectives. The alternatives developed by the Olympic National Forest during this planning step are fully described in Chapter II of this FEIS.

6. *Estimation of Effects of Alternatives*: The physical, biological, economic, and social effects of each alternative are estimated and analyzed at this point in the process. The purpose is to identify the degree to which each alternative responds to individual ICOs. An understanding of the overall influence of each alternative on the Forest's environment is also gained as a result of this step. Effects to be assessed include direct and indirect effects on components of the physical and biological environment, potential conflicts with other agencies and landowners, depletable resource requirements and conservation potential, and economic and social consequences within local communities. Many of the effects of alternatives can be estimated through use of the FORPLAN model, while the assessment of others requires additional analysis. Discussions of the effects of the alternatives may be found in Chapters II and IV of this FEIS.

7. *Evaluation of Alternatives*: This step involves comparing the outputs and effects associated with each alternative, with the intent of identifying the alternative which entails the most desirable pattern of responses to ICOs. Each management alternative considered in detail is to be examined in light of its significant physical, biological, economic, and social effects. This evaluation includes a comparative analysis of the aggregate effects of the alternatives by the interdisciplinary team. The results of the evaluation process lead directly to step 8, selection of the preferred alternative. The comparison of the alternatives developed by this Forest may be found in Chapter II of this FEIS.

8. *Selection of Preferred Alternative*: This step includes selection of the alternative to be presented in the Final Environmental Impact Statement as preferred. Responsibility for this selection lies with the Regional Forester. His charter is to select the alternative which, in his estimation, comes closest to maximizing net public benefits. Essential material upon which this decision is based includes the interdisciplinary team's evaluation of the alternatives, the ICOs and the responsiveness of the alternatives to them, and the recommendation of the Forest Supervisor regarding the relative merits of the alternatives. The Regional Forester's preferred alternative for management of the Olympic National Forest is the alternative identified as "Preferred" in this FEIS.

9. *Plan Implementation*: This step is not initiated until the Forest Plan, and the Final Environmental Impact Statement associated with it, receive final approval from the Regional Forester. Implementation involves the actual application of the land allocations, prescriptions, and management strate-

gies included in the selected alternative. The implementation plan associated with the preferred alternative identified in this FEIS is included in the Forest Plan for the Olympic National Forest. If no changes are identified as a result of final review of this proposal, the Forest Plan will be implemented as presented.

10. *Monitoring and Evaluation*: This step involves continuous evaluation and assessment of the outputs and effects resulting from plan implementation. The purpose is to determine if the outputs and effects projected during plan development are actually occurring at predicted levels. Monitoring also serves to indicate whether the management direction established in the Forest Plan is fully feasible when applied on the ground. If discrepancies between planned and actual outputs or effects are identified, the result could be minor revisions of the Forest Plan, supplementation of the Environmental Impact Statement, or development of a new Forest Plan. The need for any of these actions depends on the magnitude of the differences between planned and actual results. The monitoring plan associated with implementation of the preferred alternative for this Forest is presented in the Forest Plan.

The steps of the process described above can be divided into three distinct categories: judgmental, analytical, and executional. Steps 1, 2, 7, and 8 are essentially judgmental in nature. Steps 3-6 constitute the analytical phase of the process, and are the focus of this appendix report. The executional phase of the process consists of steps 9 and 10.

Steps 1 and 2 entail the application of judgment in sorting through extensive input in order to identify the issues, concerns, and opportunities which fall within the scope of the planning process, and then establish ground rules for the analysis which addresses these ICOs. Chapter I and Appendix A of this FEIS, as well as process records on file in the Forest Supervisor's Office, document the results of these steps. Steps 7 and 8 are also primarily judgmental, as the decisionmaker must synthesize volumes of analytical information into a conclusion as to which alternative best responds to ICOs and maximizes net public benefits. Chapter II of this FEIS covers this stage of the process.

Steps 9 and 10 constitute the executional phase of the process, as they involve implementation of the Forest Plan and evaluation of the effects resulting therefrom. The Forest's proposal for conducting these steps is presented in the Forest Plan associated with this FEIS.

INVENTORY DATA AND INFORMATION COLLECTION

INTRODUCTORY NOTE

In developing its Forest Plan, the Olympic National Forest has been faced with a rather unique situation. A major component of the land area to be covered by the plan consists of private land. This is due to the existence of the Shelton Cooperative Sustained Yield Unit, a cooperative management unit within which the productive capability of 110,000 acres of National Forest land is combined with that of 250,000 acres of Simpson Timber Company land for the purpose of establishing timber harvest levels. Simpson's land is an integral part of the land base for which the Forest Plan has been developed, and has been included in the Forest's planning model in essentially the same way as National Forest land.

The presence of private land within the planning formulation presents an unusual problem with respect to discussions of model characteristics, yield estimation, and other aspects of plan development. Simpson Timber Company, as a private enterprise, is entitled to confidentiality regarding the management information upon which its operations are based. Therefore, only limited coverage of the aspects of planning related directly to Simpson land will be presented. This applies both within this section and throughout the remainder of this appendix.

FOREST DATA BASE

The purpose of forest planning is to address those issues, concerns, and resource use opportunities which fall within its scope. It is essential that planners obtain enough information about the land base and its outputs to accomplish this task. This section describes the ways in which raw data concerning the Forest's land and its output capabilities was used to facilitate development of land management alternatives, estimate yields, and aid in the assessment of the potential effects of management. Much of the necessary data was available at the outset of the planning process in the form of existing inventories, but additional data collection was necessary when existing information was insufficient to facilitate issue resolution.

The FORPLAN analysis model was not used in the estimation of the outputs and effects of Alternative NC-No Change. Therefore, land base data pertaining to this alternative was not organized into the capability area/analysis area structure described below.

CAPABILITY AREAS

The capability area is the basic building block in the construction of land characteristic/output yield relationships. An individual capability area is a distinct unit of land that is homogeneous with respect to the characteristics which define it. This homogeneity results in a set of output capabilities, resource values, and/or management costs which are different from the yield characteristics of all other capability areas. Thus, the capability area can be described as the basic response unit to which the outputs and effects of different management regimes can be tied.

The capability areas of the Olympic National Forest were delineated on the basis of the characteristics outlined below. Capability areas as such were not defined for Simpson Timber Company land.

Riparian Character: Land within 200' of any streamcourse (including intermittent streams) is defined as riparian on this Forest. Because of the important influence of riparian zones on water quality and the quality of habitat for both fish and wildlife, the land base was subdivided into riparian and non-riparian zones.

Visual Quality Objective: The potential effects of management activities on scenic quality vary with visual sensitivity. Therefore, the land base was subdivided on the basis of inventoried Visual Quality Objectives.

Elevation: Wildlife habitat characteristics are strongly influenced by elevation (e.g. winter range/summer range), as are timber management options, values, and costs. Therefore, the land base was subdivided into three elevation zones: 0'-1500', 1500'-3000', and 3000'+.

Timber Site Productivity: The primary factor affecting timber growth and production potential (and, to some extent, the values and costs associated with timber management) is site productivity. This variable also influences the rate of development of wildlife habitat. Therefore, the land base was subdivided into site productivity classes (including a category for unsuitable lands).

Slope Class: Steepness of slope influences logging and road construction costs. It also affects rates of erosion and mass failure, which in turn influence water quality and fish habitat characteristics. Therefore, the land base was subdivided on the basis of differences in slope.

Erosion Hazard: Although correlated to some extent with slope class, the rate of erosion also depends on soil type (regardless of steepness of slope). The effects of activities on water quality and fish habitat vary with erosion rate. Therefore, the land base was subdivided into three general categories of erosion hazard (high, medium, low). It should be noted that the erosion hazard categories relate more closely to probability of mass failure than to surface erosion potential.

ANALYSIS AREAS

The capability areas described above were originally intended to serve as analysis areas within the FORPLAN model. This could have been done with only minor modification of the basic capability area delineation. However, the capability areas were defined early in 1980, while the set of analysis areas ultimately used in FEIS analysis was not completed until December of 1989. Over this lengthy period, several refinements in the Forest's approach to analysis occurred which made the direct use of capability areas in FORPLAN inefficient and cumbersome. Chief among these was the switch (in late 1983) from the original version of FORPLAN to the more flexible and efficient Version II FORPLAN (see "The Forest Planning Model"). Thus, the analysis area structure described below bears only a moderate resemblance to the capability area delineation. Nonetheless, the critical features and yields captured by capability area definition are also covered in the analysis area structure.

Development of analysis areas is one of the first basic steps in constructing the FORPLAN model. Analysis areas are land units with relatively homogeneous outputs and effects. They serve as the basic land areas to which management prescriptions are applied. Their delineation is intended to capture significant differences in the way the land responds to a variety of alternative management strategies. The Olympic's analysis area structure was developed so as to enable the Forest to identify as fully as possible the effects of different prescriptions on outputs, values, and costs relating to issues and concerns. The principal limitation on full definition of "real world" variability was model size, as there are practical limits on the number of analysis areas which can be accommodated by FORPLAN.

Establishment of analysis area identifiers and boundaries was based on extensive use of the Mt. Hood Map computerized grid mapping system and the Total Resource Inventory (TRI) System 2000 database. Information from these systems was installed in the Forest's Geographic Information System (GIS) database for the generation of analysis areas. Replacing Mt. Hood Map with GIS as the Forest's primary computerized data base has greatly increased the ID team's ability to analyze and map basic planning information for FEIS analysis.

The discussion which follows identifies and describes the factors which delineate analysis areas; detail regarding the reasoning behind selection of these factors may be found under "Development of Analysis Areas." Identifiers are covered by FORPLAN level (five levels were used by the Olympic). Each analysis area consists of the combination of one identifier from each level.

In addition to the analysis areas developed to cover National Forest land, the model includes several analysis areas which define the characteristics of Simpson Timber Company land. These were delineated on the basis of timber site class, stand age, and existing cover type. To avoid undue disclosure, the discussion which follows addresses National Forest analysis area identifiers only.

Level One - Watershed

The principal geographic delineator in the FORPLAN model is the watershed boundary. The Forest was subdivided into 21 major river drainages, each representing a distinct geographic area within the model. This delimitor proved very useful, as it enabled the interdisciplinary team to assess outputs and effects as they related to both individual drainages and larger land areas made up of combinations of drainages (e.g. Ranger Districts). The watersheds used as identifiers are as follows:

1. East Straits Drainages (streams flowing directly into the eastern portion of the Strait of Juan de Fuca)
2. Dungeness River
3. Little Quilcene River
4. Big Quilcene River
5. Dosewallips River
6. Duckabush River
7. Hamma Hamma River
8. Hood Canal Drainages (streams flowing directly into Hood Canal that are not included in drainages 3-7, 9, or 10)
9. Skokomish River outside the Shelton CSYU
10. Skokomish River within the Shelton CSYU
11. Satsop River outside the Shelton CSYU
12. Satsop River within the Shelton CSYU
13. Wynoochee River
14. Humptulips and Wishkah Rivers
15. Quinault and Raft Rivers
16. Queets River
17. Hoh and Bogachiel Rivers
18. Calawah (main stem) and North Fork Calawah Rivers
19. South Fork Calawah and Sitkum Rivers
20. Soleduck River
21. West Straits Drainages (streams flowing directly into the western portion of the Strait of Juan de Fuca)

Level Two - Land Class

The land class delineation serves to distinguish areas which are tentatively suitable for timber production from those which are not, and to identify areas with distinct features (such as Wilderness). Identification of tentatively suitable timberlands is necessary to define the Forest's potential timber harvest base, while the remaining identifiers are associated with variations in nontimber outputs. Identifiers within this level are as follows:

1. Tentatively Suitable - all lands available, capable, and suitable for the production of timber.
2. Unsuitable - all classes of land not tentatively suitable for timber production, with the exception of administratively withdrawn areas.
3. Administratively Withdrawn - Wilderness, Research Natural Area.

Level Three - Species/Productivity Class

The species/productivity class delineation separates the land base into timber productivity classes by species group. The primary purpose of the identifiers of this level is to reflect differences in yields, values, and costs relating to timber production. Also important are the effects of timber site class on the rate at which wildlife habitat develops. The "doghair" identifiers distinguish the large area of heavily overstocked, stagnated timber stands from the remainder of the Forest's productive timberland. Identifiers within this level are as follows:

1. Productivity Class 2 Douglas-fir - most productive Douglas-fir areas.
2. Productivity Class 3 Douglas-fir - least productive Douglas-fir areas.
3. Productivity Class 2 Silver Fir - most productive silver fir areas.
4. Productivity Class 3 Silver Fir - least productive silver fir areas.
5. Productivity Class 1 Western Hemlock - most productive Western hemlock areas.
6. Productivity Class 2 Western Hemlock - least productive Western hemlock areas.
7. Natural Regen - stands for which natural regeneration silvicultural systems are necessary.
8. Doghair, Roaded - doghair with access available.
9. Doghair, Unroaded - doghair without existing road access.

Level Four - Age Class

This level serves to stratify tentatively suitable timberland by age class. This is necessary in order to establish the approximate present age of each timber stand. Harvest availability and scheduling, as well as the timing of costs, values, and yields (of both timber and other outputs), are heavily dependent on starting age. This set of identifiers, therefore, helps to define the Forest's production opportunities and limitations as they presently exist. The identifiers used to define stand age structure are as follows:

1. Age 10 - recently harvested areas and plantations.
2. Age 20.
3. Age 30.
4. Age 40.
5. Age 50.
6. Age 60.
7. Age 70.
8. Small Saw - stands ranging from 9" to 21" in diameter.
9. Large Saw - stands with average diameters of 21" or more. Existing stands of this size are at least 160 years of age.
10. Doghair - a separate identifier is needed to segregate "doghair" stands from other timber stands.
11. Other - this identifier applies to analysis areas not tentatively suitable for timber production. Such areas are not stratified by age.

Level Five - Accessibility

The availability of road access to a given area has a strong influence on both the costs of management and the outputs which may be produced. Primitive and Semi-Primitive recreation opportunities occur only in areas which have not been roaded. Timber production costs increase sharply if extensive construction of harvest access roads is necessary. Because of the role of existing access availability in determining outputs and costs, the Forest was subdivided into the following access categories:

1. Developed - relatively minor road development needed to fully access timber for harvest.
2. Undeveloped - major road development needed for timber harvest. Also applies to large, contiguous areas in which helicopter logging would be more cost-effective than road development.

PRODUCTION COEFFICIENTS

Information from the Forest data base was used in combination with numerous yield prediction theories and models to develop production coefficients for the outputs and effects associated with resolution of ICOs. Detail regarding the coefficients and their development may be found under "Development of Yield Coefficients". The outputs and effects for which coefficients were developed are listed below. Most of these coefficients were incorporated directly into the FORPLAN model; those that were not are so identified.

1. Scenic quality - coefficients were developed to estimate acreage meeting Retention and Partial Retention Visual Quality Objectives.

2. Recreation outputs - coefficients were developed to track changes in use of the Forest for developed, roaded and unroaded dispersed, and Wilderness recreation.

3. Timber harvest volume - estimates developed for per-acre timber yield resulting from a variety of harvest regimes.

4. Road construction and reconstruction - estimates developed to track mileage of these activities.

5. Sediment - estimates developed for volume of sediment generated by road construction, timber harvest activities, and existing roads.

6. Fish-related recreation - estimates developed for numbers of user days of recreation associated with anadromous and resident fish outputs.

7. Anadromous fish outputs - estimates were developed for tonnage of commercial anadromous fish catch and numbers of anadromous smolts produced in each alternative.

8. Elk and deer - estimates developed for numbers of animals associated with vegetative management regimes.

9. Wildlife-related recreation - estimates developed for numbers of user days of recreation associated with deer and elk populations.

10. Old-growth - coefficients developed to track acreage of old-growth through time.

11. Employment and personal income - estimates developed for changes in jobs and income associated with various levels of timber, recreation, and fishery outputs (not modelled in FORPLAN).

12. Suspended air particulates - coefficients developed to estimate residue tonnage and total suspended air particulates associated with residue treatment (not modelled in FORPLAN).

13. Potential energy from residues - coefficients developed to estimate energy which could be produced by harvest residues (not modelled in FORPLAN).

LAND SUITABILITY - TIMBER PRODUCTION

NFMA regulations state that timber production and harvesting may be considered only on lands classified as tentatively suitable for timber production. Lands are considered as not tentatively suitable if:

- The land is not forest land as defined in NFMA.

- Technology is not available to ensure that timber production will not lead to irreversible damage to soil productivity or watershed condition.

- There is not reasonable assurance that the land can be adequately restocked as provided in NFMA.

- The land has been withdrawn from timber production by Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service.

The Olympic National Forest has lands which fall into each of the above categories. The procedures used to identify such lands are outlined below. The results of the suitability stratification process are displayed in Table B-I. The timberland suitability stratification has been redone since publication of the DEIS, and has resulted in a reduction in land classified as tentatively suitable for timber production. The original analysis included 485,425 acres of tentatively suitable timberland, while the updated total is 446,939 acres. The principal reasons for this change are the transfer of approximately 11,900 acres to the Bureau of Indian Affairs (in trust for the Quinault Indian Nation) and the determination that roughly 23,000 acres that were originally classified as requiring natural regeneration are, in actuality, not reforestable.

The base of tentatively suitable timberland used in Alternative NC-No Change potential timber yield determination was derived from current timber management plans, rather than the application of NFMA suitability criteria to the Forest's land base. As a result, there is a significant difference between the tentatively suitable land base of Alternative NC (507,930 acres) and that of the remaining alternatives (446,939 acres). The primary source of this difference is the treatment of lands which are presently considered not reforestable or subject to irreversible damage if harvested. Such lands are classified as "unsuitable" in the current land stratification system. In the timber management plans upon which Alternative NC is based, these areas are generally classified as "marginal" and included in the base from which potential yield is determined.

Areas Not Forested

Two primary sources of information were used to identify these areas: the Total Resource Inventory (TRI) and the Transportation Inventory System (TIS) data bases. The TRI data base was used to isolate areas identified by District personnel as being either unforested or developed for purposes other than timber production. TRI photo base maps and aerial photos were examined to assure that delineations adequately represented areas that do not have at least 10% tree cover. Local knowledge served to verify that vegetation present on areas having greater than 10% cover, but classed as unforested, consists of non-commercial tree species.

TIS was used to identify total mileage of Forest roads. An average road prism area of 8 acres per mile for single lane roads and 12 acres per mile for double lane roads was used to convert road mileage data to acreage occupied by roads. The results reflect road system conditions as of the end of fiscal year 1989.

Lands Subject to Irreversible Resource Damage

The principal basis for this determination was the Soil Resource Inventory (SRI). Soil mapping units were categorized on the basis of expected susceptibility to mass movement. Two classes of susceptibility ("active" and "sensitive") were identified as being unsuitable for timber production. The "active" mass movement classification covers areas currently moving naturally or as a result of past activity. Local knowledge based on field reconnaissance was the primary source of information used to identify such areas. The "sensitive" classification includes areas on steep slopes (over 65%) within soil mapping units having a history of mass movement when clearcutting has been applied. Indications are that the root systems of standing trees are the key factor in maintaining slope stability in such areas. Therefore, clearcut harvesting in these areas is likely to result in resource damage.

Harvest of areas classified as "sensitive" could occur without resource damage if a) at least 50% of stand basal area were left, and b) the residual stand was windfirm (if not, the effect would be equivalent to clearcutting). However, such a regime does not lend itself to the establishment of a new timber stand. Residual overstory could not be removed until the understory was large enough to provide the root strength needed to hold soil in place. Protecting an understory stand of this size while removing a fairly dense residual overstory on slopes exceeding 65% would be exceedingly difficult. Because of both the risk of windthrow and the likelihood of excessive understory damage during residual stand harvest, partial harvest of these areas is not practical.

Lands Subject to Regeneration Difficulty

Two primary sources of information were used to develop this determination: the soil subsystem of TRI and the preliminary plant association inventory for the Olympic National Forest. Areas with physical barriers to successful planting were delineated via interpretations of soil mapping complexes. Plant association information was used to delineate areas in which regeneration through either natural or artificial means is unlikely. The latter areas are considered unsuitable for timber production. Areas with barriers to artificial regeneration, however, are considered tentatively suitable if they occur within regenerable plant associations. Natural reforestation is specified for such areas.

Lands Withdrawn from Timber Production

The Olympic National Forest contains one Research Natural Area and five Wildernesses. These lands are administratively withdrawn from timber production.

Table B-1. Timberland Suitability Stratification

	Acres		
National Forest Area	632,324		
Lands not Forested	45,535		
Water		1,752	
Non-Forest		28,108	
Roads		16,764	
Other Uses (Campgrounds, etc.)		1,911	
Forested Land	583,789		
Legislatively Withdrawn from Timber Production		69,501	
Lands Irreversibly Damaged if Logged or Roaded		27,761	
Lands not Reforestable within 5 years		41,034	
Unsuitable			41,034
Separate Suitability Component			0
Tentatively Suitable Forested Land	446,939		
Plantable Lands		439,849	
Lands Requiring Natural Reforestation		7,090	
Suitable under Current Plans	507,930		

LAND SUITABILITY - RECREATION

The Olympic National Forest contains 88,265 acres in five designated Wildernesses. In addition, limited areas outside Wilderness are suitable for providing Primitive and Semi-Primitive recreation opportunities and/or unroaded area characteristics. There are presently 60,441 acres in the Primitive and Semi-Primitive Recreation Opportunity Spectrum (ROS) classes outside Wilderness. These lie almost exclusively within areas which have unroaded area characteristics, and represent the acreage of Forest land which is far enough from roads and other human-related influences to provide recreation experiences which can be classed as Primitive or Semi-Primitive.

The current unroaded area inventory of the Forest consists of 85,807 acres in thirteen unroaded areas. These range in size from 491 acres to 19,017 acres. It is within these areas that the opportunities for providing unroaded recreation outside Wilderness are found. The inventory of unroaded areas is not expected to increase in the future (although the necessary undisturbed characteristics can be achieved over time if management activity is precluded in areas not currently eligible for unroaded area classification). Expansion of road access, timber harvest, and other ground-disturbing activity into unroaded areas will result in reduction in unroaded acreage. Please refer to FEIS Chapter III ("Recreation" and "Unroaded Areas") for complete discussion of unroaded areas and unroaded recreation.

LAND SUITABILITY - WILDLIFE HABITAT

The habitat requirements for the seven management indicator species (or species groups) used in this planning process are summarized below. Each indicator species represents other wildlife species which use the habitat type in question. The amount of suitable habitat available for any of these species will change through time with the succession of vegetative stages as lands pass from one habitat type into another. Almost all of the Forest's land can be suitable habitat of one form or another as a result of vegetative manipulation and the passage of time. In other words, the amount of potentially suitable habitat is essentially limited only by the size of the Forest. Please refer to FEIS Chapter III ("Wildlife") for detail regarding management indicator species and their habitat requirements.

Northern Spotted Owl: Requires old-growth and mature conifer habitat (large trees, multistoried stands, large snags and down logs).

Pileated Woodpecker: Requires mature conifer habitat (large snags and down logs).

Pine Marten: Requires mature conifer habitat (down logs).

Primary Cavity Excavators: Require a mix of snags, with sufficient numbers of large snags to support feeding and nesting.

Columbian Black-Tailed Deer: Requires a mix of forage and cover areas.

Roosevelt Elk: Requires a mix of forage and cover areas, with adequate availability of thermal cover a prime consideration.

Bald Eagle: Requires mature timber within or close to riparian areas for nesting and roosting.

DEVELOPMENT OF ALLOCATION AND SCHEDULING ALTERNATIVES

The allocation of land units to specific uses, and the scheduling of activities associated with those uses, are essential steps in the development of a Forest Plan. The Plan as a whole is, in essence, an aggregation of the allocations and schedules selected for individual land areas. Therefore, development of alternative strategies for management of the Forest as a whole depends in large part on the alternatives which are available for allocating the uses of, and scheduling activities on, basic land units.

The Forest data base is the building block from which alternative allocations and schedules are derived. Analysis areas define individual land units to be managed, and production coefficients determine the outputs to be realized as a result of management. Both of these FORPLAN model components are derived directly from information contained in the data base. Both are essential to the development of allocation and scheduling alternatives.

The links which relate analysis areas to production coefficients and the yields they represent are prescriptions (which could also be labeled allocation alternatives) and timing options (or scheduling alternatives). A specific prescription (see "Development of Prescriptions"), in combination with a specific timing option (see "Development of Timber Options"), yields a distinct set of outputs when applied to a given analysis area. The range of potential prescription/timing/output combinations available for a given analysis area defines the limits of allocation/scheduling alternatives for that area.

The range of possible permutations of analysis area alternatives establishes the bounds on the allocation and scheduling alternatives that are available for management of the Forest as a whole. It is these

Forest-wide alternatives that form the focus of the planning effort. The primary function of the FORPLAN model is to sort through the almost infinite number of possible Forest-wide allocation and scheduling alternatives, finding the one which best meets the objectives and limitations being investigated by the interdisciplinary team in a given FORPLAN run.

IMPLEMENTATION MONITORING

At intervals established in the Forest Plan, management practices will be evaluated to determine how well objectives are being met, and how closely management standards and guidelines are being applied. The accuracy of projections of effects, outputs, and costs will also be evaluated at regular intervals. The results of monitoring and evaluation may be used to analyze the management situation during review and revision of the Forest Plan in future years.

The Forest data base will provide the basis for evaluating changes in resource production rates, determining validity of inventory data, and monitoring the effects of implementation activities. The plan for conducting monitoring and evaluation of management effects may be found in Chapter V of the Forest Plan.

DEVELOPMENT OF PROGRAMS FOR PLAN IMPLEMENTATION

The data base provides biological and physical data that will be helpful in developing the programs associated with implementation of the Forest Plan. As more information becomes available, the data base will be updated and improved. Some of the information which will be needed to develop implementation plans is too detailed in scope to be included in the Forest Plan data base. Such data is, however, readily available in the Forest's TRI and/or GIS data bases. For detail regarding implementation plans and programs, refer to the Forest Plan.

SOURCES OF DATA

DATA SOURCES DEVELOPED AND MAINTAINED ON-FOREST

1. Information relating to soil characteristics came from the Soil Resource Inventory (SRI).

2. Minerals information came from Forest inventories of mineral potential and common variety mineral resources.

3. Energy-related information came from Forest inventories of potential energy resources (including hydropower).

4. Timber stand data, site index information, etc. came from the timber inventory of 1973-74.

5. Vegetative base data came from inventories and maps covering ecoclass and plant associations.

6. Stream classification information came from stream class inventories and maps. The stream system is subdivided into four stream classes.

7. Information relating to streamside conditions came from maps identifying Water Influence Zones (WIZ), Streamside Management Units (SMU), wetlands, and floodplains.

8. Fish habitat information came from assessments and maps covering fish habitat availability and condition. Streams are divided into anadromous, resident, and supportive habitat classifications.

9. Information relating to the existing road system came from the Forest Road Management Objectives and the Transportation Inventory System (TIS).

10. Cultural resource information came from the historic and cultural resource inventory of 1978 (continually updated by ongoing reconnaissance).

11. Land ownership information, by county and District, came from the Forest's land status records (as of 1989).

12. Information relating to wildlife indicator species came from assessments and maps covering known bald eagle and northern spotted owl nest sites and territories. Data have also been developed regarding potential habitat for eagles, spotted owls, pine marten, and pileated woodpeckers.

13. Fire history information came from records covering the location, size, and intensity of past fire occurrences.

14. Basic recreation data came from the Recreation Opportunity Spectrum (ROS) inventory and Recreation Information Management (RIM) Report #2300-1. This report contains use data by recreation type.

15. Information regarding scenic quality came from the Forest's Visual Quality Objective (VQO) inventory.

16. Information regarding logging system requirements and road access needs in undeveloped areas came from site-specific assessments performed by District and Supervisor's Office planners.

17. Cost information came from three principal sources. Most of the data (other than logging costs) came from experienced costs on-Forest. Costs of logging were either derived from generalized empirical appraisals done by the Forest logging systems specialist or based on the Region 6 Appraisal Guide.

DATA FROM OFF-FOREST SOURCES

1. Sediment yields were based on the "*Guidelines for Predicting Sediment Yields*" developed by Regions 1 and 4. These were adapted to conditions on the Olympic. University of Washington sediment studies conducted in the Clearwater drainage on the Olympic Peninsula were helpful in making this adaptation.

2. Fish population data and escapement goals for anadromous fish were obtained from the Washington Department of Wildlife and the Washington Department of Fisheries.

3. Wild and Scenic River data came from an inventory of potential Wild and Scenic Rivers performed by the National Park Service Heritage Conservation and Recreation Service.

4. Information regarding sensitive plants came from "*Endangered, Threatened, and Sensitive Vascular Plants of Washington*," published in 1984 by Washington Natural Heritage/Department of Natural Resources.

5. Information regarding off-Forest timber supply came from several sources. Included are unpublished supply studies provided by the Washington Department of Natural Resources (DNR) and "*Timber Resource Statistics for the Olympic Peninsula, Washington*," published by the Pacific Northwest Forest and Range Experiment Station in 1981. Also valuable were various communications with representatives of DNR, Bureau of Indian Affairs, American Indian tribes, and forest industry, as well as recently completed timber supply analyses (Fox 1989, Columbia Consulting Group 1989).

6. Data relating to timber yields, stand age distribution, site classes, and management costs on Simpson Timber Company lands were provided by the company and verified by interdisciplinary team members.

7. Population information and management goals regarding deer and elk herds were provided by the Washington Department of Wildlife (WDW). The publication "*Strategies for Washington's Wildlife*" (WDW, 1982) was helpful in this regard.

8. Recreation use projections and development goals were based on data from the State (of Washington) Comprehensive Outdoor Recreation Plan (SCORP).

9. Information regarding National Natural Landmarks (NNLs) came from a National Park Service inventory of potential NNLs.

10. 1989 estimates of employment by sector for the Olympic Peninsula were provided by the State of Washington Employment Security Department.

11. Basic employment and income data for Olympic Peninsula counties were developed from the data base and transactions matrices of the Region 6 Input/Output Model (IMPLAN), 1977 version.

12. Population data came from the 1980 Census of Population (U.S. Bureau of Census) and from 1989 population estimates developed by the State of Washington Employment Security Department.

13. Qualitative information regarding the social and economic characteristics of Olympic Peninsula counties was derived from the "*Socio-Economic Overview of the Olympic Peninsula*," developed by Eleanor Y. Adelman in 1980.

14. Structural characteristics of the Peninsula timber industry were derived from data contained in the Washington DNR's "*Washington Mill Survey*" of 1986.

15. Data regarding economic values came from two sources. Values of resources other than timber were based on data developed for the 1985 RPA Program. Timber values were derived from a Region 6 assessment of average stumpage values for each Forest (disaggregated by species and District).

16. Fishery-related outputs were based in part on "*A Method for Predicting Fish Response to Sediment Yields*" developed by Regions 1 and 4.

17. Data regarding elk and deer habitat carrying capacity was derived from two 1980 studies by R.D. Taber and K.J. Radaeke: "*Roosevelt Elk of the Olympic National Forest*" and "*Black-tailed Deer of the Olympic National Forest.*"

DATA FOR ALTERNATIVE NC-NO CHANGE

East-West Zone

The Quinault (1969) and Peninsula (1968) Timber Management Plans served as the principal sources of information in the development of Alternative NC-No Change as it relates to the East-West portion of the Forest. These plans were based on the timber inventory of 1963, with District Multiple Use Plans providing guidance regarding land allocations and uses. The Quinault, Soleduck, Canal Front, and Satsop Block Land Use Plans, developed after the timber management plans and designed to specify land allocations for the same area, served as an important source of allocation-related outputs and effects in the analysis of Alternative NC.

Shelton CSYU

The Shelton CSYU Timber Management Plan (1977) provided the basic timber yield and land allocation information needed in constructing Alternative NC for this portion of the Forest. This plan was based on timber resource information obtained from the Forest timber inventory of 1973-74, in combination with Simpson Timber Company inventory information relating to the private land component of the Shelton CSYU.

THE FOREST PLANNING MODEL

OVERVIEW

Forest Plan development is a very complex process, involving consideration of enormous volumes of information and a multitude of interdependent relationships prior to selection of a recommended course of action. The goal of the process is to identify the alternative management plan which best addresses the issues, concerns, and opportunities identified at the outset of the planning process (as well as those which have emerged during plan development). To assist in the pursuit of this goal, several computer models and related analytical tools have been utilized in the development of alternatives and the analysis of their effects. These tools also aid in assuring the cost-effectiveness of the strategies used to meet the goals and objectives of the various land management alternatives.

The principal computer model used in planning is called FORPLAN, an acronym for FORest PLANning model. FORPLAN is a linear program-based computer modeling system which has evolved from earlier systems, such as RAM (Resource Allocation Model) and MUSYC (Multiple Use Sustained Yield Calculations). FORPLAN is better adapted to use in planning than these predecessors, as it includes significant increases in both breadth of scope and flexibility of operation. The FORPLAN model consists of three components:

1. A matrix generator to translate the interdisciplinary team's input into the proper format for the linear programming component to use,

2. A linear programming solution system (FMPS or Functional Mathematical Programming System), and

3. A report writer to translate the linear programming solution into useful information for decisionmaking.

The majority of the Forest's analysis, including computer runs covering all the final alternatives, was done using Version II FORPLAN, Release 13. The system is maintained and operated on the Department of Agriculture's Univac computer at Fort Collins, Colorado. The Forest's analysis was conducted with a PC-adapted version of FORPLAN known as RMS FORPLAN. This program is identical to the program maintained at Fort Collins. Use of the PC greatly facilitated the Forest's analysis, providing efficient computer use at very low cost.

Linear programming (LP) is a mathematical modeling technique used to solve a series of simultaneous linear equations such that a specific criterion is maximized or minimized, subject to accomplishment of all constraints placed on the solution. Pertinent information about the Forest must be translated into linear equations in order to apply linear programming to the planning problem. This translation was accomplished by the interdisciplinary team (ID team).

The Olympic's FORPLAN model was designed to help the ID team analyze the economic and production tradeoffs associated with alternative strategies for management of the recreation, timber, fishery, wildlife, and scenic resources of the Forest. Concurrently, the effectiveness of alternatives in addressing ICOs required assessment. To accomplish these goals, the principal elements of the FORPLAN model were structured to reflect the Olympic's resource relationships.

The key elements comprising the FORPLAN model are analysis areas, yield coefficients, prescriptions and the associated timing options, costs and values, and the objective function and constraints which, in

combination, reflect management goals. Analysis areas define the characteristics of the land, and prescriptions define unique combinations of activities and practices which can be applied to the land. Yield coefficients quantify the outputs and effects associated with the application of specific prescriptions to specific analysis areas. Cost and value data define the economic consequences of each analysis area/prescription/yield combination, while prescription timing options cover the range of possibilities for the timing of yields, costs, and values. Finally, the management goals governing the limits on a given alternative's mix of outputs and economic performance are expressed by the objective function and set of constraints which direct the model's solution process.

The primary function of FORPLAN is to assign prescriptions to analysis areas. In the process of doing this, the model relates the objective function and constraints under which it is operating to yield information and economic data. The first goal of the solution process is to satisfy all constraints. These can be in the form of land allocation requirements (e.g. a certain acreage must be assigned to old-growth habitat maintenance), output level specifications (e.g. a given volume of timber must be harvested each decade), input level limitations (e.g. a maximum budget), or bounds on the fluctuation of outputs (e.g. timber harvest cannot decline more than a given proportion). If the model can find a set of analysis area/prescription mixes capable of meeting all of the specified constraints simultaneously, the remainder of the solution process is driven by the objective function.

The purpose of the objective function is to guide the model in making choices that remain open once the constraints have been met. For example, a given model may have 100 billion possible analysis area/prescription/timing option combinations when unconstrained. Meeting constraints may result in the elimination of 75 billion of the possible solutions. The objective function provides the criterion by which one of the remaining 25 billion possibilities is selected.

The Forest ID team used two principal objective functions in its analyses: "maximize timber production" and "maximize present net value (PNV)". All runs in which timber production was maximized were further refined to maximize PNV. In essence, therefore, the ultimate decision criterion for all of the Forest's FORPLAN runs was maximization of PNV. This, in combination with the fact that all prescriptions modelled in FORPLAN were designed to represent the most cost-efficient means of attaining the intended goals (see "Development of Prescriptions"), leads to an important conclusion regarding FORPLAN solutions. Of all the possible permutations entailed in both prescription development and FORPLAN optimization, the solution of any given FORPLAN run represents the single most cost-efficient way of accomplishing the management objectives associated with that run.

The FORPLAN model was not used in the analysis of Alternative NC-No Change. Therefore, material in this section relating to FORPLAN model development and analysis is not applicable in the case of this alternative.

THE ANALYSIS PROCESS AND ANALYTICAL TOOLS

ANALYSIS PRIOR TO FORPLAN

The initial step in the analysis process was the identification of public issues, management concerns, and resource use and development opportunities (ICOs). This involved analysis and consolidation of input, from both public and internal sources, into concise and understandable problem statements and planning questions. Because of the length of the planning process, the ICOs continued to evolve as the plan developed, with changes and refinements being incorporated as necessary into the flow of planning

analyses. Most of the analysis conducted throughout the planning process centered around addressing the ICOs.

Another basic step in the analysis process was the development of the planning data base. This entailed assessment of information availability, consideration of possible FORPLAN formulations and the data needs associated with them, and determination of additional data needs. The result of these deliberations was the data base described earlier in this appendix.

Development of management strategies, as well as the standards and guidelines which govern their application, was another essential pre-FORPLAN analysis step. The preliminary management strategies were, in effect, the roots of the more detailed management prescriptions which would follow. Standards and guidelines specified the means by which basic objectives of the management strategies were to be accomplished. As they were developed, proposed standards and guidelines were evaluated (either quantitatively or subjectively) so as to assure that no alternative standard or guideline would be more cost-efficient in attaining management strategy goals.

Also important in the subsequent development of FORPLAN analysis parameters was the estimation of future demand for Forest outputs. In order to ascertain the Forest's potential to satisfy anticipated demand, projections of demand were developed for timber, recreation, fisheries, and wildlife outputs. These served to identify the outputs for which demand could be expected to exceed the Forest's supply capability, as well as those for which supply expansion beyond a certain level would be meaningless in terms of demand satisfaction.

In conjunction with demand projections, the ID team estimated future supplies of key resources expected to be available from non-Forest sources. Examples include recreation opportunity and wildlife habitat available within Olympic National Park. Of particular importance in developing timber output options was an assessment of expected fluctuations in timber supply availability from non-National Forest ownerships on the Olympic Peninsula. These projections of supply from other sources assisted in putting the Forest's role as a supplier of goods and services in the context of the broader Peninsula environment.

Another analysis dealing with the Forest's surroundings was an assessment of the social and economic characteristics of the Olympic Peninsula. An overview of the Forest's socio-economic environment was prepared under a contract with a private consultant. At the Regional Office level, the data base for the Region 6 IMPLAN input-output model was compiled. For detail regarding this model, see "Social and Economic Impact Analysis".

A final important aspect of analysis conducted prior to use of FORPLAN involved construction of the model itself. Analysis areas were delineated, and yield coefficients, management prescriptions, and timing options were developed. These processes are described throughout the remainder of this section of Appendix B. Costs and benefit values were developed as described in "Economic Analysis." Management Requirements were identified (see "Development of Management Requirements"), as were lands tentatively suitable for timber production. Once the development of these modeling parameters was completed, the FORPLAN analysis phase of the planning process could begin.

USE OF FORPLAN IN ANALYSIS

The first use of FORPLAN in the analysis process occurred with the Analysis of the Management Situation (AMS). The purposes of this step included assessment of the Forest's potential to produce outputs, investigation of the output levels associated with maximizing PNV, and evaluation of tradeoffs associated with some basic legal and policy requirements. The end result of the AMS was a definition of the decision

space within which the Forest could operate in developing alternatives, as well as an understanding of some of the tradeoffs associated with operating at given points within that decision space.

The central focus of the AMS was the development and evaluation of several "benchmark" FORPLAN runs. Some of these were designed to determine the maximum levels of specific outputs that could be produced by the Forest. Others were developed to assess the outputs and effects that would be associated with maximizing PNV under a variety of assumptions. Still others tested the effects of modifying policy constraints, such as nondeclining flow, harvest prior to attainment of culmination mean annual increment, and Management Requirements. The benchmark runs developed for the Olympic's AMS and the results of benchmark analysis are detailed in "Benchmark Analysis".

The AMS served as the basis for the development and analysis of the land management alternatives presented in this FEIS. The principal difference between benchmarks and alternatives lies in the complexity of the objectives associated with each. Individual benchmark runs were designed to assess the results of carrying a specific objective (e.g. maximize timber) to its limit, subject only to a handful of limited and rigidly defined constraints. The alternatives, on the other hand, are broader in scope and are designed to assess the outputs and effects associated with varying responses to the entire spectrum of issues and concerns. While benchmarks could, in theory, develop into alternatives, their limited responsiveness to ICOs makes it unlikely that they should do so.

As with benchmarks, the primary tool used by the Olympic's ID team in the analysis of alternatives was FORPLAN. The Forest's model was developed with the intent of capturing all significant relationships affecting ICO resolution within the model structure. Accomplishment of this goal was facilitated by the comprehensiveness and adaptability of Version II FORPLAN. This model has the capacity to represent highly complex and detailed resource relationships in a realistic way, and includes many modeling options which make Version II a powerful analytical tool.

Using FORPLAN, the ID team developed and analyzed land management alternatives. Development was based on the issues and concerns, with the goal of exploring a wide range of management packages that would address these in significantly different ways. The understanding of production possibilities and tradeoff relationships gained from benchmark analysis served to define the range of output levels which should be considered and the probable patterns of output change that would result from different objectives. The ICOs provided the key to development of alternative goal packages, expressed to the model as the objective function and constraints associated with each run. A detailed discussion of the alternative development process is presented in "Formulation of Alternatives."

Analysis of alternatives consisted largely of interpretation of FORPLAN run results. In essence, the bulk of the analysis was performed by the model itself. Once a run had been completed, the ID team evaluated the outputs and effects associated with that alternative formulation to determine whether the run did indeed represent a viable means of accomplishing the objectives upon which it was based. This evaluation sometimes led to the conclusion that the alternative as formulated did not adequately reflect the management goals it was designed to achieve (or that the goals were unrealistic). When this occurred, the alternative was restructured and rerun until a satisfactory result was obtained.

The primary reason that the ID team was able to rely on FORPLAN exclusively for the bulk of its alternative analysis was that most of the outputs, effects, and economic values related to the ICOs were incorporated directly within the model formulation. While additional refinement of FORPLAN output was necessary for full understanding of effects (see the discussion of post-FORPLAN analysis which follows), most of the important outputs were directly estimated by the model. These include:

1. Scenic quality - acreage meeting Retention and Partial Retention Visual Quality Objectives.

2. Recreation opportunity and use - acreage yielding unroaded recreation opportunity and estimated recreation visitor days (RVDs) of developed, roaded and unroaded dispersed, and Wilderness recreation use.

3. Timber harvest volume - allowable sale quantity (ASQ) by decade, subdivided into numerous geographic areas and silvicultural regimes.

4. Road construction and reconstruction - Forest-wide mileage of these activities by decade.

5. Sediment generated by management activity - tons per decade resulting from road construction and use, timber harvest activity, and existing roads.

6. Fishery outputs (on-Forest) - recreation use and commercial anadromous fish harvest associated with the quality of on-Forest fish habitat, both anadromous and resident.

7. Fishery outputs (off-Forest) - effects of Forest activities on quality of off-Forest fish habitat, modelled in terms of changes in fishery outputs, both commercial and recreational.

8. Fish habitat capability - expressed in terms of smolt production capability (on-Forest) or changes in smolt production (off-Forest).

9. Elk and deer populations - numbers of animals through time.

10. Recreation resulting from wildlife outputs - wildlife and fish user days (WFUDs) associated with elk and deer populations, subdivided into big game, small game, and nonconsumptive uses.

11. Old-growth - acreage of old-growth by decade.

12. Economic values - total benefits, costs, and PNV associated with each alternative. Includes market or assigned values for timber, all RVDs and WFUDs incorporated in the model, and commercial fish harvest.

The above outputs were reported as described for each FORPLAN run. Due to the flexibility of the Version II report writer, the model was also able to supply numerous additional reports subdividing or aggregating outputs and economic variables into a variety of useful categories. Many of these reports provided information regarding output levels from geographic subdivisions of the Forest, and were very helpful in assessing localized effects of the alternatives.

POST-FORPLAN ANALYSIS

The results of each FORPLAN run served as the basis for several post-run analyses, designed primarily to enhance the ID team's understanding of effects. These included:

- Qualitative assessment of the effects of activities on the fisheries resources of individual drainages.

- Assessment of cumulative sediment outputs, considering both on-Forest and off-Forest sources.

- Qualitative analysis of the effects of alternatives on overall wildlife habitat quality, both Forest-wide and within individual drainages.

- Assessment of the effects of alternatives on air quality.

- Analysis of the fuelwood availability associated with each alternative, including estimation of the energy potential represented by fuelwood.

- Assessment of the effects of alternatives on road system traffic flows and major road reconstruction requirements.

- Translation of transportation-related FORPLAN outputs into estimates of road mileage to be open to various types of public use through time.

- Estimation of total Olympic Peninsula timber supply to be available for harvest under each alternative.

- Translation of FORPLAN timber, recreation, and fisheries outputs into estimates of the changes in Olympic Peninsula employment and personal income that would result from the alternatives (see also "Social and Economic Impact Analysis").

- Translation of FORPLAN economic reports into estimates of the budget, returns to the U.S. Treasury, payments to county governments, and discounted costs and benefits (by major resource group) associated with each alternative.

In addition to the above estimations and assessments, the estimates of present net value presented throughout this FEIS were developed through a series of post-FORPLAN adjustments. The model formulation upon which allocation and scheduling was based includes maximization of PNV over a period of 150 years as the ultimate objective function for all runs. The PNV figures presented in this document cover accumulated costs and values for the 50-year planning horizon. For reporting purposes, the shorter period is more useful. However, a 150-year analysis horizon was necessary within the model so that the program would have a mechanism to direct the selection of management regimes to be implemented in the distant future. Since the FORPLAN report includes accumulated PNV by decade, this distinction did not necessitate any additional calculations.

Post-FORPLAN calculations were necessary, however, to isolate the portion of total PNV directly attributable to National Forest management. The calculation of PNV within FORPLAN includes, of necessity, the costs and values associated with management of Simpson Timber Company land within the Shelton CSYU. In order to effectively assess the differences among alternatives as they affect National Forest land and its economic value, it was necessary to determine (based on FORPLAN reports) the contribution of National Forest management to total PNV. It is the result of these calculations that is presented as "PNV" throughout this FEIS. Since the Simpson contribution to PNV is very close to the same in all alternatives, this approach does not bias the comparison of alternatives. It does, however, serve to highlight differences in PNV which result from variations in the management of National Forest land. The need to avoid undue disclosure regarding Simpson operations precludes presentation of both total PNV and National Forest contribution by alternative.

The Forest's FORPLAN model was designed to incorporate all land, resource, and economic relationships of significance with respect to resolution of issues and concerns. As a result, the post-FORPLAN analyses described above did not result in adjustments to the basic allocation and scheduling solution of any FORPLAN run. If the analysis of a given run revealed serious flaws in its solution, the run was re-structured and tried again. Once a "good" run was obtained for a given alternative or benchmark, the integrity of the solution was not compromised by post-run adjustments. An advantage of this approach is that the cost-efficiency associated with each FORPLAN solution is retained intact. There is no need for concern that adjustments to the allocations selected by the model could result in a loss of cost-efficiency. This in no way precludes identifying and responding to opportunities to improve efficiency during implementation. It is

anticipated that such possibilities will arise as a result of site-specific analyses associated with project development.

DEVELOPMENT OF ANALYSIS AREAS

The analysis area structure used in DEIS analysis has been revised considerably for the FEIS. Elevation zones (level 4 in the original analysis) have been dropped as an identifier level. This was necessary in order to provide model space for two improvements which greatly enhance the precision of timber output estimation. The first of these is inclusion of tree species in the analysis area delineation. The initial analysis was based on site productivity alone, while FEIS analysis includes more detailed species/productivity class combinations as an identifier level. The second improvement is the expansion of the original seral stage level into a more thorough set of age classes, which further enhances analytical precision. The variations originally captured through use of elevation zones as an identifier have been incorporated in FEIS analysis through adjustments to yield tables and economic information.

A second significant revision of analysis area structure has been the removal of allocation zones from the Forest's FORPLAN model. In DEIS analysis, allocation zones served to capture a variety of spatially-dependent outputs and costs. In analysis for the FEIS, these zones have been replaced by a number of model modifications. Chief among these has been the use of prescription controls to assure that spatial relationships are adequately considered in management allocation selection. These controls assure that specified acreages of a particular analysis area will be assigned to a specific prescription or set of prescriptions in a given FORPLAN run, thereby aiding in the attainment of spatial feasibility. The use of prescription controls in FEIS analysis has been greatly facilitated by the data analysis and mapping capabilities of GIS, which generated the prescription control information needed to construct each FORPLAN run.

The primary reason for eliminating allocation zones from the final FORPLAN representation was to reduce the size and complexity of the model. Although they are a useful analytical tool, allocation zones and the allocation choices associated with them require a large proportion of the model's capacity. Because it became feasible to replace these zones with simpler and more straightforward means of modeling spatial relationships (with little sacrifice of analytical precision), removal of allocation zones from the model was specified for FEIS analysis. The following discussion describes the development of analysis areas as it was conducted for FEIS analysis. The changes described above have been incorporated into this discussion.

Delineation of analysis areas is the first major step in constructing a FORPLAN model, and exerts a strong influence on the way other model components are developed. The principal goal of the delineation is to uniquely identify each combination of land characteristics that is different from other combinations in terms of production capability, output values, and/or management costs. Such a goal represents an unreachable ideal--virtually every acre of forest land in distinct in some way.

The key to realistic and useful analysis area delineation is discretion. The Olympic ID team attempted to limit its differentiation to land types having significant differences in the capacity to produce (or the cost or value of producing) issue-related outputs that would vary substantially among plan alternatives. The result was the set of analysis area identifiers outlined in "The Forest Data Base."

The development of land type classifications was influenced by several factors which limited the ID team's ability to represent ground conditions within the FORPLAN model. One of these was data specificity. In many cases, it would have been possible to make finer distinctions than actually occurred if the data regarding production potential, economic variables, or characteristics of the land had been more localized or reliable. No significant sacrifices of accuracy were made as a result of data limitations, but the overall

precision of the formulation could have been enhanced somewhat with improved data. Any opportunity to use more refined data, however, probably would have been negated by the second important limitation influencing FORPLAN development: model size.

The factor which proved to be the principal limitation on the delineation of analysis areas was the need to create a solvable problem. Although the capacity of FORPLAN to analyze reams of data is truly impressive, there are limits to the number of variables it can handle. Including all of the analysis area descriptors considered by the ID team would have exceeded these limits by a large margin. Therefore, some sacrifice of precision was necessary in order to have a workable model.

In reducing the model to a viable size, the team eliminated four potential analysis area delineators that had been included in the original capability area definition: riparian character, slope class, elevation, and erosion hazard. Past experience with FORPLAN runs (using Version I) indicated that the variations associated with these identifiers had a relatively small impact on model solutions. In addition, it was possible to retain the most important features associated with these identifiers by developing averaged coefficients which could be linked to the remaining analysis area delineation. Riparian areas have been carried as a representative proportion of each analysis area, while slope class and erosion hazard information have been translated into an average condition for each drainage. Yield and cost differences associated with elevation have also been converted to average coefficients by drainage or zone. An advantage of eliminating these delineators has been that it helped make possible the inclusion of the 21 major drainages in the analysis area stratification without exceeding model size limits.

A final factor which had the potential to affect model development was the choice of modeling emphasis. Should limited model capacity be used to emphasize homogeneous response units or spatial relationships? This problem was essentially resolved through use of FORPLAN prescription controls to capture essential spatial interactions and analysis area delineation to reflect homogeneity of response. Use of this approach allowed the ID team to develop a well-balanced land categorization that incorporates both modeling considerations efficiently.

In addition to the limitations discussed above, the development of land type classifications was influenced by three primary objectives. The principal goal, of course, was to develop a system of delineations that realistically reflected differences in production, cost, and value relationships. Also important was the need to have specific subunits of the Forest identified geographically, so that output objectives and constraints could be developed for individual areas (the Shelton CSYU, for example). Finally, the value of geographic specificity as a key to generating localized output reports and assessing localized effects was a necessary consideration. The effectiveness of the final land delineation in addressing each of these goals is discussed, by individual objective, in the paragraphs which follow.

RELATIONSHIP OF LAND DELINEATION TO ECONOMIC VALUES AND PRODUCTION FUNCTIONS

Table B-2 displays the relationships between analysis area identifiers and the yields, costs, and values of key Forest outputs. The purpose of the table is to show how the land delineation was developed to reflect important differences in economic factors and/or output production. The table may be read as a series of sentences: "identifier level x responds to the way output y factor z depends on relationship xx". Note that the table covers only those outputs which vary directly with differences in land characteristics. For example, wildlife-related recreation is not included because it is a direct function of elk and deer populations (which are, in turn, functions of land type).

Also worthy of note are the aggregations of level 1 identifiers into Eastside, Westside, and Shelton zones. This definition of zones has been very useful to the ID team throughout the planning process, both in developing the FORPLAN model and in analyses entirely unrelated to FORPLAN. The three zones are

distinct from each other in a variety of ways. Substantial differences in climatic, vegetative, topographic, and socio-economic conditions, as well as variation in the present level of development within each zone, have enabled the team to link several output and effect assessments to these zones. This has been quite helpful in geographically organizing the ID team's analysis of the Forest.

Table B-2. Relationship of Identifiers to Yields, Values, and Costs

Identifier Level	Output	Factor	Relationship
Level 1 - Watershed (the 21 major drainages which make up the Forest)	Sediment	Yield	Because of differing mixes of slope classes and soil types, each drainage has a different rate of sediment production per unit of management activity.
	Fishery Outputs (all)	Yield	Each drainage is unique with respect to: acreage of fish habitat, per-acre productivity of fish habitat, and mix of fishery outputs (resident and anadromous recreation, anadromous commercial catch) per unit of habitat productivity. Therefore, each has distinct production coefficients for each category of fishery outputs.
Aggregates of Level 1:			
Eastside (drainages 1-9)	Road construction & reconstruction	Yield	Topographic features affecting road system density vary considerably by zone, as do the degree of existing system development and the reconstruction needed per unit of timber harvest. Therefore, each zone has distinct coefficients for construction and reconstruction per unit of management activity.
Shelton (drainages 10-13)			
Westside (drainages 14-21)			
		Cost	Factors affecting construction and reconstruction cost vary by zone; each has a distinct unit cost for these activities.
	Timber	Yield	Existing stand characteristics and available silvicultural options are different for each zone. Therefore, yield coefficients vary by zone.
		Cost	A variety of timber management activities (logging included) vary substantially by zone in average unit cost (due to differences in typical terrain, road system development, timber stand characteristics, etc.).
		Value	Average species composition of existing stands varies by zone. Therefore, value per unit of harvest differs from zone to zone.
	Elk & Deer	Yield	Differences in average stand characteristics (especially in existing stands) result in variation by zone in the number of animals per acre which can be supported by the various habitat types.
Level 2 - Land Class (suitable and unsuitable designations)	Timber	Yield	Timber yields can be obtained only from tentatively suitable timberlands. This stratification, therefore, delineates the area to which all timber-related costs, values, and other resource production functions apply.

Identifier Level	Output	Factor	Relationship
Level 3 - Species/ Productivity Class (six species/productivity classes, unroaded and roaded doghair, natural regen)	Road construction	Yield	The "unroaded doghair" identifier within this level is different from the other identifiers in terms of road construction needed per unit of management activity.
	Timber	Yield	The species/productivity class delineation is the primary factor influencing timber growth and yield.
		Cost	A number of timber management activity costs (including logging) vary with species/productivity class differences (particularly natural regeneration areas and doghair).
		Value	Timber values per unit harvested are different for doghair, naturally regenerated stands, and the three species groups.
	Elk & Deer	Yield	Because of its stand characteristics, the "doghair" land class is not considered a producer of elk or deer habitat.
Level 4 - Age Class (the 9 starting age classes of existing stands)	Road construction	Yield	Road construction needs associated with timber harvest are linked to initial stand age. Older seral stages will need new road development before harvest can occur, while those that have been harvested in the past will not.
	Timber	Yield	The time at which yields from existing stands become available depends entirely upon starting age.
		Cost	Some timber management costs, most notably fuel treatment, depend on the current character of the stand (previously unharvested vs. harvested).
		Value	Because of differences in species composition and wood characteristics, timber value varies with current stand age.
	Elk & Deer	Yield	Stand age is the principal variable affecting per-acre carrying capacity of the habitat.
	Old-growth	Yield	Stand age is the principle factor determining whether an existing stand is currently old-growth and, if not, when old-growth status will be reached.
Level 5 - Access (developed or undeveloped)	Road construction	Yield	Undeveloped areas require substantially greater road construction mileages per unit of output than developed areas.
		Cost	Unit costs of road construction are higher in undeveloped areas (due to more difficult terrain, etc.).
	Timber	Cost	Many timber management activities (including logging) have higher costs in undeveloped areas, since long-distance yarding is often necessary. This entails sophisticated logging systems, and makes many activities more costly due to long average distances from roads.
	Unroaded recreation	Yield	Primitive and Semi-Primitive recreation opportunities are essentially limited to currently undeveloped areas.

RELATIONSHIP OF LAND DELINEATION TO REQUIREMENTS OF LAW AND POLICY

In general, legal and policy requirements did not have a great influence on analysis area delineation. There was, however, one notable exception: the Shelton Cooperative Sustained Yield Unit (Shelton CSYU). This Unit was formed in accordance with the Federal Sustained Yield Forest Management Act of 1944, and is governed by a cooperative agreement between Simpson Timber Company and the Forest Service. Under the terms of this agreement, timber harvest from the Shelton CSYU is to be managed as a distinct, self-contained program separate from the remainder of Olympic National Forest harvest. Simpson Timber Company and National Forest lands within the Unit combine to form the base for calculating long-term sustained yield capacity and harvest level. Unit lands neither influence nor are influenced by harvest calculations pertaining to other National Forest land.

Due to the requirement that Shelton CSYU and non-CSYU harvest programs be developed independently, it was critical that Unit lands be distinguished from remaining National Forest land within the model structure. This was accomplished using the level 1 identifiers. Drainages 10, 12, and 13 from level 1 precisely define the National Forest land which lies within the Shelton CSYU. Simpson land, of course, is also uniquely identified within the model. With the lands making up the Shelton CSYU thus segregated, it was possible to develop and analyze separate harvest programs for Unit and non-Unit areas. Separate long-term sustained yield capacity calculations and harvest timing constraints (nondeclining flow or departure) for each area are included. In essence, the Olympic's model was developed to represent what amounts to two distinct Forests, at least with respect to timber harvest calculations, constraints, and outputs.

RELATIONSHIP OF LAND DELINEATION TO GEOGRAPHIC REPORTING NEEDS

In order to facilitate analysis of effects and help tie implementation plans to specific locations, it was desirable that a number of geographic subdivisions be included in land delineation. Level 1 identifiers served to satisfy much of this need. Dividing the Forest into drainages (which could then be aggregated into Ranger Districts and zones) allowed the ID team to link key outputs to geographic locations with enough detail to fill many of the team's analytical requirements and reporting needs. The principal output/geographic locator combinations used in effects analysis and implementation planning were:

1. Fish and wildlife habitat conditions, by both drainage and zone.
2. Sediment output, by both drainage and zone.
3. Timber harvest level, by both District and zone.

DEVELOPMENT OF PRESCRIPTIONS

OVERVIEW

The National Forest Management Act regulations define management prescriptions as "management practices selected and scheduled for application on a specific area to attain multiple use and other goals and objectives" (36 CFR 219.3). Management prescriptions combine a prescription goal, which establishes the purpose of the prescription, with a compatible set of management practices designed to achieve this goal by developing and/or protecting some combination of resources. Prescriptions were constructed within the requirements specified in 36 CFR 219.27. These requirements guide development, analysis, approval, implementation, monitoring, and evaluation of Forest Plans with regard to resource protection, vegetative manipulation, silvicultural practices, riparian areas, soil, water, and diversity.

The process of identifying and subsequently developing management prescriptions started with an ID team review of the ICOs. Prescription goals and associated management practices were developed to address those aspects of the ICOs most closely related to allocation and scheduling decisions. Other aspects of the ICOs did not require prescription development to move toward resolution. Items which could be appropriately addressed through application of uniform standards and guidelines or development of overall management policy were handled through these mechanisms.

The set of management activities which constitutes each FORPLAN prescription was constructed by the ID team through a sequence of prescription development steps. Initially, the team consulted available research covering possible activities which could be used to meet prescriptions goals. This was enhanced by the knowledge and experience of Forest personnel familiar with the effects of given practices. The ID team also evaluated existing policy and legislative direction for guidance in developing management prescriptions. Various stages of the process included involvement of Regional Office and Ranger District personnel, representatives of other government agencies, and interested members of the public. Finally, the management prescriptions resulting from this effort were reviewed by the Forest Management Team.

In addition to addressing issues, concerns, and opportunities, the process of designing management prescriptions was guided by the following criteria: (1) prescriptions should be achievable and contain realistic practices, (2) they should be general enough to accommodate the wide variety of on-the-ground conditions, (3) they should be specific enough to allow development of accurate yield coefficients and economic data, and (4) to the extent practicable, they should reflect the most cost-efficient means of achieving prescription goals.

The set of prescriptions developed by the ID team represents a broad range of resource management emphases, practices, and investment levels. Within the FORPLAN model, these were made available for the broadest possible application to analysis areas, limited only by feasibility of use and the objectives of specific FORPLAN runs. The former limitation applied uniformly to all analysis area/prescription combinations that could not realistically be implemented because of either physical conditions or legal restrictions (e.g. timber harvest in Wilderness). The latter limitation applied only when use of a particular prescription within a given analysis area would be contradictory to the objectives of the alternative being assessed.

One of the primary considerations in the selection of management practices to meet prescription goals was cost-effectiveness. Generally, the objectives associated with individual prescriptions could be met with a wide variety of management activity mixes. In order to keep model size within the limits of FORPLAN's capability, it was often necessary to reduce the number of activity combinations actually modelled. This was accomplished through pre-modeling analysis of the relative cost-effectiveness of alternative prescription packages. Selection of the most efficient mixes of activities through this process, in combination with the maximization of PNV within FORPLAN, served to assure that model solutions represent the most cost-efficient available means of achieving the objectives of a given alternative. The cost-efficiency analysis associated with the development of timber management prescriptions is discussed in the following section of this appendix ("Development of Timber Options").

Corollary to the construction of prescriptions was the development of standards and guidelines governing their implementation. There are several levels of standards and guidelines, from the usually broad and general direction included in laws to very specific guidance covering the application of an individual practice to a unique parcel of land. The standards and guidelines developed to guide implementation of the Forest Plan fall into two groups: those associated directly with the application of FORPLAN prescriptions, and those relating to practices to be applied uniformly in all land management alternatives (such as protection of cultural resources). Both varieties of standards and guidelines are fully listed in Chapter IV of the Forest Plan. In addition, those standards and guidelines having a direct bearing on the modeling of FORPLAN prescriptions and their outputs are discussed in the ensuing presentation of individual prescription goals and emphases.

In developing prescriptions for FORPLAN, the ID team concluded that the most efficient way to approach issue-related outputs was to treat them as functions of vegetative management. On the Olympic National Forest, the outputs and effects of greatest concern are closely correlated to timber harvest and the activities associated therewith. Some outputs can be realized only if harvest does not occur, others require modification of customary harvest regimes, and still others depend directly on harvest. Therefore, the prescriptions used by this Forest can be divided into three broad groupings: those in which harvest is precluded, those specifying modified harvest, and those including standard harvest management practices. Detail regarding individual linkages of prescriptions to analysis areas may be found in the planning records on file at the Forest Supervisor's Office.

MINIMUM LEVEL PRESCRIPTIONS

Prescriptions specifying minimum level management are synonymous with the "no timber harvest" management strategy. Within the FORPLAN model, there is only one minimum level prescription, but its application can serve a wide range of management goals. It is the only prescription available for areas which are not tentatively suitable for timber management, including both areas unsuitable because of land characteristics and areas administratively withdrawn. It is the only prescription capable of providing outputs which depend on the absence of timber harvest: unroaded recreation opportunity and maintenance of existing unroaded areas, protection of dedicated wildlife habitat, and protection of other areas in which harvest would be in contradiction with management goals. Finally, it is the prescription to which areas are allocated if they are determined to be unsuitable for timber harvest in the context of the objectives of a given FORPLAN run.

The minimum level prescription is available for selection on all analysis areas in all FORPLAN runs. This assures that the model has the opportunity to select the "no harvest" prescription for any area that would be unsuitable for harvest in the context of each run. Where the goals of a benchmark or alternative include site-specific outputs dependent on the absence of harvest, the minimum level prescription is fixed into solution for the areas involved. The various management objectives associated with the minimum level prescription are discussed individually below.

Basic Minimum Level Prescription

Purpose: To provide a "no harvest" prescription for areas unsuitable for timber harvest in the context of overall run objectives. Also provides a prescription that can meet the requirements of a variety of possible run objectives, such as "retain existing old-growth".

Standards, Guidelines, and Modeling Assumptions: This is the only minimum level prescription for which the FORPLAN model was given complete discretion regarding allocation. Any areas determined to be unsuitable for timber harvest are allocated to this prescription, including areas selected for management without timber harvest in order to achieve specific output objectives.

Spotted Owl Habitat Area (SOHA) Prescription

Purpose: To preserve selected areas of habitat for the northern spotted owl and other wildlife species dependent upon similar habitat associations.

Standards, Guidelines, and Modeling Assumptions: Areas allocated to this use are to remain unharvested. To the extent possible, they should consist of old-growth stands (although distribution requirements make use of younger stands necessary in some cases). Number and size of SOHAs is fully specified for each

run; a minimum of 30 SOHAs of 3000 acres each is currently felt to be necessary to maintain population viability on this Forest. The distribution of SOHAs across the Forest must be designed to accommodate breeding requirements.

Mature Forest Habitat Prescription

Purpose: To provide selected areas of habitat for the pileated woodpecker, pine marten, and other wildlife species with similar habitat requirements.

Standards, Guidelines, and Modeling Assumptions: Areas allocated to this use are to remain unharvested. To the extent possible, they should consist of stands whose overstory averages at least 21" in diameter (although distribution requirements make use of smaller stands necessary in some cases). A minimum of 56 areas of 600 acres each (of which only 300 acres must be in mature forest habitat and remain unharvested) and 155 areas of 160 acres each is currently felt to be necessary to maintain the viability of pileated woodpecker and pine marten populations respectively. Multiple habitat requirements may be met by the same area (e.g. a pine marten area within a pileated woodpecker area within a SOHA). The distribution of mature forest habitat areas across the Forest must be designed to accommodate breeding requirements.

Bald Eagle Habitat Prescription

Purpose: To protect selected nest sites and wintering areas for the bald eagle.

Standards, Guidelines, and Modeling Assumptions: Areas allocated to this use are to remain unharvested. In general, they should consist of stands of three or four layers. Sixteen areas of 64 acres each have been identified; these are constant across all alternatives.

"Not Tentatively Suitable for Timber Harvest" Prescription

Purpose: To provide a minimum level prescription covering Wilderness, the Quinault Research Natural Area, and areas whose physical characteristics preclude timber harvest (nonforest, unregenerable, etc.).

Standards, Guidelines, and Modeling Assumptions: In all runs, this is the only prescription available for these areas. Outputs, etc. are the same in all benchmarks and alternatives. Specific management direction for each area has been developed; standards and guidelines associated with this may be found in Forest Plan Chapter IV.

Unroaded Recreation Opportunity Prescription

Purpose: To retain currently undeveloped areas in a condition capable of providing Primitive or Semi-Primitive recreation experiences.

Standards, Guidelines, and Modeling Assumptions: Areas assigned to this prescription are to remain unharvested and unroaded. Acreage allocated in each run varies with run objectives. Acreage providing the desired output is defined by both distance from roads and absence of harvest.

Unroaded Area Protection Prescription

Purpose: To assure retention of existing unroaded area characteristics within any of the unroaded areas discussed in Appendix C of this FEIS.

Standards, Guidelines, and Modeling Assumptions: Areas assigned to this prescription are to remain unharvested and unroaded. Allocation of specific areas varies with run objectives. Most areas subject to this prescription also provide unroaded recreation opportunity, but the overlap is not total.

Special Management River Corridor Protection Prescription

Purpose: To maintain scenic, recreational, and fish and wildlife habitat values along river corridors allocated to this prescription.

Standards, Guidelines, and Modeling Assumptions: Portions of the river corridors allocated to this prescription can meet the above objectives in the context of a modified timber harvest program (see "Modified Timber Harvest Prescriptions" below). In some areas, however, harvest must be precluded if the prescription goal is to be attained. The river corridors allocated to this management strategy have essentially the same objectives as potential Wild and Scenic Rivers to be managed for the "Wild" classification. The characteristics needed to attain these objectives can be retained only if harvest is precluded within the one-eighth-mile wide corridor on either side of the river in question.

MODIFIED TIMBER HARVEST PRESCRIPTIONS

The modified timber harvest prescriptions developed for the FORPLAN model were used to provide outputs requiring limitations on timber harvest: scenic quality, protection of potential Wild and Scenic River corridors, and protection of river corridors allocated to special management. Modifications associated with these prescriptions include reduced yields from timber harvest and controls on the proportion of allocated acreage to be harvested in a given time period. The basic modified harvest prescriptions developed for use in FORPLAN involved linking standard timber management prescriptions to yield tables reflecting a 20 percent reduction in harvest volume. This reduction, in combination with limitations on the proportion of each area available for harvest per decade, served to represent the projected effects of achieving management goals within allocations specifying attainment of Retention/Partial Retention Visual Quality Objectives and within recommended Wild and Scenic River corridors and other river corridors to receive special management.

With some exceptions due to model size limits, modified harvest prescriptions were available for selection on all tentatively suitable analysis areas in all runs. This allowed the model to allocate areas to these prescriptions if doing so increased PNV. Where the goals of a benchmark or alternative include site-specific outputs dependent upon modified harvest, the appropriate prescription is fixed into solution for the areas involved. The various management objectives associated with the modified harvest prescriptions are discussed individually below.

Foreground Retention Prescription

Purpose: To assure the attainment of the "Retention" Visual Quality Objective within the foreground of the seen area.

Standards, Guidelines, and Modeling Assumptions: To meet this Visual Quality Objective, it is necessary to have, at all times, a minimum of 30 percent of the seen area in stands 30" or greater in diameter. In addition, it is necessary to limit harvest per decade to no more than 5 percent of the seen area. In FORPLAN, these requirements have been combined with the requirements of the two remaining Retention/ Partial Retention prescriptions (see below). An average timber yield reduction of 20 percent and a harvest proportion limitation of 10 percent per decade are used to represent the combined effect of application of all three prescriptions as needed to reach the desired level of Visual Quality Objective attainment.

Middleground Retention and Foreground Partial Retention Prescription

Purpose: To assure the attainment of the "Retention" Visual Quality Objective within the middleground of the seen area or the "Partial Retention" objective in the foreground.

Specific Standards and Guidelines: To meet these Visual Quality Objectives, it is necessary to have, at all times, a minimum of 30 percent of the seen area in stands 21" or greater in diameter. In addition, it is necessary to limit harvest per decade to no more than 9 percent of the seen area. See above discussion of the Foreground Retention prescription for detail regarding the FORPLAN modeling of these requirements.

Background Retention/Partial Retention, Middleground Partial Retention Prescription

Purpose: To assure the attainment of the "Retention" Visual Quality Objective within the background of the seen area or the "Partial Retention" objective in the middleground or background.

Specific Standards and Guidelines: To meet these Visual Quality Objectives, it is necessary to have, at all times, a minimum of 30 percent of the seen area in stands 11" or greater in diameter. It is also necessary to limit harvest per decade to no more than 12 percent of the seen area. See above discussion of the Foreground Retention prescription for detail regarding the FORPLAN modeling of these requirements.

Potential Wild and Scenic River Corridor Protection Prescription

Purpose: To retain the characteristics which qualify a given river corridor for inclusion in the Wild and Scenic River System.

Standards, Guidelines, and Modeling Assumptions: This objective can be accomplished through use of the Middleground Retention/Foreground Partial Retention prescription described above. The potential Wild and Scenic River corridors on the Forest that include land tentatively suitable for timber harvest have the potential for either "Scenic" or "Recreation" classification. The characteristics needed to qualify for either of these designations can be retained if Middleground Retention/Foreground Partial Retention standards and guidelines are followed within the quarter-mile wide corridor on either side of the river in question. Therefore, in terms of model formulation, this prescription and the Middleground Retention/Foreground Partial Retention prescription are identical. Prescription effects are modelled using an average timber yield reduction of 20 percent and a harvest proportion limitation of 10 percent per decade.

Special Management River Corridor Protection Prescription

Purpose: To maintain scenic, recreational, and fish and wildlife habitat values, while managing for a reduced level of timber production, along river corridors allocated to this prescription.

Standards, Guidelines, and Modeling Assumptions: This objective can be accomplished through use of the Potential Wild and Scenic River Corridor Protection prescription described above. The river corridors allocated to this management strategy have essentially the same objectives as potential Wild and Scenic Rivers to be managed for either the "Scenic" or "Recreation" classification. These objectives can be met for river corridors if the Potential Wild and Scenic River Corridor Protection prescription is applied within the one-eighth-mile wide corridor on either side of the river in question.

STANDARD HARVEST MANAGEMENT PRESCRIPTIONS

The primary objective of the standard harvest management prescriptions is timber production. This set of prescriptions incorporates the range of timber management regimes available for use when objectives for other resource outputs do not preclude or limit timber harvest. It includes the full spectrum of silvicultural options that can be used successfully on the Forest: planting, precommercial thinning, commercial thinning, fertilization, use of genetically improved stock, and regeneration harvest. The mix of these treatments that can be applied to a particular analysis area depends on the characteristics of that area. Some analysis areas can accommodate a wide range of treatments with equal success, while others have features that severely limit timber management options.

Every analysis area that is tentatively suitable for timber production is linked to at least one (and usually four or five) standard harvest management prescription(s) in the FORPLAN model. Unless harvest is precluded or must be modified in order to meet the objectives of a specific run, the model allocates analysis areas to the mix of standard harvest regimes that is most effective in meeting run objectives. If no harvest prescription is cost-efficient, minimum level is selected. For most analysis areas, the set of available harvest options includes the regimes and yields associated with the modified timber harvest prescriptions.

In addition to the primary objective of timber production, these prescriptions include the objective of meeting the basic Management Requirement (MR) specifications necessitated by the provisions of NFMA regulations. Two of the means of meeting MRs are modelled using reductions in timber yield tables: the riparian area/water quality MR and the dead and defective tree habitat MR. In all alternatives, and in benchmark runs in which application of MRs is specified, timber yield tables adjusted for MR attainment are linked to the "Standard Harvest" prescriptions. In benchmarks analyzed without MRs, timber yield tables without these adjustments are used to represent prescription outputs.

Prescriptions for Plantable Lands (Conventional Logging Systems)

Purpose: To represent the full range of timber management options available on lands which (a) can be planted, and (b) do not require sophisticated logging systems to harvest.

Standards, Guidelines, and Modeling Assumptions: All tentatively suitable analysis areas which are plantable and do not require sophisticated logging systems are in this category. On such lands, the full range of silvicultural options could be applied. However, pre-FORPLAN analysis of potential harvest regimes indicated that some options could be excluded in specific areas without sacrificing cost-efficiency. As a result of this analysis, and in the interest of staying within model size limits, the following limitations were applied to development of FORPLAN prescriptions emphasizing timber production from these analysis areas (see also "Development of Timber Options"):

1. It is assumed that all plantable lands will be reforested by planting; natural regeneration is not included in FORPLAN timber management options.

2. Precommercial thinning is included in prescriptions for all analysis areas. All analysis areas also have at least one prescription that does not include precommercial thinning.

3. The choice between commercial thinning and not commercial thinning is available only for Douglas-fir analysis areas. All Douglas-fir areas have a commercial thinning prescription available. Thinning regimes consist of two or three intermediate harvests, depending on productivity class.

4. Fertilization is included as an option only on Douglas-fir analysis areas 0'-1500' in elevation within drainages 1-10 (the eastern portion of the Forest). All such analysis areas have both fertilization and non-fertilization prescriptions available.

5. Planting of genetically improved stock is limited to Douglas-fir analysis areas 1500'-3000' in elevation within drainages 11-21 (the western portion of the Forest). Within these analysis areas, it is assumed that improved stock will be used (there is no prescription including standard stock).

6. All prescriptions specify clearcutting as the regeneration harvest method to be used.

Prescriptions for Lands Requiring Natural Regeneration

Purpose: To represent the timber management options available on the roughly 7,000 acres of tentatively suitable timberland that cannot be successfully reforested by planting.

Standards, Guidelines, and Modeling Assumptions: Only one standard harvest prescription is available for analysis areas requiring natural regeneration. Because of slow growth, predominance of low-value species, and lack of responsiveness to silvicultural treatment, intermediate activities (such as precommercial and commercial thinnings) involve management costs in excess of potential returns in these areas. Therefore, there are no treatment options other than regeneration/final harvest included in natural regeneration prescriptions.

It is expected that, on average, harvest units to be naturally restocked will be a maximum of 10 acres in size and no wider than 330' in order to assure successful regeneration. It is also expected that interplanting will be necessary on most units in order to reach adequate stocking levels. These assumptions are reflected within FORPLAN in the costs associated with natural regeneration prescriptions.

Prescriptions for Lands Requiring Sophisticated Logging Systems

Purpose: For some of the lands within undeveloped analysis areas, the use of long-span skyline or helicopter yarding systems is more cost-effective than the combination of access road construction and conventional yarding. On such land, both logging cost and timber management costs are higher than in areas to be harvested with conventional yarding systems. These prescriptions were developed to represent management options within such areas. It should be pointed out that, in some cases, the management objectives of a particular alternative (rather than land characteristics alone) make use of sophisticated systems necessary.

Standards, Guidelines, and Modeling Assumptions: Where site-specific analyses of logging system requirements have revealed the need for sophisticated logging systems, two separate prescription types ("skyline" and "helicopter") have been used. The "skyline" prescription includes cable systems with yarding distances over 3000', multi-span situations, and balloon yarding. "Helicopter" applies to areas in which helicopter yarding is most appropriate. FORPLAN economic data includes the higher logging and management costs associated with these systems.

The silvicultural options available in these prescriptions are identical to those associated with conventional yarding systems, with two exceptions. There are no commercial thinning prescriptions or fertilization prescriptions available within areas requiring sophisticated systems. Because these systems involve long average yarding distances and limited road access, commercial thinning would be impractical and is therefore not included as an option. The added cost of fertilization in such areas is not economically justified by the returns it generates, thus making this treatment impractical as well.

DEVELOPMENT OF TIMBER OPTIONS

The purpose of this discussion is to describe the ID team's selection, from a virtually infinite set of possibilities, of the timber management options to be included in the FORPLAN model. The process used to accomplish this task was designed to identify timber prescriptions which best met three primary goals: attainment of management objectives, cost-efficiency, and a high level of timber output. This process consisted of a series of eight sequential steps. At each step, a full range of possibilities was considered and assessed, and those management strategies which proved to be less effective, efficient, or productive were dropped from consideration. By thus eliminating numerous less effective options at each step in the process, the ID team was able to narrow the range of possibilities to a workable number of timber options for FORPLAN analysis. The options that survived were, for each combination of land characteristics and timber management regime, those which had proven themselves most effective in meeting the goals listed above.

In DEIS analysis, timber yield table development for all managed stands was conducted through use of the DFSIM and DP/DFSIM yield models. For FEIS analysis, Arney's Stand Projection System (SPS) was used to generate managed yield tables for Western hemlock and silver fir stands, while DFSIM and DP/DFSIM were used for Douglas-fir stands. SPS was chosen for hemlock and silver fir analysis because it was designed specifically for these species, and provides a more precise method for projecting their growth responses. The following discussion describes timber option development as it was conducted for FEIS analysis.

The eight steps followed by the ID team in selecting timber options for FORPLAN analysis were as follows:

1. Identification of the management objectives for which vegetative manipulation (or its absence) is a key factor in accomplishment.

2. Selection of the basic timber management strategy (evenaged management, unevenaged management, or a combination of the two).

3. Selection of regeneration harvest strategy (clearcut, shelterwood, seed tree, etc.).

4. Development of silvicultural treatment options (commercial thinning, fertilization, etc.).

5. Development of yield projections and analysis of alternative schedules for harvest regimes involving uncomplicated options for timing, frequency, and intensity of silvicultural treatment (DFSIM and SPS analysis).

6. Development of yield projections and analysis of alternative schedules for harvest regimes involving complex options for timing, frequency, and intensity of silvicultural treatment (DP/DFSIM analysis).

7. Selection (from among those identified in steps 5 and 6) of the harvest regimes to be included in FORPLAN analysis.

8. Definition, for each prescription to be included in FORPLAN, of the range of regeneration harvest timing choices to be tested by the model.

Each of these steps is discussed individually in the following paragraphs. Detail regarding the analysis associated with each step and the results thereof may be found in the process records on file at the Forest Supervisor's Office.

The process steps detailed below are discussed in terms of their role in the development of timber options for National Forest lands only. It should be noted that essentially the same approach was used in generating FORPLAN options for Simpson Timber Company land. While Simpson's yield tables and evaluations of cost-efficiency were based on inventory data and economic information pertaining to company land and operations, the basic analytical tools and procedures were the same as those used by the Forest. The development of harvest regimes and yield projections for Simpson land was conducted by the company and verified by Forest timber management personnel. The final set of timber options to be included in FORPLAN was developed by the Forest ID team and approved by Simpson representatives.

The timber management options and prescriptions used in the development of Alternative NC-No Change potential yield estimates consisted of the set of management prescriptions applied in each of the current timber management plans. The specific yield assumptions and relationships applied in these plans are too complex and variable to examine in detail in this document, and are available for review in each plan (on file at the Forest Supervisor's Office). In general, the prescriptions used in potential yield calculations emphasized maximization of timber production. In addition, most included application of commercial thinning regimes at more intensive levels than is presently considered to be economically feasible.

IDENTIFICATION OF TIMBER-RELATED MANAGEMENT OBJECTIVES

The relationship of management objectives to timber prescriptions is discussed in detail in the preceding section ("Development of Prescriptions"). The key categories of management objectives which strongly influence timber harvest options can be summarized as follows:

1. The group of management objectives best accomplished by precluding timber harvest. Included are retention of old-growth habitat, maintenance of unroaded recreation opportunity, etc.

2. The group of management objectives best accomplished by use of modified timber harvest regimes (attainment of Visual Quality Objectives, Wild and Scenic River corridor protection, river corridor management).

3. The group of management objectives compatible with standard timber management regimes, primarily timber production emphasis and emphasis on contribution to PNV.

Any timber management option not responsive to one of the above categories of objectives would be inappropriate for continued consideration in the analysis process.

SELECTION OF BASIC TIMBER MANAGEMENT STRATEGY

This step is discussed in detail in Appendix G of this document. Analysis of available options led to the conclusion that, for both economic and practical reasons, use of evenaged management regimes exclusively is the most appropriate strategy on this Forest. While the application of unevenaged regimes is not precluded, and may be prescribed for individual areas when site-specific study so indicates, timber options to be evaluated through FORPLAN analysis have been limited to evenaged management systems.

SELECTION OF REGENERATION HARVEST STRATEGY

This step focused on the selection of the final harvest strategy to be applied in conjunction with evenaged management regimes. Three principal alternatives were considered: clearcut, shelterwood, and seed tree harvest systems. Of these, clearcutting was determined to be the optimum means of achieving management objectives on all Forest land types. Therefore, timber management options included in FORPLAN analysis were all based on use of clearcutting as the regeneration harvest strategy.

There are three primary reasons for the preferability of clearcutting on the Olympic National Forest. The first is its economic advantage relative to alternative methods. Because damage to residual trees within harvest units is not a consideration with clearcutting, the costs of both logging and slash treatment are generally lower than those associated with other methods. In addition, the discounted value of harvested timber is greater when clearcutting is employed, since the existing mature stand is harvested in its entirety in one entry rather than in two or more stages. While these advantages are offset to some extent by the generally lower reforestation costs of the shelterwood and seed tree systems, the net economic advantage of clearcutting remains.

The second principal advantage of clearcutting is that where reforestation by artificial means (primarily planting) is feasible, regenerated stands usually become established more quickly and begin rapid growth sooner. Shelterwood involves at least some damage to the regenerated stand when shelter trees are removed, and the seed tree method results in slower reforestation and increased potential for an undesirable species mix. Clearcutting generally results in somewhat faster early growth and greater long-term timber output than alternative methods.

The third advantage of clearcutting relates to the risks associated with its use as opposed to those entailed in the use of other methods. Clearcutting involves a greater risk of occasional unsuccessful reforestation than do the alternative methods. This is more than offset, however, by risks associated with wind damage to residual stands when shelterwood or seed tree systems are employed. The Forest in general is quite susceptible to windthrow problems, particularly in areas in which shelterwood or seed tree methods could have the greatest advantage: lands requiring natural reforestation. When a high proportion of a given residual stand is lost to wind damage, the effect is essentially that of clearcutting (but with much higher overall management costs and longer reforestation delay). Therefore, on balance, clearcutting generally involves a more acceptable set of risks than do the alternative regeneration harvest methods.

Because of its advantages, clearcutting is the only regeneration harvest system employed in FORPLAN prescriptions. Where necessitated by either land features or management goals, limitations on clearcut unit size, shape, and/or entry timing have been developed and modelled. The use of such limitations to assure attainment of management objectives has been determined to be preferable to changes in harvest technique. The use of alternative methods during Plan implementation, however, is not precluded and may be prescribed on the basis of site-specific analysis.

DEVELOPMENT OF SILVICULTURAL TREATMENT OPTIONS

Included in this step was the selection of the silvicultural treatments which could be advantageously applied on the Olympic National Forest. Potential treatments associated with evenaged management and regeneration harvest by clearcutting were evaluated. Those identified as having the capacity to contribute significantly to either PNV or timber production (or both) were carried forward for detailed analysis (steps 5 and 6) and possible inclusion in FORPLAN prescriptions. Treatments meeting this criterion are as follows:

1. Reforestation through use of planted stock - applicable on all lands except those requiring natural regeneration.

2. Reforestation through use of natural seeding - applicable on all lands.

3. Reforestation through planting of genetically superior stock. This treatment is applicable only within Douglas-fir areas in drainages 11-21 (western portion of the Forest) between 1500' and 3000' elevation, as this is the only area for which such stock is presently available.

4. Control of stocking level through precommercial thinning - applicable on all lands.

5. Acceleration of stand growth through use of fertilizer. This treatment is applicable only within Douglas-fir areas in drainages 1-10 (eastern portion of the Forest) between sea level and 1500' elevation. Analysis of Forest experience shows this to be the only area in which gains resulting from fertilization have been demonstrated to be reliable and economically justifiable.

6. Acceleration of residual stand growth through use of commercial thinning - applicable on all Douglas-fir areas accessible to use of conventional logging systems. Residual stands of silver fir and hemlock are subject to severe damage as a result of commercial thinning, and also demonstrate a relatively low growth response to this treatment. The commercial thinning option, therefore, has not been included for such stands.

Other treatments, such as brush control to release suppressed stands, receive only occasional application on the Forest and were thus not considered to be sufficiently important to warrant inclusion in the analysis of timber options. Measures designed to protect silvicultural investments, such as animal damage control in newly established stands, are considered to be integral components of the treatments with which they are associated. The costs and effects of such measures are included in the basic treatment data used in development and analysis of timber management prescriptions.

ANALYSIS OF UNCOMPLICATED SILVICULTURAL TREATMENT OPTIONS

Once basic harvest strategies and potential treatment types were identified, it was possible to begin analysis of the relative effectiveness of various mixes of treatments in meeting management objectives. The first step of this process consisted of a comparative assessment of treatment mixes involving combinations of reforestation, precommercial thinning (PCT), and clearcut harvest only. The reason for developing this analysis first is that the alternatives for timing, frequency, and intensity of these treatments are fairly uncomplicated, at least when compared with the alternatives available for commercial thinning and fertilization. By starting at this point, the ID team hoped to eliminate some of the less complex treatment combinations from further consideration, thereby simplifying subsequent analyses.

The initial phase of this comparison was the development of timber yield tables for each combination of treatments on the land types to which they had been determined applicable (see preceding section). The variables which served as the basis for yield estimation were as follows:

1. Treatment options	Plant / PCT / Final Harvest (FH) Plant / No PCT / FH Genetic Stock / PCT / FH Genetic Stock / No PCT / FH Natural Regen / PCT / FH Natural Regen / No PCT / FH
2. Land types	Level Three Identifiers: Productivity class 2 Douglas-fir Productivity class 3 Douglas-fir

Productivity class 2 silver fir
Productivity class 3 silver fir
Productivity class 1 Western hemlock
Productivity class 2 Western hemlock
Productivity Class 3, Natural Regen (NR)
Doghair (roaded and unroaded)

Level Four Identifiers:
Ages 10-30 (managed yield tables)
Ages 40-70 (empirical yield tables)
Small Saw (empirical yield tables)
Large Saw (empirical yield tables)

Level One Aggregates (associated with variations in empirical yield tables only):
Eastside
Shelton
Westside

Empirical yield projections were developed for existing timber stands which had not been subject to full stocking level control from inception (ages 40-70, small saw, large saw). An "empirical" yield table is one based on projection of continued growth from a starting point (current condition) determined from stand inventory data. The Forest's empirical yield projections were based on data from the 1973-74 timber inventory and a yield projection methodology developed by John Teply (Regional Office, Region 6). Refer to "*The Development and Projection of Standing Yield Tables, Region 6*" (J. L. Teply, October 6, 1976) for a description of this methodology.

Managed yield projections were developed for stands subject to full stocking level control (ages 10-30 and all regenerated stands). These were generated through use of the DFSIM (Douglas-fir Simulation) model for Douglas-fir and the SPS (Stand Projection System) model for silver fir and Western hemlock. Refer to "*A New Stand Simulator for Coast Douglas-fir: DFSIM User's Guide*" (Robert O. Curtis et al, USDA Forest Service, 1981) for detail regarding DFSIM. This model, which is based on data gathered from experienced growth responses in fully managed Douglas-fir stands, projects the growth which will result from variations in productivity and treatment patterns and intensities. Its basic function is to predict, for a given site productivity, the timber volumes that will be available through time as a result of variations in silvicultural treatment. The same basic objectives apply to Arney's SPS model, which is designed specifically to predict silver fir/hemlock responses.

The results of the yield table development process were analyzed, in terms of both PNV and timber growth responses, to determine what treatment options could reasonably be dropped from further assessment. This analysis yielded three important results:

1. The optimum age for precommercial thinning was established (by DFSIM and SPS analysis) for each species/productivity class combination. These range from a low of 10 years for productivity class 2 Douglas-fir to a high of 18 years for productivity class 3 silver fir. Optimum residual stand density was determined to be 300 trees per acre.

2. Planting of genetically improved stock, where applicable, was found to be superior (both economically and in terms of timber production) to use of standard stock. This was due primarily to the combination of low variable cost and volume gain associated with improved stock. The volume increase over standard stock is now estimated to be 5 percent, down substantially from the 15 percent gain projected for DEIS analysis.

3. Planting of any kind, where applicable, was found to be superior (both economically and in terms of timber production) to natural regeneration. This was due primarily to the combination of higher logging costs and reduced volume outputs associated with natural reforestation.

The second and third conclusions were particularly valuable in reducing the complexity of subsequent analysis, as they allowed reforestation strategies to be firmly established for all land types and prescriptions. The ID team concluded that, since both economic and production criteria were best met by the more intensive reforestation strategies, each land type should be reforested through the most sophisticated applicable means. No other options need be considered further.

ANALYSIS OF COMPLEX SILVICULTURAL TREATMENT OPTIONS

This step of the timber option development process consisted of analysis of alternative regimes involving commercial thinning and/or fertilization. These treatments are considered to be "complex" because each has a wide range of potential combinations of treatment timing, frequency, and intensity. For example, commercial thinning in a given stand could be initiated at a variety of different ages, could entail a number of different subsequent entries for each initiation age, and could involve a wide range of removal volumes for each entry pattern. Adequate analysis of such a wide range of possibilities is necessarily a rigorous and complicated process.

Analysis of commercial thinning and fertilization options was facilitated by the DP/DFSIM (Dynamic Programming/DFSIM) computer model developed by Norman Johnson and Kathy E. Sleavin of Colorado State University. This system combines the growth prediction features of DFSIM with the ability to assess both the economic and timber production consequences of differing timing, frequency, and intensity mixes. For a given set of land characteristics and silvicultural treatments, DP/DFSIM analysis provides both the timber output through time and the soil expectation values (SEV) associated with potential mixes of timing, frequency, and intensity.

DP/DFSIM analysis was conducted, for both commercial thinning and (where applicable) fertilization, for both productivity classes of Douglas-fir and for both the "PCT" and "no PCT" treatment options. In the case of existing small saw stands, the analysis was varied by zone (Eastside, Shelton, Westside) as well. For these stands, initial stand condition was defined by empirical data, with DP/DFSIM projecting the growth and economic consequences resulting from alternative treatment patterns. Yields for stand ages 10-30 and all regenerated stands were based on fully managed conditions; large saw stands were not included in this analysis, since neither commercial thinning nor fertilization would be appropriate. A real stumpage price trend of one percent (the same as that used in FORPLAN analysis - see "Economic Analysis") was used in DP/DFSIM analysis).

Once the DP/DFSIM runs were completed, the ID team selected the commercial thinning and fertilization regimes which would be carried forward into the next step of the timber option analysis. The goal of this selection process was to identify, for each set of land and treatment variables analyzed, one commercial thinning strategy and (as appropriate) one fertilization strategy for use in later analyses. Two principal criteria were used in making these selections: soil expectation value and timber volume output. In many cases, the regime with the highest SEV also provided the greatest total harvest volume, thus making selection straightforward. When economic and production optima were represented by different regimes, a regime reflecting a balanced mix of SEV and production potential (not necessarily either of the optimal regimes) was chosen. The tradeoffs in both volume and economic return associated with selection of these "compromise" regimes were small in all cases.

SELECTION OF HARVEST REGIMES FOR FORPLAN ANALYSIS

The analyses described above yielded, in essence, one management regime (and timber yield table) for each viable mix of silvicultural treatments on each combination of land characteristics for which development of distinct treatment packages or yield estimates was needed. The resulting set of timber options, while narrowed considerably from the original array of possible choices, was still too cumbersome to fully incorporate in the FORPLAN analysis without exceeding model size limitations. Therefore, further elimination of treatment options was necessary.

The array of treatment options was reduced to workable size by eliminating those regimes which showed neither economic advantage nor superior timber production capacity when compared to other regimes applicable to the same land type and management objective. Since the principal objective functions used in FORPLAN runs would be "maximize PNV" and "maximize timber production", this approach involved little risk of deleting a regime that would be selected by the model in any run. The set of options which survived this reduction process was further narrowed when analysis of preliminary benchmark runs showed that a few of the available choices had virtually no chance of being selected.

The final set of timber options available for FORPLAN analysis is displayed in Table B-3. In order to fully understand this table and its relationship to the actual analysis, it is necessary that several factors concerning land types, prescriptions, and treatment option applicability be kept in mind. These are as follows:

- Each line of the table is associated with unique timber yield tables developed specifically for each of the species/productivity classes listed in combination with the zone and treatment option shown. For example, the FH treatment option for large saw within the East/West zones has a separate yield table for each of the seven possible species/productivity classes.

- Each of the options shown for managed Douglas-fir stands actually represents two options and yield tables: planting of genetically superior stock where applicable, and planting of standard stock elsewhere.

- Fertilization options are available only within drainages 1-10 below 1500' elevation.

- There is a "no harvest" prescription available for all analysis areas in all runs.

- Modified harvest prescriptions are available for most analysis areas, regardless of management objective. When objectives specify modified harvest, only the appropriate treatment options are made available.

- Options involving commercial thinning are not available where sophisticated logging systems are needed.

- Commercial thinning options involving two or three thinning entries include the possibility of final harvest prior to the final thinning entry.

- After final harvest, existing doghair stands are treated as productivity class 3 regenerated Douglas-fir stands.

- Existing managed stands (ages 10-30) are assumed to have been reforested with the appropriate stock.

- Components of treatment options in Table B-3 are abbreviated as follows:

  P - Plant (either standard or genetically superior stock)
  RN - Reforest through natural regeneration
  PCT - Precommercial thinning
  F - Fertilize (preceded by number of applications, e.g. 1F)
  CT - Commercial thinning (preceded by number of entries, e.g. 2CT)
  RY - Reduced yield final harvest; treatment option as a whole is applicable only to modified harvest prescriptions
  FH - Normal yield final harvest; treatment option as a whole is applicable only to normal harvest prescriptions

- Species/productivity class combinations are abbreviated as follows:

  DF2 - Productivity class 2 Douglas-fir
  DF3 - Productivity class 3 Douglas-fir
  SF2 - Productivity class 2 silver fir
  SF3 - Productivity class 3 silver fir
  WH1 - Productivity class 1 Western hemlock
  WH2 - Productivity class 2 Western hemlock
  NR - Natural regen (all species)

Table B-3. Timber Options for FORPLAN Analysis

Age Class	Species/Productivity	Zone	Treatment Options
Large Saw	All	East/West	FH RY
	All	Shelton	FH RY
Small Saw	DF2	East/West	FH RY 1CT-FH 1F-1CT-FH
		Shelton	FH
	All but DF2	East/West	FH RY
		Shelton	FH RY
Doghair	Doghair	All	FH RY
40-70	All	All	FH RY

Age Class	Species/Productivity	Zone	Treatment Options
30	DF2	All	FH RY 1F-FH 3CT-FH 1F-3CT-FH
	All but DF2	All	FH RY
10-20	DF2	All	FH RY PCT-FH PCT-RY 1F-FH PCT-1F-FH PCT-3CT-FH PCT-1F-3CT-FH
	NR	All	FH RY
	All but DF2, NR	All	FH RY PCT-FH PCT-RY
All Regen Stands	DF2	All	P-FH P-RY P-PCT-FH P-PCT-RY P-1F-FH P-PCT-1F-FH P-PCT-3CT-FH P-PCT-1F-3CT-FH
	DF3	All	P-FH P-RY P-PCT-FH P-PCT-RY P-1F-FH P-PCT-1F-FH P-PCT-2CT-FH P-PCT-1F-2CT-FH
	NR	All	RN-FH RN-RY
	SF2,SF3,WH1,WH2	All	P-FH P-RY P-PCT-FH P-PCT-RY

All of the Douglas-fir managed yield tables referenced by the above prescription linkages include an adjustment for operational falldown equal to 10 percent of the theoretical maximum timber volume calculated by the yield models used. This falldown accounts for natural and operational losses such as openings

in timber stands, random excessive mortality (fire, insect and disease, etc.), timber defect, and breakage during harvest operations. Use of 10 percent for operational falldown is based on local estimates.

Operational falldown for Western hemlock and silver fir was included in managed yield tables via adjustments for assumed "holes" in typical managed stands. A .85 "clumpiness" factor was used in the SPS model to represent this falldown. This is roughly equivalent to the 10 percent reduction used in DFSIM modeling for Douglas-fir.

DEFINITION OF REGENERATION HARVEST TIMING CHOICES

The final task in developing timber options for FORPLAN involved selecting the range of final harvest timing possibilities to be associated with treatment options. In developing timing choices, the ID team's goal was to provide as much flexibility in harvest timing as possible (so as to give FORPLAN maximum opportunity to optimize) while keeping model size within reasonable limits. In approaching this goal, the team used the following guidelines:

1. Stands now at or near harvest age should have the greatest flexibility in harvest timing, since such stands are likely to have the most substantial effect on model solutions.

2. The range of available timing choices for any prescription should include both the age at which mean annual increment culminates and the age at which harvest would result in the greatest contribution to PNV.

Through application of these guidelines, the ID team developed the general pattern of timing choices outlined in Table B-4. Although the range of timing choices varied considerably from this pattern in some cases (usually in response to model size considerations), most of the analysis area/prescription combinations modelled in FORPLAN followed the pattern quite closely. The full set of timing choice data may be found in the process records on file at the Forest Supervisor's Office.

Table B-4. Timing Choices for Final Harvest

Age Class	Range of Available Final Harvest Ages
Large Saw	Existing age to 150 years thereafter
Small Saw	Existing age to 150 years thereafter
10-70	Age at which MAI = 95% of CMAI to age 150 years
Regenerated Stands	Age at which MAI = 95% of CMAI to age 150 years

ECONOMIC STRATIFICATION OF TIMBERLAND (STAGE II ANALYSIS)

The DP/DFSIM analysis of silvicultural treatment options, which included per acre analysis of both management costs and projected returns through time, enabled the ID team to identify the timber management prescription which generates the greatest net return (per acre managed) from Douglas-fir stands. Analysis of the per-acre contributions to PNV of individual FORPLAN analysis area/prescription combinations, which supplemented the DP-DFSIM analysis, established maximum net return by prescription for all species/productivity groups and land types. This FORPLAN per-acre PNV analysis represents the "Stage II" analysis specified in 36 CFR 219.14(b).

The Stage II analysis established the fact that, for most of the Forest's timberland, there is at least one (and usually several) timber management regime for which returns exceed management costs. All of the analysis areas within which relatively normal operating costs and timber values apply fall in this category. In general, and as would be expected, the most productive growing site for each species generates the greatest potential contribution to PNV.

Although most of the timberland on the Forest is capable of yielding per-acre revenues in excess of management costs, there are three situations in which this is not the case:

1. Doghair stands (both roaded and unroaded)--11,500 acres.

2. Most of the areas in which use of helicopter is the most cost-effective harvest system--22,700 acres.

3. Scattered undeveloped areas which can be logged conventionally, but in which the combined costs of access development and logging, when added to other timber management costs, result in total costs which exceed potential returns--6,500 acres.

For areas falling in these categories, no timber management regime has been identified which can yield a positive PNV on a per-acre basis. Roughly 40,000 acres (a little over 9 percent of the tentatively suitable timberland) have this characteristic. With the exception of doghair, which is identified uniquely in the analysis area delineation, all of this acreage lies within undeveloped analysis areas in the planning model.

The areas in which timber management costs exceed returns were specifically identified through analysis of the per-acre contribution to PNV associated with the analysis area/prescription combinations of benchmark 3 (the unconstrained maximum PNV benchmark). These areas are allocated differently in different alternatives. The allocation of such land depends entirely on the objective function and constraints associated with each alternative. When the primary objective function is "maximize timber", these areas are allocated to timber harvest (unless otherwise constrained) because of their contribution to timber output. When "maximize PNV" is the primary objective function, allocation of lands with timber management costs in excess of revenues depends on a complex relationship involving costs, values, nondeclining flow, long-term sustained yield capacity (LTSYC), and the value of additional harvest in the early decades.

When the nondeclining flow (NDF) constraint is applied in conjunction with a "maximize PNV" objective function, some of the areas with negative per-acre PNV may be allocated to harvest for scheduling reasons. Including such areas in the harvest base increases scheduling flexibility, which may increase the volume (from areas in which harvest revenues exceed timber management costs) which may be harvested in the early decades. This increase in harvest adds to total PNV if the discounted net revenues of such harvest exceed the discounted net costs associated with harvesting (in some future decade) the areas in which costs exceed returns.

It should be noted that the allocation of areas with negative per-acre PNV to harvest does not contradict the principle that alternatives should reflect the most cost-efficient means of meeting objectives. Such allocations are made entirely within the context of the objectives of each alternative, and are selected only when they do in fact represent the most cost-efficient approach to accomplishing these goals. The use of "maximize PNV" as the final objective function in all FORPLAN runs, even those in which the initial objective is to maximize timber output, assures that this will be the case.

It should also be noted that per-acre PNV calculations within FORPLAN, and the land allocations that result therefrom, are based on inclusion of existing timber stands in the overall flow of costs and benefits. In essence, this means that the decision point with respect to allocation of land to timber production occurs at the time of maturation of the present stand. This is entirely appropriate if it is assumed that management activities necessary for the development of subsequent stands will be undertaken as scheduled. Since the

Forest Service is committed to managing its timber production areas for sustained yield, and since the management activities selected for future stands are the most cost-efficient means of meeting Plan objectives, this is a valid assumption.

There is a school of thought which holds that soil expectation value (SEV) should be the sole determinant of the allocation of land to timber production. The decision point in such an analysis is the "bare ground" condition. If the discounted return from future harvests exceeds the discounted costs (beginning from bare ground) of managing for such harvests, then timber production is a viable option. If costs exceed projected returns, timber production should be foregone.

This is a valid approach if and only if the true decision point is the bare ground condition. In the case of this Forest Plan, the presence of the current timber stands (combined with the fact that harvest of these stands entails the commitment to manage for future production) makes the point of decision harvest of the existing stand rather than bare ground. Under these circumstances, to disregard existing conditions and base allocation decisions on SEV alone would be to ignore a significant resource and the economic value it represents. Such an approach would result in substantial (and inappropriate) reductions in PNV.

DEVELOPMENT of YIELD COEFFICIENTS

The purpose of this section is to describe the process used by the ID team in developing production coefficients for the various yields included in FORPLAN analysis. Yield coefficients are an essential component of the total analysis process, as they establish the magnitude and timing of the output flows that result from application of prescriptions to analysis areas. Thus, when used in combination with cost and benefit data, yield projections define the extent to which a given analysis area/prescription combination meets management goals and facilitates resolution of ICOs.

The goal of the ID team in developing yield estimates was to capture as fully as possible any substantial differences in output flows that result from variations in either land characteristics or management prescriptions. As with other model components, this was tempered by the need to remain within model size limitations. Addressing this goal involved extensive consultation of available research and investigation of several existing yield simulation models. The final set of yield coefficients selected by the ID team for use in FORPLAN represents the team's best judgment as to the degree of precision and detail most compatible with a workable level of model complexity. Many of the final yield tables were reviewed by Regional Office personnel for technical adequacy prior to use in analysis.

Yield coefficients were generated for each of the ICO-related outputs and effects previously identified as being included in FORPLAN analysis (see "Production Coefficients"). Development of the yield estimates for each output or effect is discussed individually in the following paragraphs. The focus of each discussion is the process used to generate coefficients. More detailed information regarding both yield estimation and the actual coefficients used may be found in the process records on file at the Forest Supervisor's Office.

SCENIC QUALITY

Yield estimates were developed to reflect attainment of the three categories of Visual Quality Objective (VQO) which require specific restrictions on timber harvest age and/or timing if the objectives are to be met. These groups are: Foreground Retention, Middleground Retention/Foreground Partial Retention, and Middleground Partial Retention/Background Retention or Partial Retention. The areas to which the various VQOs apply were identified through the Forest's VQO inventory. The ID team developed timber harvest prescriptions expressly designed to meet the objectives of each of the three visual categories (see

"Development of Prescriptions"). Objectives can also be met through application of "no harvest" prescriptions.

Attainment of scenic quality is a function of spatial relationships rather than simple acre-by-acre application of the appropriate prescriptions. Therefore, VQO yields are obtained in modeling by constraining those aggregations of analysis areas which are to provide VQO yields in a given alternative to either a "modified yield" or "no harvest" prescription. This is accomplished through use of FORPLAN prescription controls. When it is necessary to meet the objectives of an alternative, the possible range of prescriptions available for VQO-yielding analysis areas (or parts of analysis areas) is limited to preclude selection of full harvest management regimes. This assures that each acre so constrained will provide an acre of VQO attainment.

UNROADED RECREATION OUTSIDE WILDERNESS

Yield factors were developed for each of the three Recreation Opportunity Spectrum (ROS) classes of unroaded recreation: Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized. Two separate types of coefficient were used to assess unroaded recreation outputs: acres of opportunity provided and recreation visitor days (RVDs) of use associated with this opportunity.

Areas having the potential to provide unroaded recreation opportunity were identified from the Forest's ROS class inventory. The ability of a given land area to provide unroaded recreation depends on the absence of both roads and evidence of timber harvest. Since the time period needed for the return of a disturbed area to an "unroaded" condition is extensive, it was assumed that only those areas currently providing unroaded recreation outputs would be capable of doing so over the 50-year planning horizon. For analysis purposes, there were no projected additions to the existing base of land areas having unroaded ROS classes.

As with scenic quality, the attainment of unroaded recreation opportunity objectives depends on spatial relationships. Therefore, the yields for this output are obtained through use of analysis area prescription controls. Only those analysis area aggregations for which the appropriate prescription (no harvest) is specified over a contiguous area large enough to provide unroaded recreation opportunity provide these yields.

In most cases, the acreage of unroaded recreation opportunity yielded is not equivalent to the acreage allocated to "no harvest" prescriptions. Two factors interact to cause this. First, because unroaded ROS classifications depend in part on distance from roads, it is generally necessary to have an undisturbed buffer between the area providing unroaded recreation and the nearest open road. This results in a larger area being subject to harvest restrictions than actually provides unroaded recreation outputs. This is counterbalanced to some extent by inclusion, as appropriate, of land not tentatively suitable for timber harvest in unroaded recreation acreage yields.

The RVD yield associated with unroaded recreation opportunity is the output to which the unroaded recreation economic values are linked. This yield is a direct function of the acreage of opportunity provided. Each unroaded ROS class has a distinct set of coefficients reflecting RVDs of use per acre of opportunity. The coefficients are based on use figures from 1986 Recreation Information Management (RIM) data and existing acreage by ROS class from the ROS class inventory. RVDs of use per acre of opportunity as of 1986 served as the basic yield coefficient for each ROS class. These per-acre factors were then increased through time at the rate of growth in demand for unroaded recreation projected in the State Comprehensive Outdoor Recreation Plan (SCORP).

DEVELOPED, GENERAL DISPERSED, AND WILDERNESS RECREATION

Yields of these three types of recreation were developed on the basis of the assumption that recreational quality (and thus recreation use) is an inverse function of timber management activity. It is projected that the maximum level of recreation use will occur when no harvest activity is evident. Background values for this condition were developed on the basis of SCORP recreation demand projections through time. The basic assumption in generating these background values was that recreation use would exceed SCORP-projected use by 10 percent in any decade in which there was no harvest activity. Coefficients were then developed linking acreage of timber harvest activity to RVD reductions in each of the three recreation types, with total output for each type having a projected lower limit of 10 percent below SCORP projections. Net recreation yields were thus estimated by subtracting harvest activity-generated RVD reductions in each decade from the maximum projected use by recreation type for that decade.

The above modeling methodology was developed for FEIS analysis. In the DEIS, yields of these recreation outputs were assumed to be constant across all alternatives. Further evaluation in response to public comments regarding this assumption led to the conclusion that modeling of potential variations in these outputs was indeed possible and reasonable. Therefore, the yield estimation strategy described above was developed to provide a more realistic representation of the effects of the alternatives on recreation use.

It should be noted that, in the case of Wilderness recreation, current use on the Forest exceeds the capacity of Forest Wildernesses to provide high-quality Wilderness experiences. At present, the Forest's capacity for high-quality Wilderness recreation is 65,700 RVDs per year. Complete development of the proposed Wilderness trail system would result in a capacity of 87,100 RVDs per year. Actual Wilderness use in 1986 was 88,900 RVDs, and use is projected to increase significantly in the future (the SCORP projection for 2030 is 131,300 RVDs). Because current use exceeds the potential capacity for high-quality Wilderness experience, the economic value associated with Wilderness use is the "less than standard" value from the 1985 RPA DEIS. Please refer to "Benefits Considered in Economic Analysis" for further detail.

TIMBER HARVEST VOLUME

The generation of timber yield tables was an integral part of the development and analysis of timber options for FORPLAN. Therefore, the process by which yield estimates for timber were created is discussed fully in the preceding section ("Development of Timber Options"). Refer to this discussion for information regarding timber yield tables.

ROAD CONSTRUCTION AND RECONSTRUCTION

Road construction projections were generated from the basic assumption that the Forest's younger stands (age 70 and below) had been harvested in the past and had thus reached their ultimate road density. While some of these existing stands are the result of natural processes rather than harvest, most of these occur in undeveloped areas and do not negate this premise. Given this assumption, determination of the level of construction needed to achieve full access for timber harvest in older stands could be accomplished by comparing the existing road densities in such stands with those found in younger stands.

To develop the basis for this comparison, a systematic sample of existing road densities within developed areas was conducted, using maps of analysis area delineations in conjunction with the transportation system inventory. By tracking the frequencies of roaded and unroaded sample points, the relative levels of existing road development for several pairs of mutually exclusive land characteristics (e.g. younger stands vs. older stands) were derived. The results of this process indicated that two sets of density comparisons would be most useful for further analysis. These were the differences in existing development

between younger stands and older stands and the contrast in road densities between winter range areas (0'-1500' elevation) and non-winter range areas (1500'+ elevation) in each of the three geographic zones (Eastside, Westside, Shelton). The variations by elevation and zone are the result of substantial differences in both topographic characteristics and current level of development among the six elevation zone/ geographic zone combinations.

The information derived from the sample was used to project the per-acre mileage of road construction that would be necessary to reach full access density in older stands. Different construction need estimates were developed for each geographic zone. These were linked to final harvest prescriptions in small saw and large saw stands: each acre of harvest yields the appropriate mileage of new road construction (on average, 0.0022 miles per acre). These coefficients were then adjusted upward for first and second decade harvest and downward for later decade harvest to account for the fact that construction needed per acre will be higher for the initial entries into existing sawtimber stands. Under this approach, the Forest road system within currently developed areas will be completely constructed (in FORPLAN modeling) upon completion of the initial round of final harvesting within the small saw and large saw stands allocated to harvest.

Road construction coefficients for undeveloped areas are based on the assumption that complete access system development will be necessary for each area. The ultimate road density needed for each area was estimated, with the analysis aided by input from Ranger District personnel regarding road location opportunities and logging system requirements for many of the undeveloped areas. Construction coefficients were developed on the basis of ultimate density estimates, with each acre of small saw or large saw harvest yielding an average of .00417 miles of new construction.

Road reconstruction coefficients were based on the assumption that the current intensity of reconstruction per unit of activity on the Forest would continue into the future. An additional important assumption was that the primary cause of variability in the reconstruction program would be level of timber harvest. In response to these assumptions, the coefficients projecting reconstruction needs relating to the existing road system reflect the best available index of timber-related reconstruction intensity: miles currently reconstructed per million board feet harvested. These coefficients vary by geographic zone, as there are currently substantial differences in the ratio of existing road miles to harvest volume from zone to zone (due primarily to differences in topography and timber stand characteristics).

Existing road system reconstruction coefficients were also varied to reflect the generally lower mileage of reconstruction per unit of harvest volume when commercial thinning is the harvest treatment. Reconstruction mileage per million board feet harvested in commercial thinnings is estimated to be half that associated with clearcut harvest. The primary reason for this difference is the low total volume of typical commercial thinning operations, which limits the extent of reconstruction directly attributable to the harvest activity. The reconstruction mileage coefficients per unit of harvest volume for both commercial thinning and final harvest, varied by geographic zone, were linked to volume of harvest in the FORPLAN model. Estimated reconstruction needs, therefore, vary directly with the timber harvest level of each alternative. Estimates were also developed to cover periodic reconstruction of the roads built within each FORPLAN run to access future timber harvest. It was assumed that these would be reconstructed, on average, once every 20 years after construction (this being the current average reconstruction frequency for existing roads). Thus each mile of road construction generated by the model has associated with it a mile of reconstruction every other decade following construction.

SEDIMENT

The basic tool for estimating activity-generated sediment on the Olympic was a sediment yield prediction model developed in Region 4 of the Forest Service. Refer to "*Guidelines for Predicting Sediment Yields*",

Division of Soil and Watershed Management, USDA Forest Service Intermountain Region (R-4, July 1980) for detail regarding this model. The Region 4 model estimates the level of sedimentation associated with several activities related to roads and timber harvest: road construction and reconstruction, logging, and slash treatment (broadcast burning). Soil characteristics and slope are the physical factors over which the model's yield predictions are varied.

The Region 4 model was modified and adapted to Olympic conditions. Factors dependent on road maintenance, reconstruction, and use (vehicle traffic) were added. Data regarding soil characteristic/slope relationships on the Forest were taken from the Soil Resource Inventory update of 1982. Information from local studies, such as in the Wynoochee and Clearwater drainages (U.S.G.S. and University of Washington Department of Fisheries respectively), was used to validate and calibrate the sediment yield estimates generated by the model. Studies conducted by the Forest Service within experimental watersheds on the westside of the Cascade Mountains in Oregon were also used.

In the Forest's original planning model (Version I FORPLAN), sediment yield predictions were associated with slope class and erosion hazard identifiers. The change in identifiers associated with the switch to Version II, however, necessitated a different approach. For Version II, distinct sediment yield coefficients were developed for each of the 21 drainages included in the model. These coefficients were based on average slope class and erosion hazard conditions within each drainage. While not quite as precise as the original formulation insofar as yields from specific analysis areas are concerned, this approach has the advantage of generating drainage-specific sedimentation projections. Since the individual drainage is the focal consideration when assessing the effects of sediment output, modeling yields by drainage has proven to be an important improvement in model structure.

The sediment output estimates generated by FORPLAN include three separate yield functions. The first and most important of these is the set of coefficients related to timber harvest activities and associated road maintenance, periodic reconstruction, and use (timber haul and support traffic). These coefficients are linked to harvest prescriptions, with sediment output a direct function of acres clearcut, and represent the largest component of total activity-generated sediment. Second in importance is ongoing sedimentation associated with the continued existence of the present road system. This is treated as a constant sediment output through time in each drainage. The third category of yields represents the yield function linking sediment output to new road construction, including expected periodic reconstruction of newly constructed roads. In this case, sediment yield output is a function of road mileage constructed.

The three sediment yield formulations combine to provide, for each drainage, an estimate (by decade) of the total tonnage of sediment above natural levels which can be expected to result from management activities. These estimates can be used to project the implications of each alternative with respect to water quality. They are also vital in estimating fisheries outputs (see the following discussion), which are also developed on a drainage-specific basis.

FISHERY YIELDS (RECREATION, COMMERCIAL CATCH)

Estimates of changes in the productivity of the Forest's fisheries are linked directly to sediment yields within the FORPLAN model. This formulation assumes that the level of non-natural sedimentation is the limiting factor with respect to fisheries production capability. While it is true that the availability of sources of large organic debris (needed for maintenance of rearing habitat) is also an important consideration, the strategy for meeting the specifications of the Management Requirement (MR) for riparian areas assures that adequate sources of this habitat component will be provided. Therefore, at least within the range of sediment levels likely to be associated with Plan alternatives, it is reasonable to assume that sediment will be the principal variable affecting fish populations.

A second important assumption behind the ID team's approach to fishery yields is that change in productive potential, rather than production itself, is the best measure of effects. This assumption is rooted in the fact that the Forest Service manages fish habitat, not the fishery itself. Therefore, productivity of the habitat is the factor which the Forest Service affects most directly. The degree to which the available habitat is actually utilized depends upon management of the fishery, and is difficult to predict with any degree of accuracy. This being the case, the ID team established change in productive potential as being the most meaningful basis for comparison of the effects of management activities on the fishery resource.

The basic simulation model for projecting change in habitat productivity as a function of sediment output was developed by Forest Service Regions 1 and 4. This model is described in "*A Method for Predicting Fish Response to Sediment Yields*", a 1980 working draft document prepared by the Intermountain and Northern Regions, USDA Forest Service. The model equates sediment outputs (in terms of percentage above natural rates) with a percentage reduction in fishery productivity. Magnitude of effect is varied by river channel type.

The basic information needed to convert the habitat productivity/sediment output relationships of the fish response model into yield coefficients for FORPLAN analysis consisted of the following items (all available in the Forest data base):

1. Natural sedimentation rate and current level of sedimentation above natural for each Forest drainage.

2. Acreage of available fish habitat, both anadromous and resident, by drainage.

3. The maximum potential of an acre of habitat to produce fishery-related outputs: Wildlife and Fish User Days (WFUDs) of recreation (for both anadromous and resident habitat) and pounds of commercial anadromous catch.

The above data items were used in conjunction with the fish response model to develop fishery output coefficients for both the on-Forest and influenced off-Forest components of each drainage. The procedure for calculating these coefficients consisted of the following steps:

1. 100 X the inverse of the natural sediment output of a given drainage (in tons) = percentage over natural rate per ton of sediment.

2. Percentage over natural rate per ton yields percent reduction in fish production potential per ton (from fish response model).

3. Percent reduction in fish production potential per ton X potential production of fishery-related outputs by drainage = loss per ton of each output in each drainage.

Coefficients developed in this way approximate the results that would be obtained from direct application of the fish response model. They are not exact because the coefficients used in FORPLAN represent a linear relationship, while the response model itself is non-linear (the incremental effect of an additional ton of sediment decreases slightly as the total tonnage increases). By basing the calculation of reductions in fish production potential on the average effect per ton of the current level of sediment output above natural rates, fish response model predictions are very closely approximated within the range of sediment outputs likely to result from Plan alternatives. In the interest of FORPLAN model simplification, the ID team elected to accept this approximation.

Fishery reduction coefficients were used in FORPLAN to track fishery-related outputs in different ways for on-Forest and off-Forest fish habitat. The effects of management activities on on-Forest habitat were

modelled in terms of net outputs produced subsequent to adjustment for the effects of sediment. Total potential outputs (free of non-natural sediment) for each drainage were modelled as background values. Negative coefficients, reflecting output loss per ton of sediment, were modelled for anadromous and resident WFUDs, pounds of anadromous commercial catch, and number of anadromous smolts and linked to sediment output. Within FORPLAN, output reductions due to activity-generated sediment could then be subtracted from output potentials to yield net expected outputs. Economic values for fishery-related outputs were linked to these net production levels.

The effects of Forest-generated sediment on influenced off-Forest habitat were expressed in terms of the reductions in output potential associated with activity-generated sediment. Background values were not developed for off-Forest fisheries. This approach had the advantage of reducing model complexity (by limiting the number of variables tracked) while providing information from which an index of the relative effects of Plan alternatives on off-Forest fisheries could be developed. Both the on-Forest and off-Forest forms of FORPLAN output can be directly translated into additional useful projections (adult fish population, habitat capability index, etc.) through straightforward post-run arithmetic conversions.

ELK AND DEER

Coefficients for estimating elk and deer populations were based on studies of Olympic Peninsula big game populations conducted by R.D. Taber and K.J. Radaeke. Refer to "*Black-tailed Deer of the Olympic National Forest*" and "*Status Report: Roosevelt Elk of the Olympic National Forest*" for descriptions of these studies. These documents include estimates of the elk and deer carrying capacities of various habitat types, thereby providing the foundation for FORPLAN big game population coefficients.

The Taber and Radaeke studies developed approximations of the acreage needed to support a single elk or deer, varied by elevation (winter and summer ranges) and timber stand age. In the case of deer populations, the estimates vary by geographic zone (Eastside, Westside, Shelton) as well. For use in FORPLAN, these estimates were converted into age-dependent per-acre carrying capacity coefficients for the relevant geographic zones. Population projections associated with Plan alternatives, therefore, vary directly with vegetative management activities. Per-acre carrying capacity coefficients are linked directly to changes in timber stand age as each stand develops through time.

WILDLIFE-RELATED RECREATION

The elk and deer population coefficients discussed above formed the basis for estimating the output of Wildlife and Fish User Days (WFUDs) of recreation associated with wildlife populations. Three separate sets of coefficients were developed, in order to derive yields for each of the three subdivisions of wildlife-based recreation: big game use, small game use, and nonconsumptive use. The initial set of coefficients to be developed relates big game use to elk and deer populations, and was derived from data supplied by the Washington State Department of Wildlife. Information regarding proportions of populations harvested and hunter-days of use per harvested animal was converted into estimates of WFUDs of big game use per animal supported by Forest habitat for both elk and deer.

Once big game use coefficients were available, use factors for small game and nonconsumptive recreation could be derived. These were based on correlations developed for the 1980 RPA analysis which relate small game and nonconsumptive use directly to big game use. Each WFUD of big game use is, on average, associated with specific rates of nonconsumptive use and small game use. When fully developed, the wildlife-related recreation use coefficients per animal were linked to elk and deer population outputs within FORPLAN in order to generate estimates of each category of WFUD production. WFUD estimates were, in turn, linked to economic data in order to determine the economic benefit associated with wildlife outputs.

OLD-GROWTH

Acreage of old-growth available by decade was tracked by linking an old-growth yield coefficient (1 acre per acre) to stand ages through time. Timber stands contribute to the old-growth total when the appropriate age is attained: 160 years for existing large saw and small saw stands, 200 years for unthinned younger stands, and 250 years for thinned stands. Only stands presently in the 50-70, small saw, or large saw age classes can reach an age sufficient to yield old-growth within the 150 year analysis horizon. It is assumed that doghair stands will never reach the old-growth condition.

YIELD COEFFICIENTS FOR ALTERNATIVE NC-NO CHANGE

Yield coefficients for resources other than timber were not specifically developed for the analysis of Alternative NC-No Change. The focus of the timber management plans upon which this alternative is based is timber production. These plans include little emphasis on the level of production of nontimber resources.

While precise yield coefficients and FORPLAN analysis were not used in the assessment of Alternative NC nontimber outputs, it was possible to develop quantitative estimates of output levels for many of the important issue-related outputs. Such estimates came from two principal sources: the potential yield projections of the timber management plans and the land allocations specified in unit plans (incorporated into the timber management plans via amendment).

Estimates of nontimber outputs and effects which are most closely associated with the level of timber harvest are based on the potential yield of each timber management plan. Where possible, the same timber/other resource yield coefficients and relationships that were applied in the analysis of the original alternatives were used directly in the analysis of Alternative NC. An example of this is the estimation of timber-related employment levels. In other cases, it was necessary to derive output estimates on the basis of interpolations of or extrapolations from information obtained from FORPLAN analyses of other alternatives. An example is estimated road construction mileage, which was projected by applying the miles of construction per million cubic feet of timber harvest occurring in Alternative A-Current Direction (No Action) to the potential yield of Alternative NC.

Outputs which are most directly related to land use rather than timber harvest are estimated on the basis of unit plan land allocations. Examples of these are Primitive/Semi-Primitive recreation opportunity and attainment of Visual Quality Objectives, both of which can be assessed directly from unit plan allocations (since specific areas are identified as having the purpose of providing these outputs). Outputs for which a reasonable quantitative estimate could not be derived from either potential yield information or unit plan allocations were assessed qualitatively in the evaluation of Alternative NC outputs and effects. Such estimates are usually expressed in terms of the relationship of Alternative NC to other alternatives.

ECONOMIC ANALYSIS

Economic analysis is required by the National Forest Management Act regulations (36 CFR 219), and played an important role in the development and evaluation of benchmarks and Plan alternatives. Specific references within the Regulations to facets of such analysis include the following:

> "The primary goal in formulating alternatives, besides complying with NEPA procedures, is to provide an adequate basis for identifying the alternative that comes nearest to maximizing net public benefits." (36 CFR 219.12(f))

> "Each alternative shall represent to the extent practicable the most cost efficient combination of management prescriptions examined that can meet the objectives established in the alternative." (36 CFR 219.12(f)(8))

This section defines some basic concepts involved in economic analysis and describes the costs and benefits that were used in the Forest's economic assessments. Discussion of the derivation of cost and benefit information and how it was used in analysis is also included.

Economic analysis, as described below, was not conducted in the case of Alternative NC-No Change. While it was possible to estimate a few economic variables (budgetary costs, returns to county governments and the Federal treasury, etc.) through use of FORPLAN results from other alternative runs, the calculation of PNV could not be reasonably accomplished outside of FORPLAN. It is the ID team's qualitative assessment that the PNV of the No Change Alternative is probably slightly below that of Alternative B-Departure (Modified), based on similarities between the two alternatives in harvest level and structure of the timber harvest base.

Another area in which the economic parameters of Alternative NC differ from those of other alternatives is the cost-efficiency of prescriptions. NFMA regulations specify that:

> "Each alternative shall represent to the extent practicable the most cost efficient combination of management prescriptions examined that can meet the objectives established in the alternative." (36 CFR 219.12(f)(8))

In the development of the alternatives to be analyzed in FORPLAN, the constraints and management prescriptions used to achieve the objectives of each alternative were evaluated prior to FORPLAN analysis to assure that they represent the most cost efficient way of obtaining the desired results. Given such testing, the optimization process of FORPLAN itself assures that the model's solution is consistent with the cost-efficiency criterion presented above.

In the case of the Forest's timber management plans, the prescriptions upon which potential yield estimates are based were not subjected to a similar cost-efficiency evaluation. Also, the ultimate mix of prescriptions used to meet timber management plan objectives was not developed through FORPLAN optimization. Because of these differences, there is no assurance that the set of timber management prescriptions employed in generating potential yield estimates represents the most cost-efficient means of achieving timber management goals.

BASIC CONCEPTS RELATED TO ECONOMIC ANALYSIS

PRESENT NET VALUE (PNV)

Present net value is the quantitative measure of cost-efficiency, and is a key variable in the comparison of alternatives. It is the principal criterion used to ensure that each alternative includes the most cost-efficient mix of priced outputs and management activities that is responsive to the objectives of that alternative. PNV is defined as the difference between the discounted value (benefits) of all outputs to which monetary values or established market prices are assigned and the total discounted costs of managing the planning area. All monetary costs are included in PNV calculation, regardless of whether they were incurred for the production of priced and/or nonpriced outputs or for overhead and general operations and management. Therefore, PNV is an estimate of the current value of future outputs of priced Forest resources, after consideration of all costs associated with producing both priced and nonpriced outputs and meeting other multiple use objectives.

Within the FORPLAN model, benefits and costs over the entire 150 year timber harvest scheduling horizon were considered in PNV calculations. This was necessary in order to provide the model with a framework for making rational scheduling decisions in the later decades. PNV estimates reported throughout this document, on the other hand, include only accumulated net value over the 50 year planning horizon. This approach is needed to maintain consistency with RPA assessment parameters. Exclusion of the final 100 years from PNV estimates has virtually no effect on comparisons of PNV among alternatives, since the effect of discounting on present value makes these final decades relatively unimportant.

In order to effectively represent the differences among alternatives as they affect National Forest land and its economic value, only the National Forest contributions to PNV are in included in the displays of PNV found throughout this document. The contribution to total PNV resulting from management of Simpson Timber Company lands is not. Since the Simpson contribution to PNV is very close to the same in all alternatives, doing this does not bias the comparison of alternatives, but does serve to highlight differences resulting from land use variations on National Forest land. The need to avoid undue disclosure regarding Simpson operations precludes presentation of both total PNV and National Forest contribution by alternative.

Timber management costs associated with the harvest and management of timber on Simpson land were developed by the company and verified by Forest personnel. Recent experienced costs of Simpson operations served as the basis for these cost figures. Value estimates covering Simpson timber were developed by the ID team in the same manner as for National Forest timber, and reviewed by company officials.

NET PUBLIC BENEFITS

The purpose of forest planning is to identify and select for implementation the alternative which most nearly maximizes net public benefits. Net public benefits are defined as the "...overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not...consistent with the principles of multiple use and sustained yield" (36 CFR 219.3).

By providing a monetary, quantitative measure of cost-efficiency, PNV is a very useful indicator of differences among alternatives in their total output of public benefits. To fully assess net public benefits, however, requires that the output of public benefits and costs to which dollar values have not been

assigned be considered in addition to PNV. Included in this category are nonpriced outputs (such as increased populations of endangered species), physical conditions (such as maintenance of scenic quality), and desirable distributive effects (such as increased employment in dependent communities). The value of such outputs and effects cannot be reasonably reflected in dollar terms, since the data and/or methodology necessary to do so are not available. It is important to keep in mind that PNV, while a useful indicator of overall public benefit, does not and can not tell the entire story.

The assessment of net public benefits includes both those outputs which have prices and those to which no price can be attached. Therefore, they cannot be expressed in terms of a single, quantitative measure, but rather must be gauged using both quantitative and qualitative criteria. There is no precise formula for determining which alternative maximizes net public benefits. Indeed, there are often differences of opinion as to whether particular outputs or effects are benefits or costs. Therefore, identification of the alternative which maximizes net public benefits is, of necessity, a subjective and judgmental process.

PRICED OUTPUTS

Priced outputs are those that are, or can be, exchanged in the marketplace. The dollar values of these outputs fall into one of two categories: market or nonmarket (assigned). Market values constitute the unit price of an output normally exchanged in a market, and are expressed in terms of what people are willing to pay as evidenced by actual transactions. Nonmarket values reflect the estimated unit price of an output not normally exchanged in a market, and must be derived by using comparable transactions data in combination with various theoretical techniques. Such values represent projections of what reasonable people would be willing to pay (above participation costs) for the nonmarket good if an established market did exist.

Market resources include timber, that portion of total developed recreation which is covered by use fees, commercial fish production, minerals, and special uses for which fees are collected. Nonmarket resources to which dollar values have been assigned include roaded and unroaded dispersed recreation, Wilderness recreation, forms of developed recreation for which no fee is charged, and recreation generated by fish and wildlife outputs. The purpose of assigning dollar values to these resources is to reflect their full economic value, even though none or only part of that value is actually collected as fees under current laws and policies.

Timber values are expressed in terms of dollars per thousand cubic feet paid by purchasers at the time of harvest. They are based upon transactions which occurred on the Olympic National Forest. Values were developed by geographic zone (Eastside, Westside, Shelton) for key species sold on the Forest. Prices vary by tree diameter as well as by species and zone.

Non-recreation special uses for which fees are charged are valued in terms of the fees actually paid on the Forest. Use fees are also charged for several forms of developed recreation facility, including full service campgrounds, recreation residences, and resort special use permits. Although those aspects of developed recreation for which fees are charged are technically market goods, the fee does not reflect the full value of the services provided. These outputs have had nonmarket values developed for them that are considered to be truer estimates of their actual value. These nonmarket values have been used in the economic analysis, and fee receipts have been excluded from benefit calculations to avoid double-counting.

Roaded and unroaded dispersed recreation, Wilderness recreation, and recreation generated by fish and wildlife outputs are not normally subject to marketplace transactions. The values for these outputs, and the assigned values used for developed recreation, were those used in the 1985 RPA Program analysis. These were generated by examining comparable market transaction data in conjunction with a variety of

theoretical estimation techniques. The values are expressed in terms of dollars per recreation visitor day (RVD) or wildlife and fish user day (WFUD), and are specific to the different types and qualities of recreation activity that may be experienced as a result of Forest allocations and outputs.

Commercial fish production values are expressed in terms of dollars per pound of harvest at dockside. These values were also derived from the 1985 RPA analysis, and are based on commercial anadromous fishery transactions within the Pacific Northwest Region. They represent average value per pound of commercial catch, and are not varied by species.

The economic values used in the Forest's analysis do not include those which may result from possible future production of locatable minerals, oil and gas, or hydroelectric power. The possibility of future development of these outputs does exist on the Forest, but the timing of their development and the magnitude of their production are highly speculative. It is possible that the economic values of these activities, if they are undertaken, will vary from alternative to alternative.

NONPRICED OUTPUTS

In addition to the priced outputs discussed above, there are several outputs associated with the alternatives to which no monetary value can be reasonably assigned. For these outputs, there is no available market transaction data and therefore no reasonable basis for estimating dollar values that would be comparable to those associated with priced outputs. Such outputs have no direct effect on the calculation of present net value, but are nonetheless an important component of issue resolution and, therefore, net public benefits.

Present net value is used to compare alternatives with regard to their relative efficiency in producing priced outputs. The output of nonpriced goods and services is also an essential consideration influencing the decisionmaking process. The importance of the need to consider these benefits, which can only be valued subjectively, is addressed in the NFMA regulations' direction to the Forest Service to identify the alternative which comes nearest to maximizing net public benefits (36 CFR 219.12(f)). The calculation of PNV includes consideration of all priced outputs and all costs associated with managing the Forest. In order to assess net public benefits, it is necessary to include the net subjective values of nonpriced outputs.

Increased production of nonpriced outputs often entails a reduction in the output of priced goods and services. In FORPLAN analysis, this is generally achieved through use of constraints which either require nonpriced output production or limit priced output production (e.g. timber harvest limitation constraints). These constraints usually result in a decrease in PNV, since this is based on priced outputs only. When this occurs, subjective judgments are necessary to assess whether the benefits of producing the nonpriced outputs exceed the opportunity costs associated with loss of priced output production. The principal nonpriced outputs considered during the development and analysis of alternatives, and the relationship of each to priced outputs and PNV, are as follows:

Maintenance of Scenic Quality - As this output increases, PNV decreases because of restrictions on timber harvest. Scenic quality maintenance is complementary to other priced outputs (recreation and fisheries outputs).

Unroaded Area Acreage - Since unroaded area retention and timber harvest are mutually exclusive, increases in this output can lead to reductions in PNV. Nonetheless, maintenance of unroaded areas is compatible with increases in PNV in many cases, as many of the Forest's unroaded areas are located in areas in which timber management costs exceed returns. This output is complementary to other priced outputs.

Wild and Scenic Rivers and River Corridors - These outputs have essentially the same relationship with other outputs as scenic quality, and are particularly compatible with increased fisheries outputs.

Old-growth Retention - Increasing this output has substantial effects on both timber harvest and PNV. Because old-growth distribution goals often dictate that highly productive and readily accessible areas remain unharvested, increases in this nonpriced output can lead to relatively large reductions in PNV. Old-growth retention is complementary to other priced outputs.

Employment - Of all the Forest outputs, that which has by far the greatest effect on employment is timber harvest. Therefore, there is generally a close link between PNV and employment level. This linkage does not prevail, however, when incremental harvest investments exceed incremental harvest returns. When this occurs, employment rises while PNV drops. Production of other outputs (both priced and nonpriced), to the extent that it involves reduced timber harvest, generally leads to reduced employment.

Of the above nonpriced outputs, the two which bear the strongest relationship to PNV are old-growth retention and employment. Alternatives involving high old-growth retention targets are low in PNV due to the high per-acre cost of precluding harvest on timberland having high potential to contribute to PNV. Alternatives involving high timber harvest levels, and thus high employment levels, provide the greatest returns in terms of PNV, although increasing timber production beyond the breakeven point reduces PNV while still generating additional employment.

DISTRIBUTIVE EFFECTS AND IMPACTS

The distributive effects associated with alternative mixes and levels of Forest outputs are an additional consideration to be weighed in the evaluation of net public benefits. Such effects can be either positive or negative, and can be of local, regional, or national scope. Some distributive effects, such as changes in consumer prices or taxpayer costs, have impacts at the national level. Others, such as changes in employment opportunity or payments to county governments in lieu of property taxes, are more local or regional in nature. These effects relate more closely to questions of equity (i.e. who pays and who benefits) than cost-efficiency. They are not assessed in the context of the economic criteria associated with PNV analysis. Distributive effects are considered, however, in the overall assessment of net public benefits. See "Social and Economic Impact Analysis" for a detailed discussion of the measurement and analysis of distributive effects.

DISCOUNTING

Financial analyses of alternative investment options usually involve cash flows over different periods in the future. Due to society's preference for consuming now rather than later, a dollar today is more valuable than a dollar to be received ten years from now. Thus, there is an inherent time value associated with money. Discounting is the process by which the dollar values of costs and benefits which will occur at different times in the future are adjusted to a common time period so that they may be compared. Usually the common period is the present. When this is the case, the discounted cash flow is called present value. The discount rate used for present value calculations in this analysis was four percent. The effect of an alternative discount rate of 7.125 percent on PNV was also considered.

OPPORTUNITY COSTS

Opportunity cost is defined as the net value that is foregone when a given resource is employed in something other than its most efficient alternative use (FSM 1970.5). In relation to the economic analysis performed for forest planning, opportunity costs are reflected in the decrease in PNV of an alternative or benchmark when an economically suboptimal level of resource outputs is forced into solution. Therefore, opportunity costs are measured by the change in PNV associated with changes in the output of priced resources, and can be used to assess the relative value traded off in order to produce particular nonpriced outputs.

NET CASH FLOW

Comparison of total benefit to total cost measures the overall PNV of each alternative. Another important consideration is the flow of dollars to and from the U.S. Treasury and the taxpayers of the United States. In this regard, the important variables are receipts (the portion of total market output collected as fees or payments) and budget costs. The difference between the two is the net cash flow to or from the Treasury.

PARAMETERS AND ASSUMPTIONS USED FOR ECONOMIC ANALYSIS

In order to calculate the present net value of each alternative, it was necessary to make several assumptions regarding discount rates, demand curves, real dollar value adjustments, and trends in real prices and costs. This section summarizes these assumptions and the analysis parameters which result from them. More detailed discussions of economic analysis assumptions may be found in the process records on file at the Forest Supervisor's Office.

DISCOUNT RATES

Discounting requires the use of a discount rate (an interest rate representing the time value of money) in determining the present value of future costs and benefits. Two different discount rates were used in the analysis of benchmarks and alternatives. Both were "real" discount rates, meaning that they were adjusted to exclude the effects of inflation (real dollar adjustments will be discussed below). FSM 1971.21 specifies the following:

> "Use a 4 percent real discount rate for evaluations of long-term investments and operations in land and resource management. Also, determine the sensitivity of alternatives to variations in the discount rate. At a minimum, use the rate used in the most recent Resources Program and Assessment to test sensitivity."

The 4 percent rate approximates the "real" rate of return (above the rate of inflation) on investments in Aaa corporate bonds from 1960 through 1978 (Row et. al., l981). This rate was used in FORPLAN runs as the basis for PNV calculation. The 1985 RPA Program used a real discount rate of 7.125 percent. The effect of this alternative discount rate on PNV was evaluated. All costs and benefits were discounted from the midpoint of the decade in which they occurred.

DEMAND CURVES AND REAL PRICE TRENDS

As specified by the Washington Office (in a letter to Regional Foresters, "Downward Sloping Demand Curves", February 1981), and in keeping with FSM 1971.65, horizontal demand curves for both timber and nontimber resources were used in the analysis of benchmarks and alternatives. Many factors influence the demand for stumpage from any one Forest (Adams and Haynes, 1985). These can include trends in (1) interest rates, (2) the species and product mix of forest products consumption, (3) use of wood for energy, (4) forest products exports, (5) the cost of wood in Canada, (6) the rate of technical improvements in wood and fiber processing, and (7) harvest levels from other Forests. All of these entail uncertainty regarding future conditions.

Another source of uncertainty is whether a single National Forest represents a definitive enough market to influence prices. The mobility of logs and timber purchasers suggests that variations in the harvest level of a single Forest may well have little influence on prices. Additional uncertainty arises regarding the magnitude of potential price responses to changes in output level. It is uncertain whether an allowable sale quantity (ASQ) change of 1 million board feet (MMBF) or 500 MMBF is needed to precipitate a significant change in prices.

Neither empirical nor theoretical bases have been well enough developed to derive reliable estimates of the demand functions for resources offered at the Forest level. Given the complexities and geographic interactions of timber flows, however, it seems most reasonable to assume that the elasticity in the portion of the timber demand curve over which the Forest can influence output levels is such that prices would be relatively insensitive to a "reasonable" range of quantity offerings. In other words, it is likely that the timber demand curve for the range of output levels analyzed in the development of alternatives is nearly horizontal.

Because of the uncertainties involved in estimating a demand function, and because it appears most likely that changes in a single Forest's output would have little effect on prices, the Forest has used a horizontal demand curve in its Forest Plan analysis. While this assumption could lead to a slightly suboptimal resource output mix in cases in which the ASQ of an alternative is considerably above or below current outputs, it is the most practical approach to use. Justifiable and defensible alternative assumptions are not available. Comparison of DEIS Benchmark 7 with DEIS Benchmarks 7-0% and 7-2% (see "Benchmark Analysis") indicates that the effect of this assumption on ASQ is not likely to be substantial, since a change in price trend assumption has very little effect on ASQ.

Real price trends were developed and used to represent the rate at which resource values will change over time as a result of anticipated supply and demand interactions in the marketplace. As specified by the Regional Office (letter to Forest Supervisors, "Timber Price Trends, Values, and Costs", Sept. 1984), a one percent per year real price trend for stumpage was used in FORPLAN harvest scheduling analysis. This was applied for the first 50 years, with a zero percent price trend assumed for the remaining 100 years of the analysis horizon. This implies that nominal stumpage prices (those which include the effects of inflation) will increase during the next 50 years at a rate of one percent greater than the general rate of inflation, and at a rate equal to that of inflation thereafter.

Since price trends are reflections of expected futures, there is uncertainty involved in making such projections. In recognition of this, sensitivity analysis was performed by testing the effects of alternative price trends of 0, 2, and 3 percent on one of the key benchmark runs. The results of these tests are discussed in "Benchmark Analysis". Generally, higher price trends make silvicultural treatments economically more attractive and lengthen timber harvest rotations.

Based on Washington Office direction, a 0 percent real price trend was used for all other resources in the development of benchmarks and alternatives. In other words, the nominal values of nontimber resources are expected to change at the general rate of inflation in the future.

REAL COST TRENDS

Based on Washington Office direction, 0 percent real cost trends were used for all future costs included in the analysis of benchmarks and alternatives. In other words, the costs of labor, fuels, materials, and all other factors of production involved with managing the Forest are expected to change at a rate equal to the general inflation rate.

REAL DOLLAR ADJUSTMENTS

Future prices and costs can be expressed in both nominal and real terms. The projection of nominal values includes the effect of inflation on prices and costs. The projection of real values does not. For example, assume that the future price of a commodity is projected to increase annually at a rate of 8 percent, while the rate of inflation is expected to be 5 percent. In real terms, the price of this commodity is then increasing by only 3 percent per year, since this is the rate of increase above the inflation rate. Real value changes such as this are the result of the interactions of supply and demand forces only, and do not include the effect of inflation.

All future prices and costs used in the planning process were expressed in real terms. To remove the effect of inflation and express values in terms of stable and comparable dollars, it is necessary to establish a base year to which all dollar values can then be adjusted. The base year for dollar values used in planning analysis was 1982, the same base year as was used in the 1985 RPA Program assessment. The GNP implicit price deflator index was used to convert both historic and future nominal costs and prices to this common base (FSM 1971.32b).

COSTS USED IN ECONOMIC ANALYSIS

This section describes the cost estimates that were used in the economic analysis of alternatives and benchmarks. Cost estimates were made by the ID team using historic data, projections made for the 1985 RPA assessment, and empirical evaluations of anticipated future needs and conditions. Professional judgment was a key factor in assessing the relationship between data covering past costs and anticipated future conditions. Costs were originally estimated in 1981, revised as necessary in 1984, and reviewed in 1989. Cost estimates were approved where appropriate by Forest Management Team members.

The cost estimates used in FORPLAN analysis can be subdivided into two distinct components: costs to the Forest Service (budget costs) and costs to others. The principal component of "costs to others" is the logging cost associated with harvest of National Forest timber. This cost alone constitutes about 60 percent of the total cost of each alternative. The remaining 40 percent covers anticipated budget expenditures.

The budget costs associated with each alternative also fall into two separate categories: capital investments and operations/maintenance costs. Capital investments are expenditures on the Forest's physical plant which are designed to provide long-term returns. Examples include road construction, tree planting, and fish habitat improvement structures. Operations/maintenance costs cover those activities which are necessary to conduct the day-to-day business of the Forest. Such things as road maintenance, timber sale administration, and habitat condition monitoring fall into this category. On the Olympic National Forest,

virtually all capital investment costs are for either road construction or activities associated with continued timber production. These form a substantial proportion of the projected budget of each alternative.

In all alternatives, $8.1 million in budget costs are "fixed" and do not vary from alternative to alternative. Included in this category are basic overhead and administrative costs, as well as costs associated with programs which will be essentially the same in all alternatives. Examples of such programs include management of Dennie Ahl Seed Orchard and the base level of road maintenance needed to keep the existing road system serviceable.

All remaining costs change as the objectives of the alternatives change. Since timber harvest and the associated road construction are the primary factors contributing to variable budget costs, projected budgets for alternatives increase as harvest level increases, and vice versa. The unit costs of harvest-related activities vary considerably, depending on the characteristics of the area in which they occur. For example, the costs of timber sale preparation, fuel treatment, and silvicultural treatments all increase as difficulty of access increases. Road construction cost varies with slope, soil stability, and average rainfall (expense increases as the need for drainage structures increases).

All of the costs included in economic analysis, both fixed and variable, were represented in the FORPLAN model. Fixed costs were included, even though they do not change from alternative to alternative, in order to facilitate the estimation of budgets and eliminate the need for recalculation of PNV to incorporate fixed costs after each FORPLAN run.

Note that the effects of Forest activities on off-Forest fish habitat quality, which were included as a variable cost to others in DEIS analysis, have been removed as a factor in the calculation of PNV. While these effects have still been estimated to facilitate comparison of alternatives, it is felt that including them in the economic calculations is inappropriate. Both the procedures used to estimate such effects and the degree to which available off-Forest habitat will actually be utilized (which determines actual output level as opposed to theoretical output level) are highly speculative. As a result, monetary values for these effects are no longer included in the PNV analysis.

FIXED COSTS

A cost was classified as "fixed" if it either (1) was not expected to vary significantly over the range of alternatives to be considered, or (2) would represent an insignificant proportion of the total Forest budget in all alternatives. Projections of fixed costs were developed by members of the Forest Management Team, based on estimates of future expenditures necessary to maintain ongoing Forest management programs at levels approximately equivalent to those of today. These costs were included in the budget estimates and PNV calculations of each alternative. Fixed cost projections for the first decade of the planning horizon are displayed, by major program category, in Table B-5.

Table B-5. Fixed Costs by Major Program Component

Program Component	Projected Annual Cost 1st Decade (thousands of dollars)
Fish and Wildlife Habitat Management	381.5
Fire Prevention, Detection, and Suppression	906.6
Timber Planning	129.0
Tree Improvement Program	176.0
Land Management Planning	91.0
Law Enforcement	130.0
Recreation and Scenic Resource Management	477.9
Minerals, Special Uses, Lands	252.1
Soil Resource Monitoring and Management	166.0
FA&O Construction and Maintenance	479.4
FR&T Construction and Reconstruction	1,941.1
FR&T Maintenance and Road Management	997.4
General Overhead and Administration	2,000.0
TOTAL FIXED COST 1/	8,128.0

1/ Fixed Cost as Percent of 1989 Budget ($20.5 million) - 39.6%

VARIABLE BUDGET COSTS

All Forest Service costs not considered to be fixed were included in FORPLAN as variable costs. These costs are tied to the implementation of the activities included in management prescriptions, and are expressed as costs per acre of activity or unit of output. In total, these costs range from 9.0 percent to 71.4 percent of the estimated first decade budgets of the various alternatives. The principal categories of variable costs are displayed in Table B-6, along with the range of values included in FORPLAN analysis and the sources of cost estimation data.

The range of cost figures shown in Table B-6 for each cost category results from both differences in prescription intensities and the relationship between land characteristics and costs. The cost of virtually any activity depends in part on the type of land to which it is being applied. In developing variable cost estimates for economic analysis, the ID team incorporated cost differences associated with land type variations wherever clear distinctions could be established without adding excessive complexity to model structure. Refer to Table B-2 for a presentation of the key linkages between land characteristics and variations in activity costs. Please note that the high end of the cost range for many activities represents extreme conditions in terms of terrain and access difficulty, and applies to only limited acreages.

As can be seen in Table B-6, the primary component of variable budget costs on the Olympic National Forest is the set of costs associated with the harvest and management of timber. The costs of other resource programs do not vary greatly (and are thus generally treated as "fixed"), even though the output levels of some nontimber resources show significant variation across the alternatives. The reason for this is that the output of such resources is essentially a function of land allocation rather than financial investment. Widely differing levels of output are associated with a fairly stable level of expenditure, since output level is most heavily dependent upon the land allocation pattern of a given alternative.

Table B-6. Variable Costs Used in FORPLAN Analysis

Cost Category	Cost Range (Dollars)	Unit	Source of Cost Estimate
Sale Preparation (includes other resource support)	54.60 - 98.44	per MCF	Experienced costs on-Forest
Sale Administration	11.52 - 17.28	per MCF	Experienced costs on-Forest
Fuel Treatment	297.30 - 689.80	per acre	Experienced costs on-Forest, adjusted for expected change in fuel treatment standards
Reforestation (planting)	424.80 - 706.60	per acre	Projections supplied by silviculturists (both Forest and District)
Reforestation (natural)	178.40 - 267.60	per acre	Projection developed by Forest Silviculturist
Precommercial Thinning	200.00 - 300.00	per acre	Projection developed by Forest Silviculturist
Fertilization	75.00	per acre	Experienced costs on-Forest
Road Construction	155,000.00 - 249,000.00	per mile	Projections developed by Forest engineering staff
Road Reconstruction	16,920.00 - 33,840.00	per mile	Projections developed by Forest engineering staff
Road Engineering (construction & reconstruction)	8,460.00 - 34,800.00	per mile	Experienced costs on-Forest
Road Management (per decade)	3,918.00	per mile	Experienced costs on-Forest
CWFS Maintenance	0.00 - 26.16	per MCF	Experienced costs on-Forest

The reader may note that many of the costs associated with timber management activities (including logging costs, discussed in the following section) are higher than those traditionally experienced by industrial forest managers. There are four principal reasons for this difference: terrain, accessibility, comprehensiveness of cost information, and level of environmental protection. The first two have a substantial influence on costs. Timber harvest and management activities conducted on the Olympic National Forest usually occur in areas that are significantly steeper, more dissected, and less accessible by road than the typical timber management site on industrial or State of Washington forest land. These factors add considerably to most management costs.

Comprehensiveness of cost information and environmental protection also lead to differences between the Forest's cost data and those of other timber managers, although the influence of these is less pronounced than the effect of terrain and accessibility. National Forest cost data include administration and overhead costs for many activities, while forest industry costs typically do not. In addition, measures taken to protect nontimber resources during National Forest timber management activities are often more comprehensive (and more expensive) than those associated with activities on other ownerships.

The reader may also note that the costs associated with timber harvest are linked to events that can occur up to five years before or after the actual harvest occurs. The costs shown in Table B-6 are actual costs, and have not been inflated or discounted so as to relate them to time of harvest. Such a procedure was

not needed, due to the timing pattern of the costs in question. Those that occur prior to harvest (e.g. sale preparation and road engineering) are well balanced in time and magnitude by those that occur after harvest (e.g. fuel treatment and reforestation). Thus, using actual costs directly provides a very good approximation of the relationships that would occur if all costs were adjusted to time of harvest.

VARIABLE COSTS TO OTHERS - LOGGING COSTS

The point of valuation for timber in this economic analysis is prior to harvesting, or stumpage value. Nonetheless, logging costs cannot be ignored even though they occur after the point of valuation. The value of stumpage is directly influenced by the cost of harvesting it and transporting it to the mill for further processing. Two identical logs would be worth the same amount when in the mill yard. If one log cost significantly more to deliver to the mill than the other (perhaps due to helicopter logging versus hilead logging), a timber purchaser would be willing to pay much less for that log on the stump. Therefore, stumpage values are a function of logging costs as well as the value of the finished products derived from the logs.

The Olympic National Forest FORPLAN model expresses timber value as mill value rather that stumpage value. Modelled costs include logging costs that are specific to both prescription types and land characteristics. The net effect of this modeling approach is that timber is valued as stumpage, but with stumpage value dependent upon analysis area features and harvest methods.

Logging costs were developed by the Forest logging system specialist for both final harvest and commercial thinning. Final harvest cost estimates were based on past timber sale appraisals on-Forest for hilead and skyline systems, and on the Region 6 Westside Logging Cost Guide for tractor and helicopter systems. Costs were varied by geographic zone (to reflect differences in typical logging system mixes), plantability (to reflect the additional logging cost associated with natural regeneration), and accessibility (to reflect the greater cost of sophisticated logging systems). Costs include resource protection measures (such as stream cleanout) associated with timber harvest. Final harvest logging costs range from $425.80 to $1408.60 per thousand cubic feet.

Commercial thinning cost estimates were developed on the basis of a series of empirical appraisals in which both harvest tree diameter and harvest volume per acre were varied over wide ranges. This analysis resulted in a set of cost functions for commercial thinning in which logging cost is linked to tree size and volume of harvest. These cost functions were used in both FORPLAN analysis and the DP/DFSIM analysis which served as the basis for selection of the Douglas-fir commercial thinning regimes to be included in FORPLAN prescriptions (see "Development of Timber Options"). Commercial thinning costs were also varied by geographic zone, and range from $313.30 to $1030.70 per thousand cubic feet.

Logging costs were expanded through time at the same real rate of increase as were timber mill values. This adjustment was necessary in order to net out the price trend that is, in effect, applied to logging costs when the real rate of value growth is applied to total mill value. The net effect of this procedure is to apply the projected price trend to high bid stumpage value, which is the value for which real value growth projections were originally developed.

The above logging costs per thousand cubic feet are based on experienced cost data collected in terms of cost per thousand board feet. To convert board foot costs to cubic foot costs, a range of conversion factors was used. These factors vary by species and productivity class, age class, and diameter class, and range from 1.12 board feet per cubic foot for managed 6"-10" diameter Douglas-fir to 5.87 for existing Western hemlock large saw in productivity class 1. This range of conversion factors provides a more precise estimate of board foot/cubic foot relationships than the Forest-wide average conversion factor of 4.35 used in DEIS analysis.

BENEFITS CONSIDERED IN ECONOMIC ANALYSIS

This section describes the priced benefits included in the economic analysis associated with Plan alternatives. These benefits can be segregated into two categories: those for which fees are collected, and those which are received by users without payment. Benefits for which payment is received by the U.S. Treasury (timber stumpage, special uses, a portion of developed recreation output) represent cash income to the federal government and can be used in conjunction with budget estimates to project net cash flows. Benefits accruing to users without direct payment to the Treasury (the portion of developed recreation not covered by fees, dispersed recreation, commercial fishery outputs) do not represent income to the government but add nonetheless to total economic benefit. These benefits, when added to the benefits for which fees are received and considered in conjunction with total costs, form the basis for calculation of overall net economic benefit (present net value).

As with costs, all priced benefits which were part of the assessment of Plan alternatives and economic analysis were incorporated in the FORPLAN model. This enabled the ID team to avoid the need to recalculate PNV after each run in order to adjust for unmodeled output values. Benefit values are based on the value of outputs at the production site. If off-site values are used for an output (e.g. mill values for timber), costs incurred and profits earned after the output has left the site are deducted.

TIMBER VALUES

Timber values were expressed in terms of dollars per thousand cubic feet (MCF) paid for timber delivered to the mill. Because these values were adjusted for logging costs within the FORPLAN model, however, the net effect of the model formulation was expression of timber values as stumpage values paid by timber purchasers at the time of harvest. These values represent market prices based on actual transactions which occurred on the Forest.

Average timber stumpage prices were calculated on the basis of prevailing bid rates in effect at the time of harvest of Olympic National Forest timber during the period from April 1977 through September 1983 (Hays and Barranco, 1984). This technique, often referred to as "cut value" pricing, was used to maintain consistency with 1985 RPA Program assumptions. The source of bid rate data was computerized Timber Sale Statement of Account records. Prices were generated, by geographic zone and tree species, as values per thousand board feet (MBF) and converted to cubic foot values using the range of board foot/cubic foot conversion factors developed for FEIS analysis. These factors vary by species and productivity class, diameter, and age class (the Forest-wide average conversion factor for large saw is 5.46 board feet per cubic foot). All prices were expressed in constant 1982 dollars.

In order to convert average stumpage prices for Forest timber into mill values, Forest-wide average logging cost was added to stumpage value. This cost was determined by statistical analysis of 2400-17 Timber Sale Report data covering the period 1973 to 1982. The end result of this series of calculations and adjustments was an estimate of mill value by diameter class, for each important tree species and in each geographic zone, which consisted of average stumpage value plus average logging cost.

For existing sawtimber stands, these species-specific values were then converted into timber stand values on the basis of overall stand composition, which varies by both geographic zone and elevation. Values were also varied by tree size, using price/diameter relationships developed by the Pacific Northwest Forest and Range Experiment Station. By subtracting logging costs specific to both prescriptions and site characteristics from the final set of timber stand mill values, FORPLAN analysis calculations reflect the true stumpage value of individual timber stands. Timber stand values by diameter class for existing large saw and small saw stands are displayed in Table B-7.

Note that the values for the Shelton zone are lower than Eastside-Westside values, which was not the case in DEIS analysis. The values shown here reflect the effect of noncompetitive bidding for National Forest timber from the Shelton CSYU, and thus represent expected revenues to the Treasury precisely. In the original analysis, Shelton zone values were adjusted to capture the full economic value of the timber by estimating the mill values that would prevail if bidding were competitive. Public response to the DEIS led to the conclusion that the approach used here is preferable. This change in valuation technique does not affect managed stand values (Table B-8), since these stands are expected to be harvested after termination of the Shelton CSYU Cooperative Agreement and be subject to competitive bidding.

Table B-7. Stand Mill Values by Zone ($/MCF)

Zone	Diameter Class	Mill Value
Eastside	8"-16"	$815.00
	16"-20"	1,162.40
	20"+	1,482.50
Westside	8"-16"	896.40
	16"-20"	1,244.60
	20"+	1,535.50
Shelton	8"-16"	695.20
	16"-20"	991.00
	20"+	1,262.10

For managed stands, values were developed on the basis of the species type of individual analysis areas. Separate values were developed for Douglas-fir and Western hemlock/silver fir. Once again, values were varied by tree size, using the price-diameter relationships discussed above. Mill values by species group for managed stands are presented in Table B-8. Unlike existing sawtimber stands, these values do not vary by zone (since species composition for managed stands is expected to be consistent Forest-wide).

Table B-8. Mill Value by Species and Diameter (DBH)

DBH	Douglas-fir Value ($/MCF)	Western Hemlock Value ($/MCF)
6"	$230.10	$427.70
10"	647.30	669.80
12"	851.60	851.60
14"	1,027.40	1,053.50
16"	1,187.40	1,235.60
18"	1,314.80	1,369.00
20"	1,451.80	1,486.50
22"	1,513.50	1,486.50
24"+	1,621.50	1,486.50

RECREATION AND COMMERCIAL FISH HARVEST

Outputs of Forest-generated recreation use and commercial anadromous fish harvest were priced in FORPLAN analysis. Recreation not related to fish and wildlife outputs is represented as use consumed on

the Forest, and is measured in recreation visitor days (RVDs). Fish and wildlife recreation generated by on-Forest habitat is measured in wildlife and fish user days (WFUDs) and is valued at the point of consumption, regardless of location. Commercial fish harvest values are represented as prices at the dock. Dollar values are linked to output levels as described in "Development of Yield Coefficients". The values for all of these priced outputs were derived directly from the DEIS for the 1985 RPA program assessment. The following discussion is a summary of relevant sections of Appendix F of the 1985 RPA DEIS, which covers resource value development.

> The development of recreation, Wilderness, and wildlife values for the 1985 RPA program analysis consisted of two steps: (1) development of recreation and wildlife benefit values by activity per RVD or WFUD, and (2) adjustment of values to reflect standard and less-than-standard levels of management.
>
> The Resource Evaluation Group at the Rocky Mountain Forest and Range Experiment Station conducted an extensive literature search to aid in development of the 1985 activity values for recreation. Benefit values for recreation, wildlife activities, and Wilderness were developed from recent travel cost models and contingent valuation research (Loomis and Sorg 1982). In-service and academic specialists reviewed the research and the activity values and adjusted them to achieve the methodological consistency necessary to apply them to regional conditions. The values represent average willingness to pay.
>
> In response to the question of the quality of recreation experiences, the concept of service categories (standard and less-than-standard) was introduced. The resulting impact on the value of the experience to the recreationist was estimated. If recreation facilities are not fully maintained, the quality of the experience will be lowered. Two different sets of values were developed to account for this effect. A special study showed that, on average, less-than-standard RVDs are valued at about 53 percent of the value of standard RVDs.

Recreation values were expressed in terms of Recreation Opportunity Spectrum (ROS) categories so as to be consistent with the development and analysis of alternatives. The resulting values are displayed in Table B-9.

Table B-9. 1985 RPA Benefit Values for Region 6 (1982 dollars)
(Average Willingness to Pay)

Recreation	Value ($/RVD)
Primitive - Standard (STD)	$11.25
Less-than-Standard (LSTD)	5.96
Semi-Primitive Non-Motorized - STD	13.25
LSTD	7.02
Semi-Primitive Motorized - STD	12.13
LSTD	6.43
Roaded Natural - STD	9.38
LSTD	4.97
Rural - STD	8.47
LSTD	4.49
Urban - STD	11.38
LSTD	6.03
Wilderness (all ROS classes) - STD	17.50
LSTD	9.28
Recreation from Wildlife and Fish Outputs	**Value ($/WFUD)**
Big Game Use	$30.00
Small Game Use	19.00
Nonconsumptive Use	25.00
Anadromous Fish Use	33.00
Resident Fish Use	15.00
Commercial Fishing	**Value ($/lb.)**
Anadromous Fish Harvest	$1.05

Of the above values, the following were used in the Olympic's analysis of alternatives: Semi-Primitive Non-Motorized (LSTD), Roaded Natural (STD), Wilderness (LSTD), and all of the wildlife and fish values (both recreational and commercial). Less-than-standard values were used as noted to reflect the fact that areas currently providing Semi-Primitive and Primitive recreation opportunity on-Forest are presently being used at levels which exceed their theoretical capacity to provide full quality experiences. This situation is expected to continue throughout the planning horizon. The Semi-Primitive Non-Motorized value was used to represent unroaded recreation outside Wilderness because this is by far the most common ROS class within the Forest's undeveloped areas. The roaded natural value was used for both developed and roaded dispersed recreation. Note that values for roaded dispersed recreation were not included in the DEIS economic analysis. They have been added to the PNV calculation of the FEIS in order to adequately represent the full array of the Forest's recreation outputs.

SOCIAL AND ECONOMIC IMPACT ANALYSIS

OVERVIEW

THE ROLE OF THE OLYMPIC NATIONAL FOREST IN THE LOCAL ECONOMY

The principal social and economic effects of Forest activities are felt in the four counties that comprise the Olympic Peninsula: Clallam, Grays Harbor, Jefferson, and Mason. The Peninsula is essentially rural, with population centers generally small and scattered. The principal towns are Port Angeles (Clallam County, population 17,500) and Aberdeen-Hoquiam (Grays Harbor County, population 26,250). Other important population concentrations include Shelton (Mason County), Port Townsend (Jefferson County), and Forks (Clallam County). About 35 percent of the Peninsula's population is located in these five centers, with the remainder in smaller settlements and unincorporated areas. Virtually the entire population lives on the Peninsula's perimeter, along or close to the Highway 101 corridor. The mountainous core, consisting primarily of National Forest and National Park lands, is essentially uninhabited.

The economic bases of the Peninsula are closely tied to the natural resources of the area. Much of the land is highly productive forest land. As a result, the management, harvest, and processing of timber form a dominant component of the economy. Outdoor recreation opportunities are abundant and diverse; therefore, recreation and recreation-related enterprise are a second major component of the Peninsula economy. The Peninsula has an extensive saltwater shoreline (Hood Canal, Strait of Juan de Fuca, Pacific Ocean); as a result, commercial fishing and aquaculture are important. These three natural resource-related enterprises form the foundation of the Peninsula economy.

In terms of basic employment figures, four sectors account for the vast majority (over 80 percent) of Peninsula employment. These are government (23.8 percent of total employment), wholesale and retail trade (23.3 percent), services (18.1 percent), and wood and paper products manufacture (17.5 percent) (Washington State Employment Security Department, 1989). However, the first three of these are essentially service and support industries, with employment therein largely dependent on the three basic industries mentioned above. Much of the employment directly generated by recreational activity, for example, is recorded as occurring in the retail trade or services sectors. Therefore, the remainder of this discussion will focus on the Peninsula's principal basic industries: timber, recreation, and fisheries.

Timber harvest and processing is the principal extractive industry on the Olympic Peninsula, and as such serves as one of the area's economic mainstays. Over 40 percent of Peninsula employment is directly or indirectly generated by the timber industry. Timber harvest from National Forest lands (including Simpson Timber Company lands within the Shelton CSYU) presently accounts for over 20 percent of the total harvest on the Peninsula. Therefore, National Forest timber output forms a significant proportion of the local timber industry and is thus an important factor in the overall economy.

The role of Forest timber in the local economy goes beyond the employment and personal income generated by harvest. Twenty-five percent of the receipts from timber sales are returned to county governments in the form of payments in lieu of taxes, with the remainder of these receipts going to the Federal treasury. Harvest from Simpson land within the Shelton CSYU does not affect county and treasury receipts, but the company's property tax and yield tax payments also contribute to the flow of capital into government treasuries.

Employment and income generated by recreation is not as easily identified as that related to timber harvest, since there is no one economic sector which can be labeled as the "recreation industry." It is

estimated that roughly 25 percent of total Peninsula employment results from all forms of recreation. Less than 10 percent of estimated total recreation employment is attributable to National Forest recreation, making this a relatively minor component of the overall Peninsula economy. As with timber, receipts from National Forest recreation for which a fee is charged (developed recreation, including special uses) contribute to county and Federal treasuries.

The role of commercial fishing and aquaculture in the Peninsula economy is likewise difficult to identify. Much of the employment and income generated by the fisheries resource is recreational (sport fishing), and is included in estimates of recreation sector employment. Remaining fishery-related employment and income comes from two principal sources: commercial anadromous fishing and the shellfish industry. Perhaps 5 to 10 percent of total Peninsula employment is generated in these sectors.

The role of National Forest management in the commercial fishery is as a supplier of fish habitat. This habitat produces catchable adult anadromous fish, thereby increasing the supply base of the commercial fishing industry. The economic effects of the Forest's contributions to the fishery are not limited to the Peninsula, as the fish are harvested throughout Puget Sound and in the Pacific Ocean. Although its effects spread beyond the confines of the Peninsula, the importance of the Forest's fishery outputs in the overall economy is negligible. Only a small proportion of the total commercial catch in the Puget Sound area originates from Forest habitat.

Beyond the borders of the Peninsula, the social and economic importance of Forest activities diminishes greatly. The Forest does have some direct economic effect on Thurston County (directly southeast of the Peninsula), as about six percent of the Forest's timber is processed here. Also, the Forest Supervisor's Office is located in Thurston County. These two factors combined, however, form only a small proportion of the County's total economy. The principal Forest effects outside the Peninsula center around the recreational opportunities and visual amenities provided by the Forest to the urban populations of Thurston, Pierce, King, Snohomish, and Kitsap Counties. Many of the residents of these areas enjoy outdoor recreation activities on the Forest (particularly the eastern portions), and many more are sensitive to the scenic attractiveness of the eastern slopes of the Forest as seen from urban areas (especially Seattle and Tacoma). These are the principal concerns when considering the social and economic effects of Forest activities within the urban counties of western Washington.

At the regional (i.e. the Pacific Northwest as a whole) and national levels, the influence of Forest activities on social and economic well-being is small indeed. To be sure, wood products from the Forest's timberlands contribute to the overall supply of housing materials and paper products, and the recreational opportunities provided by the Forest attract visitors from outside western Washington. In terms of the Forest's contribution to the total supply of wood products and recreational opportunities, however, the importance of the Forest at the regional and (especially) national levels is minor. For example, the Forest's share of total Forest Service harvest in Region 6 has historically been roughly 6 percent; nationally, the share has been 3 percent. The proportions for recreation are even lower.

CURRENT CONDITIONS WITHIN THE LOCAL ECONOMY

Employment and Personal Income

Table B-10 displays the dependency of each Peninsula county's labor force on wood and paper products. The "Direct Employment" column indicates the number of person-years employed specifically in the wood products industry, while the "Total Employment" figures show estimates of the overall employment, including service and support jobs, generated by the wood products industry. The "National Forest Employment" column displays the estimated number of person-years of total employment generated by National Forest

harvest, based on the average harvest level from 1980 through 1988. Harvest during this period averaged 380 million board feet, or 86 percent of the planned harvest (441.8 million board feet). These figures include harvest from Simpson Timber Company lands within the Shelton Cooperative Sustained Yield Unit (Mason County).

Table B-10. Employment - Wood Products Industry

County	Total Labor Force (Person-Years)	Direct Employment	Percent Labor Force	Total Employment	Percent Labor Force	National Forest Employment	Percent Labor Force
Clallam	16,630	2,590	15.6	6,190	37.2	1/ 1,185	7.1
Grays Harbor	22,170	4,670	21.1	10,090	45.5	1/ 1,430	6.4
Jefferson	5,040	760	15.1	1,840	36.5	2/ 160	3.2
Mason	7,970	1,050	13.2	3,010	37.8	2,305	28.9
TOTAL PENINSULA	51,810	9,070	17.5	21,130	40.8	5,080	9.8

1/ Probably a slight overestimate, due to necessary harvest disaggregation assumptions.
2/ Probable underestimate, due to disaggregation assumptions.

As can be seen, over 40 percent of Peninsula employment is either directly or indirectly dependent upon the wood products industry. It is difficult to estimate the proportion of the labor force which is dependent upon the second important industry, recreation. Estimates place the figure at roughly 25 percent. While it is difficult to develop a reliable estimate of the total importance of recreation to the Peninsula economy, it is possible to assess the contribution of National Forest recreation.

Table B-11 displays total employment (including service and support jobs) related to recreation (developed and dispersed combined) on Forest lands, based on 1986 use levels. The low proportion of the labor force (2.1 percent) which is dependent on National Forest recreation is not surprising, given the variety of recreational opportunities on the Peninsula as a whole. The principal natural attractions are the shoreline and Olympic National Park; both of these attract more people than the Forest. In addition, tourist attractions in the Port Townsend-Sequim-Port Angeles area generate considerable employment, as do services to retirees and commuters ("recreationists" in the sense that they reside on the Peninsula for its natural amenities). When considered in the context of the overall recreation picture on the Peninsula, the Forest's role as a source of recreation-related employment is relatively minor.

Table B-11. Employment Resulting from National Forest Recreation

County	Total Labor Force (Person-Years)	Total National Forest Employment	Percent Labor Force
Clallam	16,630	1/ 105	0.6
Grays Harbor	22,170	325	1.5
Jefferson	5,040	2/ 295	5.9
Mason	7,970	1/ 365	4.6
TOTAL PENINSULA	51,810	1,090	2.1

1/ Probably a slight underestimate, since the employment estimates are directly related to numbers of recreation visitor days (RVDs) experienced in each county and many of the services provided to recreationists on NF land in Jefferson County are actually purchased in Clallam and Mason Counties.
2/ Probable overestimate for reason stated in footnote 1.

In Tables B-10, B-11, and B-12, "Total Labor Force" and "Direct Wood Products Industry Employment" data were taken from employment estimates for 1988 provided by the State of Washington Employment Security Department. The remaining estimates were derived using employment and income multipliers generated by the Region 6 Input-Output Model. This model is based on 1977 employment and income data for each county, and provides the most reliable set of multipliers currently available. Applying multipliers determined under 1977 conditions to 1988 employment figures may lead to slight distortions in the estimates. However, since all employment and income factors are estimated using the same set of data, the relative changes are comparable and the accuracy of the estimations is considered acceptable.

Patterns in personal income generated by the timber and recreation industries predictably follow employment patterns very closely. These are displayed in Table B-12, which includes the same type of information breakdown as the employment tables. The footnotes included for Tables B-10 and 11 also apply to this table.

Table B-12. Personal Income (1982 dollars), Timber and NF Recreation

County	Total Personal Income (Thousand Dollars)	Timber: Direct Income	Percent Total	Timber: Total Income	Percent Total
Clallam	319,700	68,070	21.3	130,050	40.7
Grays Harbor	469,940	121,980	26.0	227,490	48.4
Jefferson	79,440	22,050	27.8	40,660	51.2
Mason	136,880	26,540	19.4	57,070	41.7
TOTAL PENINSULA	1,005,960	238,640	23.7	455,270	45.3

County	National Forest Timber: Total Income	Percent Total	National Forest Recreation: Total Income	Percent Total
Clallam	24,510	7.7	1,390	0.4
Grays Harbor	31,530	6.7	4,250	0.9
Jefferson	3,220	4.1	3,090	3.9
Mason	43,660	31.9	4,770	3.5
TOTAL PENINSULA	102,920	10.2	13,500	1.3

Precise data for commercial fishery employment, and its direct and indirect effects on total employment in the Puget Sound area, are not available. A rough estimate of the Forest's potential contribution to employment in this sector has been derived using the current estimated potential commercial fish output from Forest habitat (1.12 million pounds). In doing this, twice the 1982 dockside value of $1.05 per pound is used as a conservative estimate of direct personal income derived from this industry. The Peninsula average of $19,400 in personal income per person-year of employment (1982 dollars) is used to convert this income estimate into employment. Finally, an estimate of two service and support jobs for every basic industry job (a standard assumption when precise information is not available) is used to estimate total employment.

The above assumptions yield an estimate of approximately 360 person-years of employment per year (throughout the Puget Sound area) generated by the Forest's potential commercial fishery output. This is equivalent to 0.7 percent of the total Peninsula labor force. Based on the same estimation procedure, the production potential of off-Forest fish habitat which is influenced by Forest activities has associated with it an additional 4500 to 5000 jobs, equivalent to roughly 9 percent of the total Peninsula labor force. These potential jobs are scattered throughout the Puget Sound area rather than limited to the Olympic Peninsula alone.

From the above discussion of employment and personal income factors, it is possible to draw several conclusions which are meaningful in the assessment of Forest effects on the local economy. These are:

1. With respect to stability of employment and income, changes in Forest timber output would have more significant effects than changes in recreation output or fishery productivity.

2. Because the Peninsula economy depends so heavily on timber and recreation, it is strongly responsive to regional and national economic conditions. Demand for both wood products and outdoor recreation tends to fluctuate more strongly with economic cycles than does overall demand. Therefore, when the broader economy is strong and expanding, the Peninsula economy could potentially "boom." Conversely, stagnation or recession in the larger economy is likely to result in serious downturns in the Peninsula economy.

3. Because timber harvest and recreation are the principal economic bases, employment is normally sporadic and seasonal. Both industries are most active during the summer months, and both are highly responsive to economic cycles. Consequently, periods of unemployment and/or reduced income are familiar phenomena to many Peninsula residents, and may be somewhat less disruptive here than in an economy in which constancy is the usual condition.

Timber Industry Characteristics

Timber industry in the four-county Peninsula area had, in 1986, the following makeup (Washington State Department of Natural Resources, "*1986 Washington Mill Survey*"): 10 sawmills with annual single-shift

capacity of 40 MMBF or more, 7 veneer and plywood mills, and 5 pulp mills (the total number of operations is, however, less than 22, as more than one mill type may be present at a given site). In addition, there are numerous small sawmills and shake/shingle mills. In 1986, Peninsula sawmills averaged 213 operating days per year. This is up considerably from the 1982 average of 165, and reflects the resurgence of demand for western Washington wood products in the late 1980's.

About three-quarters of the larger mills and most of the small mills depend on "outside" sources for raw materials. The remainder have timberland holdings of their own and are somewhat independent from outside supply sources (provided their land contains sufficient harvest-age timber). According to the "*1986 Washington Mill Survey*," approximately one-quarter of both the large sawmills and the veneer and plywood mills relied on National Forest timber as a major source of supply (at least two-thirds of total milled volume) in 1986. The complete breakdown of Peninsula mill supply sources in 1986 is shown in Table B-13.

In addition to timber milled on the Peninsula, a high proportion (43.4 percent in 1986) of the annual log harvest is exported, mostly to Japan. About 70 percent of the export volume comes from private land, with the remainder from State of Washington and American Indian lands. This large export volume serves to intensify competition among Peninsula mills for that timber which remains available for local processing, and also leads to reduced employment opportunity within the Peninsula timber industry. The export of raw logs generates fewer jobs per million board feet of harvest than does complete processing of logs into lumber and other wood products. It should be noted that National Forest timber may not be exported in log form.

Table B-13. Olympic Peninsula Mill Supply Sources 1/

Source	Percent of Total Milled Volume	Percent of Total Export Volume	Percent of Total Harvest 2/
National Forest	25.8	0.0	14.6
State of Washington	16.6	22.8	19.3
Other Public Land	1.5	5.1	3.1
Forest Industry Land 3/	48.5	61.9	54.4
Small Private Holdings	7.6	10.2	8.7

1/ "*1986 Washington Mill Survey*,"Washington State DNR. Because of the way the survey is compiled, the above data include Pacific, Lewis, and Thurston counties. Nonetheless, the figures should be fairly representative of the four Peninsula counties alone.
2/ Milled and export volumes combined.
3/ Includes harvest from Simpson land within the Shelton CSYU.

Payments to Counties and Treasury Receipts

One quarter of total National Forest cash income is paid to local counties in lieu of property tax. While the sale of National Forest timber is by far the largest contributor to these payments to counties, all revenue-generating activities (campground fees, special use fees, oil and gas lease payments, etc.) on the Forest play a part in providing income to county governments.

The system used to distribute payments to counties is based on total Federal ownership within each county. The 25 percent fund is pooled and then divided among the five counties containing National Forest land (Clallam, Jefferson, Mason, Grays Harbor, and Thurston) on the basis of a fixed percentage rate, regardless of the amount of income generated in each county. This system was devised at the time Olympic National Park was created because those counties with a large proportion of Federal land in the

Park (which generates relatively little income per acre) would receive disproportionately small payments relative to total Federal acreage. Therefore, in the interest of equity, the fixed proportion system was implemented.

The remaining 75 percent of National Forest income is used in two ways. Some of it is allocated to the income-generating activity in order to cover direct operations costs. For example, the 25 percent county share of timber sale receipts is based on *gross* receipts, including purchaser credits for road construction. Since the Forest receives its purchaser credit "income" in the form of a road rather than cash, it is essentially a direct cost of timber harvest. After direct costs such as this have been defrayed, the remaining income is deposited in the Federal treasury. Payments to counties and treasury deposits for the 1980-1989 period are displayed in Table B-14.

Please note that the Treasury deposits shown in Table B-14 are *not* equivalent to the net receipts displayed in FEIS Chapter II. Treasury deposits are calculated by subtracting direct costs and payments to counties from total receipts, and represent actual deposits from the Forest to the Treasury. Net receipts are the difference between total receipts and total Forest budget, and represent overall net cash flow resulting from Forest operations.

Table B-14. Payments to Counties and Treasury Deposits

	Payments to Counties (Million $): 1/					
Year	Clallam	Grays Harbor	Jefferson	Mason	Total	Treasury Deposits (Million Dollars)
1980	2.95	0.91	3.99	0.94	8.79	19.0
1981	2.16	0.67	2.92	0.69	6.43	11.2
1982	1.38	0.43	1.87	0.44	4.12	6.0
1983	1.12	0.34	1.51	0.35	3.32	3.9
1984	1.58	0.49	2.13	0.50	4.70	6.6
1985	1.12	0.35	1.51	0.35	3.33	8.8
1986	1.53	0.47	2.07	0.49	4.56	12.3
1987	1.59	0.49	2.14	0.50	4.72	13.8
1988	2.35	0.72	3.17	0.74	6.98	24.2
1989	2.57	0.79	3.46	0.81	7.63	26.8
Average	1.83	0.57	2.48	0.58	5.46	13.3

1/ Payments to Thurston Co. are minimal (0.046% of the total), and are not included in table.

The Shelton Cooperative Sustained Yield Unit

The Shelton Cooperative Sustained Yield Unit is discussed here because of the significant role it has played in the economy of Mason County since it was formed in 1946. See the discussion of "Sustained Yield Units" in FEIS Chapter III for additional information about this area. In 1946, Simpson land on the south Peninsula was essentially cutover. Little timber of harvest age was available, and Simpson's sawmills in Mason County were without a log source. The former Shelton District of the Olympic National Forest (now part of the Hood Canal District), on the other hand, contained extensive acreage in old-growth timber. Under nondeclining flow policies applicable to National Forest timber, the Shelton District old-growth could not have been sold at a rate fast enough to provide the volume needed to keep Simpson's mills operating at their customary level. Therefore, in order to avoid a significant disruption of the Mason County economy, the Sustained Yield Unit was created.

Since it was formed in 1946, the Unit has been successful in accomplishing its purpose. The economy of Mason County has remained quite stable, and potentially disruptive timber supply shortages did not materialize. The present importance of the Unit to Mason County is demonstrated by the proportion of total county employment (28.9 percent) dependent upon timber harvest from the Shelton CSYU.

HISTORIC TRENDS

The modern-era economy of the Olympic Peninsula was originally based almost exclusively on the harvest and processing of timber. Beginning in the early 1900's, Peninsula industry and the associated communities developed as harvest progressed. Through the 1950's, timber retained its position as the primary factor dominating the Peninsula economy. In the 1960's, recreation began to play a more important role in the overall economic picture, as an increasingly mobile society discovered the scenic and recreational attractions of the area. In the recent past, the relative importance of timber in the local economy has decreased, while that of recreation has increased. Nonetheless, the timber industry still forms the largest component of the Peninsula's economic base.

In the early 1980's, a significant reduction in demand for Pacific Northwest timber resulted in a decline in Peninsula employment, income, and overall economic health. Total employment in 1984 was approximately 9 percent below the 1977 level, based on comparison of Region 6 Input-Output model data (1977) with State of Washington Employment Security Department estimates for 1984. Employment in the wood products industry dropped as much as 24 percent during the same period. In the late 1980's, however, demand for local timber has recovered strongly, with average annual Peninsula harvest volume increasing 35 percent from the 1980-84 period to the 1985-88 period. This recovery in economic activity has probably been a major factor in the 9.5 percent increase in total Peninsula employment between 1984 and 1988.

The Olympic National Forest's role in the local economy has paralleled the development of the economy itself, with the exception of the timing of timber harvest expansion. Until the mid-1940's, the Forest was essentially a preserve rather than a supplier of products, and played only a minor role in the economy. In the mid-1940's, harvest volume from the Forest began increasing markedly, reaching current levels by the 1970's. The Forest's contribution to the supply of recreation opportunities became important in the 1960's, when the Peninsula recreation industry as a whole began to achieve significance.

FUTURE TRENDS

The trend which is most likely to affect the Peninsula economy in the future is a probable decline in the relative importance of the timber industry. The projected timber supply picture on the Peninsula (see "Vegetation", FEIS Chapter III) serves as the basis for this projection. In addition, economic development planners for the State of Washington as a whole are now predicting that timber harvest and other extractive industries will decline in importance, and that increased emphasis on other forms of economic activity will be needed if the State's economy is to remain healthy. Tourism and recreation are among the industries identified as being vital to the future of the State, and present the most likely opportunity for expansion of the Peninsula economy.

A potential scenario for the future of the Peninsula economy includes eventual stabilization of the timber industry at a production level substantially below that of the late 1980's. The adjustments necessitated by such a shrinkage would affect employment and income for some time to come, especially if continued improvements in sawmill and pulp/paper mill efficiency reduce the number of workers required per unit of production. Growth in the recreation and tourism sector could compensate for at least some of these effects, especially if the population of retirees and commuters continues to expand (see "Population Trends" later in this section). In summary, it seems most likely that the economic base of the Peninsula will

shrink to some extent over the next twenty to thirty years, with the importance of the timber industry decreasing while that of the recreation industry increases.

THE ROLE OF THE OLYMPIC NATIONAL FOREST IN LOCAL COMMUNITIES

The activities and outputs of the Olympic National Forest occur in the context of the values and lifestyles of the surrounding communities. Every Forest action has the potential to be either consistent with or in conflict with the goals, preferences, and desires of community members. As a general rule, actions pleasing to some are displeasing to others, since there is much variability in values within the Peninsula society.

Because the Forest is a source of employment, a supplier of recreational and aesthetic opportunities, and a component of the overall pattern of American Indian traditional values, it can affect community members in a variety of ways. The lifestyles, values, traditional beliefs, cohesion, and even stability of local communities can be disrupted or enhanced by the management of the Forest. Because goals and desires differ, and because increases in one output or resource quality generally entail changes in another, there is no single factor by which to gauge the compatibility of Forest activities with the surrounding communities. It is the *mix* of outputs and resource qualities, considered in the context of individual community values and desires, that determines the nature of the Forest's role within its community environment.

Much of the following discussion is based on information and guidance found in two key documents. General instruction regarding assessment of the effects of Forest activities on local communities was taken from Chapter 1970 ("Economic and Social Analysis") of the Forest Service Manual. This document outlines the basic analytic approach to be used and key variables to consider. Specific information regarding community characteristics has come largely from the "*Socio-Economic Overview of the Olympic Peninsula*" prepared in 1980 by Eleanor Y. Adelman. This document covers the characteristics of Olympic Peninsula communities and identifies trends in community values and beliefs. The information contained in this overview, supplemented with knowledge provided by Forest personnel familiar with local communities, is the foundation of the description and analysis of the Forest's role within its community environment (see also FEIS Chapter IV, "Local Communities").

CURRENT CONDITIONS WITHIN LOCAL COMMUNITIES

Community Characteristics

The goals, values, and lifestyles of communities affected by Forest activities vary greatly as one travels around the Peninsula and its environs. While individual concerns and desires are, of course, highly varied, it is possible to group those related to Forest management into two distinct lifestyle types and value sets: those most closely tied to forest products and timber harvest, and those oriented toward recreation and/or conservation of natural resources.

Close ties with timber harvest are characteristic of those who perceive their employment and/or income to be dependent upon the timber industry. Harvest is also an important consideration to many long-term Peninsula residents who are not directly involved in the industry, but hold values which have evolved in an environment dominated by the "timber ethic" (a set of beliefs which places high value on the timber-oriented lifestyle). The orientation toward recreation and conservation is generally held by newer residents and non-Peninsula residents who perceive no direct economic dependency on the timber industry (or recognize some dependency but deem it unimportant), and by many whose livelihood is perceived to be tied to the recreation or fishing industry.

Given these two value sets and their geographic distribution within the areas of concern, five separate community groups have been identified to serve as the basis for discussion of social considerations and effects. Each of these community groups is sufficiently uniform in characteristics to be analyzed as a unit, and each is distinct from the others. They are discussed individually below.

The Eastside Community Group: Geographically, this community group includes the northeastern and eastern portions of the Peninsula, from Port Angeles in the north to Hoodsport in the south. It is a highly diverse set of communities, characterized by a good deal of conflict between timber-related lifestyles and values and those tied most closely to recreation and conservation.

The population can be divided into four major components: (1) retirees and commuters, (2) persons whose employment is most closely tied to recreation, fishing, or aquaculture, (3) younger urban emigrants who have chosen the Peninsula's more peaceful lifestyle, and (4) persons whose employment and/or value systems are tied to the timber industry. Of these, the first three tend to be strongly oriented toward recreational/conservational concerns, while the fourth is equally strong in its timber orientation. Both groups are deeply concerned about land management issues, and the timber-oriented segment in particular feels quite vulnerable to disruptive changes in lifestyle. In sum, it can be concluded that the Eastside community is an area of divergent value systems with high potential for conflict regarding Forest management.

The Westside Community Group: Included in this community group is the western half of the Peninsula, from Forks in the north to Aberdeen/Hoquiam in the south. Unlike the Eastside, this area is characterized by uniformity of interest. Some retirees and younger persons have moved here from other areas, and recreation plays a meaningful role in the Westside economy. In addition, the Peninsula's most productive fisheries lie in this zone, and fishing is a factor in the area's economic base. Nonetheless, the primary source of employment and income is the timber industry, and the overwhelming majority of the population has grown up with the timber ethic and lifestyle. Due to this relative uniformity of goals and values, conflict regarding land management practices is minimal within the Westside community.

The Shelton CSYU Community Group: Most of Mason County (everything south of Hoodsport) and the eastern part of Grays Harbor County (the McCleary area) are included in this group. The Shelton Cooperative Sustained Yield Unit (Shelton CSYU) is an important economic feature in this area. With respect to social characteristics, this set of communities can be considered as a transition between the Eastside and Westside community groups. Here, as on the Westside, the timber industry is the principal source of employment, and the majority of the population is attuned to the timber ethic. In Mason County, however, there is a growing retiree/commuter population with a strong recreation/conservation orientation. In addition, the recreation industry is expanding in importance in the county economy, increasing the proportion of the population which perceives recreation as its economic mainstay.

These changes in the demographic and economic characteristics of the community have resulted in increased potential for conflict concerning land management goals and values. In this regard, the primary difference between the Eastside and Shelton CSYU community groups lies in the relative importance of each of the divergent orientations. The recreation/conservation orientation is, at least at present, a minority position within Mason County, while on the Eastside it is becoming (or has perhaps become) the dominant value set.

The Urban Community Group: This includes the urban populations of Thurston, Pierce, King, Snohomish, and Kitsap Counties (particularly the cities of Seattle, Tacoma, Everett, Bremerton, and Olympia). While this area is much too large and diverse to be treated as a unit in most respects, it can be considered as such with respect to its relationship to management of the Olympic National Forest. By and large, the members of this community group are concerned with two aspects of land management--recreation opportunity and scenic quality. Many Puget Sound urbanites frequently visit the Forest for outdoor recreation. Many more

view the eastern slopes of the Forest from their homes, and are quite sensitive to changes in the landscape. Thus, it may be said that the values and concerns of the urban community group are strongly oriented toward recreation and overall environmental quality. It should also be made clear that the importance of Forest activities to the typical member of this community group is relatively minor when contrasted with their significance to Peninsula residents.

The American Indian Community Group: Unlike the others, this community group is culturally rather than geographically defined. Its members live throughout the Peninsula, both on tribal reservations and within the general population. The relationship between this community group and Forest management is multi-faceted due to the varying values and needs of its members. American Indians on the Peninsula rely on the recreational and commercial fishing industry and the timber industry for much of their employment and income, and are thus concerned with the maintenance of timber harvest and protection of fishery habitats. Subsistence fishing is particularly important, both as a cultural activity and as a source of sustenance. In addition, traditional values and beliefs (centered around fish, wildlife, and old-growth cedar) form the basis for a high interest in the protection and conservation of natural resources. Closely associated with this is the concern held by American Indians that treaty rights must be fully protected and preserved. Because of these varying concerns, there is potential for conflict regarding Forest management within this community group.

The existence of treaty rights reserved to members of this community group is an important aspect of managing the Forest. All Peninsula tribes have certain rights extended to them in perpetuity through treaties with the United States. Typically, these treaties assure the right to hunt, fish, and gather food in "usual and accustomed places." Most include some additional provisions, which vary somewhat from treaty to treaty. In addition, parts of the Forest (specific locations have not usually been identified) are considered religiously significant by individual tribal members and organizations.

For specific details on treaty rights and cultural and religious concerns, please refer to the sections of FEIS Chapter III titled "Historical and Cultural Resources" and "American Indians." Forest management must be conducted in such a way as to assure that American Indian treaty rights and religious traditions are protected.

Population Trends

Population dynamics of the Olympic Peninsula are closely related to its natural resources. Historically, Peninsula population has fluctuated in concert with the economic cycle of the timber industry, growing in "boom" periods while shrinking during "busts." More recently, the natural amenities of the area have generated a population boom in the eastern portion of the Peninsula. The area was "discovered" by retirees and commuters (to jobs in the urban counties of Puget Sound) alike in the late 1960's. This led to rapid population growth in all but Grays Harbor County (see Table B-15). This influx has continued into the 1980's, although at a substantially slower rate. Population estimates from the State of Washington Employment Security Department (1989) indicate that between 1980 and 1989 the combined population of Clallam, Jefferson, and Mason Counties has increased 13.3 percent, while the population of Grays Harbor County has decreased 4.1 percent. Once the retiree/commuter population has stabilized, population trends may again become most dependent on the economic health of the timber industry.

Table B-15. Olympic Peninsula Population Trends

	Population			Percent Change:		
County	1970	1980	1989	70-80	80-89	Percent of Population: 65+ Years of Age
Clallam	34,770	51,648	55,200	48.5	6.9	16.2
Grays Harbor	59,553	66,314	63,600	11.4	-4.1	14.5
Jefferson	10,661	15,965	19,200	49.8	20.3	17.8
Mason	20,918	31,184	37,500	49.1	20.3	14.4
TOTAL PENINSULA	125,902	165,111	175,500	31.1	6.3	15.4
State of Washington	3,413,244	4,132,156	4,660,700	21.1	12.8	12.0

Racial and ethnic minorities constitute 6.6 percent of the total Peninsula population. The principal component of this minority population is the American Indian community. The Olympic Peninsula is home to many Pacific Northwest American Indian tribes, with a combined population of approximately 6,300 (about 3.6 percent of the total population). As discussed previously, the American Indian community has a very strong tribal orientation, with traditional beliefs and values playing a key role in the lifestyles of many of its members. This cohesive and distinctive cultural group is an important component of the overall fabric of Olympic Peninsula society.

TRENDS IN COMMUNITY VALUES

The development of Olympic Peninsula community characteristics has closely paralleled the economic development of the area. Initially, the predominant value system throughout the Peninsula centered around timber harvest and the "timber ethic." As recreation began to increase in importance in the 1960's, so too did the importance of the recreation/conservation orientation in community value systems. This change was accelerated by the influx of retirees and commuters into the eastern areas of the Peninsula. It is anticipated that, as recreation continues to increase its relative importance in the local economy, the trend toward greater importance of recreation (and conservation in general) in community value systems will continue as well. This generalization does not apply to the American Indian community. This group has traditionally had a strong conservation orientation as well as a substantial link to the timber industry.

SOURCES OF DATA

The principal sources of data which were used in the analysis of social and economic impacts are listed below. Information and guidance from these sources formed the basis of both the Forest's identification of prevailing current conditions and trends and its analysis of potential socio-economic effects.

1. The primary source of information regarding the characteristics of local communities was the "*Socio-Economic Overview of the Olympic Peninsula*", prepared in 1980 by Eleanor Y. Adelman. This work was also of great assistance in the analysis of effects, as it provided many useful insights into the workings of Peninsula communities.

2. FSM 1970 ("Economic and Social Analysis") provided substantial guidance regarding procedures to be used in the assessment of the effects of Forest activities on local communities.

3. Information regarding current characteristics of the timber industry on the Olympic Peninsula was derived from the "*1986 Washington Mill Survey*", published by the State of Washington Department of Natural Resources.

4. Estimates regarding the current employment situation on the Peninsula were taken from the 1989 "Annual Demographic Information" publications for Service Delivery Areas I and II, provided by the State of Washington Employment Security Department.

5. 1980 population data for the Olympic Peninsula was derived from the "*1980 Census of Population*," developed by the U.S. Census Bureau. 1989 population estimates came from the 1989 "Annual Demographic Information" for Washington State (State of Washington Employment Security Department).

6. Information regarding the basic economic structure of Olympic Peninsula counties was derived from the data base of the Region 6 Input-Output model (IMPLAN). This data base also served as the source of employment and income coefficients associated with changes in Forest output levels. The input-output model is discussed in detail in the following section.

THE ECONOMIC IMPACT ANALYSIS MODEL

The IMPLAN model was the mechanism used to estimate the employment and personal income effects of Plan alternatives within Olympic Peninsula counties. IMPLAN is an input-output model software program which resides on the Univac computer at the Fort Collins Computer Center. It is not the purpose of this discussion to describe IMPLAN in detail. Thorough coverage of the model may be found in the IMPLAN User's Manual (1982) and several additional papers which describe the system in detail.

Economic input-output (IO) analysis is a procedure for describing and analyzing the structure of interindustry dependencies in a regional economy. The region, in this case, is the Olympic Peninsula--Clallam, Grays Harbor, Jefferson, and Mason Counties. Input-output analysis is based on the interdependence of the production and consumption sectors of the economy for the area under study. Its foundation rests on the concept that industries must purchase inputs from other industries, as well as from primary sources (i.e. natural resources), for use in the production of outputs which are then sold to either other industries or final consumers. A set of input-output accounts can be thought of as a "picture" of an area's economic structure at a specific point in time. In the case of the Region 6 IO Model, the point in time is 1977. The structure of the county economies of the Olympic Peninsula, as of 1977, is represented within the IMPLAN data base as a mathematical transactions matrix of buyers and sellers.

The proposed output levels associated with each alternative are represented as changes in the current levels of final demand for these outputs in the IMPLAN model. Changes in production requirements associated with satisfying these changes in final demand, and the resulting flow of industrial inputs and outputs, can be traced via the IO accounts to show both the linkages between and the impacts on the various industries composing the regional economy. Through mathematical matrix manipulations, the estimated direct, indirect, and induced effects of Plan alternatives can be evaluated. Because changes in employment and personal income are of primary concern to many people within local economies, these are the factors most commonly tracked in economic impact analysis.

The IMPLAN Data Base

The IMPLAN model has a data base consisting of (1) a national level technology matrix, (2) a file of estimated activity levels for total gross output, 6 final demand components, and 3 final payment indicators, and (3) employment estimates for 466 industrial/business sectors (Alward and Palmer, date unknown). The national level technology matrix is based on a 1972 Department of Commerce IO model that was converted to an "industry by industry" basis and updated to 1977 using the RAS procedure (Clopper, Almon, et.al., 1974).

National Data Base Reduction to Impact Area

County level information is based on a 1977 data set constructed by Engineering Economics Associates of Berkeley, California. Given the national technology matrix and the control totals for the four Peninsula counties, a data reduction method (the "supply-demand pool technique") was used to develop input-output tables for the economic impact area. This method exploits the "openness" of smaller regional economies when compared to the national economy (Richardson, 1972). Small regional economies exhibit much greater tendencies to import and export goods and services than does the national economy. Therefore, they are more "open". Based on the assumption that trade balances are the principal difference between national and regional purchase patterns (i.e. industry production functions are identical but regional imports and exports make local inter-industry transactions different), the supply-demand pool technique for data reduction was adopted.

Final Demand Expenditures

For each alternative, the input-output model was used to translate proposed changes from current levels of resource output production into changes in employment and income within the area directly influenced by Forest management. An intermediate step in this process was to equate changes in the respective resource outputs to changes in final demand expenditures by sector. Final demand expenditures are different from the values used in economic analysis, in that they represent the dollars spent at the point of final consumption rather than some intermediate point in the production process (e.g. "on the stump", in the case of timber). The point of final consumption is either the sector from which the ultimate consumer purchases a product or the sector beyond which the output is exported from the region. The point of final consumption of a board foot of timber, for example, would be the construction sector if that timber were used to build a house for consumer purchase. If that timber were exported following processing at a local sawmill, on the other hand, the point of final consumption would be the primary wood processing sector. By identifying the final consumption point, the transactions of all industries involved in processing a given output are considered. Final demand expenditures were estimated for timber, dispersed recreation, and developed recreation in the Olympic's IO analysis.

Employment and Income Response Coefficients

The ultimate goal of input-output modeling is to generate estimates of the changes in employment and personal income that would result from changes in output levels. Specific incremental changes in output level (e.g. 1 million board feet of timber) were used as input to the IO model and it, in turn, provided the estimated direct, indirect, and induced employment and income effects that would be associated with each increment of change. These incremental effects coefficients are called "response coefficients". The response coefficients used in the Forest's economic impact analysis are displayed in Table B-16 below. Current output levels and the incremental output changes used to generate response coefficients are also shown. Base year 1982 dollars are used. All figures represent annual levels.

Table B-16. Employment and Income Response Coefficients by Resource

				Response Coefficients:	
Output	County	Current Level 1/	Production Increment	Employment (Jobs/year)	Income (Millions of Dollars)
Timber	Clallam	88.0	1 million board feet	13.46	0.28
	Grays Harbor	88.0		16.23	0.36
	Jefferson	19.0		8.55	0.17
	Mason	185.0		12.47	0.24
Developed Recreation	Peninsula-wide	3.67	100,000 RVDs	91.80	1.04
Dispersed Recreation 2/	Peninsula-wide	9.56	100,000 RVDs or WFUDs	68.53	0.88
Commercial Fishing 3/	Peninsula-wide	15.32	1 million pounds	324.74	6.30

1/ Timber harvest disaggregation is based on both location of harvest and location of processing. While the estimates are somewhat uncertain because several assumptions were necessary in developing them, the separation by county was maintained due to the variations in county-specific response coefficients.

2/ Includes estimates of all forms of on-Forest dispersed recreation activity, including WFUDs of wildlife-related recreation generated by Forest habitat and potential production of WFUDs of fishery-related recreation generated by on-Forest habitat.

3/ Includes estimates of the potential of both on-Forest and influenced off-Forest anadromous habitat to produce commercial fish harvest. Response coefficients for this output were not generated by the IO model, but rather estimated as described in "Current Conditions Within the Local Economy".

INFORMATION GENERATED BY THE ANALYSIS OF SOCIAL AND ECONOMIC EFFECTS

The anticipated social and economic effects associated with Forest Plan alternatives are discussed in detail in Chapters II and IV of this FEIS. A brief summary of these effects is presented below.

EMPLOYMENT AND PERSONAL INCOME EFFECTS

Employment and personal income on the Olympic Peninsula are affected by the differences in output mix among the alternatives. Table B-17 displays the projected changes from present levels of employment (person-years of employment) and personal income (millions of 1982 dollars) associated with each of the alternatives. The factors considered in developing these projections are (in order of magnitude of effect): timber harvest level, commercial fish output, and projected level of recreation use. In assessing the effects of changes in commercial fishery outputs, the projected effects of Forest activities on off-Forest habitat have been included. Although the products of off-Forest fisheries are not Forest outputs, changes in productivity due to Forest management are clearly effects of the alternatives. Therefore, it is appropriate to consider such effects in the estimation of employment and income changes.

Of the above factors, timber harvest level has by far the greatest effect on employment and personal income. This output varies widely from alternative to alternative and, therefore, has significant employment and income differences associated with it. Commercial fish production shows a low degree of variation from alternative to alternative, and thus results in relatively moderate changes in employment and income. Variations in recreation use are also relatively small, and result in employment and income effects of fairly low magnitude.

Employment and income estimates were generated on the basis of the following assumptions:

1. All timber offered for sale will be purchased, harvested, and processed. The planned harvest level of each alternative is related to the current level of *actual* harvest (380 million board feet, on average, from 1980 through 1988) to estimate the effects of variations in harvest level by alternative.

2. Recreation opportunities provided will be consumed at the projected rates.

3. Available fish habitat, both on and off-Forest, will be fully utilized and, therefore, provide the outputs associated with the potential productivity estimated for each alternative.

In considering the information in Table B-17, note that all the pluses and minuses relate to the current employment situation. For example, assume that 50,000 people are currently employed on the Peninsula. Alternative A-Current Direction (No Action) is expected to result in the loss of an annual average of 200 jobs in the first decade. If this alternative were to be implemented, then the average employment on the Peninsula during the first decade would be 50,000 - 200 = 49,800.

Table B-17. Employment and Personal Income Changes by Alternative

Change in Employment = Person-years of Employment per Year
Change in Income = Million Dollars of Personal Income per Year

	1st Decade Changes in Employment:				1st Decade Changes in Income:			
Alternatives	Timber-Related	Recreation/Fish Related	Total	Percent Labor Force	Timber-Related	Recreation/Fish Related	Total	Percent of Total
No Change	+850	-200	+650	1.3	+17	-3	+14	1.4
A-Current Direction	-300	+100	-200	0.4	-6	+1	-5	0.5
B-Dep (Modified)	+1,100	-250	+850	1.6	+22.5	-4.5	+18	1.8
C-Pref (Modified)	-1,150	+350	-800	1.6	-23	+6	-17	1.7
H (Modified)	-2,250	+400	-1,850	3.5	-45.5	+7.5	-38	3.8
I	-3,000	+600	-2,400	4.6	-60.5	+10.5	-50	5.0

Of all the alternatives, Alternatives NC-No Change and B-Departure (Modified) stand alone insofar as increasing employment and personal income is concerned. These alternatives generate substantial increases in jobs and income in the first decade. Alternative A-Current Direction (No Action) is the only alternative that results in projected employment and income levels roughly equivalent to the present situation.

Alternatives C-Preferred (Modified), H (Modified), and I entail increasingly significant reductions in total employment and income. Alternative I in particular involves an employment and income decrease in the first decade which must be labelled significant, as it involves close to five percent of the total labor force. The reductions in timber harvest level associated with these alternatives are the principal factor generating these effects. While increased recreation outputs and improved fish habitat conditions lead to employment and income gains in these areas, these gains are insufficient to balance the losses in the timber industry sector. This is especially true in the case of personal income, since employment associated with wood products generates a higher level of income per job than does that associated with recreation and fisheries.

Two of the alternatives have first-decade effects on employment and personal income which may be disruptive: Alternatives H (Modified) and I. Any large shift in employment availability has the potential to disrupt an economy. Even the rather substantial employment increases projected for Alternatives NC-No Change and B-Departure (Modified) could be potentially disruptive (in an essentially positive way). The considerable drops in employment and income associated with Alternatives H (Modified) and (especially) I may be significant enough to pose some threat to the stability of timber-dependent communities on the Peninsula.

EFFECTS ON LOCAL COMMUNITIES

Most of the effects associated with implementation of the alternatives discussed in FEIS Chapter IV are important primarily when considering the relationships between Forest activities and the affected community groups. They are likely to have relatively small impact when considered in the context of the affected community groups as a whole. Two of the alternatives, however, entail effects within specific community groups which have the potential to be quite disruptive. Alternatives B-Departure (Modified) and I, for entirely different reasons, could conceivably affect community stability within certain areas.

Alternative B-Departure (Modified), with its high harvest level and almost total lack of amenity emphasis, could affect community cohesion and lifestyles within the Eastside and American Indian community groups to the extent that stability is impaired. Alternative I, entailing as it does an extensive reduction in harvest level, could result in employment opportunity reductions severe enough to disrupt the stability of the Westside and American Indian community groups.

The above conclusions were reached in the context of an assumption (necessary in isolating specific effects of alternatives) that current conditions in local communities, as a whole, will remain fairly stable. In actuality, this is not likely to be the case. It is projected that the effects of timber supply reductions from non-National Forest sources (see also FEIS Chapter III, "Vegetation") will precipitate a state of continuous change within Peninsula communities over the next 15-25 years. A decline in timber industry-related employment is expected to be an important factor in the pattern of overall change. At the same time, the emphasis on and relative importance of recreation and tourism is expected to increase. These combined elements could disrupt community groups in which values centered around the "timber" ethic are in conflict with environmentally oriented values. It is quite likely that community group members whose values are based on the "timber" ethic will be less satisfied with future circumstances and changing emphases in forest management.

How do the projected effects of the alternatives relate to the expected changes within Peninsula communities? In the short run (i.e. the next 20 years), it is likely that alternatives more consistent with values based on the "timber" ethic (Alternatives A-Current Direction, B-Departure (Modified), and NC-No Change) would serve to mitigate, to some extent, the concerns of timber-oriented community group members. Alternatives that emphasize amenity outputs (Alternatives C-Preferred (Modified), H (Modified), and I) are likely to further aggravate these concerns. In the long run, however (assuming that recreation and tourism do indeed increase in relative importance within Peninsula communities), the alternatives that are more amenity oriented may be most consistent with the ultimate mix of value sets and lifestyles on the Peninsula.

Regardless of the mix of community characteristics that ultimately evolves, conclusions may be drawn regarding probable interactions between the current state of change on the Peninsula and the effects of the alternatives. In community groups where there is conflict between timber-oriented and environmentally oriented values, polarization is likely to increase. Thus, the effects of alternatives expected to increase polarization between interest groups are likely to be intensified by the predicted changes in overall community conditions. Similarly, the effects of alternatives that are likely to foster differences between the Forest Service and those with timber-oriented interests are likely to be emphasized by the expected trends affecting the community as a whole.

ANALYSIS PRIOR TO DEVELOPMENT OF ALTERNATIVES

INTRODUCTION

The principal component of the analysis performed prior to the development of alternatives was the analysis of the management situation (AMS). This involved assessment of the current condition of the Forest, its potential to produce outputs, and society's demand for its resources. The analysis associated with the AMS helped to define the "decision space" within which the Forest can operate in addressing planning issues, concerns, and opportunities. Detailed results of the AMS may be found in the document "*Analysis of the Management Situation*", on file at the Forest Supervisor's Office.

A central feature of the AMS is "Benchmark Analysis." The Forest's benchmark analysis was performed in compliance with the requirements of National planning direction regarding the establishment of benchmark levels of production and present net value (PNV). The resulting benchmarks served as reference points from which the costs and effects of various objectives and constraints used in the development of alternatives could be evaluated. The specific purposes of benchmark analysis were:

1. Define the maximum potential of the Forest to produce both economic benefits and resource output levels, considering both market and nonmarket goods.

2. Evaluate the complementary and conflicting production relationships (tradeoffs) among pertinent market and nonmarket outputs.

3. Analyze the relative costs and implications associated with constraints used to satisfy resource management requirements specified by law or policy.

4. Identify the overall range of resource outputs within which management alternatives can be developed.

5. Provide a preliminary analysis of the implications of continuing to implement current management direction, thereby making it possible to determine whether alternative ways of changing said direction need be considered.

To accomplish these objectives, a series of required and optional benchmarks was developed and analyzed in accordance with Regional planning direction. The principal tool used in this analysis, as in the analysis of Plan alternatives, was the FORPLAN model. Although a few of the benchmarks could be analyzed without computer assistance, the majority were run in FORPLAN. Refer to "Benchmark Analysis" for a complete description of the benchmark analysis process and the associated results and findings.

DEVELOPMENT OF WAYS OR MEANS OF MEETING MANAGEMENT REQUIREMENTS (MRs)

While the analysis process was in its early stages, national planning direction was developed to assure that the process would be consistent with the requirements of applicable laws and regulations. Subsequently, the Pacific Northwest Region developed direction to ensure that requirements would be applied consistently throughout the Region. This direction is included in "*A Report on Minimum Management Requirements for Forest Planning on the National Forests of the Pacific Northwest Region, USDA Forest Service*" (June 1986), and provides guidelines for meeting MRs pertaining to management of the following resources of the Olympic National Forest:

1. Timber
2. Fish and Wildlife
3. Soil and Water Resources and Land Productivity
4. Water Quality
5. Riparian Areas

Through examination of resource management conditions and planning issues, it was determined that many of the resources addressed in MR direction could be sufficiently protected (through the use of standards and guidelines) without affecting the production of other outputs. Specific management direction involving constraints on operations that would affect resource outputs was, however, necessary in order to meet requirements in four general areas. These are: (1) dispersion and size of timber harvest units, (2) water quality in municipal watersheds, (3) riparian zone and fish habitat management, and (4) maintenance of adequate habitat for northern bald eagle, northern spotted owl, pileated woodpecker, pine marten, and cavity excavators. The development of the Forest's strategies for meeting management requirements for each of these areas is discussed below.

There have been numerous changes in the specifications and/or strategies for meeting management requirements since publication of the Forest's DEIS. The acreage of old-growth considered necessary to assure maintaining viable populations of the northern spotted owl has increased substantially. Both the modeling technique for and the means of meeting the dead and defective tree habitat MR have changed, and the method for representing the riparian zone/fish habitat MR in FORPLAN has been revised. Finally, changes in distribution specifications have reduced the number of pileated woodpecker and pine marten habitat areas needed to meet the objectives of the mature conifer habitat MR. The following discussions are based on the updated MR specifications included in FEIS analysis. Detail regarding the means of meeting management requirements may be found in Appendix I of this FEIS.

DISPERSION AND SIZE OF TIMBER HARVEST UNITS

Planning regulations require that regeneration harvest units be no larger than 60 acres in size (36 CFR 219.27 (d)(2)). In addition, new units may not be harvested until previously harvested areas adjacent to them are no longer considered to be openings. An area is no longer considered to be an opening once it is adequately stocked with trees at least 4.5 feet tall (standard and guideline 2-3, R-6 Regional Guide). On the basis of local measurements on the Olympic, it is assumed that this height is reached an average of 10 years after final harvest.

Analysis of possible harvest patterns and timing sequences over large areas indicated that up to 25 percent of a given area could be harvested per decade without violating the above requirements. This proportion was used as a FORPLAN constraint to assure that model solutions would reflect attainment of the necessary harvest dispersion. The constraint was applied to total area assigned to harvest prescriptions within each drainage individually.

WATER QUALITY IN MUNICIPAL WATERSHEDS

Prevailing conditions in the Forest's municipal watersheds have indicated that, in order to assure that adequate water quality is maintained, harvest per decade should be limited to no more than 16 percent of the total area available for harvest. This proportion was included, where applicable, as a constraint in the FORPLAN formulation. Within the three major drainages which are municipal watersheds (Big Quilcene, Dungeness, and Little Quilcene), the 25 percent dispersion constraint discussed above was reduced to 16 percent. Within the Humptulips-Wishkah drainage (as modelled in FORPLAN), only a small part (the Wishkah component) is used as a municipal water source. In this combination of drainages, the harvest

proportion constraint was reduced to 24.5 percent (reflecting 16 percent within the municipal watershed and 25 percent elsewhere).

RIPARIAN ZONE AND FISH HABITAT MANAGEMENT

Methods of meeting management requirements for riparian zones (36 CFR 219.27 (e)) were developed so as to assure maintenance of water quality and provide for an adequate source of large organic debris (vital for future rearing habitat for fish). For modeling purposes, these took the form of reduced timber yields in the empirical and managed yield tables. The intent of this approach was to approximate, within FORPLAN, the yield conditions that would result from managing so as to produce the desired results. It is expected that the standards and guidelines associated with riparian management will lead to the desired future riparian condition which the FORPLAN modeling represents.

The riparian protection allocations incorporated into FORPLAN modeling were cooperatively developed by the Forest Hydrologist and Forest Fisheries Biologist, and were based on consideration of both water quality and fish habitat needs. The allocations were reviewed by the Watershed Staff in the Regional Office. After investigation of several alternative possibilities, the conclusion was that the desired future riparian condition could best be represented by a set of harvest management limitations reflecting streamside conditions compatible with the attainment of management goals. These limitations were translated into timber yield reductions for FORPLAN modeling.

The limitations developed by the hydrologist and fisheries biologist (and reviewed in the Regional Office) are presented in Table B-18. They vary by stream class and distance from stream, to reflect the relative sensitivity of the different components of the riparian zone. The requirements extend to a distance of 200' from the stream because, on the Olympic, this is the average distance over which vegetative management activities directly influence stream characteristics. They are expressed in terms of allocations to harvest prescriptions. For example: within 100' of a class III stream, at least 10 percent of the acreage of tentatively suitable timberland must be allocated to "no harvest", at most 70 percent may be allocated to normal rotation prescriptions, and the remaining 20 percent may be allocated to either no harvest or an extended rotation equal to twice the normal rotation length.

Table B-18. Quantification of Riparian Zone Management Requirements

		Timber Harvest Allocation:		
Stream Classification	Distance from Stream	No Harvest	2X Rotation 1/	Normal Rotation
Class I	0 - 100 ft 100 - 200 ft	50%	50% 50%	 50%
Class II	0 - 100 ft 100 - 200 ft	25%	75% 25%	 75%
Class III	0 - 100 ft 100 - 200 ft	10%	20%	70% 100%
Class IV	0 - 100 ft 100 - 200 ft	5%	10%	85% 100%

1/ Rotation twice the normal length.

Once the above limitations had been developed, harvest allocations to be used in modeling the MR attainment strategy were generated. These were compiled on a drainage-specific basis, using the Forest fish habitat inventory. The information in this inventory enabled the ID team to estimate, by seral stage, the acreage of riparian zone in each stream class within each drainage. Application of the above percentages to these acreage figures yielded the acreages needed to represent the means of attaining riparian management goals. The results indicated that allocation of 8.15 percent of the riparian areas to be managed for timber harvest to "no harvest" prescriptions and 19.96 percent of such areas to "extended rotation" prescriptions would provide a sound modeling representation of the application of riparian management standards and guidelines. These proportions translate into a Forest-wide reduction of full yield timber yield tables of 3.4 percent.

MAINTENANCE OF ADEQUATE HABITAT FOR KEY WILDLIFE SPECIES

The Management Requirements for wildlife, as specified in 36 CFR 219.19 and 36 CFR 219.27 (a)(6), were developed on the basis of the habitat needs of indicator species. Olympic National Forest species for which methods of meeting MRs were developed include the northern spotted owl, northern bald eagle, marten, pileated woodpecker, and cavity excavators (as a species group). The sequence of steps that was followed in developing strategies for meeting the management requirements associated with these wildlife species is outlined below.

1. Sixteen historic and potential bald eagle management areas (BEMAs), established in response to the requirements of the Pacific States Bald Eagle Recovery Plan, were identified for allocation to "no harvest" prescriptions. Many other suitable areas exist in Wilderness, SOHAs, pileated woodpecker areas, pine marten areas, potential Wild and Scenic Rivers, and River Corridor allocations. Twenty-one such areas were established for DEIS analysis.

2. Spotted Owl Habitat Areas (SOHAs) were identified based on current occupancy patterns and habitat availability. SOHAs were identified through use of distribution requirements included in Regional direction. Because of limited spotted owl habitat capability within Wilderness areas, SOHAs outside Wilderness were needed to reach the MR level. These were selected on the basis of least impact to other resource outputs. Wherever possible, they were developed to incorporate as much unavailable and/or unsuitable timberland as possible. When it was necessary to include tentatively suitable timberland in SOHA allocations, areas involving timber management costs greater than projected revenues or capable of yielding high levels of nontimber outputs (or both) were given preference. The SOHA designation process resulted in the establishment of 30 SOHAs averaging 3,000 acres each.

3. Once SOHA allocations were established, management areas for the marten and pileated woodpecker were identified. Selection of these was based on habitat capability, distribution requirements, and the availability and suitability of timberland. A total of 56 pileated woodpecker habitat areas and 155 pine marten habitat areas were needed to meet MR specifications. In establishing these areas, full advantage of every opportunity to overlap habitat areas was taken. As a result, a majority of the pileated woodpecker allocations are included within SOHAs, and most of the marten allocations are included in either SOHAs or woodpecker areas.

When the wildlife management allocations had been established, the analysis area acreages included therein were identified and limited within the FORPLAN model to "no harvest" prescriptions in all runs in which attainment of MRs was included as a management objective (i.e. all runs other than those benchmarks in which MRs are specifically excluded).

Methods for meeting the needs of cavity excavating species were developed independently, based on the need for perpetual retention of an adequate base of appropriately sized and distributed snags. The strategy for meeting these needs was modelled in FORPLAN in a manner similar to that associated with meeting riparian zone needs, with full yield timber yield table reductions (averaging 4.6 percent) used to reflect snag retention requirements.

Selection of the management strategy for wildlife "no harvest" allocations was based on an analysis of the economic and timber output implications of the two principal options: dedication (no programmed harvesting) and management (regularly scheduled timber harvesting allowed). In the case of both old-growth habitat (bald eagle, spotted owl) and mature forest habitat (pileated woodpecker, marten), the "dedication" approach was clearly superior in terms of both present net value and timber production. Several combinations of habitat area size and rotation age were tried, but none were found that would make a regime of programmed timber harvest (while maintaining required habitat conditions) competitive with precluding harvest on much smaller "dedicated" areas. The lengthy rotations that would be needed over relatively large areas would result in substantial sacrifices of both harvest volume and present net value when compared to application of the Olympic's relatively short normal rotation lengths on all but the necessary dedicated acreage. Therefore, harvest was precluded in all wildlife MR areas in the FORPLAN analysis of benchmarks and alternatives.

GENERAL INFORMATION

The MRs described above do not apply to Alternative NC-No Change. In the case of this alternative, the management objectives and prescriptions associated with meeting MRs will be implemented only if doing so is completely compatible with the provisions of the timber management plans upon which the alternative is based. In most cases, when MR attainment necessitates the allocation of specific land areas to prescriptions which preclude or limit timber harvest, such allocations are inconsistent with timber management plan objectives.

Subsequent to the development of the Olympic's Draft Forest Plan and DEIS, the incorporation of MR attainment strategies into each Forest's Current Direction alternative was appealed (appeal number 1770, brought by the Northwest Forest Resource Council on September 18, 1986). In response to decisions of the Chief of the Forest Service and the Deputy Assistant Secretary of Agriculture regarding this appeal (which was denied), Appendix I of this document was prepared as part of a Supplement to the DEIS.

The appellants requested that the appropriateness of MRs be examined through the environmental analysis process. The analysis presented in Appendix I addresses the issues raised by the appellants by examining alternative means of meeting Management Requirements and determining the opportunity costs associated with the selected MR strategies. If a given MR results in a reduction of over 2 percent in either the present net value (PNV) or the long-term sustained yield capacity (LTSYC) of the maximum PNV benchmark, alternative MR implementation means and opportunity costs are evaluated in Appendix I.

The Appendix I analysis (which has been updated since publication of the Supplement to the DEIS) indicates that three of the Forest's Management Requirements entail PNV or LTSYC opportunity costs over 2 percent. The largest effects are associated with the "no harvest" allocations (SOHAs) necessary to assure maintenance of viable northern spotted owl populations. The timber yield reductions resulting from riparian zone management and maintenance of viable populations of cavity excavators also involve opportunity costs exceeding the 2 percent level of significance. Please refer to Appendix I for complete discussion of MRs, alternative means of their implementation, and the opportunity costs of their application.

Once the means of meeting MRs described above had been developed, they played a key role in both benchmark analysis (see following section) and alternative development. The full set of management

requirement attainment strategies was included in all alternatives. Most of the benchmark runs also included the full set, although several benchmarks were analyzed both with and without MR attainment provisions so that the effects of these on outputs and PNV could be assessed.

BENCHMARK ANALYSIS

The purposes of benchmark analysis are to establish the range of resource management potentials (of both priced and nonpriced outputs) available to the Forest, identify opportunities for and limitations on responding to ICOs, and assess the opportunity costs associated with changes in a variety of basic management assumptions. Each benchmark is designed to provide specific information about resource output possibilities, while simultaneously serving as a basis for determining particular opportunity costs (through comparison with other benchmarks).

The Olympic's original (DEIS) benchmark analysis accomplished these purposes and provided a framework for the development of alternatives. Since publication of the DEIS, there have been numerous changes in the basic information and modeling parameters incorporated in the Forest's FORPLAN model. Because of these updates, some key benchmarks were reanalyzed in order to assess the PNV and ASQ effects of the changes. The majority of the original benchmarks, however, were not reanalyzed. These had fulfilled their purpose in the alternative development process, and reanalysis with the new FORPLAN data was not deemed necessary. The original benchmark analysis is presented, as it was developed for the DEIS, in the following sections. The key results and conclusions of benchmark reanalysis follow the discussion of the original analysis.

The original benchmark analysis process involved the development of sixteen benchmarks in addition to the Current Direction benchmark described below. These are covered individually following the discussion of Current Direction. Important outputs associated with the benchmarks are displayed in Table B-21, which is followed by discussions covering the range of potential outputs and the opportunity costs associated with key management assumptions. Please note that much of the data and management direction used in developing the original benchmarks has changed since publication of the DEIS. To avoid confusion, the reader should keep in mind that the information in the following presentation is not current in all cases.

CURRENT DIRECTION BENCHMARK

The purpose of the Current Direction Benchmark is two-fold: to assess the effects of continuing management under present plans and practices, and to provide a "No Action" alternative with which alternative land management strategies can be compared. It is based upon current land use and timber management plans, Forest Service policies which are currently in effect, and current budget levels.

The Current Direction Benchmark was formulated on the basis of the direction, constraints, and assumptions discussed below. Each constraint or constraint set is derived from a specific aspect of the plans and policies guiding current Forest management. The source of each constraint is included in the ensuing presentation. Please refer to "Formulation of Alternatives" for discussion of the structure of Alternative A-Current Direction (No Action) as developed for FEIS analysis.

Objective function: Maximize timber in the first decade, rolled over to maximize timber for 15 decades, rolled over to maximize PNV for 15 decades. This sequence utilizes the "rollover" capability unique to Version II FORPLAN. This feature improves the solution of the primary objective by applying subsequent objective functions until the solution becomes satisfactory in all relevant respects.

Source: Timber management plans for Shelton CSYU, Quinault Working Circle, Peninsula Working Circle. The philosophy behind all three plans is essentially timber output maximization as opposed to emphasis on contribution to PNV as the primary criterion for land allocation and prescription selection. Therefore, the "maximize timber" objective function was selected.

Constraint: Nondeclining flow, applied individually to both the Shelton CSYU and remaining National Forest land (hereinafter referred to as "East-West").

Source: Timber management plans--all three are based on nondeclining flow, with the Shelton CYSU (including Simpson Timber Company land) being completely separated from and independent of harvest and growth on East-West land.

Constraint: No final harvest from stands which have not reached 95 percent of culmination mean annual increment (applies to National Forest land only).

Source: Current Forest Service policy.

Constraint: Budget must not exceed $26.3 million per year (current budget level) in any of the first five decades.

Source: "*Region 6 Direction for Land and Resource Management Planning*," November 10, 1983.

Constraint: Allocation of land to commercial thinning (CT) intensities limited to the following proportions of land allocated to all harvest intensities:

Area	Stand Type	Maximum CT Proportion
Eastside winter range	Existing small saw All others of CT age	55% 80%
Eastside summer range	Existing small saw All others of CT age	65% 90%
Westside winter range	Existing small saw All others of CT age	45% 80%
Westside summer range	Existing small saw All others of CT age	30% 50%
Shelton winter range	All of CT age	95%
Shelton summer range	All of CT age	85%

(NOTE: CT is not included for Pacific silver fir stands.)

Source: The above limitations represent the maximum proportions accessible to commercial thinning, given the existing and projected road networks and current yarding capabilities. It is taken as given that roads (other than minor spurs) will not be constructed solely for commercial thinning access.

Constraint: If helicopter logging areas are allocated to harvest, they must be harvested at an orderly rate. It is required that at least some of each helicopter area be harvested in the early decades. Constraints vary from area to area; a requirement that 20 percent of the harvest-age timber in a given area be harvested in each of the first four decades is typical.

> *Source*: When the timing of helicopter harvest is left open, the model consistently chooses to postpone it as long as possible and then harvest. This management strategy can increase total PNV (by increasing LTSYC, and thus early decade harvest when NDF is applied) if the net cost associated with helicopter harvest is postponed long enough. Such management is physically feasible but impractical. Harvesting the large, contiguous blocks that comprise the helicopter areas in the space of a few decades would clearly violate dispersion and size of opening requirements. Also, it is debatable whether a market will exist for large offerings of old-growth several decades after sawmills have adapted to second-growth timber. Therefore, the Forest has chosen to constrain the timing of helicopter harvest as described above.

Constraint: District harvest volumes in the first three decades allowed to fluctuate within the following limits only:

District	1st Decade Minimum Harvest	Maximum Decade - Decade Drop	Maximum Decade - Decade Rise
Hoodsport	23.0 MMCF	50%	100%
Quilcene	34.5 MMCF	50%	100%
Quinault	160.9 MMCF	25%	50%
Shelton	0 MMCF	No limit	No limit
Soleduck	114.9 MMCF	25%	50%

> *Source*: Using the current harvest program as a basis, these levels were selected to assure a degree of continuity in District programs. The constraint values were chosen so as to be non-binding with respect to timber harvest capability.

Constraint: No more than 5 percent of lands allocated to Foreground Retention prescriptions, 9 percent of lands allocated to Foreground Partial Retention and Middleground Retention prescriptions, and 12 percent of lands allocated to Middleground Partial Retention and Background Retention or Partial Retention prescriptions may be clearcut in any decade.

> *Source*: Minimum requirements necessary to assure that Visual Quality Objectives are met where this is the management objective.

Constraint: Preclude harvest within 29 1,000-acre Spotted Owl Habitat Areas, 28 300-acre pileated woodpecker areas (with 58 more included in other wildlife allocations), and 17 160-acre pine marten areas (with an additional 172 in other wildlife allocations).

> *Source*: Specifications for meeting management requirements (MRs). These are the allocations felt to be necessary to provide the habitat needed to sustain viable populations of the above wildlife indicator species.

Constraint: Preclude harvest within 21 northern bald eagle nest sites and wintering areas (6 of which are at least partially included in other wildlife allocations).

Source: Specifications for meeting MRs. Sites were identified in accordance with the Bald Eagle Recovery Plan and U.S. Fish and Wildlife Service standards and guidelines for bald eagle habitat management.

Constraint: Selected areas within riparian zones are to be allocated to no harvest (8,120 acres) and extended rotation (19,901 acres) prescriptions in order to assure maintenance of desired riparian conditions.

Source: Specifications for meeting MRs. These allocations are felt to be necessary in order to maintain the current level of fish rearing habitat quality and prevent reductions in overall water quality.

Constraint: Final harvest acreage per decade in any of the Forest's 21 major drainages limited to the following proportions of total drainage acreage allocated to harvest prescriptions:

Little Quilcene and Big Quilcene drainages: 16%
Humptulips drainage: 24.5%
All other drainages: 25%

Source: Specifications for meeting MRs. The 25 percent limitation represents the estimated maximum allowable harvest proportion which is consistent with dispersion and size of opening policies. The more restrictive limitations (16 percent, 24.5 percent) reflect additional requirements needed to meet management standards within municipal watersheds.

Constraint: Several areas, identified as special management areas in existing plans, are allocated to specific treatments designed to meet management goals. These are identified below.

Area	Acreage 1/	Allocation	Source
Pat's Prairie	327	Botanical-No harvest	Canal Front
Dungeness	4,449	Soil Protection-No harvest	Canal Front
Green Mountain	2,204	Meet Visual Quality Objectives	Canal Front
Duckabush River	1,129	Wild and Scenic River	Canal Front
Lena Lake	2,479	Recreation-No harvest	Canal Front
Lightning Peak	3,568	Recreation-No harvest	Canal Front 2/
Mt. Ellinor-Mt. Washington	2,043	Recreation-No harvest	Canal Front
Spider Lake	195	Recreation-No harvest	Shelton CSYU
South Skokomish VRM	6,788	Meet Visual Quality Objectives	Shelton CSYU
Rule Creek	254	No roads (harvest OK)	Shelton CSYU
Upper Skokomish	4,185	Recreation-No harvest	Shelton CSYU
Satsop Lakes	796	Recreation-No harvest	Satsop Block
Satsop VRM	1,445	Meet Visual Quality Objectives	Satsop Block
Wynoochee VRM	4,037	Meet Visual Quality Objectives	Shelton CSYU
Klone Lake	764	Recreation-No harvest	Shelton CSYU
Moonlight Dome	3,553	Recreation-No harvest	Quinault
Lake Quinault	1,918	Recreation-No harvest	Quinault
South Quinault Ridge	4,901	Meet Visual Quality Objectives	Quinault
Rugged Ridge	4,321	No roads (harvest OK)	Soleduck
Calawah River	120	Botanical-No harvest	Soleduck
Mt. Baldy A	1,765	No roads (harvest OK)	Soleduck
Mt. Baldy B	3,974	Recreation-No harvest	Soleduck

1/ Acreage includes unsuitable land.
2/ From Canal Front FEIS prior to decision notice amendment resulting from RARE II recommendation, and as amended by Washington Wilderness Act.

Source: See listing above.

Table B-19 summarizes the land use pattern on the Forest under current direction. It is derived from the Olympic's suitability stratification, allocations for wildlife habitat maintenance and riparian area protection needed to attain MR specifications, and the special management area allocations contained in current land use plans. The outputs associated with the Current Direction benchmark are shown in Table B-20.

Table B-19. Olympic National Forest Land Use

	Acres		
Net National Forest acreage	649,704		
Non-Forest, other uses		49,871	
Forested acreage	599,833		
Withdrawn		74,957	
Unsuitable		39,451	
Suitable acreage	485,425		
No harvest:		49,760	
Special management			20,325
Wildlife habitat			22,711
Riparian protection			6,724
Available for harvest	435,665		
Extended rotation:		33,622	
Visual management			12,748
Wild and Scenic River			973
Riparian protection			19,901
Available for normal rotation harvest	402,043		

Table B-20. Outputs: Current Direction

Harvest levels (MMCF/yr)	
East-West	
1st Decade	48.1
50 year average	48.1
SCSYU	
1st Decade	38.1
50 year average	38.1
Long-term sustained yield capacity (MMCF/yr)	
East-West	48.1
Decade reached	1st
SCSYU	57.6
Decade reached	7th
All NF land	59.5
Discounted benefits (MM$)	
1st 50 years	1,946.9
Discounted costs (MM$)	
1st 50 years	1,471.2
Present net value (MM$)	
1st 50 years	475.7
Budget (MM$/yr)	
1st decade	24.3
50 year average	24.4
RVDs (M/yr) (1st 50 years)	
Wilderness	162.1
Other unroaded	45.6
Developed	573.5
WFUDs (M/yr) (1st 50 years)	
Wildlife related	45.1
Fish related 1/	34.8
Commercial fish production (M lbs/yr)	
1st 50 years 1/	1,316
Old-growth (acres)	
Midpoint 5th decade	86,249

Table B-20. Outputs: Current Direction (Cont'd)

Sediment (tons/yr) 1st 50 years	174,423
Total Miles of Road construction 1st 50 years	475
Unroaded ROS Class Acres (other than withdrawn)	18,668
Acres Meeting Visual Quality Objectives 2/	24,348
Acres Suitable to "no harvest"	51,137
Acres to extended rotation harvest prescriptions 3/	33,509
Acres normal rotation harvest prescriptions	400,779

1/ Fisheries outputs generated by on-Forest habitat only
2/ Outside Wilderness, other than Modification and Maximum Modification.
3/ Includes both acres for which extended rotation is required and those selected for this prescription in FORPLAN optimization.

OTHER BENCHMARKS INCLUDED IN ANALYSIS

Benchmark 0: Minimum level

Purpose: To assess the costs and outputs associated with maintaining the Forest in Federal ownership while conducting no active resource management programs.

Assumptions: Only those activities necessary to protect the Forest and its incidental users will be undertaken. Management for resource output production will not occur.

Significant features and results: This benchmark was not analyzed in FORPLAN. Therefore, the results displayed in Table B-21 are estimates only. The nature of this benchmark is such that those outputs which depend on active management programs (timber production, developed recreation) drop to zero, while those which benefit most from inactivity (scenic quality, natural fisheries) rise toward their potential level. It should be noted that only those resource values which will be incorporated into the analysis of alternatives have been included in the PNV estimation for benchmark 0. Therefore, the negative PNV shown in Table B-21 is somewhat misleading.

Benchmark 1: Maximum timber

Purpose: To determine the Forest's timber production capability, given that all tentatively suitable land is available for harvest.

Objective function: Maximize timber output in the first decade, rolled over to maximize timber for fifteen decades, rolled over to maximize PNV (fifteen decades).

Constraints: Nondeclining flow Forest-wide, no regeneration harvest prior to 95 percent of CMAI, commercial thinning access limitations, visual prescription access limitations, and timing requirements for helicopter logging are included. See Current Direction benchmark constraints for detailed discussion of these requirements.

Significant features and results: All suitable land is allocated to timber production, including the entire block of acreage which must be helicopter logged (roughly 28,000 acres). Long-term sustained yield capacity is reached in the first decade on the East-West portion of the Forest, thus establishing that this zone contains surplus available timber inventory. This is not the case on the Shelton CSYU, where long-term sustained yield capacity is not reached until the seventh decade. Nontimber resource outputs are at low levels, especially those which depend most heavily on elimination or modification of harvest (e.g. scenic quality, Primitive and Semi-Primitive recreation).

Benchmark 2: Maximum PNV with departure, harvest before 95 percent of CMAI

Purpose: To determine the outputs associated with relaxation of nondeclining flow and 95 percent CMAI limitations, unconstrained by Management Requirements (MRs).

Objective function: Maximize PNV for fifteen decades.

Constraints: Nondeclining flow on Shelton CSYU only (consistent with cooperative agreement), commercial thinning and visual prescription access limitations, helicopter timing requirements. Harvest floor equal to 80 percent of benchmark 7 LTSYC and maximum decade-to-decade harvest level change of 25 percent used to limit departure harvest fluctuations (East-West zone).

Significant features and results: Timber stands in which management costs exceed returns (helicopter ground, "doghair") are not allocated to harvest, demonstrating that the PNV effects of allocating such areas to harvest under NDF are not a factor in this benchmark. As a result, nontimber resource outputs are, in general, substantially higher than in benchmark 1. First decade harvest level (East-West) is over 50 percent above that of benchmark 1; harvest drops to the harvest floor level in the fourth decade. Harvest prior to 95 percent of CMAI is selected sparingly, with just over 20 percent of the stands which could receive this treatment actually being so allocated.

Benchmark 3: Maximum PNV with nondeclining flow, no regeneration harvest prior to 95 percent of CMAI

Purpose: To determine output levels associated with application of two basic Forest Service policy limitations (NDF, 95 percent CMAI), unconstrained by Management Requirements. In conjunction with benchmark 7, serves as the principal source of information regarding the maximum opportunity cost of the selected means of meeting MRs.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to those of benchmark 1.

Significant features and results: Over 80 percent of the Forest's helicopter logging acreage remains unharvested due to lack of economic return. However, "doghair" stands (in which management costs also exceed returns on a per-acre basis) are allocated to harvest, as this allocation results in increased PNV due to the interaction of the nondeclining flow constraint with the surplus of harvestable inventory. Overall,

use of contribution to PNV rather than timber production as the primary objective results in timber output levels substantially below those of benchmark 1, while nontimber outputs increase significantly.

Benchmark 4: Maximum PNV, departure, harvest before 95 percent of CMAI, with means of meeting Management Requirements in effect.

Purpose: To assess the effects of relaxing nondeclining flow and 95 percent CMAI constraints when MR specifications are included. When compared with benchmark 2, provides opportunity cost of the means of meeting management requirements when flow and harvest age limitations are removed.

Objective function: Maximize PNV for fifteen decades.

Constraints: Includes all of the constraints of benchmark 2 plus the MR constraint package. This consists of the following (see also Current Direction benchmark discussion):

(a) Maximum final harvest proportions by drainage - 16 percent in Big Quilcene and Little Quilcene, 24.5 percent in Humptulips, 25 percent elsewhere. Needed to meet dispersion and size of opening requirements, water quality criteria in municipal watersheds.

(b) Riparian zone and fish habitat management allocations - selected areas within riparian zones are allocated to no harvest and extended rotation prescriptions in order to assure maintenance of the current level of fish rearing habitat quality and to prevent reductions in overall water quality. Harvest is precluded on 8,120 acres and extended rotation is required on 19,901 acres as a result of these minimum requirements.

(c) Wildlife habitat management areas - harvest is precluded in several areas in order to provide the habitat needed to sustain viable populations of wildlife indicator species and to meet the requirements of the Bald Eagle Recovery Plan. These habitat allocations consist of:

- 29 1,000-acre Spotted Owl Habitat Areas (SOHAs)
- 21 bald eagle nest sites and wintering areas (6 of which are partially included in other areas)
- 28 300-acre pileated woodpecker areas (an additional 58 are included in other areas)
- 17 160-acre pine marten areas (an additional 172 are included in other areas)

Significant features and results: Results parallel those of benchmark 2 very closely, with the exception that addition of the means of meeting MRs leads to reduced timber harvest (down 11.6 percent in first decade, 5.8 percent drop in LTSYC) and a concurrent increase in nontimber outputs. Allocation of areas where harvest costs exceed returns, drop to harvest floor, and use of pre-95 percent CMAI harvest are essentially the same as in benchmark 2.

Benchmark 5: Maximum PNV, departure, no regeneration harvest before 95 percent of CMAI, with means of meeting MRs in effect.

Purpose: To enable determination of the opportunity costs of the 95 percent CMAI limitation in the departure mode and of nondeclining flow when harvest before 95 percent of CMAI is precluded. Comparison of benchmarks 4 and 5 provides the former; benchmarks 5 and 7 in combination yield the latter.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 4 except that regeneration harvest is restricted to 95 percent of CMAI.

Significant features and results: Outcome is very similar to that of benchmark 4, indicating that harvest before 95 percent of CMAI is a relatively minor consid- eration when in the departure mode (see also "Constraint Analysis").

Benchmark 6: Maximum PNV, nondeclining flow, harvest before 95 percent of CMAI, with means of meeting MRs in effect.

Purpose: To enable determination of the opportunity costs of the 95 percent CMAI limitation when flow is nondeclining (benchmarks 6 and 7) and of nondeclining flow when harvest prior to 95 percent of CMAI is allowed (benchmarks 4 and 6).

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 4 except that nondeclining flow is required Forest-wide.

Significant features and results: Allocation of areas in which timber management costs generally exceed returns on a per-acre basis is similar to that of benchmark 3. Helicopter harvest is generally foregone, but doghair harvest is selected due to its effect on total PNV. Nontimber resource output levels are similar to those of benchmarks 4 and 5. First decade timber harvest (East-West) is 40 percent below that of benchmark 4 due to imposition of nondeclining flow. Fewer than 10 percent of the stands eligible for regeneration harvest prior to 95 percent of CMAI receive this treatment, with the bulk of such harvest occurring in the fifth decade. Presumably, the fifth decade is the most critical in terms of maintaining harvest level at the long-term sustained yield capacity volume (necessary to sustain nondeclining flow while maximizing first decade output and thus PNV).

Benchmakr 7: Maximum PNV, nondeclining flow, no regeneration harvest prior to 95 percent of CMAI, with means of meeting MRs in effect.

Purpose: Benchmark 7 includes the basic provisions necessary to comply with current legal requirements and policy guidelines. It serves, therefore, as the basic benchmark with which other benchmark and land management alternatives are to be compared. It provides the output levels and effects associated with maximizing PNV within the context of the aforementioned legal limits and policies.

Objective function: Maximize PNV for fifteen decades.

Constraints: Includes the constraints of benchmarks 1 and 3 plus the MR constraint package (see benchmark 4).

Significant features and results: Results are similar to those of benchmark 3, but with reduced timber harvest (7.2 percent drop in LTSYC) and increased nontimber outputs due to application of the means of meeting MRs. First decade harvest (East-West) is 40 percent below that of benchmark 5. There is virtually no difference between benchmarks 6 and 7, which indicates that harvest prior to 95 percent of CMAI has an insignificant impact when applied in a nondeclining flow regime.

Benchmark 7-0%: Benchmark 7, but without the 1 percent per year real price increase applied to timber outputs for the first 50 years in all other benchmarks and alternatives.

Purpose: To test the effects of removing the 1 percent price trend used in other benchmarks and alternatives as the best available estimate of future changes in the real value of timber products.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 7. Timber value trend is removed.

Significant features and results: Differences between benchmarks 7 and 7-0% are minor at best. There is virtually no change in harvest flows or allocation patterns. This indicates that use of the 1 percent price trend (as opposed to no trend) has little impact on resource allocation tradeoffs. Timber stands for which harvest does not contribute to PNV in the absence of a trend assumption are not close enough to the break-even point to be called into solution when a 1 percent trend is assumed.

Benchmark 7-2%: Benchmark 7, but with a 2 percent per year real price increase for timber products.

Purpose: To ascertain whether the use of a 2 percent value trend for timber would materially affect output mixes and management intensities.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 7. Timber value trend is increased to 2 percent.

Significant features and results: Approximately 14,400 acres are allocated to timber harvest which are not in the harvest base of benchmark 7. Of these, almost 9,000 acres are helicopter ground. This shift increases the proportion of such land which is allocated to harvest from 18.5 percent in benchmark 7 to 56.8 percent in benchmark 7-2%. The remaining 5,400 acres are areas where the combination of road development costs and unroaded recreation values results in a "no harvest" allocation under the 1 percent trend assumption. The impact of these shifts on total output levels is a 2.3 percent increase in LTSYC, combined with declines in nontimber resource outputs.

Given the results of benchmark 7-2%, it is possible to project the effect of further increases in the timber price trend. Benchmark 7-2% leaves roughly 18,000 acres of potentially harvestable timberland allocated to the no harvest prescription, including 10,000 acres of helicopter ground. Given the dramatic increase in harvest associated with the 2 percent trend, it appears reasonable to project that increasing the trend to 3 percent would pull most of the remaining timberland into the harvest base. If all 18,000 acres were allocated to harvest with a 3 percent trend, an increase in LTSYC of approximately 2.9 percent (over benchmark 7-2%) could be expected.

Results similar to those generated by increasing timber value trends could be anticipated if management costs were to be reduced. Once again, the most sensitive variable would be allocation of helicopter ground. A 20 percent reduction in costs would almost exactly equalize costs and returns on a "typical" acre of Olympic helicopter ground. Therefore, it is estimated that a cost reduction of 20 percent, applied in benchmark 7, would lead to allocation of roughly 50 percent of the helicopter ground (the half with lower net management costs) to harvest. Such an allocation shift would be close to that which results from the shift to a 2 percent trend. Therefore, it is estimated that a benchmark based on a 20 percent reduction in costs, were it to be tested in FORPLAN, would yield results closely parallel to those of benchmark 7-2%.

Benchmark 7-300: Benchmark 7, but with SOHA size of 300 acres instead of 1000.

Purpose: To determine the opportunity cost of increasing SOHA size from 300 to 1000 acres.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 7, except SOHA allocations are 300 acres.

Significant features and results: Reduction of SOHA size quite predictably leads to increased allocation to harvest prescriptions. About 12,900 acres are added to the harvest base; effects on nontimber resource outputs (other than spotted owl habitat) are negligible. Relative to benchmark 7, LTSYC increases 3.1 percent, first decade harvest (East-West only) increases 3.4 percent, and PNV increases 3.5 percent ($19.4 million).

Benchmark 7T: Benchmark 7, but with objective of timber output maximization.

Purpose: To determine timber production potential under the provisions of benchmark 7.

Objective function: Maximize timber output in the first decade, rolled over to maximize timber for fifteen decades, rolled over to maximize PNV (fifteen decades).

Constraints: Identical to benchmark 7.

Significant features and results: Allocation patterns and resource output flows are similar in nature to those of benchmark 1, although moderated to some extent by the presence of MRs. Harvest base is approximately 32,800 acres larger than that of benchmark 7. Relative to benchmark 7, LTSYC increases 11.7 percent, first decade harvest (East-West only) increases 11.5 percent, and PNV decreases 9.5 percent ($52.8 million).

Benchmark 7H: Benchmark 7, but with helicopter harvest timing requirements relaxed.

Purpose: To determine the opportunity costs associated with fixing helicopter harvest timing.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 7, but without helicopter harvest timing requirements.

Significant features and results: The effect of relaxing helicopter harvest timing constraints is the addition of 11,750 acres to the benchmark 7 harvest base. The principal reason for this change is the effect of harvest timing on the discounted net costs associated with helicopter harvest. When timing requirements dictate that helicopter areas be harvested in the early decades, the excess of costs over returns is sufficient to cause selection of the "no harvest" prescription. When harvest is delayed to the eighth decade and beyond, however, the loss in present value associated with helicopter harvest is not sufficient to overcome the gain generated by increased LTSYC (which in turn increases allowable first decade harvest). Thus, harvest which is not cost-efficient in the early years becomes "efficient" if postponed. Relative to benchmark 7, the effects of this shift include a 2.1 percent increase in LTSYC, a 2.6 percent increase in East-West first decade harvest, and a 0.8 percent increase in PNV ($4.4 million).

Benchmark 7D: Benchmark 7, but including a departure (East-West only) structured to liquidate surplus timber inventory in the first decade.

Purpose: To determine the extent of the Forest's surplus inventory, and to assess the effects of harvesting this surplus in the first decade.

Objective function: Maximize PNV for fifteen decades.

Constraints: Identical to benchmark 7, except that nondeclining flow applies to Shelton CSYU only. East-West harvest flow controlled by a harvest floor equal to benchmark 7 LTSYC and a minimum LTSYC equal to that of benchmark 7.

Significant features and results: The first decade harvest level (72.7 percent above that of benchmark 7) indicates a surplus inventory of 323.8 MMCF. This is overstated, however, since roughly 12,300 acres are added to the timber base (relative to benchmark 7). Clearly, the effect on PNV of adding areas with per-acre harvest costs greater than returns to the harvest base is more pronounced in benchmark 7D than in benchmark 7. This is because the full benefit of such allocations can be realized in the first decade in BM 7D. Assuming that the average added acre yields 10 MCF per harvest and is harvested 1.4 times in 150 years (a 90 year rotation), the contribution of the newly added timber base to the surplus is 172.2 MMCF. This leaves roughly 150 MMCF (652.5 MMBF) of surplus inventory available under the allocation pattern of benchmark 7.

Benchmark 11: Benchmark 7, but with nonmarket values removed from objective function calculation.

Purpose: To determine the effect of considering market values only (timber, developed recreation, commercial fish harvest) on the land allocation and harvest scheduling pattern of benchmark 7.

Objective function: Maximize PNV for fifteen decades, market values only.

Constraints: Identical to benchmark 7.

Significant features and results: Approximately 8,400 acres are added to the benchmark 7 harvest base, all from lands which provide unroaded recreation outputs if left unharvested. Therefore, it is clear that unroaded recreation values have an effect on the allocation of land upon which timber management costs and returns are close to equal. Values for other nontimber outputs have no apparent effect on land allocation, although the results of benchmark 11 indicate that fisheries values have a substantial impact on harvest scheduling. The overall effects of deleting nonmarket values (relative to benchmark 7) include a 1.4 percent increase in LTSYC, a 1.5 percent increase in East-West first decade harvest, a 1.1 percent drop in PNV ($5.9 million), and a 30.4 percent drop in acreage allocated to unroaded recreation.

In view of the limited effect of removing nonmarket values on the overall land allocation pattern and output levels, it was determined that FORPLAN analysis of benchmarks 8 through 10 would provide little additional insight. These runs, had they been made, would have been structured to correspond to benchmark 4 through benchmark 6 respectively, but with nonmarket values deleted. It is likely that the results of such runs would have shown the same general effect of nonmarket value removal as did the comparison of benchmarks 7 and 11. Little change would be expected between comparable runs, other than a moderate shift of acreage providing unroaded recreation opportunity into the harvest base, and some rearrangement of harvest schedules, when market values only are the basis for PNV calculation.

Benchmark NOYU: Essentially the same as the Current Direction benchmark, but constructed to eliminate the Shelton CSYU and combine National Forest lands therein with the remainder of the Forest.

Purpose: To test the effects (given the conditions of current direction) of discontinuing the CSYU agreement with Simpson Timber Company.

Objective function: Maximize timber for the first decade, rolled over to maximize timber for fifteen decades, rolled over to maximize PNV for fifteen decades.

Constraints: Identical to the Current Direction benchmark, except that the nondeclining flow requirements are shifted from "East-West" and "Shelton CSYU" as separate entities to "all National Forest" and "Simpson Timber Company." Also, the budget constraint is removed in order to allow maximum freedom in shifting allocations and schedules in response to the revised land management alignment.

Significant features and results: The addition of the Shelton District to the harvest base from which East-West allowable harvest is determined makes the East-West surplus inventory more accessible in the early decades. Average East-West harvest in the first five decades is 6.4 percent higher than in the Current Direction benchmark. Other effects of eliminating the CSYU are less dramatic. Total National Forest harvest (50 year average) increases 5.2 percent from the Current Direction benchmark; total harvest from both ownerships increases 2.7 percent. LTSYC (all National Forest land) drops 2.2 percent, possibly because the change in harvest base eliminates the surplus inventory situation, and is reached in the first decade. PNV increases 3.1 percent ($14.8 million). There is virtually no change in nontimber resource outputs from the Current Direction benchmark to benchmark NOYU.

Table B-21. Outputs: All Benchmarks

Benchmarks 0-3:

		Benchmarks			
Output	Unit of Measure	0	1	2	3
Harvest Level					
East-West 1st Decade	MMCF/yr	0	53.9	84.0	48.1
	MMBF/yr	0	234.3	365.6	209.4
East-West 50 Year Average	MMCF/yr	0	53.9	53.2	48.1
	MMBF/yr	0	234.3	231.4	209.4
SCSYU 1st Decade	MMCF/yr	0	41.1	39.0	38.2
	MMBF/yr	0	178.7	169.7	166.3
SCSYU 50 Year Average	MMCF/yr	0	41.1	39.9	38.6
	MMBF/yr	0	178.7	173.4	168.1
LTSYC					
East-West	MMCF	0	53.9	44.0	48.1
	MMBF	0	234.3	191.3	209.4
Decade Reached		1st	1st	N/A	1st
SCSYU	MMCF	0	58.7	57.4	57.6
	MMBF	0	255.5	249.5	250.4
Decade Reached		1st	7th	15th	6th
All National Forest Land	MMCF	0	66.5	54.9	59.1
	MMBF	0	289.1	239.0	257.3
Discounted Benefits					
1st 50 Years	MM$	138.3	2,223.3	2,437.3	2,039.0
Discounted Costs					
1st 50 Years	MM$	178.4	1,663.6	1,749.7	1,423.6
Present Net Value					
1st 50 Years	MM$	-40.1	559.7	687.6	615.4
Budget					
Decade 1	MM$/yr	7.6	26.2	34.2	24.8
50 Year Average	MM$/yr	7.6	27.0	27.5	25.1
RVD (1st 50 years)					
Wilderness	M/yr	162.1	162.1	162.1	162.1
Other Unroaded	M/yr	114.6	1.5	82.1	82.1
Developed	M/yr	0	573.5	573.5	573.5
WFUD					
Wildlife Related	M/yr	55.0	44.6	45.1	44.6
Fish Related	M/yr	41.3	33.4	31.0	33.5

Benchmarks 0-3 (cont'd):

		Benchmarks			
Output	Unit of Measure	0	1	2	3
Commercial Fish Production					
1st 50 years	M lbs/yr	1,535	1,281	1,179	1,285
Old-Growth					
Midpoint of 5th Decade	Acres	217,330	54,863	68,399	71,174
Sediment					
1st 50 years	Tons/yr	51,093	196,357	233,272	194,326
Road Construction					
1st 50 years	Total Miles	0	583	529	504
Unroaded ROS Classes					
Outside Wilderness	Acres	50,169	390	35,691	35,691
Retention & Partial Retention VQOs	Acres	90,085	0	21,950	25,952
No Harvest	Acres	485,425	799	57,323	39,379
Extended Rotation Harvest Prescriptions	Acres	0	10,894	3,786	5,821
Normal Rotation Harvest Prescriptions	Acres	0	473,732	424,316	440,225

Benchmarks 4-7:

		Benchmarks			
Output	Unit of Measure	4	5	6	7
Harvest Level					
East-West 1st Decade	MMCF/yr	74.3	72.9	44.2	44.5
	MMBF/yr	323.1	317.1	192.2	193.7
East-West 50 Year Average	MMCF/yr	48.8	48.5	44.2	44.5
	MMBF/yr	212.4	211.1	192.2	193.7
SCSYU 1st Decade	MMCF/yr	37.7	36.7	37.7	36.9
	MMBF/yr	163.9	159.8	164.0	160.6
SCSYU 50 Year Average	MMCF/yr	38.8	37.6	38.8	37.6
	MMBF/yr	168.6	163.7	168.6	163.5
LTSYC					
East-West	MMCF	41.4	41.7	44.2	44.5
	MMBF	180.0	181.6	192.2	193.7
Decade Reached		N/A	N/A	1st	1st
SCSYU	MMCF	56.7	56.9	56.7	57.0
	MMBF	246.7	247.6	246.6	247.8
Decade Reached		15th	6th	15th	6th
All National Forest Land	MMCF	51.7	52.1	54.6	54.9
	MMBF	225.1	226.7	237.4	238.7
Discounted Benefits					
1st 50 Years	MM$	2,197.0	2,141.3	1,907.6	2,182.2
Discounted Costs					
1st 50 Years	MM$	1,585.6	1,542.6	1,345.9	1,584.4
Present Net Value					
1st 50 Years	MM$	611.4	598.7	561.7	597.8
Budget					
Decade 1	MM$/yr	30.7	30.3	23.4	31.4
50 Year Average	MM$/yr	25.8	25.1	24.1	26.1
RVD (1st 50 years)					
Wilderness	M/yr	162.1	162.1	162.1	162.1
Other Unroaded	M/yr	82.9	82.9	83.5	83.5
Developed	M/yr	573.5	573.5	573.5	573.5
WFUD					
Wildlife Related	M/yr	45.1	44.7	44.7	44.5
Fish Related	M/yr	31.9	32.8	33.3	34.0

Benchmarks 4-7 (cont'd):

		Benchmarks			
Output	Unit of Measure	4	5	6	7
Commercial Fish Production					
1st 50 years	M lbs/yr	1,212	1,238	1,277	1,291
Old-Growth					
Midpoint of 5th Decade	Acres	87,203	87,125	88,839	91,079
Sediment					
1st 50 years	Tons/yr	214,842	202,339	194,440	182,756
Road Construction					
1st 50 years	Total Miles	480	480	435	453
Unroaded ROS Classes					
Outside Wilderness	Acres	36,158	36,158	36,496	36,496
Retention & Partial Retention VQOs	Acres	23,531	25,768	27,533	27,533
No Harvest	Acres	80,978	79,689	37,879	67,578
Extended Rotation Harvest Prescriptions	Acres	22,305	20,937	24,375	25,185
Normal Rotation Harvest Prescriptions	Acres	382,142	384,799	393,171	392,662

Benchmarks 7-0% , 7-2%, 7-300 & 7T:

		Benchmarks			
Output	Unit of Measure	7-0%	7-2%	7-300	7T
Harvest Level					
East-West 1st Decade	MMCF/yr	44.4	45.9	46.0	49.6
	MMBF/yr	193.3	199.6	200.2	215.9
East-West 50 Year Average	MMCF/yr	44.4	45.9	46.0	49.6
	MMBF/yr	193.3	199.6	200.2	215.9
SCSYU 1st Decade	MMCF/yr	37.7	34.7	37.6	39.8
	MMBF/yr	164.2	150.9	163.4	173.2
SCSYU 50 Year Average	MMCF/yr	37.7	38.7	37.9	39.8
	MMBF/yr	164.2	168.2	165.0	173.2
LTSYC					
East-West	MMCF	44.4	45.9	46.0	49.6
	MMBF	193.3	199.6	200.2	215.9
Decade Reached		1st	1st	1st	1st
SCSYU	MMCF	55.7	56.9	57.1	57.8
	MMBF	242.5	247.4	248.4	251.8
Decade Reached		6th	16th	6th	7th
All National Forest Land	MMCF	54.6	56.2	56.6	61.3
	MMBF	237.4	244.3	246.1	266.6
Discounted Benefits					
1st 50 Years	MM$	1,610.0	2,272.4	1,941.3	2,041.0
Discounted Costs					
1st 50 Years	MM$	1,128.6	1,559.4	1,364.6	1,536.5
Present Net Value					
1st 50 Years	MM$	481.4	713.0	576.7	504.5
Budget					
Decade 1	MM$/yr	22.7	23.7	23.6	26.9
50 Year Average	MM$/yr	21.6	27.0	24.2	26.0
RVD (1st 50 years)					
Wilderness	M/yr	162.1	162.1	162.1	162.1
Other Unroaded	M/yr	84.5	68.0	82.1	2.3
Developed	M/yr	573.5	573.5	573.5	573.5
WFUD					
Wildlife Related	M/yr	44.5	44.6	44.5	44.6
Fish Related	M/yr	34.1	33.8	33.7	34.0

Benchmarks 7-O% , 7-2%, 7-300 & 7T (cont'd):

		Benchmarks			
Output	Unit of Measure	7-0%	7-2%	7-300	7T
Commercial Fish Production					
1st 50 years	M lbs/yr	1,296	1,285	1,283	1,288
Old-Growth					
Midpoint of 5th Decade	Acres	91,286	88,477	82,413	78,392
Sediment					
1st 50 years	Tons/yr	182,481	186,323	186,888	183,204
Road Construction					
1st 50 years	Total Miles	446	477	471	540
Unroaded ROS Classes					
Outside Wilderness	Acres	37,025	27,408	35,691	590
Retention & Partial Retention VQOs	Acres	27,533	11,295	26,837	6,136
No Harvest	Acres	69,110	53,194	54,693	34,804
Extended Rotation Harvest Prescriptions	Acres	26,304	25,276	25,482	29,037
Normal Rotation Harvest Prescriptions	Acres	390,011	406,955	405,250	421,584

Benchmarks 7H, 7D, 711, CD & NOYU:

		Benchmarks				
Output	Unit of Measure	7H	7D	711	CD	NOYU
Harvest Level						
East-West 1st Decade	MMCF/yr	45.7	76.9	48.1	48.1	48.8
	MMBF/yr	198.8	334.5	196.7	209.3	212.4
East-West 50 Year Average	MMCF/yr	45.7	51.0	45.2	48.1	51.2
	MMBF/yr	198.8	221.8	196.7	209.3	222.7
SCSYU 1st Decade	MMCF/yr	36.9	36.8	37.1	38.1	39.7
	MMBF/yr	160.5	160.0	161.6	165.8	172.9
SCSYU 50 Year Average	MMCF/yr	37.6	37.6	38.0	38.1	37.4
	MMBF/yr	163.5	163.5	165.4	165.8	162.6
LTSYC						
East-West	MMCF	45.7	44.7	45.2	48.1	46.9
	MMBF	198.8	194.3	196.7	209.3	204.0
Decade Reached		1st	N/A	1st	1st	N/A
SCSYU	MMCF	57.0	56.9	56.9	57.6	57.9
	MMBF	247.9	247.6	247.6	250.6	252.0
Decade Reached		6th	6th	16th	7th	N/A
All National Forest Land	MMCF	56.0	55.0	55.7	59.5	58.2
	MMBF	243.8	239.3	242.1	258.7	253.0
Discounted Benefits						
1st 50 Years	MM$	1,907.6	2,182.2	1,900.7	1,946.9	2,018.9
Discounted Costs						
1st 50 Years	MM$	1,345.9	1,584.4	1,349.3	1,471.2	1,528.4
Present Net Value						
1st 50 Years	MM$	561.7	597.8	551.4	475.7	490.5
Budget						
Decade 1	MM$/yr	23.4	31.4	23.4	24.3	24.2
50 Year Average	MM$/yr	24.1	26.1	24.2	24.4	25.4
RVD (1st 50 years)						
Wilderness	M/yr	162.1	162.1	162.1	162.1	162.1
Other Unroaded	M/yr	75.5	65.1	56.1	45.6	45.6
Developed	M/yr	573.5	573.5	573.5	573.5	573.5
WFUD						
Wildlife Related	M/yr	44.5	44.6	44.3	45.1	45.1
Fish Related	M/yr	33.7	32.5	33.8	34.8	34.0

Benchmarks 7H, 7D, 711, CD & NOYU (cont'd):

		Benchmarks				
Output	Unit of Measure	7H	7D	711	CD	NOYU
Commercial Fish Production						
1st 50 years	M lbs/yr	1,277	1,226	1,285	1,316	1,283
Old-Growth						
Midpoint of 5th Decade	Acres	89,904	84,138	89,056	86,249	85,073
Sediment						
1st 50 years	Tons/yr	186,618	207,068	186,727	174,423	184,170
Road Construction						
1st 50 years	Total Miles	463	523	494	475	491
Unroaded ROS Classes						
Outside Wilderness	Acres	31,775	26,476	25,419	18,668	18,668
Retention & Partial Retention VQOs	Acres	15,616	13,316	22,063	24,348	24,348
No Harvest	Acres	55,825	55,273	59,181	51,137	51,247
Extended Rotation Harvest Prescriptions	Acres	25,732	21,003	24,494	33,509	35,407
Normal Rotation Harvest Prescriptions	Acres	403,868	409,149	401,750	400,779	398,771

OUTPUT POTENTIALS

Potential output levels of the Forest's principal resources are displayed in Table B-22. These represent the maximum possible production of each output, without regard for interactions among resources. They form the boundaries beyond which the decisionmaker cannot go in determining how much of what to produce. Identification of these output potentials is the first step in the process of defining the Forest's decision space.

Because of the importance of the means of meeting Management Requirements in establishing the bounds within which the Forest may operate, potential output levels with and without MR attainment strategies are shown in Table B-22. In addition, the source (benchmark run, calculated estimate, etc.) of each figure is given. Due to the possible obscurity of the meaning of some of the raw data, the following notes are provided to clarify the derivation of the output potentials:

Timber - The best expression of potential timber production is long-term sustained yield capacity, as this represents the steady state sustainable output level. Therefore, timber potential is presented as maximum LTSYC rather than harvest level for any specific decade.

PNV - Because departure from nondeclining flow has a substantial effect on PNV, maximum values are shown for both nondeclining flow and departure. It should be noted that the departure "maximum" is not the true maximum PNV, but that which can be obtained within the established harvest flow limitations. Full maximization of PNV would involve the liquidation, in the first decade, of all harvest-age timber capable of contributing to PNV. This option has not been analyzed.

Acres unroaded - This reflects the maximum acreage in Semi-Primitive and Primitive ROS classes outside Wilderness. The figure is based on the current ROS classification; no provision has been made for the possibility of acreage returning to the unroaded condition over time.

Wilderness RVDs - Derived from the fixed base of established Wilderness, and therefore constant across all runs.

Unroaded RVDs - Based on maximum unroaded acres (see above), completion of the planned trail system, and projected use. Current use already exceeds the capacity for supplying "full quality" unroaded recreation experiences. Therefore, unroaded RVD output estimates are calculated as a function of current and expected use per acre and acreage in the relevant ROS classes. RVDs so produced will be "less than standard," but will reflect the quality of experience level currently being realized in the Forest's unroaded areas.

Developed RVDs - Based on current and projected use. The Forest has adequate capacity in existing and planned developed recreation sites to meet projected demand until roughly 2025. Developed RVD outputs are constant across all runs.

Wildlife WFUDs - This estimated potential is based on use of a timber harvest regime which optimizes deer and elk habitat condition. Such a program precludes harvest below 1500' elevation (winter range) while requiring evenly distributed harvest (in both space and time) above 1500'. This regime was not analyzed in FORPLAN; the output estimate was calculated based on the ultimate steady-state condition which such a harvest pattern would produce.

Fisheries outputs - These are derived from the present biological potential of Forest fisheries. No habitat enhancement is included, but management activities needed to reduce sediment output to natural levels (closure and revegetation of all roads, etc.) are assumed to have occurred. Note that the resulting output level is higher than associated with the minimum level benchmark, which includes the retention and continued use of the Forest's road system.

Acres meeting VQOs - Based on the current inventory of Retention and Partial Retention Visual Quality Objectives.

Acres old-growth - Based on retention of all acreage currently in the old-growth condition.

Table B-22. Potential Outputs

Output	Unit of Measure	Potential	Source	Potential w/MRs	Source
Timber LTSYC:					
East-West	MMCF/yr	53.9	BM1	49.6	BM 7T
	MMBF/yr	234.3	BM1	215.9	BM 7T
SCSYU	MMCF/yr	58.7	BM1	57.8	BM 7T
	MMBF/yr	255.5	BM1	251.8	BM 7T
All National Forest	MMCF/yr	66.5	BM1	61.3	BM 7T
	MMBF/yr	289.1	BM1	266.6	BM 7T
PNV (50 yr):					
Nondeclining flow	MM$	615.4	BM3	557.3	BM7 1/
Departure	MM$	687.6	BM2	611.4	BM4
Acres unroaded	Acres	50,169	BM0	No change	
RVDs:					
Wilderness		162.1	Constant	No change	
Unroaded		114.6	BM0	No change	
Developed		573.5	Constant	No change	
WFUDs:					
Wildlife	M/yr	56.3	Estimated	No change	
Fish	M/yr	44.1	Estimated	No change	
Commercial Fish	M lbs/yr	1,625	Estimated	No change	
VQOs met	Acres	90,085	BM0	No change	
Old-growth	Acres	217,330	BM0	No change	

1/ 1/While BM6 is slightly higher in PNV ($561.6 MM), BM7 is used in latter analyses as the highest potential PNV attainable with nondeclining flow and full MR specification attainment. The difference in PNV between BMs 6 and 7 is minor, and the need to compare benchmarks with and without the means of meeting MRs makes the use of BM7 very convenient, as it is directly comparable to BM3. BM6 has no directly comparable benchmark run that does not include the means of meeting MRs.

DECISION SPACE

The output potentials displayed in Table B-22 represent the maximum obtainable level of each resource. While each individual output level can be reached, it would be impossible to produce all of the maxima simultaneously. Production of one output generally involves sacrifice of others. Such resource interactions define the true decision space open to land managers. The shape of this space depends on the nature and direction of the interactions which mold it. The following discussion covers the significant tradeoffs involved in maximizing each of the Forest's principal outputs. To simplify the analysis, the effects of the means of meeting management requirements on output potentials are not considered.

Maximizing timber production involves some sacrifice of all other outputs. PNV declines (dropping 9.1 percent from BM3 to BM1) for two reasons: some timber stands involve timber management costs in excess of returns, and prescriptions which maximize timber output generally involve longer rotations and more intensive management than those which maximize PNV. Unroaded recreation opportunity, scenic quality, and old-growth habitat disappear completely (on acres which are tentatively suitable for harvest), as providing these requires elimination or modification of harvest. Fish and wildlife outputs are reduced (a drop of close to 20 percent from BM0 to BM1) as a result of habitat changes brought about by harvest. These changes include increased sediment load and reduced streamside cover in the case of fish, and modified stand age structure in the case of wildlife.

Maximizing present net value also leads to reductions in all other areas. Its effect on timber output potential (LTSYC drops 11.0 percent from BM1 to BM3) results from the elimination of harvest in areas in which management costs exceed returns and the use timber management prescriptions selected on the basis of contribution to PNV rather than timber output. Fish, wildlife, scenic quality, and old-growth outputs are affected to nearly the same degree as when timber is maximized, since a high level of timber production is entailed in maximizing PNV. Unroaded recreation opportunity is affected less severely (BM3 yields 71.6 percent of potential), since most of the timber stands having management costs in excess of returns lie in currently unroaded areas.

Maximizing unroaded recreation opportunity involves sacrifice of timber output and PNV. Of the 50,169 acres currently providing this opportunity, 38,759 are tentatively suitable for timber production. Assuming the LTSYC contribution of these to be .13 MCF/acre/year (the Forest average), allocation of these acres to unroaded recreation results in a drop in LTSYC of 5 MMCF/yr (7.6 percent of potential). If it is further assumed that the ratio of tentatively suitable unroaded to total unroaded (.773) holds true for unroaded areas in which timber harvest is likely to contribute to PNV, then maximizing unroaded recreation drops 11,185 acres of such timberland from the harvest base (of BM3). If the value of these is estimated at $920 per acre (half of the Forest average per acre timber contribution to PNV under nondeclining flow), the cost in PNV is $10.3 MM (1.7 percent of potential). Other outputs--fish, wildlife, scenic quality, old-growth--are essentially unaffected.

Maximizing wildlife WFUDs (based on deer and elk habitat condition) has effects in all other areas. It should be noted that the assumptions and estimates that serve as the basis for this discussion are imprecise, but serve to indicate the magnitude of possible tradeoffs. The most important feature of this scenario is the elimination of harvest in winter range. Since roughly 40 percent of the Forest's tentatively suitable timberland lies within winter range, it may be reasonable to project that both LTSYC and PNV would drop by approximately 40 percent under such a regime. Other resources--unroaded recreation, fisheries, scenic quality, old-growth--would be affected primarily outside winter range. Since the harvest regime for the area above 1500' closely parallels that which would maximize timber, the effects on these resources can be roughly estimated by assuming that they will incur 60 percent of the effect estimated for Forest-wide timber maximization.

Maximizing both fisheries outputs and old-growth habitat results in virtual elimination of timber harvest. The minimum level benchmark provides a good representation of the effects of such a regime. Incompatible outputs (timber, PNV) are essentially eliminated, while complementary outputs (scenic quality, wildlife, unroaded recreation) approach or achieve potential levels.

Maximization of scenic quality can be accomplished by either precluding timber harvest or imposing restrictions on harvest rate and rotation length. Since the latter option has the lesser impact on timber and PNV potentials, it will be used as the basis for scenic quality tradeoff assessment viz these outputs. Of the 90,085 acres with Visual Quality Objectives of Retention or Partial Retention, 79,974 are tentatively suitable for timber production. The harvest rotation modifications necessary to meet VQOs reduce long-term sustained yield capacity by an average of .03 MCF/acre/year. Therefore, LTSYC would drop 2.4 MMCF/yr

(3.6 percent of potential) when maximizing scenic quality. Change in PNV is more difficult to project; assuming a change of equal magnitude (3.6 percent of potential or $22.2 MM) probably overestimates the effect to some extent, but is likely to be fairly close. The potential to produce other resources--fish, wildlife, unroaded recreation, old-growth--is not affected by the maximization of scenic quality, especially if the "no harvest" option for meeting VQOs is employed.

The foregoing discussion represents an attempt to identify the interactions and tradeoffs which define the Forest's decision space. Admittedly, many of the assumptions and projections included in the analysis are oversimplifications of an extremely complex interaction system. Those outputs and effects which can be derived directly from FORPLAN results (see Table B-21) can be stated with a fair degree of confidence. Those which must be interpolated, extrapolated, estimated, and projected from more concrete information should be taken as estimates only. Nonetheless, the overall portrayal of management opportunities and limitations which can be developed from these deliberations is probably not too far from the mark. This is summarized in Table B-23.

The output changes shown below for each resource are the estimated drop from the potential level given in Table B-22 that would result from the maximization of each of the other resources. The figures show only the unavoidable effect of maximizing output A on the potential to produce output B, without regard for other resource interactions. In effect, the table can be used to determine how much of output B can be obtained if and only if it is maximized directly after the output A maximum has been reached.

Table B-23. Resource Maximization Tradeoffs

	Change in potential output of:						
Output Maximized	Timber	PNV	Acres Unroaded	Wildlife	Fish	VQO Acres	OG Acres
Timber (LTSYC all NF, MMCF/yr)	--	-55.7	-50,169	-11.7	-10.7	-90,085	-162,467
PNV (50 yr, NDF, $MM)	-7.4	--	-14,478	-11.7	-10.8	-64,133	-146,156
Acres Unroaded	-5.0	-10.3	--	0	0	0	0
Wildlife WFUD (M/yr)	-26.6	-246.2	-30,101	--	-6.4	-54,051	-97,480
Fish WFUD (M/yr)	-66.5	-615.4	0	-1.3	--	0	0
Acres meeting VQO	-2.4	-22.2	0	0	0	--	0
Acres old-growth (5th decade)	-66.5	-615.4	0	-1.3	0	0	--

CONSTRAINT ANALYSIS

Each constraint used to impose management limitations on output production has a cost, both in terms of PNV and production capability. In this section, the principal constraints used in benchmark analysis are discussed in terms of these opportunity costs. Table B-24 provides a summary of this analysis.

Table B-24. Opportunity Costs of Constraints

		Changes in:						
Constraint	Benchmarks Compared	Discounted Benefits - MM$	Discounted Costs - MM$	PNV 1st 50 years - MM$	Total Decade 1 Harvest - All Ownerships - MMCF (MMBF)	NF LTSYC - MMCF (MMBF)	Unroaded Recreation Opportunity - Acres	OG - Midpoint 5th Decade - Acres
MRs	3 & 7	-164.0	-105.9	-58.1	-4.9 (-21.4)	-4.2 (-18.6)	+805	+19,905
SOHAs	3 & 7	Unestimated	Unestimated	-28.1	Unestimated	-2.1 (-9.0)	Unestimated	Unestimated
Other Wildlife (Pine Marten, Pileated Woodpecker, Bald Eagle Habitat)	3 & 7	Unestimated	Unestimated	-10.3	Unestimated	-0.8 (-3.3)	Unestimated	Unestimated
Water (Riparian Area & Watershed Protection)	3 & 7	Unestimated	Unestimated	-19.7	Unestimated	-1.4 (-6.3)	Unestimated	Unestimated
Dispersion & Size of Opening Requirements	3 & 7	Primary impact is on harvest scheduling.						
CMAI (Harvest 95%)	4 & 5	-55.7	-43.0	-12.7	-2.4 (-10.1)	+0.4 (+1.6)	Same	-78
NDF	4 & 6	-300.2	-250.4	-49.8	-30.1 (-130.8)	+2.9 (+12.3)	+338	+1,636
CMAI & NDF simultaneously	4 & 7	-322.0	-267.9	-54.1	-30.6 (-132.7)	+3.2 (+13.6)	+338	+3,876
Current Direction Special Management Allocations	7T & CD2	-94.1	-65.3	-28.8	-3.2 (-14.0)	-1.8 (-7.9)	+18,078	+7,857
Helicopter Harvest Timing Requirements	7H & 7	-32.6	-28.2	-4.4	-1.2	-1.1	+4,721	+1,175
Budget	7 & CD1	Non-binding in all relevant runs.						
District Harvest Flows	7 & CD1	Primary impact is on harvest scheduling.						

Means of Meeting Management Requirements

The most effective means of determining the cost of applying the means of meeting MRs is a direct comparison of benchmarks 3 and 7. This shows that application of MR attainment strategies results in a drop of 21.4 MMBF/yr in total first decade harvest (East-West and Shelton CSYU combined), and a drop of 18.6 MMBF/yr (7.2 percent) in total National Forest LTSYC. Change in PNV is $58.1 MM, a drop of 9.4 percent. Changes in other resource outputs are minimal, except that acreage in old-growth (5th decade) increases 28.0 percent when the means of meeting MRs are included. Acreage added to the "no harvest" allocation totals 28,199 acres.

While determining the opportunity cost of applying the means of meeting MRs as a package is fairly straightforward, assessing the cost of each MR attainment strategy individually requires a bit more calculation. This can be done, using the information provided by benchmarks 3 and 7, as follows:

Change in LTSYC = 18.6 MMBF/yr
Change in PNV = $58.1 MM
Loss in PNV/MBF LTSYC = $3,124/MBF (equates to stumpage value of $125/MBF, which is very close to the Forest average of $130 and is the perpetual annual return needed to generate a PNV of $3,125 at 4%).

Loss in LTSYC per acre "no harvest" = .566 MBF
Loss in LTSYC per acre extended rotation = .131 MBF (based on average LTSYC contributions of normal and extended rotations)

Maximum allocations for means of meeting MRs:

SOHAs - 20,097 acres "no harvest"	
Other wildlife - 7,331 acres "no harvest"	
Watershed and fisheries protection	8,120 acres "no harvest"
	19,901 acres extended rotation

Maximum opportunity costs associated with means of meeting MRs:

SOHAs	20,097 ac. x .566 MBF/ac. x $3,124/MBF = $35.5 MM
Other Wildlife	7,331 ac. x .566 MBF/ac. x $3,124/MBF = $13.0 MM
Watershed	8,120 ac. x .566 MBF/ac. x $3,124/MBF
	+ 19,901 ac. x .131 MBF/ac. x $3,124/MBF = $22.5 MM

Actual opportunity costs associated with means of meeting MRs:

The maximum possible "no harvest" allocation to meet MR attainment objectives is 35,548 acres, while the actual "no harvest" allocation for this purpose in benchmark 7 is 28,199 acres, or 79.3% of the possible total. If it is assumed that the "no harvest" allocation for each individual means of meeting MRs in benchmark 7 is 79.3% of maximum, opportunity costs can be estimated for each means of MR attainment.

MR	Acres "no harvest"	Acres extended rotation	LTSYC Lost (MMBF)	PNV Lost (MM$)
SOHAs	15,942	0	9.0	28.1
Other wildlife	5,815	0	3.3	10.3
Watershed	6,441	19,901	6.3	19.7
TOTAL	28,198	19,901	18.6	58.1

It is assumed throughout this exercise that the 25 percent maximum harvest per drainage per decade constraint necessary to meet dispersion and size of opening requirements has little effect on harvest or PNV. Analysis of FORPLAN runs shows this to be the case. Although harvest schedules are rearranged extensively as a result of this constraint, total harvest volume is not affected at all and change in PNV is too small to be discernable.

95 Percent CMAI

The maximum impact of restricting final harvest to stands which have reached 95 percent of CMAI can be determined by comparing benchmarks 4 and 5. This indicates that the effect of this constraint is relatively minor, even in a departure mode. First decade total harvest drops 10.1 MMBF (2.1%) when the constraint is applied, while LTSYC is virtually unchanged. Change in PNV is $12.7 MM, or 2.1 percent of the benchmark 4 total PNV. Other outputs are essentially unaffected.

Nondeclining Flow

The opportunity cost of nondeclining flow (NDF) is best demonstrated by the differences between benchmarks 4 and 6. The change in PNV due to imposition of nondeclining flow is substantial - $49.8 MM or 8.1 percent of the benchmark 4 PNV. Change in first decade harvest (East-West) is dramatic (130.9 MMBF/yr), as would be expected when moving from departure to NDF. LTSYC is considerably higher (up 5.5 percent) when NDF is applied, due to the addition of over 13,000 acres to the harvest base and selection of LTSYC-maximizing management intensities. These shifts result from the effect on total PNV generated by interactions among the nondeclining flow constraint, an initial surplus of harvest-age timber, and the "maximize PNV" objective function.

95 Percent CMAI and Nondeclining Flow

The cost of applying these two constraints simultaneously can be assessed by comparing benchmarks 4 and 7. The results of this comparison are very close to those obtained when comparing benchmarks 4 and 6. This is because the NDF constraint has significant impact, while the effect of the 95 percent CMAI requirement is quite small. The changes from benchmark 4 to benchmark 7 include a $54.1 MM drop in PNV (8.8%), a 129.4 MMBF/yr drop in East-West first decade harvest, and a 6.0 percent increase in LTSYC.

Current Direction Special Management Allocations

Comparison of benchmark 7T and the Current Direction benchmark yields a good estimate of the opportunity cost of the Forest's current special management area allocations, since the primary difference between these benchmarks is the "special area" constraint. The total cost of the Olympic's current allocation pattern (given full application of MRs and an objective of maximizing timber) is $28.8 MM. Total first decade harvest is 14.0 MMBF/yr lower (3.6%); LTSYC drops 7.9 MMBF (3.0%). The primary effect of these special allocations on other resources is an increase of 18,000 acres in unroaded recreation.

It should be noted that the opportunity costs developed above are based on comparison of benchmarks with timber maximization objective functions. When the opportunity cost of timber maximization ($52.8 MM when comparing benchmarks 7 and 7T) is added, the total opportunity cost of the current management pattern (given full MMRs and relative to benchmark 7) becomes $81.6 MM.

Helicopter Harvest Timing Restriction

Comparison of benchmarks 7 and 7H establishes the opportunity cost of requiring that fixed proportions of helicopter logging areas which are allocated to timber production be harvested in the early decades. Change in PNV when harvest timing constraints are removed is $4.4 MM, up 0.8 percent from benchmark 7. First decade East-West harvest and LTSYC increase 5.1 MMBF, a 2.6 percent rise. Allocation of helicopter ground to harvest prescriptions increases from 4,342 acres to 13,661. The change in PNV is small (relative to the size of the changes in harvest volume and acreage) due to the relationship of per-acre costs to potential returns in the timber stands involved.

Budget Constraint

In the run to which it is applied (Current Direction), the budget constraint has no effect on the FORPLAN solution. In fact, with the exception of benchmarks 1, 7-2%, and 7T, the projected FORPLAN budget falls below the current level in each of the first five decades when nondeclining flow is applied. As would be expected, budgets rise well above the current level in the early decades of departure runs.

District Harvest Flows

This requirement has little effect on the benchmarks to which it is applied. Although a minor amount of re-scheduling is precipitated when District flow limits are imposed, the effects on total harvest volume and PNV, if any, are too small to be discernable.

BENCHMARK ANALYSIS BETWEEN DEIS AND FEIS

The numerous changes in both basic inventory data and management requirements and opportunities that have occurred since publication of the DEIS have necessitated reanalysis of key benchmarks in order to assess PNV and ASQ effects. Benchmarks 3, 7, 7T, and 11 have been rerun using the Forest's revised FORPLAN model. Key features of the new benchmark analysis are summarized in Table B-25. Data from the original benchmark analysis is provided for comparison purposes. Discussion of the key differences between the DEIS benchmarks and the FEIS benchmarks follows the table.

Table B-25. PNV and ASQ Outputs of Reanalyzed Benchmarks

				First Decade ASQ					
Run	PNV (MM$)	Discounted Costs	Discounted Benefits	East-West		Shelton CSYU		Total	
				MMCF	MMBF	MMCF	MMBF	MMCF	MMBF
BM 3	763.7	1,320.3	2,084.0	38.3	220.0	38.2	180.3	76.5	400.3
BM 7	592.1	996.0	1,588.1	27.4	155.0	34.8	162.3	62.2	317.3
BM 7T	528.1	1,227.0	1,755.1	32.0	166.5	44.5	213.8	76.5	380.3
BM 11	593.9	1,024.1	1,618.0	27.9	159.9	35.4	167.0	63.3	326.9
Original Benchmarks									
BM 3	615.4	1,423.6	2,039.0	48.1	209.4	38.2	166.3	86.3	375.7
BM 7	557.3	1,317.7	1,875.0	44.5	193.7	36.9	160.6	81.4	354.3
BM 7T	504.5	1,536.5	2,041.0	49.6	215.9	39.8	173.2	89.4	389.1
BM 11	551.4	1,349.3	1,900.7	45.2	196.7	37.1	161.6	82.3	358.3

Changes in Benchmark Constraints

The constraints applied to all benchmarks reanalyzed for the FEIS were revised for the updated analysis as follows:

> The commercial thinning access constraints were modified to reflect current timber stand data and thinning accessibility assumptions. Allocation of land to commercial thinning is limited to 60 percent of the area in Douglas-fir stands allocated to harvest. In addition, commercial thinning harvest volume in the first decade is limited to 1.275 MMCF per year.
>
> Visual prescription access limitations are no longer applied to benchmark runs.
>
> Timing requirements for helicopter logging are no longer applied.

The constraints applied to Benchmarks 7, 7T, and 11 in the updated analysis were revised as follows:

> The technique for modeling the means of meeting the riparian area/water quality management requirement was revised. Instead of a direct FORPLAN constraint, this has been modelled as a 3.4 percent reduction from full yield in timber yield tables.

The modified means of meeting the dead and defective tree habitat management requirement has been added to the constraint package of these benchmarks. As with the riparian area/water quality MR, this has been modelled as a reduction (averaging 4.6 percent) from full yield in timber yield tables. The combined riparian area/water quality and dead and defective tree habitat reductions were included in the timber yield tables used for Benchmarks 7, 7T, and 11. Full yield was used for Benchmark 3.

The number and size of SOHAs needed to meet the specifications of the management requirement for northern spotted owls has changed. In the updated analysis, 30 SOHAs averaging 3,000 acres in size are specified.

The number of bald eagle management areas has dropped from 21 to 16. The numbers of pileated woodpecker and pine marten habitat areas have dropped from 86 and 189 to 56 and 155 respectively. Since most of these areas are included in SOHAs and other allocations in both DEIS and FEIS analysis, this change has had little effect on the results of benchmark (and alternative) FORPLAN runs.

Comparison of Original and Final Analyses

The PNV and ASQ outputs of the reanalyzed benchmarks are different from the original results in four key respects: PNV figures, the relationship of board feet and cubic feet in ASQ totals, the difference between Benchmarks 3 and 7, and the effect of maximizing timber production (Benchmark 7T) within the Shelton CSYU. These differences are discussed individually below.

The PNV differences between the two sets of benchmarks, which are substantial in the case of Benchmark 3, are attributable to changes in the economic values included in the calculation of PNV during FEIS analysis. Roaded dispersed recreation outputs, which were not valued in the original analysis, have been added to the set of outputs which contributes to PNV in the revised FORPLAN model. Conversely, the dollar cost (reflecting potential productivity lost) of the effects of activity-generated sediment on off-Forest fish habitat is no longer included in PNV calculation. These two changes serve to generate PNV increases in FORPLAN runs conducted for FEIS analysis. The magnitude of these increases is fairly stable from run to run.

The differences in ASQ totals, and in the relationship between board foot totals and cubic foot totals, result from two factors. The first is the net effect of a wide range of changes in timber data and modeling between DEIS analysis and FEIS analysis. Included are updating the timber inventory for recent harvest, the switch to SPS for generating Western hemlock and silver fir yields, the reassessment of timberland suitability, and the transfer of 11,900 acres of National Forest land to the Bureau of Indian Affairs. These modifications (and several additional minor updates and changes) have led to a general drop in cubic foot outputs, especially on the East-West portion of the Forest. The second factor is the change in board foot/cubic foot conversion factors, which are generally greater (more board feet per cubic foot) than those used in DEIS analysis.

The greater differences in ASQ and PNV between Benchmarks 3 and 7 in the FEIS analysis are, in part, the result of changed specifications for meeting the northern spotted owl management requirement. The additional SOHA acreage needed to meet these specifications has increased their effect on PNV and ASQ. Addition of the modified attainment strategy for the dead and defective tree habitat management requirement has also affected the Benchmark 7 results. Changes in the means of meeting management requirements have affected the opportunity costs associated with them. Please refer to Appendix I for complete discussion of current opportunity costs.

An interesting consequence of the many changes in inventory data and management direction between DEIS and FEIS has been a shift in the nature of the timber inventory on the East-West portion of the Forest. This area was in a "surplus" condition at the time of DEIS analysis, with first decade ASQ equal to LTSYC in most FORPLAN runs in which nondeclining flow was applied (see also the discussion of original Benchmark 7D). This condition no longer exists, as the reduction in available harvest-age inventory has resulted in a "deficit" inventory situation (first decade ASQ below LTSYC). This shift in conditions has led to somewhat reduced flexibility in scheduling the early decade harvest of existing sawtimber stands.

The effect of using the "maximum timber production" objective function (Benchmark 7T) on Shelton CSYU harvest volume, which is much greater in the updated analysis than in the DEIS analysis, is largely explained by revisions to Simpson Timber Company's timber yield tables. The new yield information, in combination with price/diameter relationships and revised board foot/cubic foot conversion factors, has resulted in a greater ASQ difference between "maximum timber" and "maximum PNV" objective functions than occurred in the original analysis.

Despite the above differences between the results of the DEIS benchmark analysis and the updated analysis, the results of the new analysis and the incremental changes from benchmark to benchmark are quite comparable to those of the original analysis. Therefore, it is concluded that the evaluations and determinations which resulted from the DEIS benchmark analysis are valid, and that the original benchmarks were appropriate in their role of setting the framework for alternative development.

FORMULATION OF ALTERNATIVES

OVERVIEW

The alternatives considered in this Final Environmental Impact Statement represent different ways of managing the lands and resources of the Olympic National Forest. Each alternative contains a unique combination of land allocations, management prescriptions, and activity schedules. As a result, each alternative generates a different mix of goods and services for the public, and a different combination of resource outputs, land uses, and environmental effects.

An even distribution of reasonable alternatives, designed to cover a broad range of possible actions and outputs, was formulated by the Olympic National Forest ID team. The team was guided by several factors in formulating these alternatives, with primary consideration being given to the public issues, management concerns, and resource use and development opportunities which had been identified throughout the planning process. More information is presented on these topics in Chapter I and Appendix A of this FEIS.

The set of alternatives considered in detail in FEIS analysis has changed considerably from that which was analyzed in the DEIS. Alternative NC-No Change has been added, while DEIS Alternatives C-Departure, D-Departure, E, F, and G have not been carried forward for detailed consideration. DEIS Alternatives B-Departure (RPA), C-Preferred, and H have been modified in response to public comments, and are now referred to as Alternatives B-Departure (Modified), C-Preferred (Modified), and H (Modified) respectively.

NFMA planning regulations (36 CFR 219.12(f)) contain numerous requirements regarding the development of Plan alternatives. The provisions of these regulations specify that alternatives must:

- Be distributed within the minimum and maximum resource potentials so as to reflect to the extent practicable the full range of major commodity and environmental resource uses and values that could be produced by the Forest;

- Reflect a range of resource outputs and expenditure levels;

- Be formulated to facilitate analysis of opportunity costs and resource use and environmental effects tradeoffs among alternatives and between alternatives and benchmarks;

- Provide different ways of addressing and responding to the major public issues, management concerns, and resource use opportunities identified during the planning process;

- Be formulated to facilitate evaluation of effects on present net value, benefits, and costs of achieving various outputs and nonpriced benefits;

- Be formulated to consider changes in existing laws and policies, and include implementation of such changes if needed to address issues, concerns, or opportunities;

- Respond to and incorporate the RPA Program tentative resource output objectives in at least one alternative;

- Reflect the current level of goods and services provided by the Forest and the future output levels that would be associated with continuation of current management direction in at least one alternative (the "no action" alternative pursuant to NEPA);

- Represent to the extent practicable the most cost-efficient combination of management prescriptions examined that can meet the objectives established in each alternative;

- State the conditions and uses that will result from the long-term application of each alternative;

- State for each alternative what goods and services will be produced, including the timing and flow of outputs and the associated costs and benefits;

- Incorporate appropriate resource management standards and guidelines;

- incorporate statements describing the purposes of proposed management direction.

In responding to the above direction, the ID team developed a wide range of alternatives. Some of these would result in the Olympic National Forest being managed to maximize the production of priced commodities, primarily timber, while others would emphasize the output of nonpriced amenities such as unroaded recreation and scenic quality. Alternatives were developed to reflect the effects and outputs associated with continuation of current direction and to respond to RPA Program objectives. Additional alternatives were generated to represent the full range of possible operating strategies that fall within the Forest's decision space, as identified through analysis of benchmarks. The resulting set of alternatives was designed to be broad enough and varied enough to provide the Regional Forester with a firm basis for identifying and selecting the alternative which most nearly maximizes net benefits to the public.

The primary goal of alternative development was to provide an adequate basis for identifying the alternative that comes closest to maximizing net public benefits (36 CFR 219.12 (f)). Formulating a broad range of reasonable management alternatives to accomplish this purpose is an extensive and complex process. Each alternative represents a distinct combination of land uses, management prescriptions, and activity and output schedules that is a unique reflection of the resource capabilities of the Forest. Each alternative is designed to manage the Forest on the basis of a specific set of alternative goals and objectives. The process used in the development of alternatives, from initial ICO identification through establishment of the objectives to be met by individual alternatives, is outlined below as a sequence of steps. Many of these steps overlap and were performed concurrently.

- Major public issues, management concerns, and opportunities were identified through a series of public meetings and internal reviews. See Chapter I and Appendix A of this FEIS for additional detail.

- A comprehensive multiresource data base was formed, based on information needs associated with responding to the ICOs, and stored in a computer mapping system.

- A set of management prescriptions was prepared to represent a variety of possible strategies for managing the Forest in response to the ICOs. These prescriptions, and the different management intensities associated with them, were evaluated to assure that each represents the most cost-efficient set of activities available that can meet prescription goals.

- Analysis areas representing similar physical attributes and biological response characteristics were identified and mapped. Assessment of the availability, capability, and suitability of individual areas of the Forest for specific management uses was included in this step.

- The applicability of individual prescriptions to specific analysis areas was assessed and the appropriate linkages were identified.

- Yield functions defining the outputs and effects associated with the application of prescriptions to analysis areas were developed.

- The costs of applying management prescriptions to analysis areas and the values of the resultant resource outputs were estimated.

- Projections of demand for Forest outputs were made.

- The FORPLAN model was developed to incorporate the information gained in the preceding steps into a format that would facilitate the analysis of alternative management strategies.

- In the Analysis of the Management Situation, the FORPLAN model was used to assess the Forest's potential to provide various outputs in response to the ICOs. A variety of assumptions, constraints, and objectives was developed and tested in the establishment and analysis of benchmarks to which the performance of Plan alternatives could be compared. The Forest's range of output possibilities was established, and the opportunity costs associated with a variety of management assumptions were evaluated.

- Alternative goals and objectives were established to provide a broad range of options for future management of the Forest, and to represent a wide range of responses to the Forest's planning questions. The goals and objectives formulated in this step were based on the opportunities and limitations associated with the decision space defined in the Analysis of the Management Situation.

- Alternatives were reevaluated in light of public responses to the DEIS. Where public input identified opportunities to make DEIS alternatives more responsive to public desires, alternative management goals and objectives were revised to accomplish this.

All but one of the alternatives analyzed in detail in this FEIS were formulated in the context of the requirements of NFMA planning regulations and designed to represent a range of responses to the issues, concerns, and resource management opportunities which constitute the central focus of this planning process. Alternative NC-No Change, which has been added as an alternative considered in detail since publication of the DEIS, was not formulated in this manner. This alternative was developed from an entirely different base: the timber management plans currently in effect on the Forest.

The Forest's timber management plans were developed outside the scope of NFMA, and do not include provisions for many of the Act's requirements. In addition, these plans were designed for the principal purpose of establishing timber production capabilities and objectives, and include little consideration of issues and concerns not directly related to timber output. Finally, the plans (and thus Alternative NC) do not incorporate the most recent information regarding timber yield relationships or timberland suitability. Because of these differences between Alternative NC and the other alternatives, much of the discussion in this section does not apply to the No Change alternative.

The establishment of alternative sets of management goals and objectives marks the initial step in the process of developing specific, detailed alternatives and analyzing their outputs and effects. In addition to the need to reflect a wide range of opportunities within the Forest's decision space and a variety of approaches to addressing ICOs, the development of alternative goal sets was conducted within the framework of three specific considerations: the cost efficiency of FORPLAN solutions, the relationship of the Shelton CSYU to the remainder of the Forest, and the set of required alternatives included in National

and Regional planning direction. These considerations are discussed individually in the following paragraphs.

NFMA regulations require that the activity and output schedule associated with each alternative reflect, to the extent practicable, the most cost-efficient combination of management prescriptions examined that can meet the objectives established for that alternative. While this requirement does not directly affect the establishment of specific alternative goals, it strongly influences the way in which FORPLAN analysis is conducted. In order to ensure that the ultimate solution of each FORPLAN analysis represents maximum cost-efficiency, the ID team used "maximize PNV over the 150 year analysis horizon" as the final objective function in the FORPLAN analysis of each alternative.

Working in response to the "maximize PNV" objective function, the model uses what is essentially a two-step process in developing its solution for each alternative run. The first step consists of limiting the range of possible solutions to those which fully attain the goals of the alternative (expressed as constraints and/or output objectives). The second involves identifying, from within this range, the unique solution which accomplishes these goals in the most cost-efficient way. This procedure, in combination with pre-FORPLAN analysis of the cost-efficiency of prescriptions to be included in the model, assures that each alternative's goals are met in the most cost-efficient manner available.

The second important consideration influencing the development of alternatives was the necessity of maintaining the distinction between the Shelton CSYU and the remainder of the Forest. The nature and provisions of the cooperative agreement governing management of the Shelton CSYU make it necessary to treat this area and the remainder of the Forest as separate entities, particularly with regard to the development of timber harvest schedules. Therefore, two distinct sets of alternative goals were developed: those relating to the CSYU (some of which include responses to the management objectives of Simpson Timber Company), and those covering management of the remaining National Forest land. Complete alternatives, covering all lands included in the planning area, were created by combining alternatives for non-CSYU lands with CSYU alternatives having similar management emphases. With the exception of DEIS Alternative F, in which dissolution of the CSYU was proposed, all alternatives were constructed on the basis of complete separation of the two management entities. Resource interactions do not cross the boundaries of the CSYU, and the activities and outputs of one area are in no way dependent on those of the other.

In DEIS analysis, the complete separation of the Shelton CSYU and the remainder of the Forest was maintained throughout the 150-year analysis horizon. For FEIS analysis, this approach was modified to incorporate the eventual recombination of all National Forest land upon termination of the Cooperative Agreement. The analysis of Alternatives C-Preferred (Modified), H (Modified), and I now includes merging of National Forest land at the end of the sixth decade, with the entire National Forest being treated as a single management entity from the seventh decade on. To maintain the completeness of the FORPLAN analysis, Simpson Timber Company land is also modelled as a distinct entity after the sixth decade. This change in modeling has had no discernable effect on first decade timber harvest levels.

Recombination was not included for Alternative A-Current Direction (No Action) because the current calculations of harvest level within and outside of the CSYU, based on timber management plans, are based exclusively on the long-term production potentials of the two areas separately. Recombination was also excluded in the analysis of Alternative B-Departure (Modified), since the departure aspect of this alternative negates any possibility that eventual merging of National Forest land could have an effect on management during the 50-year planning horizon. Including termination of the Cooperative Agreement in the analysis can only have an effect on early decade harvest levels and other outputs in the case of nondeclining flow alternatives.

An additional aspect of Shelton CSYU management which has had an influence on the development of alternatives is the question of the applicability of Management Requirements. Simpson Timber Company

has expressed the concern that these requirements may not be consistent with the terms of the Cooperative Agreement, and has asked that alternatives be developed which include differing approaches to MR application. In response to this concern, two alternatives were developed in the DEIS (Alternatives B-Departure (RPA) and D-departure) which do not fully meet Management Requirement specifications on the Shelton CSYU. All of the alternatives considered in detail in the FEIS have been designed to fully incorporate the same means of meeting MRs on National Forest land within the Shelton CSYU as are used on the remainder of the Forest.

The final consideration in the development of alternatives was the set of alternatives required by NFMA regulations and direction from the National and Regional levels. These required alternatives are as follows (the No Change alternative has been added since publication of the DEIS):

- No Change: This alternative has been developed as a result of discussions between the Forest Service and the Northwest Forest Resource Council regarding Appeal No. 1588, filed by the Council in May of 1986. Appellants asked that a "true no action alternative representing current management plans be included in Forest Plans and EISs." While the appeal was denied, the concerns it raises are important, and the No Change alternative has been designed to respond to these concerns. It is based on the timber output targets and land use assumptions contained in the timber management plans currently in effect on the Forest.

- Alternative NC is the No Change alternative in this document, and is identified as Alternative NC-No Change throughout.

- Current Direction (No Action): This is the alternative of "No Action" required by Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14) and the National Forest Management Act (NFMA) planning regulations (36 CFR 219.12(f)). It continues management of the Olympic National Forest as defined by existing direction in approved management plans, and involves continuation of existing policies, standards and guidelines. It includes, to the extent possible, continued production of current levels and mixes of resources.

- Alternative A is the Current Direction Alternative (or the "No Action" Alternative) in this document and is identified as Alternative A-Current Direction (No Action) throughout.

- Emphasis on the Current RPA Program: This alternative attempts to meet the objectives of the current (1980) RPA Program, as distributed to the Forest through the Regional Guide.

- Alternative B meets this requirement and is identified as Alternative B-Departure (RPA) throughout the DEIS. Alternative B-Departure (Modified) is presented in this FEIS, and represents a variation of Alternative B-Departure (RPA) that is more responsive to public desires.

- Emphasis on Market Opportunities: This alternative emphasizes resource commodities that have an established market price. In the case of the Olympic National Forest, timber, fish caught for commercial enterprise, and developed recreation are the commodity outputs with established prices. Management for other resources will be at levels consistent with the emphasis of this alternative.

- Due to the resource characteristics of this Forest, this requirement is best fulfilled by Alternative B-Departure (Modified).

- Emphasis on Nonmarket Opportunities: This alternative puts emphasis on dispersed recreation in unroaded areas, scenic quality, wildlife, fish caught for recreational purposes, water, and other amenity values. Market resources will be produced at a level compatible with the emphasis of this alternative.

- Alternative I represents this required alternative.

- Emphasis on Nondevelopment and Intensified Management: This alternative retains most of the unroaded areas on the Forest in an undeveloped condition, while increasing production of commodities (primarily timber) from those areas already roaded. Its purpose is to mitigate the employment effects of precluding commodity production in unroaded areas.

- DEIS Alternative E is the alternative which best represents this requirement. This alternative has not been considered in detail in FEIS analysis.

- Departure from Nondeclining Flow: The planning direction covering this Forest requires analysis of at least one "departure" alternative. This is an alternative in which the timber harvest schedule deviates from the nondeclining flow schedule associated with equivalent land allocations and management prescriptions. Timber harvest level may drop from one decade to the next under a departure regime, provided that the long-term sustained yield capacity associated with the departure is at least equal to that of the nondeclining flow alternative on which the departure is based.

- Three departure alternatives were included in the Forest's DEIS analysis: B-Departure (RPA), C-Departure, and D-Departure. Alternative B-Departure (Modified) is the sole departure considered in detail in FEIS analysis.

Given the above set of requirements and considerations, and the results of the Analysis of the Management Situation (AMS), the ID team could begin the process of developing alternatives (in addition to the required alternatives) in response to the ICOs. This process was essentially iterative in nature, with each specific step largely dependent upon the results of the preceding step. The benchmark analysis provided key insights into production opportunities and tradeoff relationships, and was critical in defining the kinds of alternative goal sets that would be worthy of investigation. The ICOs provided direction as to the possible objectives which should be analyzed. Finally, the required alternatives (which were analyzed first) provided the framework from which to develop additional alternatives, since they addressed individual ICOs to widely differing degrees.

Numerous discretionary alternatives were developed and analyzed in the DEIS: Alternatives C-Preferred, C-Departure, D-Departure, F, G, and H. Of these, only two were found to be responsive enough to public concerns to be considered in detail in this FEIS: Alternatives C-Preferred and H. Both of these have been carried forward, in modified form, for additional analysis and evaluation. The development of these two alternatives is discussed below.

The generation of discretionary alternatives started with the development of DEIS Alternative C. This alternative evolved primarily from Alternative A-Current Direction, and included three principal adjustments in management strategy: a shift in emphasis from timber production as the basis for land allocation, a shift to a somewhat increased level of nonmarket output production, and a modification of the provisions of existing plans where experience gained during implementation had shown current requirements to be inappropriate. These changes combined to produce an alternative substantially different from Alternative A in its response to ICOs and its location within the Forest's decision space. Alternative C-Preferred (Modified) was revised for the FEIS through intensive analysis designed to make the alternative both more responsive to public concerns and more practical for implementation. A major change was the substantial expansion of the Forest's SOHA network, necessary to meet revised specifications regarding management of northern spotted owls.

DEIS Alternative H was essentially a modification of the objectives of Alternative I, and was developed to assess the effects of emphasizing response to the wildlife habitat issue by allowing a well-balanced mix of habitat types to develop. This alternative falls into a substantially different location within the Forest's

decision space than do the other alternatives, and provides a bridge between Alternatives C-Preferred (Modified) and I in terms of output mixes and resource management emphases. This alternative was modified for FEIS analysis so as to make it more responsive to public concerns.

CONSTRAINTS COMMON TO ALL ALTERNATIVES

Some constraints and prescriptions were applied uniformly in all alternatives. This was necessary in order to assure that particular planning requirements, laws and policies, and prescription objectives were met consistently. Many of these standard constraints were developed and tested during the analysis of benchmarks. Please refer to "Benchmark Analysis" for discussion of constraints associated with the benchmark process. The constraints which are common to all alternatives are listed below. Because of the unique nature of Alternative NC-No Change, many of these constraints do not apply to this alternative. Those which do apply are so noted.

Constraint: Some areas of the Forest are to be managed the same way in all alternatives. These include the congressionally designated Wildernesses, the Quinault Research Natural Area, and existing administrative sites, special use sites, and developed recreation facilities. This constraint applies to Alternative NC-No Change in addition to the other alternatives.

Purpose: To perpetuate the values, resources, and uses for which these areas were established or developed.

Rationale: In the case of Wilderness and the Research Natural Area, changes in land use are beyond the scope of this planning effort. Present designations of the other areas are well established, and have been determined to provide greater benefit than possible alternative uses.

Tradeoff: Impacts of the Wilderness and Research Natural Area allocations have not been analyzed, but it is projected that PNV and commodity output would increase to some extent if this constraint were removed. Amenity production would decline. The other designations involve insignificant land area, and would provide very little in the way of additional resource outputs were they to be allocated to different uses.

Constraint: Timber management may be prescribed only on those lands classified as tentatively suitable for timber harvest. This applies to Alternative NC-No Change in addition to the other alternatives, since the formulation of this alternative is consistent with the intent of the constraint. However, Alternative NC is based on different data regarding timberland suitability than the original alternatives. The current suitability assessment results in a tentatively suitable land base of 446,939 acres. In constrast, Alternative NC (which is based on older information) includes a tentatively suitable base of 507,930 acres.

Purpose: To meet the timber resource land suitability requirements of NFMA (36 CFR 219.14 and 219.27(b)(2)).

Rationale: Necessary to assure that harvest will be limited to lands that are sufficiently productive, reforestable, and not subject to unacceptable resource damage due to harvest.

Tradeoff: Impacts of this assumption were not analyzed, but it is projected that the losses in PNV and harvest volume that are associated with it are quite small.

Constraint: The harvest level of the fifteenth period will be less than or equal to the long-term sustained yield capacity (long-term sustained yield capacity link). In Alternatives A-Current Direction (No Action) and B-Departure (Modified), this constraint was applied to East-West and Shelton CSYU lands individually. In Alternatives C-Preferred (Modified), H (Modified), and I, it was applied separately to Simpson Timber Company and National Forest lands.

Purpose: To assure that the timber scheduling requirements of NFMA (36 CFR 219.16(a)(1)) are met.

Rationale: This constraint assures that the harvest level of the fifteenth decade will not exceed that which can be maintained in perpetuity, thus providing a link between the nondeclining flow constraint (when applied) and long-term productive capacity. The constraint was applied separately to the land area combinations discussed above in order to assure that each area maintained its integrity as a distinct management unit.

Tradeoff: This constraint has the effect of limiting nondeclining flow harvest levels to the ultimate LTSYC volume. It could, therefore, result in some reduction of harvest and PNV throughout the 150-year timber harvest scheduling horizon. It is projected that such effects, if any, are minor.

Constraint: Control the volume of timber inventory left at the end of the fifteenth period (ending inventory constraint). Applied to East-West and Shelton CSYU lands in the same way as the long-term sustained yield capacity link.

Purpose: The use of this constraint assures that the total inventory volume at the conclusion of the harvest scheduling horizon will equal or exceed the volume that would occur in a fully regulated forest managed under the same prescriptions for regenerated timber.

Rationale: If this constraint were not used, the FORPLAN model would have no incentive to leave enough inventory to assure that harvest levels could be sustained perpetually.

Tradeoff: PNV and allowable sale quantity may be reduced in some decades due to the need to retain an age class distribution capable of supporting future harvests. Specific effects were not quantified.

Constraint: Timber stands may not be scheduled for harvest prior to reaching 95 percent of culmination mean annual increment (CMAI). Exceptions may occur when earlier harvest is needed to meet other resource objectives; no such exceptions were modelled. This constraint was not applied to Simpson land. This is essentially the same approach as was used in the determination of potential yield levels in current timber management plans. Therefore, this constraint applies to Alternative NC-No Change in addition to the other alternatives.

Purpose: To comply with NFMA planning regulations (36 CFR 219.16(a)(2)).

Rationale: Without this constraint, harvest could be scheduled as soon as stands reached minimum merchantability standards. In most cases, harvest at this point would be too early to comply with NFMA specifications.

Tradeoff: Comparison of original benchmarks 4 and 5 indicates that imposition of this constraint has the following effects (in the context of these benchmarks): drop in first decade harvest of 10.1 MMBF (2.1 percent), drop in PNV of $12.7 MM (2.1 percent). LTSYC is essentially the same in both benchmarks. When original benchmarks 6 and 7 are compared there is very little difference, indicating that the CMAI constraint has its greatest impact in departure situations.

Constraint: Final harvest acreage per decade in any of the Forest's 21 major drainages is limited to the following proportions of total drainage acreage allocated to harvest prescriptions:

Dungeness, Little Quilcene, and Big Quilcene drainages - 16 percent
Humptulips drainage - 24.5 percent
All other drainages - 25 percent

Purpose: A limitation of 25 percent was necessary to assure adequate dispersion of harvest, as specified in NFMA regulations (36 CFR 219.27(d) and (f)). The more restrictive proportions were necessary to assure adequate protection of water quality within municipal watersheds.

Rationale: The proportions used were found to be the least restrictive limits that could be applied without sacrificing reasonable assurance that management requirements could be met. The constraint was applied to harvest presciption acreage rather than total drainages acreage to assure dispersion within harvested areas. Since most of the Forest's non-harvest areas occur in large, contiguous blocks, including these in the base from which maximum harvest acreage is calculated could lead to inadequate dispersion within harvest areas.

Tradeoff: Analysis of benchmark runs indicates that this set of constraints has little effect on harvest level or PNV, although harvest schedules are rearranged considerably when the proportion constraints are applied.

Constraint: Harvest is precluded in several areas in order to provide the habitat needed to sustain viable populations of wildlife indicator species and to meet the requirements of the Bald Eagle Recovery Plan. These allocations consist of:

30 3,000-acre Spotted Owl Habitat Areas (SOHAs)

16 bald eagle nest sites and wintering areas (some of which are partially included in other areas)

56 600-acre pileated woodpecker areas (most of which are included in other areas). While these habitat areas are to be 600 acres in size, only 300 acres of each must be in mature conifer habitat and therefore precluded from harvest.

155 160-acre pine marten areas (virtually all of which are included in other areas)

Purpose: To meet the specifications of the Management Requirements for wildlife species dependent upon old-growth and mature forest habitats (36 CFR 219.19 and 219.27(a)(6)).

Rationale: Based on specifications regarding distribution and abundance of habitat, the allocations described above are the minimum necessary to assure maintenance of viable populations. Refer to "Development of Ways or Means of Meeting Management Requirements (MRs)" for additional detail.

Tradeoff: Analysis of revised benchmark runs 3 and 7 indicates that this set of constraints has the following effect (in the context of these benchmarks): drop in LTSYC of 6.7 MMCF (13.9 percent), drop in PNV of $109.9 MM (14.4 percent). See FEIS Appendix I for further detail.

Constraint: Allocation of land to commercial thinning (CT) intensities limited to 60 percent of the area in Douglas-fir stands allocated to harvest. In addition, first decade CT volume is limited to 1.275 MMCF per year.

Purpose: To assure that commercial thinnings are not extended into areas that are either essentially inaccessible for this treatment because of long yarding distances or clearly impractical for economic reasons.

Rationale: The above limitation reflects the maximum proportion of Douglas-fir stands accessible to commercial thinning, given the existing and projected road networks, current yarding capabilities, and economic practicality. It is taken as given that roads (other than minor spurs) will not be constructed solely for commercial thinning access. Thinning is precluded in hemlock and silver fir stands because growth response is generally poor and damage to residual stands is often extensive in these timber types. The first decade harvest limit reflects the maximum level of commercial thinning output which is considered practical for this decade.

Tradeoff: The effect of this constraint was not specifically evaluated. It is projected, however, that the commercial thinning restrictions have only a minor effect on total harvest volumes in runs in which timber is maximized, and virtually no effect when PNV is maximized.

Constraint: In areas allocated to attainment of Retention/Partial Retention VQOs or Wild and Scenic River and River Corridor prescriptions allowing timber harvest, no more than 10 percent of large saw and small saw stands may be harvested per decade. This constraint is applied by drainage, with large saw and small saw constrained individually.

Purpose: To assure that Retention and Partial Retention Visual Quality Objectives are met where this is the management objective. Attainment of these objectives will assure accomplishment of management goals within recommended Wild and Scenic Rivers and River Corridors in which harvest is planned.

Rationale: Attainment of Visual Quality Objectives requires that specific standards for tree sizes and proportion of seen area disturbed be met. These constraints assure that applicable standards will be met continually when areas are allocated to scenic resource management prescriptions.

Tradeoff: These constraints involve no direct tradeoff, as they are an integral part of these resource management prescriptions and necessary to the accomplishment of management objectives when these prescriptions are specified.

DEVELOPMENT OF ALTERNATIVES

The minimum and maximum potential output levels of Forest resources, as well as several important resource tradeoff relationships, were identified in the benchmark analysis process. The maximum PNV benchmark (BM 7) served to establish the most cost-efficient available land allocation and schedule of activities and outputs, given the information quantified in FORPLAN. The understanding gained from benchmark analysis, in particular the results of benchmark 7, provided one of the two key bases around which alternatives were developed.

The second principal focus of alternative development was the set of issues, concerns, and opportunities to be addressed in the planning process. While the benchmarks were useful in establishing output and PNV maximums, they were in no way intended to address ICOs. This task called for the more subjective process of mixing understanding of production potentials and tradeoffs with knowledge of the issues to be addressed and the possible ways in which this could be done. The construction of alternatives, or possible ways to address issues, involved the development of a variety of sets of goals and objectives, each based on understanding of production possibilities and tradeoff relationships, and each reflecting

a distinct approach to issue resolution. These alternative objectives were expressed to the planning model in the form of an objective function and constraints, thereby translating each alternative into a format adapted to analysis by FORPLAN.

As a result of the use of constraints designed to improve issue resolution, none of the alternatives achieves the levels of PNV or output production associated with the benchmarks. This is primarily due to the fact that many of the issues involve nonpriced outputs, the production of which generally leads to reduced PNV and lowered output of priced goods and services. Such items were not valued within FORPLAN in benchmark analysis. Therefore, the many of the constraints associated with the alternatives reduce PNV and priced output production below the maximum levels established in the benchmarks.

While the constraints which define the alternatives generally result in lowered PNV, they are nonetheless intended to represent the most cost-efficient means available for achieving the goals and objectives of the alternative to which they are applied. The workings of FORPLAN assure that constraints, in the form in which they are expressed to the model, will be applied in the most cost efficient possible manner. The key to avoiding unnecessary reductions in cost efficiency, therefore, lies in the way in which constraints are developed and modelled. Each constraint used in FORPLAN was evaluated by the ID team to assure that no other approach would accomplish the same objective at lower cost. In addition, care was taken to model constraints so as to allow maximum flexibility in the optimization process. The goal in modeling was to assure that each constraint accomplished its objective, and only its objective, without unnecessarily limiting the model's opportunity to increase production or improve cost-efficiency.

The discussions which follow focus on the development of each alternative considered in detail in FEIS analysis. Numerous iterations occurred during the evolution of some of the alternatives, as schedules, prescriptions, constraints, and/or objectives were adjusted in order to better address ICOs. The results of preliminary alternative runs are on file at the Forest Supervisor's Office; the descriptions in this section cover only the ultimate set of constraints and objectives associated with each alternative. Detailed descriptions of the alternatives are located in Chapter II of this FEIS. Note that Alternative NC-No Change is substantially different from the other alternatives in terms of the requirements and considerations which served as the basis for its development.

It should be noted that the analyses of tradeoffs included in the following discussions focus primarily on changes in PNV and timber output. This is not intended to imply that these factors are necessarily more important than other outputs and effects, but was done for consistency and efficiency in presenting tradeoffs. Many factors which are not accounted for in the PNV calculations or harvest totals are significantly enhanced by some constraints and adversely influenced by others. Table II-14 in Chapter II of the FEIS presents a wide range of outputs and effects which vary greatly from alternative to alternative. The variations in all of the factors presented in this table result directly from differences in the objective functions and constraints associated with the alternatives.

ALTERNATIVE NC-NO CHANGE

The basis for this alternative is quite different from that of the other alternatives. It is designed to reflect the provisions and assumptions included in existing timber management plans *only*, without adjustment for direction developed or information gained subsequent to the publication of those plans (unless such changes are incorporated in plan amendments). As a result, there are numerous important differences between Alternative NC-No Change and the remaining alternatives:

- Alternative NC does not incorporate the management requirements outlined in the regulations governing implementation of the National Forest Management Act (NFMA). The other alternatives include these requirements.

- Among the key requirements not included in Alternative NC are the Management Requirement specifications developed to assure attainment of specific resource management goals. These requirements will not be applied in Alternative NC unless doing so is consistent with the provisions of existing timber management plans.

- Alternative NC is based on the timberland suitability stratification used in the development of the timber management plans. The other alternatives are based on the suitability reassessment conducted in support of this planning process.

- The timber yield estimates associated with Alternative NC are based on the yield tables and projection techniques used in developing the timber management plans. Timber outputs of the other alternatives are estimated on the basis of current yield information.

- The focus of the Forest's timber management plans was the establishment of Alternative NC timber harvest targets. Many of the resource outputs and effects analyzed in this planning process were not considered or evaluated during the development of the timber management plans. Consequently, many of the nontimber resources for which output estimates have been made for the other alternatives cannot be reasonably evaluated in the case of Alternative NC.

- Analysis of the other alternatives was conducted through use of the FORPLAN linear programming model. This model was not used in evaluating Alternative NC. For this alternative, information contained in the timber management plans served as the basic analysis tool, with extrapolations and interpretations of this information used to estimate outputs and effects where it was reasonable to do so.

- The timber output estimated for Alternative NC reflects "potential yield" (as developed in the timber management plans) rather than "allowable sale quantity". The distinction between the two is subtle, and has to do with the degree to which the timber output target is integrated with other resource management objectives. The potential yield calculations of the Olympic's timber management plans were based on the viewpoint that timber is a single resource, to be managed for its maximum yield with minimal adjustment for other resource considerations. The allowable sale quantity developed for the other alternatives, in contrast, is based on complete integration of each alternative's full range of resource management objectives in the calculation of timber output levels.

- The other alternatives were developed specifically to address the issues, concerns, and opportunities outlined in Chapter I and Appendix A of the FEIS. These were not a consideration in the development of Alternative NC.

- The other alternatives were designed in the context of the decision space identified through benchmark analysis. Alternative NC was derived from a different basis. It would therefore be inappropriate to relate the outputs and effects of this alternative to the decision space developed in benchmark analysis.

The No Change alternative has been developed as a result of discussions between the Forest Service and the Northwest Forest Resource Council regarding Appeal No. 1588, filed by the Council in May of 1986. The appeal centered on a decision by Regional Forester James F. Torrence "to require inclusion of MRs (Management Requirements) in the Current Direction alternative for each Forest Plan." The crux of the appeal was that a "true no action alternative representing current management plans" was not included in Forest Plan DEISs. While the appeal was denied, the concerns it raises are important, and the No Change alternative has been designed to respond to these concerns. This alternative is based on existing timber management plans, and thus does not comply with all provisions of NFMA and the regulations promulgated by the Secretary of Agriculture to implement this act.

Background Information

Management of the East-West portion of the Forest is currently guided by the Peninsula (1968) and Quinault (1969) Timber Management Plans. These plans specify timber harvest objectives (potential yields) for the two working circles they cover. Both plans have been amended several times. The three most critical amendments have been:

1. 1984 amendments removing Wildernesses created by the Wilderness Act of 1984 from the timber harvest base;

2. A 1988 amendment to the Quinault Plan incorporating the transfer of approximately 11,900 acres of National Forest land to the Bureau of Indian Affairs in trust for the Quinault Indian Nation;

3. 1980 amendments which incorporated the land allocations of the Quinault, Soleduck, Satsop Block, and Canal Front Land Use Plans into the timber management plans.

While the third set of amendments accounted for the allocations of the unit plans (by shifting acreage from the "standard" to the "special" component of the timber management plan land classification system), it did not change the potential yield calculation to reflect the changed allocations. This was to have been done through the Forest Planning process. The most recent amendment to these timber management plans extends their application until such time as the Forest Plan has been completed.

Management of the Shelton CSYU portion of the Forest is currently guided by the Shelton CSYU Timber Management Plan. Unlike the plans for the East-West zone, this plan includes current land use allocations as well as potential yield objectives. For this zone of the Forest, therefore, timber harvest goals are coordinated with land allocations. This plan has not been formally amended, except to extend its application to January 1, 1991.

In the development of the No Change alternative, amendments to the original timber management plans have been considered to be an integral part of these plans. Therefore, the land allocations of current unit plans are assumed to be a facet of the timber management plans, and therefore a component of the No Change Alternative, even though the potential yields of the East-West zone timber management plans have not been adjusted to reflect these allocations.

Purpose of Alternative NC-No Change

This is the "No Change" alternative precipitated by discussions between the Forest Service and the Northwest Forest Resource Council regarding Appeal No. 1588, filed by the Council in May of 1986. Its purpose is to project the outputs and effects associated with management of the Forest on the basis of the output projections and land uses specified in existing timber management plans. The timber harvest potential yield estimates and land use assumptions upon which this alternative is based are specified in the Peninsula Working Circle, Quinault Working Circle, and Shelton CSYU Timber Management Plans.

The principal guidelines and objectives underlying the development of this alternative are:

> The goal of the alternative is to provide a level of timber availability equal to the potential yield of timber specified in current timber management plans. Output of other resources is subsidiary to this primary goal.

Land allocations and uses specified in current timber management plans will be applied.

Management Requirements and other elements of current planning direction that are not fully compatible with timber management plan provisions will not be applied.

Determination of availability, capability, and suitability of land for timber harvest shall be based on timber management plan suitability stratifications, not the most recent available information.

Timber harvest prescriptions will emphasize volume output rather than contribution to present net value (PNV), as this is the basic emphasis of current timber management plans.

Timber yield data and resource relationship information used in the formulation of the timber management plans will serve as the data base for this alternative. FORPLAN analysis will not be conducted.

The following discussions of the other alternatives include a listing of the constraints applied to each alternative in order to assure that alternative objectives are be met. Since Alternative NC was not analyzed in FORPLAN, such a presentation would be inappropriate here.

In the sense that the No Change alternative is essentially a "given" (in that it represents the aggregation of past plans rather than a newly developed option), this alternative could be considered to be unconstrained in the context of the current planning process. Of course, the potential yield levels of existing timber management plans were based on the management limitations and constraints recognized at the time of their development. Thus it would be inaccurate to assert that Alternative NC was developed entirely without constraints. The management assumptions and limitations applied during the development of each timber management plan are too numerous to discuss here, and are available for review in the individual plans (on file at the Forest Supervisor's Office).

ALTERNATIVE A-CURRENT DIRECTION (NO ACTION)

This is the "no action" alternative required by Council of Environmental Quality (CEQ) regulations (40 CFR 1502.14) and planning direction. Its purpose is to project the outputs and effects associated with continued management of the Forest on the basis of current plans, policies, and direction. Land allocations upon which this alternative is based are specified in the Soleduck, Quinault, Satsop Block, and Canal Front land management plans and the Timber Management Plan for the Shelton CSYU. Other plans which apply to or are affected by this alternative are listed in Table I-1 in Chapter I of this FEIS.

The criteria and assumptions underlying the development of this alternative are:

The set of constraints common to all alternatives (see earlier discussion), including attainment of all management requirement specifications, is to be applied.

The goal of the alternative is to simulate as closely as possible the future condition of the Forest if implementation of current plans is continued.

Land allocations specified in existing plans will be applied.

Determination of availability, capability, and suitability of land for timber harvest shall be based on the most recent available information, not currently approved Timber Management Plans.

Timber harvest schedules on both the East-West and Shelton CSYU segments of the Forest will be based on nondeclining flow.

Within the East-West zone, timber harvest prescriptions will be selected to emphasize contribution to PNV rather than volume output, as this is the basic emphasis of present implementation of current direction.

Within the Shelton CSYU, timber harvest prescriptions will be selected to emphasize volume output rather than contribution to PNV. This best approximates the objectives of the Shelton CSYU Timber Management Plan.

In addition to the constraints common to all alternatives, the following objective function and constraints were used to reflect the above criteria and assumptions:

Objective function: Maximize PNV for 15 decades, East-West zone. On the Shelton CSYU, maximize timber production in the first decade, rolled over to maximize PNV for 15 decades.

Purpose: To reflect current timber management philosophy.

Rationale: Based on implementation of the timber management plans for Shelton CSYU, Quinault Working Circle, Peninsula Working Circle. Although the philosophy behind all three plans is essentially timber output maximization, implementation of the Quinault and Peninsula plans in particular is being conducted with strong sensivity to economic considerations. Recent direction has been strong in its emphasis on cost-efficiency, and this is reflected in the way current direction activities are being managed. Therefore, the "maximize PNV" objective function was selected for the East-West zone. On the Shelton CSYU, with the majority of harvest-age timber on Simpson Timber Company land, "maximize timber production" is most consistent with current management philosophy.

Tradeoff: This mix of objectives is the primary cause of the 8.1 MMCF per year increase in first decade harvest relative to BM 7. Most of this increase comes from the Shelton CSYU. It also contributes (along with land allocation) to the $23.6 MM (4.0%) drop in PNV from BM 7, and probably accounts for close to 50 percent of this difference.

Constraint: Nondeclining flow, applied individually to both the Shelton CSYU and remaining National Forest land.

Purpose: To reflect the provisions of current timber management plans.

Rationale: All three existing timber management plans include nondeclining flow, with the Shelton CYSU (including Simpson Timber Company land) being completely separated from and independent of harvest and growth on East-West land.

Tradeoff: Early decade harvest and PNV could be increased if departure from nondeclining flow was included in this alternative.

Constraint: Several areas, identified as special management areas in existing plans, are allocated to specific treatments designed to meet management goals. These are identified below. FORPLAN runs for Alternative A-Current Direction (No Action) were constrained (through use of prescription controls) to provide these allocations.

Area	Acreage 1/	Allocation	Source
Pat's Prairie	414	Botanical-No harvest	Canal Front
Dungeness	5,866	Soil Protection-No harvest	Canal Front
Green Mountain	2,204	Meet Visual Quality Objectives	Canal Front
Duckabush River	1,129	Wild and Scenic River	Canal Front
Lena Lake	2,479	Recreation-No harvest	Canal Front
Lightning Peak	3,568	Recreation-No harvest	Canal Front 2/
Mt. Ellinor-Mt. Washington	2,043	Recreation-No harvest	Canal Front
Spider Lake	195	Recreation-No harvest	Shelton CSYU
South Skokomish VRM	6,788	Meet Visual Quality Objectives	Shelton CSYU
Rule Creek	254	No roads (harvest OK)	Shelton CSYU
Upper Skokomish	4,185	Recreation-No harvest	Shelton CSYU
Satsop Lakes	796	Recreation-No harvest	Satsop Block
Satsop VRM	1,445	Meet Visual Quality Objectives	Satsop Block
Wynoochee VRM	4,037	Meet Visual Quality Objectives	Shelton CSYU
Klone Lake	764	Recreation-No harvest	Shelton CSYU
Moonlight Dome	3,553	Recreation-No harvest	Quinault
Lake Quinault	1,918	Recreation-No harvest	Quinault
South Quinault Ridge	4,901	Meet Visual Quality Objectives	Quinault
Rugged Ridge	6,168	No roads (harvest OK)	Soleduck
Calawah River	102	Botanical-No harvest	Soleduck
Mt. Baldy A	1,750	No roads (harvest OK)	Soleduck

1/ Acreage includes unsuitable land.
2/ From Canal Front FEIS prior to decision notice amendment resulting from RARE II recommendation, and as amended by Washington Wilderness Act.

Purpose: To reflect the land allocations specified in existing land management plans.

Rationale: This constraint represents the current direction land allocation pattern.

Tradeoff: The effect of current land allocations can best be estimated by comparing Alternative A with BM 7, which has essentially the same objectives and constraints other than the above special management area allocations. The drop in PNV from BM 7 to Alternative A is $23.6 MM (4.0%). First decade harvest increases 8.1 MMCF (13.0%) in Alternative A, due to the "maximize timber" objective function within the Shelton CSYU. East-West harvest declines 0.5 MMCF (1.8%) from BM 7 to Alternative A, which best reflects the effects of current land allocations. Note that many of the above allocations are included in SOHAs, which are common to both runs.

Key Comparisons with Other Runs

FORPLAN Run	PNV ($MM)	Discounted Costs ($MM)	Discounted Benefits ($MM)	1st Decade ASQ (MMCF/yr) 1/
Benchmark 7 (maximum PNV)	592.1	996.0	1,588.1	62.2
Alternative A maximum PNV, East-West, maximum timber CSYU, land allocation constraints	568.5	1,005.5	1,574.0	70.3

1/Includes harvest from Simpson Timber Company land within the Shelton CSYU.

ALTERNATIVE B-DEPARTURE (MODIFIED)

This alternative was designed to assess the effects associated with a commodity production oriented alternative. This represents the "community stability" alternative suggested by some members of the public, including the timber industry. A departure from nondeclining flow is necessary to achieve the proposed timber volume output in the first (and second) decades.

The criteria and assumptions underlying the development of this alternative are:

The set of constraints common to all alternatives is to be applied.

The goal of the alternative is to achieve high levels of commodity outputs while meeting management requirement specifications for other resource protection.

Land allocations (other than those common to all alternatives) will be completely open in FORPLAN optimization to give the model total flexibility in attaining timber targets.

Departure from nondeclining flow will be allowed on the East-West portion of the Forest. Harvest from the Shelton CSYU will be governed by the nondeclining flow policy.

Decade-to-decade decline in total National Forest harvest will be limited to a maximum of 25 percent, as suggested in planning direction covering departure alternatives. See "*Region 6 Direction for Land and Resource Management Planning*", November 10, 1983.

Timber harvest prescriptions will be selected to emphasize volume output rather than contribution to PNV, as this will be necessary in order to achieve targeted harvest levels.

In addition to the constraints common to all alternatives, the following objective function and constraints were used to reflect the above criteria and assumptions:

Objective function: Maximize timber for the first decade, rolled over to maximize timber for 15 decades, rolled over to maximize PNV for 15 decades.

Purpose: To maintain an East-West ASQ of 250 MMBF as long as possible.

Rationale: Necessary to assure that timber production throughout the planning horizon (50 years) would be at the maximum possible level consistent with the constraints associated with this alternative.

Tradeoff: The cost in PNV of maximizing timber production was best shown by comparison of BMs 7 and 7T, which differ in PNV by $64.0 MM. Because this alternative is quite similar to BM 7T (with the exception of the departure), it is likely that the same magnitude of effect is associated with this run.

Constraint: Nondeclining flow is specified for the Shelton CSYU.

Purpose: To manage in a manner consistent with current stand conditions on the Shelton CSYU.

Rationale: While not required in the Cooperative Agreement covering the CSYU, nondeclining flow is favored for this zone because of the current "deficit" nature of CSYU timber stands. Current availability of harvest-age timber is low relative to LTSYC. Thus, there is little opportunity for departure on the CSYU without entailing substantial harvest reductions in later decades.

Tradeoff: This provision does not decrease the potential to produce timber from East-West land in the early decades. Since the "community stability" proposal applies to East-West harvest only, there is no cost (relative to the basic objective function) associated with this constraint.

Constraint: Harvest volume targets are established to meet the "community stability" target of 250 MMBF per year from the East-West zone in the first two decades. From the third decade through the fifth, the decline in harvest from National Forest land is limited to 25 percent per decade. From the fifth decade on, nondeclining flow is applied to East-West harvest as well as Shelton CSYU harvest.

Purpose: To structure harvest goals so as to meet alternative objectives as fully as possible.

Rationale: The results of several runs (DEIS Benchmark 7D, the base sale schedule for this alternative, preliminary runs of Alternative B-Departure) indicated that the above structure would approach the timber harvest goals of this alternative very closely while remaining within the limits of feasibility. Nondeclining flow was applied for the period following the fifth decade in order to return harvest scheduling criteria to those applicable under existing Forest Service policy.

Tradeoff: The principal tradeoff associated with this harvest flow pattern is the decline in harvest from decades three through five. The total drop in harvest from East-West land from decade two to decade five is quite dramatic -- from 45.1 MMCF/year to 19.0.

Constraint: East-West long-term sustained yield capacity required to equal or exceed that which resulted from the base sale schedule (BSS) run for this alternative (30.5 MMCF/year).

Purpose: To assure that the departure schedule would not result in a long-term production potential lower than that which would be associated with the same land management patterns under a nondeclining flow regime.

Rationale: Assuring that departure schedules do not result in a sacrifice of long-term production potential is required in both Regional and National planning direction.

Tradeoff: None discernable in this alternative.

Key Comparisons with Other Runs

FORPLAN Run	PNV ($MM)	Discounted Costs ($MM)	Discounted Benefits ($MM)	1st Decade ASQ (MMCF/yr) 1/
Benchmark 7 (maximum PNV)	592.1	996.0	1,588.1	62.2
Benchmark 7T (BM 7 w/maximum timber)	528.1	1,227.0	1,755.1	76.5
Alternative B - base sale schedule	521.9	1,229.7	1,751.6	76.5
Alternative B maximum timber & "community stability" targets	547.2	1,385.5	1,932.7	89.6

1/ Includes harvest from Simpson Timber Company land within the Shelton CSYU.

ALTERNATIVE C-PREFERRED (MODIFIED)

The purpose of this alternative is to determine the outputs and effects that would be associated with changing existing management direction so as to (1) increase the emphasis on nonmarket outputs in areas of high public interest, (2) develop timber harvest schedules on the basis of contribution to PNV rather than harvest volume, (3) provide a mix of allocations and outputs which addresses all issues, concerns, and opportunities. Modifications to current direction include changes in land allocation designed to increase amenity outputs, elimination of restrictive allocations no longer seen as necessary to meet management goals, and increased emphasis on contribution to PNV in the allocation of land to timber harvest. This alternative is a modified version of DEIS Alternative C.

The criteria and assumptions underlying the development of this alternative are:

The set of constraints common to all alternatives is to be applied.

The goal of the alternative is to make changes in current direction that will (1) increase amenity outputs from key areas, (2) reduce the emphasis on timber volume production in land allocation and harvest prescription selection, and (3) address ICOs in a manner responsive to public input regarding the DEIS.

Land allocations will be adjusted as indicated by experience gained during implementation of current plans and by DEIS responses.

Timber harvest schedules on both the Eastside-Westside and Shelton CSYU components of the Forest will be based on nondeclining flow.

Timber harvest prescriptions will be selected on the basis of contribution to PNV rather than volume output. Prescription selection on Simpson Timber Company land will be based on timber output maximization.

Determination of harvest levels and schedules will include eventual recombination of Shelton CSYU and Eastside-Westside National Forest lands in the analysis.

In addition to the constraints common to all alternatives, the following objective function and constraints were used to reflect the above criteria and assumptions:

Objective function: Maximize PNV for fifteen decades for National Forest land, maximize timber production (rolled over to maximize PNV) for Simpson land.

Purpose: To assure that contribution to PNV is the basis for allocation and scheduling on National Forest land, while assuring a timber output level from Simpson land that is consistent with company goals and production capacities.

Rationale: Analysis of benchmarks indicated that timber maximization operating strategies result in output levels which are inconsistent with maximizing present net value. This is particularly apparent when comparing BM 7 with BM 7T. Therefore, the opportunity exists to change the results of timber maximization management by switching emphasis from timber production to contribution to PNV. With respect to Simpson land, the timber maximization approach is consistent with both management goals and economic considerations.

Tradeoff: The first decade timber output of Alternative C is 16.2 MMCF per year below that of BM 7T, a drop of 21.2 percent. PNV, on the other hand, decreases only $7.8 MM (1.5%) in Alternative C. The majority of these shifts are directly attributable to the change in objective function.

Constraint: Nondeclining flow, applied individually to both the Shelton CSYU and East-West components of the Forest.

Purpose: To include nondeclining flow harvest management in this alternative.

Rationale: It was desired that the effects associated with the changes in management strategy included in this alternative be evaluated in the context of nondeclining flow. A departure schedule based on the goals, objectives, and constraints of Alternative C was, however, included in DEIS Alternative C-departure (not analyzed in detail in the FEIS).

Tradeoff: The difference in PNV between the original Alternatives C and C-departure is $28.2 MM. This can be fully attributed to the nondeclining flow constraint of Alternative C.

Constraint: The special management allocations of Alternative A-Current Direction (No Action) are revised (through changes in prescription controls) as outlined below.

The Dungeness soil protection allocation does not apply. Improved data has enabled the ID team to remove areas of critical soil from the timber harvest base as part of the land suitability stratification. Therefore, timber may be harvested from the remainder of this area without unusual risk of resource

damage. It should be noted that much of the original Dungeness area will be included in allocations which preclude or limit timber harvest (unroaded recreation, scenic management, Wild and Scenic River recommendation).

The Mt. Zion unroaded area is to be allocated to unroaded recreation. Timber harvest is precluded. Numerous other additions to and refinements of Alternative A unroaded areas are included -- a total of 55,700 acres will remain unroaded.

Timber harvest is allowed within the Dry Creek portion of the Lightning Peak recreation allocation. The remainder of the area will continue in its present allocation.

The Dungeness-Gray Wolf river system corridor is to be managed so as to maintain the characteristics which qualify it for Wild and Scenic River designation, and is to be recommended for this designation.

Road construction will be allowed within the "harvest-no roads" allocations on Rugged Ridge and Mt. Baldy. On-the-ground investigation by District personnel has identified acceptable road locations within these areas.

In addition, the following allocation provisions are included:

In addition to retaining the Quinault RNA, Wet Weather Creek is proposed as an RNA.

Twelve botanical areas have been identified, reflecting the increased emphasis on protection of native plant species between draft and final EIS (three areas were proposed in the DEIS). The twelve areas included in this alternative are:

- Three Peaks Botanical Area
- Cranberry Bog Botanical Area
- Pat's Prairie Botanical Area
- Buckhorn Botanical Area
- Three O'Clock Ridge Botanical Area
- Tyler Peak Botanical Area
- "Bill's Bog" Botanical Area
- Matheny Prairie, Old Western Redcedar Botanical Area
- Matheny Ridge, Old Alaska Yellowcedar Botanical Area
- North Fork Matheny Ponds, Old Alaska Yellowcedar Botanical Area
- Pine Mountain Botanical Area
- South Fork Calawah River Botanical Area

All areas having Visual Quality Objectives of Retention or Partial Retention are expected to be managed to meet these objectives. Although about 30 percent of such areas lie within timber production allocations in this alternative, standards and guidelines calling for VQO attainment will apply. Therefore, the constraint requiring that no more than 10 percent of the large saw and small saw stands in such areas be harvested per decade applies to all Retention and Partial Retention areas.

Corridors of variable width (approximately 1/8 mile each side of river) adjacent to fourteen rivers have been allocated to the "River Corridor" prescription, a prescription designed to provide a variety of recreation opportunities in a pleasing scenic environment while maintaining or enhancing water quality and wildlife and fish habitat. This is an increase of twelve rivers from the two allocated to this prescription in the DEIS. The fourteen rivers include portions of the Dosewallips, Hamma Hamma,

S. Fork Skokomish, Wynoochee, E. Fork Humptulips, W. Fork and main Humptulips, Soleduck, Sam's, Calawah system, Big Quilcene, Quinault, Elwha, Bogachiel, and Hoh.

Purpose: To incorporate information and understanding gained since the development of current plans and public response to the DEIS into the objectives of this alternative.

Rationale: Each of the allocation changes presented above represents either a modification designed to improve the overall balance of resource outputs or a response to an opportunity for increasing the efficiency of Forest operations. Changes of the former type are based on consideration of the ICOs and their relationship to the management strategies entailed in current direction, as well as incorporation of public input. The latter category of changes results from information obtained since current direction was initially implemented.

Tradeoff: The difference in PNV between Alternatives A and C is $48.2 MM, a drop of 8.5 percent. First decade harvest level is 10.0 MMCF lower in Alternative C, a 14.2 percent decline. A substantial proportion of these differences can be attributed to the special management allocations associated with Alternative C.

Constraint: The drainage constraints used to model the means of meeting the harvest dispersion MR (see "Constraints Common to All Alternatives") are refined to apply the harvest proportion constraint by drainage to both large saw stands and small saw stands specifically for the first three decades.

Purpose: Extensive review by District personnel indicates that such a provision is needed to assure avoidance of undesirable cumulative effects, balance the timber harvest program by geographic area, and include practical and economic on-the-ground considerations in developing an implementable alternative.

Rationale: Avoidance of cumulative effects, especially to fisheries and wildlife habitat resources, is an important concern on this Forest. This can be accomplished by assuring that early decade harvest is distributed, both geographically and temporally, in such a way as to preclude excessive impact in any one area or period. In addition, practical considerations currently affecting the development of timber sale programs in the near future make a more cautious approach to implementation feasibility advisable.

Tradeoff: The principal differences between Alternatives A and C are changes in land allocation and this constraint. It is likely that substantial proportions of the $48.2 MM difference in PNV and 10.0 MMCF difference in first decade harvest level are attributable to these harvest proportion controls. When analyzed in the context of BM 7, this constraint resulted in a PNV change of $19.3 MM and a first decade harvest drop of 0.7 MMCF.

Constraint: The nondeclining flow constraint is applied to East-West and Shelton CSYU lands separately for the first six decades, then modified to apply to National Forest and Simpson Timber Company lands for decades seven through fifteen.

Purpose: To represent the eventual termination of the Shelton CSYU Agreement and the recombination of National Forest land into a single management entity.

Rationale: It was suggested during the DEIS response period that modeling this recombination could have an effect on early decade harvest levels from East-West land.

Tradeoff: There was no discernable effect resulting from use of this constraint during the 50-year planning horizon. Harvest patterns are redistributed substantially after recombination occurs (seventh decade).

Key Comparisons with Other Runs

FORPLAN Run	PNV ($MM)	Discounted Costs ($MM)	Discounted Benefits ($MM)	1st Decade ASQ (MMCF/yr) 1/
Benchmark 7 (maximum PNV)	592.1	996.0	1,588.1	62.2
Benchmark 7 with drainage harvest controls	572.8	961.3	1,534.1	61.5
Alternative A-Current Direction	568.5	1,005.5	1,574.0	70.3
Alternative C-Pref (Modified) revised land allocations, drainage controls	520.3	830.2	1,350.5	60.3

1/ Includes harvest from Simpson Timber Company land within the Shelton CSYU.

ALTERNATIVE I

NOTE: Alternative I is presented before Alternative H (Modified) because it served as the basis from which Alternative H was constructed. Therefore, the continuity and logic of the discussion of alternatives is best served by covering Alternative I first.

This alternative was developed to provide the maximum possible level of amenity outputs and nonpriced benefits that can be obtained from the Forest. It is the "amenity emphasis" alternative specified in Regional planning direction, and represents an approach to ICO resolution that essentially limits commodity production to that which is fully compatible with management for nontimber resources. It is, therefore, the direct opposite of Alternative B-Departure (Modified), the "commodity emphasis" alternative.

The criteria and assumptions underlying the development of this alternative are:

The set of constraints common to all alternatives is to be applied.

Land allocations will be based on the goal of providing amenity outputs and nonpriced benefits. All areas capable of producing nontimber outputs related to issues or concerns will be allocated to prescriptions which provide these outputs.

Timber harvest schedules on both the East-West and Shelton CSYU components of the Forest will be based on nondeclining flow.

Timber harvest prescriptions will be selected on the basis of contribution to PNV rather than volume output.

The existing acreage of old-growth (266,800 acres Forest-wide) will be retained throughout the 150-year analysis horizon.

Determination of harvest levels and schedules will include eventual recombination of Shelton CSYU and Eastside-Westside National Forest lands in the analysis.

In addition to the constraints common to all alternatives, the following objective function and constraints were used to reflect the above criteria and assumptions:

Objective function: Maximize PNV for 15 decades.

Purpose: To assure that contribution to PNV is the basis for allocation and scheduling.

Rationale: Use of contribution to PNV in allocation and scheduling is consistent with the goals of this alternative.

Tradeoff: Benchmark analysis indicated that use of this objective function can reduce first decade harvest level by up to 18.7 percent (based on the comparison of BMs 7 and 7T). Because of the limited harvest base of this alternative, it is doubtful that timber maximization would result in early decade harvest levels appreciably different from those associated with PNV maximization.

Constraint: Nondeclining flow, applied individually to both the Shelton CSYU and East-West components of the Forest.

Purpose: To include nondeclining flow harvest management in this alternative.

Rationale: Use of nondeclining flow in harvest scheduling is more consistent with amenity output goals than departure scheduling, since it distributes the effects of timber harvest more evenly through time. The harvest fluctuations associated with departures can concentrate these effects in specific decades.

Tradeoff: Given the reduced harvest base associated with this alternative, the opportunity for a meaningful departure is very limited. Therefore, tradeoffs associated with nondeclining flow are not significant.

Constraint: The special management allocations prescribed for this alternative are designed to provide the maximum possible levels of amenity outputs and nonpriced benefits. The special management allocations of Alternative I, modelled through use of prescription controls, are as follows:

Unroaded recreation opportunities are permanently retained in all areas currently providing this type of experience. The existing 85,800 acres of unroaded areas will be retained.

In addition to retaining the Quinault RNA, this alternative proposes adding the Wet Weather Creek and Buckhorn RNAs (Buckhorn is proposed as a botanical area rather than an RNA in Alternative C-Preferred (Modified)).

Eleven botanical areas have been identified, reflecting the increased emphasis on protection of native plant species between draft and final EIS:

- Three Peaks Botanical Area
- Cranberry Bog Botanical Area
- Pat's Prairie Botanical Area
- Three O'Clock Ridge Botanical Area
- Tyler Peak Botanical Area
- "Bill's Bog" Botanical Area

- Matheny Prairie, Old Western Redcedar Botanical Area
- Matheny Ridge, Old Alaska Yellowcedar Botanical Area
- North Fork Matheny Ponds, Old Alaska Yellowcedar Botanical Area
- Pine Mountain Botanical Area
- South Fork Calawah River Botanical Area

All areas with Visual Quality Objectives of Retention or Partial Retention will be allocated to prescriptions specifying attainment of these objectives.

All rivers meeting eligibility criteria for Wild and Scenic River designation and for which the Forest Service has been identified as the logical lead agency will be recommended for inclusion in the National Wild and Scenic Rivers System. These include the Dungeness, Gray Wolf, Dosewallips, Duckabush, Hamma Hamma, Main Stem and West Fork of the Humptulips, Soleduck, S. Fork Skokomish, E. Fork Humptulips, and Wynoochee.

Olympic National Forest lands within the corridors of the Quinault, Bogachiel, Hoh, and Elwha Rivers will be allocated to the River Corridor prescription (see constraints for Alternative C-Preferred (Modified)) in order to protect the attributes that make these rivers eligible for consideration as Wild and Scenic Rivers. In addition, the Big Quilcene, Calawah and its three forks, and Sam's River will be managed under this prescription .

Purpose: To assure that land allocations provide maximum levels of amenity outputs and nonpriced benefits.

Rationale: Attainment of maximum amenity output levels is one of the specific goals of this alternative.

Tradeoff: The special management allocations of Alternative I are similar to those of original Alternative G, although more comprehensive. Comparison of original Alternatives C and G showed that DEIS Alternative G involves reductions of $53.5 MM in PNV (10.4%) and 6.1 MMCF in first decade harvest level (7.8%). It was estimated that approximately one-third of the total change in PNV (about $18 MM) could be attributed to special management allocations. It is likely that the allocations of Alternative I entail approximately the same effect relative to Alternative C.

Constraint: Retain the existing acreage of old-growth (266,800 acres) for the full 150 year analysis horizon.

Purpose: To assure that the presently available level of old-growth habitat is not diminished.

Rationale: For a variety of reasons, the management of old-growth is one of the central issues on the Forest. Its value as wildlife habitat and its aesthetic qualities make retention of old-growth desirable to much of the public. Therefore, including the provision that the current acreage of old-growth not be decreased is consistent with this alternative's emphasis on nonpriced benefits.

Tradeoff: The Forest's existing old-growth stands include 170,000 acres of tentatively suitable timberland. The majority of the opportunity to harvest timber in the early decades is found in these stands. Therefore, the tradeoffs associated with retaining old-growth at the present level are substantial. Relative to Alternative C-Preferred (Modified), which includes many of the same provisions as Alternative I other than the old-growth constraint, PNV drops $169.1 MM (32.5%). First decade harvest from National Forest land drops to 2.25 MMCF, a reduction of 89.1 percent, due to the lack of available harvest-age timber. Average annual National Forest harvest over the first 5 decades is 12.3 MMCF, less than half that of Alternative C. Most of these differences between Alternatives C and I can be directly attributed to the retention of old-growth, with the remainder resulting from land allocation changes.

Constraint: The drainage constraints used to model the means of meeting the harvest dispersion MR (see "Constraints Common to All Alternatives") are refined to apply the harvest proportion constraint by drainage to both large saw stands and small saw stands specifically for the first three decades.

Purpose: Extensive review by District personnel indicates that such a provision is needed to assure avoidance of undesirable cumulative effects, balance the timber harvest program by geographic area, and include practical and economic on-the-ground considerations in developing an implementable alternative.

Rationale: Avoidance of cumulative effects, especially to fisheries and wildlife habitat resources, is an important concern on this Forest. This can be accomplished by assuring that early decade harvest is distributed, both geographically and temporally, in such a way as to preclude excessive impact in any one area or period. In addition, practical considerations currently affecting the development of timber sale programs in the near future make a more cautious approach to implementation feasibility advisable.

Tradeoff: The old-growth retention objective of this alternative limits harvest opportunity to the extent that this constraint is likely to have little additional effect. When analyzed in the context of BM 7, this constraint resulted in a PNV change of $19.3 MM and a first decade harvest drop of 0.7 MMCF.

Constraint: The nondeclining flow constraint is applied to East-West and Shelton CSYU lands separately for the first six decades, then modified to apply to National Forest and Simpson Timber Company lands for decades seven through fifteen.

Purpose: To represent the eventual termination of the Shelton CSYU Agreement and the recombination of National Forest land into a single management entity.

Rationale: It was suggested during the DEIS response period that modeling this recombination could have an effect on early decade harvest levels from East-West land.

Tradeoff: There was no discernable effect resulting from use of this constraint during the 50-year planning horizon. Harvest patterns are redistributed substantially after recombination occurs (seventh decade).

Key Comparisons with Other Runs

FORPLAN Run	PNV ($MM)	Discounted Costs ($MM)	Discounted Benefits ($MM)	1st Decade ASQ (MMCF/yr) 1/
Benchmark 7 (maximum PNV)	592.1	996.0	1,588.1	62.2
Benchmark 7 with drainage harvest controls	572.8	961.3	1,534.1	61.5
Alternative C-Pref (Modified) revised land allocations, drainage controls	520.3	830.2	1,350.5	60.3
Alternative I amenity emphasis with old-growth retention	351.2	382.5	733.7	33.9

1/ Includes harvest from Simpson Timber Company land within the Shelton CSYU.

ALTERNATIVE H (MODIFIED)

This alternative was developed primarily in response to the wildlife habitat issue. It was designed to evaluate the effects associated with providing an age class distribution that would yield the best mix of habitat conditions for elk and deer populations, while also stressing the availability of habitat for old-growth dependent species and retaining the amenity emphasis of Alternative I in other respects. Substantial input into the structuring of Alternative H was provided by the State of Washington Department of Wildlife. Between DEIS and FEIS, this alternative was modified to reflect changes suggested by environmental organizations and other interested members of the public.

The criteria and assumptions underlying the development of this alternative are:

The set of constraints common to all alternatives is to be applied.

Land allocations will be based on the goal of providing amenity outputs and nonpriced benefits. With the exception of a few areas in which timber harvest would be beneficial to big game populations, all areas capable of producing nontimber outputs related to issues or concerns will be allocated to prescriptions which provide these outputs.

Timber harvest schedules on both the East-West and Shelton CSYU components of the Forest will be based on nondeclining flow.

Timber harvest prescriptions will be selected on the basis of contribution to PNV rather than volume output.

The existing acreage of old-growth in winter range will be retained throughout the 150-year analysis horizon.

Determination of harvest levels and schedules will include eventual recombination of Shelton CSYU and Eastside-Westside National Forest lands in the analysis.

In addition to the constraints common to all alternatives, the following objective function and constraints were used to reflect the above criteria and assumptions:

Objective function: Maximize PNV for 15 decades.

Purpose: To assure that contribution to PNV is the basis for allocation and scheduling.

Rationale: Use of contribution to PNV in allocation and scheduling is consistent with the goals of this alternative.

Tradeoff: Benchmark analysis indicated that use of this objective function can reduce first decade harvest level by up to 18.7 percent (based on the comparison of BMs 7 and 7T). Because of the limited harvest base of this alternative, it is doubtful that timber maximization would result in early decade harvest levels appreciably different from those associated with PNV maximization.

Constraint: Nondeclining flow, applied individually to both the Shelton CSYU and East-West components of the Forest.

Purpose: To include nondeclining flow harvest management in this alternative.

Rationale: Use of nondeclining flow in harvest scheduling is more consistent with amenity output goals than departure scheduling, since it distributes the effects of timber harvest more evenly through time. The harvest fluctuations associated with departures can concentrate these effects in specific decades.

Tradeoff: Given the reduced harvest base associated with this alternative, the opportunity for a meaningful departure is very limited. Therefore, tradeoffs associated with nondeclining flow are not significant.

Constraint: The drainage constraints used to model the means of meeting the harvest dispersion MR (see "Constraints Common to All Alternatives") are refined to apply the harvest proportion constraint by drainage to both large saw stands and small saw stands specifically for the first three decades.

Purpose: Extensive review by District personnel indicates that such a provision is needed to assure avoidance of undesirable cumulative effects, balance the timber harvest program by geographic area, and include practical and economic on-the-ground considerations in developing an implementable alternative.

Rationale: Avoidance of cumulative effects, especially to fisheries and wildlife habitat resources, is an important concern on this Forest. This can be accomplished by assuring that early decade harvest is distributed, both geographically and temporally, in such a way as to preclude excessive impact in any one area or period. In addition, practical considerations currently affecting the development of timber sale programs in the near future make a more cautious approach to implementation feasibility advisable.

Tradeoff: The winter range old-growth retention objective of this alternative limits harvest opportunity to the extent that this constraint is likely to have little additional effect. When analyzed in the context of BM 7, this constraint resulted in a PNV change of $19.3 MM and a first decade harvest drop of 0.7 MMCF.

Constraint: The nondeclining flow constraint is applied to East-West and Shelton CSYU lands separately for the first six decades, then modified to apply to National Forest and Simpson Timber Company lands for decades seven through fifteen.

Purpose: To represent the eventual termination of the Shelton CSYU Agreement and the recombination of National Forest land into a single management entity.

Rationale: It was suggested during the DEIS response period that modeling this recombination could have an effect on early decade harvest levels from East-West land.

Tradeoff: There was no discernable effect resulting from use of this constraint during the 50-year planning horizon. Harvest patterns are redistributed substantially after recombination occurs (seventh decade).

Constraint: The special management allocations prescribed for this alternative are the same as those included in Alternative I, except that timber harvest is permitted in selected areas within the summer range portions of the Quilcene, Jupiter Ridge, Jefferson Ridge, and Lightning Peak unroaded areas.

Purpose: To assure that land allocations provide maximum levels of amenity outputs and nonpriced benefits, except where harvest would be beneficial to big game populations.

Rationale: Attainment of high amenity output levels and management for increased deer and elk populations are specific goals of this alternative.

Tradeoff: The special management allocations of Alternative H are similar to those of original Alternative G, although more comprehensive. Comparison of original Alternatives C and G showed that DEIS Alternative G involves reductions of $53.5 MM in PNV (10.4%) and 6.1 MMCF in first decade harvest level (7.8%). It was estimated that approximately one-third of the total change in PNV (about $18 MM) could be attributed to special management allocations. It is likely that the allocations of Alternative H entail approximately the same effect relative to Alternative C.

Constraint: Retain the existing acreage of old-growth in winter range for the full 150 year analysis horizon.

Purpose: To assure that the presently available level of winter range old-growth habitat is not diminished.

Rationale: Old-growth within winter range is considered to be one of the key components of wildlife habitat, particularly with regard to elk populations. Therefore, including the provision that the current acreage of winter range old-growth not be decreased is consistent with this alternative's emphasis on wildlife habitat quality.

Tradeoff: Removal of winter range old-growth from the harvest base has a substantial impact on the overall capability of the Forest to produce timber, although it does not drop the early decade harvest level to near zero, as when all old-growth is retained. Relative to Alternative C-Preferred (Modified), which includes many of the same provisions as Alternative H other than the winter range old-growth constraint, PNV drops $67.7 MM or 13.0 percent. First decade harvest from National Forest land drops 18.2 MMCF, a decline of 29.3 percent from Alternative C. A large proportion of the PNV and harvest level differences between Alternatives C and H can be attributed to the retention of old-growth in winter range.

Comparison of Alternatives H and I, in which the principal variation is the extent to which old-growth is retained, indicates the difference in effect between removing a large portion of the early decade harvest base and removing almost all of it. The first decade National Forest harvest level associated with Alternative

H is almost six times that of Alternative I (13.3 MMCF vs. 2.25 MMCF). This is because there is enough harvest-age timber in the Alternative H harvest base to sustain a substantial harvest program until younger stands reach harvest age. The drop in PNV from Alternative H to Alternative I is $101.4 MM (22.4%).

Key Comparisons with Other Runs

FORPLAN Run	PNV ($MM)	Discounted Costs ($MM)	Discounted Benefits ($MM)	1st Decade ASQ (MMCF/yr) 1/
Benchmark 7 (maximum PNV)	592.1	996.0	1,588.1	62.2
Benchmark 7 with drainage harvest controls	572.8	961.3	1,534.1	61.5
Alternative C-Pref (Modified) revised land allocations, drainage controls	520.3	830.2	1,350.5	60.3
Alternative I amenity emphasis with old-growth retention	351.2	382.5	733.7	33.9
Alternative H amenity emphasis with summer range harvest	452.6	634.3	1,086.9	44.0

1/ Includes harvest from Simpson Timber Company land within the Shelton CSYU.

ESTIMATION OF EFFECTS OF ALTERNATIVES

INTRODUCTION

This section provides a discussion of the outputs and effects associated with each of the Plan alternatives. This comparative analysis of alternatives is the basis for evaluating possible management patterns and selecting a proposed action, planning steps seven and eight. The analysis includes detailed coverage of the economic effects (present net value analysis) of both the alternatives and two of the key benchmarks (3 and 7).

The preceding section, "Formulation of Alternatives", focused on the tradeoffs associated with individual discretionary constraints in the context of their application within each alternative. This discussion highlights the changes in present net value, discounted costs, discounted benefits, and nonpriced outputs associated with each alternative taken as a whole and in the context of the relationships among the alternatives.

PROCESS FOR EVALUATING SIGNIFICANT CONSTRAINTS

The multiple resource management objectives associated with a particular benchmark or land management alternative were represented in FORPLAN as an objective function and a series of constraints. The ultimate objective function of each FORPLAN run was "maximize present net value for 150 years." This objective function guided the model in selecting the most cost-efficient combination of prescriptions, activity schedules, and resource output levels capable of satisfying the resource management objectives (i.e. constraints) of each specific benchmark or alternative.

Prior to modeling a particular management objective as a constraint within the FORPLAN model, it was often necessary to evaluate a variety of options for accomplishing that objective. Selection of the most cost-effective approach to meeting Spotted Owl Habitat Area objectives, for example, involved analysis of the relative efficiencies of "dedication" and "management." Analyses of such alternative constraint formulations were usually performed by the ID team outside of FORPLAN.

In analyzing constraint options, the ID team developed possible alternatives and assessed each on the basis of the output yields, costs, and values that would be associated with that formulation. In most cases, the comparison of constraint formulations was based on economic analysis of the projected per-acre outputs through time that would be associated with each potential formulation on a typical Forest acre or land area. Once the economically preferred constraint formulation was identified, it was developed for use within FORPLAN as the established means of meeting the management objective involved. The analyses of individual constraint options may be found in the process records, on file at the Forest Supervisor's Office.

Within the FORPLAN model, application of the ultimate objective function (maximization of PNV) was subject to first satisfying all constraints used to represent resource management objectives that would not be accomplished under the objective function alone. The imposition of such constraints usually resulted in reduced PNV. Such a reduction in PNV is called the "opportunity cost" associated with achieving the management objectives represented by the constraint in question. To isolate the opportunity cost of a given constraint or set of constraints, the solutions of FORPLAN runs made with and without the constraint(s) being evaluated were examined for differences in PNV (and other outputs and effects of interest). As long as the only difference between runs being compared was the presence or absence of

the constraint(s) in question, the difference in PNV represented the opportunity cost (at the margin and only in the context of the runs being compared) of achieving constraint objectives.

During benchmark analysis, constraint sets which were needed to achieve a variety of multiple resource management objectives were developed and evaluated in the manner described above. For example, the set of different constraints proposed for the purpose of achieving MR specifications was evaluated to determine the magnitude of the associated opportunity costs. Many discretionary constraints were also examined to assess opportunity costs. The special management land allocations prescribed in current direction, for example, were evaluated in terms of the specific opportunity cost associated with this package of allocations. Policy constraints related to nondeclining flow and rotations based on 95 percent of CMAI were also examined in the context of their effects on PNV and timber output levels. Finally, sensitivity testing was performed in order to evaluate the consequences involved in making different assumptions regarding timber management costs and trends in stumpage value. Refer to "Benchmark Analysis" for a discussion of the results of these analyses.

The opportunity costs associated with the individual constraints of each alternative were not evaluated in FORPLAN, due to the prohibitive cost of performing such an analysis. However, many of the constraints used in the formulation of alternatives were examined in benchmark analysis, thus enabling approximate determination of their opportunity costs in the context of the alternatives in which they were used. In addition, the development of many of the alternatives involved a series of FORPLAN runs, as this was often necessary in order to achieve a satisfactory final formulation of alternative goals, objectives, and constraints. Intermediate runs generated during alternative development were often useful in evaluating opportunity costs, since solutions could be compared to determine the changes in PNV associated with specific differences in formulation. Finally, many pairs of alternatives differ from each other only in terms of one specific constraint or constraint set, thereby enabling determination of the opportunity cost of such constraints in the context of those two alternatives. Refer to "Formulation of Alternatives" for discussion of the analysis of opportunity costs associated with constraints used in alternative formulation.

Comparison of the outputs, effects, and present net values of the alternatives in their final form provides the means of assessing the economic tradeoffs resulting from the resource management objectives of each alternative taken as a whole. These economic tradeoffs can then be assessed in light of the environmental and socio-economic consequences and nonpriced benefit outputs associated with each alternative, in order to help identify the alternative that comes closest to maximizing net public benefits. The comparative analysis of the alternatives as a whole is the focus of the following discussion.

ANALYSIS OF TRADEOFFS AMONG ALTERNATIVES

DIFFERENCES IN PRESENT NET VALUES

The economic implications of the alternatives are displayed in Tables B-26, B-27, and B-28. Included for comparison in these tables are the economic results of benchmark 3 (maximum PNV unconstrained) and benchmark 7 (maximum PNV with management requirements included). Presented with the tables are discussions of the variations in costs, benefits, PNV, and cash flows among the alternatives. Very little of the economic data in these tables could reasonably be estimated for Alternative NC-No Change, as this alternative was developed and analyzed on the basis of timber management plan information rather than FORPLAN optimization. Where appropriate, the relationship of Alternative NC to the other alternatives has been subjectively evaluated and discussed.

Tables B-26 and B-27 summarize the benefits, costs, and PNV associated with each alternative and the benchmarks included in this comparison. These summaries are presented in two formats: in order of increasing discounted costs and in order of decreasing PNV. Table B-28 disaggregates benefits and costs, displaying the contributions of specific priced outputs to benefits and assigning approximate costs to major accounting or budgeting categories. It would be incorrect to assume a direct relationship between the dollar benefits associated with a particular output and the cost figure assigned to it. This is because Forest-wide production of any specific output is generally supported by complex combinations of input costs.

The benchmarks included in Tables B-26 and B-27 are higher in PNV than the alternatives. This is because these benchmarks were designed to maximize present net value, without regard for effective resolution of the other issues and concerns which directed alternative development. Thus, the benchmarks represent a very limited approach to land management, geared solely to the maximization of one output (PNV), and developed primarily to serve as an indicator of potential and a basis for comparison with more "well-rounded" alternatives.

In order to effectively represent the differences among alternatives as they affect National Forest land and its economic value, only the National Forest contributions to PNV are displayed in Table B-26 (and elsewhere throughout this document); the contribution to total PNV resulting from management of Simpson Timber Company lands is not displayed. Since the Simpson contribution to PNV is very close to the same in all alternatives, doing this does not bias the comparison of alternatives, but does serve to highlight differences resulting from land use variations on National Forest land. The need to avoid undue disclosure regarding Simpson operations precludes presentation of both total PNV and National Forest contribution by alternative.

Table B-26. Present Net Value and Discounted Costs and Benefits of Alternatives 1/

Presented in Order of Increasing Discounted Costs
(Figures represent millions of 1982 dollars)

Alternatives	Discounted Costs	Change	Discounted Benefits	Change	PNV	Change
I	382.5	+251.8	733.7	+353.2	351.2	+101.4
H (Modified)	634.3	+195.9	1,086.9	+263.6	452.6	+67.7
C-Pref (Modified)	830.2	+165.8	1,350.5	+237.6	520.3	+71.8
BM 7 2/	996.0	+9.5	1,588.1	-14.1	592.1	-23.6
A-Current Direction	1,005.5	+314.8	1,574.0	+510.0	568.5	+195.2
BM 3 3/	1,320.3	+65.2	2,084.0	-151.3	763.7	-216.5
B-Departure	1,385.5		1,932.7		547.2	

1/ Alternative NC not included. Data necessary to estimate discounted costs and benefits (and thus PNV) throughout the 50-year planning horizon not available in timber management plans.
2/ Maximum PNV with management requirements included.
3/ Maximum PNV unconstrained.

Table B-27. Present Net Value and Discounted Costs and Benefits of Alternatives 1/

Presented in Order of Decreasing PNV
(Figures represent millions of 1982 dollars)

Alternatives	PNV	Change	Discounted Costs	Change	Discounted Benefits	Change
BM 3 2/	763.7	-171.6	1,320.3	-324.3	2,084.0	-495.9
BM 7 3/	592.1	-23.6	996.0	+9.5	1,588.1	-14.1
A-Current Direction	568.5	-21.3	1,005.5	+380.0	1,574.0	+358.7
B-Dep (Modified)	547.2	-26.9	1,385.5	-555.3	1,932.7	-582.2
C-Pref (Modified)	520.3	-67.7	830.2	-195.9	1,350.5	-263.6
H (Modified)	452.6	-101.4	634.3	-251.8	1,086.9	-353.2
I	351.2		382.5		733.7	

1/ Alternative NC not included. Data necessary to estimate discounted costs and benefits (and thus PNV) throughout the 50-year planning horizon not available in timber management plans.
2/ Maximum PNV unconstrained.
3/ Maximum PNV with management requirements included.

Among the alternatives, PNV ranges from a low of $351 million (Alternative I) to a high of $569 million (Alternative A-Current Direction (No Action)). The maximum PNV that could be attained under present laws and regulations and with a nondeclining flow harvest schedule is $592 million (Maximum PNV Benchmark), while present net value could climb to $764 million under nondeclining flow if the provisions necessitated by law and regulation were removed. The total discounted value of priced outputs varies from $734 million (Alternative I) to $1933 million (Alternative B-Departure (Modified)), while discounted costs range from $383 million in Alternative I to $1386 million in Alternative B-Departure. Variations in PNV among the alternatives are due to the wide range of possible costs and benefits which the alternatives represent. Each alternative is designed to produce a unique set of both priced and nonpriced outputs and effects, each of which generates a distinct pattern of values and costs.

The principal factor which influences priced benefits, costs, and PNV is the volume and timing of timber harvest. Since this activity has relatively large investment costs and dollar returns associated with it, the extent of harvest is the primary determinant of the magnitude of the economic variables in each alternative. Timing of harvest (departure vs. nondeclining flow) is also important, as departure schedules serve to both increase total harvest level and accelerate investments and returns, thereby increasing PNV relative to their nondeclining flow counterparts.

The changes in PNV and total costs and benefits among the alternatives are determined by three primary factors: harvest timing, the contribution to PNV of harvest on lands that are added to or removed from the harvest base of each alternative, and the relative cost-efficiency of prescriptions selected for areas to be

managed for timber production. The effect of timing is best illustrated by Alternative B-Departure. Because this alternative is a departure, the harvest investments and returns associated with it occur earlier than would those of the same basic alternative with a nondeclining flow schedule, thereby making discounted costs, discounted benefits, and PNV all relatively high. The PNV of Alternative B-Departure is $547 million, while that of its base sale schedule (the nondeclining flow counterpart) is $522 million.

The roles in establishing PNV of both the PNV contribution of lands allocated to harvest and the selection of prescriptions on lands to be managed for timber output are also best demonstrated by Alternative B-Departure. Contrasting this alternative with Alternative A-Current Direction (No Action) provides some useful insights. The primary objective function of Alternative B-Departure is "maximize timber production", while that of Alternative A is "maximize PNV". In Alternative B-Departure, the primary objective leads to the allocation to timber production of areas in which timber management costs exceed returns. It also results in the selection of timber management prescriptions which entail considerable use of intensive management practices. Such practices often involve lower return per unit of investment cost, on a per-acre basis, than more extensive management strategies. The principal objective of Alternative A, on the other hand, leads to allocations and prescription selection patterns that are guided by contribution to PNV. The result: a lower timber harvest level, combined with a higher PNV, for Alternative A than for Alternative B-Departure.

The remaining variations among alternatives in PNV and total costs and benefits are due primarily to differences in land allocation. Alternative B-Departure (modified) has timber production as its primary objective, and thus entails allocation of a high proportion of the available land base (including areas in which timber management costs exceed returns) to timber harvest. For the remaining alternatives (which include few areas in which timber management costs exceed returns in the harvest base), both costs and PNV decrease as increasing acreages of land from which harvest would contribute to PNV are allocated to the production of outputs which are incompatible with timber harvest.

Several of the entries in Table B-28, presented below, require explanation to enhance understanding. The following notes are presented as an aid to the reader:

Timber benefits are expressed in terms of total mill value (value delivered at the mill) rather than stumpage value. This approach was taken to facilitate variation of logging costs by land type within the planning model. Therefore, the benefit shown has logging cost embodied within it.

Timber costs represent both management costs and the cost of getting the timber to the mill, or logging cost. Logging cost represents about 80 percent of total timber cost in all alternatives. PNV is not affected by this approach, but total timber benefits and costs are shown to be considerably higher than would be the case if stumpage value alone were used.

Wildlife and fish user days (WFUD) represent the recreation benefits generated by wildlife and fish outputs.

Recreation benefits include all forms of recreation (other than WFUD) which occur on-Forest: developed, roaded and unroaded dispersed, and Wilderness use.

Commercial fishery benefits represent harvest of commercial fish produced by on-Forest fish habitat.

Fish and wildlife habitat management (F&WL) and *recreation management costs* represent the cost of managing these programs.

Other costs represent the bulk of the Forest's fixed cost, primarily administration.

Table B-28. Present Net Value and Discounted Benefits and Costs by Resource Group (Millions of 1982 Dollars) 1/

		Discounted Benefits:				Discounted Costs:				
Alternatives	PNV	Timber	Recreation	WFUD	Commercial Fish	Timber	Roads	F & WL	Recreation	Other
BM 3	764	1,687	321	46	30	972	173	15	12	148
BM 7	592	1,179	332	46	31	694	127	15	12	148
A-Current Direction	569	1,167	331	45	32	702	129	15	12	148
B-Dep (Modified)	547	1,545	312	46	29	1,016	194	15	12	148
C-Pref (Modified)	520	934	339	46	31	555	100	15	12	148
H (Modified)	453	660	348	47	32	399	60	15	12	148
I	351	294	360	47	32	179	28	15	12	148

1/ Alternative NC not included. Data necessary to estimate discounted costs and benefits by resource group throughout the 50-year planning horizon not available in timber management plans.

Many of the priced outputs included in the calculation of PNV are essentially competitive with timber harvest. Fisheries outputs (both recreational and commercial) and recreation opportunities decrease as harvest increases. This relationship is made especially clear by comparing the discounted nontimber benefits of Alternatives B-Departure (Modified) and I. Alternative B-Departure produces total discounted nontimber benefits of $387 million. In Alternative I, the most amenity-oriented of the alternatives, this figure climbs to $439 million.

While the effect of recreation and fisheries outputs on PNV is small relative to the effect of timber harvest, the competitive nature of their relationship with harvest tends to moderate differences in PNV among alternatives. Alternatives with low timber harvest levels (e.g. Alternative I) have relatively high fisheries and recreation benefits. As a result, differences in PNV between low-timber alternatives and high-timber alternatives are somewhat smaller than would be the case considering timber alone.

Some priced outputs remain fairly stable across all alternatives, and thus have little effect on differences in PNV. Included in this category are on-Forest commercial fishery outputs and fish and wildlife-related recreation. Fishery outputs vary only slightly from alternative to alternative because the total potential productivity of the on-Forest fishery is somewhat insensitive to changes in management. Large changes in acreage allocated to timber production result in relatively small changes in fishery outputs. The lack of variation in wildlife-related recreation benefits results from the use of estimated big game (deer and elk) populations as the principal variable in the calculation of these values. Since these populations are expected to be quite similar in all alternatives, there is little variation in the projected benefits associated with them. Costs which remain stable across alternatives include administrative and support costs (see "Other", Table B-28).

In addition to the priced outputs discussed above, there are several outputs associated with the alternatives to which no monetary value can be reasonably assigned. While these outputs have no effect on the calculation of PNV, they are an important component of issue resolution and, therefore, net public benefits. These outputs, and the relationship of each to priced outputs and PNV, are as follows:

Maintenance of Scenic Quality: As this output increases, PNV decreases due to restrictions on timber harvest. Scenic quality maintenance is complementary to other priced outputs (recreation, fisheries outputs).

Unroaded Area Acreage: Since unroaded area retention and timber harvest are mutually exclusive, increases in this output can lead to reductions in PNV. Nonetheless, maintenance of unroaded areas is compatible with increases in PNV in many cases, as many of the Forest's unroaded areas are located in areas in which timber management costs exceed returns. This output is complementary to other priced outputs.

Wild and Scenic Rivers and River Corridors: These outputs have essentially the same relationship with other outputs as scenic quality, and are particularly compatible with increased fisheries outputs.

Old-Growth Retention: Increasing this output has substantial effects on both timber harvest and PNV. Because old-growth distribution goals often dictate that highly productive and readily accessible areas remain unharvested, increases in this nonpriced output can lead to relatively large reductions in PNV. Old-growth retention is complementary to other priced outputs.

Employment: Of all the Forest outputs, that which has by far the greatest effect on employment is timber harvest. Therefore, there is generally a close link between PNV and employment level. This linkage does not prevail, however, when incremental harvest investments exceed incremental harvest returns. When this occurs, employment rises while PNV drops. Production of other outputs (both priced and nonpriced), to the extent that it involves reduced timber harvest, generally leads to reduced employment.

Of the above nonpriced outputs, the two which bear the strongest relationship to PNV are old-growth retention and employment. Alternatives involving high old-growth retention targets are low in PNV due to the high per-acre cost of precluding harvest on timberland having high potential to contribute to PNV. Alternatives involving high timber harvest levels, and thus high employment levels, provide the greatest returns in terms of PNV, although increasing timber production beyond the breakeven point reduces PNV while still generating additional employment.

The economic values displayed do not include those associated with possible future production of locatable minerals, oil and gas, or hydroelectric power. The possibility of future development of these outputs does exist on the Forest, but the timing of their development and the magnitude of their production are both highly speculative. It is possible that the economic values of these activities, if they are undertaken, will vary from alternative to alternative (see FEIS Chapter III, "Minerals" and "Energy").

The economic values also do not include the value of changes in fishery outputs projected to result from the effects of Forest activities on off-Forest fish habitat. While these effects have been estimated to facilitate comparison of alternatives, it is felt that including them in the economic calculations would be inappropriate. Both the procedures used to estimate such effects and the degree to which available off-Forest habitat will actually be utilized (which determines actual output level as opposed to theoretical output level) are highly speculative. Therefore, quantified economic values for these effects are not included in the PNV analysis. In general, the productivity of off-Forest fisheries is expected to be inversely proportional to timber harvest level.

DIFFERENCES IN COSTS

The discounted costs shown in Tables B-26 through B-28 have two separate components: costs to the Forest Service (budget costs) and costs to others. The principal component of "costs to others" is the logging cost associated with harvest of National Forest timber. This cost alone constitutes about 60 percent of the total cost of each alternative. The remaining 40 percent covers anticipated budget expenditures.

The budget costs associated with each alternative fall into two categories: capital investments and operations/maintenance costs. Capital investments are expenditures on the Forest's physical plant which are designed to provide long-term returns. Examples include road construction, tree planting, and fish habitat improvement structures. Operations/maintenance costs cover those activities which are necessary to conduct the day-to-day business of the Forest. Such things as road maintenance, timber sale administration, and habitat condition monitoring fall into this category.

On the Olympic National Forest, virtually all capital investment costs are for either road construction or the numerous activities associated with continued timber production. These form a substantial proportion of the projected budget of each alternative. Projected annual budget costs for Alternatives NC-No Change and B-Departure (Modified) are well above the current (1989) level of $20.5 million in the first decade. This is because of the high first decade harvest levels of these alternatives combined with relatively high levels of harvest from National Forest land within the Shelton CSYU. The projected budget for Alternative A-Current Direction (No Action) is very close to the 1989 level, while those of the remaining alternatives are well below the current budget. These reduced budget levels result from lower first decade harvest levels overall, in combination with the general shift of harvest from National Forest land to Simpson Timber Company land within the Shelton CSYU.

In all alternatives, $8.1 million in budget costs are "fixed" and do not vary from alternative to alternative. Included in this category are basic overhead and administrative costs, as well as costs associated with programs which will be essentially the same in all alternatives. Examples of such programs include management of Dennie Ahl Seed Orchard and the base level of road maintenance needed to keep the existing road system serviceable.

All remaining costs change as the objectives of the alternatives change. Since timber harvest and the associated road construction are the primary factors contributing to variable budget costs, the projected budgets of alternatives increase as harvest level increases, and vice versa. The unit costs of harvest-related activities vary considerably, depending on the characteristics of the area in which they occur. For example, the costs of timber sale preparation, fuel treatment, and silvicultural treatments all increase as difficulty of access increases. Road construction cost varies with slope, soil stability, and average rainfall (expense increases as the need for drainage structures increases). Such differences in unit cost contribute substantially to the high total costs and relatively high ratios of costs to benefits in alternatives emphasizing timber output. In such alternatives, timber harvest is extended into areas entailing high production costs per unit of output.

ECONOMIC VALUES AND RESPONSES TO MAJOR ISSUES, CONCERNS, AND RESOURCE USE AND DEVELOPMENT OPPORTUNITIES

This section summarizes the relationships among economic values, key social and economic effects, and the differing responses of the alternatives to selected issues, concerns, and opportunities (ICOs). The purpose is to highlight major economic and noneconomic tradeoffs that can be quantified by using indicators of responsiveness to ICOs as a means of comparing alternatives. Keep in mind that a complete understanding of the differences among alternatives requires reading all of Chapters II and IV of this FEIS. The ICOs are discussed in detail in Appendix A. Refer to "Social and Economic Impact Analysis" for discussion of the effects of alternatives on the local economy and local communities. Refer to Table II-14 in Chapter II of this FEIS for a detailed presentation of the full set of outputs and effects associated with the alternatives.

The major reason that alternatives differ is that each responds in different ways to the issues, concerns, and resource use and development opportunities (ICOs) identified for this Forest. This section summarizes many of these differences in response by defining, where possible, quantifiable indicators of responsive-

ness and displaying in Table B-29 the mix of such responses embodied in each alternative. It also discusses indicators of central concern to the nation as a whole (the owner of this Forest). The ICOs and indicators of responsiveness found in Table B-29 are:

- Maintenance of Scenic Quality

  Indicator: Acres to be managed to meet Preservation, Retention, and Partial Retention Visual Quality Objectives (VQOs).

- Availability of Unroaded Recreation Opportunity and Management of Existing Unroaded Areas Outside Wilderness

  Indicators: Acres outside Wilderness to be managed to retain Primitive and Semi-Primitive (P/SP) ROS classes.

  Proportion of existing unroaded areas to be retained in undeveloped condition.

- Retention of Old-growth and Wildlife Habitat Quality

  Indicator: Acres of old-growth remaining at the end of the fifth decade.

- Timber Harvest Level

  Indicators: Average annual allowable sale quantity (ASQ), million cubic feet, in the first decade.

  Average annual ASQ for the first five decades. Harvest figures include harvest from Simpson land within the Shelton CSYU.

- Transportation System Management

  Indicator: Miles of road system open to public use (both passenger car and high clearance vehicle) in the fifth decade.

- Soil Resource Management and Water Quality

  Indicators: Average annual sediment output (thousand tons) for the first two decades.

  Percent of riparian areas harvested during the first two decades.

- Fish Habitat Quality

  Indicator: Average annual fishery production potential (in millions of anadromous smolts), first five decades. Estimates include productivity of on-Forest habitat only.

- Wild and Scenic Rivers

  Indicator: Number of river corridors to be recommended for inclusion in the Wild and Scenic River System.

- Social and Economic Effects

Indicators: Average annual change from present employment level over the first decade (expressed as percentage of total Peninsula labor force).

Average annual change in personal income over the first decade (in millions of 1982 dollars).

In addition to local issues and concerns, the nation as a whole has an interest in ensuring that the Forest is managed in an economically prudent manner concurrent with adequate protection of the quality of the physical environment. Indicators of this national interest are:

Present net value (PNV - million 1982 dollars).
First and fifth decade net receipts (cash flows - million 1982 dollars).
First and fifth decade noncash benefits to users (million 1982 dollars).

It should be noted that for two of the indicators of responsiveness displayed in Table B-29, there are base output levels which none of the alternatives may drop below. All alternatives meet 89,700 acres of the "Preservation" Visual Quality Objective, as this is the objective which applies in Wildernesses and the Quinault Research Natural Area. In addition, all alternatives provide at least 97,000 acres of old-growth habitat in all decades, as this is the acreage of old-growth currently in areas classified as unsuitable or unavailable for timber harvest (including Wilderness). These base output levels are included in the output totals shown in the table. The 97,000 acre old-growth habitat base mentioned above does not apply to Alternative NC-No Change, since the suitability classification of this alternative is based on determinations made in developing the timber management plans rather than the most current suitability assessment.

It should also be noted that the outputs and effects shown for Alternative NC were estimated in a different manner than those of the other alternatives. Since Alternative NC was not analyzed in FORPLAN, other sources of output estimation were needed. Two principal sources were used. Estimates of outputs and effects most closely associated with the level of timber harvest are based on the potential yield timber outputs associated with current timber management plans. Examples include timber-related employment levels and miles of road construction. Outputs most directly related to land allocation, such as Primitive/ Semi-Primitive recreation opportunity and Visual Quality Objectives met, are estimated on the basis of unit plan land allocations. Qualitative estimates of those outputs and effects for which a quantitative projection could not reasonably be made are based on the expected combined effects of timber harvest level and land allocation pattern, and are usually expressed in terms of the relationship of Alternative NC to other alternatives.

Table B-29. Indicators of Responsiveness of Alternatives to Major Issues and National Concerns
(Alternatives Presented in Order of Decreasing PNV)

Indicators	A - Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I	No Change
PNV, Million 1982 $	568.5	547.2	520.3	452.6	351.2	2/
ASQ, Million Cubic Feet						
1st Decade	70.3	89.7	60.2	44.0	33.9	81.5
50 Year Ave.	70.3	78.2	65.3	56.8	48.7	77.7
Net Receipts, Million 1982 $						
1st Decade	8.1	15.9	2.2	-1.3	-6.4	22.4
5th Decade	3.6	-1.8	5.0	5.2	3.6	22.6
Noncash Benefits, Million 1982 $						
1st Decade	14.1	13.0	14.9	15.2	15.9	2/
5th Decade	20.5	20.8	20.7	20.6	20.8	2/
Visual Quality Objective Met 1/						
1000 Acres	114.1	89.7	179.8	179.8	179.8	114.1
Primitive/Semi-Primitive ROS						
1000 Acres	35.8	20.6	41.9	55.2	60.6	17.5
Unroaded Retained Percent of Exist.	58.8	35.7	67.0	93.2	100.0	29.6
Wild & Scenic Rivers	1	0	3	10	10	1
Old-Growth, 5th Decade, 1000 Acres	173.7	151.5	185.0	218.9	266.8	126.8
Open Road Miles	2,110	2,336	2,003	1,792	1,528	2,237
Sediment, 20 yr. Ave., 1000 Tons	153.6	225.0	122.8	97.5	62.8	191.2
Riparian Areas Harvested, Percent 1st 20 years	10.9	19.2	7.9	5.1	1.4	17.1
Fishery Poten. Million Smolts (50 year average)	11.2	11.0	11.3	11.4	11.5	11.1
Change in Jobs, 1st Decade Percent of Peninsula Labor Force	-0.4	+1.6	-1.6	-3.5	-4.6	+1.3
Change in Income, 1st Decade Million 1982 $	-5	+18	-17	-38	-50	+14

1/ Includes provision in Alternative C-Preferred (Modified) that Retention and Partial Retention Visual Quality Objectives VQOs are to be met in all areas, regardless of Management Area designation. Acreages shown are Preservation, Retention, and Partial Retention VQOs only.
2/ Not estimated for Alternative NC. Timber management plans do not provide sufficient data to enable reasonable estimation of these indicators. PNV of Alternative NC expected to fall between those of Alternative B-Departure (Modified) and Alternative C-Preferred (Modified).

DIFFERENCES AND SIMILARITIES OF INDIVIDUAL ALTERNATIVES

The alternatives are displayed in order of decreasing present net value in Table B-29. They are discussed below in the same order. The comparisons of alternatives consist largely of discussions of incremental differences from one alternative to the next. Alternative B-Departure (Modified) is compared to Alternative A-Current Direction (No Action), Alternative C-Preferred (Modified) is compared to Alternative B-Departure, and so on in order of decreasing PNV. The single exception to this ordering system is Alternative NC-No Change, which is presented first in the following discussion.

The comparison of alternatives begins with Alternative NC because information available in the timber management plans upon which this alternative is based is not sufficient to enable calculation of PNV. Alternative NC is compared to Alternative B-Departure, which has the most closely parallel timber harvest level and pattern of timber management strategies. Since Alternative NC is different in structure from the remaining alternatives, and since many of the indicators of responsiveness displayed in Table B-29 could not be quantified for this alternative, the format of the Alternative NC discussion is different from those for the remaining alternatives.

Alternative NC-No Change

This alternative is derived from the provisions contained in existing timber management plans. Assumptions and analysis parameters have not been updated to incorporate more current information regarding resource capabilities or management requirements. As a result, some of the outputs and effects of Alternative NC differ markedly in scope and magnitude from those of the other alternatives, while others could not be reasonably estimated.

While the PNV of Alternative NC could not be estimated quantitatively, it is likely that this alternative would fall slightly below Alternative B-Departure in PNV. This would place it third among the alternatives in this regard. The principal reason for anticipating a slightly lower PNV for Alternative NC is the higher level of early decade harvest from areas in which timber management costs exceed revenues, combined with more extensive early decade use of intensive management practices with low per-acre returns. Both of these practices will be necessary if the timber output objectives of this alternative are to be met. Since Alternatives NC and B-Departure are quite similar in most of the key factors influencing PNV, it is projected that these differences would lead to a slightly lower PNV for Alternative NC.

The high output of National Forest timber associated with Alternative NC is expected to result in first decade net receipts above those of Alternative B-Departure. This would make Alternative NC highest among the alternatives in this area. Noncash benefits to users, while not estimated quantitatively, are expected to be similar to those of Alternative B-Departure and thus lower than for the remaining alternatives.

The discretionary land allocations of this alternative parallel those of Alternative A-Current Direction (No Action) quite closely. As a result, the level of VQO attainment is the same as in Alternative A, and thus ranks above Alternative B-Departure and below the remaining alternatives in this area. Primitive and Semi-Primitive recreation opportunity and unroaded area retention, on the other hand, are at levels well below Alternative A, and fall just below Alternative B-Departure. Alternative NC ranks lowest among the alternatives in these areas. The reason these outputs do not parallel those of Alternative A is the absence of allocations to meet MR specifications in Alternative NC. In Alternative A, MR allocations add substantial unroaded acreage to the discretionary unroaded area allocations of current direction. This does not occur in Alternative NC.

The qualifying characteristics of one potential Wild and Scenic River corridor (the Duckabush) are to be maintained in Alternative NC, as opposed to none in Alternative B-Departure.

The availability of old-growth habitat in Alternative NC is lower than is the case for Alternative B-Departure, primarily due to the lack of old-growth habitat allocations for maintenance of northern spotted owl populations. This places Alternative NC below the others in old-growth retention.

Because of the similarities in harvest levels and expected road development programs, particularly in the first decade, it is likely that the early decade sediment output associated with Alternative NC will be very similar to that of Alternative B-Departure. As a result, fish habitat productivity should be roughly equivalent to that of Alternative B-Departure, ranking below that of all other alternatives. Level of harvest in riparian areas should also be similar to that of Alternative B-Departure and higher than in the other alternatives.

The effect of Alternative NC on the local economy is similar to that of Alternative B-Departure, but with employment and personal income levels a bit lower in the early decades and substantially higher in later decades. Alternative NC ranks second among the alternatives in first-decade employment and income levels.

Alternative A-Current Direction (No Action)

Of the alternatives for which PNV could be estimated, Alternative A-Current Direction (No Action) has the highest PNV. This is primarily a result of this alternative's relatively high early decade harvest level (third highest among the alternatives), combined with the fact that this harvest comes from areas in which the returns to timber management exceed costs. Allocation to harvest of areas in which costs exceed returns and use of management intensities with low per-acre returns are both minimal.

Although the allocation of land to timber harvest and the selection of harvest prescriptions are based on contribution to PNV in this alternative, the land allocations of Alternative A still reflect a strong timber production emphasis. There are few discretionary allocations to nontimber uses. As a result, this alternative provides the third highest levels of both first decade harvest and 50-year average harvest. First decade net receipts fall in the middle range of the alternatives (ranking third) because the harvest level is low relative to those of Alternatives B-Departure and NC. Noncash benefits in the first decade are also in the middle range, again essentially a function of harvest level.

Many nontimber outputs are relatively low in Alternative A, due primarily to the emphasis on timber production in the assignment of discretionary allocations. This alternative ranks fourth among the alternatives in VQOs met, Semi-Primitive and Primitive recreation opportunity, unroaded area retention, and old-growth habitat availability. Recommendation for inclusion in the Wild and Scenic River System is prescribed for one river corridor (the Duckabush) in Alternative A, as opposed to as many as ten in other alternatives.

The harvest level of Alternative A also results in a relatively high sediment output (third highest among the alternatives) and a relatively low level of fisheries productivity. The fishery production potential of Alternative A ranks fourth among the alternatives. This alternative has the third highest level of harvest in riparian areas.

The employment and personal income effects associated with Alternative A project Peninsula economic conditions roughly equivalent to those of today. Employment opportunities and personal income are higher in Alternative A than in the more amenity-oriented alternatives, and this alternative ranks third in these categories.

Alternative B-Departure (Modified)

The drop in PNV ($21.3 million) from Alternative A-Current Direction (No Action) to Alternative B-Departure (Modified) is the net result of two factors, one of which increases PNV while the other reduces it. The substantial departure from nondeclining flow of Alternative B-Departure, which provides the highest timber harvest level of the alternatives, could be expected to generate a PNV substantially above that of Alternative A. However, the effect of this difference between the two alternatives is more than negated by reductions in PNV associated with Alternative B-Departure's strong emphasis on timber harvest.

Much of Alternative B-Departure's PNV reduction results from the goal of maximizing timber production, as opposed to the emphasis on contribution to PNV associated with harvest management in Alternative A. This goal results in the inclusion in this alternative's harvest base of virtually every acre of tentatively suitable timberland (other than areas needed to meet MR specifications) on which timber management costs exceed returns. In addition, the objective of maximizing early decade harvest (rather than sustainable harvest) is best served by postponing harvest from faster-growing stands (of harvest age) until the third or fourth decade, while concentrating initial harvests in areas of slower growth and greater management cost. These slow-growing stands are less valuable (per thousand cubic feet) than their more rapidly growing counterparts, and also require greater levels of investment per unit of harvest. Therefore, harvesting them first results in a lower PNV than would occur if the more valuable stands were harvested first.

The high first decade harvest of Alternative B-Departure results in both higher first decade net receipts (second highest among the alternatives) and lower first decade noncash benefits (lowest among the alternatives) than occur with Alternative A. The substantial increase in net receipts (almost twice those of Alternative A) is a result of the large difference between the two alternatives (about 20 million cubic feet) in first decade harvest from National Forest land.

As a result of the strong timber harvest emphasis of Alternative B-Departure, many of the non-timber outputs drop substantially below the levels provided by Alternative A. This alternative ranks lowest in VQOs met, with attainment of VQOs dropping to near zero outside Wilderness. Alternative B-Departure exceeds only Alternative NC in Primitive and Semi-Primitive recreation opportunity, unroaded area retention, and old-growth habitat availability. The qualifying characteristics of potential Wild and Scenic River corridors are not maintained in any corridor.

Alternative B-Departure has the highest level of road mileage available for public use in the fifth decade, and is considerably above Alternative A in this regard. This is a result of the extensive road construction program which will be needed to serve the timber harvest level of this alternative. Harvest level also influences the proportion of the existing road system which will be kept open, since greater harvest volumes require that more of the road system be available for timber haul at any given time.

Another consequence of the harvest emphasis of Alternative B-Departure is its high sediment output (highest among the alternatives) and the resultant effect on fisheries. Fish habitat productivity ranks lowest among the alternatives, with average fishery production potential roughly 200,000 smolts per year below that of Alternative A. Alternative B-Departure has the highest level of harvest in riparian areas.

The principal favorable effect of the increased harvest level of Alternative B-Departure, aside from the higher first decade cash flow mentioned previously, is the effect of the alternative on the local economy. First-decade employment and personal income rank first among the alternatives, and are considerably higher than in Alternative A.

Alternative C-Preferred (Modified)

The PNV of Alternative C-Preferred (Modified) is $26.9 million below that of Alternative B-Departure. This is the result of substantial differences between the two alternatives in the conditions which generate overall PNV. While the timber harvest of Alternative B-Departure is based on a substantial departure from nondeclining flow, Alternative C includes the nondeclining flow limitation. The first decade harvest of Alternative C is almost 30 million cubic feet per year below that of Alternative B-Departure, and ranks fourth among the alternatives in this regard. The switch from departure to nondeclining flow, taken by itself, should result in an extremely large drop in PNV from Alternative B-Departure to Alternative C.

There are two characteristics of Alternative C which counterbalance the effect of lower harvest volume on PNV: the use of harvest regimes based on contribution to PNV, and removal from the harvest base of areas in which timber management costs exceed returns. The objectives of Alternative C include emphasis on basing land allocation and prescription selection on contribution to PNV rather than timber production. Therefore, where land is allocated to timber harvest in Alternative C, the management regimes and harvest schedules which contribute the most to PNV are applied. In addition, the allocation of areas in which timber management costs exceed returns to timber production is greatly reduced from Alternative B-Departure.

The final factor influencing the PNV of Alternative C as opposed to Alternative B-Departure is the stronger emphasis on the production of nontimber outputs in Alternative C. In this alternative, selected areas in which full yield timber management would contribute to PNV have been allocated to uses which preclude or limit timber harvest (an example being some of the areas providing Primitive and Semi-Primitive recreation opportunities). The interactions of all these factors (departure vs. nondeclining flow, emphasis on contribution to PNV vs. timber production, and extent of allocation for nontimber outputs) have resulted in a moderate drop in PNV from Alternative B-Departure to Alternative C.

The large drop in net receipts from Alternative B-Departure to Alternative C results from the decrease in overall first decade harvest, combined with a very substantial drop in harvest from National Forest land within the Shelton CSYU in the first decade. The substantial increase in noncash benefits results from the expanded emphasis on nontimber outputs and the removal from the harvest base of areas in which timber management costs exceed returns.

Related to Alternative C's increased noncash benefits are the increased levels of VQOs met (equal to Alternatives H (Modified) and I), Primitive and Semi-Primitive recreation opportunity (ranked third among the alternatives), unroaded area retention (also third), and old-growth habitat availability (ranked third). The three river corridors recommended for inclusion in the Wild and Scenic River System in Alternative C reflect a substantial increase in this output relative to Alternative B-Departure.

Road mileage open for public use in the fifth decade decreases from Alternative B-Departure to Alternative C, largely as a result of the reduced harvest program. Road construction needs are lower in Alternative C, as is the proportion of the existing road system which must be kept open and available for timber haul.

The reduced harvest level and changed allocation patterns of Alternative C also result in a much lower sediment output than occurs in Alternative B-Departure. Alternative C has the fourth highest sediment level, while Alternative B-Departure is highest in this regard. Associated with this decrease in sediment is a substantial increase in fisheries outputs, with Alternative C ranking third among the alternatives in this area. Average fishery production potential is roughly 300,000 smolts per year above that of Alternative B-Departure. The level of harvest within riparian areas in Alternative C is third lowest among the alternatives.

An additional consequence of the substantial harvest reduction of Alternative C is the drop in employment opportunity and personal income associated with this alternative. While Alternative B-Departure provides

the second highest level of employment opportunity, Alternative C ranks fourth among the alternatives and entails a substantial decrease from the level of employment opportunity currently provided by the Forest.

Alternative H (Modified)

The principal difference between Alternatives C and H (Modified) is the emphasis, in Alternative H, on maintaining old-growth habitat within winter range (below 1500' elevation). The goals of Alternative H include retaining all such habitat at its present level. This results in the allocation of a large acreage of timberland having a high potential to contribute to PNV to a use which precludes timber harvest, and explains the bulk of the $67.7 million drop in PNV from Alternative C to Alternative H.

The first decade harvest level of Alternative H is over 15 million cubic feet per year below that of Alternative C, and ranks fifth among the alternatives. In addition to its effect on PNV, the lower harvest level results in a substantial decline in net receipts in Alternative H, which ranks fifth in this regard as well. In fact, the low level of harvest of this alternative, combined with the basic costs involved in operating the Forest at even a substantially reduced output level, result in a negative cash flow (net receipts below zero) in the first decade.

Many of the nontimber outputs are produced at a higher level in Alternative H than in Alternative C. In addition to retention of old-growth in winter range, this alternative places greater emphasis (relative to Alternative C) on allocation of land to nontimber uses. As a result, Semi-Primitive and Primitive recreation opportunity reaches its maximum potential level in Alternative H, and proportion of existing unroaded area retained approaches its potential. Attainment of VQOs reached its potential in Alternative C, and does not change in this alternative.

Potential Wild and Scenic River corridors are also managed at the maximum potential level in Alternative H. All ten of the rivers which are eligible for Wild and Scenic River classification and have the Forest Service as the lead classification study agency are recommended for inclusion in the Wild and Scenic River System.

Availability of old-growth habitat increases substantially from Alternative C to Alternative H, and ranks second among the alternatives in this area. Harvest of existing old-growth within winter range is precluded in Alternative H. This limitation applies throughout the 150-year analysis horizon.

The reduced harvest level of Alternative H results in a substantial decline in road mileage open to public use in the fifth decade relative to Alternative C. Alternative H ranks fifth among the alternatives in road system availability.

Another result of the change in harvest level is the reduced sediment output of Alternative H. Associated with this is increased fish habitat productivity, which ranks second among the alternatives. Average fishery production potential is roughly 100,000 smolts per year above that of Alternative C. Alternative H has the second lowest level of harvest within riparian areas among the alternatives.

Also related to harvest level are the employment opportunity and personal income associated with Alternative H. These fall considerably below the levels provided by Alternative C, and rank fifth among the alternatives.

Alternative I

The principal change from Alternative H to Alternative I is the expansion of old-growth retention to include all National Forest land. The goals of this alternative include maintenance of all currently available old-growth habitat in perpetuity. The effect of this objective is to severely reduce the availability of harvestable timber, especially in the early decades. As a result, both PNV and first decade harvest drop sharply ($101 million and over 10 million cubic feet per year respectively) from Alternative H to Alternative I. This alternative provides the lowest harvest level among the alternatives.

It should be noted that most of the first decade harvest shown for Alternative I in Table B-29 comes from Simpson Timber Company land within the Shelton CSYU. Harvest from National Forest land drops to 2.6 million cubic feet per year. This results in a first decade cash flow substantially less favorable than that of Alternative H (which is itself negative in cash flow), and places Alternative I lowest among the alternatives in this regard. Noncash benefits increase from Alternative H to Alternative I, and rank first among the alternatives.

While the harvest level of Alternative I is low, its production of nontimber outputs ranks first among the alternatives in many areas. This alternative provides the maximum potential levels of VQOs met, Primitive and Semi-Primitive recreation opportunity, unroaded area retention, and old-growth habitat availability. Outputs of these are higher than those of Alternative H in two cases: unroaded area retention (a small increase) and old-growth habitat (a large increase). Management of potential Wild and Scenic River corridors is the same as in Alternative H.

Road mileage available for public use in the fifth decade drops substantially from Alternative H to Alternative I. Road construction needs associated with Alternative I are relatively minor, especially in the early decades, and the light timber haul on the existing road system makes reduction of maintenance levels practical. As a result, Alternative I ranks sixth in road system availability.

Alternative I's low harvest level results in a substantial decrease in sediment output relative to Alternative H, giving Alternative I the lowest sediment output among the alternatives. Associated with this is a modest increase in fisheries productivity, which places Alternative I first among the alternatives in this regard. The average fishery production potential of Alternative I is roughly 100,000 smolts per year greater than that of Alternative H. This alternative has the lowest level of harvest within riparian areas.

The principal unfavorable effect of the low harvest level of Alternative I, aside from its low PNV and cash flows, is the effect of the alternative on the local economy. Employment opportunity and personal income are substantially below Alternative H, and represent the lowest levels provided by any of the alternatives.

RELATIONSHIP OF ALTERNATIVES TO BENCHMARK 7 (MAXIMUM PNV, NONDECLINING FLOW)

Table B-30 relates Plan alternatives to benchmark 7 in terms of two factors: changes in PNV (including the principal causes thereof) and emphasis on issue-related outputs. The PNV comparisons are made by showing the difference in PNV between each alternative and benchmark 7, with the principal factors which influenced changes in PNV (both increases and decreases) also displayed. This presentation is quite general in nature, and is intended to provide a brief summary of the major causes behind variations in present net value. For a detailed discussion of specific reasons for PNV differences, refer to "Development of Alternatives".

The presentation of issue-related output emphases contrasts the outputs and effects associated with each alternative to the levels of production of issue-related outputs provided by benchmark 7. Keep in mind that benchmark 7 was not designed to address issues, and therefore did not "emphasize" the resolution of any

of the ICOs. Also keep in mind that issues that are related to output levels are not necessarily "resolved" by providing a higher level of a specific output. Each issue entails two points of view, one supporting increased production and the other supporting decreased production of whatever output is in question. The relationships displayed in Table B-30, therefore, are not intended to imply that a particular alternative resolves a given issue better or worse than another. The idea is simply to show which issue-related outputs are emphasized, to an extent greater than would be associated with maximizing present net value, in each alternative. This comparison is designed to provide an indication of how the differences in PNV between the alternatives and benchmark 7 are related to the ICOs and the various options for addressing them.

Several of the abbreviations and terms used in Table B-30 require explanation. The expressions used are defined as follows:

1. Factors Decreasing PNV

Timber max.	Use of "maximize timber" as the initial objective function in a given FORPLAN run.
Land alloc.	The set of land allocations specified for a given alternative which involve limiting or precluding timber harvest within areas in which timber harvest could contribute to PNV.
Primary	When two causes are shown for decrease in PNV, "primary" refers to the more influential factor.
Secondary	The less influential factor, relative to "primary".
Dominant	Refers to the factor resulting in most of the PNV change.
Minor	Of small influence, relative to "dominant" factors.
WR	Winter range (0'-1500' elevation)
OG	Old-growth

2. Issue-related Outputs/Effects

Soc/econ	Social and economic effects, primarily employment and personal income.
Unroaded	Includes unroaded recreation opportunity and retention of currently unroaded areas.
F & WL habitat	The full range of fish and wildlife related issues: old growth, water quality, fish and wildlife habitat quality, and riparian area management.
W & S Rivers	Management of river corridors to retain characteristics which would qualify them for inclusion in the Wild and Scenic River System.
Timber	Self-explanatory.
Scenic Quality	Self-explanatory.

Table B-30. Relationship of Alternatives to Benchmark 7

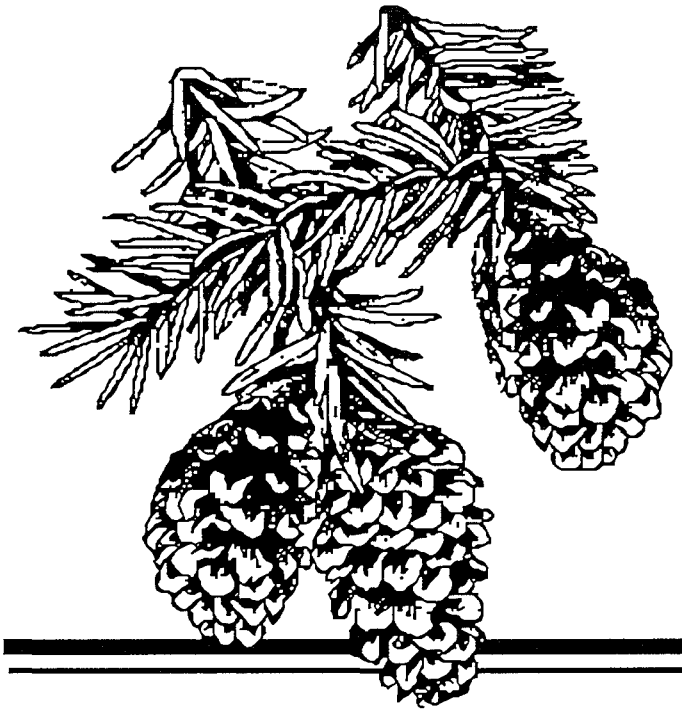
Differences in PNV and Issue-related Output Emphasis

Alternatives	PNV Change (MM$)	Factors which Increase PNV	Factors which Decrease PNV	Issue-related Outputs/Effects Emphasized	Issue-related Outputs/ Effects De-emphasized
No Change	1/		Timber max.	Timber Soc/Econ	Unroaded F & WL habitat
A-Current Direction	-23.6		Land allocation	Unroaded Scenic Quality	Timber Soc/econ
B-Dep (Modified)	-44.9	Departure	Timber max.	Timber Soc/econ	Scenic quality Unroaded F & WL habitat
C-Pref (Modified)	-71.8		Land allocation	Unroaded Scenic quality W & S Rivers F & WL habitat	Timber Soc/econ
H (Modified)	-139.5		Retain WR OG (dominant) Land alloc. (minor)	Unroaded Scenic quality W & S Rivers F & WL habitat	Timber Soc/econ
I	-240.9		Retain all OG (dominant) Land alloc. (minor)	Unroaded Scenic quality W & S River F & WL habitat	Timber Soc/econ

1/ PNV not calculated for Alternative NC. Data necessary to determine present net value not available in timber management plans.

Appendix C

Unroaded Areas



Olympic National Forest

APPENDIX C

UNROADED AREAS

INTRODUCTION

The purpose of Appendix C is to provide an analysis of each of the 13 unroaded areas on the Olympic National Forest. See Table C-1 for current unroaded acres. Management of unroaded areas is one of the public issues identified in this planning process.

With the passage of The Washington State Wilderness Act of 1984 (PL 98-339), Congress stated that the Forest Service was not required to review the Wilderness option for the remaining Roadless Area Review and Evaluation (RARE II) areas, areas less that 5,000 acres in size, and certain areas evaluated for Wilderness in unit plans when developing this Forest Plan. The Act does provide that areas still in an unroaded condition when this Forest Plan is revised shall be reviewed with Wilderness as an option. The full text of this portion of the Act states:

Sec.5.(a). The Congress finds that --

(1) the Department of Agriculture has completed the second roadless area review and evaluation program (RARE II);

(2) the Congress has made its own review and examination of National Forest System roadless areas in the State of Washington and of the environmental impacts associated with alternative allocations of such areas.

(b). On the basis of such review, the Congress hereby determines and directs that --

(1) without passing on the question of the legal and factual sufficiency of the RARE II final Environmental Statement (dated January, 1979) with respect to National Forest System land in States other than Washington, such statement shall not be subject to judicial review with respect to National Forest System land in the State of Washington;

(2) with respect to the National Forest System land in the State of Washington which were reviewed by the Department of Agriculture in the second roadless area review and evaluation (RARE II) and those lands referred to in subsection (d), that review and evaluation or reference shall be deemed for the purposes of the initial land management plans required for such lands by Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 to be an adequate consideration of the suitability of such lands for inclusion in the National Wilderness Preservation System and the Department of Agriculture shall not be required to review the Wilderness option prior to the revisions of the plans, but shall review the Wilderness option when the plans are revised, which revisions will ordinarily occur on a

ten-year cycle, or at least every fifteen years, unless, prior to such time the Secretary of Agriculture finds that conditions in a unit have significantly changed;

(3) areas in the State of Washington reviewed in such environmental statement or referenced in subsection (3) and not designated as Wilderness upon enactment of this Act or identified for special management in Section 7 or 8 of this Act shall be managed for multiple use in accordance with land management plans pursuant to Section 6 of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Planning Act of 1976: Provided, That such areas need not be managed for the purpose of protecting their suitability for Wilderness designation prior to or during revision of the initial land management plans;

(d). The provisions of this section shall also apply to:

(1) those National Forest System roadless land in the State of Washington in the Gifford Pinchot, Olympic and Umatilla National Forest which were evaluated in the Upper Cispus; Lone Tree; Clear Creek; Upper Lewis; Trapper-Siouxon; Soleduck; Quinault; Oregon Butte; and Shelton Cooperative Sustained Yield Unit plans; and

(2) National Forest System roadless land in the State of Washington which are less that five thousand acres in size.

Since Congress has not designated the remaining Roadless Areas as Wilderness, there is not a recommendation on Wilderness options in the EIS. Congress has done this job.

Appendix C provides a brief summary of each unroaded area's attributes, including acreage identified in RARE II, current acreage, and reasons for change when these acreages differ. Appendix C also provides a narrative for each unroaded area which addresses the following five major categories:

DESCRIPTION: The history, location and access, physiographic and biologic features, current resource uses, and appearance, surroundings, and attractions are described.

CAPABILITY: The presence or absence of Wilderness characteristics, including manageability and special features, are identified.

AVAILABILITY: The presence or absence of opportunities for resource uses, both extractive and non-extractive, are described.

NEED: The relationship of each area to nearby areas and uses, the value of each area as a potential ecosystem representative, and public interest are presented.

ENVIRONMENTAL CONSEQUENCES: The consequences associated with each alternative within each unroaded area are discussed. Because implementation of projects is unlikely to follow allocations from the FORPLAN model exactly, consequences described in this appendix have to be viewed as approximations. This is especially true for activities such as road construction and timber harvest. The schedule of activities likely to occur during implementation of any alternative may be different than those described here. Actual consequences on the character and opportunities of the unroaded areas would be discussed in environmental assessments associated with those projects.

BACKGROUND

There were thirteen areas inventoried on the Olympic National Forest during the first Roadless Area Review and Evaluation (RARE). In October of 1973, in the RARE Final Environmental Impact Statement (FEIS), three areas, totaling 70,270 acres, were selected as Wilderness study areas. This total included 216 acres of private land, Tubal Cain Mine, on the Quilcene Ranger District. The three identified areas were Quilcene, The Brothers and Mildred Lakes. Table C-1 displays a chronology of unroaded (roadless) areas from the original RARE process, through the results of the Washington State Wilderness Act of 1984, to today.

Three unroaded areas were analyzed in the Soleduck Unit Plan completed in March, 1975. The decision in this plan allocated 3,898 acres to be managed as roadless with no timber harvesting. The remaining 16,262 acres were allocated to general forest uses and management with an emphasis on timber production.

The Quinault Unit Plan, completed in July 1976, analyzed four roadless areas totaling 32,607 acres. The decision for this plan allocated 12,120 acres to be added to Wilderness Study Areas, 3,418 acres to roadless - no timber harvesting, 1,261 acres to special recreation and scenic management, and the remaining 15,808 acres to general forest uses and management with an emphasis on timber.

The decision for the Timber Resource Management Plan for the Shelton Cooperative Sustained Yield Unit, made in November 1978, allocated an area in the upper South Fork Skokomish drainage to a special recreation management area aimed at providing roadless recreation opportunities. This area had not been identified as an unroaded area in the RARE process because of a prior agreement between the USDA-Forest Service and Simpson Timber Company whereby these lands became part of the Shelton Cooperative Sustained Yield Unit.

In the January 1979, RARE II FEIS, there were nine unroaded areas inventoried, totaling 155,028 acres. Four of these areas (Quilcene, The Brothers, Mildred Lakes, and Colonel Bob totalling 87,656 acres) were proposed for Wilderness, one area (Wonder Mtn., 9,468 acres) was identified for further planning. Remaining roadless areas were allocated to general forest uses and management.

The Canal Front Unit Plan for the Hoodsport and Quilcene Ranger Districts was completed in May 1979. The FEIS included an analysis for seven roadless areas involving 142,894 acres. The decision for that plan allocated portions of three of the areas, with a total of 70,270 acres, to Wilderness study. An additional 530 acre unroaded area plus 6,165 acres in several parcels adjacent to previously identified unroaded areas were added to the RARE II inventory. The remaining 65,929 acres were allocated to a variety of general forest uses and special management activities.

The Washington State Wilderness Act of 1984 created five Wildernesses on the Olympic National Forest. In November 1986, there was a boundary adjustment between the Forest and the Olympic National Park that changed the Wilderness acreage. The five Wildernesses and current acreages are as follows: Buckhorn, 44,258; The Brothers, 16,682; Mt. Skokomish, 13,015; Wonder Mountain, 2,349; and Colonel Bob, 11,961. This same boundary change also altered the size of three unroaded areas and eliminated one. The Forest transferred 1,757 acres of the Mt. Baldy unroaded area and 218 acres of the Pine Mountain unroaded area to the Park. The Pine Mountain area was only 230 acres and, therefore, the remaining 12 acres are no longer considered an unroaded area. The Madison Creek unroaded area was altered, with 120 acres of the Park added to the Forest and 510 Forest acres transferred to the Park. Five hundred and fifty-five acres of the Park were added to the Rugged Ridge unroaded area. A total net change of 1,810 acres of unroaded Forest land were transferred to the Park.

In November 1988, Congress created an 876,669-acre Olympic Wilderness in the Olympic National Park. Wilderness management is consistent with the purpose of the Park which is to preserve for the benefit, use and enjoyment of the people, the natural features of the Park; to provide protection for the Roosevelt elk; and to conserve and make the Park's natural features available to the people for their recreational use.

Since the RARE inventory process started, the Olympic National Forest has identified 17 unroaded areas. Due to timber harvesting and road contruction, Elk-Reade and Matheny are no longer unroaded. Two hundred eighteen acres of the 230 acre Pine Mountain unroaded area were transferred to the Olympic National Park in 1986 and, therefore, this area is not longer identified as an unroaded area. The five Wildernesses are also no longer considered in this discussion. Refer to Table C-1 for a summary of the history of individual areas since the original RARE inventory.

Table C-1. Current Unroaded Areas

RARE II Number	Unroaded Area	Net RARE II Acres	Current Inventoried Acres	Reason for Acre Change
B6081	Quilcene	24,445	19,017	Some acres were included in the Buckhorn W. in 1984 and some have been roaded.
6082	Mt. Zion	5,419	5,384	Road Construction
6083	Green Mountain	5,379	4,561	Road Construction
B6084	Jupiter Ridge (The Brothers) 1/	11,516	8,308	Some acres were included in the Brothers W. in 1984
B6085	Jefferson Ridge (Mildred Lakes) 1/	10,385	9,369	Road Construction
6086	Lightning Peak (Wonder Mountain) 1/	9,468	7,174	Some acres were included in Wonder Mtn W. in 1984.
6088	McDonald	530	491	New acre estimate.

1/ ( ) = Name of unroaded area inventoried in RARE II.

The following areas are also being analyzed as unroaded areas in this FEIS. All were evaluated in previous environmental impact statements and have since remained unroaded. Therefore, these areas currently meet the criteria for unroaded areas:

Unroaded Area	DEIS, 1987	FEIS, 1990	Reason for Change
Upper Skokomish	6,182	6,182	
Moonlight Dome	5,931	5,931	
South Quinault Ridge	9,852	9,852	
Rugged Ridge	4,009	4,564	1986 Forest/Park boundary adjustment.
Mt. Baldy	5,652	3,895	1986 Forest/Park boundary adjustment.
Madison Creek	1,469	1,079	1986 Forest/Park boundary adjustment.

CHANGES BETWEEN DRAFT AND FINAL

The Forest had 14 unroaded areas with a total of 87,629 acres identified in the DEIS. In 1986 there was a boundary adjustment between the Olympic National Forest and the Olympic National Park that altered the size of three unroaded areas and eliminated one. 555 acres of the Park were added to the Rugged Ridge unroaded area. 1,757 acres of the Mt. Baldy area and 218 acres of the Pine Mountain area were transferred to the Park. The Pine Mountain area was only 230 acres in size and, therefore, it is no longer identified as an unroaded area. The Madison Creek unroaded area was altered, with 120 acres of the Park added to the Forest and 510 Forest acres transferred to the Park. A total net change of 1,810 acres of the unroaded Forest land were transferred to the Olympic National Park. Currently, there are 13 unroaded areas with a total of 85,807 acres.

See Table C-2 for acres by management prescription by alternative and Table C-3 for unroaded acres remaining after fifth decade for each unroaded area.

Table C-2. Summary of Unroaded Area Management by Alternative (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	20.1	19.6	0	28.6	42.1	46.4
Undeveloped Recreation (Motorized) A1B	3.8	3.8	0	2.6	11.6	11.6
Scenic A2	7.8	7.8	0	10.6	0	0
Wild & Scenic River A4A	0.5	0.5	0	1.5	1.5	1.5
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	25.6	29.2	24.8	24.8	24.8
Timber Management E1	46.2	21.1	55.1	10.8	1.5	0
Municipal Watersheds F1	5.9	5.9	0	5.4	2.8	0
Research Natural Areas J2	1.5	1.5	1.5	1.5	1.5	1.5
FOREST TOTAL UNROADED ACRES	85.8	85.8	85.8	85.8	85.8	85.8

Table C-3. Acres of Unroaded Area at End of Fifth Decade (Thousands of Acres)

		Alternatives					
Unroaded Area	Existing Acres	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
McDonald	0.5	0	0.5	0.5	0.5	0.5	0.5
Quilcene	19.0	3.8	14.2	13.3	14.2	14.2	19.0
Mt. Zion	5.4	0	1.8	1.8	3.6	5.4	5.4
Green Mtn.	4.5	0	0.7	0.7	0.7	4.5	4.5
Jupiter Ridge	8.3	1.6	2.8	1.2	4.5	7.3	8.3
Jefferson Ridge	9.4	3.8	4.3	0.5	4.3	9.4	9.4
Lightning Peak	7.2	3.6	5.4	1.8	5.4	7.2	7.2
Upper Skokomish	6.2	4.3	5.0	1.9	5.0	6.2	6.2
Moonlight Dome	5.9	5.3	5.3	0	5.9	5.9	5.9
S. Quinault Ridge	9.8	3.0	4.5	3.0	7.4	9.8	9.8
Rugged Ridge	4.6	0	2.5	2.5	2.5	4.6	4.6
Mt. Baldy	3.9	0	2.5	2.5	2.5	3.9	3.9
Madison Creek	1.1	0	1.0	1.0	1.0	1.1	1.1
TOTAL ACRES	85.8	25.4	50.5	30.7	57.5	80.0	85.8

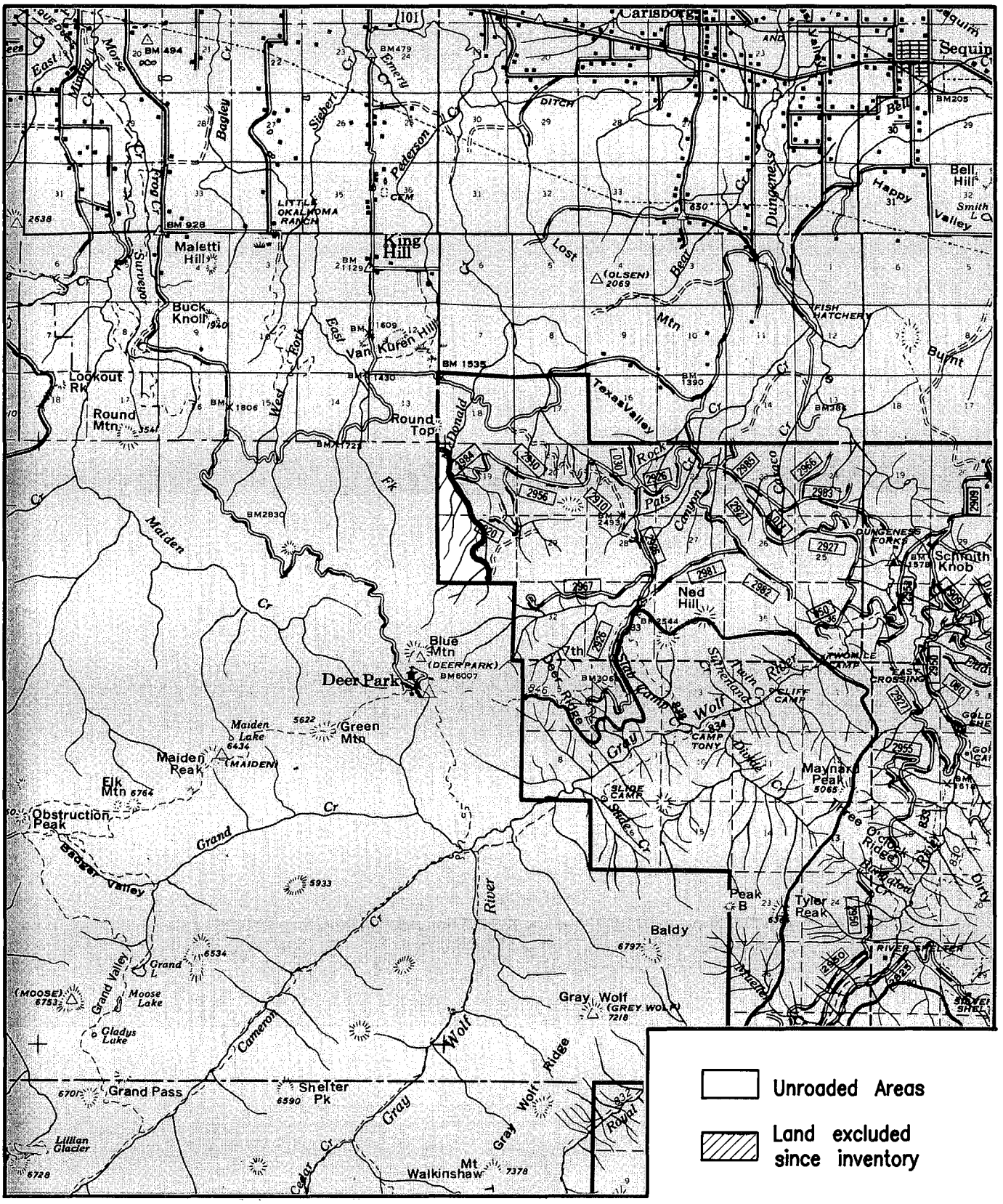


Figure C-1. McDONALD UNROADED AREA

McDONALD UNROADED AREA (491 acres)

DESCRIPTION

HISTORY

The McDonald unroaded area was originally inventoried for study as a potential Wilderness during the RARE II process. It was allocated to non-wilderness use in the decision resulting from that process.

In May 1979, an FEIS prepared for the Land Management Plan for the Canal Front Planning Unit allocated the McDonald unroaded area to a range of resource uses with the emphasis on utilization of the timber resource. The Plan specified that management activities should be designed to protect the soil and water resources, fisheries and wildlife values, and visual quality.

The roadless character of this area has not changed since its original inventory. Its current size is 491 acres.

LOCATION AND ACCESS

This small unroaded area is located near the extreme northeast corner of the Forest within the Quilcene Ranger District. It is situated against the northeast boundary of Olympic National Park and is contiguous to the Park's Wilderness. The Area is separated from the Buckhorn Wilderness by roads and harvest units which extend along its eastern boundary.

The area is accessible from the town of Sequim by driving county and Forest roads for approximately 20 miles. There are no existing trails within the area.

PHYSIOGRAPHY AND SOIL

The topography is moderately gentle, sloping upwards toward Blue Mountain. The slopes face to the northeast with elevation ranging from slightly less than 2,000 to a little over 3,600 feet.

Bedrock is composed of dark gray, massive to thinly bedded feldspathic, arkosic, and basaltic sandstone, siltstone, massive conglomerate, and moderately to highly fractured marine basalt. Overlaying this is deep moderately compact glacial till on the lower hills and across rolling drift plains.

Soils are generally shallow to moderately deep with weak to moderate structure. They are well drained, medium textured soils which overlay sedimentary and basalt bedrock.

VEGETATION

The area is completely forested with conifers, although most of the trees are relatively small in size as a result of past forest fires throughout the area. Douglas-fir, western hemlock, and pacific silver fir are the major species. Salal and coastal rhododendrons are common understory plants in the area.

ECOSYSTEM

This small area consists of a young Douglas-fir forest. It is within the Kuchler ecotype K2 - Redcedar, western hemlock, and Douglas-fir forest.

CURRENT USES

There are no developed recreation sites, trails, or dispersed campsites within this area. Recreational use is minimal, estimated at less than 50 RVDs per year. All of the area is in the ROS classification of Roaded Natural.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

McDonald unroaded area has a common visual variety of landforms and vegetation. There are no major rock formations. McDonald Creek forms the eastern boundary. There are no major rivers or lakes. The area consists of moderately steep slopes that are covered with a dense, textured, vegetative cover.

The area is not readily visible from its surrounding areas. It is situated near the toe of the slope of Blue Mountain, a popular vista point in Olympic National Park. The area can best be viewed from Forest roads that provide access to the north and east boundaries. It is is not visible from any recreation site or trail on the Forest.

There are no significant attractions within this unroaded area. A nearby attraction consists of the summit of Blue Mountain within the Olympic National Park.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

This 491 acre unroaded area shares its west and south boundaries with the Olympic National Park. The north and east boundaries are defined by several timber harvest units and minor creeks and ridges.

Due to its close proximity to logging roads and timber harvest activities, sights and sounds of human intrusion are readily noticeable throughout.

NATURAL INTEGRITY

The McDonald unroaded area was inventoried during the RARE II process. It was considered as potential Wilderness in that process because of its proximity to Olympic National Park but was not selected for Wilderness classification. The 1984 Washington Wilderness Act did not classify this unroaded area as Wilderness either and, at that time, it was designated be available for general forest uses. The area has not changed since its initial inventory as an unroaded area; however, the number of acres has changed because of more accurate measurements.

NATURAL APPEARANCE

Due to the areas small size and close proximity to sights and sounds of human habitation, the area lacks the feeling of naturalness and expansiveness.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Opportunities for primitive recreational experiences do not exist due to the closeness of roads. Opportunities for solitude are very limited; however, due to the dense vegetation and limited use, a person could seek out and find small areas that project a feeling of solitude.

Opportunities for challenging experiences and risk are lacking.

SPECIAL FEATURES

There are no known threatened or endangered plants or animals within this unroaded area. This entire unroaded area is within a Spotted Owl Habitat Area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education or scientific and historic study in the area which cannot already be found in existing Wildernesses on the Forest.

AVAILABILITY

RESOURCE POTENTIAL

Minerals

The area is primarily underlain by sedimentary rocks of the Eocene age. Even though this unroaded area has not been studied by the USGS and Bureau of Mines, available data indicates the area does have at least a low potential for the occurrence of managanese deposits. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low. There is no mining activity within the area, and none of the area is encumbered by mining claims. The area has not been classified "prospectively valuable" for leasable mineral commodities, and it has no mineral leases or pending lease applications.

Water

Part of the upper reaches and western tributaries of McDonald Creek are in the area. There are no major rivers, lakes or ponds.

Vegetation

The area contains about 460 acres (93 percent of area) of tentatively suitable forest land of which about 100 acres are doghair. Seral stage and estimated standing volume are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
PL	16	1.1	0.2
MS	82	12.6	2.3
LS	2	0.5	0.1
TOTAL	100	14.2	2.6

PL = Young Forest MS = Mature Forest LS = Old-Growth and Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.1 million cubic feet per year.

Special Areas

Approximately 15 to 20 percent of the area is in riparian zones which consist primarily of small tributary streams of McDonald Creek. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Big game summer habitat is provided in the area. Other wildlife, both game and non-game birds and mammals, use the area. In addition, the entire area is included in a Spotted Owl Habitat Area (SOHA).

Fisheries

There are no known fish bearing streams, lakes or ponds within the this area. However, McDonald Creek supports both resident and anadromous fish populations.

Cultural

This area was professionally surveyed in 1984 and no historic or pre-historic sites were discovered. There are no reported or suspected historic or pre-historic sites in the area.

Recreation

The McDonald unroaded area has limited potential for providing unroaded types of recreation activities. The area is small in size and does not have any recreational attractions other than big game hunting. There

are no climbing routes or proposed trails. The entire area is classified as Roaded Natural since it is within 1/2 mile of a road. The area has a potential recreation capacity of 50 RVDs per year.

Scenery

The natural landscape character consists primarily of a densely textured forest on moderately steep landforms. The area is not viewed from any major recreation travel routes or sites. The Visual Quality Objective for the entire area is Modification.

Wild and Scenic Rivers

There are no potential Wild and Scenic Rivers in this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present, but they are at endemic levels and of little concern. There is no record of a major insect outbreak within the McDonald unroaded area. Diseases are also present within this area. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

The current state of the vegetation in the area is likely the result of past wildfire. Fire occurrence in this area is not any different than in surrounding areas of the Forest or Olympic National Park.

The fire suppression objective for the designated SOHA portion of the unroaded area is to minimize the acreage burned.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The McDonald unroaded area lies immediately north of the Buckhorn Wilderness and adjacent to Olympic National Park Wilderness. The area is separated from the Buckhorn Wilderness by roads and harvest units which extend along its eastern boundary.

DISTANCE FROM POPULATION CENTERS

The area is approximately 85 miles or 2 hours driving time from Seattle, Washington. The closest town is Sequim, approximately 20 miles northeast of the area. It is approximately 8 miles from US Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest and input was low for this unroaded area during the evaluation of RARE II areas, the Canal Front Planning Unit FEIS, and passage of the Washington Wilderness Act of 1984.

ENVIRONMENTAL CONSEQUENCES

This small 491 acre unroaded area is included in a Spotted Owl Habitat area and, therefore, existing resource conditions and potentials will remain unchanged in all alternatives except the NC Alternative in which the entire area is allocated to Timber Management.

WILDERNESS POTENTIAL

The option of future consideration of the McDonald unroaded area for Wilderness will be maintained in all alternatives except the No Change Alternative.

Table C-4. McDonald 491 Acres (0.5) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	0	0	0
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	0.5	0.5	0.5	0.5	0.5
Timber Management E1	0.5	0	0	0	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	0.5	0.5	0.5	0.5	0.5	0.5

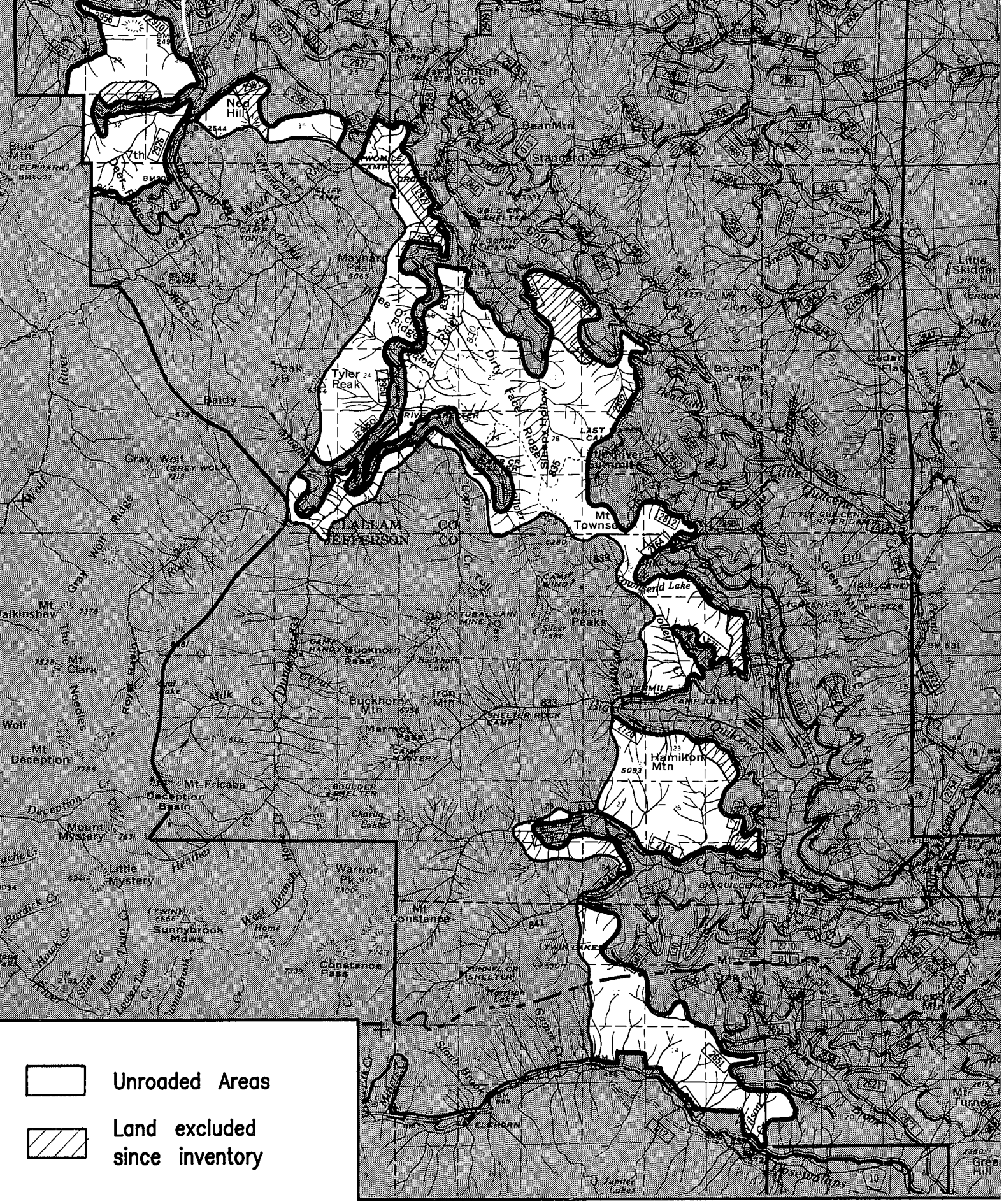


Figure C-2. QUILCENE UNROADED AREA

QUILCENE UNROADED AREA (19,017 acres)

DESCRIPTION

HISTORY

The Quilcene unroaded area was initially inventoried during the first RARE process as a portion of the original Quilcene unroaded area. About 43,000 acres out of 67,585 acres were administratively endorsed as a Wilderness Study Area in January, 1973. The area was again inventoried during RARE II. Some minor boundary adjustments were made at this time because of changed conditions, but the decision was the same.

In May, 1979, the decision made for Canal Front Planning Unit reaffirmed the previous Wilderness recommendations and allocated remaining portions of the unroaded area to general forest uses.

The Washington Wilderness Act of 1984 created the Buckhorn Wilderness. There are currently 19,017 roadless acres identified as the Quilcene unroaded area.

LOCATION AND ACCESS

The Quilcene unroaded area is located primarily in the central portion of the Quilcene Ranger District. It extends from near the District's northern boundary to the Dosewallips River road on the Hood Canal District in the south. The area consists of narrow strips of land bordered by the Buckhorn Wilderness to the west and roads and harvest units to the north, east, and south.

From the north, the area is accessible from the town of Sequim by driving county and Forest roads for approximately 20 miles. From the east, access is from Quilcene, with the closest distance being approximately 12 miles. As mentioned, the Dosewallips River road forms the southern boundary.

An extensive forest road system provides access to most of the northern, eastern, and southern boundaries. Six trails also provide access to these three boundaries. Westerly access into the area from the Buckhorn Wilderness is possible by hiking several trails, or by cross-country hiking routes.

PHYSIOGRAPHY AND SOIL

Landforms range from the steep eastern slopes of Mt. Townsend through foothills to valley bottoms. The elevational range is from about 500 feet in the extreme southern portion to over 6,000 feet on Mt. Townsend. Major landforms include Hamilton Mountain, the northeast end of Mt. Townsend and the steep slopes of Dirty Face Ridge.

Bedrock of this area is composed of graywacke, brittle black argillite, red limy argillite, mudstone, and altered basalt. The graywacke and basalt are generally competent (non-crumbly) while the argillites and mudstone are moderately competent. Basalt and sedimentary rock outcrops occur on high ridges and barren sideslopes.

Soils on ridges and sideslopes consist primarily of shallow, well drained, medium textured soils (loamy). Midslope and toeslope soils consist primarily of deep, well drained, gravelly medium textured soils.

VEGETATION

Vegetation varies with elevation. On the lower slopes, a nearly unbroken canopy of Douglas-fir and western hemlock extends upward to a higher elevation where Pacific silver fir and western hemlock are more common. Above timberline, scattered clumps of subalpine fir and whitebark pine can be found. A noteworthy vegetative community occurs on Three O'Clock Ridge. A stand of Rocky Mountain juniper occurs on this ridge, which is bordered by Cougar Creek, Bungalow Creek, the Dungeness River, and Maynard Peak. It is the largest known stand of this species on the Olympic Peninsula. It is within an unusual complex of dry forest types not normal to Western Washington.

ECOSYSTEM

This diverse unroaded area consists of dry forest types and some meadows. The area is primarily occupied by Kuchler type K2 plus small amounts of K4 (subalpine fir-mountain hemlock), K11 (Douglas-fir) (one of the few places on the Forest, or Western Washington, where this type occurs) K14 (Englemann spruce-subalpine fir) K108 (lodge pole pine) K45 (alpine meadows).

CURRENT USES

Roads access all but the west boundary. Trails provide access into portions of the unroaded area. Most of the trails extend through the area into either the Buckhorn Wilderness or Olympic National Park. However, the Dirty Face Ridge and Little Quilcene trails are entirely within the area. Existing recreation uses are closely allied to trail access and consist primarily of hiking, horseback and trail bike riding, backpacking, lake and stream fishing, and hunting. Total recreation use equals approximately 1,200 RVDs per year.

Approximately 12,447 acres of this unroaded area are in the Roaded Natural/ Modified ROS class and 6,570 acres are Semi-Primitive.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

The area consists mostly of a common visual variety of undulating and steep landforms and dense conifer vegetation. Major streams consist of portions of the Gray Wolf, Dungeness, and Big Quilcene Rivers and Sleepy Hollow, Silver, and Tunnel Creeks. Sink Lake is the only lake. Interesting, but unexceptional rock formations are present along the west face of Dirty Face ridge and major ridges extending from Mt. Townsend, and Maynard and Taylor Peaks.

Much of the area is visible from various locations within Buckhorn Wilderness, such as from Mt. Townsend, Buckhorn Pass and the Tubal Cain Mine trail. Most of the area is also visible from Forest roads and trails that provide access to the north and east boundaries. The upper part of Mt. Hamilton, located in the southern portion of the unroaded area, is visible from the summit of Mt. Walker, a popular observation site off U.S. Highway 101.

The main attractions within this unroaded area are activities associated with the Gold Creek, Little Quilcene and Mt. Townsend trails. Sink Lake is the most popular destination.

The major nearby attraction is the Buckhorn Wilderness with over 65 miles of trail, alpine meadows, ridges and lakes, and major peaks such as Mt. Fricaba (the highest point on the Forest), Tyler and Maynard Peaks, Buckhorn and Iron Mountain, and Mt. Townsend.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The area is almost entirely bordered by National Forest land. There is a small portion near the northwest boundary that is adjacent to Olympic National Park and a small portion next to private land at the southeast end of the area. The Buckhorn Wilderness forms the western boundary, while forest roads, timber harvest units, ridges and streams form the remainder of the boundary.

This large, irregular unroaded area consists of several small, narrow areas adjacent to roads and harvest units. Due to the area's close proximity to these management activities, the sights and sounds of human intrusion are readily noticeable.

NATURAL INTEGRITY

The current Quilcene unroaded area consists of small narrow areas that were no included in the Buckhorn Wilderness when it was created. Portions of the original RARE area outside the Wilderness have changed since it was originally inventoried. Several areas, such as the north side of Ned Hill, the northern most slopes of Maynard Peak ridge and Hamilton Mountain, have had, or are scheduled for timber harvesting. The current unroaded area of 19,017 acres remains in a natural state, free from human influences other than constructed trails and evidences of recreation use. The Gold Creek trail is the only trail open to motorized use.

NATURAL APPEARANCE

The Quilcene unroaded area is so irregular in shape and diverse in topography and aspect that persons visiting the area have the opportunity to seek out drainages and areas that appear natural and isolated from human activity and development. However, it is possible to observe roads and timber harvest activities from many locations within the area.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Managing for Primitive or Semi-primitive experiences within this area is affected by its irregular boundary and narrow ridgetop extensions. Off-site intrusions from surrounding roads and timber harvest activities make it difficult to provide for Primitive recreational experiences. The opportunity for solitude is limited to areas near Dirty Face Ridge and Hamilton Mountain. Few challenges await the visitor.

SPECIAL FEATURES

There are no known threatened, or endangered plants or animals within this unroaded area but it does have portions of three Spotted Owl Habitat Areas.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wildernesses on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by volcanic and sedimentary rocks of Eocene age. The zone of contact between these two types of rock appear to have the most potential for occurrence of metallic mineral resources. Even though this unroaded area has not been evaluated by the USGS and Bureau of Mines, available data indicates most of the area has a low to moderate potential for occurrence of manganese deposits (Lawson and Evarts, 1983). These deposits may have associated copper, molybdenum, iron, chromium and nickel. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low.

A small part of the area lying within sections 8, 9, 15 and 16, T.28N., R.3W. may be encumbered by mining claims, the validity of which has not been determined. There is no mining activity at present, and, under current conditions, it appears they may not be valid claims. Even though most of the area is classified "prospectively valuable" for oil and gas resources, none of the area is encumbered by leases or pending lease applications.

Water

Major streams consist of portions of the Gray Wolf, Dungeness, and Big Quilcene Rivers and Sleep Hollow, Silver, Townsend and Tunnel Creeks. Sink Lake is the only lake in the area.

The area that is within the Big and Little Quilcene drainages is in the Municipal Watershed which serves the City of Port Townsend.

Vegetation

The area contains about 15,000 acres (79 percent of area) of tentatively suitable forest land of which about 2,900 acres are doghair. Seral stage and estimated standing volume are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
SS	4	--	--
PL	18	45.9	8.4
MS	44	220.6	40.4
LS	34	251.2	46.0
TOTAL	100	517.7	94.8

SS = Early Stage PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 1.9 million cubic feet per year.

Special Areas

Approximately 15 to 20 percent of the area is in riparian zones which consist of portions of several main stem streams (Big Quilcene, Dungeness, and Gray Wolf Rivers) and their small tributary streams. Cliffs and talus slopes are scattered throughout the higher elevations.

Wildlife

This area provides big game summer and winter range. As a result of its large size and topographic features, most of the wildlife species found on the Forest inhabit the area. Spotted owls make extensive use of the area. The area contains all of two Spotted Owl Habitat Areas and a portion of a third.

Fisheries

The Gray Wolf, Dungeness, and Big Quilcene Rivers all provide substantial anadromous and resident fish habitat. The Dungeness/Gray Wolf River system is especially significant because it supports one of the three major pink salmon runs on the Olympic Peninsula. Sleepy Hollow, Silver, Tunnel, and Townsend Creeks, as well as Sink Lake, support resident trout populations.

Cultural

The Quilcene unroaded area traverses a wide range of topography and environmental systems that have played a part in the development of its cultural resource values. These values are fairly significant from both a pre-historic and historic perspective. Several major anadromous streams or tributaries are within this area, and these played a role in the occupancy and hunting-gathering forays by early inhabitants. While major significant use by pre-historic peoples focused on the marine and estuary environments, considerable summer use occurred inland. Prehistoric sites have been discovered at nearby Slab Camp and Deer

Park. The area is fairly rich in historic values. Many sites have been discovered, evaluated, and protected. Some examples are trails, information and facilities related to early day mining, trail shelters, fire-lookouts, structures and facilities related to Forest Service management, CCC era properties and records, homesteading, livestock grazing use by settlers, and logging.

Nearly all the mentioned resources occur in this unit or have a periphery relationship because of the wide range of resources available. Many of these resources are documented through the reconnaissance reports filed by cultural resource technicians and professional surveys.

Recreation

The Quilcene unroaded area has moderate potential for providing opportunities for unroaded recreation. The Gold Creek trail currently provides opportunities for trail bike use as well as hiking. The Little Quilcene trail and a short portion of the Mt. Townsend trail also provide hiking and horseback riding opportunities. There are very few areas available for camping, even along the trail corridors. There is one trail shelter within the area. It is located at Sink Lake and is in poor condition. There are no proposed trails for the area.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive Non-Motorized	5,612	560
Semi-Primitive Motorized	958	95
Roaded-Natural/Modified	12,447	1,245
TOTAL	19,017	1,900

Scenery

Landscape character consists of densely textured forested areas and openings of rock formations and meadows. Landforms range from the steep eastern slopes of Mt. Townsend, through foothills, to valley bottoms. The area is viewed from popular forest roads, Mt. Walker observation point, and several trails. This unroaded area involves the four Visual Quality Objectives of Retention, Partial Retention, Modification, and Maximum Modification.

Wild and Scenic Rivers

Portions of the Dungeness-Gray Wolf and Dosewallips Rivers flow near this unroaded area. With the exception of a very minor portion of the Gray Wolf, the unroaded area does not reach the river bank of these two river systems.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Quilcene unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally, these diseases are isolated in small areas and spread very slowly.

FIRE

Fire occurrence has been more frequent for this area than any of the other unroaded areas of the Forest. Large fires have burned the area on several occasions. This is related to the drier climate found in the northeast corner of the Olympic Peninsula. With fire management activities that occur today, this area is not expected to have any more fires than others, but the likelihood of a large fire occurring is greater.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Quilcene unroaded area is located one mile northwest of the Buckhorn Wilderness. This small unroaded area is within eight miles of the Mt. Zion unroaded area and 12 miles from the Green Mountain unroaded area. The Brothers Wilderness is located within one mile south of the area.

DISTANCE FROM POPULATION CENTERS

Portions of the area are within 70 miles or two hours driving time from Seattle, Washington via the Puget Sound ferry system, Hood Canal floating bridge, and US Highway 101. The closest town, Quilcene, is within 10 miles.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest and input was high for this unroaded area when it was part of the Quilcene area prior to Wilderness classification in 1984. Since the passage of the Washington Wilderness Act of 1984, there has been moderate interest for adding portions of the area to Wilderness by environmental proponents. Opposition to development of some of the area is likely.

There is some concern for keeping trails currently open to motor bikes excluded from Wilderness classification. The Gold Creek trail offers 6.4 miles of trail bike riding in an unroaded natural setting.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction and C-Preferred (Modified), interest in conducting exploration and development activities within areas identified as having a "low" potential for the occurrence of manganese resources would be affected. Under Alternative C-Preferred (Modified) interest in exploring for oil and gas within unleased areas classified "prospectively valuable" for oil and gas resources could be adversely affected.

Under Alternative B-Departure (Modified) there would be very little, if any, adverse consequences.

Under Alternatives H (Modified) and I, not only would interest in exploring unleased areas classified "prospectively valuable" for oil and gas be affected, but interest in exploring areas identified as having a "low" to "moderate" potential for the occurrence of manganese resources and about 50 mining claims would be adversely affected.

All of these adverse effects are associated with increased costs for exploration and development because of environmental protection measures beyond those that would be normally encountered if the area were allocated to general forest uses.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from Alternatives H (Modified) and I. Alternative C-Preferred (Modified) should have little risk of affecting the above resources. Alternatives NC, A-Current Direction, and B-Departure (Modified), pose more risk of impacts to the above resources. The risk of impacting soils, water, or Special Areas (riparian) increases with intensity of timber harvest and road construction activity. Alternatives A-Current Direction, and B-Departure (Modified) have potential to affect the Port Townsend city water supply when activities from these alternatives occur in the Big and Little Quilcene drainages.

VEGETATION

Timber harvesting is expected to be implemented during the first decade in all alternatives except Alternatives H (Modified) and I. Harvesting activities will increase in the second decade and then level off for the next three decades.

In Alternative NC (No Change), about 15,000 acres or 79 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity contribution in this alternative is about 1.9 million cubic feet. Emphasis will be on timber management, with habitat for wildlife indicator species kept in a natural condition.

In Alternative A-Current Direction, about 4,800 acres or 25 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity contribution to timber production is 0.6 million cubic feet per year. Emphasis will be on timber management, with the Dungeness special management area and habitat for wildlife indicator species kept in a natural condition.

In Alternative B-Departure (Modified), about 5,700 acres or 38 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity contribution in this alternative is about 0.7 million cubic feet. Emphasis will be on timber management, with habitat for wildlife indicator species kept in a natural condition.

Alternatives C-Preferred (Modified) and H (Modified) will have about 3,800 acres (20 percent of the unroaded area) planned for timber harvest. The long-term sustained yield capacity contribution in this alternative is 0.5 million cubic feet per year.

No timber harvest activities would be scheduled in this unroaded area in Alternative I; therefore, contribution to long-term sustained yield capacity is zero.

WILDLIFE

Alternatives NC, A-Current Direction, and B-Departure (Modified) have the greatest impact on wildlife. Alternatives C-Preferred (Modified) and H (Modified) will have less of an impact and Alternative I will have no impact.

FISHERIES

Alternatives NC-No Change, A-Current Direction, and B-Departure (Modified) will have the greatest impact on the fisheries resources because of the environmental perturbations associated with roading and/or other timber management activities. Alternatives C-Preferred (Modified) and H (Modified) will have less impact than NC, A-Current Direction and B-Departure, whereas Alternative I should not have any influence on the fisheries resources.

FIRE

Resource value effects of fire in this unroaded area are essentially the same as those in Wilderness, except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas is more likely to affect air quality and visibility and may affect air quality in the Puget Sound trough.

Numbers of fires, acres burned, and resource value effects of fire in the Quilcene unroaded area in the average year of the 1st decade of implementation of the Forest Plan varies by alternative as follows:

The fire suppression objective for the designated SOHA portion of the unroaded area is to minimize the acreage burned.

CULTURAL

The consequences to cultural resource values will not change significantly with the implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low, as will the consequences. Some historic properties may deteriorate, and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat similar for Alternative C-Preferred (Modified), since increases in ground disturbing activities are only moderately higher than in Alternatives H (Modified) and I.

Current program levels will be maintained through Alternative A-Current Direction.

Alternatives B-Departure (Modified) and NC-No Change may affect cultural resources substantially. More sites are likely to be discovered and some may be impacted because of the increased amount of ground disturbance likely. Significant historic properties are not expected to be found, although further deterioration may take place. Pre-historic sites may be discovered and impacted as opposed to being left intact under other alternatives.

RECREATION

The No Change Alternative would have the greatest effect on unroaded recreation by retaining only 3,800 unroaded acres. These 3,800 acres would be allocated to Undeveloped Non-motorized Recreation while the remaining 15,200 acres would be allocated to Timber Management and Municipal Watershed. Alternative B-Departure (Modified) is the only alternative that does not allocated any of this unroaded area to unroaded recreation. This alternative would retain 13,300 in spotted owl habitat which would continue to provide semi-primitive oppourtunities for some recreational activities. The remaining 5,700 acres would be allocated to Timber Management. Alternaitves H and I would retain the most unroaded acres. Alternative I would retain the entire area in an unroaded condition with 7,600 acres allocated to Undeveloped Non-motorized Recreation, 1,000 acres allocated to Wild and Scenic Rivers, and 10,400 acres allocated to spotted owl habitat. Alternative H would allocate 3,800 acres to Undeveloped Non-motorized Recreation and 10,400 acres to spotted owl habitat and 1,000 acres to Wild and Scenic Rivers for a total of 15,200 acres to remain unroaded. Under this alternative, 1,000 acres would be allocated to Timber Management and 2,800 acres allocated to Municipal Watershed. Alternative A-Current Direction would retain 14,200 acres in an unroaded condition. 3,800 would be allocated to Undeveloped Non-motorized Recreation, 10,400 to spotted owl habitat and the remaining 4,800 allocated to Timber Management and Municipal Watershed. Alternative C-Preferred (Modified) would retain 14,200 acres in an unroaded condition with 3,800 acres allocated to Undeveloped Non-motorized Recreation and 10,400 acres allocated to spotted owl habitat. Three thousand eight hundred acres will be managed as a Municipal Watershed and 1,000 acres will be allocated to Wild and Scenic Rivers.

SCENERY

Only a small portion of this unroaded area is within a viewshed. The Hamilton Mountain area is viewed as background within the Mt. Walker viewshed and this area is also identified as spotted owl habitat so this portion of the viewshed will be retained in its natural appearance in all alternatives except the No Change Alternative. In the No Change Alternative most of this unroaded area could eventually have a moderately to heavily altered appearance. The 3,800 acres allocated to Undeveloped Recreation would continue to have a natural appearance. Alternative B-Departure (Modified) would retain approximately 70 percent of the area in a natural appearance while the remaining 30 percent could have a heavily altered appearance. Alternatives H and I would have the least effect on scenery. Alternative I would retain the entire area in a

natural appearance. Alternative H would retain 15,200 acres in a natural appearance with the remaining 3,800 acres having a moderately to heavily altered appearance. Alternatives A-Current Direction and C-Preferred (Modified) would provide a middle range of protection for scenery. Alternative A-Current Direction would retain 14,200 acres in its natural appearance with the remaining 4,800 acres having a moderately to heavily altered appearance. Alternative C-Preferred (Modified) would retain 15,200 acres in a natural appearance. The remaining 3,800 acres could have a moderately to heavily altered appearance.

Wild and Scenic Rivers

Management objectives within Wild and Scenic river corridors are compatible with those for maintaining unroaded conditions. Therefore, Wild and Scenic rivers have no effects on unroaded areas in any alternative.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-5. The figures show estimated development for the 50-year planning horizon in total, and are included in the road construction totals shown in Chapter IV of this FEIS. They are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in Table C-5 is needed to serve timber harvest by conventional logging systems. Alternatives A-Current Direction and B-Departure (Modified) also include substantial harvest allocations within areas in which use of highly sophisticated logging systems (predominantly helicopter) is necessary. Road construction to serve these systems will be minimal.

Table C-5. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	27	9	13	9	9	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest allocations and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 127 person-years. Conversely, an average of 11 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-6 below. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-6. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	127	40	47	33	33	11

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within any of those communities. It can be stated that maintenance of this area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of the area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

The Quilcene Unroaded Area is adjacent to the Buckhorn Wilderness and therefore, if portions of the area were allocated to uses that would eliminate them from future Wilderness consideration and the remaining portions were retained in an unroaded condition and yet had less than 5,000 acres, they could still be considered for future Wilderness.

The No Change Alternative would eliminate all but 3,800 acres of this area for future consideration for Wilderness. The remaining 15,200 acres would be allocated to other uses that could prevent them from being considered for future Wilderness allocation.

Alternative B-Departure (Modified) would retain 13,300 acres in a SOHA and therefore, could be considered for Wilderness. The remaining 5,700 acres are allocated to Timber Management and would be removed from future consideration as Wilderness.

Alternative A-No Change, C-Preferred (Modified) and H (Modified) are very similar. They would retain 14,200 acres in an unroaded condition and would therefore be available for future Wilderness consideration. The remaining 4,800 acres would be allocated to uses that could eventually eliminate them from future consideration.

Alternative I would retain the option of future consideration of the entire area for Wilderness.

Table C-7. Quilcene 19,017 Acres (19.0) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	3.8	3.8	0	3.8	3.8	7.6
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	1.0	1.0	1.0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	10.4	13.3	10.4	10.4	10.4
Timber Management E1	11.4	1.0	5.7	0	1.0	0
Municipal Watersheds F1	3.8	3.8	0	3.8	2.8	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	19.0	19.0	19.0	19.0	19.0	19.0

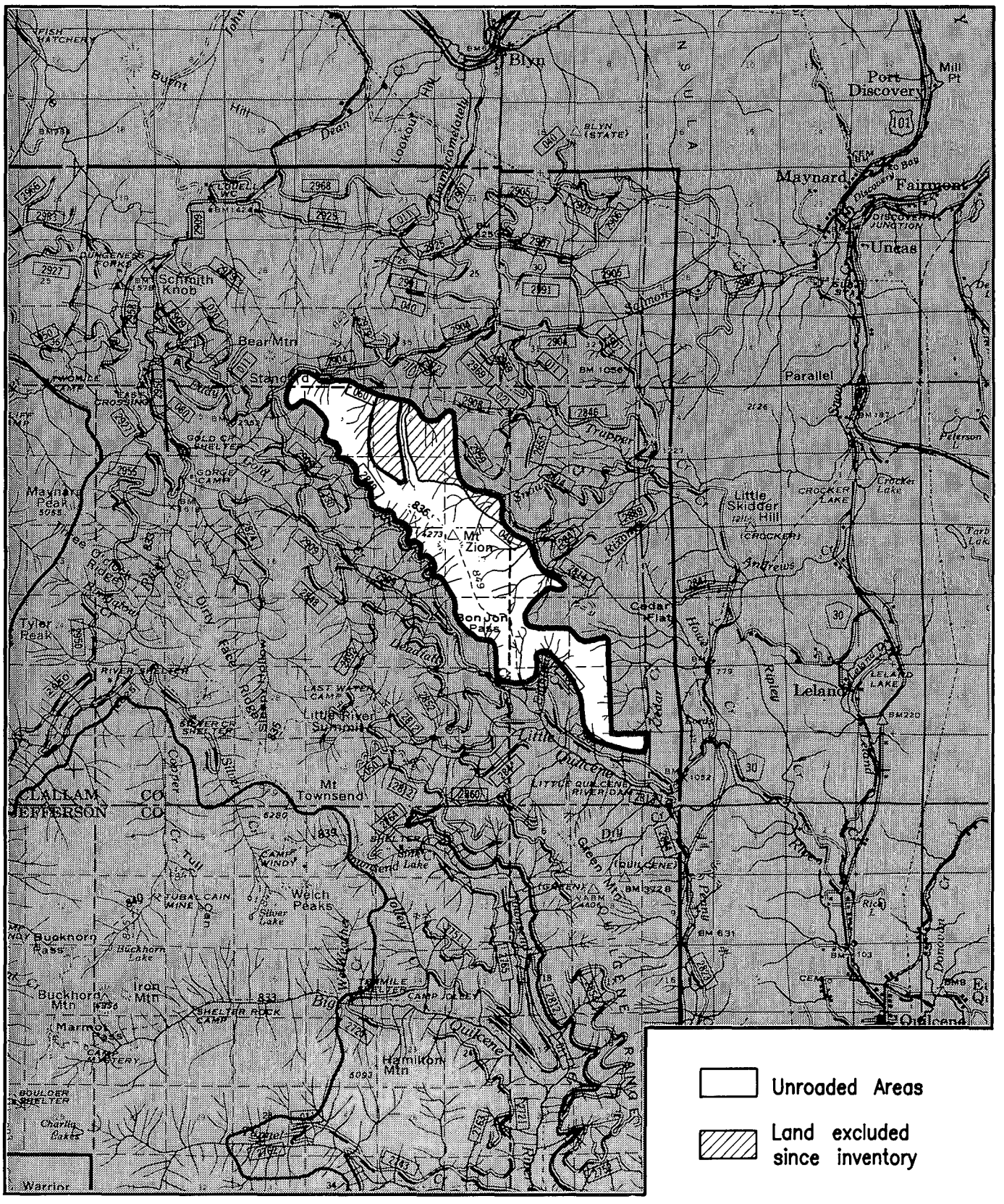


Figure C-3. MOUNT ZION UNROADED AREA

MOUNT ZION UNROADED AREA (5,384 acres)

DESCRIPTION

HISTORY

The Mt. Zion unroaded area was originally inventoried for study as a potential Wilderness during the RARE process. It has also been considered for its Wilderness potential in the RARE II process and in the Canal Front Planning Unit. In all three studies, decisions have been made to allocate the Mt. Zion area to general forest uses.

LOCATION AND ACCESS

This unroaded area lies in the northeast portion of the Forest, entirely within the Quilcene Ranger District. The most easterly portion adjoins the National Forest boundary near the Little Quilcene River. It extends northwesterly for approximately 8 miles along a narrow, usually less than two miles wide, ridge of undeveloped land.

The area is accessible in the north from the town of Sequim by driving county and Forest roads for approximately 20 miles, or in the south from the town of Quilcene by driving State, county, and Forest roads for approximately 15 miles.

The Mt. Zion trail, 1.8 miles, is open to hikers, pack and saddle stock, and motor bikes. The trail extends from road 2810 on the west boundary to the summit of Mt. Zion. The Deadfall trail extends from road 28 along the southern boundary to the terminus of the Mt. Zion trail. However, this trail has received little to no maintenance during the last decade and is difficult to follow along certain sections.

PHYSIOGRAPHY AND SOIL

Elevation ranges from about 1,500 feet near the soutnern end at the Little Quilcene River, to 4,273 feet at the summit of Mt. Zion. The summit provided a panoramic view of the northern half of the Quilcene Ranger District for a fire lookout that remained in service until about 1970.

The escarpment along the west side of this area displays a hornblende andesite lava flow that, according to Rowland Tabor of the U.S. Geological Survey, is the furthest west occurrence of a rock of Cascade volcanic affinity. This lava flow is in striking contrast to the oceanic derived basalt normally found in the Olympic mountains.

Other bedrock is composed of gray massive to thinly bedded feldspathic, arkosic, and basaltic sandstone, siltstone, massive conglomerate, and moderately to highly fractured marine basalt. This is overlain by deep, moderately compact glacial till on the lower hills and across rolling drift plains.

Soils are generally shallow to moderately deep with weak to moderate structure. They are well drained, medium textured (loamy) soils which overlay sedimentary and volcanic bedrock.

VEGETATION

The vegetation has been altered by extensive wildfires that occurred as late as the early 1920's. The fire resulted in dense stands of timber as the area reforested following the burn. In a short period of time, these stands became stagnated so that growth is very slow. The resulting condition is one of a doghaired forest evident around this unroaded area. Douglas-fir, western hemlock and Pacific silver fir are the main tree species.

ECOSYSTEM

The area consists primarily of Kuchler Ecotype K2 (red cedar, western hemlock, Douglas-fir) with very small amounts of Ecotype K3, Pacific silver fir and Douglas-fir in the higher elevations.

CURRENT USES

There are no developed sites within the area. Recreation use is low to moderate, with most taking place along trails and on the summit. Total RVDs of use within the area is less than 1,000.

The Semi-Primitive Motorized component of the Recreation Opportunity Spectrum (ROS) contains 2,250 acres. The remainder is Roaded Natural/Modified. Primary recreation activities are big game hunting, horseback and trail bike riding, hiking and dispersed camping. This area is one of the few areas on the Forest that offers unroaded Semi-Primitive Motorized opportunities.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

Mt. Zion has a unique visual variety of landform and rock formation as viewed from the west because of the escarpment mentioned earlier. The area's vegetation and water offer common visual variety. There are no major streams or lakes.

The area is very visible. It is seen as an island of undeveloped forest land surrounded by roads and timber harvest activities. The east side is visible from US Highway 101, while the west side is seen from several Forest roads, as well as from areas within the Buckhorn Wilderness.

As viewed from the east, Mt. Zion is a moderately steep ridge covered with a conifer forest from its base to near the eastern summit of the ridge. The western side is much steeper and has a long escarpment extending along much of the ridge. Except for the steep cliff, the west side is also covered with conifer forest.

Conditions surrounding Mt. Zion do not vary greatly. Vegetation consists primarily of dense conifer stands covering rolling to low elevation ridges. Man's activities, consisting primarily of road building, timber harvesting and fire, have modified the environment surrounding the area by giving it a mosaic of patchcuts and uncut timber in a variety of age and size classes.

The area's primary attribute is a spectacular 360 degree view from the summit looking out over the Strait of Juan de Fuca, Puget Sound, the Cascades, and into the Buckhorn Wilderness.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The Mt. Zion unroaded area is bounded almost entirely by National Forest, except for a small portion at the southeast end. Adjacent land along this portion of the area is administered by Washington State Department of National Resources.

NATURAL INTEGRITY

The Mt. Zion unroaded area was inventoried during the original RARE inventory. It has since been considered as potential Wilderness in the RARE II and Canal Front Planning planning processes. It was not selected for Wilderness classification in any of these. The Washington Wilderness Act of 1984 did not classify this unroaded area as Wilderness either, and, at that time, the area was designated as available for general forest uses. The area is currently smaller in size than when it was originally inventoried due to road construction and timber harvesting. It remains in a natural state with the exception of the existing trails and old lookout site. Foundation remnants of the old lookout are noticeable.

NATURAL APPEARANCE

Due to the areas relatively small size and close proximity to the sights and sounds of man's activities which surround the area, feelings of naturalness and expanse are lacking.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

The ability to manage the area in a natural state for Primitive or Semi-primitive recreational experiences is affected by its location and size. The area's long narrow shape and its relatively small size make it very difficult to eliminate or reduce off-site intrusions from surrounding roads, timber harvest activities, and any other associated noise or sights of human activities.

Due to the area's rugged terrain and dense vegetation, access is mostly limited to the existing trail. Once on top, cross country travel opportunities are limited to a small portion of the area that is not heavily forested. There are four proposed trails which could provide access to the summit from the other three sides. Because of the area's steep sideslopes, cliffs and dense vegetation, cross-country hiking provides the greatest opportunities for solitude and physical challenges.

SPECIAL FEATURES

There are no known threatened or endangered plants or animals within this unroaded area. A portion of a Spotted Owl Habitat Area is located at the northern end.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by volcanic and sedimentary rocks of Eocene age. The zone of contact between these two types of rock appears to have the most potential for the occurrence of metallic mineral resources. Even though this unroaded area has not been evaluated by the USGS and Bureau of Mines, available data indicates the area has a low to moderate potential for the occurrence of manganese deposits. These deposits may have associated copper, molybdenum, iron, chromium and nickel. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low.

A small part of the area lying within sections 4, 14 and 24 may be encumbered by mining claims, the validity of which has not been determined. There is no present mining activity, and under current conditions it appears they may not be valid claims. Even though the entire area is classified "prospectively valuable" for oil and gas resources, none of the area is encumbered by leases or pending lease applications.

Water

There are no major streams in the Mt. Zion unroaded area. Water originating in the area drains into the Lttle Quilcene River and Gold Creek (a tributary of the Dungeness) on the west, and Salmon, Trapper, and Snow Creek on the east.

Vegetation

This area contains about 5,200 acres (96% of area) of tentatively suitable forest land, of which about 2,700 acres are doghair. Seral stage and estimated standing volume are as follows:

		Estimated Standing Volume	
Seral Stage	Acres in Percent	Million Board Feet	Million Cubic Feet
PL	24	20.7	3.8
MS	68	117.4	21.5
LS	8	20.2	3.7
TOTAL	100	158.3	29.0

PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

Special Areas

Approximately 15 percent of the area is in riparian zones which consist primarily of small tributary streams of Gold Creek and the Little Quilcene River. The westside of Mt. Zion has a large area of cliffs several hundred feet high. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

This area is heavily used by spotted owls and a portion of the area has a Spotted Owl Habitat Area. Deer use of the area is limited. Other small mammals and birds inhabit the area.

Fisheries

There are no known fish bearing streams or lakes within the area; however, all of the previously mentioned drainages located downstream from the area support both resident and anadromous fish populations.

Cultural

Essentially there has been no reconnaissance or survey work completed in this area. Historic properties or remnants that are known to exist are not significant and it isn't likely that new discoveries will be made. It is too early to speculate with any confidence about the existence of pre-historic sites. Pre-historic sites may exist, and management will proceed with this assumption until determined otherwise.

Recreation

The Mt. Zion area has moderate potential for providing unroaded recreation opportunities. The Mt. Zion trail currently provides opportunities for hiking, backpacking, horseback and trail bike riding in an unroaded environment. Reconstruction of the Deadfall trail would provide the opportunity for a trail/road loop for trail bikes. This area is one of three unroaded areas that is currently providing roadless Undeveloped Recreation opportunities for trail bike riders. There are 23 miles of proposed trail within the area.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive Motorized	2,250	225
Roaded Natural/Modified	3,134	300
TOTAL	5,384	525

Scenery

The natural landscape character of this unroaded area consists of a moderately steep ridge with a textured vegetative cover from its base to near the eastern summit. The western side of the ridge is much steeper and has a long escarpment extending along much of the ridge. The area is visible from surrounding roads

and from the Buckhorn Wilderness, located 4 miles to the west. There are two trails within the area that offer foreground views. The Visual Quality Objectives assigned to this unroaded area are Retention, Partial Retention, and Modification.

Wild and Scenic Rivers

There are none associated with this area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Mt. Zion unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire is not known for this area. However, it is likely that large fires occurred in the past. These fires may be the cause of the extensive doghair stands that are now present on much of the area. With fire management activites that occur today, the frequency of fire in this area is no greater than other National Forest lands.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Mt. Zion Area lies approximately 6 miles east of the Buckhorn Wilderness, one-half mile east of the Quilcene unroaded area, and one-quarter mile north of the Green Mountain unroaded area.

DISTANCE FROM POPULATION CENTERS

This island of undeveloped land is within 70 miles or two hours driving time from Seattle, Washington via the Puget Sound ferry system, Hood Canal floating bridge, US Highway 101, and Forest roads. The nearest town is Quilcene, approximately 20 miles to the southeast.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest for designation as Wilderness or retention of current unroaded condition was low to moderate for this area during the RARE, RARE II, Canal Front planning processes and passage of the Washington Wilderness Act of 1984.

There is some concern to keep trails that are currently open to motor bikes excluded from wilderness classification. The Mt. Zion trail offers 1.8 miles of trail bike riding in an unroaded natural setting. There are approximately 20 miles of trail proposed for this area.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives NC-No Change, A-Current Direction and B-Departure (Modified), there would be very little, if any, adverse consequences as a result of additional restrictions on mineral exploration and development.

Under Alternatives C-Preferred (Modified), H (Modified) and I, interest in conducting exploration and development activities within areas encumbered by 10 mining claims and areas identified as having a "low" to "moderate" potential for the occurrence of manganese resources would be affected. In addition to these effects, interest in exploring for oil and gas within unleased areas classified "prospectively valuable" for oil and gas resources could be adversely affected.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from Alternatives C-Preferred (Modified), H (Modified) and I. Alternatives NC, A-Current Direction, and B-Departure (Modified), pose more risk of impacting the above resources. The risk of impacting soils, water, or Special Areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting will probably begin in the first decade in Alternatives NC (No Change), A-Current Direction, and B-Departure (Modified). Harvesting activities will increase in the second decade in these Alternatives, and in Alternative C-Preferred (Modified), then level off for the next three decades. Only Alternatives H (Modified) and I have no harvest activities scheduled.

In Alternative NC (No Change), about 5,400 acres or 96 percent of the unroaded area would be planned for timber harvest. The contribution to long-term sustained yield capacity for this alternative is about 0.7 million cubic feet per year. The emphasis for this alternative is timber management.

In Alternatives A-Current Direction and B-Departure (Modified), about 3,600 acres or 67 percent of the unroaded area would be planned for timber harvest. The contribution to long-term sustained yield capacity for each of these alternatives is about 0.5 million cubic feet per year. The emphasis for both alternatives is timber management.

Alternative C-Preferred (Modified) will have about 1,800 acres or 33 percent of the unroaded area planned for timber harvest activities. The long-term sustained yield capacity contribution for this alternative is about 0.2 million cubic feet per year. Timber harvest activities will probably start in the second decade.

Alternatives H (Modified) and I will not have any area planned for timber harvest.

WILDLIFE

Alternatives NC, A-Current Direction and B-Departure (Modified) have the greatest impact on wildlife. None of the other alternatives change the character of the unroaded area in the first decade so impacts on wildlife should be absent. By the end of the fifth decade only Alternatives H and I will have no impact.

FISHERIES

Due to management related disturbances such as road construction and timber harvesting, Alternatives NC-No Change, A-Current Direction, and B-Departure will have the most impact on fisheries habitat capability downstream from the Mt. Zion unroaded area. Alternative C-Preferred (Modified) will have a less impact than Alternatives NC, A and B. Alternatives H (Modified) and I should not significantly influence downstream fish habitat capability.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness, except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in the unroaded area may affect air quality and visibility in Wildernesses and the Park and may affect air quality in the Puget Sound trough.

The fire suppression objective for the designated SOHA portion of the unroaded area is to minimize the acreage burned.

CULTURAL

The consequences to cultural resource values will not change significantly with implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low, as will the consequences. Some historic properties may deteriorate and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat similar for Alternative C-Preferred (Modified) since increases in ground disturbing activities are only moderately higher than in Alternatives H (Modified) and I.

Alternatives B-Departure (Modified), A-Current Direction, and NC-No Change may affect cultural resources substantially. More sites will be discovered, some may be impacted. Significant historic properties are not expected to be found, although further deterioration may take place. Pre-historic sites may be discovered and impacted as opposed to being left intact under other alternatives.

RECREATION

The No Change Alternative would have the greatest effect on unroaded recreation in this unroaded area. All 5,400 acres are allocated to either Timber Management or Municipal Watershed and, therefore, would eventually be eliminated as an unroaded area. Alternative B-Departure (Modified) does not allocated any of this unroaded area to recreation, however, 1,800 acres would remain unroaded for spotted owl habitat. The remaining 3,600 acres are allocated to Timber Management. Alternative A-Current Direction is very similar to Alternative B-Departure (Modified) except 2,200 is allocated to Timber Management and 1,400 is allocated to Municipal Watershed. Alternative C-Preferred (Modified) allocates 1,800 to Undeveloped Motorized Recreation and 1,800 acres to spotted owl habitat for a total of 3,600 acres to remain unroaded. The remaining 1,800 acres are allocated to Timber Management under the Preferred alternative. Under both Alternatives H and I, there would be 3,600 acres allocated to Undeveloped Motorized Recreation and 1,800 allocated to spotted owl habitat. The entire area would remain unroaded under both of these alternatives.

SCENERY

The Mt. Zion unroaded area is not within one of the twenty viewsheds on the Forest. The No Change Alternative would have the greatest effect on scenery as the entire unroaded area is allocated to either Timber Management or Municipal Watershed. This unroaded area could have a heavily altered appearance under the No Change Alternative. Alternatives A-Current Direction and B-Departure (Modified) would retain 1,800 acres in a natural appearance. The remaining 3,600 acres could be heavily altered as it would be managed for Timber Management in Alternative B-Departure (Modified) and Timber Management and Municipal Watershed in Alternative A-Current Direction. Alternative C-Preferred (Modified) Alternative would retain 3,600 acres in a natural appearing condition and the remaining 1,800 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternatives H and I would have the greatest protection for scenery as the entire area would remain unroaded and, therefore retain its natural appearance.

WILD AND SCENIC RIVERS

There are none associated with this area.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-8. The figures show estimated development for the 50-year planning horizon in total, and are included in the road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Table C-8. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	10	9	4	7	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 47 person-years. Conversely, an average of 3 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-9 below. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-9. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	47	33	33	13	3	3

LOCAL COMMUNITIES

The expected affects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternatives No Change, A-No Action, B-Departure and C-Preferred (Modified) would remove the area from future consideration as Wilderness. Alternative No Change would eliminate the entire area while the other three alternatives would reduce size of the unroaded area to less than 5,000 acres.

Alternatives H (Modified) and I would retain the option of future consideration of the area for Wilderness.

Table C-10. Mt. Zion 5,384 Acres (5.4) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	0	0	0
Undeveloped Recreation (Motorized) A1B	0	0	0	1.8	3.6	3.6
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	1.8	1.8	1.8	1.8	1.8
Timber Management E1	4.0	2.2	3.6	1.8	0	0
Municipal Watersheds F1	1.4	1.4	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	5.4	5.4	5.4	5.4	5.4	5.4

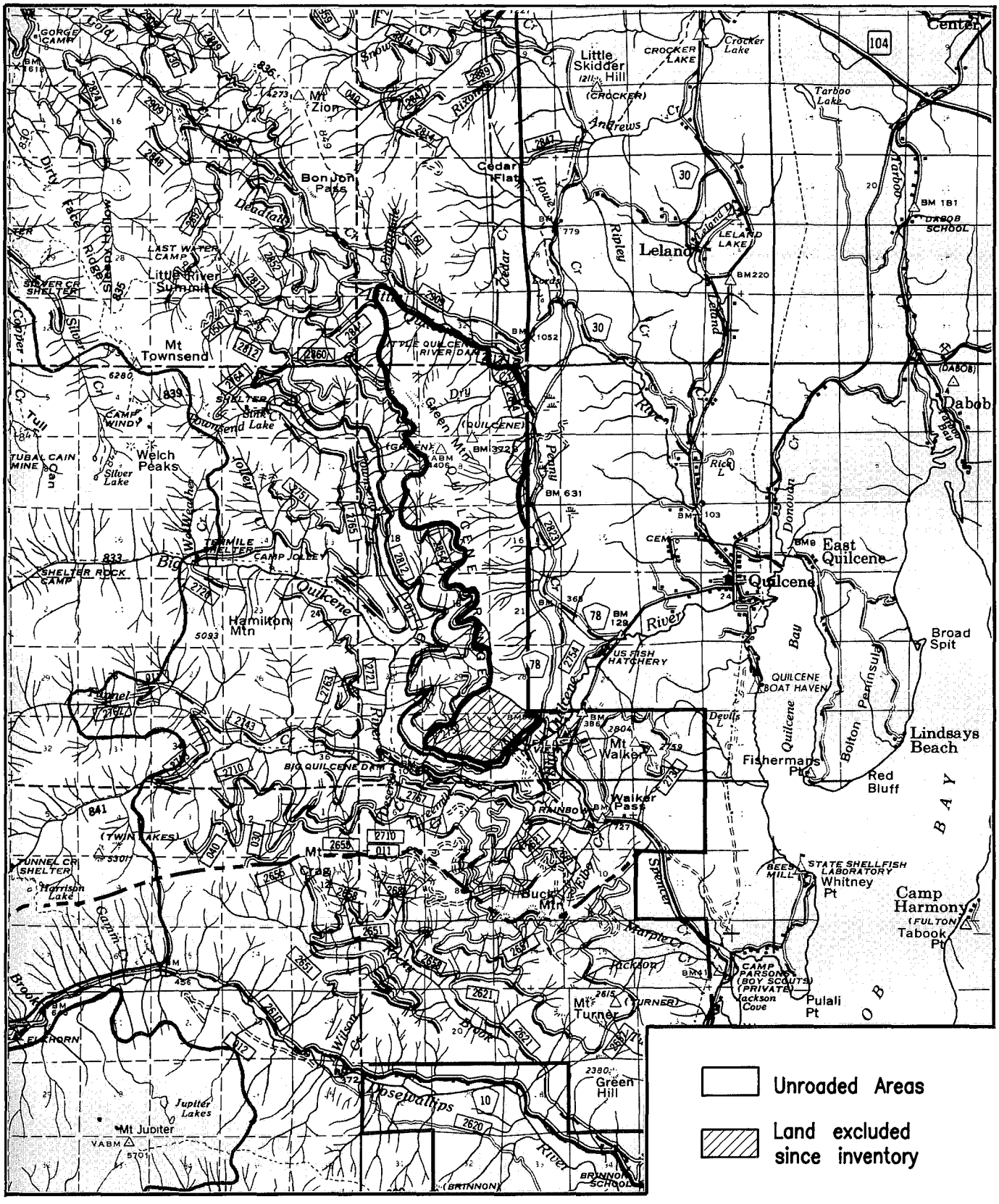


Figure C-4. GREEN MOUNTAIN UNROADED AREA

GREEN MOUNTAIN UNROADED AREA (4,561 acres)

DESCRIPTION

HISTORY

The Green Mountain unroaded area has been evaluated for its Wilderness attributes in four separate studies. In all four, RARE, RARE II, Canal Front, and the 1984 Washington Wilderness Act, the area was allocated to or designated for general forest uses. The area is slightly smaller today than when it was originally identified in the RARE process.

The Canal Front planning process identified the east side of this area as an important scenic backdrop from the metropolitan areas of Puget Sound. Management direction for this part of the area specifies that visual quality objectives should be met. Other parts of the area are to be managed for general forest uses.

LOCATION AND ACCESS

The Green Mountain unroaded area abuts the eastern boundary of the National Forest near the town of Quilcene and extends the length of Quilcene Ridge. Green Mountain is the highest point of the ridge. The area is approximately seven miles long, usually less than two miles wide, and consists primarily of the east facing slopes of this Range.

Extensive roading and logging has occurred on land surrounding Green Mountain. It is separated from the more remote Buckhorn Wilderness to the west by development in both the Big and Little Quilcene drainages. This ridge is a middleground focal point from the town of Quilcene, US Highway 101, and the observation point on Mt. Walker. It is seen from many areas in the Puget Sound Basin as a background ridge leading into the high country.

Easy access to near the top of the range is provided by the road system in the Big and Little Quilcene drainages. Access into the area is a little more difficult due to the lack of trails and the dense stands of trees usually encountered.

PHYSIOGRAPHY AND SOILS

Elevation ranges from about 1,000 feet near the Little Quilcene River to 4,413 feet at the summit of Green Mountain.

Bedrock in this area is composed of dark gray marine basalt and basaltic breccia which are moderate to highly fractured. There are some inclusive graywacke and sandstone. The basalts and basaltic breccia are competent (non-crumbly) to moderately competent. Overlying the basalt, and occurring intermittently elsewhere, is moderately deep to very deep, compact, coarse textured glacial till.

Soils exhibit little morphological development. They are generally shallow, weakly structured, well drained, gravelly, medium textured (loamy) soils derived from basalt on sedimentary bedrock.

VEGETATION

Most of the area has been burned over, changing the vegetative character from larger, old-growth trees to stagnated, dense stands (doghair). The dominant tree species is Douglas-fir.

ECOSYSTEM

The area consists mostly of Kuchler Ecotype K2 (red cedar, western hemlock, Douglas-fir) in which minor occurrences exist in a doghair condition. There are small amounts of Ecotype K3, Pacific silver fir and Douglas-fir, in the higher elevations.

CURRENT USES

The area is completely surrounded by roads. However, recreation use within the area is minimal. There are no developed recreation sites, trails, or dispersed camp sites. Recreational use is minimal, with hunting being the most popular activity. RVDs of use are less than 50 per year.

The Green Mountain area consists of approximately 2,300 acres of Semi-Primitive Nonmotorized and the remaining acres are in the Roaded Natural/Modified ROS class.

Opportunity exists for development of a lowland trail on the eastern flank of the ridge. A few groups of people have sought development of what is termed the East Rim Hiking Trail for year round use.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

The area has a common visual variety of landforms, vegetation, and rock formations. Short, but steep, creeks drain the area. There are no major rivers or lakes. The entire area is viewed as a moderately steep ridge with an undulating ridgetop. A dense forest of conifers covers most of the area.

From the ridgetop, a panoramic view of the Olympic mountains, Puget Sound and the Cascade mountains is the most significant attraction. The area is viewed as a scenic backdrop from the town of Quilcene.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The Green Mountain unroaded area is bounded on the north, west, and south by National Forest and on the east by Washington State Department of Natural Resources land. This area is an island of undeveloped land surrounded by roads and cutover land.

NATURAL INTEGRITY

This unroaded area was inventoried with the original RARE inventory. It has since been evaluated as potential Wilderness in the RARE II and Canal Front planning processes. It was not selected for Wilderness classification in any of these efforts. The Washington Wilderness Act of 1984 did not classify this unroaded

area as Wilderness and, at that time, it was made available for general forest uses. This unroaded area is currently smaller in size than its original RARE inventoried size due to recent road construction and timber harvesting. The current unroaded area remains in a natural state.

NATURAL APPEARANCE

Due to the relatively small size and close proximity of the area to nearby management activities, it lacks the feeling of naturalness and expanse.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

The ability to manage the area in a natural state for Primitive or Semi-primitive recreational experiences is affected by its size and boundary. The area's relatively small size and its long narrow shape make it difficult to eliminate or reduce off-site intrusions from surrounding roads, timber harvest activities and other noise and sights of human activities.

SPECIAL FEATURES

There are no known threatened, endangered, or sensitive plants or animals within this unroaded area.

HISTORIC AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education or scientific and historic study in the area which cannot already be found in existing Wilderness on the Forests.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by volcanic rocks of Eocene age. Even though it has not been evaluated by the USGS and Bureau of Mines, available data indicates the area has at least a low potential for the occurrence of manganese deposits. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low. None of the area is encumbered by mining claims, and there is no present mining activity. Even though the area is classified "prospectively valuable" for oil and gas, none of the area is encumbered by leases or pending lease applications.

Water

The only known named stream is Dry Creek, located in the northeast corner. Watershed values are important since water originating here feeds the Little Quilcene River to the north, the Big Quilcene River to the south and west, and Penny Creek, a tributary of the Big Quilcene, to the east. The contribution to

domestic use is slight since the intakes are located above the point where the area's streams enter the major rivers. Penny Creek supplies the fish hatchery located on the Big Quilcene River.

Vegetation

This area contains about 4,140 acres (91 percent of area) of tentatively suitable forest land. There are minor isolated occurrences of doghair stands within this area. The seral stages and estimated standing volumes are shown on the next page.

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
BG	8	--	--
SS	4	--	--
PL	39	27.3	5.0
MS	48	66.1	12.1
LS	1	2.2	0.4
TOTAL	100	95.6	17.5

BG = Pioneer Stage SS = Early Stage PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.5 million cubic feet per year.

Special Areas

Approximately 15 percent of the area is in riparian zones which consist of small tributary streams of the Big and Little Quilcene Rivers and Penny Creek. Small cliffs are scattered throughout the area. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Deer as well as other common forest birds and mammals make use of the area.

Fisheries

There are no known fish bearing streams, lakes or ponds within the area. Downstream resources in the Little Quilcene and Big Quilcene River systems include both resident and anadromous fish populations.

Cultural

There has been no specific survey or reconnaissance work completed in this area. The Olympic National Forest Overview Report for cultural resources does not list any sites. Most of the early trail system and associated activities were confined to the valley bottoms. Historic maps show one trail running east and west through the area, but this trail has been long since abandoned. The old Port Townsend water line is located on the eastern boundary and may meet some National Register criteria.

Recreation

The Green Mountain unroaded area has very little potential for providing unroaded recreation opportunities. The area is relatively small in size and does not have any recreation attractions other than big game hunting. There are no climbing routes or proposed trails within the area.

Approximately 50 percent of the area is in the Semi-Primitive Nonmotorized ROS class. The remaining 50 percent is classified as Roaded Natural/Modified since it is within one-half mile of several roads. The area has a potential recreation capacity of approximately 450 RVDs per year.

Scenery

This unroaded area has a natural landscape character consisting of steep side slopes along an undulating ridge that is covered with a textured conifer forest. The area is visible from the Mt. Walker observation site, Highway 101, and the town of Quilcene. The Visual Quality Objectives assigned to this area are Partial Retention and Modification.

Wild and Scenic Rivers

There are none associated with this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Green Mountain unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire is not known for this area. However, it is likely that large fires occurred in the past. These fires may be the cause of the extensive doghair stands that are now present on much of the area. With fire management activites that occur today, the frequency of fire in this area is no greater than other National Forest lands.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Green Mountain unroaded area lies immediately south of the Mt. Zion unroaded area and approximately 4 miles east of the Buckhorn Wilderness.

DISTANCE FROM POPULATION CENTER

The area is 60 miles or approximately an hour and a half from Seattle, Washington via the Puget Sound ferry system, Hood Canal floating bridge, and US Highway 101. The town of Quilcene is within 3 miles of the eastern boundary.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Past public interest in this unroaded area has been aimed primarily at protecting its visual qualities as viewed from the local community of Quilcene and travel ways throughout the Puget Sound basin. The area is currently one of two areas on the Forest where any proposed management activities must meet the established visual quality objectives.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction and B-Departure (Modified) and NC-No Change, there would be very little, if any, adverse consequences as a result of additional restrictions on mineral exploration and development.

Under Alternatives C-Preferred (Modified), H (Modified) and I, interest in conducting exploration and development activities within areas encumbered by mining claims would not be affected. However, areas identified as having a "low" potential for the occurrence of manganese resources would be. In addition, under these alternatives, interest in exploring for oil and gas within unleased areas classified "prospectively valuable" for oil and gas resources could be adversely affected.

SOIL, WATER AND SPECIAL AREAS

There should be no affect to soils, water, or Special Areas (riparian) from Alternatives H (Modified) and I. Alternative C-Preferred (Modified), should have little risk of affecting the above resources. Alternatives NC, A-Current Direction and B-Departure (Modified) pose more risk of impacting the above resources. The risk

of impacting soils, water, or special areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities will likely begin in the first decade in all alternatives except H (Modified) and I. Harvesting will increase in the second decade and then level off for the next three decades.

Alternative NC (No Change) will have about 4,140 acres or 91 percent of the unroaded area planned for timber harvest. The long-term sustained yield capacity contribution to timber management for this alternative is about 0.5 million cubic feet per year.

Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) will each have about 3,800 acres or 83 percent of the unroaded area planned for timber harvest. The long-term sustained yield capacity contribution for each of these alternatives is about 0.4 million cubic feet per year. The emphasis for both alternatives is timber management.

Alternatives H (Modified) and I do not allow timber harvest.

WILDLIFE

Only Alternatives NC, A-Current Direction and B-Departure will have an impact on wildlife during the first decade. Except for Alternatives H (modified) and I, all of the alternatives will have an impact by the fifth decade.

FISHERIES

In the first decade, Alternatives NC, A-Current Direction, B-Departure (Modified), and C-Preferred (Modified) will all impact downstream fish habitat capability due to associated timber management activities. Alternatives NC, A and B-Departure (Modified) will have the greatest effect whereas, Alternative C-Preferred (Modified), will have a lesser impact. Alternatives H (Modified) and I should have no effect. By the end of the fifth decade, Alternatives NC, A-Current Direction and B-Departure (Modified) will still generate the greatest impacts. Alternative C-Preferred will have less impact than NC, A or B-Departure (Modified) and Alternatives H (Modified) and I should have no impact on downstream fisheries resources.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than those in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in these Wildernesses and the Park and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences to cultural resource values will not change significantly with the implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low as will be the consequences. Some historic properties may deteriorate and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat greater for Alternative C-Preferred (Modified) due to increases in ground disturbing activities over Alternatives H (Modified) and I.

Alternatives B-Departure (Modified), NC-No Change and A-Current Direction may affect cultural resources substantially. More sites are likely to be discovered, some may be impacted. Significant historic properties are not expected to be found although further deterioration may take place. Pre-historic sites may be discovered and impacted as apposed to being left intact under other alternatives.

RECREATION

The No Change Alternative would have the greatest effect on recreation. None of this unroaded area would be allocated to recreation and the entire area would be allocated to either Scenic, 2,900 acres, Timber Management, 900 acres, and Municipal Watershed, 700 acres. Under this alternative, none of the area would remain unroaded. Alternative B-Departure (Modified) would have similar effects as Alternative NC as none of the area would be allocated to recreation. 700 acres would remain unroaded and allocated to spotted owl habitat. The remaining 3,800 acres would be allocated to Timber Management. Alternative C-Preferred (Modified) would not allocate any of the area to unroaded recreation, however, 700 acres would remain unroaded as spotted owl habitat. The remaining 3,800 acres would be subject to timber harvesting with 2,200 allocated to Scenic and 1,600 allocated to Timber Management. Alternative A-Current Direction would not allocate any of the area to recreation either; however, 1,800 acres would be allocated to spotted owl habitat. Both Alternatives H and I would allocate 3,800 acres to Undeveloped Non-motorized Recreation and the remaining 700 acres to spotted owl habitat. The entire area would remain unroaded in both of these alternatives.

SCENERY

The east side of the Green Mountain Unroaded Area is within the Mt. Walker viewshed and is seen as a scenic backdrop from Highway 101 and from the Mt. Walker Observation site. The No Change Alternative would have 2,900 acres allocated to scenery in which the visual quality objectives must be met. The area allocated to scenery would either have a natural appearance or appear slightly altered. The remaining 1,600 acres could have a heavily altered appearance. Alternative B-Departure (Modified) would have the greatest effect on scenery. Only 700 acres would remain in a natural appearing condition while the remaining 3,800 acres would be allocated to Timber Management and could have a heavily altered appearance. Alternative A-Current Direction would have 2,900 acres allocated to scenery that would have a natural or slightly altered appearance and 700 acres allocated to spotted owl habitat that would remain in a natural appearing condition. The remaining 900 acres would be allocated to either Timber Management or Municipal Watershed and could have a heavily altered appearance. Alternative C-Preferred (Modified) would allocate 2,200 acres to scenery and would appear as a natural or slightly altered area.

700 acres would be allocated to spotted owl habitat and would remain in a natural appearing condition. The remaining 1,600 acres would be allocated to Timber Management and could have a moderate or heavily altered appearance. Both Alternatives H and I would allocate 3,800 acres to Undeveloped Non-motorized Recreation and 700 acres to spotted owl habitat. The entire area under these two alternatives would remain in a natural appearing condition and, therefore, offer the greatest protection for scenery. Alternative B-Departure (Modified) is the only alternative that would not provide any protection for the scenery within the viewshed portion of this unroaded area.

WILD AND SCENIC RIVERS

There are none associated with this area.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-11. The figures show estimated development for the 50-year planning horizon in total, and are included in the road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in Table C-11 is needed to serve timber harvest by conventional logging systems. Alternative A-Current Direction also includes substantial use of highly sophisticated logging systems (predominantly helicopter), as this is the most efficient means of conducting timber harvest while also meeting the visual quality objectives specified in current direction. Road construction to serve these systems will be minimal.

Table C-11. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	4	6	8	7	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield contribution, is 33 person-years. Conversely, an average of 3 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-12 below. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-12. Employment Potential (Person-Years/Year)

	Alternatives					
	No Change	A-Current Direction	B-dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	33	27	27	27	3	3

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternatives No Change, A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) would remove the area from future consideration as Wilderness.

Alternatives H (Modified) and I could retain the entire area in an unroaded condition. However, because the area's existing size is less than 5,000 acres and it is not adjacent to an existing Wilderness it is not likely to be considered for future Wilderness.

Table C-13. Green Mountain 4,561 Acres (4.5) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	0	3.8	3.8
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	2.9	2.9	0	2.2	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	0.7	0.7	0.7	0.7	0.7
Timber Management E1	0.9	0.2	3.8	0	0	0
Municipal Watersheds F1	0.7	0.7	0	1.6	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	4.5	4.5	4.5	4.5	4.5	4.5

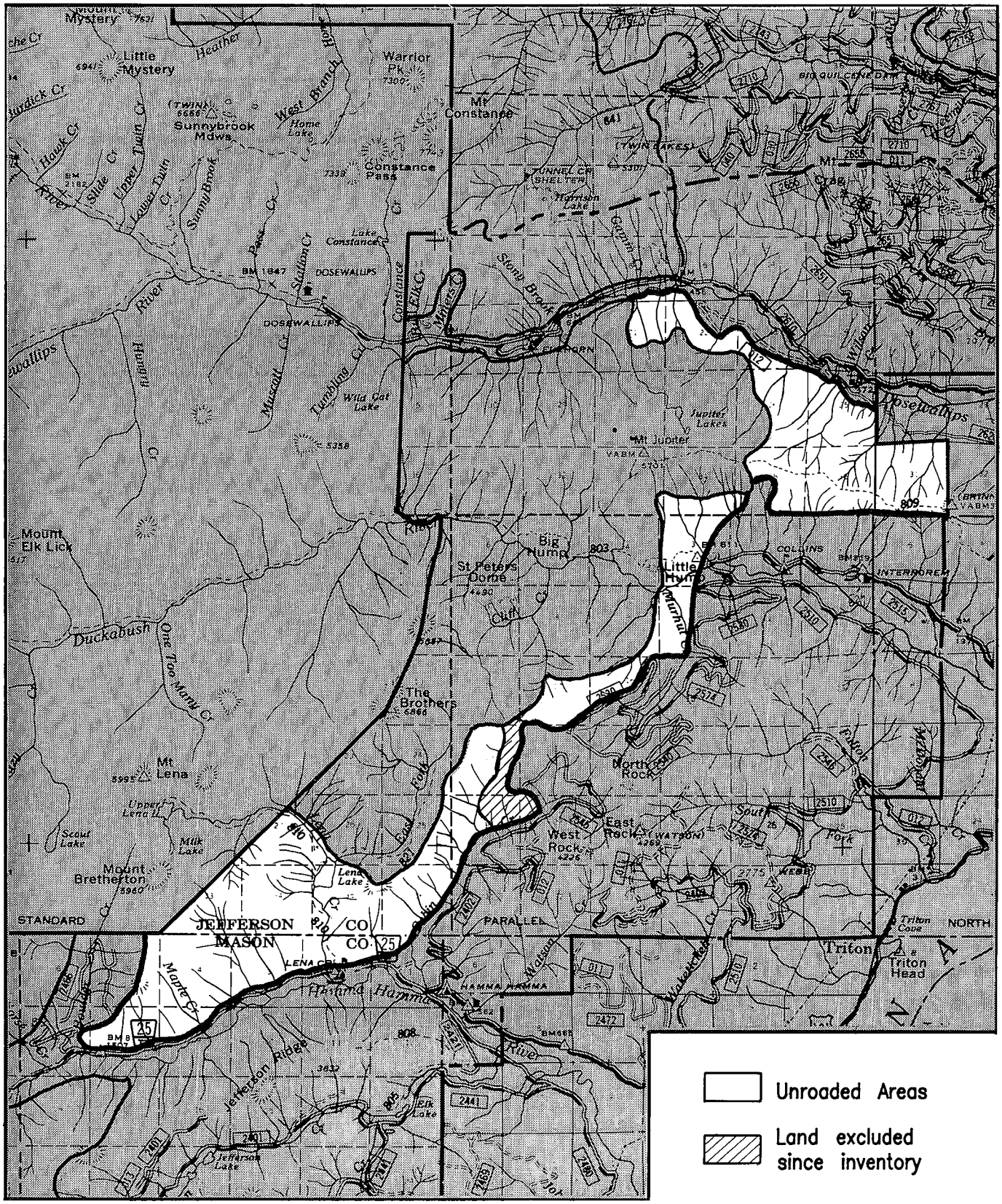


Figure C-5. JUPITER RIDGE UNROADED AREA

JUPITER RIDGE UNROADED AREA (8,308 acres)

DESCRIPTION

HISTORY

The Jupiter Ridge unroaded area was originally inventoried as part of The Brothers unroaded area in the RARE inventory process. In RARE, The Brothers unroaded area consisted of 23,909 acres of which 13,229 acres were proposed for study as Wilderness. In RARE II, The Brothers unroaded area consisted of 27,629 acres, of which 16,113 acres were proposed as administratively endorsed Wilderness. The remaining 11,516 acres were allocated for non-Wilderness uses.

In May 1979, a Final Environmental Impact Statement prepared for the Land Management Plan for the Canal Front Planning Unit allocated acres of The Brothers unroaded area for Further Planning for Wilderness, 2,275 acres to the Lena Lake Special Management Area, and the remaining acres to general forest uses. Management of Lena Lake Special Management Area is aimed at maintaining and enhancing the recreation resource.

The Washington Wilderness Act of 1984 established The Brothers Wilderness with a total of 16,682 acres. The remaining roadless acres that were excluded from the 1984 Wilderness Act are now included in the Jupiter Ridge unroaded area and were designated for general forest uses.

LOCATION AND ACCESS

The Jupiter Ridge unroaded area is located in the center of the Hoodsport Ranger District. It extends from the Dosewallips River on the north to the Hamma Hamma River drainage on the south. The area is a narrow section of land situated between The Brothers Wilderness, Olympic National Park and developed Forest land. Extensive roading provides ready access to the boundary on all but the west side.

The small town of Brinnon is the closest town to the northern portion and Eldon is the closest town to the southern portion.

The area has three separate trails that provide foot access into the area. The Lena Lake and Upper Lena Lake trails provide access into the southern portion of the area and the Mt. Jupiter Trail provides access to Jupiter Ridge in the northern section.

PHYSIOGRAPHY AND SOILS

Elevation ranges from about 600 feet near the Dosewallips River to 4,800 feet in the western headwaters of Cabin Creek.

The bedrock in this rugged and steep area is composed of graywacke, brittle black argillite, red limy argillite, mudstone, and altered basalt. The graywacke and basalt are generally competent (non-crumbly) while the argillites and mudstone are moderately competent. Basalt and sedimentary rock outcrops occur on high ridges and barren sideslopes.

Soils on ridges and sideslopes consist primarily of shallow, well drained medium textured (loamy) soils. Midslope and toeslope soils consist primarily of deep, well drained, gravelly medium textured soils.

VEGETATION

Most of this area is vegetated with a conifer forest consisting mostly of Douglas-fir, western hemlock, and western redcedar. Salal, coastal rhododendron, and western swordfern are common understory plants.

ECOSYSTEMS

This unroaded area has a diversity of young and old-growth throughout all elevations. The area contains Kuchler Ecotypes K2, K3, K4, and small amounts of K45 (meadows).

CURRENT USES

Lena Lake campground is the only developed site within the area. Located along the northwest and north shore of the lake, this 29 unit campground is the most popular backcountry camping area on the Forest. The campground and lake are reached by hiking the 4.5 mile Lena Lake trail. The trail and campground receive over 9,000 RVDs of use annually while the remainder of the area receives less than 2,000 RVDs. This large low elevation backcountry lake supports a "put and take" fisheries and receives heavy fishing pressure.

The Upper Lena Lake trail provides access from Lena Lake to Upper Lena Lake, which is in Olympic National Park. The Mt. Jupiter trail is a major access route into The Brothers Wilderness providing access to Jupiter Lakes. All three trails in the area are closed to motor bikes. Lena Lake and Upper Lena Lake trails are also closed to pack and saddle stock.

Approximately 5,900 acres are in Semi-Primitive Nonmotorized, 300 acres in Semi-Primitive Motorized, and the remaining are in the Roaded Natural/Modified ROS class. The major recreational activities are back-packing, hiking, fishing, and lake-side camping. Dispersed camping is very limited due to steep and rugged topography.

The Black Hump prospect in the western upper reaches of Cabin Creek and the North Pole Quartz prospect on the ridge east and slightly south of Lena Lake are the only known manganese deposits in the area. There may be occurrences of manganese and iron oxide in basalt over a very small area but no work has been done on these deposits. Geological evidence indicates that the probability of finding economically developable ore is unlikely.

Two overlapping power site classifications, the first withdrawn in 1927 and the other in 1951, apply to a one quarter mile wide strip on both sides of the Duckabush River. Two potential reservoir sites for hydro-electric power generation have been inventoried on the Duckabush River. One is located within one-half mile of the Park boundary and the other is at Big Hump. Potential output at both of these sites is rated at less than 10 megawatts. Two sites have also been inventoried on the Dosewallips but neither would appreciably affect the area. Lena Lake has been inventoried as the upper reservoir for a potential pumped storage-peak power generating facility. Lena Creek below Lena Lake has been inventoried as a potential run-of-river hydroelectric project site. In the early and mid-1980s, Rainsong Company studied the stream for a hydroelectric project. In addition, Kitsap County PUD #1 has applied for water rights on the Duckabush, but none have been granted as of 1985.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

This unroaded area consists of common visual variety in landforms, rock formations, waterbodies, and vegetation. There are moderate to steep slopes that extend upward to the summits of Mt. Jupiter and The Brothers, both of which are inside Wilderness. A dense conifer forest blankets the area except for rock outcrops along the higher ridgetop elevations.

The area is visible from much of the surrounding area including the Jefferson Ridge unroaded area, The Brothers and Mt. Skokomish Wildernesses and Olympic National Park.

The major attraction is the popular, 55 acre, Lena Lake. Secondary attractions are panoramic views from Jupiter Ridge and trail routes through the area accessing The Brothers Wilderness and Olympic National Park.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The Jupiter Ridge unroaded area is bounded almost entirely by National Forest. There is a small portion of the area near its southwest boundary that is next to Olympic National Park. Its north, east, south, and a small section of its western boundary are adjacent to roads and timber harvest units. The majority of its western boundary is The Brothers Wilderness and a small portion of Olympic National Park. The north and east section of the area is very narrow and irregular in shape. The southern section is a much wider area.

Human intrusions and the sights and sounds of nearby management activities, such as logging roads and harvest units, are noticeable from most of the area.

NATURAL INTEGRITY

The current Jupiter Ridge unroaded area consists of small, narrow areas, in addition to Lena Lake basin, which were not included in The Brothers Wilderness which was created with the Washington Wilderness Act of 1984. This unroaded area is currently smaller in size due to recent road construction and timber harvesting activities in the central eastern portion. The remaining acres within the area appear in their natural state and are free of human influences other than those associated with the existing trails and Lena Lake campground.

NATURAL APPEARANCE

Although irregular in shape, the topography is diverse enough to provide visitors opportunities to seek out drainages and areas that appear natural and isolated from human activity and development. However, it is possible to observe nearby management activities from many of the higher elevations. Also, the Lena Lake area receives such heavy use that isolation from other visitors is very difficult in this portion of the unroaded area.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

The ability to manage the area in a natural state for Semi-primitive recreational experiences is limited by its shape. Those portions that are narrow consist of steep slopes extending from ridge top or midslope Wilderness boundary lines down to adjacent roads or harvest units. In these narrow sections it would be very difficult to get away from off-site intrusions.

The Lena Lake area, meanwhile, is a much wider portion and has the potential to provide Semi-primitive experiences. However, due to the heavy recreational use this area receives, a true primitive experience would be very difficult to achieve.

Cross-country travel and ridge top scrambling are opportunities for challenge.

SPECIAL FEATURES

There are no known threatened, or endangered plants or animals within this unroaded area. There is a Spotted Owl Habitat Area located in the Lena Lake area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by volcanic rocks of Eocene age. Even though this unroaded area has not been studied in detail by the USGS and Bureau of Mines, available data indicate the area has a low to moderate potential for the occurrence of manganese deposits, which may have associated copper, molybdenum, iron, chromium and nickel (Lawson and Evarts, 1983). Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of these commodities is low.

A small part of the area in Section 9, T.24N., R.4W. may be encumbered by mining claims, the validity of which has not been determined. There is presently no mining activity, and under current conditions, it appears they may not be valid claims. This area has not been classified "prospectively valuable" for leasable mineral commodities, and it has no leases or pending lease applications.

Water

There are no major rivers with headwaters in the area although the Duckabush, originating in the Park, passes through the mid-section. The Dosewallips skirts the northern boundary and the Hamma Hamma lies just below the southern boundary.

Lena Lake, a 55 acre lake at 1800 feet elevation, is the only lake within the area.

Vegetation

This area contains about 6,380 acres (77 percent of area) of tentatively suitable forest land of which about 120 acres are doghair. The seral stages and estimated standing volumes are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
SS	8	--	--
PL	35	37.7	6.9
MS	18	38.2	7.0
LS	39	121.8	22.3
TOTAL	100	197.7	36.2

SS = Early Stage PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.8 million cubic feet per year.

Special Areas

Approximately 15 to 20 percent of the area is in riparian zones which consist of small tributary streams in the Dosewallips, Duckabush, and Hamma Hamma drainages. The northern boundary is adjacent to several major floodplains of the Dosewallips River. Cliffs and talus slopes are common in higher elevations. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

This area provides good big game transition range between winter and summer habitat. Other common wildlife species make use of the area. There is a Spotted Owl Habitat Area within the boundary of this area.

Fisheries

The Duckabush and Dosewallips Rivers support both resident and anadromous fish populations. The on-National Forest reach of the Hamma Hamma River provides habitat for resident trout populations. Lena Lake supports resident trout which are managed on a put-and-take basis.

Cultural

Minor portions of this area have been professionally surveyed. Some reconnaissance work has also been completed. Not much is known about pre-historic use. Historic evidence and reports have been documented in the Olympic National Forest Overview Report for cultural resources. Historic use generally involved minor hunting, trapping, and mining. Forest Service work during its custodial period, with resulting trails, look-outs, shelters, etc. may be found. There are some recorded railroad logging grades within this area. Remains found to date all lack integrity and it isn't likely that any National Register eligible properties will be found.

Recreation

The Jupiter Ridge unroaded area has moderate potential for providing visitors with opportunities for unroaded recreation. There are three popular trails in the area that provide opportunities for hiking and backpacking, however, opportunities for trailside camping are limited due to steep topography and vegetation. The Upper Lena Lake trail provides access into Olympic National Park, with Upper Lena Lake as the major destination. The Jupiter Ridge trail provides access into The Brothers Wilderness, with Jupiter Lakes and the summit of Mt. Jupiter as the main destinations. The Lena Lake trail provides hiking access to Lena Lake and Lena Lake campground. Recreation facilities at the campground consists of steel fire rings, cleared tent pads, signs, bulletin boards, and pit toilets. There is a 1.5 mile trail proposed along the south and east shore of Lena Lake. This short trail would provide visitors with access to The Brothers trail without having to hike through the popular campground.

Estimated capacity by ROS Class is as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive Nonmotorized	5,900	590
Semi-Primitive Motorized	300	30
Roaded Natural/Modified	2,108	210
TOTAL	8,308	830

Scenery

The natural landscape character of this area consists of portions of river bottoms, steep side slopes and ridge tops. Dense conifer forests blanket most of the land. The area is visible from several forest roads, Buckhorn, The Brothers and Mt. Skokomish Wildernesses, and from a trail and climbing routes that access the area. The Visual Quality Objectives assigned to this area are Retention, Partial Retention, Modification, and Maximum Modification.

Wild and Scenic Rivers

Portions of the Dosewallips (south bank), Duckabush, and Hamma Hamma (north bank) Rivers flow through or near this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Jupiter Ridge unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire is not known for this area. However, it is likely that large fires occurred in the past. These fires may be the cause of the extensive doghair stands that are now present on much of the area. With fire management activites that occur today, the frequency of fire in this area is no greater than other National Forest lands.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Jupiter Ridge unroaded area lies adjacent to The Brothers Wilderness and Olympic National Park. The Buckhorn Wilderness is immediately north of the unroaded area and the Mt. Skokomish Wilderness is less than one mile east of the southern portion of the area.

DISTANCE FROM POPULATION CENTERS

The northern portion of the Jupiter Ridge unroaded area is within 75 miles or less than 2 hours driving time from Seattle, Washington. Brinnon is the nearest town to the northern portion of the area and Eldon is the closest town to the southern portion. The eastern boundary is within 3-5 miles of US Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest and input was high for this area when it was part of The Brothers unroaded area prior to Wilderness classification in 1984. The Jupiter Ridge unroaded area consists of the acres of The Brothers unroaded area that were not classified as part of The Brothers Wilderness. There continues to be high interest for keeping the Lena Lake basin in an unaltered condition. About 2,275 acres surrounding Lena Lake have been placed in a Special Management designation in current plans. Management is aimed at maintaining and enhancing unroaded recreation opportunities.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction, C-Preferred (Modified), H (Modified) and I, interest in conducting exploration and development activities within areas identified as having a "low" to "moderate" potential for the occurrence of manganese resources would be affected. However, of these alternatives only under Alternatives C-Preferred (Modified), H (Modified) and I would 11 and 34 mining claims be affected respectively. Since none of the area is classified "prospectively valuable" for oil and gas resources, the effects that Alternatives A-Current Direction, C-Preferred (Modified), H (Modified) and I would have on this mineral resource appear negligible.

Under Alternatives B-Departure (Modified) and NC-No Change there would be very little, if any, adverse consequences.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or special areas (riparian) from Alternatives C-Preferred (Modified), H (Modified), and I. Alternatives NC, A-Current Direction, and B-Departure (Modified) pose some risk of impacting the above resources. The risk of impacting soils, water, or special areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified), and C-Preferred (Modified), and in the second decade under Alternative H (Modified). The harvest level would increase in the second decade for Alternatives NC (No Change), A-Current Direction, B-Departure (Modified), and C-Preferred (Modified), before leveling off.

Alternative NC (No Change) will have about 6,200 acres or 75 percent of the unroaded area planned for timber harvest. The long-term sustained yield capacity for this alternative is about 0.7 million cubic feet per year.

In Alternative A-Current Direction, about 5,000 acres or 60 percent of the area would be planned for timber harvest. The long-term sustained yield capacity contribution to timber management is about 0.6 million cubic feet per year. The emphasis is timber management, with the land near Lena Lake and in the Duckabush Wild and Scenic river corridor maintained in a natural condition.

In Alternative B-Departure (Modified), about 6,380 acres or 77 percent of the area would be planned for timber harvest. The long-term sustained yield capacity contribution is about 0.8 million cubic feet per year. The emphasis is timber management.

Alternative C-Preferred (Modified) has about 3,300 acres or 39 percent of the unroaded area planned for timber harvest. The long-term sustained yield capacity contribution is about 0.4 million cubic feet. The emphasis is on meeting visual quality objectives (Hamma Hamma drainage), providing Wild and Scenic rivers (Duckabush River), and natural appearing areas (Lena Lake and Jupiter Ridge).

In Alternative H (Modified), about 500 acres or 6 percent of the area would be planned for timber harvest. The long-term sustained yield capacity contribution to timber production is about 0.1 million cubic feet per year. The emphasis is timber management, with the land near Lena Lake and in the Duckabush Wild and Scenic river corridor maintained in a natural condition.

Alternative I does not include timber harvest.

WILDLIFE

Alternatives NC and B-Departure (Modified) will have the greatest impact on wildlife. Alternative A-Current Direction has less of an impact followed by Alternative C-Preferred (Modified). There is a very small impact from Alternatives H (Modified) and I. These impacts are fairly constant through the fifth decade.

FISHERIES

In the first decade, Alternatives NC, A-Current Direction, B-Departure (Modified), and C-Preferred (Modified) will all impact downstream fish habitat capability due to associated timber management activities. Alternatives NC, A and B-Departure (Modified) will have the greatest effect whereas, Alternative C-Preferred (Modified), will have a lesser impact. Alternatives H (Modified) and I should have no effect. By the end of the fifth decade, Alternatives NC, A-Current Direction and B-Departure (Modified) will still generate the greatest impacts. Alternative C-Preferred (Modified) will have less impact than NC, A or B-Departure (Modified) and Alternatives H (Modified) and I should have no impact on downstream fisheries resources.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where the merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Wildernesses and Park and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences on cultural resource values will not change significantly with the implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low, as will the consequences. Some historic properties may deteriorate and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat similar for Alternative C-Preferred since increases in ground disturbing activities are only moderately higher than in Alternatives H (Modified) and I.

Alternatives B-Departure (Modified), NC-No Change, and A-Current Direction may affect cultural resources substantially. More sites will be discovered, some may be impacted. Significant historic properties are not expected to be found although further deterioration may take place. Pre-historic sites may be discovered and impacted as opposed to being left intact under other alternatives.

RECREATION

Alternative B-Departure (Modified) would have the greatest effect on unroaded recreation. Under this alternative, none of the area would be allocated to recreation. 1,200 acres would remain unroaded as spotted owl habitat and the remaining 7,100 acres would be allocated to Timber Management. The No Change Alternative would allocate 1,600 acres to Undeveloped Non-motorized Recreation and 500 acres to Wild and Scenic Rivers which would retain their unroaded condition. The remaining 6,200 would be allocated to Timber Management. Alternative A-Current Direction would allocate 1,600 acres to Undeveloped Non-motorized Recreation, 500 acres to Wild and Scenic Rivers, and 1,200 acres to spotted owl habitat, retaining a total of 3,300 acres in an unroaded condition. Alternative C-Preferred (Modified) allocates 5,000 acres to remain unroaded; 3,300 acres is allocated to Undeveloped Non-motorized Recreation, 500 acres is allocated to Wild and Scenic Rivers and 1,200 acres is allocated to spotted owl habitat. 1,200 acres are allocated to scenery. The remaining 2,100 acres are allocated to Timber Management under this alternative. Alternative H would allocate 4,500 acres to Undeveloped Non-motorized Recreation, 1,600 to Undeveloped Motorized Recreation, 500 acres to Wild and Scenic Rivers and 1,200 to spotted owl habitat. A total of 7,800 acres would remain in an unroaded condition under Alternative H. Alternative I would provide the greatest benefit to recreation by retaining the entire unroaded area in an unroaded condition. 5,000 acres would be allocated to Undeveloped Non-motorized Recreation, 1,600 acres to Undeveloped Motorized Recreation, 500 acres to Wild and Scenic Rivers and 1,200 acres to spotted owl habitat.

SCENERY

The Jupiter Ridge unroaded area involves two viewsheds. The north side of the unroaded area is in the Dosewallips viewshed while the south side of the unroaded area is in the Duckabush viewshed. Alternative B-Departure (Modified) would have the greatest effect upon scenery. 1,200 acres of this unroaded ares would be allocated to spotted owl habitat and would remain unroaded. The remaining 7,100 acres would be allocated to Timber Management and could have a heavily altered appearance. The No Change Alternative would allocate a total of 2,100 acres to remain unroaded and, therefore, would maintain a natrual appearance. The remaining 6,200 acres would be allocated to Timber Management and could have a heavily altered appearance. Alternative A-Current Direction would retain 3,300 acres in a natural appearing condition with the remaining 5,000 acres allocated to Timber Management which could have a heavily altered appearance. Alternative C-Preferred (Modified) would allocate a total of 5,000 acres to remain in a natural appearing condition and 1,200 acres would allocated to scenery in which the visual quality objectives must be met and would have a natural to slightly altered appearance. The remaining 2,100 acres would be allocated to Timber Management and could have a heavily altered appearance. Alternative H would allocate all but 500 acres to remain unroaded and, therefore, be natural appearing. The 500 acres would be allocated to Timber Management and could have a heavily altered appearance. Alternative I would provide the greatest protection for scenery by allocating the entire area to allocations that would keep the area in a natural appearing condition.

WILD AND SCENIC RIVERS

Management objectives within Wild and Scenic river corridors are compatible with those for maintaining unroaded conditions. Therefore, Wild and Scenic rivers have no effects on unroaded areas in any alternative.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-14. The figures show estimated development for the 50-year planning horizon in total, and are included in the road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in Table C-14 is needed to serve timber harvest by conventional logging systems. Alternative A-Current Direction also includes substantial use of highly sophisticated logging systems (predominantly helicopter), as this is the most efficient means of conducting timber harvest while also meeting the visual quality objectives specified in current direction. Road construction to serve these systems will be minimal.

Table C-14. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	12	9	15	7	4	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest allocations and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 53 person-years. Conversely, an average of 5 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recre-

ation combined) to employment associated with each alternative is displayed in Table C-15 below. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-15. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	47	40	53	27	10	5

LOCAL COMMUNITIES

The expected affects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternatives No Change, A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) would remove the area from future consideration as Wilderness.

Alternative H (Modified) would retain all but 1,000 acres in an unroaded condition that would be available for future Wilderness consideration. Alternative I would retain the entire area for future consideration for Wilderness.

Table C-16. Jupiter Ridge 8,308 Acres (8.3) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	1.6	1.6	0	3.3	4.5	5.0
Undeveloped Recreation (Motorized) A1B	0	0	0	0	1.6	1.6
Scenic A2	0	0	0	1.2	0	0
Wild & Scenic River A4A	0.5	0.5	0	0.5	0.5	0.5
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	1.2	1.2	1.2	1.2	1.2
Timber Management E1	6.2	5.0	7.1	2.1	0.5	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	8.3	8.3	8.3	8.3	8.3	8.3

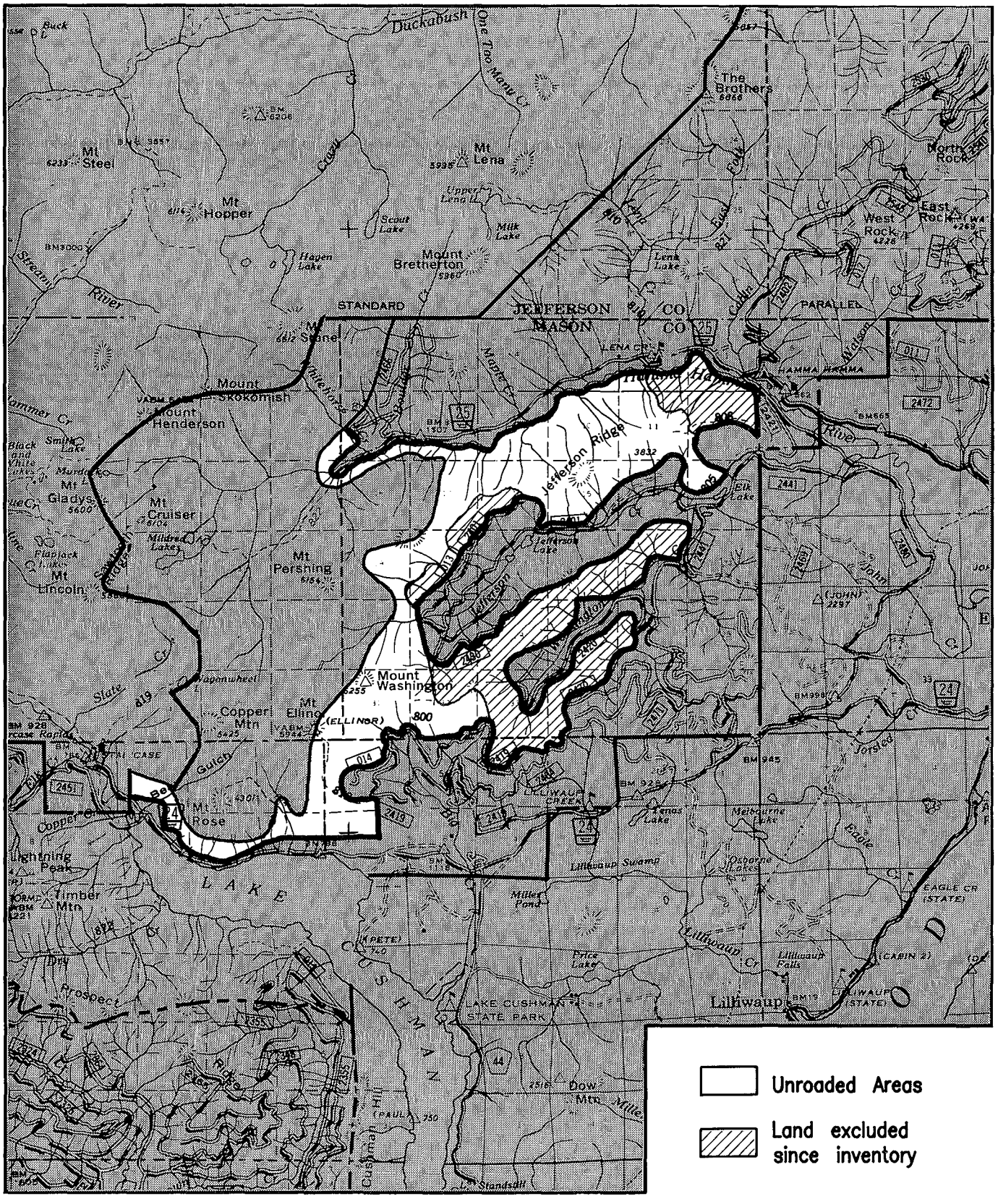


Figure C-6. JEFFERSON RIDGE UNROADED AREA

JEFFERSON RIDGE UNROADED AREA (9,369 acres)

DESCRIPTION

HISTORY

The Jefferson Ridge unroaded area was originally inventoried during the RARE process as a portion of the Mildred Lakes unroaded area. This area consisted of 23,874 acres in which 14,041 acres were administratively endorsed as a new Wilderness study area.

This area was again inventoried with the RARE II process. The RARE II Mildred Lakes unroaded area had a total of 26,071 acres. Of these, 15,686 acres were recommended for Wilderness and the remaining 10,385 acres were allocated to non-Wilderness use.

In May 1979, a Final Environmental Impact Statement prepared for the Land Management Plan for the Canal Front Planning Unit allocated some of the Mildred Lake unroaded area to Further Planning. For the remaining unroaded areas, 1,779 acres were allocated to the Mt. Ellinor-Mt. Washington Special Management Area with direction aimed at retaining the visual integrity and the opportunity for Undeveloped Recreation and the rest were allocated to general forest uses with an emphasis on timber management.

The Washington Wilderness Act of 1984 established a 13,015 acre Mt. Skokomish Wilderness from the Mildred Lakes unroaded area. Most of the remaining roadless acres are now identified as the Jefferson Ridge unroaded area.

LOCATION AND ACCESS

The Jefferson Ridge unroaded area is located in the southwestern portion of the Hood Canal Ranger District. This area consists of narrow strips of undeveloped land along the eastern and southern boundaries of the Mt. Skokomish Wilderness and narrow fingerlike sections of several ridges extending northeast from Mt. Washington and Mt. Pershing.

The small town of Eldon is the closest town to the area. Forest roads provide access to the south and east boundaries.

There are four trails that provide hiking access into the area. The 2.9 mile Jefferson Ridge trail provides access to the top of Jefferson Ridge. The Mt. Rose trail, 4.8 miles in length, provides access into the southern portion and to the summit of Mt. Rose, which is in the Mt. Skokomish Wilderness. The Mt. Ellinor trail, 2.4 miles, and the Mt. Washington trail, 1.1 miles, provide hiking access to the southeastern portion of the area.

PHYSIOGRAPHY AND SOILS

The area consists mostly of steep, rugged side slopes and ridges. Elevations range from 600 feet along the Hamma Hamma River to over 6,000 feet on the east face of Mt. Washington.

Bedrock consists of massive to poorly bedded graywacke and sandstone, and thinly bedded mudstone, slate, and siltstone. These rocks are moderately competent (non-crumbly) to incompetent (crumbly).

Soils on ridges and upper slopes consist primarily of shallow, gravelly medium textured (loamy) colluvial and residual soils derived from sedimentary bedrock. Midslope soils consist primarily of moderately deep, well to imperfectly drained soils which are derived from highly weathered sedimentary bedrock.

VEGETATION

Stands of old-growth trees which occur on the lower slopes consist primarily of Douglas-fir, western hemlock and western redcedar. At upper elevations, subalpine fir, western white pine and dwarf juniper give way to the rock and scattered alpine vegetation commonly found in the subalpine and alpine zones. It has been pointed out that the upper slopes of Mt. Ellinor apparently are the only known Olympic Peninsula habitat for *Pedicularis contorta*. *Petrophytum hendersonii*, Olympic rockmat, is listed on the National List as a threatened plant species and is also known to occur on Mt. Ellinor.

ECOSYSTEM

This area consists mostly of Kuchler Ecotype K2 (red cedar, western hemlock, Douglas-fir), with some K3 (Pacific silver fir and Douglas-fir), and small amounts of K4 (mountain hemlock and subalpine fir) and K45 (meadows).

CURRENT USES

Due to the ease of access by surrounding roads and trails, this area receives heavy recreational use. Primary recreation uses are backpacking, hiking, mountain climbing and hunting. The area provides good hunting opportunity for elk, deer, goat, and bear. Hunter success for big game is average to less than average because of the heavy cover and difficult terrain encountered. Hunter success fluctuates according to local snow conditions that may range between three and six feet. Winter deer losses of up to 40 percent have been recorded. Very little area is identified as big game winter range. The area has approximately 3,800 RVDs of use annually.

Approximately 2,400 acres of this unroaded area are in the Semi-Primitive Nonmotorized ROS class. The remaining acres are in Roaded Natural/Modified ROS class.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

The Jefferson Ridge unroaded area consists of common visual variety in landforms, rock formations, water bodies, and vegetation. The area has moderate to very steep slopes that extend upward to the summits of Mt. Rose, Mt. Ellinor, Mt. Washington, and Jefferson Ridge. A dense conifer forest covers most of the area. The headwaters of Big Creek and portions of Jefferson and Washington Creeks drain from the area. There are no major rivers or lakes.

Much of the Jefferson Ridge unroaded area is viewed from two major recreational areas. The southern portion is viewed from the Lake Cushman area while the northern portion is seen from the Hamma Hamma Road.

The area's major attractions are the four hiking trails and the views seen from Jefferson Ridge and the slopes of Mt. Rose, Mt. Ellinor and Mt. Washington. Climbing routes to the summits of Mt. Ellinor and Mt. Washington are also popular attractions.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

This unroaded area is bounded on its westerly side by the Mt. Skokomish Wilderness and Olympic National Park. The remaining boundaries are adjacent to Forest roads and timber harvest units. The southern boundary is also near the Lake Cushman development which consist of recreational property and residential lots. There are also several day-use sites along the shoreline of Lake Cushman immediately south of the area.

This relatively large and very irregular unroaded area consists of several long and narrow areas adjacent to roads and harvest units. Due to the areas close proximity to these management activities, sights and sounds of human intrusion are readily noticeable.

NATURAL INTEGRITY

This unroaded area involves several narrow fingerlike areas that were not included in the Mt. Skokomish Wilderness which was established with the Washington Wilderness Act of 1984. Portions that were excluded from Wilderness classification were made available for general forest uses and have changed.

Several areas, such as the western edge of Jefferson Ridge next to Jefferson Lake and the ridge between Washington Creek and Jefferson Creek, have had or are scheduled for timber harvesting. The current remaining unroaded area of 9,369 acres remains in a natural state, free from human influences other than those related to the trails.

NATURAL APPEARANCE

The Jefferson unroaded area involves such narrow fingerlike areas, consisting of steep topography close to roads and timber harvest units, that visitors will have difficulty finding areas that appear natural and isolated from human influences.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Managing for Semi-primitive experiences is affected by its irregular boundary and narrow ridge top extentions. Off-site intrusions from surrounding roads, timber harvest activities and developed recreational activities adjacent to Lake Cushman, limit opportunities for solitude. The area does offer opportunities involving risk and challenge. Route finding, cross-country travel and mountain climbing activities offer the greatest challenge.

SPECIAL FEATURES

Petrophytum hendersonii, Olympic rockmat, is on the National threatened plant species list and known to occur on Mt. Ellinor. There is a portion of a Spotted Owl Habitat Area in the extreme southwest corner.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by sedimentary and volcanic rocks of Eocene age. Even though this area has not been studied in detail by the USGS and Bureau of Mines, the adjacent Wonder Mountain unroaded area has been (Church and Others, 1983). Based upon results of that study and other available data, it appears that the area has a low to moderate potential for the occurrence of manganese deposits, which may have associated copper, molybdenum, iron, chromium and nickel. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of these commodities is low.

A small part of the area in Section 9, T.24N., R.4W. may be encumbered by mining claims, the validity of which has not been determined. There is presently no mining activity, and under current conditions, it appears they may not be valid claims. This area has not been classified "prospectively valuable" for leasable mineral commodities, and it has no leases or pending lease applications.

Water

Portions of Jefferson Creek, Washington Creek and Big Creek are in the area. There is one very small lake to the west of Jefferson Lakes that is inside the boundary. Jefferson Lakes are outside of the unroaded area.

Vegetation

This area contains about 6,740 acres (72% of area) of tentatively suitable forest land, of which about 570 acres are doghair. The seral stages and estimated standing volumes are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
SS	9	--	--
PL	26	27.8	5.1
MS	20	42.6	7.8
LS	45	140.9	25.8
TOTAL	100	211.3	38.7

SS = Early Stage PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.9 million cubic feet per year.

Special Areas

Approximately 20 percent of the area is in riparian zones which consist primarily of small tributary streams of Jefferson, Washington, and Big Creeks. Cliffs and talus slopes are common in higher elevations. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Big game and those wildlife species associated with higher elevation habitats are found in this area.

Fisheries

Jefferson and Washington Creeks, which are both Hamma Hamma River tributaries, support resident trout populations. Big Creek, a Lake Cushman tributary, also supports resident salmonids. The small lake to the west of Jefferson Creek does not provide fish habitat.

Cultural

A minor amount of reconnaissance work has been conducted by cultural resource technicians in this area. A trapper's shelter in the upper Cabin Creek area has been inventoried and there is likely evidence of others. There is evidence and recorded information about early Forest Service activities and associated facilities such as trails, trail shelters and lookouts. Many of the Forest Service facilities have been inventoried or formally documented and most have been removed or lost integrity through deterioration. The Jefferson Ridge Lookout is a good example. Historic National Register eligible properties are not expected to be found. Pre-historic sites may exist but some have been discovered to date.

Some mining activity occurred in the Copper Mountain/Mt. Rose area and there may have been other incidences, but not much is specifically known or recorded at this time.

Recreation

This unroaded area has limited potential for providing unroaded recreation opportunities, due to its steep topography and its narrow irregular shape. Mountain climbing, hunting, and hiking are activities with the most potential for providing unroaded opportunities. There are two proposed trails within the area involving an extension of 1.2 miles on the Mt. Washington trail and an extension of 2.3 miles on the Jefferson Ridge trail.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive, Nonmotorized	2,400	240
Roaded Natural/Modified	6,969	700
TOTAL	9,369	940

Scenery

The natural landscape character of this unroaded area consists of portions of stream bottoms, steep side slopes and ridge tops. Vegetation is viewed as a dense textural forest. There are minor amounts of rock outcrops. The area is visible from popular travel routes such as the Hamma Hamma and Lake Cushman roads. The area is also visible from several trails, Lake Cushman, the Mt. Skokomish Wilderness, and the Jupiter Ridge and Lightning Peak unroaded areas. The Visual Quality Objectives assigned to this unroaded area are Retention, Partial Retention, and Modification.

Wild and Scenic Rivers

The south side of the Hamma Hamma River corridor is included within this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Jefferson Ridge unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire is not known for this area. With fire management activites that occur today, the frequency of fire in this area is no greater than other National Forest lands.

NEED

NEARBY WILDERNESS AND UNROADED AREAS

The Jefferson Ridge unroaded area is located adjacent to the Mt. Skokomish Wilderness. The Jupiter Ridge unroaded area is within one mile of the northern portion of this area and the Lightning Peak unroaded area is within one mile of the southern portion. The Wonder Mountain Wilderness is situated three miles to the west.

DISTANCE FROM POPULATION CENTERS

The area is within 65 miles, or approximately an hour and a half driving time from Seattle, Washington. The nearest town to the northern end of the area is Eldon. The town of Hoodsport is the closest to the southern end. The area is within 7 miles of US Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT AND INTEREST

Public interest and input was high for this area when it was part of the Mildred Lakes unroaded area prior to Wilderness classification in 1984. Since most of the Mildred Lakes unroaded area was involved with the creation of the Mt. Skokomish Wilderness, there has been little interest demonstrated toward this unroaded area.

There is some concern for the visual quality as viewed from the Lake Cushman area and the Hamma Hamma road.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction, B-Departure (Modified) and NC-No Change there would be very little, if any, adverse consequences.

Under Alternatives C-Preferred (Modified), H (Modified) and I, interest in conducting exploration and development activities within areas encumbered by 6 mining claims, as well as in areas identified as having a "low" to "moderate" potential for the occurrence of manganese resources would be affected. Since none of the area is classified "prospectively valuable" for oil and gas, the effects on this resource appear negligible.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from Alternatives C-Preferred (Modified), H (Modified), and I. Alternatives NC, A-Current Direction, and B-Departure (Modified) pose some risk of impacting the above resources. The risk of impacting soils, water, or Special Areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified), and C-Preferred (Modified). The harvest level would increase in the second decade for Alternative B-Departure (Modified), and in the third decade for the others, before leveling off. No timber harvest is scheduled in Alternatives H (Modified) and I.

With the NC (No Change) Alternative, about 5,600 acres or 60 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity is about 0.7 million cubic feet per year.

With Alternative A-Current Direction and C-Preferred (Modified), about 5,100 acres or 54 percent of the area is planned for timber harvest. The long-term sustained yield capacity contribution is about 0.7 million cubic feet per year. The emphasis is on timber management, with the areas around Mt. Washington and Mt. Ellinor left in their natural conditions.

Alternative B-Departure (Modified) will have about 6,740 acres or 72 percent of the unroaded area planned for timber harvest. The long-term sustained yield capacity is about 0.9 million cubic feet per year. Emphasis is on timber management.

With Alternatives H (Modified) and I, no timber would be harvested.

WILDLIFE

Alternatives NC, A-Current Direction, and B-Departure (Modified) have the greatest impact on the wildlife resource. Alternatives H (Modified) and I have no impact while Alternative C-Preferred (Modified) will some effect but significantly less impact than Alternatives NC, A, and B-Departure (Modified).

FISHERIES

Alternatives NC, A-Current Direction, and B-Departure (Modified) will have the greatest effect on associated fisheries resources during both the first and fifth decades because of related management activities. In the first decade, Alternatives C-Preferred (Modified), H (Modified), and I will have no impact. During the fifth decade, Alternatives C-Preferred (Modified) and H (Modified) will have less impact than Alternatives NC, A and B-Departure (Modified). I will continue to have no effect.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands, or future yields

(harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Wildernesses and Park and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences to cultural resource values will not change significantly with the implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low, as will the consequences. Some historic properties may deteriorate, and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat similar for Alternatives C-Preferred (Modified), since increases in ground disturbing activities are only moderately higher than in Alternatives H (Modified) and I.

Alternative B-Departure (Modified), A-Current Direction and NC-No Change may affect cultural resources substantially. More sites will be discovered, some may be impacted. Significant historic properties are not expected to be found, although further deterioration may take place. Pre-historic sites may be discovered and impacted as opposed to being left intact under other alternatives.

RECREATION

Alternative B-Departure (Modified) would have the greatest effect on unroaded recreation in this area. Only 500 acres would remain unroaded while the remaining 8,900 acres would be allocated to Timber Management. The No Change Alternative would have the next greatest effect on the Jefferson Ridge unroaded area by reducing the area from 9,369 acres to approximately 3,800 acres. Under this alternative, 5,600 acres would be allocated to Timber Management and the 3,800 acres would be allocated to Undeveloped Motorized Recreation. Alternative A-Current Direction would allocate 3,800 acres to Undeveloped Motorized Recreation and 500 acres to spotted owl habitat for a total of 4,300 acres remaining in an unroaded condition. The remaining 5,100 acres would be allocated to Timber Management. Alternative C-Preferred (Modified) allocates 3,800 acres to Undeveloped Recreation non-motorized and 500 acres to spotted owl habitat for a total of 4,300 acres to remain unroaded. 3,700 acres would be allocated to scenic and 1,400 acres would be allocated to Timber Management. Both Alternatives H and I would have the least effect on the unroaded area. The entire unroaded area would remain unroaded in both of these alternatives. 4,700 acres would be allocated to Undeveloped Non-motorized Recreation, 4,200 acres to Undeveloped Motorized Recreation and the remaining 500 acres would be allocated to spotted owl habitat.

SCENERY

A portion of this unroaded area is within the Hamma Hamma viewshed. Alternative B-Departure (Modified) would have the greatest effect upon scenery within this unroaded area. Only 500 acres, which would be allocated to spotted owl habitat, would remain in a natural appearing condition while the other 8,900 acres, which would be allocated to Timber Management, could vary from moderately to heavily altered in appearance. Alternative No Change and A-Current Direction would have similar effects upon scenery.

Alternative No Change would allocate 3,800 acres to Undeveloped Recreation and would remain natural appearing. 5,600 acres would be allocated to Timber Management and could vary from moderately to heavily altered in appearance. Alternative A-Current Direction would 3,800 acres to Undeveloped Recreation and 500 acres to spotted owl habitat for a total of 4,300 acres remaining in a natural appearing condition. The other 5,100 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternative C-Preferred (Modified) would allocate 4,300 acres to allocations that would retain the natural appearing character of the area, 3,700 acres would be allocated to scenic and would appear natural or slightly altered. The remaining 1,400 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternatives H and I make the same allocations and would not have any effect upon the scenery as the entire unroaded area would remain in a natural appearing condition.

WILD AND SCENIC RIVERS

Management objectives within Wild and Scenic river corridors are compatible with those for maintaining unroaded conditions. Therefore, Wild and Scenic rivers have no effects on unroaded areas in any alternative.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-17. The figures show estimated development for the 50-year planning horizon in total, and are included in road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in Table C-17 is needed to serve timber harvest by conventional logging systems. Alternative A-Current Direction also includes substantial use of highly sophisticated logging systems (predominantly helicopter), as this is the most efficient means of conducting timber harvest while also meeting the visual quality objectives specified in current direction. Road construction to serve these systems will be minimal.

Table C-17. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	18	14	22	10	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest allocations and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity, is 60 person-years. Conversely, an average of 6 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-18 below. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-18. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	47	47	60	47	6	6

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternatives No Change, A-Current Direction, B-Departure (Modified) would remove the area from future consideration as Wilderness.

Alternatives H (Modified) and I would retain the option of futur consideration of the area for Wilderness.

Table C-19. Jefferson Ridge 9,369 Acres (9.4) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	3.8	4.7	4.7
Undeveloped Recreation (Motorized) A1B	3.8	3.8	0	0	4.2	4.2
Scenic A2	0	0	0	3.7	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	0.5	0.5	0.5	0.5	0.5
Timber Management E1	5.6	5.1	8.9	1.4	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	9.4	9.4	9.4	9.4	9.4	9.4

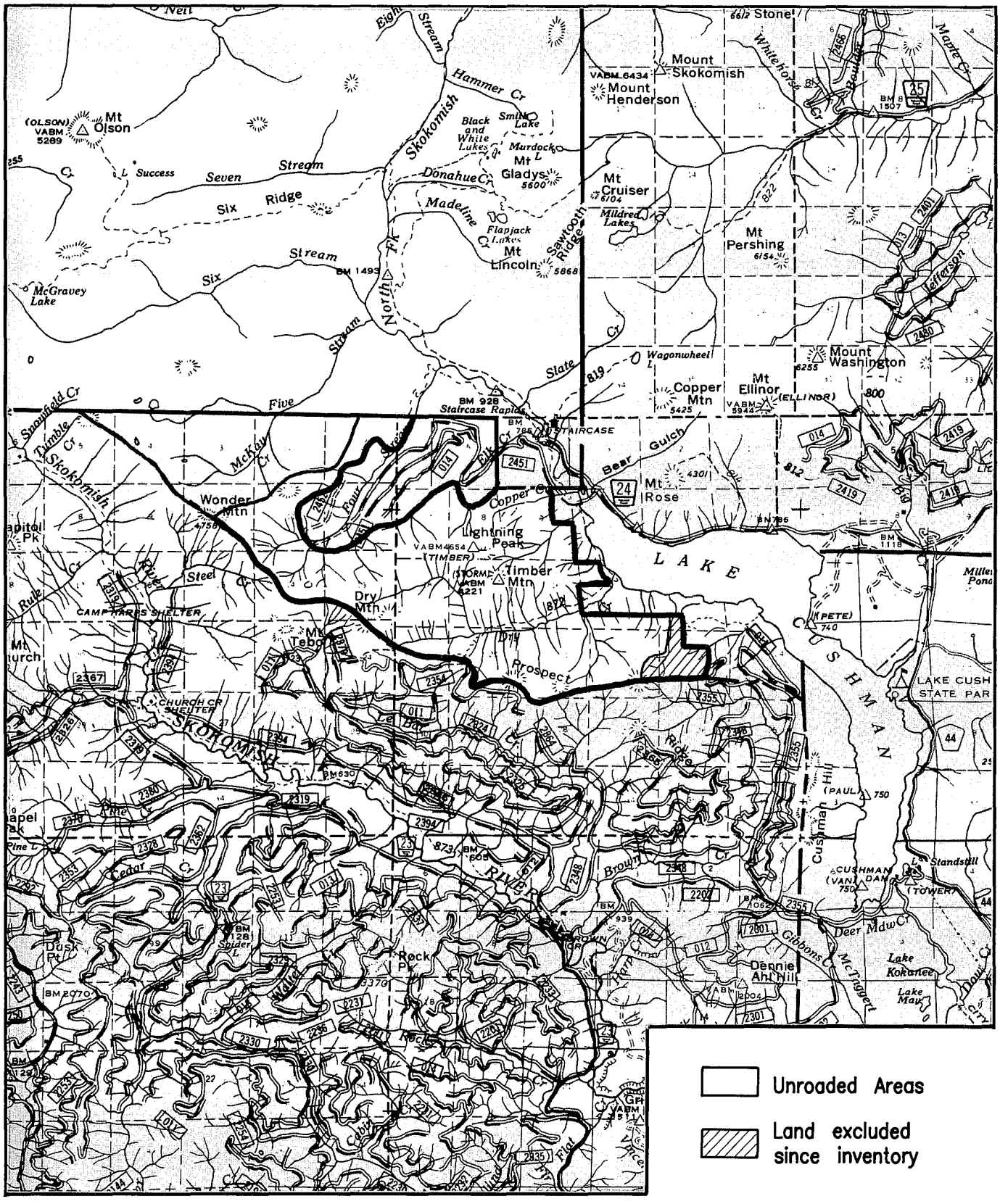


Figure C-7. LIGHTNING PEAK UNROADED AREA

LIGHTNING PEAK UNROADED AREA (7,174 acres)

DESCRIPTION

HISTORY

The Lightning Peak unroaded area was originally included in the RARE process as a portion of the Wonder Mountain unroaded area. The area was not proposed as a Wilderness at that time.

The Wonder Mountain unroaded area was again inventoried for potential Wilderness classification in the RARE II inventory. It was allocated to Further Planning.

The Land Management Plan for Canal Front Planning Unit allocated most of this area to the Wonder Mountain Special Management Area. Management was aimed at making most of the area available for dispersed, roadless recreation, and to permit developments needed to accommodate such use. Further road construction is prohibited and no timber harvest will be scheduled. Remaining acres were allocated to general forest uses with an emphasis on timber management.

The Washington Wilderness Act of 1984 created a 2,349-acre Wonder Mountain Wilderness. The remaining 7,174 roadless acres from the Wonder Mountain unroaded area are now identified as the Lightning Peak unroaded area.

LOCATION AND ACCESS

This unroaded area is located in the extreme southwest portion of the Hoodsport Ranger District, lying southwest of Lake Cushman. It consists of the undeveloped acres that were excluded from the Wonder Mountain Wilderness.

The area is accessible from the north from the town of Hoodsport by driving county and Forest roads for approximately 20 miles. It can also be reached from the south from the town of Shelton by driving Highway 101, county and Forest roads for approximately 30 miles.

The Dry Creek trail, 7.3 miles in length, is the only trail accessing the area. There are several cross-country climbing routes that access Lightning Peak and Dry Mountain.

PHYSIOGRAPHY AND SOILS

The land forms consist of mainly steep rugged ridges and side slopes with narrow stream bottoms. The elevation range is from approximately 800 feet along the northeast portion near Lake Cushman to 4,654 feet at Lightning Peak. Major land forms include Lightning Peak, Timber Mountain, and Dry Mountain.

The graywacke and basalt are generally competent (non-crumbly) while the argillites and mudstone are moderately competent. Basalt and sedimentary rock outcrops occur on high ridges and barren sideslopes.

Soils on ridges and sideslopes consist primarily of shallow, well drained medium textured (loamy) soils. Midslope and toeslope soils consist primarily of deep, well drained, gravelly medium textured soils.

VEGETATION

The lower slopes, and the area east of Dry Creek, contain substantial amounts of timber. Western hemlock, Douglas-fir and western redcedar at lower elevations and mountain hemlock and Pacific silver fir at higher elevations constitute the major tree species. There are some stands of very large Pacific silver fir on the north slopes of Lightning Peak.

ECOSYSTEM

This unroaded consists mostly of Kuchler Ecotypes K2 (red cedar, western hemlock, Douglas-fir) and K3 (Pacific silver fir). There are minor amounts of K4 (mountain hemlock and subalpine fir) and K45 (meadows) in the higher elevations on Lightning Peak and Dry and Timber Mountains.

CURRENT USES

The major recreational activities include hiking, backpacking, trailbike riding and mountain climbing. There are no developed recreation sites and no potential sites have been inventoried. The opportunity for dispersed area camping is limited to a few areas along the Dry Creek trail, and around the small lake in the headwaters of Four Stream. Hunting activity is limited in the area due to dense forest cover at lower elevations and rugged topography at higher elevations. Total RVDs of use is less than 2000 per year.

Much of this area serves as a scenic backdrop to the Lake Cushman recreation area, including Olympic National Park.

Approximately 6,300 acres of this unroaded area are in the Semi-Primitive Nonmotorized ROS class. The remaining acres are in the Roaded Natural/Modified ROS class.

The principle mineral prospects are located at the Apex prospect, about halfway up Copper Creek, and at the Triple Trip (Brown Mule) mine on the ridge to the southeast. The manganese vein at the Apex prospect was fairly extensive; however, the tonnage of available ore appears to be small. A carload of ore was reportedly shipped from the Tripple Trip mine in the early 1900's, but mining must not have been profitable for little, if any, work has been accomplished since.

The area supplies water for downstream power generation at the City of Tacoma's Lake Cushman facilities.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

This unroaded area shows a diversity of visual variety from the undulating Prospect Ridge, covered with a textured conifer forest, to the rugged and steep rock cliffs of Lightning Peak. Dry Creek is the main tributary draining the area. There is a small lake in the headwaters of Four Stream.

The Lightning Peak unroaded area is viewed from Olympic National Park, the Mt. Skokomish Wilderness and the Lake Cushman road, which provides access to several recreation sites, a housing development on the north shore of Lake Cushman, and Olympic National Park. The area, as viewed from these recreation areas, is seen as a rugged and steep ridge extending the full length of Lake Cushman and connecting with the Wonder Mountain Wilderness.

Views of the area from the Dry Creek trail, within the area, are limited due to the dense vegetative corridor along the trail. The best views of the area from within are from the higher elevations of Lightning Peak, and Timber and Dry Mountain.

The main attractions are big game hunting, hiking along Dry Creek, and mountain climbing on Lightning Peak.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The area is bound by a small portion of the Wonder Mountain Wilderness along the extreme western boundary, roads and harvest units on National Forest lands along the northwest and south boundary, Olympic National Park to the north, and private land to the northeast.

The ability to manage this unroaded area in a natural state for Primitive or Semi-primitive recreational experiences is affected by its moderate size and the surrounding management activities. Off-site intrusions, such as noise and the sights of close-by management activities, cannot be eliminated or reduced when on the higher elevations of Lightning Peak, Dry Mountain, Timber Mountain and the top of Prospect Ridge. Semi-primitive experiences are more likely to be available along most of the Dry Creek trail and in the lake basin in the headwaters of Four Stream.

NATURAL INTEGRITY

The current Lightning Peak unroaded area consists of the acres that were not included in the Wonder Mountain Wilderness. The area has changed very little since the original RARE inventory. The current remaining unroaded acres, 7,174, remain in a natural state, free from human influences other than those associated with the Dry Creek trail.

NATURAL APPEARANCE

Due to its moderate size, one can obtain a feeling of naturalness, especially in the Dry Creek drainage. However, from higher elevations, the sights and sounds of surrounding management activities intrude upon the naturalness of the area.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Opportunities for solitude are limited to certain portions within the area. Due to its moderate size, dense vegetation, and limited use away from the trail corridor, visitors are able to seek solitude by traveling cross-country or on climbing routes within the area. Big game hunting and mountain climbing are activities involving risk and challenge.

SPECIAL FEATURES

There are no known threatened or endangered plants or animals within this unroaded area. There is a portion of a Spotted Owl Habitat Area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wildernesses on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by sedimentary and volcanic rocks of Eocene age. Based on results of a study by the by the USGS and Bureau of Mines (Church and Others, 1983), it appears that the area has a low to moderate potential for the occurrence of manganese deposits, which may have associated copper, molybdenum, iron, chromium and nickel. Under current supply/demand conditions, however, the potential for discovering a valuable deposit is low.

A small part of the area in Sections 8 and 9, T.23N., R.5W. may be encumbered by mining cliams, the validity of which has not been determined. There is no mining activity, and under current conditions, it appears they may not be valid claims. This area has not been classified "prospectively valuable" for leasable mineral commodities, and it has no leases or pending lease applications.

Water

The area is dissected by several major drainages, all tributary to the North Fork of the Skokomish River and its impoundment at Lake Cushman. Four Stream, Elk Creek, Copper Creek, and Dry Creek serve to drain this area of land. Snow Lake, which is a small six-acre lake, is found in the headwaters of Four Stream.

Vegetation

This area contains about 4,830 acres (67% of area) of tentatively suitable forest land none of which are doghair stands. The seral stages and estimated standing volumes are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
PL	22	18.0	3.3
MS	15	24.0	4.4
LS	63	149.1	27.3
TOTAL	100	191.1	35.0

PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.6 million cubic feet per year.

Special Areas

Approximately 15 to 20 percent of the area is in riparian zones which consist primarily of small tributary streams of the North Fork of Skokomish River. Cliffs and talus slopes are common in higher elevations near Lightning Peak. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

A portion of a Spotted Owl Habitat Area is located in this unroaded area. Deer and elk make use of the area, as do other species of wildlife. The majority of the area is old-growth habitat.

Fisheries

Due to steep topography and stream gradients, the major drainages within this area only support resident fish populations in the lower reaches. Lake Cushman is not accessible to anadromous fish species; however, the lake does support a significant resident sport fishery.

Cultural

There are no known, suspected, or recorded sites in this area, except for the Dry Creek trail. The area is extremely rugged and does not provide much utility or attraction for human occupation and use. A certain amount of mining activity and prospecting did take place, but there is little documentation. Some hunting and trapping very likely occurred, but remains or evidence is not expected to be discovered. In all likelihood, any pre-historic use that may have occurred was probably minor and transitory. The discovery of important or significant sites is doubtful.

Recreation

The Lightning Peak unroaded area has good potential for providing unroaded recreation opportunities. These consist of mountain climbing, hunting, fishing, and hiking. There are no proposed trails.

Approximately 88 percent of the area is in the Semi-primitive Non-motorized ROS class. The remaining 12 percent is classified as Roaded-Natural/Modified.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive Nonmotorized	6,300	600
Roaded Natural/Modified	874	100
TOTAL	7,174	700

Scenery

The visual character of this area involves undulating ridges and steep slopes that extend upward to rocky cliffs and the summits of Lightning Peak and Dry Mountain. The lower elevations are blanketed with a dense forest cover, while the higher elevations consist of rock cliffs, rock outcrops and open meadows. The Lightning Peak unroaded area is primarily visible from the Lake Cushman area, Mt. Skokomish Wilderness and the southeast corner of Olympic National Park. The area involves Visual Quality Objectives of Retention, Partial Retention, Modification, and Maximum Modification.

Wild and Scenic Rivers

There are none associated with this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Lightning Peak unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire is not known for this area. With fire management activities that occur today, the frequency of fire in this area is no greater than other National Forest lands.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

This unroaded area is adjacent to the Wonder Mountain Wilderness, two miles south of the Mt. Skokomish Wilderness and one mile south of the Jupiter Ridge unroaded area. The Upper Skokomish unroaded area is adjacent to the area's southwest boundary.

DISTANCE FROM POPULATION CENTERS

The area is within 110 miles, or two hours driving time, of Seattle, Washington via Interstate 5, US Highway 101 and county and Forest roads. Hoodsport is the nearest town. The area is approximately 20 miles from Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest was moderate for the Wonder Mountain unroaded area during the evaluation of RARE and RARE II, the Canal Front Planning Unit, and passage of the Washington Wilderness Act of 1984. Moderate interest has been shown concerning the acres involved in the current unroaded area, mostly in relation to retaining current scenic attributes from Lake Cushman developments.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction, C-Preferred (Modified), H (Modified) and I, interest in conducting exploration and development activities within areas encumbered by four to seven mining claims, as well as within areas identified as having a "low" to "moderate" potential for the occurrence of manganese resources, would be affected. Since none of the area is classified "prospectively valuable" for oil and gas, the effects on this mineral resource appear negligible. There would be little effect in Alternative B-Departure (Modified) or NC-No Change.

SOIL, WATER AND SPECIAL AREAS

There should be no affect to soils, water, or Special Areas (riparian) from Alternatives H (Modified) and I. Alternatives NC, A-Current Direction, B-Departure (Modified), and C-Preferred (Modified) should have little risk of affecting above resources. The risk of impacting soils, water, and special areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified), and C-Preferred (Modified). The harvest level would increase in the second decade for Alternatives NC (No Change) and B-Departure (Modified) before leveling off. No timber harvest activities are scheduled for Alternatives H (Modified) and I.

With Alternative NC (No Change), about 3,600 acres or 50 percent of the unroaded area would be planned for harvest. The long-term sustained yield capacity is about 0.4 million cubic feet per year.

With Alternatives A-Current Direction and C-Preferred (Modified), about 1,800 acres or 25 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity contribution for each alternative is about 0.2 million cubic feet per year. Harvest will occur in the area from Dry Creek east.

In Alternative B-Departure (Modified), about 4,830 acres or 67 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity is about 0.6 million cubic feet per year. Most of the area between Four Stream and Dry Creek would be helicopter logged.

WILDLIFE

Alternatives NC and B-Departure (Modified) have the greatest impact through decade five. The impact from Alternatives A-Current Direction and C-Preferred (Modified) are less for the same time period, while the remaining alternatives have no impact.

FISHERIES

As a result of land management activities the downstream fisheries habitat, capability will be impacted the most in the first decade by Alternatives NC, A-Current Direction, and B-Departure (Modified). Alternative C-Preferred (Modified) will have some effect. Alternatives H (Modified), and I will not affect capability. In the fifth decade, Alternatives NC and B-Departure (Modified) will have the greatest impact. Alternatives A-Current Direction and C-Preferred (Modified), will, to a lesser extent, also have some impact. Alternatives H (Modified) and I will have no significant impact during the fifth decade.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Wildernesses and Park, and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences on cultural resource values will be similar, and rather inconsequential, regardless of alternative implemented. The potential for existence of cultural resources is very low, any that may exist will lack integrity, and none are expected to meet National Register criteria. The existence of pre-historic sites is considered to be very speculative and unlikely at this time.

RECREATION

Alternative B-Departure (Modified) would produce the greatest effects on unroaded recreation. Only 1,800 acres would remain in an unroaded condtion in a spotted owl habitat allocation. The other 5,400 acres would be allocated to Timber Management and would be lost as unroaded acres. Alternative No Change would allocate half of the area, 3,600 acres, to Undeveloped Non-motorized Recreation and the half to Timber Management. Alternative A-Current Direction and C-Preferred (Modified) have very similar effects on recreation. They both allocate 3,800 acres to Undeveloped Non-motorized Recreation use and 1,800 acres to spotted owl habitat. Alternative C-Preferred (Modified) would allocated 700 acres to scenic and 1,100 acres to Timber Management while Alternative A-Current Direction allocates all of the remaining 1,800 acres to Timber Management and none to scenery. Both Alternatives H and I have the least effect on unroaded recreation. In both of these alternatives the entire unroaded area would remain unroaded. 5,400 acres would be allocated to Undeveloped Non-motorized Recreation and 1,800 acres would be allocated to spotted owl habitat.

SCENERY

Alternative B-Departure (Modified) would have the greatest effect upon scenery in this unroaded area. 5,400 acres would be allocated to Timber Management and would have a moderately to heavily altered appearance while the remaining 1,800 acres would remain natural appearing in a spotted owl habitat allocation. The No Change Alternative would allocate half of the unroaded area, 3,600 acres, to Timber Management and the other half to Undeveloped Recreation. Alternative A-Current Direction and C-Preferred (Modified) are similar in their effects upon scenery in this unroaded area. Alternative A-Current Direction allocates 3,600 acres to Undeveloped Recreation and 1,800 acres to spotted owl habitat. These 6,400 acres would remain natural in appearance. The remaining 1,800 acres would be allocated to Timber Management and could range from moderately to heavily altered in appearance. Alternative C-Preferred (Modified) allocates the same as Alternative A, except that only 1,100 acres would be allocated to Timber Management and 700 acres would be given a scenic allocation. Alternatives H and I would not have any effect upon scenery as the entire unroaded area would be allocated to uses that would retain its natural appearing condition in both alternatives.

WILD AND SCENIC RIVERS

There are none associated with this area.

ROADS

Projected mileage of road construction for each alternative is displayed in Table C-20. The figures show estimated development for the 50-year planning horizon in total, and are included in road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each

alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternative A-Current Direction also includes substantial use of highly sophisticated logging systems (predominantly helicopter), as this is the most efficient means of conducting timber harvest while also meeting the visual quality objectives specified in current direction. Road construction to serve these systems will be minimal.

Table C-20. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	11	9	11	3	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. Average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity, is 40 person-years. Conversely, an average of 4 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-21 below. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-21. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	27	13	40	13	4	4

LOCAL COMMUNITIES

The expected effects of alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternatives No Change and B-Departure (Modified) would remove the area from future consideration as Wilderness.

Alternative A-Current Direction would allocate 1,800 acres to Timber Management and therefore, would not be available for future Wilderness consideration.

Alternative C-Preferred (Modified) would allocate 1,100 acres to Timber Management which would not be available for future Wilderness consideration.

Alternatives H (Modified) and I would retain the entire area in an unroaded condition and would be available for future Wilderness consideration.

Table C-22. Lightning Peak 7,174 Acres (7.2) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	3.6	3.6	0	3.6	5.4	5.4
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0.7	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	1.8	1.8	1.8	1.8	1.8
Timber Management E1	3.6	1.8	5.4	1.1	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	7.2	7.2	7.2	7.2	7.2	7.2

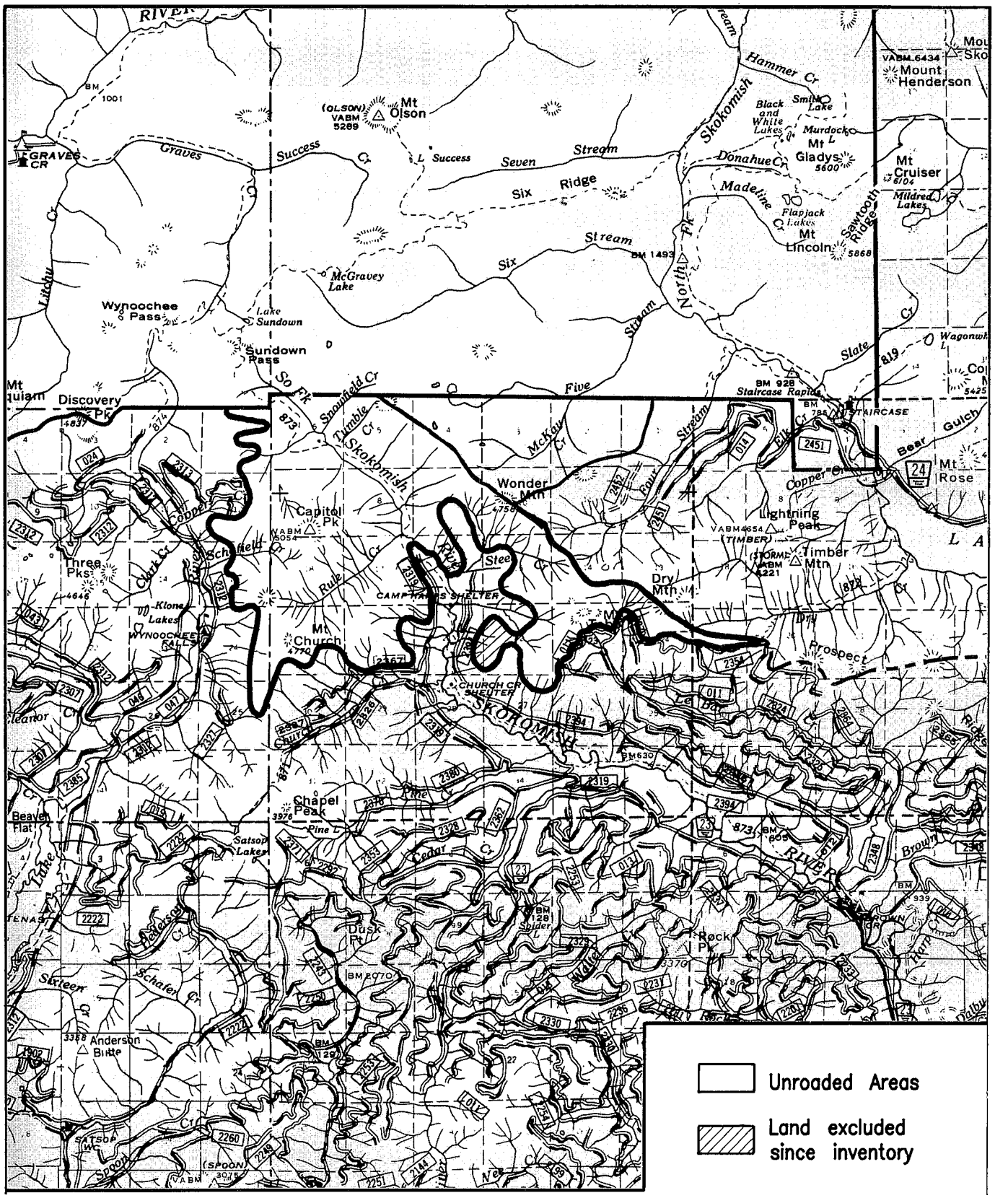


Figure C-8. UPPER SKOKOMISH UNROADED AREA

UPPER SKOKOMISH UNROADED AREA (6,182 acres)

DESCRIPTION

HISTORY

The Upper Skokomish unroaded area was not inventoried in either the 1973 RARE or 1976 RARE II review process. Since the area is part of the Shelton Cooperative Sustained Yield Unit (Shelton CSYU) which was created in 1946, all land within the Unit is committed to a prior use. Land withdrawals are generally not made if they will result in a significant reduction in timber yield.

In November 1978, a decision made in the FEIS for the Timber Resource Management Plan for the Shelton CSYU identified a corridor along the Upper Skokomish drainage to be managed as a special component, with emphasis aimed at maintaining the high recreational and aesthetic value of the area. No timber harvesting or road construction is scheduled in this area.

LOCATION AND ACCESS

This unroaded area is located in the southern portion of the Hood Canal Ranger District. It extends from the Olympic National Park boundary in the north to Mt. Church to the south, and from Schofield Creek in the west to the southeastern flanks of Dry Mountain in the east. This area includes much of the upper reaches of the Skokomish River, and some of the Copper and Schofield Creeks in the Wynoochee drainage.

The area is accessible from the town of Shelton by driving US Highway 101, and county and Forest roads for approximately 25 miles.

The only trail within the area is the Upper Skokomish trail, 4.9 miles in length. This trail provides access through the area along the South Fork Skokomish River and then climbs to subalpine elevations within Olympic National Park, ending at Sundown Pass. All other access involves cross-country travel or climbing routes within the area.

PHYSIOGRAPHY AND SOIL

Elevations range from approximately 1,300 feet on the Skokomish River to 5,054 feet at the Summit of Capital Peak.

The southern portion consists of marine basalt, while the northern portion consists of sedimentary bedrock. At higher elevations, rock outcrops are common. The topography is characterized by convex ridgetops with moderately dissected sideslopes.

Soils on ridges and sideslopes consist primarily of shallow, well drained medium textured (loamy) soils. Midslope and toeslope soils consist primarily of deep, well drained, gravelly medium textured soils.

VEGETATION

Stands of old-growth Douglas-fir and western hemlock occur on the lower slopes and Pacific silver fir and mountain hemlock are common at higher elevations.

ECOSYSTEM

This area consists predominantly in Kuchler Ecotype K3, Pacific silver fir and K2, red cedar, western hemlock, Douglas-fir (old growth) and small amounts of K4, mountain hemlock and subalpine fir and K45, meadows.

CURRENT USES

The majority of recreational use occurs along the trail corridor. Hiking, backpacking, hunting, and fishing are the more popular activities. The Upper South Fork Skokomish trail also serves as a major access route into the southern portion of Olympic National Park. This area receives less than 2,000 RVDs annually.

Approximately 3,700 acres of the area are in the Primitive ROS class, 1,300 in Semi-Primitive Nonmotorized, and the remaining acres are in the Roaded Natural/Modified ROS class.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

The area has a common visual variety of landform, vegetation and rock formations. A portion of the South Fork Skokomish river flows through the area. There are also several small streams, such as Rule, Tumble and Snowfield Creeks, that drain into the South Fork. There are no lakes. The steep landforms are covered with dense conifer vegetation.

The area is visible primarily from within the area itself. Much of this unroaded area is viewed as steep slopes extending from the river to the rocky summits of Capital Peak, Mt. Church, and Wonder and Dry Mountains.

Recreational uses associated with the trail corridor and access into the high country of the Park are major attractions.

CAPABILITY - WILDERNESS CHARACTERISTICS

The area is bounded by timber management activities and roads on three sides. The Park and Wonder Mountain Wilderness bounds the area to the north.

Even though it is relatively small in size, visitors can avoid the sights and sounds of nearby management activities by staying at lower elevations. As one hikes, camps, or fishes along the river, adjacent sights and sounds of man are screened out due the surrounding ridges that form the boundary of this area.

NATURAL INTEGRITY

The Upper Skokomish area was not included in any previous roadless area evaluation completed on the Forest. The area has not changed since it was classified as special component in the Timber Resource Plan. Current management is aimed at maintaining recreational and aesthetic values. The area remains in a natural condition, free from human influences other than those associated with the Upper Skokomish trail.

NATURAL APPEARANCE

Due to topography, one can have a feeling of being in an undisturbed area, especially while traveling along the river. However, from the ridgetop along the south boundary, the sights and sounds of management activities are evident.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGE EXPERIENCES

Opportunities for solitude are available once away from the trail corridor. The area offers challenging cross-country routes for accessing the Wonder Mountain Wilderness, mountain climbing routes on Mt. Church and Capital Peak and big game hunting on steep terrain.

Primitive or semi-primitive experiences within this area are affected by its irregular boundary, elevations, and topography. Semi-primitive experiences can be provided along the trail corridor, from which outside intrusions are not visible or noticeable. Also, the steep slopes near the upper reaches of the South Fork Skokomish River provide ample opportunities for rugged cross-country travel within a primitive setting.

SPECIAL FEATURES

There is a portion of a Spotted Owl Habitat Area within this unroaded area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

The area is primarily underlain by volcanic and sedimentary rocks of Eocene age. The zone of contact between these two types of rock appear to have the most potential for the occurrence of locatable mineral resources. Even though this unroaded area has not been evaluated by the USGS and Bureau of Mines, available data indicates most of the area has a low to moderate potential for the occurrence of manganese deposits; and these deposits may have associated copper, molybdenum, iron, chromium and nickel.

Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low. A small part of the area in Sections 16 and 17, T.23N., R.6W. may be encumbered by mining claims, the validity of which has not been determined. There is presently no mining activity, and under current conditions it appears that they may not be valid claims. The area has not been classified "prospectively valuable" for leasable mineral commodities, and it has no mineral leases or pending lease applications.

Water

Major streams include the South Fork Skokomish River and Rule, Schofield, Tumble and Snowfield Creeks. There are no lakes in this unroaded area.

Vegetation

This area contains about 2,840 acres (46% of area) of tentatively suitable forest land. The seral stages and estimated standing volumes are as follows.

		Estimated Standing Volume	
Seral Stage	Acres in Percent	Million Board Feet	Million Cubic Feet
PL	3	1.6	0.3
MS	40	54.6	10.0
LS	57	77.5	14.2
TOTAL	100	133.7	24.5

PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

The area's estimated potential contribution to the long-term sustained yield capacity is 0.4 million cubic feet per year.

Special Areas

Approximately 20 to 25 percent of the area is in riparian zones which consist of the main stem of the upper South Fork of Skokomish River and its tributary streams. There is a small floodplain on the South Fork Skokomish River near Snowfield Creek. Cliffs and talus slopes are common in higher elevations, particularly near Capital Peak. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

The Upper Skokomish area is important wildlife habitat. It provides some of the last undisturbed habitat in the Shelton CSYU. Two Spotted Owl Habitat Areas are located within its boundaries and the lower elevations provide important winter habitat for big game.

Fisheries

The main stem of the South Fork Skokomish River and the lower reaches of its major tributaries support excellent populations of resident fish species. Downstream from the area, the South Fork Skokomish supports anadromous fish.

Cultural

The South Fork Skokomish River, downstream from this unroaded area, was professionally surveyed in 1982. The South Fork Skokomish trail and several trail shelters were inventoried and evaluated. Except for the trail, there are no known or reported historic sites in this unroaded area. A literature review suggests that historic resources are likely to relate to trapping, early travel, exploration, mining, and Forest Service activities. It is not likely, however, that any remains will be found, or that any found will have sufficient integrity or significance. The area professionally investigated was judged to have a low probability for the presence of pre-historic sites. If this conclusion is valid, it isn't likely that pre-historic sites will be found in this area.

Recreation

The Upper Skokomish unroaded area provides moderate opportunities for unroaded recreation. Mountain climbing, fishing, hunting, camping, and hiking are opportunities available. There are no proposed trails within this area.

Approximately 44 percent of the area is in the Primitive ROS class, 6 percent in Semi-primitive Non-motorized, 30 percent in Semi-primitive Motorized, and 20 percent in the Roaded-Natural class.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Primitive	2,722	272
Semi-Primitive Nonmotorized	364	37
Semi-Primitive Motorized	1,844	327
Roaded Natural	1,252	125
TOTAL	6,172	761

Scenery

The visual character of this unroaded area involves portions of the headwaters of the South Fork Skokomish River and its upper tributaries: Rule, Tumble, and Snowfield Creeks. The slopes, extending up from the river, are steep and densely covered with conifer forests. The rocky summits of Capital Peak and Mt. Church are dominant landform features. The area is not readily visible from its surroundings. It is viewed primarily from within, mainly from the South Fork Skokomish trail and from the ridge tops and peaks surrounding the area. The Visual Quality Objectives are Partial Retention, Modification, and Maximum Modification.

Wild and Scenic Rivers

There are none associated with this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Mt. Skokomish unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Fire occurrence in the Upper Skokomish unroaded area is low. Based on the vegetative condition of the old-growth in the area, it is likely that a large fire swept through the area about 300 years ago. Since current fire management activity has started, this area does not have more than average fire occurrence for the Olympic National Forest.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Upper Skokomish unroaded area is adjacent to Olympic National Park and the Wonder Mountain Wilderness. The Lightning Peak unroaded area is adjacent to the eastern boundary.

DISTANCE FROM POPULATION CENTERS

The area is within 70 miles, or one and one-half hours driving time of Seattle, Washington via the Puget Sound ferry system, State Highway 3, US Highway 101 and county and Forest roads. Shelton is the nearest town. The area is approximately 18 miles from Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest and input was moderate for this unroaded area during development of the Timber Management Plan but local environemental groups actively campaigned for its inclusion in the RARE II study.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives B-Departure (Modified, NC No-Change, and A-Current Direction there would be very little, if any, adverse consequences.

Under Alternatives C-Preferred (Modified) H (Modified) and I, interest in conducting exploration and development activities within areas encumbered by three mining claims and within areas identified as having a "low" to "moderate" potential for the occurrence of manganese resources would be affected. Since none of the area is classified "prospectively valuable" for oil and gas, the effect on this resource appears negligible.

SOIL, WATER AND SPECIAL AREAS

There should be no effect to soils, water, or Special Areas (riparian) from Alternatives C-Preferred (Modified), H (Modified) and I. Alternative A-Current Direction should have little risk of affecting the above resources. Alternatives NC and B-Departure (Modified) pose more risk. The risk of impacting soils, water, and Special Areas increases with intensity of timber harvest and road construction activity. Maintaining the Upper Skokomish unroaded area would help mitigate impacts on downstream water quality which has been affected by intensive timber harvest in past decades.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade in part of the area under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified) and C-Preferred (Modified). The harvest level would increase in the second decade for Alternatives NC (No Change) and B-Departure (Modified), before leveling off. No timber management activities are scheduled for Alternatives H (Modified) and I.

With Alternative NC (No Change), about 1,900 acres or 31 percent of the unroaded area would be harvested. Long-term sustained yield capacity is less than 0.3 million cubic feet per year.

With Alternative A-Current Direction and C-Preferred (Modified), about 1,200 acres or 19 percent of the unroaded area would be planned for harvest. The long-term sustained yield capacity contribution is about 0.2 million cubic feet per year. The emphasis is on keeping the Upper Skokomish Management Area in its natural condition.

With Alternative B-Departure (Modified), about 2,840 acres or 46 percent of the unroaded area would be planned for harvest. Long-term sustained yield capacity is about 0.4 million cubic feet per year. The emphasis is on timber management.

WILDLIFE

Only Alternatives NC, A, and B-Departure (Modified) have an effect on wildlife. All of the area will be roaded in Alternative B-Departure (Modified) and over 25 percent be roaded in Alternative A-Current Direction. The remaining alternatives will keep the area intact.

FISHERIES

Due to management related activities, only Alternatives NC, A-Current Direction and B-Departure (Modified) have a measurable impact on the associated fisheries resource during the first decade. During the fifth decade, Alternatives NC, and B-Departure (Modified) will have the greatest impact. To a lesser degreee, Alternatives A-Current Direction and C-Preferred (Modified) will also have an impact. Alternatives H (Modified) and I will have no effect.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Wildernesses and Park and may affect air quality in the Puget Sound trough.

CULTURAL

Consequences on cultural resource values will not change significantly with the implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low, as will the consequences. Some historic properties may deteriorate and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat similar for Alternative C-Preferred (Modified) since increases in ground disturbing activities are only moderately higher than in Alternatives H (Modified) and I.

Alternatives B-Departure (Modified), NC No-Change, and A-Current Direction may affect cultural resources substantially. More sites will be discovered, some may be impacted. Significant historic properties are not expected to be found, although further deterioration may take place. Pre-historic sites may be discovered and impacted, as opposed to being left intact under other alternatives.

RECREATION

Alternative B-Departure (Modified) would have the greatest effect on unroaded recreation within this unroaded area. No acres would be allocated to dispersed unroaded recreation and 1,900 acres would remain unroaded in a spotted owl habitat allocation. The other 4,300 acres would be allocated to Timber Management. Alternative No Change would allocate 4,300 acres to Undeveloped Non-motorized Recreation use and the remaining 1,900 acres to Timber Management. Alternatives A-Current Direction and C-Preferred (Modified) have identical allocations. 3,800 acres would be allocated to Undeveloped Non-motorized Recreation and the remaining acres would be allocated to Timber Management. Alternatives H and I are also identical and have the least effect on unroaded recreation. The entire area would remain

unroaded with 5,000 acres allocated to Undeveloped Non-motorized Recreation and 1,200 acres allocated to spotted owl habitat.

SCENERY

Alternative B-Departure (Modified) would impact scenery the most in the Upper Skokomish unroaded area and would have the fewest acres remaining in a natural or near natural condition. 1,900 acres would be allocated to spotted owl habitat and would remain natural in appearance while 4,300 acres would be allocated to Timber Management and could vary from moderately to heavily altered in appearance. The No Change Alternative would allocate 4,300 acres to Undeveloped Recreation and would remain natural in appearance while 1,900 acres would be allocated to Timber Management and could range from moderately to heavily altered in appearance. Alternatives A-Current Direction and C-Preferred (Modified) would have identical effects on scenery within this unroaded area. 3,800 acres would be allocated to Undeveloped Recreation and 1,200 acres to spotted owl habitat and would remain natural in appearance. 1,200 acres would also be allocated to Timber Management and could have an appearance that would range from moderately to heavily altered. Alternatives H and I are also identical in their effects on scenery in the Upper Skokomish unroaded area. Both alternatives would allocate 5,000 to Undeveloped Recreation and 1,200 acres would be allocated to spotted owl habitat. The entire area would remain in a natural appearing condition in both of these alternatives.

WILD AND SCENIC RIVERS

There are none associated with this alternative.

ROADS

Projected mileage of road construction for each alternative is displayed in Table C-23. The figures show estimated development for the 50-year planning horizon in total, and are included in road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternative B-Departure also includes substantial harvest allocations within areas in which use of highly sophisticated logging systems (predominantly helicopter) is needed. Road construction to serve these systems will be minimal.

Table C-23. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	1	2	9	2	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. Average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 27 person-years. Conversely, an average of 4 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-24. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-24. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	20	13	27	13	4	4

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternative B-Departure (Modified) would remove a major portion of the area from future consideration as Wilderness by allocating 4,300 acres to Timber Management.

Alternative No Change would eliminate 1,900 acres from future Wilderness consideration. Alternatives A-Current Direction and C-Preferred (Modified) would eliminate 1,200 acres from future Wilderness consideration.

Alternatives H (Modified) and I would retain the entire area in an unroaded state and it's future consideration as Wilderness.

Table C-25. Upper Skokomish 6,182 Acres (6.2) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	4.3	3.8	0	3.8	5.0	5.0
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	1.2	1.9	1.2	1.2	1.2
Timber Management E1	1.9	1.2	4.3	1.2	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	6.2	6.2	6.2	6.2	6.2	6.2

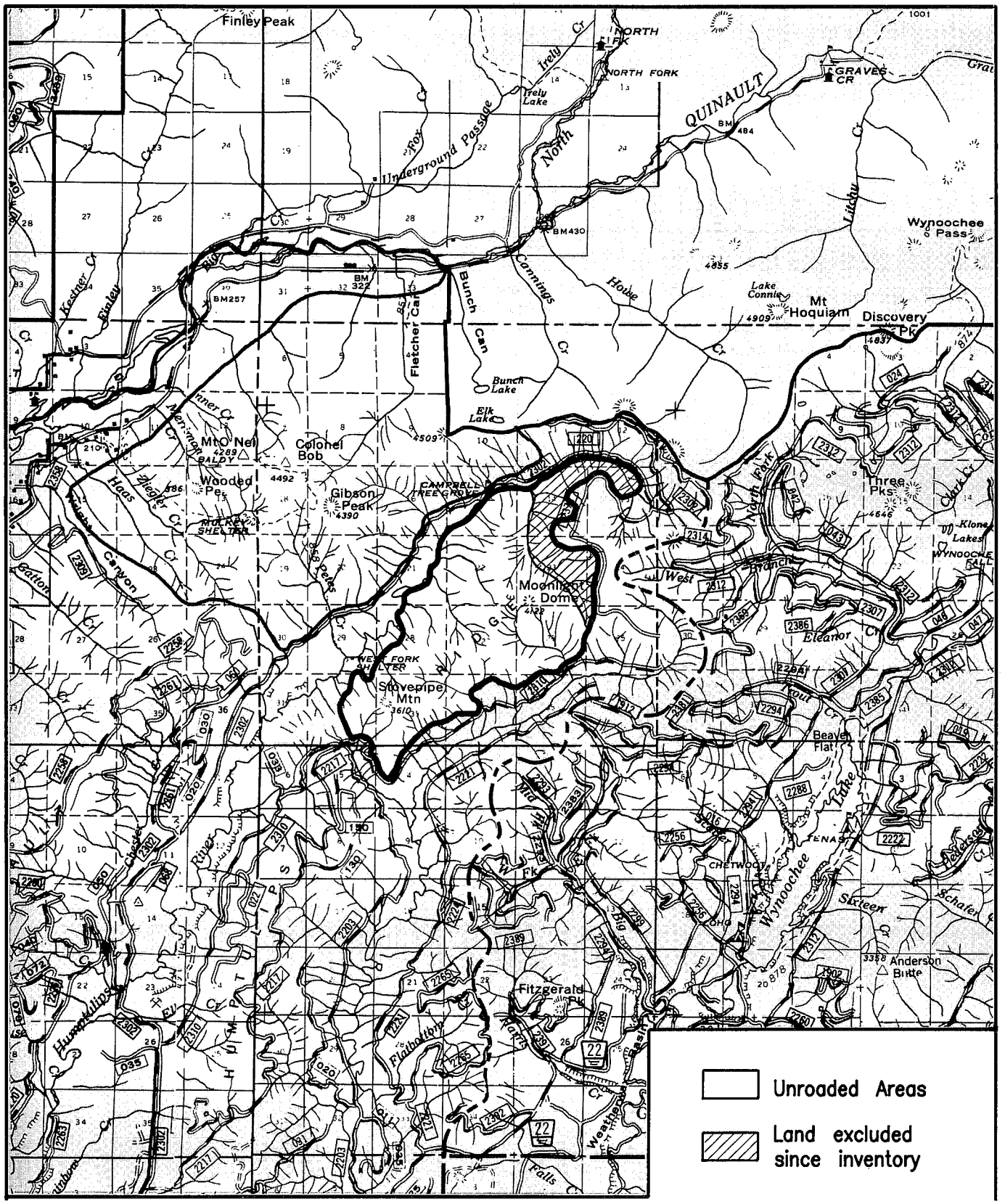


Figure C-9. MOONLIGHT DOME UNROADED AREA

MOONLIGHT DOME UNROADED AREA (5,931 acres)

DESCRIPTION

HISTORY

The Moonlight Dome area was inventoried in the RARE process in 1973 but not in RARE II because it had been studied in the Quinault Planning Unit by then.

In the July, 1976, FEIS for the Land Management Plan for the Quinault Planning Unit, the Moonlight Dome area was inventoried as a 5,202 acre unroaded area. The decision in that process allocated 3,418 acres to be managed primarily for roadless recreation opportunities, emphasizing rock climbing and other forms of trailless recreation. The 1,784 acres of commercial forest land within the area were allocated for Timber Management.

LOCATION AND ACCESS

The Moonlight Dome unroaded area is located in the eastern portion of the Quinault Ranger District. The area is approximately 6 miles long and 3 miles wide. This unroaded area is an island of undeveloped land surrounded by roads and harvest units.

The area is accessible from the town of Humptulips by driving US Highway 101 and county and Forest roads for 25 miles.

There are no existing trails in the area.

PHYSIOGRAPHY AND SOILS

Elevations range from 1000 feet near the West Fork of the Humptulips River, on the west side of the area, to 4,122 feet at the summit of Moonlight Dome.

Geologic mapping shows most of the area as having Metchosin formation with marine basalt and minor interbedded marine sedimentary rock, while a small portion consists of continental and alpine glacial deposits over Metchosin formation.

Soils consist primarily of shallow, gravelly, medium colluvial and residual soils derived from basalt occurring on steep sideslopes. Basalt rock outcrops occur on higher elevation ridges and sideslopes throughout the area.

VEGETATION

The lower slopes and flatter areas at higher elevations are generally heavily forested with Pacific silver fir, Douglas-fir, hemlock, and western redcedar. At higher elevations, the tree cover of mountain hemlock and subalpine fir gives way to rock outcrops and rock ridges.

ECOSYSTEM

This area consists mostly of Kuchler Ecotype K3, Pacific silver fir and Douglas-fir old growth and K4 mountain hemlock and subalpine fir in the higher elevations. There is also small amounts of Ecotype K2, red cedar, western hemlock, Douglas-fir.

CURRENT USES

There are no developed recreation sites or trails within this area. Due to the area's limited access, dense vegetation, rugged topography, and lack of a major attraction, the area receives limited recreational use. Fishing, climbing, and hunting are the activities that are most likely to occur. The area receives less than 1,000 RVDs of use annually.

Approximately 3,200 acres are in the Semi-Primitive Nonmotorized ROS class, and the remaining acres are in Roaded Natural/Modified.

APPEARANCE, SURROUNDINGS AND ATTRACTIONS

The area has moderate diversity of visual variety. Steep and well dissected slopes covered with a dense conifer forest extend upward to cliffs and the rocky summits of Moonlight Dome and Stovepipe Mountain. The West Fork of the Humptulips River flows along the area's northwest boundary, while many small streams drain from the area. There are no lakes.

The Moonlight Dome unroaded area is viewed as an island of undeveloped land from surrounding roads and from trails and peaks within the Colonel Bob Wilderness. Due to the dense vegetation that blankets this area, views from within are mostly limited to higher elevations on Moonlight Dome and Stovepipe Mountain .

Big game hunting, fishing the Humptulips River, and rock climbing on Moonlight Dome and Stovepipe Mountain are the major attractions.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

This area is an island of undeveloped forest and rocky peaks located between the West Fork and the East Fork of the Humptulips River. The area is bounded on all sides by roads and timber harvest units.

The ability to manage this unroaded area in a natural state for primitive and semi-primitive types of activities is affected by its moderate size and the surrounding management activities. Off-site intrusions such as noise and the sights of nearby management activities are evident from throughout the area, especially from the higher elevations.

NATURAL INTEGRITY

The current Moonlight Dome unroaded area was not identified in the RARE II inventory. The area consists of 5,931 acres of undeveloped land that remains in a natural state, free from human influences.

NATURAL APPEARANCE

Due to the moderate size of this area, the topography, and dense vegetation, one can obtain a feeling of naturalness. From the higher elevations, however, the sights and sounds of surrounding management activities minimize that feeling.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Management aimed at providing primitive or semi-primitive experiences would be affected by off-site intrusions surrounding the area. However, due to the dense vegetation, rugged topography and size of this area, the visitor could achieve a sense of challenge, risk, and in some cases, solitude.

Under current conditions, the area would present a challenge for any recreationist desiring to penetrate its interior. The range of use opportunities is limited to foot travel and climbing.

SPECIAL FEATURES

There are two Spotted Owl Habitat Areas within this unroaded area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIAL

Minerals

The area is primarily underlain by volcanic and sedimentary rocks of Eocene age. The zone of contact between these two types of rock appear to have the most potential for the occurrence of locatable mineral resources. Even though this unroaded area has not been evaluated by the USGS and Bureau of Mines, available data indicate most of the area has a low to moderate potential for the occurrence of manganese deposits. These deposits may have associated copper, molybdenum, iron, chromium and nickel. Under current supply/demand conditions, the potential for discovering a "valuable" deposit of manganese is low. There is presently no mining activity, and none of the area is encumbered by mining claims. The area has not been classified "prospectively valuable" for leasable mineral commodities, and it has no mineral leases or pending lease applications.

Water

Many unnamed streams and creeks flow from this unroaded area. The northwest face of the ridge drains into the West Fork Humptulips River and the southeast face drains into the East Fork of the Humptulips River. There are no lakes.

Vegetation

This area contains about 4,660 acres (79% of area) of tentatively suitable forest land. The seral stages and estimated standing volumes are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
PL	2	1.6	0.3
MS	12	21.3	3.9
LS	86	251.7	46.1
TOTAL	100	274.6	50.3

PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.6 million cubic feet per year.

Special Areas

Approximately 20 percent of the area is in riparian zones which consist of headwaters of East and West Forks of Humptulips River and their small tributary streams. Cliffs are common on upper slopes of Moonlight Dome. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Moonlight Dome provides elk winter range and contains all of one Spotted Owl Habitat Area and a portion of another. Other wildlife species including black bear use the area.

Fisheries

Suitable habitat within the drainages of this area support resident trout populations. Downstream, both the East Fork and West Fork of the Humptulips River support significant anadromous fish populations.

Cultural

A literature review suggests that historic resources are likely to relate to trapping, mining, and Forest Service activities. Trails, shelters, and camping areas are confined to the valley bottom. Mine shaft "evidence" of the Campbell mine are documented in the Olympic National Forest Overview Report on cultural resources. However, all known or reported sites are not within this area. There is little to suggest that any cultural resources would be found in this area, since it is extremely steep and rugged. Based on evidence collected thus far, it would also seem unlikely that pre-historic sites would be discovered.

Recreation

The Moonlight Dome unroaded area has good potential for providing unroaded recreation opportunities where route finding can be a major challenge. Mountain climbing, hunting and fishing provide the greatest recreation opportunities. Approximately 35 percent of the area is in the Roaded-Natural ROS class and approximately 65 percent is classified as Semi-primitive Non-motorized.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive Nonmotorized	3,200	320
Roaded Natural/Modified	2,731	300
TOTAL	5,931	620

Scenery

The visual character of this unroaded area consists of common variety. Steep side slopes extending from rivers to ridge top. Slopes are blanketed with conifer forests with a course textured appearance. Rock outcrops and cliffs are dominant features in higher elevations. The area is visible from surrounding Forest roads and the Colonel Bob Wilderness. The Visual Quality Objectives are Modification and Maximum Modification.

Wild and Scenic Rivers

A short portion of the east bank of the West Fork Humptulips is within this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Moonlight Dome unroaded area. Diseases are also present. Root rots,

heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Fire occurrence in the Moonlight Dome unroaded area is rare. Many of the forested areas on the west side of the Olympic Peninsula have developed over a period in excess of 600 years without major interruptions due to fire.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Moonlight Dome unroaded area lies one mile southeast of the Colonel Bob Wilderness and three miles east of the South Quinault Ridge unroaded area.

DISTANCE FROM POPULATION CENTERS

The area is within 160 miles or approximately three hours driving time from Seattle, Washington via Interstate 5, US Highway 101, State Highway 8 and county and Forest roads. Humptulips is the closest town. Highway 101 is approximately 20 miles from the area.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT, AND INVOLVEMENT

Public interest in this unroaded area has been very low.

ENVIRONMENTAL CONSEQUENCES

No mining claims would be affected by any alternative. Interest in conducting exploration and development activities within areas identified as having a "low" potential for the occurrence of manganese resources would be in all alternatives except B-Departure (Modified). Since none of the area is classified "prospectively valuable" for oil and gas, the effect on this resource appears negligible.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from Alternatives C-Preferred (Modified), H (Modified) and I. Alternative A-Current Direction should have little risk of affecting the above

resources. Alternatives NC and B-Departure (Modified) pose more risk of impacting the above resources. The risk of impacting soils, water, and Special Areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, and B-Departure (Modified). The harvest level would increase in the second decade for Alternative B-Departure (Modified) before leveling off. No timber management activities are scheduled for Alternatives C-Preferred (Modified), H (Modified) and I.

With Alternatives NC (No Change) and A-Current Direction, about 600 acres or 10 percent of the unroaded area would be planned for harvest. The long-term sustained yield capacity contribution is about 0.1 million cubic feet per year. Both alternatives would leave the Moonlight Dome Special Management Area in its natural condition.

With Alternative B-Departure (Modified), about 4,660 acres or 79 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity is about 0.6 million cubic feet per year. The emphasis is on timber management. No roads would be built within the Moonlight Dome Special Management Area, but the area would be harvested.

Alternatives C-Preferred (Modified), H (Modified) and I do not allow timber harvest.

WILDLIFE

Only Alternatives NC, A-Current Direction, and B-Departure (Modified) affect wildlife in the first decade. Alternatives NC and B-Departure (Modified) have an impact throughout the entire planning period. Alternative A only has an impact in the first decade. After the first decade, Alternatives A-Current Direction and C-Preferred (Modified) have the same impact through the fifth decade. There is no effect from Alternatives H (Modified) and I.

FISHERIES

Alternatives C-Preferred (Modified), H (Modified), and I, during the first decade, and Alternatives H (Modified) and I, during the fifth decade, should not have any impact on the fisheries resources. Conversely, Alternatives NC and B-Departure (Modified), in both the first and fifth decades will have the greatest impact, due to management related perturbations. Alternatives A and C-Preferred (Modified) will also have impact but to a lesser extent.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Wildernesses and Park and may affect air quality in the Puget Sound trough.

CULTURAL

The effects on cultural resource values will be similar and rather inconsequential regardless of the alternative selected. The potential for the existence of cultural resources is very low, any that may exist will lack integrity, and none are expected to meet National Register criteria. The existence of pre-historic sites is considered to be very speculative and unlikely at this time.

RECREATION

Alternative B-Departure (Modified) would have the greatest effect on unroaded recreation in the Moonlight Dome unroaded area. The entire area would be allocated to Timber Management. Alternatives No Change and A-Current Direction would have identical effects on unroaded recreation. They both would allocate 5,300 acres to Undeveloped Non-motorized Recreation and 600 acres to Timber Management. Alternatives C-Preferred (Modified), H and I would provide the greatest recreation benefits as the entire unroaded area would be allocated to Undeveloped Non-motorized Recreation and would remain unroaded.

SCENERY

Alternative B-Departure would have the greatest effect on scenery in this unroaded area. The entire area would be allocated to Timber Management and could have a moderately to heavily altered appearance. Both the No Change and A-Current Direction Alternatives would have minimal effects on scenery. 5,300 acres would be allocated to Undeveloped Non-motorized Recreation and remain in a natural appearing condition. The remaining 600 acres would be allocated to Timber Management in both of these alternatives. Alternatives C-Preferred (Modified), H and I would provide the greatest benefits for scenery. The entire unroaded area would be allocated to Undeveloped Recreation and would remain in a natural appearing condition.

WILD AND SCENIC RIVERS

Management objectives within Wild and Scenic river corridors are compatible with those for maintaining unroaded conditions. Therefore, Wild and Scenic rivers have no effect on unroaded areas in any alternative.

ROADS

Projected mileage of road construction for each alternative is displayed in Table C-26. The figures show estimated development for the 50-year planning horizon in total, and are included in road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with

implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternative B-Departure (Modified) also includes substantial harvest allocations within areas in which use of highly sophisticated logging systems (predominantly helicopter) is needed. Road construction to serve these systems will be minimal.

Table C-26. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	2	2	4	0	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity , is 40 person-years. Conversely, an average of 4 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-27. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-27. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	10	10	40	4	4	4

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternative B-Departure (Modified) would eliminate the entire area from future Wilderness consideration.

Alternatives No Change and A-Current Direction would remove 600 acres from future Wilderness consideration and retain 5,300 acres for future Wilderness consideration.

Alternatives C-Preferred (Modified), H (Modified) and I would retain the entire area for future Wilderness consideration.

Table C-28. Moonlight Dome 5,931 Acres (5.9) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	5.3	5.3	0	5.9	5.9	5.9
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	0	0	0	0	0
Timber Management E1	0.6	0.6	5.9	0	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	5.9	5.9	5.9	5.9	5.9	5.9

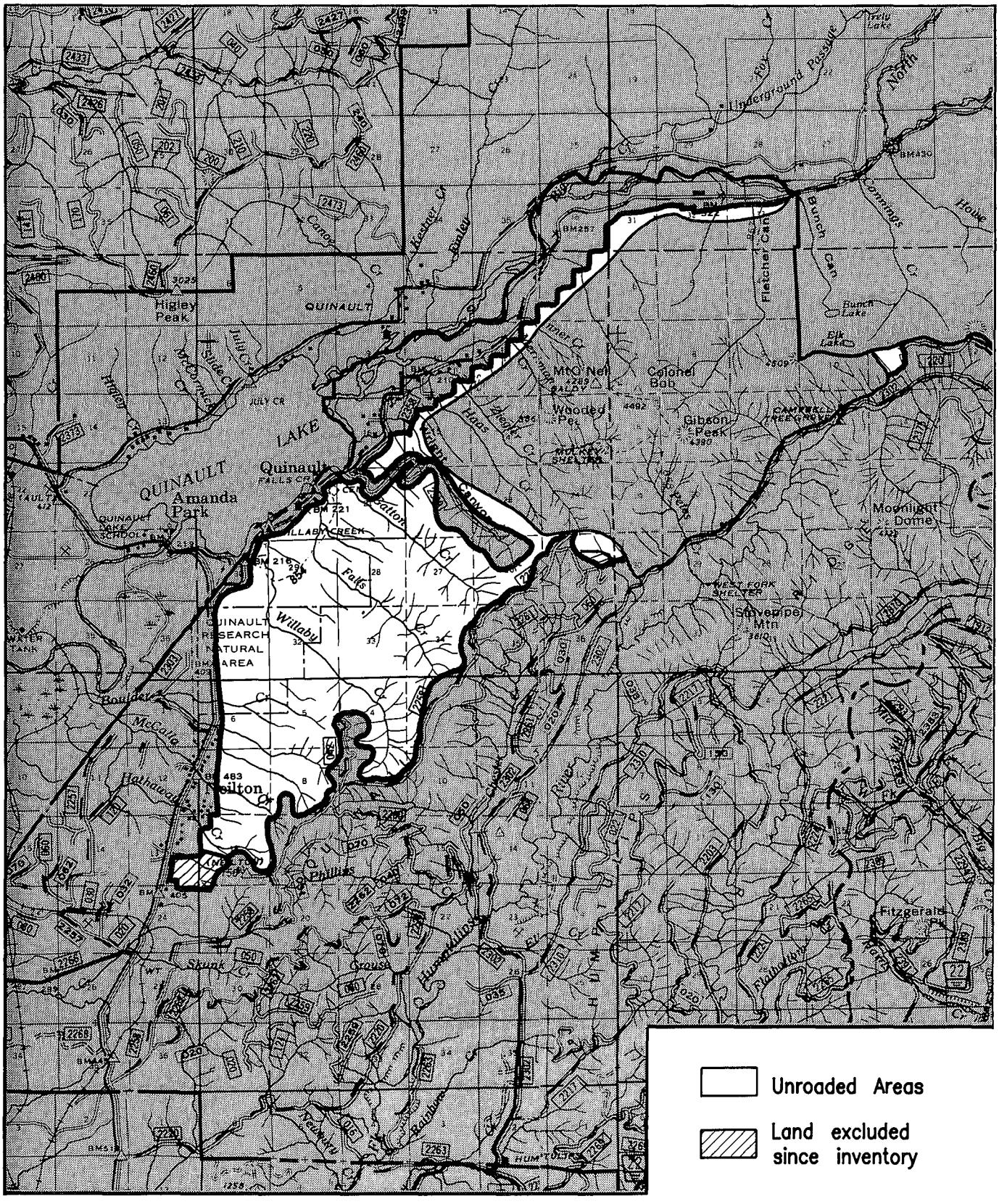


Figure C-10. SOUTH QUINAULT RIDGE UNROADED AREA

SOUTH QUINAULT RIDGE UNROADED AREA (9,852 acres)

DESCRIPTION

HISTORY

The South Quinault Ridge unroaded area was originally inventoried in the RARE process. It was not identified in RARE II because it had been evaluated for its Wilderness potential in an approved planning process prior to that time.

In July 1976, the FEIS for the Land Management Plan for the Quinault Planning Unit allocated 8,866 acres of this unroaded area to a Special Management Area. Recreation was the emphasis for 1,261 acres in the Lake Quinault Special Management Area, while remaining acres were to be managed as a scenic area to ensure protection of the scenic backdrop for Lake Quinault. This area was the only area within the Quinault Planning Unit where all management activities would have to meet the assigned visual quality objectives. The acres allocated for scenic backdrop are available for timber harvest. Roads are not permitted in Gatton, Falls, or Willaby Creek drainages. Water quality in these drainages and the fisheries resource will be protected. The remainder of the area, with the exception of the Research Natural Area, will be available for roaded access under constraints protecting visual and water quality.

LOCATION AND ACCESS

This 9,852 acre unroaded area is located in the south central portion of the Quinault Ranger District. The area lies adjacent to the south shore of Lake Quinault and is approximately 6.5 miles long and 3.5 miles wide. It is accessible in the south from the town of Hoquiam by driving US Highway 101 and the South Shore county road for 41 miles.

Roads surround the entire area, while the 3.9 mile Quinault Loop trail provides hiker access into the western portion. Two other short trails, both totaling only 2.3 miles, also provide access into the area and connect to the Loop trail.

PHYSIOGRAPHY AND SOILS

This area consists of the west face of Quinault Ridge, between the road in Wrights Canyon and Cook Creek. Elevations range from approximately 300 feet near Lake Quinault to nearly 3,100 feet at high points on the ridgeline.

The lower elevations consist of Continental and Alpine glacial deposits over Metchosin Formation. The higher elevations involve Metchosin Formation with Marine basalt and minor interbedded Marine Sedimentary rocks.

Soils consist primarily of shallow, gravelly medium colluvial and residual soils derived from basalt, and occur on steep side slopes. Basalt rock outcrops occur on higher elevation ridges and sideslopes throughout the area.

VEGETATION

Stands of large old-growth, consisting of Douglas-fir, western hemlock, western redcedar, and Sitka spruce, occur on the lower slopes. Higher elevations are forested with stands of Pacific silver fir and mountain hemlock.

ECOSYSTEM

This area consists mostly of Kuchler Ecotype K3, Douglas-fir and Pacific silver fir old-growth. There are also small amounts of Ecotypes K1, Sitka spruce, western hemlock, and western redcedar and K2, red cedar, western hemlock, Douglas-fir.

CURRENT USES

The major recreation activities include hiking, hunting, nature study, and viewing outstanding scenery. There are no developed recreation sites within the area, however, there is a proposed campground to be constructed in the Willaby Creek flats, located in the southwest portion of the area. This area annually receives over 9,000 RVDs of use.

The area is surrounded by roads. The western portion is readily accessible from U.S. Highway 101, the South Shore County Road and three trails with a total mileage of 6.2 miles. The Quinault Rain Forest Nature Trail receives extremely heavy use during the summer recreation season.

The South Quinault Ridge unroaded area consists of approximately 1,150 acres of Rural ROS class 5,400 acres of Semi-Primitive Nonmotorized, and the remaining acres are in the Roaded Natural/Modified ROS class.

Approximately 1,343 acres of the Quinault Research Natural Area is within this unroaded area. The Natural Area is reserved for, and dedicated to, research purposes and is not subject to development.

APPEARANCE, SURROUNDINGS, AND ATTRACTIONS

This unroaded area has common visual variety in landforms, rock formations, and waterbodies, and unique vegetative variety. One of the best examples of the Olympic rain forest is located on the lower slopes, along the southwest boundary. Several creeks, including, Gatton, Falls, and Willaby flow from the area. There are no lakes.

The area is viewed as a moderately steep ridge with a dense cover of conifer forest extending from the lower elevations to the top of the ridge. It is seen from Quinault Lake, US Highway 101, the South Shore Road and from Olympic National Park along the north shore of Lake Quinault.

The area is surrounded by man's activities and developments. It is bounded by logging roads and timber harvest units along its northeast, southeast and southwest boundaries. Adjacent to the areas' northwest boundary is the South Shore County Road, 68 summer homes, Lake Quinault Lodge, the Quinault Ranger Station Office, service area, trailer court, sewage disposal plant, three developed campgrounds, and four trailheads, including a large parking lot with flush toilets at the Quinault Rain Forest Nature Trail.

The most significant attraction within the area is the Quinault Rain Forest. Three trails provide hiker access to large stands of old-growth conifers and lush understory vegetation. This unroaded area also provides a scenic backdrop for Quinault Lake.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The South Quinault Ridge unroaded area is bounded mostly by National Forest lands. A small portion on the southwest end is adjacent to private land.

The ability to manage this area for primitive and semi-primitive recreational experiences is affected by the heavy use it gets at lower elevations, and intrusions from surrounding noises and visible activities at higher elevations.

NATURAL INTEGRITY

The area has changed very little since it was originally identified as an unroaded area. A small portion at the southern end of the area has been deleted because of timber harvesting. The remaining acres have retained their natural state and are free from human influences.

NATURAL APPEARANCE

Due to the area's size and dense vegetation, there are portions that offer a feeling of naturalness. However, from the ridge top, the sights and sounds of surrounding activities are evident.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Opportunities for solitude are limited. Due to the closeness to the recreation area along the south shore of Quinault Lake, opportunities for solitude along the northwest and southwest boundary are very limited. Those who are willing to travel cross-country, away from the areas of high use, will have better opportunities for seeking solitude.

Activities that offer challenging experiences are limited to hunting and cross-country hiking.

SPECIAL FEATURES

There are two Spotted Owl Habitat Areas within this unroaded area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

The area is primarily underlain by volcanic rocks of Eocene age, marine terrace deposits of Pleistocene age and recent alluvium. Even though this unroaded area has not been evaluated by the USGS and Bureau of Mines, available data (including Lawson and Evarts, 1983) indicate the area has at least a low potential for the occurrence of manganese resources. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low. There is presently no mining activity, and none of the area is encumbered by mining claims. The area has been classified "prospectively valuable" for oil and gas resources, and it was recently encumbered by oil and gas leases. As a result of the present energy supply/demand conditions or the absence of evidence indicating a petroleum resource exists in this area, all except one of the leases have terminated.

Water

Major streams within the area are Gatton, Falls and Willaby Creeks, all of which flow into Quinault Lake, and portions of Boulder, McCalla and Hathaway Creeks, which drain into the Quinault River. The upper basins of Falls and Gatton Creeks have been inventoried as potential sites for small pumped-storage reservoirs for peak demand hydroelectric sites. Hathaway and McCalla Creeks are used as municipal surface water systems for homes in the Neilton area. There are several springs or small streams in this unroaded area which are used for single or multiple domestic sources.

Vegetation

This area contains about 8,230 acres (93% of area) of tentatively suitable forest land. The seral stages and estimated standing volumes are as follows:

		Estimated Standing Volume	
Seral Stage	Acres in Percent	Million Board Feet	Million Cubic Feet
PL	1	1.6	0.3
MS	1	3.3	0.6
LS	98	506.7	92.8
TOTAL	100	511.6	93.7

PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 1.1 million cubic feet per year.

Special Areas

Approximately 20 percent of the area is in riparian zones which consist primarily of small tributary streams to Quinault Lake and River. Wetland conditions exist in numerous flat areas southeast of Quinault Lake. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Elk make year-round use of this area. Other wildlife species associated with old-growth habitat also make extensive use of this undisturbed area.

Fisheries

Major drainages support resident trout populations in their upper reaches. The Quinault River, Quinault Lake and the lower reaches of their major tributaries support important anadromous fish populations. The Quinault River system supports the most significant run of sockeye salmon on the Olympic Peninsula.

Cultural

A portion of the area adjacent to the south shore of Quinault Lake has been professionally surveyed. A few historic sites were discovered and inventoried. These sites reflect the fairly intensive settlement and use of the Lake area. Even at that, however, fewer sites remain or were discovered than what one might expect. A possible mill site, trail, remnants of a trail/junction road, were discovered, inventoried, and evaluated. These sites did not meet National Register criteria, or lacked integrity. Most of the remaining portion of this unroaded area has not been examined and there is very little documented evidence that other cultural resources might be found. Prehistoric use occurred along the shores of the lake, but except for some transitory use, it would not seem likely that this use extended into the steep dissected slopes of the ridge area.

Recreation

The South Quinault Ridge unroaded area has good potential for providing unroaded recreation opportunities. Unroaded opportunities consist of hunting, hiking, and nature study. However, a developed campground with automobile access is proposed in the Willaby Creek area.

There is an old abandoned trail that extends off the Quinault Loop Trail for 2.2 miles up Willaby Creek. If this trail were reconstructed, and an additional 2.2 miles of new construction, there would be hiker access from Quinault Lake to the ridge top.

Approximately 12 percent of the area is in the Rural ROS class, 48 percent in Roaded Natural, and 40 percent in Semi-Primitive Nonmotorized.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Rural	1,150	630
Roaded-Natural	3,302	330
Semi-Primitive Nonmotorized	5,400	540
TOTAL	9,852	1,500

Scenery

The landscape character of this unroaded area consists of a relatively flat area extending away from the South Shore of Quinault Lake for a short distance of one quarter to one half mile as it climbs steeply to the top of Quinault Ridge. Vegetative diversity includes rain forest and very large, old-growth along the south shore of the lake blending into a dense canopy of textural conifer forest on the side slopes of the ridge. The area is visible from Olympic National Park, US Highway 101 and the North and South Shore county roads. There is also a loop trail and a short nature trail that provide hiking opportunities. Visual Quality Objectives for this unroaded area are Retention, Partial Retention, and small amounts of Modification.

Wild and Scenic Rivers

There are none associated with this area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreaks within the South Quinault Ridge unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Fire occurrence in the South Quinault Ridge unroaded area is rare. Many of the forested areas on the west side of the Olympic Peninsula have developed over a period in excess of 600 years without major interruptions due to fire.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

This unroaded area lies within one mile of the southern portion of the Colonel Bob Wilderness and approximately four and a half miles west of the Moonlight Dome unroaded area.

DISTANCE FROM POPULATION CENTERS

The Area is approximately 150 miles or three hours driving time from Seattle, Washington via Interstate 5, US Highway 101 and the South Shore county road. The small towns of Quinault, Amanda Park and Neilton are nearby. The area is within one-half mile of Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

Other than the existing Quinault Research Natural Area, there are no unique or special ecosystems within the area in need of representation through a specified designation such as Research Natural Area.

PUBLIC INTEREST, INPUT AND INVOLVEMENT

Past public interest in this area has been high, with most of the concern expressed for maintaining the landscape quality of the area as a backdrop to Quinault Lake, and to provide opportunities for viewing rain forest vegetation.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction and NC-No Change, areas classified "prospectively valuable" for oil and gas and areas previously or presently leased for prospecting for oil and gas will not be appreciably affected. In Alternative B-Departure (Modified), there would be very little, if any, adverse consequences.

Under all other alternatives, no mining claims would be affected, but interest in conducting exploration and development within areas identified as having a "low" potential for the occurrence of manganese resources would be. In addition to these effects, interest in exploring for oil and gas within areas previously or currently leased for oil and gas resources and classified "prospectively valuable" for oil and gas could be adversely affected.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from Alternatives C-Preferred (Modified), H (Modified) and I. Alternative A-Current Direction should have little risk of affecting the above resources. Alternatives NC and B-Departure (Modified) pose more risk of impacting the above resources. The risk of impacting soils, water, and Special Areas increases with intensity of timber harvest and road

construction activity. Minimizing management activities in this unroaded area will help maintain water quality for municipal and small domestic water systems from streams in the area.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified) and C-Preferred (Modified). The harvest level would increase in the second decade for Alternatives NC (No Change), A-Current Direction and B-Departure (Modified), before leveling off. No timber management activities are scheduled for Alternatives H (Modified) and I.

With Alternative NC (No Change) and B-Departure (Modified), about 6,800 acres or 69 percent of the unroaded area would be planned for harvest. The long-term sustained yield capacity is about 0.9 million cubic feet per year.

With Alternative A-Current Direction, about 5,290 acres or 54 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity contribution is about 0.7 million cubic feet per year.

With Alternative C-Preferred (Modified), about 2,400 acres or 24 percent of the unroaded area would be planned for harvest. Long-term sustained yield capacity is about 0.3 million cubic feet per year.

Alternatives H (Modified) and I do not allow timber harvest.

WILDLIFE

Alternatives NC, A-Current Direction and B-Departure (Modified) have the greatest impact in the first decade and continue it through the planning period. Alternative C-Preferred (Modified) has some impact in the later decades with the remaining alternatives having no impact.

FISHERIES

During both the first and fifth decades Alternatives NC, A-Current Direction and B-Departure (Modified) will have the greatest impact due to management induced perturbations. Other alternatives should have little or no effect.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to the Forest's designated Wildernesses and Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Wildernesses and Park and may affect air quality in the Puget Sound trough.

CULTURAL

The effects on cultural resource values will not change significantly with the implementation of Alternatives H (Modified) and I. Impacts from ground disturbing activities will be low as will be the consequences. Some historic properties may deteriorate and some may remain undiscovered. Pre-historic sites will not be impacted and sites will remain intact for future study or recovery work.

Consequences are somewhat similar for Alternatives C-Preferred (Modified) since increases in ground disturbing activities are only moderately higher than in Alternatives H (Modified) and I.

Alternative B-Departure (Modified), NC-No Change, and A-Current Direction may affect cultural resources substantially. More sites will be discovered, some may be impacted. Significant historic properties are not expected to be found although further deterioration may take place. Pre-historic sites may be discovered and impacted as opposed to being left intact under other alternatives.

RECREATION

Alternative B-Departure (Modified) would have the greatest effect on unroaded recreation. No acres would be allocated to recreation and 1,800 acres would be allocated to spotted owl habitat. 6,800 acres would be allocated to Timber Management. Alternatives No Change and A-Current Direction are similar with each having 1,500 acres allocated to Undeveloped Non-motorized Recreation and 4,900 acres allocated to the scenic allocation. The No Change Alternative would allocate 1,900 acres to Timber Management while Alternative A-Current Direction would allocate only 400 acres to Timber Management and the remaining 1,500 acres to spotted owl habitat. Alternative C-Preferred (Modified) would allocate 4,400 acres to Undeveloped Non-motorized Recreation use, 2,400 acres to scenery and 1,500 acres to spotted owl habitat. No acres would be allocated to Timber Management under this alternative. Both Alternatives H and I would provide the greatest benefit for unroaded recreation. 6,800 acres would be allocated to Undeveloped Non-motorized Recreation use and 1,500 acres would be allocated to spotted owl habitat. The entire area would remain unroaded under both of these alternatives.

SCENERY

Alternative B-Departure (Modified) would have the greatest effect on scenery in the South Quinault Ridge unroaded area. 1,500 acres would be allocated to spotted owl habitat and 1,500 acres allocated to Research Natural Area and, therefore, 3,000 acres would remain in a natural appearing condition. The remaining 6,800 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Both Alternatives No Change and A-Current Direction would have similar effects on scenery. 1,500 acres would be allocated to Undeveloped Recreation and 1,500 acres would be allocated to Research Natural Area and would remain in a natural appearing condition. 4,900 acres would be allocated to the scenic allocation and could have a moderately to heavily altered appearance. In Alternative A-Current Direction, 1,500 acres would be allocated to spotted owl habitat and 1,500 acres would be allocated to Research Natural Area and would also remain in a natural appearing condition. Only 400 acres would be allocated to Timber Management. Alternative No Change would allocate 1,900 acres to Timber Management and could have a moderately to heavily altered appearance. Alternative C-Preferred (Modified) would allocate 4,400 acres to Undeveloped Recreation and 1,500 acres to Research Natural Area and

these acres would remain in a natural appearing condition. 2,400 acres would be allocated to scenery and would have a slightly altered appearance. Alternatives H and I would provide the greatest protection for scenery. 6,800 acres would be allocated to Undeveloped Non-motorized Recreation, 1,500 acres would be allocated to spotted owl habitat and 1,500 acres would be allocated to Research Natural Area. The entire area would be retained in its unroaded, natural appearing condition.

WILD AND SCENIC RIVERS

There are none associated with this unroaded area.

ROADS

Projected mileage of road construction for each alternative is displayed in Table C-29. The figures show estimated development for the 50-year planning horizon in total, and are included in road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternative A-Current Direction also includes substantial use of highly sophisticated logging systems (predominantly helicopter), as this is the most efficient means of conducting timber harvest while also meeting the visual quality objectives specified in Current Direction. Road construction to serve these systems will be minimal.

Table C-29. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	8	8	14	4	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix

of harvest and unroaded recreation allocations contained in each alternative. Average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 74 person-years. Conversely, an average of 6 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-30. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-30. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	60	47	60	22	6	6

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternatives No Change, A-Current Direction and B-Departure (Modified) would remove the area from future Wilderness consideration.

Alternative C-Preferred (Modified) would remove 2,400 acres from future Wilderness consideration.

Alternatives H (Modified) and I would retain the entire area for future Wilderness consideration.

Table C-31. South Quinault Ridge 9,852 Acres (9.8) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	1.5	1.5	0	4.4	6.8	6.8
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	4.9	4.9	0	2.4	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	1.5	1.5	1.5	1.5	1.5
Timber Management E1	1.9	0.4	6.8	0	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	1.5	1.5	1.5	1.5	1.5	1.5
TOTAL UNROADED ACRES	9.8	9.8	9.8	9.8	9.8	9.8

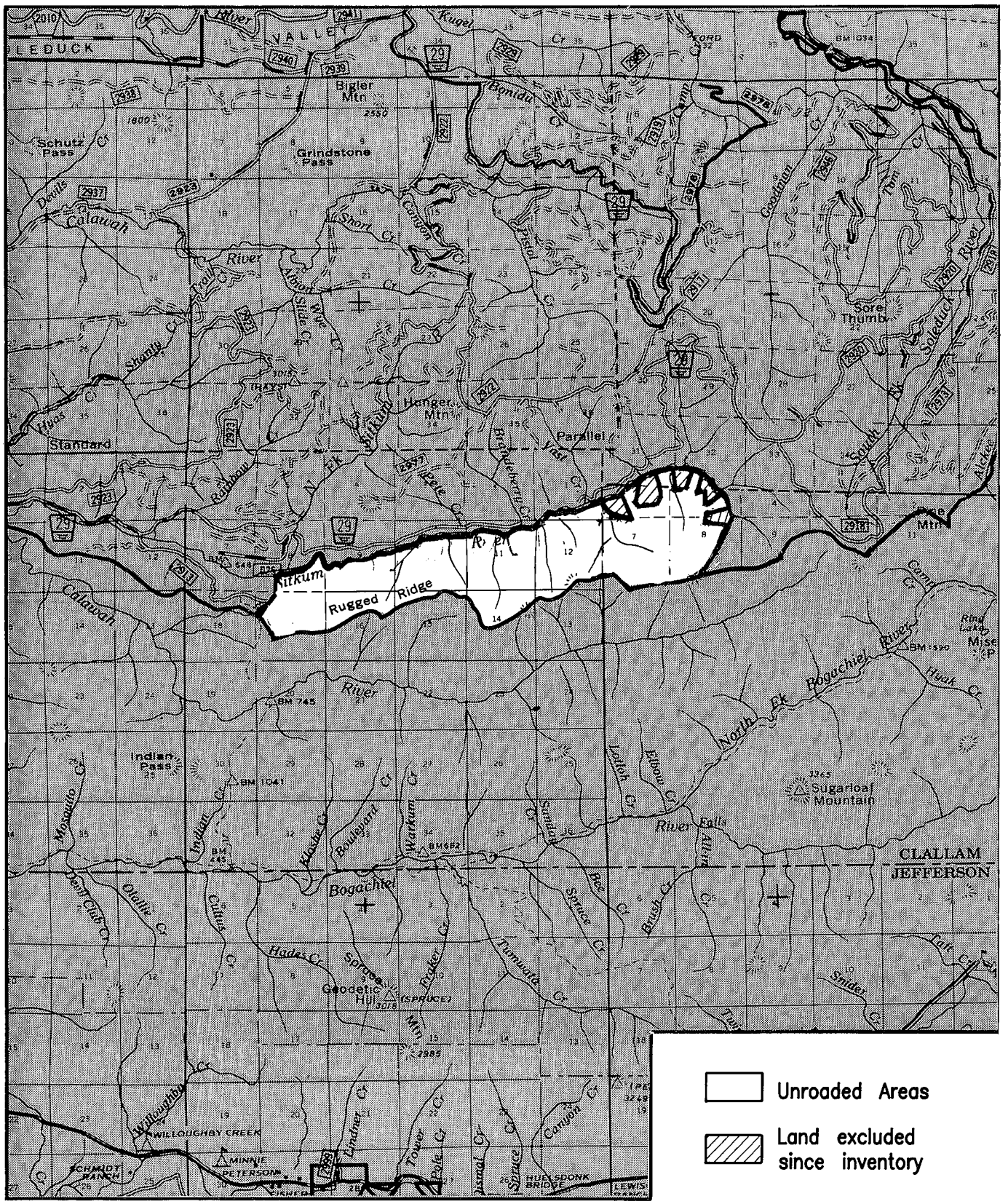


Figure C-11. RUGGED RIDGE UNROADED AREA

RUGGED RIDGE UNROADED AREA (4,564 acres)

DESCRIPTION

HISTORY

The Rugged Ridge unroaded area was originally inventoried in the 1973 RARE processes. It was not included in RARE II because land allocation decisions had been made in an approved land use plan prior to that time.

In March 1975, the FEIS for the Land Management for the Soleduck Planning Unit allocated 6,168 acres to full multiple use management within the constraints established for the remainder of the Unit. An additional constraint was imposed on the planning and construction of transportation facilities within the area.

The November 1986 Forest/Park boundary adjustment increased the current size to 4,564 acres.

LOCATION AND ACCESS

This unroaded area lies along the southern boundary of the Soleduck Ranger District, immediately adjacent to Olympic National Park. The northern boundary parallels the South Fork of the Sitkum River for a distance of approximately seven miles. The width of the area varies from less than one mile to a maximum of about one and a half miles.

The area is accessible from the town of Forks by driving US Highway 101, county and Forest roads for approximately 15 miles. Access is limited to logging roads along the north and west boundaries. Accessing the area from the road along the northern boundary would require fording the South Fork of the Sitkum River. There is a short section of trail just outside the area that provides foot access to the ridge top. Once on the ridge top, access would be cross-country.

PHYSIOGRAPHY AND SOILS

This unroaded area consists of the north face of Rugged Ridge, between the headwaters of the South Fork Soleduck River and the Calawah River. Elevations range from about 800 feet at the northwest corner on the South Fork of the Sitkum River to slightly over 3,100 feet on the ridge top near the southeast corner of the area.

Bedrock consists of massive to poorly bedded graywacke and sandstone, and thinly bedded mudstone, slate, and siltstone. These rocks are moderately competent (non-crumbly) to incompetent.

Soils (crumbly) on the ridges and upper slopes consist primarily of shallow, gravelly medium textured colluvial and residual soils derived from sedimentary bedrock. Midslope soils, consist primarily of moderately deep, well to imperfectly drained soils derived from highly weathered sedimentary bedrock.

VEGETATION

This area is vegetated with a dense conifer forest comprised mostly of old-growth western hemlock, Douglas-fir and Pacific silver fir.

ECOSYSTEMS

This unroaded area consists mostly of Kuchler Ecotype K3 Pacific silver fir and Douglas-fir. There are small amounts of K1, Sitka spruce, western hemlock, and western redcedar, and K2 red cedar, western hemlock, Douglas-fir.

CURRENT USES

There are no developed sites within the area. Recreation use is low and currently consists of fishing and big game hunting. The area receives less than 500 RVDs per year.

Over 90 percent of the area is in the Semi-Primitive Nonmotorized ROS class with the rest in Roaded Natural/Modified ROS class.

APPEARANCES, SURROUNDINGS, AND ATTRACTIONS

This unroaded area has a common visual variety of landform, rock formations, vegetation, and waterbodies. The area consists of the north face of Rugged Ridge, which is a steep, well dissected landform. The ridge separates the Sitkum River from the Calawah River. The Sitkum River forms the north boundary. There are no lakes.

Due to landform, scenery and limited access, the area is only visible from the north . It is seen as steep sideslopes covered with a continuous conifer forest. The area is not visible from the Park. Its major attraction is big game hunting and fishing.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

The Rugged Ridge unroaded area is bounded by harvest units and roads to the west, north and east and by Olympic National Park to the south. This unroaded area is contiguous to the Park's Wilderness.

The ability to manage this narrow unroaded area in a natural state for primitive and semi-primitive recreational experiences is affected by its shape, size, and steep aspect. The area faces north in which views and noises of the adjacent management activities would be evident. Unless on the ridge top, one does not see into the Park.

NATURAL INTEGRITY

Timber harvesting activity has increased considerably on the lower slopes of the area since it was first inventoried in 1973. Several clearcuts are located along the South Fork of the Sitkum River. No roads have been constructed in the area, harvest has occurred using long span skylines from the road on the north side of the river.

NATURAL APPEARANCE

Due to the area's small size and close proximity to the sights and sounds of man's activities, the feeling of naturalness and expanse are lacking.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

Due to the area's rugged terrain and dense vegetation, access is limited to cross-country hiking. Because of the area's steep sideslopes and dense vegetation, cross-country hiking provides the greatest opportunities for solitude and physical and route finding challenges.

SPECIAL FEATURES

There is a Spotted Owl Habitat Area within the area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

The area is primarily underlain by metasedimentary rocks of Mesozoic age. Even though this unroaded area has not been evaluated by the USGS and Bureau of Mines, available data indicate the area has no known mineral resource occurrences, and the potential for the occurrence of such is low. There is presently no mining activity in the area, it is not encumbered by mining claims, not classified "prospectively valuable" for leasable mineral commodities, and not encumbered by any leases or pending lease applications.

Water

Topography is steep and highly dissected by small streams and draws which drain into the South Fork Sitkum River which forms the northern boundary. There are no lakes.

Vegetation

This area contains about 4,290 acres (94% of area) of tentatively suitable forest land. The seral stages and estimated standing volumes are as follows:

		Estimated Standing Volume	
Seral Stage	Acres in Percent	Million Board Feet	Million Cubic Feet
BG	8	--	--
SS	1	--	--
PL	1	0.6	0.1
MS	3	5.0	0.9
LS	87	234.2	42.9
TOTAL	100	239.8	43.9

BG = Pioneer Stage SS = Early Stage PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.6 million cubic feet per year.

Special Areas

Approximately 20 percent of the area is in riparian zones which consist primarily of small tributary streams to the South Fork of the Sitkum River. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

This area is elk summer range and contains a Spotted Owl Habitat Area. Wildlife species associated with old growth habitat also make extensive use of this area.

Fisheries

The Sitkum River system supports significant populations of both resident and anadromous fish species.

Cultural

Cultural resource surveys have been conducted in conjunction with timber sale project purposes, and one professional survey contract was completed in 1989. No cultural resources have been found despite some reasonable potential, since animal migration routes may have attracted some pre-historic use to this area. Except for portions of the ridge top and some saddles, the area is extremely steep and side slopes are severely dissected making travel extremely difficult.

Recreation

Recreational use consists primarily of big game hunting and fishing. There are no proposed developed recreation sites or trails within the area. The South Fork Sitkum River receives moderate summer steelhead and trout fishing use.

The area consists of 429 acres of Roaded Natural/Modified ROS class and 4,135 acres of Semi-Primitive Nonmotorized.

Estimated capacity by ROS class is as follows:

ROS Class	Acres	RVD Capacity per Year
Roaded Natural/Modified	429	50
Semi-Primitive Nonmotorized	4,135	410
TOTAL	4,564	460

Scenery

The visual character of this area consists of common visual variety. Steep side slopes extend from the Sitkum River to the top of Rugged Ridge. Slopes are covered with a dense and textural conifer forest. The appearance of rock outcrops, cliffs, or other openings in the vegetation are lacking. The area is visible from Forest roads north of the area but not visible from any developed recreation site, trail, or from Olympic National Park. It has a visual quality objective of maximum modification.

Wild and Scenic Rivers

There are no potential Wild and Scenic Rivers within this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreaks within the Rugged Ridge unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Fire occurrence in the Rugged Ridge is very rare. The vegetative structure indicates that large fires have been absent for over 600 years.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Rugged Ridge unroaded area is adjacent to Olympic National Park in the northwest corner of the Peninsula and is contiguous to the Park's Wilderness.

DISTANCE FROM POPULATION CENTERS

The area is approximately 150 miles or three and a half hours driving time from Seattle, Washington via the Puget Sound ferry system, Hood Canal Floating Bridge, US Highway 101 and county and Forest roads. It is is accessible from the town of Forks by driving Highway 101 and county and Forest roads for approximately 15 miles.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as Research Natural Area.

PUBLIC INTEREST, INPUT AND INVOLVEMENT

Public interest was low to moderate for the Rugged Ridge unroaded area during the Soleduck Planning Unit EIS and the Washington Wilderness Act of 1984. Interest was aimed at wanting this area as an undeveloped buffer to the Park.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Since none of this area is identified as having potential for the occurrence of manganese resources, nor is any of the area classified "prospectively valuable" for oil and gas resources there would be very little, if any, adverse consequences under all alternatives.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from Alternatives H (Modified) and I. Alternatives A-Current Direction and C-Preferred (Modified), should have little risk of affecting the above resources. Alternatives NC and B-Departure (Modified) pose more risk of impacting the above resources. The risk of impacting geology, soils, water, and Special Areas increases with intensity of timber harvest and road construction activity.

After the first decade, Alternatives A-Current Direction, B-Departure (Modified), C-Preferred (Modified), have enough timber harvest activities to pose an increased risk of affecting soils, water, and Special Areas

(riparian) values. Alternative A-Current Direction does not include road construction, but Alternatives B-Departure (Modified), and C-Preferred (Modified) do.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Currrent Direction, B-Departure (Modified), and C-Preferred (Modified). The harvest level would increase in the second decade for Alternative NC (No Change) before leveling off. No timber management activities are scheduled for Alternatives H (Modified) and I.

With Alternative NC (No Change), about 4,292 acres or 94 percent of the unroaded area would be planned for harvest. Long-term sustained yield capacity is about 0.6 million cubic feet per year. The emphasis is on timber management.

With Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified), about 2,100 acres or 46 percent of the unroaded area would be planned for timber harvest. The long-term sustained yield capacity contribution is about 0.3 million cubic feet per year for each of these alternatives. The emphasis is on timber management.

Alternatives H (Modified) and I do not allow timber harvest.

WILDLIFE

Alternatives NC and B-Departure (Modified) have the greatest impact on the wildlife species in the area. Impacts from Alternatives C-Preferred (Modified) and A are somewhat less than B-Departure (Modified). Impacts from the remaining alternatives are not significant.

FISHERIES

Alternatives H (Modified) and I through the fifth decade should not have any impact on the fisheries resources. Because of timber management activities, Alternatives NC and B-Departure (Modified) will have the greatest impact. Alternatives A and C-Preferred (Modified) will also have an impact, but to a lesser extent.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Park and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences on cultural resource values will be similar and rather inconsequential regardless of the alternative selected. The potential for the existence of cultural resources is very low, any that may exist will lack integrity, and none are expected to meet National Register criteria. The existence of pre-historic sites is considered to be very speculative and unlikely at this time.

RECREATION

The No Change Alternative would provide no unroaded recreation opportunities. The entire area would be allocated to Timber Management. Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) are identical. Each alternative would allocate 2,500 acres to spotted owl habitat and 2,100 acres to Timber Management. There would be no acres allocated to recreation under these three alternatives. Alternatives H (Modified) and I would be the only alternatives to provide unroaded recreation opportunities. 2,100 acres would be allocated to Undeveloped Non-motorized Recreation and 2,500 acres would be allocated to spotted owl habitat. The entire area would remain in an unroaded condition under these two alternatives.

SCENERY

The No Change Alternative would have the greatest effect on scenery in the Rugged Ridge unroaded area. The entire area would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternative A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) have identical effects on scenery. Each alternative would allocate 2,500 acres to spotted owl habitat and these acres would retain their natural appearance. 2,100 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternatives H (Modified) and I would be have the greatest benefits on scenery as the entire area would remain in a natural condition with 2,100 acres allocated to Undeveloped Recreation and 2,500 acres allocated to spotted owl habitat.

WILD AND SCENIC RIVERS

There are no Wild and Scenic Rivers associated with this unroaded area.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-32. Figures show estimated development for the 50-year planning horizon in total, and are included in road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. The actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will

be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternative A-Current Direction includes use of highly sophisticated logging systems (predominantly helicopter) exclusively, as this is necessary to meet the objectives of current direction. These objectives specify timber harvest without road construction.

Table C-32. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	0	0	8	8	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. Average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity, is 40 person-years. Conversely, an average of 2 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-33. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-33. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	40	20	20	20	2	2

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in

the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternative No Change would eliminate the entire area from future Wilderness consideration.

Alternatives A-Current Direction, B-Depature (Modified) and C-Preferred (Modified) would eliminate 2,100 acres from future Wilderness consideration. The remaining 2,500 acres are adjacent to the Olympic National Park Wilderness and would be available for future Wilderness consideration.

Alternatives H (Modified) and I would retain the entire area in it's unroaded condition and therefore, retain its future option for Wilderness.

Table C-34. Rugged Ridge 4,564 Acres (4.6) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	0	2.1	2.1
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	2.5	2.5	2.5	2.5	2.5
Timber Management E1	4.6	2.1	2.1	2.1	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	4.6	4.6	4.6	4.6	4.6	4.6

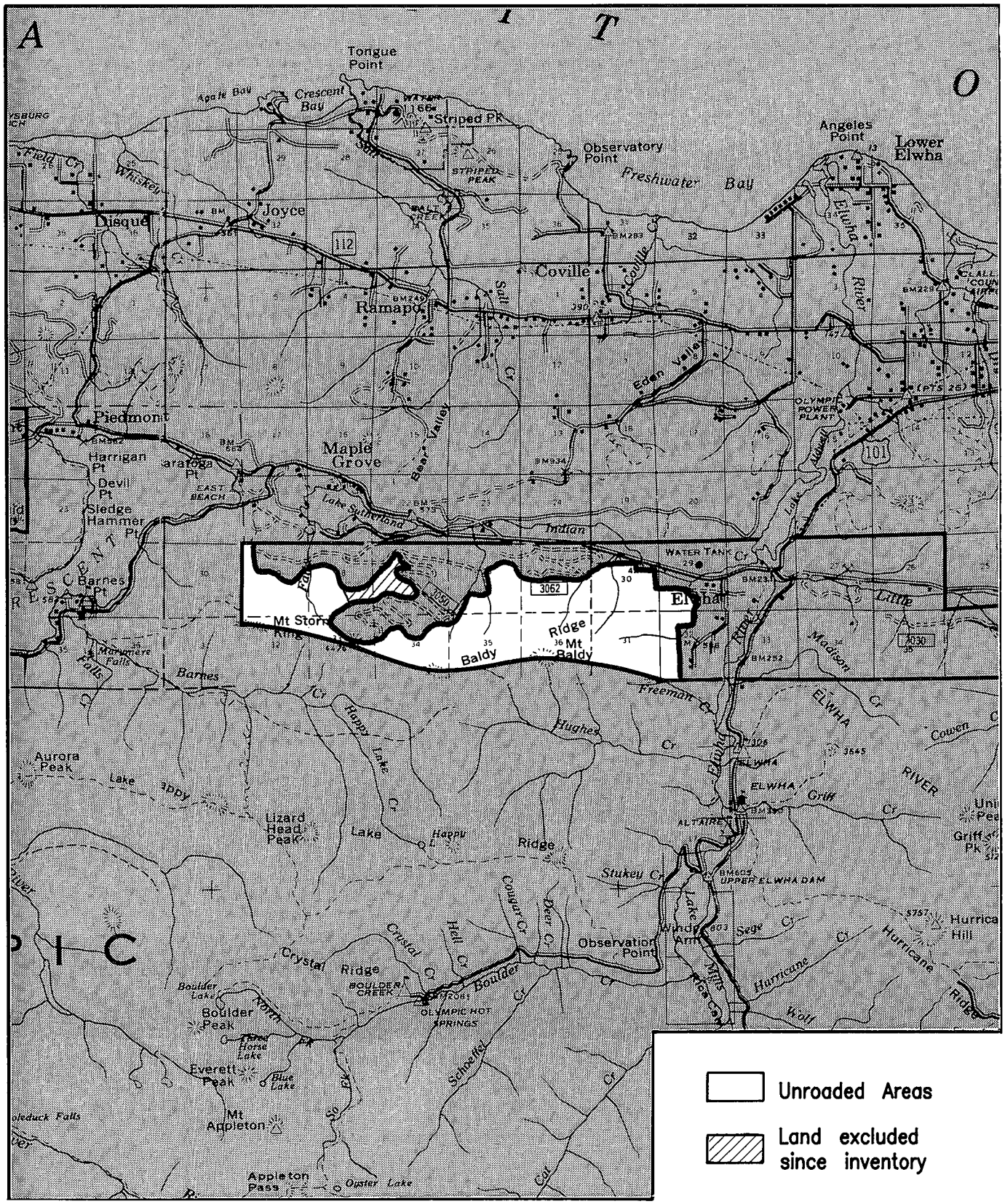


Figure C-12. MOUNT BALDY UNROADED AREA

MOUNT BALDY UNROADED AREA (3,895 acres)

DESCRIPTION

HISTORY

The Mt. Baldy unroaded area was originally inventoried in the 1973 RARE process. It was not included in RARE II because land allocation decisions had been made in an approved land use plan prior to that time.

In the March 1975, FEIS for the Land Management Plan for the Soleduck Planning Unit, a major portion of the Mt. Baldy area was allocated to a roadless classification in which the area was to be managed to retain its roadless status. Road construction and timber harvest are not planned in those areas identified as noncommercial, rocky, and marginal. Timber harvest will be planned on the remaining acres. Harvest methods are restricted to helicopter or other sophisticated equipment which eliminates the need for roads.

The November 1986 Forest/Park boundary adjustment reduced the current size to 3,935 acres.

LOCATION AND ACCESS

This area is located in the northeastern portion of the Soleduck Ranger District. It is located about one and a half miles east of Lake Crescent and is part of the Mt. Baldy-Mt. Storm King Ridge. The area is approximately six miles long and about one mile wide. It is accessible from the town of Elwha by driving US Highway 101 and Forest roads for approximately six miles. Logging roads provide access to the area's northern boundary.

There are no existing trails within the area, however, the Storm King trail in the Park provides hiking access to the unroaded area boundary on the west end.

PHYSIOGRAPHY AND SOILS

The highest elevation within the area is the summit of Mt. Storm King at 4,476 feet. The lowest elevation is about 1,000 feet near the east end of the area in the Elwha drainage.

Bedrock is composed of dark gray marine basalt and basaltic breccia which are moderate to highly fractured. There are minor inclusions of graywacke and sandstone. The basalts and basaltic breccia are competent (non-crumbly) to moderately competent. Overlying the basalt and occurring intermittently elsewhere is moderately deep, compact, coarse textured glacial till.

Soils consist primarily of shallow, gravelly medium colluvial and residual soils derived from basalt occurring on steep side slopes. Basalt rock outcrops occur on higher elevation ridges and sideslopes throughout the area.

VEGETATION

The lower slopes are vegetated with Douglas-fir and western hemlock, while Pacific silver fir and subalpine fir are common in higher elevations.

ECOSYSTEMS

The area consists mainly of Kuchler Ecotypes K2 red cedar, western hemlock, Douglas-fir and K3 Pacific silver fir and Douglas-fir. There are small amounts of K14, Engelmann spruce and subalpine fir and K45, meadows, in the higher elevations.

CURRENT USES

The area's primary recreation use is as a scenic backdrop for the two large lakes near the area. Lake Crescent, which is inside Olympic National Park, and Lake Sutherland, which is one mile east of the Park and just north of the Mt. Baldy unroaded area, are two popular recreational lakes. Big game hunting is a secondary recreation use. There are no developed campgrounds or trails inside the area. The Storm King trail begins in the Park and ends at the National Forest boundary. The area receives less than 300 RVDs annually.

Approximately 640 acres are in Semi-Primitive Nonmotorized, 1,900 in Semi-Primitive Motorized and the remaining acres are in the Roaded Natural/Modified ROS class.

APPEARANCE, SURROUNDINGS, AND ATTRACTIONS

This area has moderate diversity of visual variety. Very steep and dissected slopes covered with a dense conifer forest extend upward to rocky cliffs and the summits of Mounts Storm King and Baldy. Many small creeks drain the area, however, there are no major rivers or lakes.

The Mt. Baldy area is viewed as a steep, rugged ridge covered with a dense stand of conifers which give way to rock outcrops near the summit. The area is visible primarily from the west, north, and east. A small portion on the south side of the ridge is visible from various viewpoints within the Park.

The area's major attraction is its scenic quality as a backdrop to the two lowland lakes in the vicinity. Other major attractions are big game hunting and mountain climbing.

CAPABILITY - WILDERNESS CHARACTERISTICS

The area is bounded by National Park on two sides, private land on one side and developed National Forest land on the fourth side. This unroaded area is contiguous to the Park's Wilderness.

There are minimal opportunities to provide primitive and semi-primitive experiences within the area. The greatest chance lies on the Park side of the ridge where management activities such as roads and harvest units are not visible.

NATURAL INTEGRITY

The area has changed very little since it was inventoried as an unroaded area. A small portion along the northern boundary has been deleted from the area due to timber harvesting and road construction. The remaining acres have retained their natural state and are free from man's influences.

NATURAL APPEARANCE

Due to the area's small size and close proximity to the sights and sounds of man's activities, the feeling of naturalness and expanse are lacking in most of the area. However, the area south of the ridgetop, facing the Park, does offer the feeling of naturalness and expanse as one looks out toward the vast acres of Olympic National Park. The ridge screens out the intrusion of man's activities.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

The greatest opportunity for solitude involves the area that lies on the south side of the ridge. Because of limited access, rugged terrain, and dense vegetation, this area receives very little recreation use and, therefore, opportunities for solitude are available.

Opportunities for challenging experiences involve activities such as big game hunting, cross-country hiking, and mountain climbing.

SPECIAL FEATURES

Part of a Spotted Owl Habitat Area is within the area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing Wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

The area is primarily underlain by volcanic rocks of Eocene age. Even though this area has not been studied by the USGS and Bureau of Mines, available data indicate the area has at least a low potential for the occurrence of manganese resources. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low. There is presently no mining activity in the area, and the area is not encumbered by mining claims. The entire area is classified as being "prospectively valuable" for oil and gas resources, and it was recently encumbered by oil and gas leases. These leases did not result in any oil and gas production. As a result of the present energy supply/demand conditions or the absence of evidence indicating a petroleum resource exists in this area, the leases have terminated.

Water

The area is drained by several small streams and creeks. There are no rivers or lakes. The northern slopes of Baldy Ridge flow into Indian Creek and Lake Sutherland.

Vegetation

This area contains about 3,384 acres (86 percent of area) of tentatively suitable forest land. The seral stages and estimated standing volumes are as follows:

		Estimated Standing Volume	
Seral Stage	Acres in Percent	Million Board Feet	Million Cubic Feet
PL	3	1.5	0.3
MS	52	66.6	12.2
LS	45	95.6	17.5
TOTAL	100	163.7	30.0

PL = Young Forest MS = Mature Forest LS = Old-Growth and Climax Forest

The area's estimated potential contribution to long-term sustained yield capacity is 0.4 million cubic feet per year.

Special Areas

Approximately 15 percent or less of the area is in riparian zones which consist primarily of small tributary streams of the Elwha River. Cliffs and talus slopes are common near the upper ridges of Mt. Storm King and Mt. Baldy. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Deer utilize the area. Other common wildlife species of the Forest also inhabit the area.

Fisheries

There are no fish bearing streams within the area. Habitats downstream from the area support resident trout populations.

Cultural

This unroaded area has been professionally surveyed to locate, record, and evaluate cultural resources. The Henry Thompson mine and cabin were located, inventoried, and evaluated. The area is extremely steep and rugged and is considered to have low potential for discovery of cultural resources.

Recreation

The Mt. Baldy unroaded area has moderate potential for providing unroaded recreation opportunities. Mountain climbing and hunting are the most popular recreational activities in this area.

RVDs per year the current situation can provide are as follows:

ROS Class	Acres	RVD Capacity per Year
Semi-Primitive Nonmotorized	640	65
Semi-Primitive Motorized	1,900	190
Roaded Natural/Modified	1,355	145
TOTAL	3,895	400

Scenery

The landscape character of this area consists of a common visual variety. Steep side slopes extend upward to the summits of Mts. Baldy and Storm King. The lower slopes are blanketed with conifer forest with a course textured appearance. Rock outcrops are dominant features in the higher elevations. This unroaded area is visible from US Highway 101, the Lake Crescent area, and from several different viewpoints within Olympic National Park. The visual quality objectives are Partial Retention and Maximum Modification.

Wild and Scenic Rivers

There are none associated with this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreak within the Mt. Baldy unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire occurrence in the Mt. Baldy unroaded area is unknown. It may be slightly higher here than in other areas of the Soleduck Ranger District because this area is in the rain shadow of Mount Olympus and annual precipitation is less.

NEED

The Mt. Baldy unroaded area lies one mile west of the Madison Creek unroaded area. Olympic National Park and its Wilderness form the area's south and west boundaries.

DISTANCE FROM POPULATION CENTERS

The area is within 95 miles or two and a half hours driving time of Seattle, Washington via the Puget Sound ferry system, Hood Canal Floating Bridge, US Highway 101 and Forest roads. The small town of Elwha and Highway 101 are within one mile of the eastern boundary.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as a Research Natural Area.

PUBLIC INTEREST, INPUT AND INVOLVEMENT

What little public interest has been shown toward this area has been for protecting scenic qualities as a scenic backdrop to Lakes Crescent and Sutherland.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Under Alternatives A-Current Direction, C-Preferred (Modified), H (Modified) and I, no mining claims would be affected, but interest in conducting exploration and development within areas identified as having a "low" potential for the occurrence of manganese resources would be affected. In addition to these effects, interest in exploring for oil and gas within areas classified "prospectively valuable" for petroleum resources and previously or currently leased for oil and gas resources could be adversely affected.

Under Alternatives B-Departure (Modified) and NC-No Change there would be very little, if any, adverse consequences.

SOIL, WATER AND SPECIAL AREAS

There should be no effect on soils, water, or Special Areas (riparian) from any alternative except Alternative B-Departure (Modified). Even that alternative should have little risk of affecting the above resources. The risk of impacting soils, water, and Special Areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified), and C-Preferred (Modified). The harvest level would increase in the second decade for Alternative NC (No Change) before leveling off. No timber management activities are scheduled for Alternatives H (Modified) and I.

With Alternative NC (No Change), about 3,329 acres or 86 percent of the unroaded area would be planned for timber harvest. Long-term sustained yield capacity is about 0.4 million cubic feet per year.

Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) have about 1,400 acres or 36 percent of the area scheduled for timber harvest activities. Alternative A-Current Direction would harvest the timber on the lower slopes without building any roads. Alternatives C-Preferred (Modified) and B-Departure (Modified) result in road construction, but delay harvesting until the second decade. Each of these alternatives will have an estimated potential contribution to long-term sustained yield capacity of 0.2 million cubic feet per year.

Alternatives H (Modified) and I, do not allow timber harvest.

WILDLIFE

Alternatives NC, A and B-Departure (Modified) and C-Preferred (Modified) have some impact on wildlife. These effects are not expected to be significant. The other alternatives have no impact.

FISHERIES

As a result of management disturbances Alternatives NC, B-Departure (Modified), A and C-Preferred (Modified) will have the same impact on downstream fisheries resource. Alternatives H (Modified) and I will have no effect.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Park and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences on cultural resource values will be similar and rather inconsequential regardless of the alternative selected. The potential for the existence of cultural resources is very low, any that may exist will

lack integrity, and none are expected to meet National Register criteria. The existence of pre-historic sites is considered to be very speculative and unlikely at this time.

RECREATION

Alternative No Change would not allocate any of the area to unroaded recreation. The entire area would be allocated to Timber Management. Alternatives A-Current Direction and B-Departure (Modified) would not provide any unroaded recreation allocations either. However, 2,500 acres would be retained in an unroaded condition in a spotted owl habitat allocation. The other 1,400 acres would be allocated to Timber Management. Alternative C-Preferred (Modified) would allocate 800 acres to Undeveloped Motorized Recreation uses, 400 acres to scenery, and 1,700 acres to spotted owl habitat. 1,000 acres would be allocated to Timber Management. Alternatives H and I would provide the greatest benefits for unroaded recreation. 2,200 acres would be allocated to Undeveloped Motorized Recreation and 1,700 acres would be allocated to spotted owl habitat. The entire Mount Baldy unroaded area would remain in an unroaded condition under these two alternatives.

SCENERY

The No Change Alternative would have the greatest effect on scenery. The entire Mount Baldy unroaded area would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternatives A-Current Direction and B-Departure (Modified) are identical and would retain 2,500 acres in a natural appearing condition in a spotted owl habitat allocation. The remaining 1,400 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternative C-Preferred (Modified) would allocate 800 acres to Undeveloped Recreation and 1,700 acres to spotted owl habitat. These 2,500 acres would remain natural appearing. 400 acres would be allocated to scenic and would have a slightly altered appearance. The remaining 1,000 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Both Alternatives H and I would retain the entire unroaded area in a natural appearing condition with 2,200 acres allocated to Undeveloped Recreation and 1,700 acres allocated to spotted owl habitat.

WILD AND SCENIC RIVERS

There are none associated with this unroaded area.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-35. The figures show estimated development for the 50-year planning horizon in total, and are included in the road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. Actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates

indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternatives A-Current Direction, B-Departure (Modified), and C-Preferred (Modified) entail harvest allocations requiring the use of highly sophisticated logging systems (predominantly helicopter). Road construction to serve these systems will be minimal.

Table C-35. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	0	0	3	3	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest allocations and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 27 person-years. Conversely, an average of 3 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-36. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-36. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	27	13	13	13	3	3

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in

the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

The No Change Alternative would eliminate the entire area from future Wilderness consideration.

Alternatives A-Current Direction, B-Departure (Modified), and C-Preferred (Modified) would eliminate 1,400 acres from future Wilderness consideration and the remaining 2,500 acres, which are adjacent to the Park, would be retained for future Wilderness consideration.

Alternatives H (Modified) and I would retain the entire area for future Wilderness consideration.

Table C-37. Mount Baldy 3,895 Acres (3.9) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	0	0	0
Undeveloped Recreation (Motorized) A1B	0	0	0	0.8	2.2	2.2
Scenic A2	0	0	0	0.4	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	2.5	2.5	1.7	1.7	1.7
Timber Management E1	3.9	1.4	1.4	1.0	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	3.9	3.9	3.9	3.9	3.9	3.9

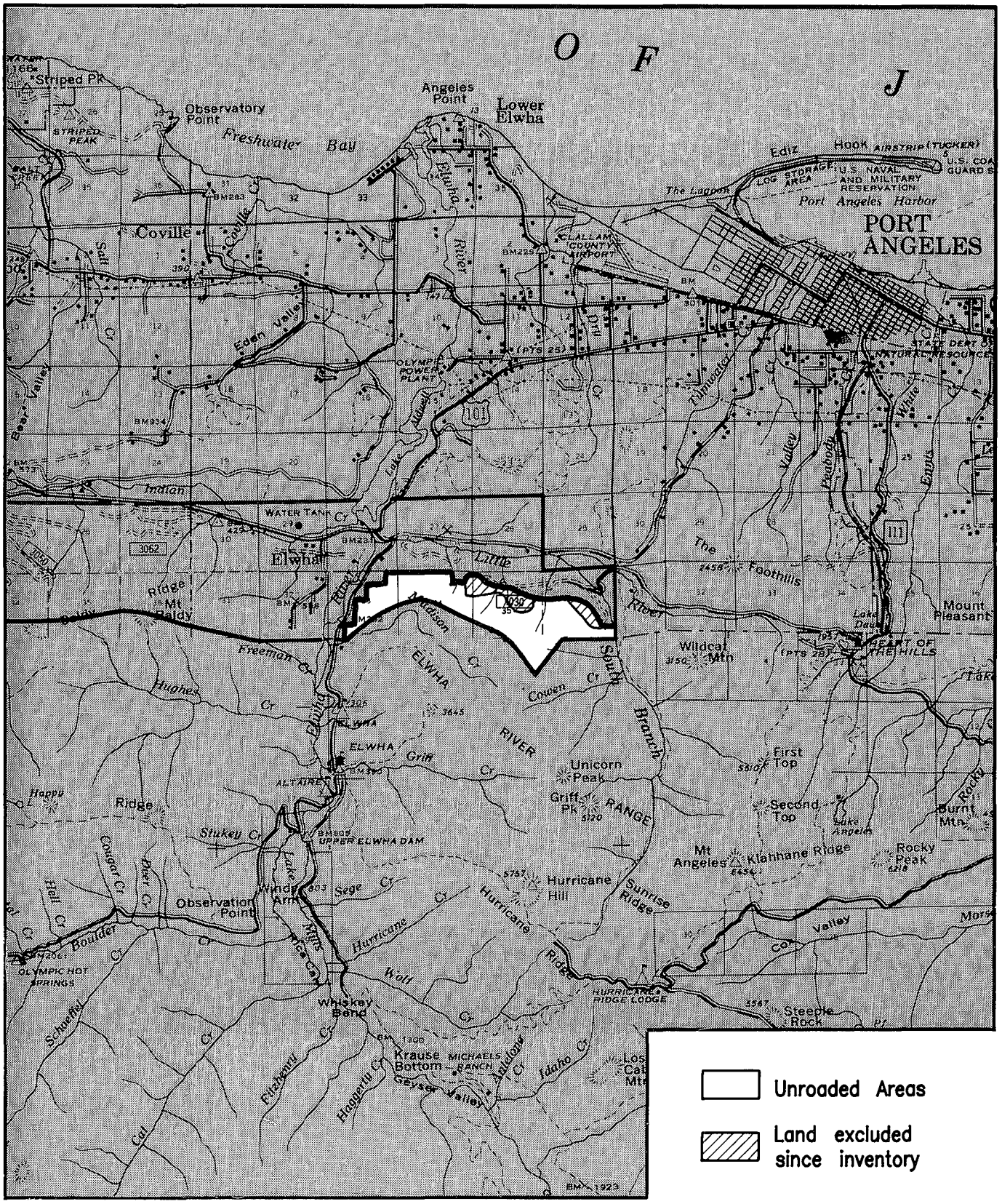


Figure C-13. MADISON CREEK UNROADED AREA

MADISON CREEK UNROADED AREA (1,079 acres)

DESCRIPTION

HISTORY

The Madison Creek unroaded area was not evaluated in either RARE study. It has been added to the unroaded area inventory because of its proximity to Olympic National Park.

In March 1975, the FEIS for the Land management Plan for the Soleduck Ranger District allocated the acres within this area to general forest uses with a major emphasis for managing the commercial forest land for timber management on a sustained yield basis.

The November 1986 Forest/Park boundary adjustment reduced the current size to 1,079 acres.

LOCATION AND ACCESS

This unroaded area is located in the northeast corner of the Soleduck Ranger District. The area is immediately adjacent to Olympic National Park. The area is one mile wide and four miles long.

This area is accessible from the town of Elwha by driving US Highway 101, county and Forest roads for approximately two miles. The Elwha Road provides access to the west boundary, while the Little River Road provides access to the north boundary. A trail on private land parallels the east boundary, and a short hiking trail, in the Park, provides access to the south boundary. There are no trails within the area.

PHYSIOGRAPHY AND SOILS

Elevations range from about 250 feet near the Elwha Road to over 3,300 feet on the ridge in the southeast portion of the area.

Bedrock of this area is composed of dark gray marine basalt and basaltic breccia which are moderate to highly fractured. There are minor inclusions of graywacke and sandstone. The basalts and basaltic breccia are competent to moderately competent. Overlying the basalt, and occurring intermittently elsewhere, is moderately deep to very deep, compact, coarse textured glacial till.

Soils consist primarily of shallow, gravelly medium colluvial and residual soils derived from basalt and occur on steep sideslopes. Basalt rock outcrops occur on higher elevation ridges and sideslopes throughout the area.

VEGETATION

The area is covered with a variety of timber stands varying from old-growth Douglas-fir, western hemlock, and Pacific silver fir to stands of pole size Douglas-fir.

ECOSYSTEMS

This unroaded area consists of Kuchler Ecotypes K2, red cedar, western hemlock, Douglas-fir and K3 Pacific silver fir and Douglas-fir.

CURRENT USES

Recreation use within the area is predominately deer hunting. There are no developed sites or hiking trails. This area receives less than 100 RVDs annually.

The area has approximately 820 acres in the Rural ROS class and 259 acres in the Roaded Natural/ Modified ROS class.

APPEARANCES, SURROUNDINGS, AND ATTRACTIONS

The area has a common visual variety of landform, vegetation and rock formations. The major streams include a portion of both Madison Creek and the South Branch of Little River. The entire area is blanketed with a conifer forest. There are no lakes.

The area is visible primarily from the north from the Little River road and is viewed as moderately steep slopes with an undulating ridge top.

The major attraction is deer hunting.

CAPABILITY - WILDERNESS CHARACTERISTICS

MANAGEABILITY AND BOUNDARIES

This small, narrow, unroaded area is bound on three sides by private land and by Olympic National Park on the fourth side. The area faces north in which views and noises of the adjacent management activities are evident, and therefore, it would be difficult to provide primitive recreational experiences within the area. This unroaded area is contiguous to the Park's Wilderness.

NATURAL INTEGRITY

There have been no major changes to the areas size since it was inventoried as an unroaded area. A small section along the north and northeast boundary has been roaded and logged. The remaining acres within the area exist in their natural state and are free from human influences.

NATURAL APPEARANCE

Due to the area's small size and close proximity to the sights and sounds of man's activities, the feeling of naturalness is lacking.

OPPORTUNITIES FOR SOLITUDE AND CHALLENGING EXPERIENCES

The opportunity for solitude is minimal and few challenges await the visitor. Cross-country travel and big game hunting offer the biggest challenges.

SPECIAL FEATURES

There is a Spotted Owl Habitat Area partially within the area.

HISTORICAL AND SCIENTIFIC STUDY

There are no special or unique opportunities for outdoor education and scientific or historic study in the area which cannot already be found in the existing wilderness on the Forest.

AVAILABILITY

RESOURCE POTENTIALS

Minerals

This area is primarily underlain by volcanic rocks of Eocene age. Even though this area has not been studied by the USGS and Bureau of Mines, available data indicate the area has at least a low potential for the occurrence of manganese resources. Under current supply/demand conditions, however, the potential for discovering a "valuable" deposit of manganese is low. There is presently no mining activity in the area, and the area is not encumbered by any mining claims. The entire area is classified "prospectively valuable" for oil and gas resources, and it was recently encumbered by oil and gas leases. As a result of the present energy supply/demand conditions or the absence of evidence indicating a petroleum resource exists in this area, the leases have terminated.

Water

The major stream in this area is a portion of Little River. There are no lakes.

Vegetation

This area contains about 1,079 acres (100% of area) of tentatively suitable forest land. The seral stages and estimated standing volumes are as follows:

Seral Stage	Acres in Percent	Estimated Standing Volume	
		Million Board Feet	Million Cubic Feet
PL	2	0.4	0.1
MS	62	25.2	4.6
LS	36	24.4	4.5
TOTAL	100	50.0	9.2

PL = Young Forest MS = Mature Forest LS = Old-Growth & Climax Forest

This area's estimated potential contribution to long-term sustained yield capacity is 0.1 million cubic feet per year.

Special Areas

Approximately 15 to 20 percent of the area is in riparian zones which consist primarily of tributary streams of Madison Creek and Little River. No other Special Areas occur in mappable size in this unroaded area.

Wildlife

Deer utilize the area. Other more common wildlife species of the Forest also inhabit the area.

Fisheries

Madison Creek, an Elwha River tributary, supports resident trout populations. The Elwha River, downstream from the area, also supports resident trout populations.

Cultural

This unroaded area has been professionally surveyed to locate, record, and evaluate cultural resources. The area, like Mt. Baldy, is extremely steep and precipitous. Some documented evidence of mining and prospecting was utilized to discover locations of these activities. What little was located was found on other than National Forest land. At this time there is no evidence to suggest that prehistoric use occurred. Potential for discovery of cultural resources is thought to be very low.

Recreation

Recreation use in the area consists primarily of big game hunting. There are no proposed developed recreation sites or trails within the area.

The area is classified as 76 percent Roaded Natural/Modified ROS class and 24 percent Rural. The area has a potential recreation capacity of approximately 100 RVDs per year.

Scenery

The natural landscape character consists of a densely textured forest on moderately steep landforms. Portions are viewed from US Highway 101, the Park's Elwha road, and the Little River county road. The Visual Quality Objectives are Retention, Partial Retention, Modification, and Maximum Modification.

Wild and Scenic Rivers

There are no potential Wild and Scenic Rivers in this unroaded area.

MANAGEMENT CONSIDERATIONS

INSECTS AND DISEASES

Insects are present within this area, but they are at endemic levels and of little concern. There is no record of major insect outbreaks within the Madison Creek unroaded area. Diseases are also present. Root rots, heart rots, and butt rots are of major concern in older stands of trees. Generally these diseases are isolated in small areas and spread very slowly.

FIRE

Frequency of fire occurrence in the Madison Creek unroaded area is unknown. It may be slightly higher here than in other areas of the Soleduck Ranger District because this area is in the rain shadow of Mount Olympus and annual precipitation is less.

NEED

NEARBY WILDERNESS AND OTHER UNROADED AREAS

The Madison Creek unroaded area is one mile west of the Mt. Baldy unroaded area. It is also adjacent to Olympic National Park Wilderness.

DISTANCE FROM POPULATION CENTERS

This area is within 90 miles or two and one-half hours driving time from Seattle, Washington via the Puget Sound ferry system, Hood Canal Floating Bridge, US Highway 101, and the Little River county road.

The small town of Elwha is within one mile of the area. The northwestern portion is within one mile of Highway 101.

THE NEED FOR ECOSYSTEM REPRESENTATION

There are no unique or special ecosystems within the area in need of representation through a specific designation such as a Research Natural Area.

PUBLIC INTEREST, INPUT AND INVOLVEMENT

The public concern for this unroaded area has been minimal.

ENVIRONMENTAL CONSEQUENCES

MINERALS

Since none of this area is identified as having potential for the occurrence of manganese resources, nor is any of the area classified "prospectively valuable" for oil and gas resources, there would be very little, if any, adverse consequences under any alternative.

SOIL, WATER AND SPECIAL AREAS

There should be no effect to soils, water, or Special Areas (riparian) from Alternatives H (Modified) and I. Alternatives NC, A-Current Direction, B-Departure (Modified), and C-Preferred (Modified) pose some risk of impacting the above resources. The risk of impacting soils, water, and Special Areas increases with intensity of timber harvest and road construction activity.

VEGETATION

Timber harvesting activities are scheduled to start in the first decade under Alternatives NC (No Change), A-Current Direction, B-Departure (Modified), and C-Preferred (Modified). The harvest level for the No Change Alternative would increase in the second decade before leveling off. No timber management activities are scheduled for Alternatives H (Modified) and I.

With the NC (No Change) Alternative, all of the unroaded area would be planned for timber harvest. Long-term sustained yield capacity is about 0.1 million cubic feet per year. The emphasis is on timber management.

With Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified), about 100 acres or 9 percent of the unroaded area would be planned for harvest. Long-term sustained yield capacity is less than 0.1 million cubic feet per year.

WILDLIFE

Alternatives NC, A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) will have some impact on wildlife. The other alternatives have no impact.

FISHERIES

Alternatives NC, A, B-Departure (Modified), and C-Preferred (Modified) will have some impact on fisheries resources due to disturbances caused by management of other resources. Other alternatives are not expected to have any influence on the fishery resource.

FIRE

Resource value effects of fire in unroaded areas are essentially the same as those in Wilderness except that economic loss will occur where merchantable timber, planned and available for harvest, is burned. In this case, timber harvesting schedules may be disrupted to salvage damaged stands or future yields (harvest levels) may be affected. However, due to high development costs, small areas/values of fire damaged timber will probably not be salvaged.

Cost of suppression of fires occurring in unroaded areas will generally be higher than in more accessible areas. These fires will also generally be larger than fires in more readily accessible areas.

Due to their close proximity to Olympic National Park, smoke from fires in these areas will affect air quality and visibility in the Park and may affect air quality in the Puget Sound trough.

CULTURAL

The consequences on cultural resource values will be similar and rather inconsequential regardless of the alternative selected. The potential for the existence of cultural resources is very low, any that may exist will lack integrity, and none are expected to meet National Register criteria. The existence of pre-historic sites is considered to be very speculative and unlikely at this time.

RECREATION

The No Change Alternative would provide no unroaded recreation opportunities. The entire area would be allocated to Timber Management. Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) are identical. Each alternative would allocate 1,000 acres to spotted owl habitat and 100 acres to Timber Management. There would be no acres allocated to unroaded recreation under these three alternatives. Alternatives H and I would be the only alternatives to provide unroaded recreation opportunities. 100 acres would be allocated to Undeveloped Motorized Recreation and 1,000 acres would be allocated to spotted owl habitat. The entire area would remain in an unroaded condition under both of these alternatives.

SCENERY

The No Change Alternative would have the greatest effect on scenery in the Madison unroaded area. The entire area would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) would have identical effects on scenery. Each alternative would allocate 1,000 acres to spotted owl habitat and these acres would retain their natural appearance. 100 acres would be allocated to Timber Management and could have a moderately to heavily altered appearance. Alternatives H and I would be have the greatest benefits on scenery as the entire area would remain in a natural condition with 100 acres allocated to Undeveloped Recreation and 1,000 acres allocated to spotted owl habitat.

WILD AND SCENIC RIVERS

There are none associated with this area.

ROADS

The projected mileage of road construction for each alternative is displayed in Table C-38. The figures show estimated development for the 50-year planning horizon in total, and are included in the road construction totals shown in Chapter IV of this FEIS. These mileages are estimates only, and are based on current understanding of timber harvest and road development patterns which best serve the objectives of each alternative as they relate to this unroaded area. Actual road construction pattern associated with implementation of the selected alternative will be developed during project planning, and will be subject to environmental analysis of potential project effects. It is expected that the majority of the anticipated construction will occur within the next 20 years.

Management of roads constructed in this area will be based on road management objectives developed for each road during project planning (see Chapter III, "ROADS"). It is expected that newly developed roads will be classified as either local or minor collector, with the great majority being local. Current estimates indicate that, within unroaded areas as a whole, approximately 33 percent of newly constructed roads will be closed to public traffic, 57 percent will be available for high clearance vehicle use only, and 10 percent will be suitable for passenger car use.

Most of the projected road construction shown in the table below is needed to serve timber harvest by conventional logging systems. Alternatives A-Current Direction and B-Departure (Modified) also include substantial harvest allocations within areas in which use of highly sophisticated logging systems (predominantly helicopter) is necessary. Road construction to serve these systems will be minimal.

Table C-38. Road Construction (Miles)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
50-year Total	3	0	0	0	0	0

LOCAL ECONOMY

The principal effect of this unroaded area within the local economy is the employment opportunity associated with each of the alternative strategies for its management. This is a direct function of the mix of harvest and unroaded recreation allocations contained in each alternative. The average annual employment (direct, indirect, and induced) which could be generated by full allocation of this area to Timber Management, based on potential long-term sustained yield capacity contribution, is 7 person-years. Conversely, an average of 1 person-years of employment per year would be associated with full retention of existing unroaded characteristics. The estimated total contribution (from harvest and recreation combined) to employment associated with each alternative is displayed in Table C-39. Note that these employment estimates are quite small relative to the total Olympic Peninsula labor force of 51,810.

Table C-39. Employment Potential (Person-Years/Yr.)

	Alternatives					
	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H - (Modified)	I
Employment	7	7	7	7	1	1

LOCAL COMMUNITIES

The expected effects of the alternatives as a whole on local communities are discussed in Chapter IV of this FEIS. It is unlikely that the management strategy selected for any individual unroaded area would have an appreciable effect within said communities. It can be stated that maintenance of this unroaded area in an undeveloped condition would be most consistent with the values of environmentally-oriented community group members. Similarly, allocation of this area to Timber Management would best fit the desires of those whose values center around the timber ethic. These generalities, however, must be considered in the context of the management patterns of each alternative in its entirety before any reasonable projection of effects on local communities can be developed.

WILDERNESS POTENTIAL

Alternative No Change would eliminate the entire area from future Wilderness consideration.

Alternatives A-Current Direction, B-Departure (Modified) and C-Preferred (Modified) would eliminate 100 acres from future Wilderness considerattion while retaining the remaining 1,000 acres, which are adjacent to the Park, for future Wilderness consideration.

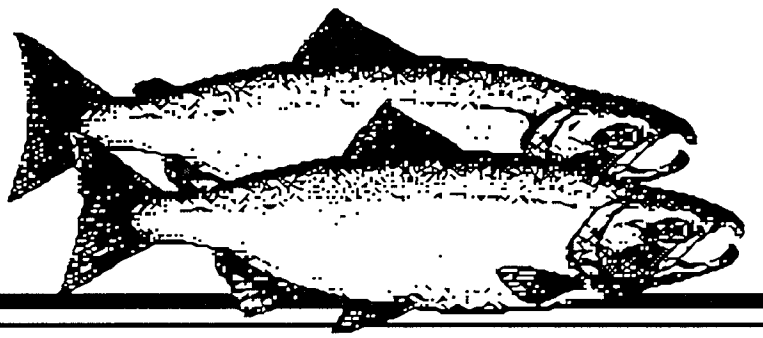
Alternatives H (Modified) and I would retain the entire area for future Wilderness consideration.

Table C-40. Madison Creek 1,079 Acres (1.1) (Thousands of Acres)

	Alternatives					
Management Prescription	No Change	A-Current Direction	B-Dep (Modified)	C-Pref (Modified)	H (Modified)	I
Undeveloped Recreation (Non-Motorized) A1A	0	0	0	0	0.1	0.1
Undeveloped Recreation (Motorized) A1B	0	0	0	0	0	0
Scenic A2	0	0	0	0	0	0
Wild & Scenic River A4A	0	0	0	0	0	0
Wilderness B1	0	0	0	0	0	0
SOHAs C1	0	1.0	1.0	1.0	1.0	1.0
Timber Management E1	1.1	0.1	0.1	0.1	0	0
Municipal Watersheds F1	0	0	0	0	0	0
Research Natural Areas J2	0	0	0	0	0	0
TOTAL UNROADED ACRES	1.1	1.1	1.1	1.1	1.1	1.1

Appendix D

Standards and Guidelines that Differ from those in the Forest Plan



Olympic National Forest

APPENDIX D

STANDARDS AND GUIDELINES THAT DIFFER FROM THOSE IN THE FOREST PLAN

INTRODUCTION

Standards and Guidelines state the bounds or constraints within which all practices will be carried out in achieving the resource objectives of the alternatives. The management of the Forest is subject to all applicable laws and regulations. Standards and Guidelines are intended to help the manager achieve the goals and objectives, while staying within constraints prescribed by law. Some of the management activities on the Forest could have adverse effects on the environment; the Standards and Guidelines provide mitigating measures for these activities.

Two categories of Standards and Guidelines are applied to management of the Forest: (1) Forest-wide Standards and Guidelines applicable to all Management Areas and (2) Standards and Guidelines specific to individual Management Areas. Although the direction for the Management Areas differs little between alternatives, the acres of land assigned to the various Management Areas vary widely by alternatives. Most of the Standards and Guidelines and Management Area prescriptions are common to all the alternatives; these are documented in the Forest Plan, Chapter IV, and are not repeated here. The purpose of this Appendix is to list those few Standards and Guidelines which are different from those found in the Forest Plan.

STANDARDS AND GUIDELINES THAT DIFFER FROM THOSE IN THE FOREST PLAN

The Forest-wide Standards and Guidelines and the Management Area-specific Standards and Guidelines in Chapter IV of the Forest Plan are applicable to all alternatives with the exceptions noted below.

Alternative NC (No Change)

The No Change Alternative would not adopt the Standards and Guidelines of the Forest Plan. The Standards and Guidelines for this alternative were established in the existing documents listed below. This direction has not been revised to comply with the National Forest Management Act (NFMA):

-Peninsula Timber Management Plan of 1968
-Quinault Timber Management Plan of 1969
-Shelton Cooperative Substantial Yield Unit Timber Management Plan of 1977

Alternatives NC, A, and B-Departure (Modified)

Visual Quality Objectives are not achieved outside of A2 (Scenic) areas.

Alternative H (Modified)

All old-growth within identified big game winter range will be retained through the planning period.

Alternative I

All existing old-growth on the Forest will be retained through the planning period.

Appendix F

Wild and Scenic Rivers

Olympic National Forest

"...A river is water in its loveliest form; rivers have life and sound and movement and infinity of variation; rivers are veins of the earth through which the life blood returns to the heart. Rivers can attain overwhelming grandeur, as the Columbia does in the reaches all the way from Pasco to the sea; they may slide softly through flat meadows or batter their way down mountain slopes and through narrow canyons; they may be heavy, almost dark, with history, as the Thames is from its mouth at least up to Richmond; or they may be sparkling fresh on mountain slopes through virgin forest and alpine meadows."

Roderick Haig-Brown

"Come Wade the River"

APPENDIX F

WILD AND SCENIC RIVERS REVIEW

INTRODUCTION

As required in the Wild and Scenic Rivers Act of October 1, 1982, and USDA-USDI Guidelines for Eligibility, Classification and Management of River Areas (September 7, 1982), seventeen rivers that originate in or flow through or have a portion of the river corridor within the Olympic National Forest were evaluated for their potential for inclusion in the National Wild and Scenic Rivers System.

Three of these rivers were recommended for listing as Wild and Scenic Rivers in the Forest Plan Preferred Alternative. Three rivers were identified as ineligible for inclusion in the system and four rivers were deferred to the National Park Service for evaluation and recommendation because they are mostly within National Park jurisdiction. National Forest lands on rivers not recommended for Wild and Scenic River designation and segments of potential Wild and Scenic Rivers that may be designated by the National Park Service or others will be managed as River Corridors.

The Federal Register definitions of Wild, Scenic and Recreational river areas are listed below. The full text of the guidelines for the study of potential National Wild and Scenic Rivers is provided at the end of this appendix:

1. Wild river areas - Those areas or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

2. Scenic river areas - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

3. Recreational river areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

In their responses to the Draft Plan many people expressed concern that more rivers were not recommended for designation while others were equally concerned that any rivers were recommended for the system. Considering these responses plus information suggesting additional information concerning "outstandingly remarkable" values that had been overlooked in our evaluation, we have reevaluated all of the rivers that appeared to have potential for Wild and Scenic Rivers designation.

EVALUATION PROCESS

PROCESS

Although this process was initiated due to the Olympic National Forest planning effort, the rivers identified were evaluated over their full length. This provided a better picture of the river, the resource and the landownership patterns that would be affected by designation.

Rivers identified for evaluation were included if they met any of the following criteria:

1. They were identified in the Heritage Conservation Recreation Service (HCRS), 1982 Nationwide Rivers Inventory.

2. They had been included in previously proposed Wild and Scenic Rivers Legislation.

3. They were identified in the Forest Planning or Draft Review process and had characteristics similar to other rivers being considered, and appeared to meet criteria in the joint Department of Agriculture- Department of the Interior Guidelines for Evaluating Wild, Scenic and Recreational Rivers. 1/

4. They had characteristics similar to the rivers identified by HCRS (now a branch of the National Park Service), and appeared to meet the criteria of the joint agency guidelines. These are referred to as Forest Inventory Rivers.

Each river was evaluated to determine its **eligibility**. If a river is free flowing and it and its adjacent land area possess an "outstandingly remarkable" scenic, recreational, geologic, fish, wildlife, historical or cultural value, it meets basic eligibility criteria. The determination of whether a river area contains "outstandingly remarkable" values is a professional judgement. With certain values, such as fish, this included the combined professional judgement of the Forest Service Fisheries Biologist, State of Washington Department of Fisheries, State of Washington Department of Wildlife, and Olympic National Park personnel. Other values, i.e.: cultural and historical for example, were based on the judgement of the Olympic National Forest Cultural Resource Coordinator or other trained, qualified persons.

Each river that was determined to be eligible was then evaluated to determine the appropriate **classification for each river segment**. This was done by applying the criteria to each river segment and determining its "highest" classification. Each river segment had to be of adequate length to provide a meaningful experience associated with that classification. Once a tentative classification was made based on the criteria, a composite classification was developed reflecting the combined criteria. If a river or river segment failed to meet the classification criteria, it was determined to be ineligible and dropped from further evaluation.

During the development of the list of eligible rivers, each river was subjected to the following administrative questions prior to developing the data base for the **suitability** analysis:

1/ Federal Register, Vol. 47, No. 173, Part VII, September 7, 1982.

1. Should the Forest Service be the lead agency in preparing the plan? If not, what agency should take the lead? If an agency other than the Forest Service should take the lead, then further evaluation/ study was deferred to that agency.

2. Did the National Forest acreage make up an insignificant percentage of the total river corridor acres? If so, further evaluation/study would be deferred to the agency with the preponderence of jurisdiction.

3. Was there time to do an adequate evaluation of the river(s) under consideration? If not, those where the deferring of a study would have the least impact on the management of the National Forest would be set aside for future evaluation/study.

4. Were there factors associated with the evaluation of a specific river, that would so complicate the evaluation and analysis process, that it would jeopardize implementation of Forest Plan? If so, the evaluation of that river and its corridor would be deferred until the next round of planning, or a separate river study.

For the rivers that remained after this set of administrative questions, a data base was compiled for use in the Forest Planning process. Emerging from the planning process will be a tentative determination of suitability, and a preliminary administrative recommendation for Wild and Scenic River designation.

Seventeen rivers and/or river systems made up the inventory of rivers in the evaluation process. Figure F-1 shows the relationship of these rivers to each other and to the Olympic Peninsula in general. Table F-1 summarizes the rivers.

Table F-1. Rivers Considered

River	How Identified
Duckabush	Nationwide Rivers Inventory
Dosewallips	Nationwide Rivers Inventory-Legislation
Big Quilcene	Forest Inventory
Dungeness	Public Interest
Gray Wolf	Public Interest
Elwha	Forest Inventory
Soleduck	Nationwide Rivers Inventory-Legislation
Calawah & 3 Branches	Legislation
Bogachiel	Legislation
Hoh	Nationwide Rivers Inventory-Legislation
Quinault	Forest Inventory
Humptulips & West Fork	Nationwide Rivers Inventory
East Fork Humptulips	Public Interest
Wynoochee	Forest Inventory
Skokomish	Forest Inventory
So. Fork Skokomish	Forest Inventory
Hamma Hamma	Public Interest

ELIGIBILITY DETERMINATION - VALUES

Based on our judgement, the following two rivers do not have an outstandingly remarkable value:

1. Big Quilcene
2. Calawah and 3 Branches

ELIGIBILITY DETERMINATION - CLASSIFICATION

Segments of seven rivers were found to be ineligible:

1. Dungeness, from the mouth to river mile (R.M.) 10.5 due to irrigation diversions and dewatering.
2. West Fork Humptulips, from R.M. 58.6 to R.M. 61, its source, due to the extensive timber harvesting within the river corridor and its inaccessibility for anadromous fish.
3. Elwha, from the mouth to the head of Lake Mills, due to two high dams and one irrigation diversion (R.M. 0.0 to R.M. 16.0).
4. Skokomish, from mouth to confluence of North and South Forks, due to extensive river bank modification.
5. East Fork Humptulips, from Stovepipe Creek (R.M. 24.5) to source, due to extensive timber harvesting within the corridor and being upstream of the outstandingly remarkable whitewater values.
6. Hoh, from mouth to river mile 1.5, within the Hoh Indian Reservation.
7. Wynoochee, from Clark Creek to source, due to extensive timber harvesting within the river corridor and from the fish collection facility at R.M. 47.8 to the head of Wynoochee Reservoir at R.M. 55.0.

ADMINISTRATIVE - LEAD AGENCY

Elwha - All of the eligible segment is within Olympic National Park. The National Park Service should be the lead agency.

It should be noted here that there is one major river system flowing out of the Olympic Mountains that does not flow through, or have a portion of its river corridor within Olympic National Forest. Therefore, it is not evaluated in this process. This river, the **Queets**, in all probability, meets the evaluation criteria for a Wild and Scenic River. As the vast majority of the river mileage and corridor lands are within Olympic National Park, the National Park Service should be the lead agency for any study.

ADMINISTRATIVE - INSIGNIFICANT NATIONAL FOREST ACREAGE

Bogachiel - Less than one percent of the corridor acreage is within Olympic National Forest. Defer to National Park Service as the logical lead agency.

Hoh - Less than one percent of the corridor acreage is within Olympic National Forest. Defer to National Park Service as the logical lead agency.

ADMINISTRATIVE - INADEQUATE TIME

None.

ADMINISTRATIVE - RISK

None.

SUITABILITY

The remaining ten rivers listed below will be included in the Forest Planning Process for determination of suitability, and potential recommendation for inclusion in the Wild and Scenic Rivers System:

1. Hamma Hamma - source to mouth.
2. Duckabush - source to mouth.
3. Dosewallips - source to mouth.
4. Dungeness - source to R.M. 10.5.
5. Gray Wolf - source to mouth.
6. Soleduck - source to mouth.
7. Humptulips and West Fork - R.M. 58.6 to mouth.
8. East Fork Humptulips - R.M. to Lake Quinault.
9. Wynoochee - Clark Creek, R.M. 59.7 to mouth, excluding the Wynoochee Dam and Reservoir segment R.M. 47.8 to R.M. 55.0.
10. South Fork Skokomish - source to confluence with North Fork.

SUITABILITY CRITERIA WERE:

1. Representation of the Puget Trough and Olympic Mountains sections of the Pacific Border province.
2. Compatibility with existing land uses.
3. Impacts on non-Federal lands.
4. Cost of land acquisition or rights in lands to be administered in the system.

5. Values foregone or foreclosed if the river is designated.

6. Public and governmental support for or opposition to designation.

7. Representation of the major ecosystems of the Olympic Peninsula.

Prior to the decision on designation, all recommended rivers will be managed to avoid or mitigate adverse effects on the river and river corridors affecting its eligibility reclassification.

Upon completion and approval of the Forest Plan, the National Forest segments of the rivers recommended for Wild and Scenic River designation, and those that were eligible but not addressed in the analysis, will be managed according to the Standards and Guidelines established in the plan. Non-recommended rivers and river corridor segments will be managed for a full range of resource values as displayed in the last section of this appendix and per Forest Plan decisions.

Segments of rivers within the Olympic National Park will be managed within the appropriate National Park strategy.

The determination of eligibility and suitability of a river segment that lies outside of the National Forest boundary will not require a change in the management of State, county, community or private lands within the river corridor. The determination of eligibility and suitability may provide a basis for consideration in drafting future Wild and Scenic River Legislation.

Table F-2. River Eligibility Summary Table

Name	Length	Description	Classification	Length	Description
Eligible:					
Hamma Hamma	17.8	Source to mouth	Wild	3.4	Source at Murdock Lk. to bridge on road 25 in NE1/4 of Sec.13, T.24N., R.5E.
			Scenic	5.5	Bridge on road 25 to Lena Ck.
			Recreational	8.9	Lena Ck. to mouth
Duckabush 1/	24.1	Source to mouth (Hood Canal)	Wild	16.9 *	Source to Brothers Wilderness boundary in NE1/4 of Sec. 9, T.25N., R.3W.
			Scenic	5.0	Brothers Wilderness boundary to Olympic NF boundary
			Recreational	2.2	Olympic NF boundary to mouth (Hood Canal)
Dosewallips	28.3	Source to mouth	Wild	12.5	Source at Claywood Lk. to Station Ck.
			Scenic	9.9 *	Station Ck. to Olympic NF boundary
			Recreational	5.9	Olympic NF boundary to mouth
Dungeness	17.6	Source to State Fish Hatchery (RM 10.5)	Wild	4.1	Confluence of Milk and Heather Cks. in NW1/4 of Sec. 23, T.27N., R.4W. to 2860 road bridge in NW1/4 of Sec. 36, T.28N., R.4W.
			Scenic	1.9	2860 road bridge to Silver Ck. in SW1/4 of Sec. 19, T.28N., R.3W.
			Wild	2.8	Silver Ck. to Sleepy Hollow Ck. in NW1/4 of Sec. 8, T.28N., R.3W.
			Scenic	5.9	Sleepy Hollow Ck. to Olympic NF boundary
			Recreational	2.9	Olympic NF boundary to State Fish Hatchery
Gray Wolf	17.4	Source to confluence w/Dungeness River	Wild	16.2 *	Source in SW1/4 of Sec. 18, T.27N., R.4W. to 2780 road bridge in NW1/4 of Sec. 31, T.29N., R.3W.
			Scenic	1.2	2870 road bridge to confluence w/Dungeness River.
Elwha	28.8	Source to head of Lake Mills (ONP)	Wild	28.8	Source to head of Lake Mills
Soleduck 1/	64.9	Source to confluence w/Bogachiel River	Wild	6.9	Source to end of Soleduck Road in SW1/4 of Sec. 33, T.29N., R.9W.
			Scenic	9.1 *	End of Soleduck Road to S. Fk. Soleduck R.
			Recreational	14.3 *	S. Fork Soleduck R. to Olympic NF boundary
			Recreational	34.6 *	Olympic NF boundary to confluence with Bogachiel River.

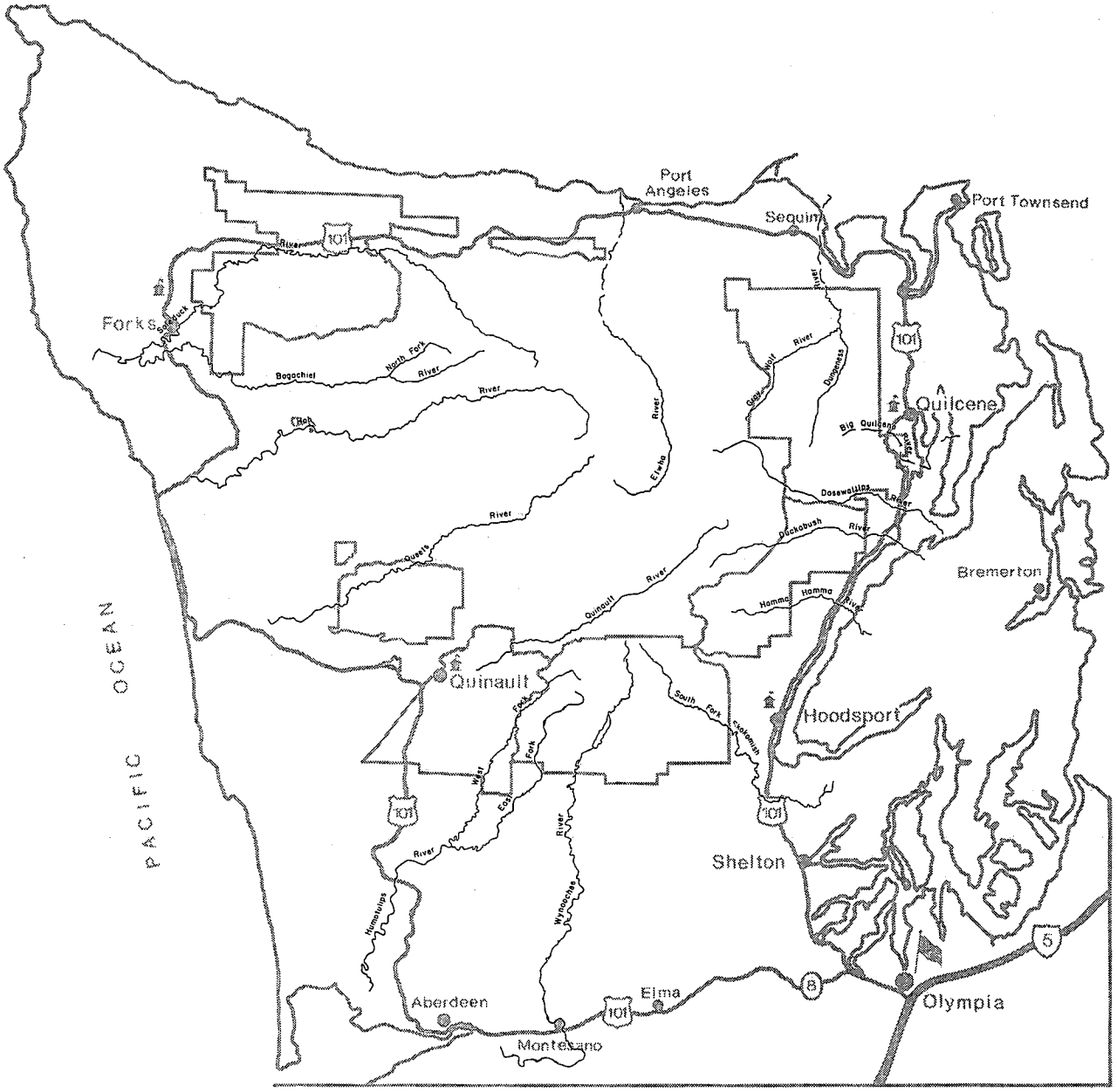
Table F-2. (Cont'd.)

Name	Length	Description	Classification	Length	Description
Bogachiel	47.0	Source to confluence w/Soleduck River	Wild Recreational	24.6 22.4	Source to Olympic NP boundary Olympic NP boundary to confluence w/Soleduck River
Hoh	54.5	Source to Hoh Indian Reservation (RM 1.5)	Wild Scenic Recreational	20.7 5.8 28.1	Source to Jackson Ck. in SE1/4 of Sec. 12, T.27N., R.10W. Jackson Ck. to Olympic NP boundary Olympic NP boundary to Hoh Indian Reservation boundary
Quinault	32.3	Source to Lake Quinault	Wild Scenic Recreational	15.9 6.5 9.9 *	Source to Graves Ck. Graves Ck. to Cannings Ck. Cannings Ck. to Lake Quinault
Humptulips & West Fork 1/	58.2	Campbell Ck. to mouth	Scenic Recreational Recreational Recreational	17.4 12.6 4.5 23.6	Campbell Creek to Olympic NF boundary Olympic NF boundary to E. Fork Humptulips River E. Fork Humptulips to Hwy 101 Bridge Highway 101 bridge to confluence w/West Fork Humptulips River.
East Fork Humptulips			Scenic Recreational	11.1 13.4	Stovepipe Ck. in NE1/4 Sec. 9, T.22N., R.8W. to Olympic NF boundary. Olympic NF Boundary to confluence w/West Fork Humptulips
Wynoochee 1/			Recreational Scenic Recreational	4.7 3.1 44.7	Clark Ck. to head of Wynoochee Reservoir Fish intake dam to Olympic NF boundary Olympic NF boundary to confluence w/Chehalis River.
South Fork Skokomish			Wild Scenic Recreational Wild Recreational	3.6 * 10.4 3.7 6.6 3.2 *	Source to Rule Ck. in SE1/4 of Sec. 8, T.23N., R.6W. Rule Ck. to LeBar Ck. in SW1/4 of Sec. 4, T.22N., R.5W. LeBar Ck. to upper end of gorge in NW1/4 of Sec. 22, T.22N., R.5W. Upper end of gorge to gauging station in NE1/4 of Sec. 2, T.21N., R.5W. Gauging station to confluence of N & S Forks Skokomish River.
Eligible & Suitable: (Recommended for Designation in the Preferred Alternative)					
Duckabush	9.4	Olympic NP boundary, RM 11.6, to exterior Olympic NF boundary, RM 2.2	Wild Scenic	4.4 5.0	Olympic NP boundary to Brothers Wilderness boundary in NE1/4 of Sec. 9, T.25N., R.3W. Brothers Wilderness boundary to Olympic NF boundary

Table F-2. (Cont'd.)

Name	Length	Description	Classification	Length	Description
Dungeness	14.7	Source to Olympic NF boundary	Wild	4.1	Confluence of Milk and Heather Cks. in NW1/4 of Sec. 23, T.27N., R.4W. to 2860 road bridge in NW1/4 of Sec. 36, T.28N., R.4W.
			Scenic	1.9	2860 road bridge to Silver Ck. in SW1/4 of Sec. 19, T.28N., R.3W.
			Wild	2.8	Silver Ck. to Sleepy Hollow Ck. in NW1/4 of Sec. 8, T.28N., R.3W.
			Scenic	5.9	Sleepy Hollow Ck. to Olympic NF boundary
Gray Wolf	8.0	Olympic NP boundary to confluence w/Dungeness River	Wild	6.8	Olympic NP boundary to 2870 road bridge in NW1/4 Sec. 31, T.29N., R.3W.
			Scenic	1.2	2870 road bridge to confluence w/Dungeness River.
Eligible, Classification Completed: (Further evaluation and recommendation deferred to Olympic NP.)					
Hoh			Wild	20.7	Source to Jackson Ck. in SE1/4 of Sec. 12, T.27N., R.10W.
			Scenic	5.8	Jackson Ck. to Olympic NP boundary
			Recreation	28.1	Olympic NP boundary to Hoh Indian Reservation boundary
Quinault			Wild	15.9	Source to Graves Ck.
			Scenic	6.5	Graves Ck. to Cannings Ck.
			Recreation	9.9 *	Cannings Ck. to Lake Quinault
Elwha			Wild	28.8	Source to head of Lake Mills
Bogachiel			Wild	24.6	Source to Olympic NP boundary
			Recreation	22.4	Olympic NP boundary to confluence with Soleduck

1/ Also, recommended by Washington State Parks as a State Scenic River.
* - Two or more segments of the same classification within the section.



LEGEND

——— **Eligible**

- - - - - - **Ineligible**

Figure F-1. POTENTIAL WILD AND SCENIC RIVERS

INELIGIBLE RIVERS

INTRODUCTION

This section presents information and evaluation results for the Big Quilcene and Calawah and its three branches: the North Fork, South Fork and Sitkum. The eligibility process described earlier was used in determining that these rivers were not eligible. The General Setting, along with eligibility values and classifications, are discussed for both of these rivers.

BIG QUILCENE RIVER

GENERAL SETTING

With a total length of 18.9 miles, the Big Quilcene is one of the shortest rivers on the Olympic Peninsula to be evaluated for its Wild and Scenic River potential. Over three-quarters of its length, 14.7 miles, is within Olympic National Forest. The remaining 4.2 miles flows over private land except for a very short segment associated with the Big Quilcene Fish Hatchery at R.M. 2.8.

Within the river corridor, the approximate mileage and acreage by ownership is as follows:

Ownership	Miles	Acres
Olympic National Forest (ONF)	14.7	4,700
U.S. Fish Hatchery	0.1	40
Private	4.1	1,300
TOTAL	18.9	6,040

The Big Quilcene River rises near Marmot Pass, which is located in the mountain ranges along the northeastern flank of the Olympic Mountains. Dropping rapidly out of the open meadow country, the Big Quilcene tumbles and cascades its way into the Douglas-fir, western hemlock forests typical of the east side of the Peninsula. Flowing through the narrow valley on its way to Quilcene Bay, the river is within the Buckhorn Wilderness. From its source to R.M. 14.7 water quality is excellent.

A resident trout fishery exists to near R.M. 11. Anadromous fish are basically restricted to the lower three miles of the river, due to the steep gradient beyond that point. There is a passage barrier at R.M. 7.6, however, it is doubtful if anadromous fish reach this point due to numerous cascades and rapids below it. Below R.M. 3, coho and chinook salmon utilize the main stem of the river.

Recreational use of, and along, the river is primarily associated with hiking and backpacking within the Buckhorn Wilderness. The Big Quilcene Trail is one of the primary access routes. Two enroute destination points are Shelter Rock Camp and Camp Mystery. Neither site has any developed improvements. Day use hiking and limited camping also occurs along the Lower Big Quilcene Trail. Fishing and hunting are minor activities. The Big Quilcene River, above R.M. 9.3, is the watershed for the City of Port Townsend. Up to 26 cubic feet per second (cfs) are diverted for Port Townsend's use.

The Big Quilcene was evaluated as a potential Wild and Scenic River because the issue surfaced during the early phases of Forest Planning, and because of its recognition as a significant river on the Olympic Peninsula.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Open meadows, seasonal snowfields, vistas of Olympic peaks, cascading water and old-growth Douglas-fir, western hemlock and true fir forests. Generally typical of rivers and river valleys in the flanks of the Olympic mountains. **Above average.**

Recreational - Serves as a major access route to the interior of the Buckhorn Wilderness. Use is along the Big Quilcene Trail and campsites at Shelter Rock, Camp Mystery and near Marmot Pass. Limited fishing and hunting. The river is not suitable for rafting or canoeing, except in its very lower reaches. **Average.**

Geologic - The river rises in mountain meadows, similar to most rivers of the Olympic Mountains; typical narrow, steep river valleys with cascading water. **Average.**

Fish - Anadromous fishery to R.M. 3, of local significance. Resident trout fishery. **Average.**

Wildlife - Typical of eastern Olympic valleys. Deer, black bear, mountain goats and numerous small game and nongame species. Old-growth habitat for northern spotted owl, marten and pileated woodpecker. **Average.**

Historical - The Big Quilcene trail was an initially used access route to Buckhorn and Iron Mountain and the mining activity referred to as the "Tubal Cain" mines. A more favored route to Tubal Cain utilized the Little Quilcene route and became the principal access route to haul equipment and supplies. The Big Quilcene route was not utilized very much, except early on, because the river needed to be crossed often and two passes in the headwaters were susceptible to lingering snows. The present day trail follows this route. No structures, improvements or sites associated with the mining effort are likely to be found along this trail. **Average.**

Cultural - Some fishing for salmon and other anadromous fish by American Indians occurred in the lower reaches of the Big Quilcene. Use in the upper reaches was probably limited to incidental hunting and gathering forays. **Average.**

Conclusion - While there are significant resource values within the Big Quilcene River and its adjacent forests, none are "outstandingly remarkable." The Big Quilcene River **is not** eligible for Wild and Scenic River consideration. Classification of the river segments and determination of suitability is not necessary.

CALAWAH AND 3 BRANCHES: NORTH FORK, SITKUM AND SOUTH FORK

GENERAL SETTING

The main stem Calawah and South Fork total 31.1 miles in length. The North Fork is 21.1 miles and the Sitkum, 12.8 miles in length.

The mileage by landownership is as follows:

	Miles		
Ownership	Calawah & S. Fork	North Fork	Sitkum
Olympic National Park	14.9	--	--
Olympic National Forest	3.8	7.7	12.8
State of Washington DNR			
within National Forest boundary		2.0	
outside National Forest boundary	1.0		
Private			
within National Forest boundary		11.3	
outside National Forest boundary	11.4	0.1	
TOTAL	31.1	21.1	12.8

The acreage within the river corridor, one-quarter mile on each side of the river, is listed below by ownership:

	Acres		
Ownership	Calawah & S. Fork	North Fork	Sitkum
Olympic National Park	4,770		
Olympic National Forest	1,220	2,460	4,100
State of Washington DNR			
within National Forest boundary		640	
outside National Forest boundary	320		
Private			
within National Forest boundary	--	3,620	
outside National Forest boundary	3,650	30	
TOTAL	9,960	6,750	4,100

Originating in the rugged foothills of the northwest corner of the Olympic Peninsula, this river system drains westerly and flows into the Bogachiel River at R.M. 8.5. The upper reaches of the South Fork and Sitkum are similar, with relatively steep river gradients and steep, forested slopes to the river edge. The Sitkum lies completely within the Olympic National Forest. The South Fork, above the confluence of the Sitkum, is in the Olympic National Park.

The North Fork flows through a broad river valley that was burned in the Forks Fire in 1951. A stand of young timber now blankets the slopes above the river. Vegetation along the banks has not reached a size to enclose the river. The middle reach of the North Fork often goes dry during late summer. Anadromous fish species utilize the North Fork up to Pistol Creek at R.M. 17.

The South Fork is utilized by fish to a point between R.M. 26 and 27, where falls and cascades block further passage. A low percentage of the main stem of the Sitkum River is suitable for spawning and receives limited use.

Recreational use within the river corridors consists of fishing, limited white water kayaking and a limited amount of camping and day use. Hunting, primarily for elk, occurs in all areas outside Olympic National Park.

The Calawah and its three tributaries, the North Fork, Sitkum and South Fork, were evaluated because of the identification of Wild and Scenic Rivers as an issue during the early stages of the planning process. Also, the State of Washington Department of Ecology has identified the Calawah as a river of Statewide significance.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Rain forest, timbered peaks, cascading waters. Typical of drainages within the lower mountains of the Olympics. Common visual variety. 2/ **Average.**

Recreational - Drift fishing and some recreational boating in lower river. Limited white water kayaking in the Sitkum and South Fork Calawah. Limited camping and day use. Little hiking. **Average.**

Geologic - Valleys vary from narrow with fixed river channels to wide with meandering river channels with sections of narrow river canyons. Lesser peaks of Olympics. **Average.**

Fish - Main stem, North Fork, and South Fork significant fish production. Major tributaries to the Bogachiel. Three species of salmon, steelhead, and sea-run cutthroat. **Above average.** Sitkum--limited production, limited potential. **Average.**

Wildlife - Elk, deer, bear, bald eagles, numerous smaller and nongame species typically found throughout west side Olympic drainages. **Average.**

Historical - In lower reaches, homesteading and early settlement occurred that was typical of the west side Olympics. But most of this use occurred outside of the National Forest. Some hunting, fishing, and trapping occurred in these drainages, but none of these activities were particularly noteworthy. **Average.**

Cultural - Prior to the arrival of European man and for some time thereafter, American Indians had established fishing camps and stations along the Calawah, North Fork and lower Sitkum. There are documented accounts of this use but no evidence of any kind has been found to date. **Above average.**

Conclusion - The Calawah and its three tributaries do not have an "outstandingly remarkable" value. The most significant value is the fishery. This will receive protection within the appropriate management strategy.

2/ USDA Forest Service, National Forest Landscape Management, 1973, 1974.

WYNOOCHEE RIVER

GENERAL SETTING

In the original evaluation of the Wynoochee it was felt that it did not have an outstandingly remarkable value, therefore was not eligible for further consideration for designation. Responses to the Draft EIS led us to reconsider the river's fishery values. It is now considered eligible for further evaluation in this part of the Forest Planning process and is reviewed in the "Suitability Analysis" section of this appendix.

SKOKOMISH AND SOUTH FORK

GENERAL SETTING

The South Fork of the Skokomish is another river that was reevaluated as a result of responses received following issuance of the Draft EIS. The South Fork is now considered to be eligible. The evaluation of the stream follows in the "Suitability Analysis" section of this appendix. The main Skokomish is still considered ineligible.

EAST FORK HUMPTULIPS

GENERAL SETTING

The East Fork of the Humptulips has been reevaluated as a result of additional information received in response to the Draft EIS and was found to be eligible for consideration for designation as a Wild and Scenic River under the Act. Refer to the "Suitability Analysis" section for the review of this river.

ELIGIBLE RIVERS, OTHER AGENCY

INTRODUCTION

This section includes four rivers that were deemed eligible with the lead agency other than the Forest Service. The process described previously was used in determining eligibility. The description of the General Setting, along with eligibility values and classifications are presented for the Elwha, Bogachiel, Quinault and Hoh Rivers. These rivers are recommended for more complete analysis and recommendation by the National Park Service.

ELWHA RIVER

GENERAL SETTING

Flowing out of the interior of the Olympic Mountains, the Elwha is one of the major rivers on the Olympic Peninsula with a main stem length of 44.8 miles. Slightly over 35 miles of this length, source to R.M. 9.6, is within Olympic National Park. From R.M. 9.6 to 7.2, (2.4 miles), the river is within the boundaries of Olympic National Forest. However, within this area there is only one segment of 0.6 mile in length where the river flows over National Forest lands. The remaining distance, 7.2 miles, flows through 6.1 miles of private ownership and 1.1 miles of the Lower Elwha Indian Reservation.

Mileage and acreage by ownership is summarized below. Acreage is based on a corridor one-quarter mile wide on each side of the river.

Ownership	Miles	Acres
Olympic National Park	35.2	11,260
Olympic National Forest	0.6	190
Lower Elwha Indian Reservation	1.1	350
Private		
within National Forest boundary	1.8	580
outside National Forest boundary	6.1	1,950
TOTAL	44.8	14,330

Rising near the heart of the Olympics, the Elwha River begins its journey to the sea from the highest regions of the Olympics with Mt. Barnes to the north and Mt. Queets to the south. This area provides some of the truly remarkable scenery in the United States. Glaciers, snowfields, rugged Olympic Peaks and mountain meadows are visible. The stream gradients are extremely steep in the first miles with nearly continuous cascades and waterfalls. Near Delabarre Creek, R.M. 40.4, the gradient moderates. From this point to Lake Mills the river gradient varies from moderate to steep. The entire reach, up to R.M. 40.3, was probably utilized by anadromous fish prior to the construction of the Lower Elwha Dam at R.M. 4.9. Between the Glines Canyon Dam, R.M. 13.4, and the upper end of Lake Aldwell, R.M. 8.4, the river is free flowing for about five miles. Below the Elwha Dam, the river is accessible to chinook, coho, pink, and chum salmon. Despite limited access and spawning material, important runs of these species are produced in this short segment.

Recreational use along this river corridor is regionally significant. The trail up the Elwha is the most known route through the Olympic Mountains. Its use dates back to the initial crossing by the Press Expedition in 1889-1890. Much of the existing trail follows their route.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Major Olympic peaks, snowfields, glaciers, waterfalls, expanses of pristine forests, mixed forest river bottoms, narrow canyons. **Outstandingly remarkable.**

Recreational - Regional attraction, premier recreational trail, developed sites, lake and river-associated use. **Well above average.**

Geologic - Major Olympic Mountain peaks, glaciers, glaciated valley, canyons, waterfalls, cliffs. **Outstandingly Remarkable.**

Fish. Significant run of four salmon species in lower 4.9 miles. Resident fisheries. Current--**Above average.** Potential, if fish passage can be established to the reaches above the dams. **Outstandingly Remarkable.**

Wildlife. Elk, deer, bear, cougar and many other large and small species can be found in an unhunted state in the mid and upper reaches of the valley. Key winter range. **Outstandingly remarkable.**

Historical - Route of the Press Expedition, which established a major route through the heart of the Olympics and named many of the peaks, river, and features within the Olympic Mountains. The Lower Elwha was also a main entry portal and activity area associated with early day Forest Service Management. Several early Ranger Stations and Guard Stations were located in the drainage and primary extent CCC structures are located at the present day Elwha Guard Station. These properties are all under the jurisdiction and management of the National Park Service. The construction and operation of Glines Canyon Dam also offers some fascinating and interesting historical perspectives to the Elwha Drainage, not the least of which are the associated impacts and effects on Wild and Scenic River values. **Above average.**

Cultural - Fishing, hunting, gathering of roots, herbs and berries was the typical use by the Klallam Indians. The use of the mid and upper reaches appeared to be quite limited. **Above average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - Two major impoundments, Lake Aldwell and Lake Mills, were created by the construction of the Lower Elwha Dam at R.M. 4.9, and the Upper Elwha (Glines Canyon) Dam at R.M. 13.4. A low diversion dam exists at R.M. 3.4.

Shoreline Development - From its source to R.M. 16, the shoreline is essentially primitive with little or no evidence of human activity. An occasional trailside camp or trail bridge may be seen. While the shoreline is undeveloped along Lake Mills, R.M. 16 to R.M. 13.4, presence of the lake itself creates an awareness of man's influence. Between Lake Mills and Lake Aldwell, the presence of the two dams, developed recreation sites (Elwha and Altaire campgrounds), the Highway 101 bridge and residences along the river create a feeling of extensive human activity. Downstream from Lake Aldwell (R.M. 4.9 to R.M. 3.0), the river flows through a canyon area with limited evidence of human activity. From R.M. 3.0 to the mouth, scattered housing, fields and pastures can be seen. Evidence of past or current timber harvesting is occasionally seen.

Accessibility - From its source to R.M. 16.5, the river is accessible only by trail. From R.M. 16.5 downstream to its mouth, the river is readily accessible from Highway 101, other State, county, private or National Park roads.

Water Quality - The Elwha meets the criteria for a Class AA "extraordinary" water. This meets or exceeds the Federal criteria for aesthetics, propagation of fish and wildlife, and primary contact recreation.

Conclusion - With the two major dams and associated reservoirs, the only free-flowing water downstream from R.M. 16.0 is the five-mile segment between Lake Aldwell and the Upper Elwha Dam, and the 4.9 miles from the Lower Elwha Dam to the river mouth. Within this lower section, there is a low diversion dam at R.M. 3.4. Based upon the classification criteria, this segment of the Elwha River is deemed ineligible for addition to the Wild and Scenic Rivers System.

From the head of Lake Mills, R.M. 16 to its source, the Elwha River meets the classification criteria for a Wild and Scenic River. As this upper segment of the river is totally within Olympic National Park, any recommendations for this segment shall rest with the National Park Service.

BOGACHIEL

GENERAL SETTING

The main stem of the Bogachiel is 46.7 miles in length, from its headwaters in the heart of the Olympics to its confluence with the Soleduck River where the Quillayute River begins.

Over half of the Bogachiel, 24.3 miles, is within the Olympic National Park. Although none of the Bogachiel River flows through the Olympic National Forest, about one-half mile of the river corridor is within the National Forest boundary. State of Washington Department of Natural Resources lands border the river on one side for 1.5 miles, and Washington State Parks for one-half mile on one side. For the remaining distance the river flows through (20.4 miles) or adjacent to (2.0 miles) private lands.

River mileage by landownership is summarized below. Acreage within the river corridor basically correlates river miles by ownership, except for the Olympic National Forest acreage.

Ownership	Miles	Acres
Olympic National Park	24.3	7780
Olympic National Forest	(0.5)	80
State of Washington DNR	1.5	240
State Parks	0.5	80
Private	20.4	6760
TOTAL	46.7	14940

The Bogachiel rises in the central Olympics, between Bogachiel Peak and Mt. Misery. Flowing westerly, the river quickly drops into the dense rain forest of the western Olympics. Stream reaches above the confluence of the main stem and North Fork (R.M. 33.7) are extremely steep with numerous cascades and waterfalls. Downstream from this point, the stream gradient becomes low to moderate as the river generally flows through a broad river valley.

The Bogachiel River system is one of the most productive anadromous fish rivers in the Region. Spring and fall chinook, coho, chum and pink salmon, as well as steelhead and sea-run cutthroat utilize the river.

Recreational use on and along the Bogachiel is predominantly linked to the fisheries in the form of drift fishing, fisherman camps, and hiking into the upper reaches of the river to fish. Hiking and camping along the Bogachiel, enroute to the high country, is a minor use of the river corridor.

Western hemlock, western redcedar and scattered hardwoods are major components of the forest within the Bogachiel Valley.

The Bogachiel is being evaluated at this time, as it was identified in the Nationwide Rivers Inventory.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Old-growth rain forest, rugged mountains, snowfields, cascades, rapids and waterfalls. **Outstandingly remarkable.**

Recreational - Drift fishing, camping, hiking. **Above average.**

Geologic - Typical Olympic Mountains and river valleys. **Above average.**

Fish - Major anadromous stream system. Regionally significant. **Outstandingly remarkable.**

Wildlife - Elk, deer, bear. Bald eagle habitat. **Above average.**

Historical - Nothing of significance, especially in the context of National Forest land. **Average.**

Cultural - Lower reaches fished extensively by Indians. Greater use than the typical major rivers of area. Probable sites along the river. **Above average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The Bogachiel River is entirely free of impoundments and diversions. Riprap and other bank stabilization have been used, on a limited basis, to protect improvements such as the Highway 101 bridge and Highway 101.

Shoreline Development - The upper 24.3 miles is essentially primitive with little evidence of human activity. Riverside hiker camps may be seen occasionally. Downstream from R.M. 22.4, the Olympic National Park boundary, to just upstream from the Highway 101 bridge (R.M. 15.6), there has been limited development along the shoreline. Evidence of timber harvesting can be seen on the slopes beyond the river. Fields and pastures are seen periodically.

A small development and the Bogachiel State Park are located in the vicinity of the Highway 101 bridge at R.M. 15.6. From the State Park to the mouth, the shoreline has few dwellings or structures. Evidence of past and ongoing timber harvesting is not readily apparent, due to the relatively flat topography and forested area along the river. A Washington State Department of Wildlife steelhead hatchery is located near R.M. 9.

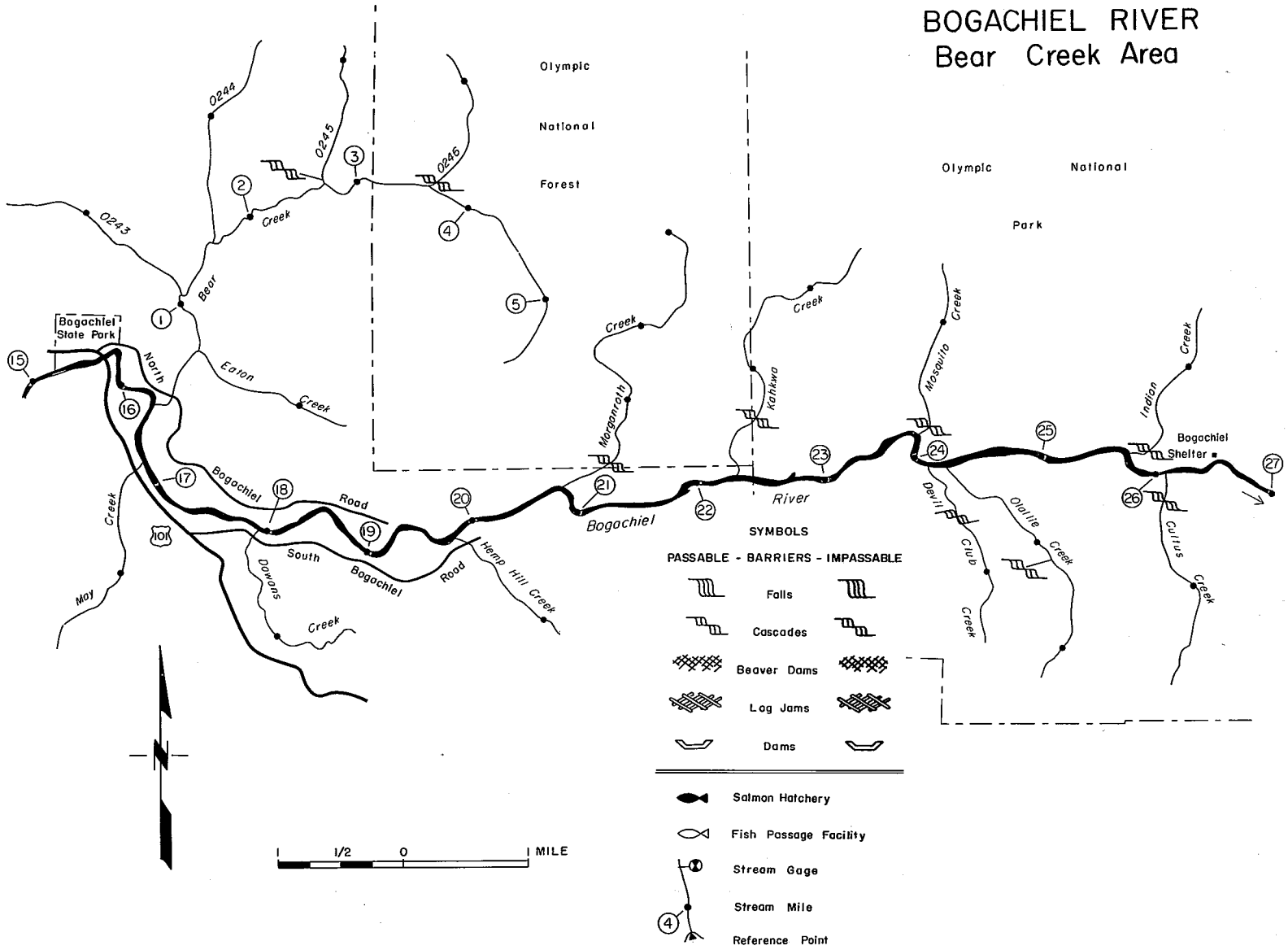
Accessibility - From its source to R.M. 33.8, the main stem of the Bogachiel is accessible only by cross-country travel. Downstream from the confluence of the North Fork and the main stem (R.M. 33.8), the Bogachiel trail is located along the north bank of the river to the trailhead near the Olympic National Park boundary (R.M. 22.4). From the Park boundary to Highway 101 (R.M. 22.4 to R.M. 15.6), there is a road immediately adjacent to, or near the river on each side of the river. Highway 101 follows the river on the north side to approximately R.M. 10.5. Easy access to the lower river (R.M. 10.5 to R.M. 0) is through a network of State, county, and private roads that approach or cross the river.

Water Quality - The Bogachiel and its North Fork meet Class AA **"extraordinary"** water standards. This meets Federal criteria for aesthetics, fish and wildlife propagation, and primary contact recreation (swimming).

Conclusion - The Bogachiel meets classification criteria for Wild and Scenic Rivers. It has an **"outstandingly remarkable"** fish value. This river system should be further evaluated for its suitability as an addition to the Wild and Scenic Rivers System.

Recommendations - The lead agency for this suitability analysis/study should be other than the Forest Service, which has less than one percent of the area within the river corridor. With just over 50 percent of the river corridor acres within Olympic National Park, the Park Service would appear to be the logical lead agency.

Interim management of National Forest lands within the Bogachiel corridor should meet, or exceed the criteria for the classification of Recreational River.


BOGACHIEL RIVER
Bear Creek Area
Olympic National Forest
Olympic National Park
Bogachiel State Park
Bogachiel Shelter
Bogachiel River
North Bogachiel Road
South Bogachiel Road
Bear Creek
Eaton Creek
May Creek
Dowans Creek
Hemp Hill Creek
Morganroth Creek
Kahkwa Creek
Mosquito Creek
Devil Club Creek
Olallie Creek
Indian Creek
Cultus Creek
0243
0244
0245
0246
101
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
MILE

HOH RIVER

GENERAL SETTING

Totalling slightly over 56 miles in length, the Hoh flows through 26.5 miles and along 1.5 miles of the Olympic National Park, and borders Olympic National Forest lands for 2.0 miles. The river also flows adjacent to 1.5 miles of Hoh Indian Reservation lands, through or adjacent to 3.0 miles of Washington State DNR lands and through nearly 24.0 miles of private lands.

Mileage, along with estimates of acreage by ownership, is summarized below. Acreage is based on a corridor one-quarter mile wide on each side of the river.

Ownership	Miles	Acres
Olympic National Park	27.2	8,700
Olympic National Forest	1.0	320
Hoh Indian Reservation	0.8	250
State of Washington DNR	3.0	960
Private	24.0	7,690
Other State and Count	0.1	30
TOTAL	56.1	17,950

Located on the west side of the Olympic Peninsula, the Hoh River is known world wide for its rain forest and regionally for its fisheries resource. Rising from Hoh Glacier on Mt. Olympus and its other tributaries on the Bailey Range, the Hoh drops quickly into the densely timbered rain forest of the Hoh River Valley. Above Glacier Creek, R.M. 48.6, the stream gradient is steep, with numerous cascades constituting a barrier to upstream migration of fish. Below Glacier Creek the river gradient moderates and the stream valley broadens. Chinook and coho salmon reach as far upstream as Glacier Creek, while chum and pink salmon are found in the river below Mt.Tom Creek, R.M. 38. The natural instability of the river channel below Mt.Tom Creek is a major factor limiting spawning success in the river.

Recreational use in the Hoh Valley is associated with the rain forest (camping and hiking), or fishing. The Hoh River Trail is the primary access route for climbers on Mt. Olympus and adjacent peaks.

The giant trees and lush growth of vegetation drew early timber industry attention to the lower Hoh drainage.

The Hoh is being considered for Wild and Scenic River status as it is currently on the HCRS inventory, because of past legislative proposals and because of its characteristics.

ELIGIBILITY DETERMINATION - VALUES

Scenic - With its source on Mt. Olympus, vistas of numerous Olympic peaks, its internatioinally significant rain forest, glaciers and snowfields, waterfalls and cascades, and its meandering river course the river's scenic values are **Outstandingly remarkable.**

Recreational - Mountaineering, hiking, camping, day use, salmon viewing, drift boat fishing, national recreation destination. **Outstandingly remarkable.**

Geologic - Glaciers, major Olympic peaks, waterfalls, cascades and meandering river course. **Outstandingly remarkable.**

Fish - Four species of salmon, noted winter steelhead run, cutthroat trout. Over 48 miles of the Hoh River utilized by anadromous fish. **Outstandingly remarkable.**

Wildlife - Elk are the most notable wildlife in the Hoh River Valley. Deer, bear, eagles and numerous other game and nongame species also can be seen. **Average or slightly above average.**

Historical - The Hoh was one of the last river drainages to be settled and developed. One of the first settlers was Peter Huelsdonk, the lengendary "iron man of the Hoh." The Huelsdonk Ranch still exists along the Hoh River road. **Above Average.**

Cultural - Prior to white man's entry into the Hoh Valley, Indians camped along the river while they fished and hunted. Year-round residence was close to the mouth of the river. No sites have been discovered on adjacent National Forest land. **Average or somewhat above average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The entire length of the Hoh River is free of impoundments, diversions or significant modification of the waterway.

Shoreline Development - From its source to near R.M. 36, there is little or no evidence of human activity. A few riverside hiker campsites may be seen.

Just below R.M. 36, the Park Service Hoh River recreation site is located along the north bank of the river. From there to just below R.M. 30, where the river leaves the National Park, there is little evidence of human activity except for a limited number of day-use sites adjacent to the Hoh River road. There is little, if any, evidence of past or ongoing timber harvesting. From the National Park boundary downstream to its mouth, there is significant evidence of human activity.

Evidence of past and present timber harvesting is nearly always visible. Rural homes and small acreage farms may be seen periodically. Six State Department of Natural Resources campgrounds are located along the river in this section, plus numerous informal sites.

Accessibility - From its headwaters downstream to the Park Service Hoh Visitor Center and campground, the access to the river is by trail only. From that point, near R.M. 36 to the Park boundary, the Hoh River road parallels the river along its north bank. While seen rather infrequently, it does provide easy access to the river. From the Park boundary to Willoughby Creek, R.M. 19.5, the Hoh River road continues to parallel the river with easy access to the river. Access from the south side of the river is over a series of private and State Department of Natural Resources roads, as is the north side from Willoughby Creek to U.S. Highway 101.

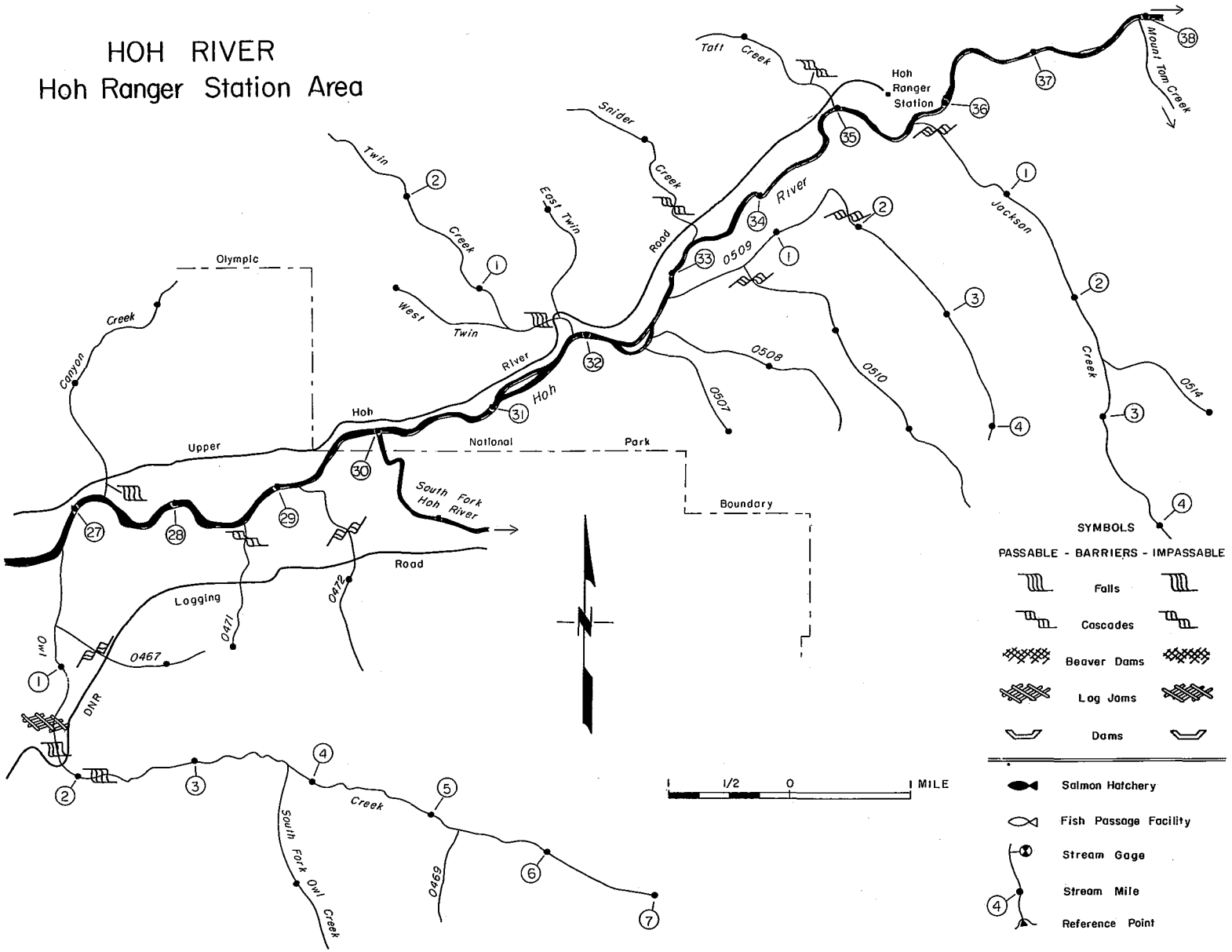
Downriver from the Highway 101 bridge to its mouth, the river is readily accessible from Highway 101 along the south bank, and the Oil City road along the north side.

Water Quality - Water quality meets State Class AA "extraordinary" water quality criteria for propagation of fish and wildlife and for primary contact recreation.

Conclusion - The Hoh River meets the classification criteria from source to mouth. Scenic, recreational, geologic, and fish values are **"outstandingly remarkable."** This river fully meets the criteria for eligibility as a Wild and Scenic River.

Recommendations - As the Forest Service has less than one percent of the river corridor acres, it would be inappropriate to take the lead agency role in a suitability analysis. The Park Service, with nearly 50 percent of the corridor acres, appears to be the logical lead agency.

During the interim, prior to a suitability analysis, the management of National Forest lands within the corridor should avoid or mitigate any adverse effects on the river or its immediate environment.


HOH RIVER
Hoh Ranger Station Area
Hoh Ranger Station
Mount Tom Creek
Toft Creek
Snider Creek
Jackson Creek
Twin Creek
East Twin
West Twin
Hoh River
South Fork Hoh River
Olympic National Park Boundary
Upper Hoh Road
Logging Road
Canyon Creek
Owl Creek
South Fork Owl Creek
DNR
0467
0469
0471
0472
0507
0508
0509
0510
0514
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
MILE

QUINAULT RIVER

In evaluating the Quinault River system, it has been considered as two separate, but linked systems. Quinault Lake and the lower river are within the Quinault Indian Reservation and access to, and use of this system is controlled by the Quinault Indian Nation. The upper river, from Quinault Lake to its source, flows through Olympic National Forest and Olympic National Park. This is the segment to be evaluated here.

GENERAL SETTING

Located on the west side of the Olympic Mountains, the Quinault River Valley is one of the three major rain forest valleys of the Olympic Peninsula. As defined by the Heritage Conservation Recreation Service, the Quinault River is entirely within the Olympic Mountain section of the Pacific border province.

Flowing out of the interior of the Olympics, the Quinault River is one of the major rivers on the Olympic Peninsula, with a length of slightly over 32 miles from its source to Quinault Lake. Over 23 miles of this length, source to R.M. 44.8, is within the Olympic National Park. From the Park Boundary at R.M. 44.8, to the point where it flows into Quinault Lake at R.M. 36.2, the river forms the boundary between Olympic National Park and Olympic National Forest with the north side; right bank within Olympic National Park and the south bank within Olympic National Forest. Intermingled private land is located along both sides throughout this section of the river.

Mileage and acreage by ownership is summarized below. The acreage is based on a corridor one-quarter mile wide on each side of the river.

Ownership	Miles	Acres
Olympic National Park - Both Riverbanks	23.7	7,580
Olympic National Park - One Riverbank	8.3	1,320
Olympic National Forest - One Riverbank	2.4	380
Private		
within National Park Boundary - One Bank	0.3	50
within National Forest Boundary - One Bank	6.2	990
TOTAL	32.3	10,320

Rising near Anderson Pass and Anderson Glacier, the Quinault River is one of the major rivers flowing out of the heart of the Olympics. Glaciers, open meadows, waterfalls, and mountain peaks dominate the view that surrounds the headwaters of the Quinault River. The stream gradient is very steep as the waters tumble and cascade down the valley. With the stream gradient moderating somewhat below Anderson Creek, the river becomes a mixture of rapids, cascades, riffles and pools. Near Fire Creek, R.M. 56, the river enters a deep canyon with numerous falls and cascades. This canyon extends to just above Graves Creek, R.M. 52.6. Few, if any salmon, pass through this canyon area. Steelhead do pass through the canyon and utilize the upper river to approximately O'Neil Creek.

Downstream from Graves Creek, the river makes the transition from a fixed channel to a meandering course, which becomes more accentuated as it approaches Quinault Lake. The vegetation along the river edge is dominated by alder, black cottonwood, and big leaf maple, rather than the nearly pure coniferous forest found in much of the upper reaches. Coho, chinook and sockeye salmon utilize this section of the Quinault, as well as its tributaries. Steelhead and sea-run cutthroat trout also utilize the river and its tributaries.

The Quinault Rain Forest and the Quinault River are Regional recreation destinations. Developed campgrounds and resorts around Quinault Lake provide a "home base" for many recreationists using the upper river. Graves Creek campground, at the end of the road, is a jump-off point for hikes into the Enchanted Valley and Anderson Pass.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Major Olympic peaks, snowfields, glaciers, mountain meadows, expanses of pristine forests, hardwood river bottoms, cascading water. **Outstandingly remarkable.**

Recreational - Regional attraction, major recreation trail through the Olympics, river-associated use, limited white water canoeing and kayaking. **Above average.**

Geologic - Major Olympic Mountain peaks, glaciers, glaciated valleys, river canyons, cliffs and waterfalls. **Above average.**

Fish - Three species of salmon (including a unique sockeye population), steelhead, sea-run cutthroat trout. Significant reaches of the river and its tributaries utilized for spawning and rearing. **Outstandingly remarkable.**

Wildlife - Elk, deer, bear, mountain goats, cougar and many other game and nongame species are found along the river and its corridor. **Above average.**

Historical - From Lake Quinault to the North Fork, the river and river corridor was the route of the Press Expedition; also, it was traversed by the O'Neil party. Much of the privately owned land above Lake Quinault remains as testimony of the early pioneering and homesteading in this area. **Above average.**

Cultural - Quinault Lake and the Quinault River at least to the North Fork, was utilized extensively by Indians as a transportation route and for fishing. River-side camps were known to have existed, but the meandering course of the river has likely had negative impacts. Actual evidence of these sites have remained undiscovered. While the historical/cultural values of this river corridor may hold significance, less than 5% of the land is administered by the Forest Service. **Above average.**

Conclusion - Having two **"outstandingly remarkable"** values, scenic and fish, the Quinault River **does** qualify for eligibility as a Wild and Scenic River.

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - There are no existing or proposed water resource development projects on the upper Quinault River.

Shoreline Development - From its source near Anderson Pass to Graves Creek, R.M. 52.6, there is little or no evidence of human activity except for the Chalet in the Enchanted Valley and the trail along the river. An occasional riverside hiker campsite may be seen.

Graves Creek Campground, in Olympic National Park, is located at R.M. 52.5. From that point to Cannings Creek, R.M. 46.1, the road accessing the upper Quinault Valley is adjacent to the south (left) bank of the river. At R.M. 46.1, a bridge spans the river connecting the North Fork and upper Quinault Valley roads. While the two roads roughly parallel the river from this point to Quinault Lake, they are generally out of sight from the river. Limited evidence of past and present timber harvesting can be seen downstream from the Park boundary, R.M. 44.8.

Rural homes, small acreage farms and an isolated gravel extraction site may be seen in the lower reaches of the river, R.M. 40-36.2. There are a few dispersed campsites along the river. The most notable is the cottonwood site near R.M. 44.5.

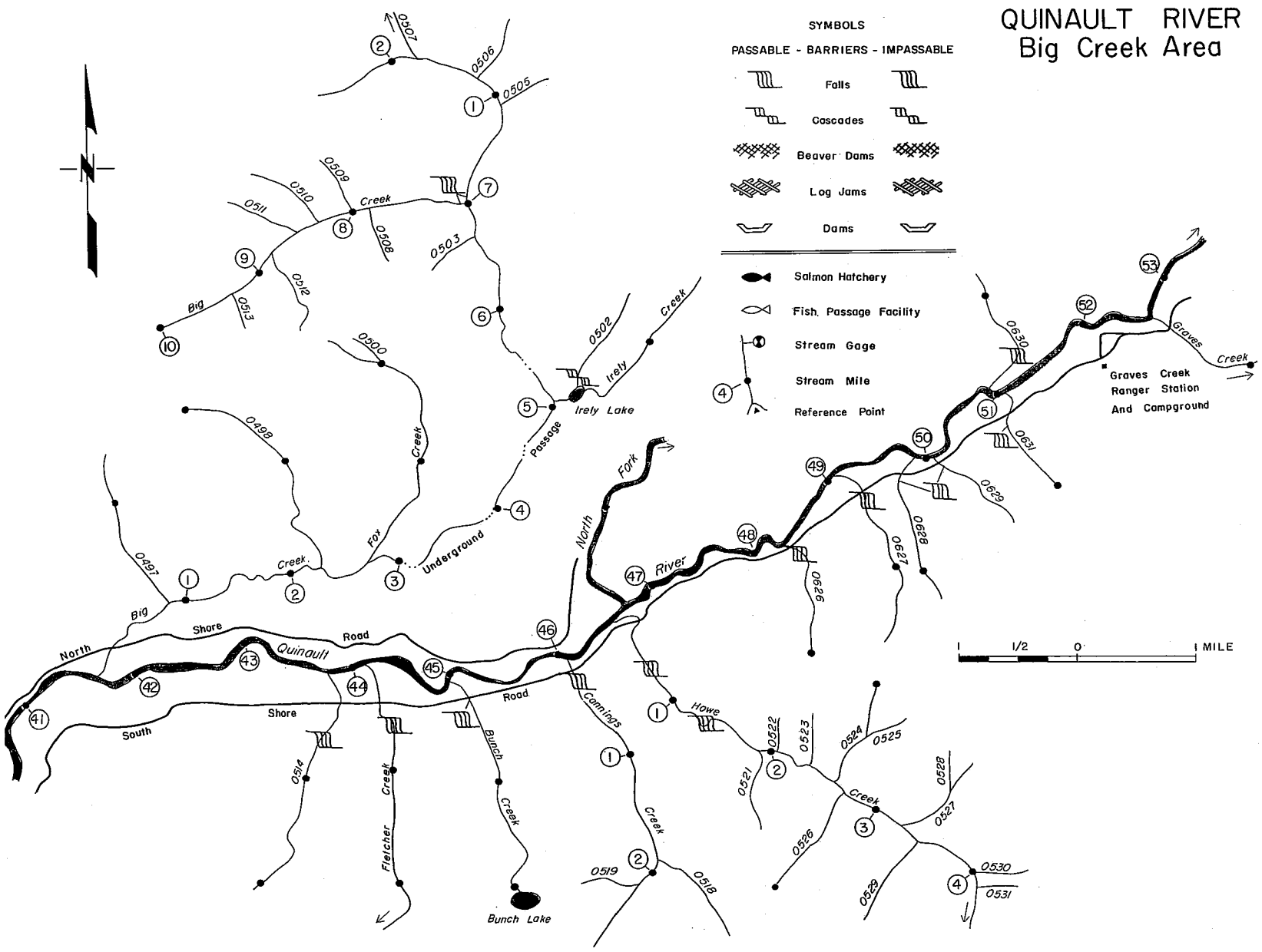
Accessibility - From its source downstream to Graves Creek Campground at R.M. 52.6, access is by trail only. From that point downstream to Cannings Creek, R.M. 46.1, the road along the south bank provides either direct or indirect access to the river. From R.M. 46.l to 36.2, there is abundant access from the main roads along each side of the river and short access roads leading to the river.

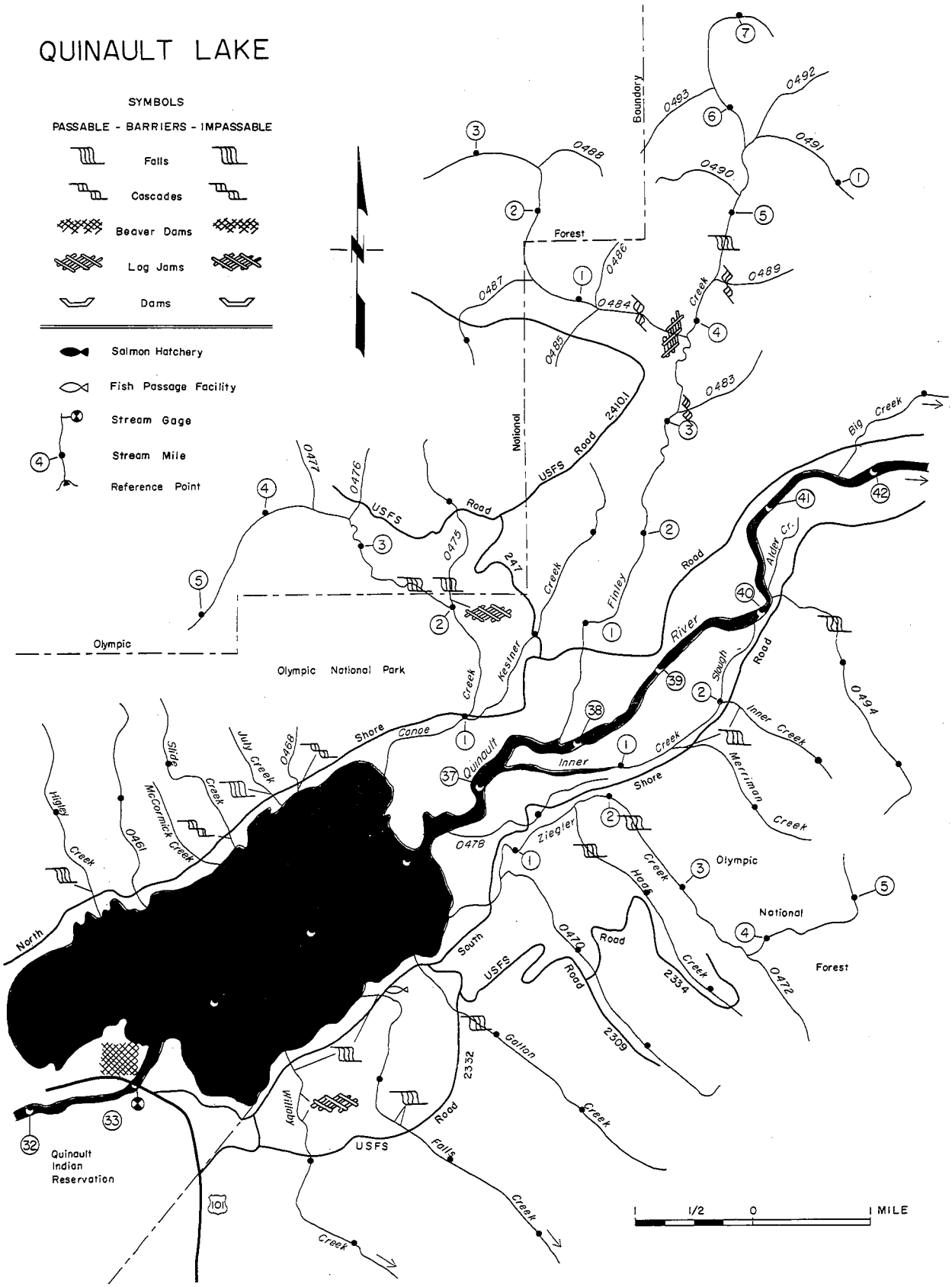
Water Quality - Water quality meets State Class AA, "extraordinary" water quality criteria for propagation of fish and wildlife and for primary contact recreation.

Conclusion - The Quinault River, from its source to Quinault Lake, meets the classification criteria for a Wild and Scenic River. Scenic and fish values are **"outstandingly remarkable"**. This river fully meets the criteria for eligibility as a Wild and Scenic River.

Recommendations - With slightly less than five percent of the river corridor acres administered by the Olympic National Forest and almost 85% of the area in the Olympic National Park, it is considered logical that the National Park Service should be the lead agency for any further evaluation and recommendation of Wild and Scenic River status for the Quinault River.

In the interim it is recommended that management of National Forest lands in the corridor should protect their qualities for inclusion in the Wild and Scenic Rivers system if so designated.


QUINAULT RIVER
Big Creek Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Graves Creek Ranger Station And Campground
Irely Lake
Bunch Lake
North Fork
Big Creek
Fox Creek
Underground Passage
Fletcher Creek
Bunch Creek
Cummings Creek
Howe Creek
Graves Creek
North Shore Road
South Shore Road
Quinault River
1/2 0 1 MILE


QUINAULT LAKE
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Olympic National Park
Olympic National Forest
Quinault Indian Reservation
Boundary
USFS Road 2410.1
USFS Road 247
USFS Road 2332
USFS Road 2309
USFS Road 2334
USFS Road 0470
Finley Road
Alder Cr.
Big Creek
Inner Creek
Merriman Creek
Hage Creek
Ziegler Creek
Gatton Creek
Falls Creek
Kestner Creek
Canoe Creek
Shore
Inner
Quinault River
Slough
Slide Creek
July Creek
McCormick Creek
Higley Creek
North
South
Willoby
0488
0493
0492
0491
0490
0489
0486
0487
0484
0485
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0476
0475
0468
0461
0478
0494
0472
101
1/2
0
1 MILE

ELIGIBLE RIVERS, NATIONAL FOREST

DOSEWALLIPS

GENERAL SETTING

The main stem of the Dosewallips River originates in the high lakes and meadow country near Mt. Claywood and Sentinel Peak. Flowing easterly from there, the Dosewallips River drops nearly 6,000 feet in its 28.3 miles to Hood Canal. Slightly over half of this distance, 14.3 miles, is within Olympic National Park. Of the remaining 14 miles, 8 are within Olympic National Forest, with the last 5.9 miles flowing through a number of private ownerships before it reaches Hood Canal, near the community of Brinnon. Near its mouth, the river forms the north boundary of the Dosewallips State Park, except for the final 0.3 miles which is State Park on both sides of the river.

Acreage and mileage by ownership are summarized below. Acreage is based on a one-quarter mile corridor each side of the river on a Forest Plan map. The National Forest acreage was extracted from the map data base.

Ownership	Miles	Acres
Olympic National Park	14.3	4,580
Olympic National Forest	7.2	2,300
Private		
within National Forest	0.9	290
outside National Forest		
one side of river	(0.5)	80
both sides of river	5.1	1,630
State Parks		
both sides of river	.3	100
one side of river	(.5)	80
TOTAL	28.3	9,060

The Dosewallips is similar to a number of the rivers flowing into Hood Canal off the east flank of the Olympic Mountains. It rises from small lakes at, or above timberline. Stream gradients are very steep, sometimes precipitous. In the upper reaches, the valley is very narrow with many ravines and short canyons. The valley begins to broaden a little below the confluence of the West Fork (R.M. 17.6). Once below timberline, the side slopes are densely forested with western hemlock, Pacific silver fir, Douglas-fir, and western redcedar. The Dosewallips is recognized regionally for its fisheries, with anadromous fish utilizing the lower 14 miles. Chinook, coho, chum and pink salmon inhabit this segment. The entire section is accessible to chinook and coho, while pink salmon use areas downstream from a series of cascades at R.M. 11.5. Chum salmon spawn in the lower 4.5 miles.

Recreationists throughout the Puget Sound basin come to the Dosewallips for fishing, hiking and camping. Dosewallips campground in Olympic National Park is a major trailhead accessing the interior of the Olympics.

The Dosewallips is being evaluated as a potential addition to the Wild and Scenic Rivers System because of its inherent qualities, the identification through the HCRS inventory, previous legislation, and the identification as an issue early in the planning process.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Mountain meadows, lakes, snowfields, mountain peaks, tumbling water, river canyons, dense forests. **Outstandingly remarkable.**

Recreational - Hiking, camping, mountaineering, day use. **Above average.**

Geologic - Mountain peaks, cliffs, river canyons. **Above average.**

Fish. Four salmon species, steelhead and cutthroat trout. Very high adult production. Regionally significant. **Outstandingly remarkable.**

Wildlife - Deer, elk, bear, eagles. Typical of Olympic drainages. **Above average.**

Historical - Early trail through to west side of Olympics and Quinault River via Anderson Pass. Railroad logging in lower valley. Also some mining activity at Bull Elk Creek. **Above average.**

Cultural. Likely use by prehistoric people, especially near the river mouth. No known sites on river or within corridor. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The entire length of the Dosewallips is currently free of impoundments.

Shoreline Development - From its point of origin to near R.M. 15.8, the river corridor is free of any evidence of human activity. Exceptions to this are the Dosewallips trail which parallels the river, and an occasional campsite adjacent to the river.

The end of the Dosewallips road and Dosewallips Campground occur at R.M. 15.7. From this point downstream to the National Forest boundary at R.M. 5.9, the Dosewallips road is located along the north bank of the river and is frequently seen from the river. Elkhorn Campground (R.M. 12) and a number of dispersed use areas, accessible by short access roads, can be seen from the river. Little evidence of timber harvesting activities can be seen within this section of the river.

Downstream from the National Forest boundary, the level of activities and shoreline development increases significantly. Housing seen from the river is similar to that in a rural setting typical of tracts from one to five acres or larger. This changes to the density of a small unincorporated community in the vicinity of Highway 101 and the community of Brinnon. Evidence of timber harvesting is seen in the background and occasionally in the foreground.

Accessibility - Upstream from Dosewallips Campground, R.M. 15.7, access to the Dosewallips River is by trail. Downstream from Dosewallips Campground to Elkhorn Campground, R.M. 12.0, the road parallels the river on the north bank but does not provide ready access due to topography and its position on the slope. From R.M. 12 to R.M. 5.9, the topography is much more gentle. The road continues to parallel the river along the north bank providing numerous access points directly to the river. Additional access is provided by secondary roads; one which bridges the river at R.M. 11.5, a bridge at R.M. 6.7, and a road

up slope of the south side of the river from R.M. 6.7 to R.M. 9.0. User-developed roads and logging spur roads from past salvage logging and thinning activities, provide additional access to the river. From R.M. 5.9 to its mouth, the Dosewallips road is somewhat distant from the river with access existing, but often closed to the general public by the individual landowners. Access within 0.8 mile of Hood Canal is available from Dosewallips State Park.

Water Quality - Water quality is classified AA, "extraordinary" for the entire river.

Conclusion - The Dosewallips River meets the classification criteria over its entire length and has two **"outstandingly remarkable"** values; scenic and fish. The determination of suitability should proceed.

GENERAL DESCRIPTION OF RESOURCES

The Dosewallips River originates in the Sentinel Peak-Mount Claywood vicinity of the Olympic interior. Principal upstream tributaries include Deception and Silt Creeks, and the West Fork Dosewallips River. The only major tributary in the lower reach is Rocky Brook, which has a steep gradient and a spectacular waterfall at R.M. 0.3.

Over the upper 11 miles, the Dosewallips cuts through a very narrow, steep-sloped valley with many ravines and short canyons. The terrain of the lower 12 miles ranges from precipitous slopes and canyons to a short, alluvial valley before it flows into Hood Canal. A very steep one-half mile section, basically a cascade, is located from R.M. 11.1 to 11.6.

In the upper 25 miles, the river has an average fall of 230 feet per mile. In the lower five miles, the Dosewallips River flows through lowlands that are subject to flooding with a gradient of three feet per mile.

Vegetation in the headwaters and upper reaches is typical of the Olympic high country, consisting of meadows with clumps of subalpine fir. As the river descends, it passes through the Pacific silver fir zone and finally into the western hemlock zone. Hardwoods, such as red alder and big leaf maple are common, especially in the lower reaches. Understory vegetation ranges from lush herb-dominated meadows to vine maple, and salmonberry in the lower reaches.

The lower reach of the Dosewallips, outside the National Forest is accessed by U.S. Highway 101 and a county road that parallels the north (left) bank. Forest Service 2610 continues along the north (left) bank up to Olympic National Park. Finally, the road continues in the Park for about 1.5 miles to its end at the Park Ranger Station. A trail follows the north (left) side of the Dosewallips River in the Park, from the Ranger Station up to Dose Meadows.

Brinnon is located just north of the river near its mouth. It is a small, timber products orientated community which recently has drawn some retirees and recreation-oriented people. 3/

Located about 60 miles from Seattle and approximately 90 miles from Tacoma, the Dosewallips River is within a two to three-hour drive from the State's largest metropolitan areas. Three other major cities are also within a two-hour drive: Olympia (60 miles), Bremerton (70 miles), and Port Angeles (60 miles).

Hiking, fishing, picnicking and camping are the primary uses. Gathering oysters and clams is a popular sport near the Dosewallips' mouth along Hood Canal.

3/ Adelman 1980.

The upper reaches, R.M. 14 to 28.3, lie within Olympic National Park. Management goals in the Park seek to maintain the natural ecosystem.

The middle reaches, R.M. 5.9 to 14, are managed by Olympic National Forest. The Brothers Wilderness boundary is along the south bank of the Dosewallips from R.M. 14.0 to the bridge downstream from Elkhorn Campground, R.M. 11.6, and again between about R.M. 10 and 11. Between R.M. 13.5 and 14, the Wilderness boundary is 200 feet south of the river to allow for the Dosewallips hydropower project. A few commercial thinnings have taken place within the river corridor. These thinnings meet the requirements for Scenic River corridor management.

Lands downstream from the Forest boundary to its mouth is owned predominantly by private individuals, with the exception of the portion in Dosewallips State Park. Houses are generally not seen from the river.

Water - Water quality in the Dosewallips River is presently classified AA, "extraordinary," by the State Water Pollution Control Commission. Except during heavy rains, the water is extremely clear. In the summer, snowmelt and glacial flour create a slightly milky gray-green color.

Water temperature is cool (actually cold) year round, thus restricting primary contact use by visitors.

The average annual discharge, measured at R.M. 0.4, is 475 cfs. The total drainage area above the gauging station is 116 square miles.

Two peak flow periods occur on the Dosewallips River; one from winter precipitation and the other, which is higher, from snowmelt and spring rains. Minimum flows generally occur in August and September. The maximum flow recorded on the Dosewallips was 13,200 cfs on November 26, 1949. Typical high flows are generally around 4,000 cfs. 4/.

The State Department of Ecology has allocated about six cfs of the Dosewallips River for use by the National Forest Elkhorn Campground (.6 cfs), private backyard fish production (5 cfs), and minor domestic use (.4 cfs). In addition, 40 cfs are allocated to a power project constructed on Rocky Brook.

The National Forest portion of the river is estimated to have a hydropower production potential of 406 Gigawatts per year at the 30% exceedance level.

The steep gradient of the Dosewallips River contributes to this hydroelectric potential. Jefferson County PUD #1 has filed a license application for the Dosewallips project located between R.M. 13.5 and 14. This area was specifically placed outside the Brothers Wilderness by the Washington Wilderness Act. This project, named Elkhorn, could produce 13.3 MW (megawatts) through a run-of-the-river type system. The Federal Energy Regulatory Commission (FERC) has put a "hold" on the license application until after the release of the Forest Plan.

Fish and Wildlife - Chinook, chum, coho and pink salmon utilize the Dosewallips River. While all species do utilize the reach between the cascades at R.M. 11.1 - 11.6 to R.M. 14.0, the predominate users of this upper reach is chinook and
coho. Pink salmon use areas downstream from the cascades at R.M. 11.1, with

4/ Pacific Northwest River Basins Commission, 1971.

heaviest spawning in the lower 3.5 miles. While chum salmon may be found up to R.M. 14, they are found, and spawn, predominately in the first 4.5 miles of the river.

The chinook runs occur in late summer or early fall. Two distinct chum salmon runs occur in the river; one extremely early (September) and the other very late (late December-early January). Salmon do not use the upper portion of the Dosewallips above R.M. 14.0 due to the very steep cascades and falls at that point. The Dosewallips is considered a good steelhead stream. There is also a good anadromous cutthroat trout population in the river. Both species inhabit the lower reaches below the cascades.

Based on the existing anadromous fish habitat, the Dosewallips River has the potential to produce annually, approximately 152,000 adult fish. About 39 percent of this habitat capability is on the eight river miles within the National Forest boundary. The following table summarizes the estimated annual production in the Dosewallips. The fisheries in the Dosewallips River have regional significance.

Table F-3. Estimated Annual Habitat Production Capabilities for Anadromous Salmonids

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Chinook	NF	140	19,600	840
	Other	220	30,660	1,310
	TOTAL	360	50,260	2,150
Coho	NF	610	30,500	4,940
	Other	950	47,710	7,730
	TOTAL	1,560	78,210	12,670
Chum	NF	1,740	391,500	5,090
	Other	2,720	612,350	7,960
	TOTAL	4,460	1,003,850	13,050
Pink 1/	NF	16,960	2,035,200	44,770
	Other	26,530	3,183,260	70,020
	TOTAL	43,490	5,218,460	114,790
Steelhead	NF	1,270	21,680	1,890
	Other	1,990	33,910	2,960
	TOTAL	3,260	55,590	4,850
Cutthroat	NF	1,270	21,680	1,890
	Other	1,990	33,910	2,960
	TOTAL	3,260	55,590	4,850
All	NF	21,990	2,520,160	59,420
	Other	34,400	3,941,800	92,940
	TOTAL	56,390	6,461,960	152,360

1/ Olympic Peninsula pink salmon spawn only during odd years, and, as such, the annual estimates shown are odd year numbers divided by two.

Generally, wildlife species common in the eastern Olympics would utilize the Dosewallips River corridor. Common large mammal species include black-tailed deer, Roosevelt elk, black bear, cougar, coyote and bobcats. Smaller mammals include raccoon, mink, river otter, beaver, mountain beaver, rabbit, skunk and marmot.

The river bottom, below 1,500 feet elevation, provides winter range for deer and elk.

With the exception of the northern bald eagle, no threatened wildlife species are known to inhabit the river corridor.

Riparian habitat is generally in a natural condition, with the exceptions of the thinnings on the National Forest, and the private development along the lower reaches.

Recreation - Three developed recreation sites occur along the Dosewallips River. These are Dosewallips State Park near the mouth, Elkhorn Campground near R.M. 12 and the Dosewallips Campground near R.M. 16. Day use and overnight camping are permitted in all three facilities.

The information on these sites is summarized in Table F-4.

Table F-4. Developed Recreation Sites

National Forest Sites					
Site	ROS Class	Capacity PAOT	Managed Season Days	1988 Use RVD's	Projected Capacity PAOT
Elkhorn	Semi-Primitive Motorized	100	110	12,200	175
Other Agency Sites					
Site	Managing Agency	Acres	Camping Units	Managed Season Days	1988 Use Visits
Dosewallips	State Parks	424	127	N/A	40,500
Dosewallips	O.N.P.	17	33	N/A	5,610

Elkhorn Campground (O.N.F.) is planned for expansion as use increases and when funding is available. A new campground, Lower Dosewallips, is programmed for the latter part of the planning period. The river and river use will be the "theme" of the site. If "designated" as a Wild and Scenic River, additional public access to the river in the vicinity of R.M. 3.6 would be desirable.

Major activities at these sites include picnicking, fishing, hiking, and camping. Opportunities for rafting or other forms of river floating are very limited due to the river's steep gradient and cascades.

The Dosewallips trail begins at the Dosewallips Campground and follows the north (left) side of the river to Dose Meadows. Approximately 2,600 people enter the trail from the trailhead near the campground. An Olympic National Park seasonal ranger station is open during the summer near the campground.

A distinctive value along the Dosewallips, particularly on the Forest and especially in the Park, is its scenery. Mount Claywood, Mt. Fromme and Lost Peak exemplify the rugged Olympic high country with snowfields,

rocky peaks and lush meadows. The cascades and pools midst the old-growth in the middle reaches, are also of scenic value. Opportunities for risk and solitude abound. Dispersed recreational use is common along the river for hiking, fishing and solitude. Use within the National Forest segments of the river corridor has been estimated and is shown in Table F-5.

Table F-5. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	12,200	14,200
Undeveloped Recreation	41,500	47,400
Boating (flatwater, whitewater)	Light	Light
Water Play (swim, wade)	Light	Moderate
Fishing	Moderate	High
Hunting	Moderate	Moderate
Camping	Moderate	High
Hiking	Moderate	High
Picnicking	Light	Moderate
Viewing Scenery	Moderate	Moderate
TOTAL	53,700	61,600

Historical/Cultural - Prehistoric use is well documented for the areas near the mouth of the Dosewallips River. A National Register Site is located at nearby Seal Rock. Inland use of the Dosewallips River no doubt occurred, but to this day, no evidence has been found.

Documented evidence and in some cases remains of old homesteads, trappers' or miners' cabins, old railroad logging, and an old guard station occur in the river corridor. None of the sites are considered significant.

Minerals/Energy - No significant mining has occurred within the Dosewallips River corridor. The "Bull Elk" mining claim which was patented lies just north of the river corridor between Bull Elk and Miners Creek. Manganese was the principal mineralization. Little, if any, ore was removed on a commercial basis. National Forest lands are open to mineral exploration and leasing, except for the area within the

Wilderness and in administrative sites. The Olympic's potential for mineral, oil or gas deposits is low. It is unlikely any significant mineral or energy deposits occur in the river corridor.

Timber - The following tables summarize acreage allocation and the tentatively suitable acres' characteristics.

Table F-6. Summary of National Forest Acres

Wilderness	550
Unsuitable	177
Tentatively Suitable	1,573
TOTAL	2,300

5/ Adelman 1980.

Table F-7. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1"-2.9" DBH)	SS Seedling-Sapling (3"-4.9" DBH)	PL Poles (5"-8.9" DBH)	MS Small Saw Timber (9"-20.9" DBH)	LS Large Saw Timber (21+" DBH)
High				83	
Medium		121	86	751	514
Low				12	
Low, Natural			6		
TOTAL		121	92	846	514

Table F-8. Tentatively Suitable Standing Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High					83	6.09	505	2,197				
Medium	514	8.98	4,616	20,080	751	6.09	4,574	19,897	86	3.09	266	1,157
Low					12	6.09	73	318	6	3.84	23	88
TOTAL	514		4,616	20,080	846		5,152	22,412	92		289	1,245

Summary: 10,057 MCF or 10.1 MMCF
43,737 MBF or 43.7 MMBF

Table F-9. Tentatively Suitable Land Potential Yield by Site and Elevation

	<1,500' Elevation (Winter Range)				>1,500' Elevation (Summer Range)			
Site/ Productivity	CF/Acre/ Year	Acres	MCF/Year	MBF/Year	CF/Acre/ Year	Acres	MCF/Year	MBF/Year
High	176.88	83	14.68	63.86				
Medium	130.74	1,466	191.66	833.72	121.24	6	.73	3.18
Low	74.56	12	.89	3.87				
Low, Natural					39.75	6	.24	1.04
TOTAL		1,561	207.23	901.45		12	.97	4.22

Summary: 208.20 MCF/Year
905.67 MBF/Year

There are no significant insect or disease problems within the corridor, based on the 1987 Insect and Disease Survey. Potential for a significant outbreak is low.

Early logging in the East Fork Drainage (about 1909), utilized splash dams to assist in transporting logs down the East Fork and Humptulips River. Little evidence remains of these structures. 20/

Transportation - Access to the Dosewallips River corridor is via county road, National Forest Road 2610 and a short stretch of National Park road. The county road is a narrow two-lane road. The National Forest Road 2610 is a gravel, single-lane road with turnouts. The latter portion of the Forest road and the Park road is a very narrow, gravel road with limited turnouts. The majority of use on these roads is recreation oriented with some logging traffic interspersed at times.

NON-FEDERAL LANDOWNERSHIP AND USES

The first 5.9 miles of the Dosewallips is outside of the National Forest. Approximately 90% of this is in private ownership. Acreages by ownership varies from individual lots to large tracts. Residential development has had little impact on the river. The existing and projected landownership and use pattern is consistent with the classification of Recreational River. Acquisition of the privately owned timber lands within the National Forest would be desirable.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

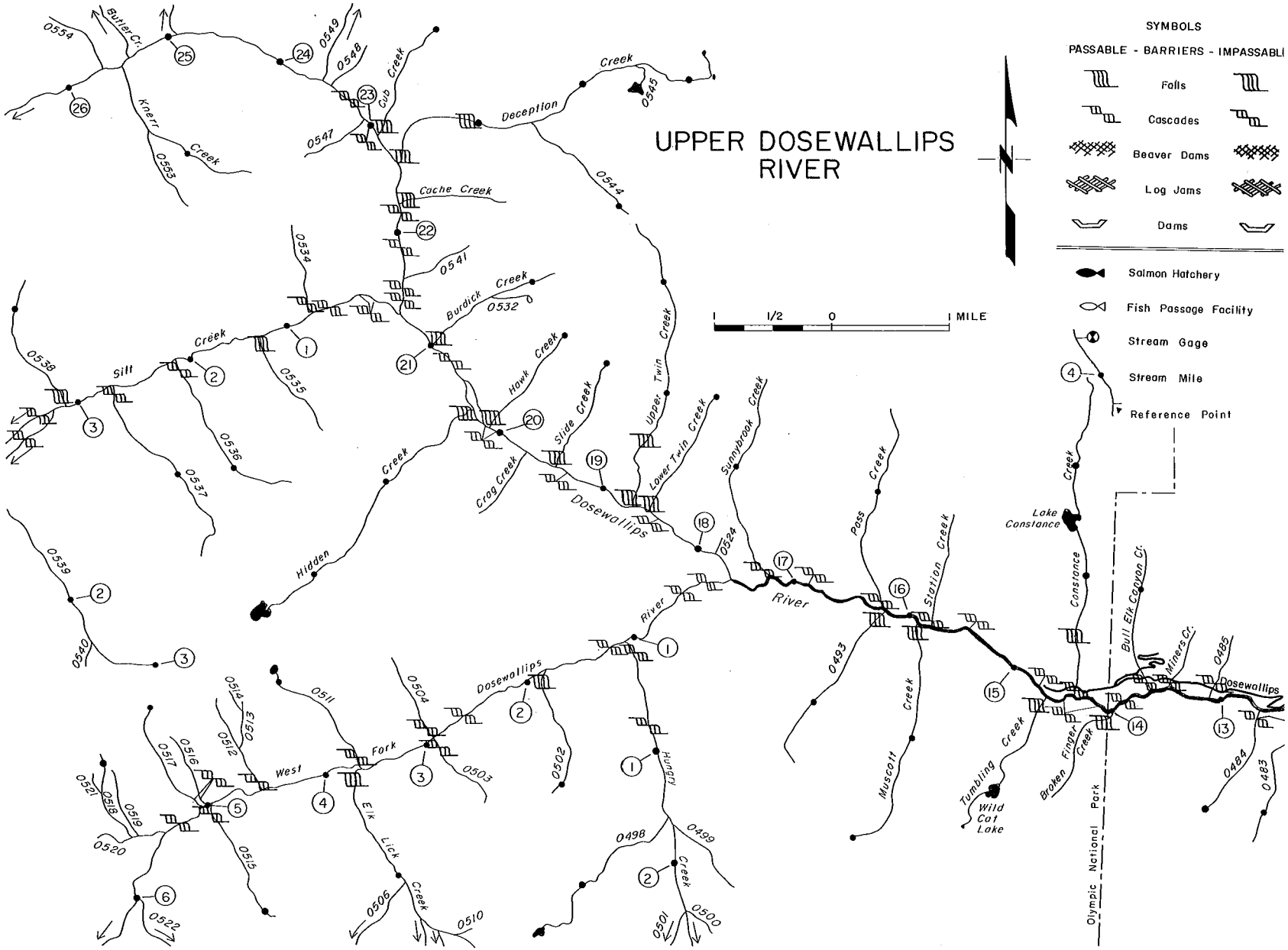
The following are expected funding needs for the Dosewallips for the first five years following a designation as a Wild and Scenic River:

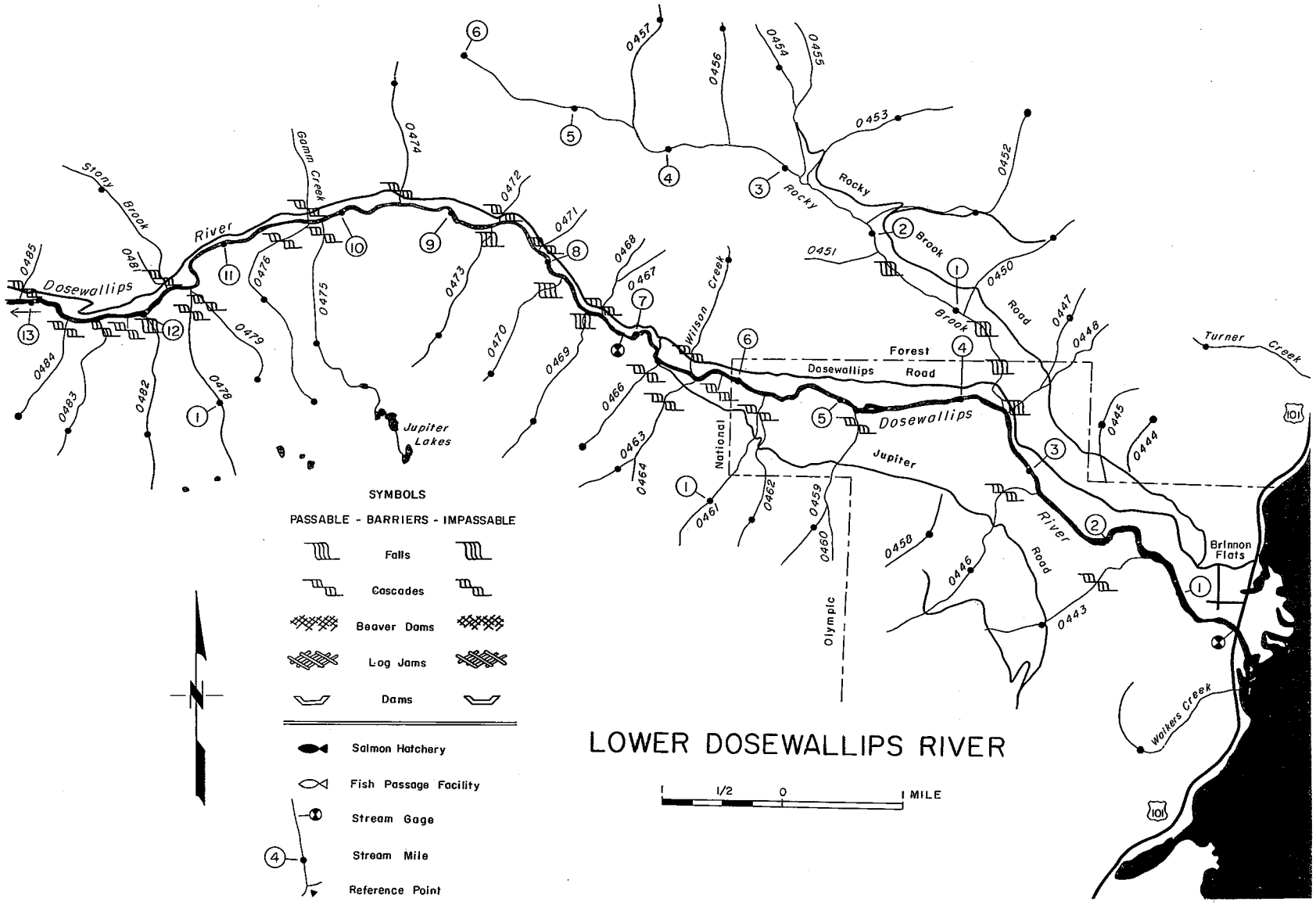
Table F-10. Estimated Cost of Management if Designated as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$17,600 72,800
	TOTAL	$90,400
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan Acquisition and development costs	$15,000 31,000 87,000
	TOTAL	$133,000
	TOTAL COST--FIRST FIVE YEARS	$223,400

1/Costs primarily in years 1 and 2.

The projected annual general administration, and operation and maintenance cost would continue at an estimated $7,800 per year.


UPPER DOSEWALLIPS RIVER
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2 0 1 MILE
Butler Cr.
Knerr Creek
Cub Creek
Deception Creek
Cache Creek
Burdick Creek
Hawk Creek
Slide Creek
Crag Creek
Upper Twin Creek
Lower Twin Creek
Sunnybrook Creek
Sill Creek
Hidden Creek
Dosewallips River
Pass Creek
Station Creek
Muscott Creek
Tumbling Creek
Wild Cat Lake
Broken Finger Creek
Lake Constance
Constance Creek
Bull Elk Canyon Cr.
Miners Cr.
Olympic National Park
West Fork
Elk Lick Creek
Hungry Creek


LOWER DOSEWALLIPS RIVER
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1 MILE
Dosewallips
River
Stony Brook
Gamin Creek
Jupiter Lakes
Rocky
Brook
Wilson Creek
Forest
Dosewallips
Road
National
Olympic
Jupiter
River
Road
Turner Creek
Brinnon Flats
Walkers Creek
101

DUCKABUSH RIVER

GENERAL SETTING

From the point of its origin near O'Neil Pass and Hart Lake, the Duckabush River flows easterly for 24.1 river miles to Hood Canal. Of this distance, slightly over one-half, or 12.5 miles, is within Olympic National Park. Of the remaining mileage, 9.4 miles is within Olympic National Forest. The lower 2.2 miles flows through private land outside of the Forest boundary.

Mileage and acreage by ownership is summarized below. Acreage is based on a corridor one-quarter mile each side of the river on a Forest Plan map base. The National Forest acreage was extracted from the map data base.

Ownership	Miles	Acres
Olympic National Park	12.5	4,000
Olympic National Forest	7.8	2,500
State of Washington, DNR		
within National Forest boundary	0.2	60
outside National Forest boundary	0.1	30
Private		
within National Forest boundary	1.4	450
outside National Forest boundary	2.1	670
TOTAL	24.1	7,710

The Duckabush River is one of a series of rivers which rises on the eastern flank of the Olympic Mountains and flows easterly to Hood Canal within the Puget Sound Basin. Most of the land that the river flows through is heavily forested, with significant evidence of human activity being evident only in the lowerreaches. The river gradient is steep with numerous cascades. Water quality is excellent. The Duckabush is known regionally for its fisheries, especially in the lower reaches. Recreationists throughout the southern Puget Sound Basin come to the Duckabush drainage for the camping and hiking opportunities.

The Duckabush is being evaluated as a potential addition to the Wild and Scenic Rivers System because of its inherent qualities, the identification as an issue early in the planning process, and its listing on the Nationwide Rivers Inventory.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Mountain meadows, snowfields, major Olympic peaks, waterfalls, cascading water, river gorges, old-growth forests. **Outstandingly remarkable.** This river was evaluated by Washington State Parks for inclusion in the State's Scenic Rivers system.

Recreational - Major access to interior of the Olympics, hiking, fishing, camping, day use, very limited rafting or canoeing due to hazards. **Above average.**

Geologic - Major Olympic peaks, numerous river gorges, extensive cliffs. **Outstandingly remarkable.**

Fish - Four species of salmon, steelhead, and sea-run cutthroat to R.M. 7.0. Regionally significant. **Outstandingly remarkable.**

Wildlife - Deer, elk; midsection of river wintering area for elk. Numerous smaller game and nongame species. **Above average.**

Historical - Considerable evidence of early railroad logging has been inventoried and evaluated. Interrorem Guard Station has been evaluated and is eligible for the National Register of Historic Places. **Above average.**

Cultural. Prehistoric use along Hood Canal is well documented. Inland use along the Duckabush no doubt occurred, but no sites have been discovered despite fairly intensive professional surveys. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resource Development - The full length of the Duckabush is currently free of impoundments, diversions, or major channel modifications. A diversion of water had occurred in the past for a fish hatchery near river mile 2.3. This hatchery has been discontinued for more than 30 years. Diversions for the proposed development of Jupiter City was anticipated. However, this never occurred as planned.

A minor channel modification was made in the vicinity of "Ranger Hole," river mile 2.7, to improve fish passage.

Shoreline Development - From its source to river mile 7.2 there is little evidence of man's activity. The Duckabush Trail and trailside camps may be seen occasionally. Between Little Hump and Big Hump a trained eye may see evidence of logging railroad grades dating back to the 1920's and 1930's.

Downstream from Little Hump to the Forest boundary, Forest Road 2510 can be seen where it is adjacent to the river near Collins Campground, river mile 5.3. A few residences are located on private land within the National Forest and may be seen from the river. Evidence of past and current timber harvesting is not readily apparent, except for recent cutting on private land.

From the Forest boundary, river mile 2.2, to the the mouth, there is an increase in residential homes and adjacent buildings. Recent subdivision and home development has occurred in this segment. A major power transmission line crosses near river mile 1.0. Highway 101 crosses the river near its mouth. Evidence of timber harvesting is seen occasionally.

Accessibility - From its source to river mile 7.2, the river corridor is accessed only by trail. From Little Hump to the Forest boundary, R.M. 2.2, there is access from the Duckabush Road via a limited number of access roads leading towards the river. From the Forest boundary to the mouth, access becomes more common.

Water Quality - Water quality is "extraordinary," meeting State class and standards.

Conclusion - The Duckabush River and its adjacent corridor have three "outstandingly remarkable" values; scenic, fish, and geological. The entire river meets the classification criteria. The following sections provide more specific information on the Duckabush.

GENERAL DESCRIPTION OF RESOURCES

From its source at the base of Mt. Duckabush, the Duckabush River flows through a narrow river valley with extremely steep side slopes laced with cliffs, rock outcrops and ledges. Feeder streams tumble down the side slopes, cascading over ledges in their descent from the ridges that parallel the river. Elevations range from near 6,000 feet at its source, to sea level at its mouth. In its midsection near the National Forest-National Park boundary, the sidewalls of the valley rise to elevations more than 4,000 feet above the river. Only after flowing through the gorge at Little Hump, do the valley walls pull away, and the valley broaden. Within the Pacific border physiographic province, this approximates the transition from the Olympic Mountains section to the Puget trough section.

Open mountain meadows, clumps of subalpine fir, and huckleberry are typical within the headwaters of the Duckabush. Dropping rapidly in elevation, the river enters a Pacific silver fir-western hemlock forest. Vine maple and huckleberry are typical understory vegetation. In the middle and lower reaches, Douglas-fir, western hemlock and western redcedar are the predominant species. Cottonwood and red alder flourish along the river's edge and larger tributaries. Vine maple, salmonberry, and salal are typical understory vegetation. Devilsclub is often found in wet, marshy areas.

Forest Road 2510 roughly parallels the Duckabush River from Highway 101 to the trailhead on the east side of Little Hump. From that point to the head of the Duckabush River near O'Neil Pass, the Duckabush Trail closely follows the river except where it climbs over Little Hump and Big Hump. Public access to the river outside of the National Forest boundary, is somewhat limited due to private ownership of the lands adjacent to the river. Access is readily available from the Duckabush road up to the Little Hump area. Upstream from this point, the river and its corridor are accessed via the Duckabush Trail which parallels the river for 22.5 miles to O'Neil Pass.

Located 55 miles from Seattle and 86 miles from Tacoma, the Duckabush River is within a two-hour drive from either city. Olympia (54 miles), Bremerton (68 miles), and Port Angeles (64 miles) are also within a two-hour drive of the river.

Hiking, fishing, and camping are the primary uses within the Duckabush corridor. Deer and elk hunting are seasonal and secondary uses. There is very little floating of the Duckabush due to its steep gradient and numerous hazards.

The Canal Front Plan allocated the area between Little Hump and the National Park boundary as "Further Planning for Wilderness." 6/ In 1984, the Washington Wilderness Act included this within The Brothers Wilderness.

The existing developed recreation sites at Collins Campground and the Interrorem day-use site are reserved for developed recreation use.

The lands within Olympic National Park are, and will be managed for preservation of the ecosystem.

The State Department of Natural Resources and private lands downstream from the Forest boundary, are being managed primarily as timberlands. Residential housing on small acreages are scattered along the lower river.

6/ USDA Forest Service 1979

Water - Based on a long-term record (over 40 years), the average annual discharge as measured at the U.S. Geological Survey (USGS) gauging station at R.M. 4.5, is 300, 700 acre-feet per year, or 415 cubic feet per second (cfs). 7/ The drainage area above the gauging station is 66.5 square miles.

The Duckabush has two distinct periods of high flows. The maximum flows are often associated with early snows followed by warm "chinook" rains. The second high flow is associated with the spring snowmelt. The maximum flow recorded on the Duckabush occurred on November 26, 1949, with a flow of 8,960 cfs. This has been classed as a 50-year flood. Low flows occur in late summer or early fall with a direct relationship to the "drought period." The lowest recorded flow at the USGS gauging station was 45 CFS on October 28, 1942.

While these represent the extremes, the typical high flow is in the 5,000-6,000 cfs range. Low flows of less than 100 cfs are experienced nearly every year.

There are limited uses of the Duckabush at this time. In an alternate basin plan (Pacific Northwest River Basins Commission, Appendix VI 1970), the Duckabush River has been identified as a potential source of water for the City of Bremerton. While this proposal has surfaced periodically, there is little evidence that it may become a reality. If this should occur, it would require an allocation of 150 cfs. The current allocations/applications are as follows: 8/

Domestic Use/Single	0.01 cfs - Allocation
Domestic Use/Municipal	100.00 cfs - Application
Commercial/Industrial	100.00 cfs - Application
TOTAL	200.01 cfs

Typical of the rivers flowing down the east flank of the Olympics, the steep gradient of the Duckabush contributes to its potential for hydropower development. The hydropower potential of the National Forest portion of the river is estimated to be 240.4 Gigawatts per year at the 30% exceedance level. Power sites near R.M. 4.5, 8.0, and 10.0 were identified by the USGS. 9/ Recent proposals by Mason County Public Utility District (PUD) #1, evaluated a number of alternatives for a hydropower project in the vicinity of Little Hump and Big Hump. Alternatives varied from one high dam to two run-of-the-river projects. These proposals were dropped following passage of the Washington Wilderness Bill which included, within The Brothers Wilderness, those National Forest lands upstream from Little Hump (approximately R.M. 7.2). At this time, there are no projects being proposed on the Duckabush River.

Water quality in the Duckabush is "extraordinary" (State Class AA) throughout its length. Normally, the waters are so clear that the river bottom can be seen except in the deepest pools. As temperatures rise during the summer months, this changes to a milky gray-green as the waters from the glaciers and snowfields feed the river. This provides a pleasant visual contrast to the extremely clear water of the cooler months. Water temperatures are on the cool side even during the warmest days of summer.

7/ Pacific Northwest River Basins Commission, Appendix XII, 1971.
8/ Department of Ecology, November, 1988.
9/ Geological Survey Circular 109, 1952.

Because the water quality is so good and free of pollutants, fish and wildlife dependent upon the Duckabush and its environment thrive, and are often seen by visitors to the area.

Primary contact use by the recreationist is limited not by the quality of the water, but by its temperature. Only during the warmest days of late summer will any significant use occur.

Fish and Wildlife - The Duckabush is occupied by four species of salmon, steelhead, sea-run cutthroat trout plus resident cutthroat trout.

Pink and chum salmon are of primary importance in the Duckabush. Although these species utilize only the lower few miles of the river, the exceptional gravel quality and production rate overshadow other anadromous fish usage. This segment contains some of the most highly productive salmon spawning areas in the State. Fall chinook also utilize this lower river area and coho are distributed throughout the river to R.M. 7.0. Steelhead and sea-run cutthroat trout are also found throughout this segment. The cascades, in the vicinity of R.M. 7.0, block the passage of all anadromous fish. 10/

Based on the anadromous fish habitat, the Duckabush and its tributaries have the potential annual production of nearly 84,000 adult fish. Approximately 58 percent of this habitat capability is within the National Forest. Table F-11 depicts production capabilities.

A good resident cutthroat trout fishery exists in the river well into the Olympic National Park.

Generally, all of the wildlife species found along the east flank of the Olympics will appear within the Duckabush drainage, and probably visit the river corridors. Some of the more common larger animals are Roosevelt elk, black-tailed deer, black bear, cougar, coyote, mountain goats and bobcats. Smaller mammals include raccoon, mink, beaver, mountain beaver, rabbit, skunk and porcupines.

The river bottoms and lower south slopes provide winter range for big game, mainly deer and elk, to near R.M. 14.

Blue grouse and ruffed grouse are two common game birds found along the river. Ducks, ospreys, eagles, kingfishers and a variety of water birds inhabit the river edge.

The northern bald eagle is the only threatened wildlife species known to inhabit the area. The habitat of the area upstream from Little Hump contains suitable habitat for the northern spotted owl, a sensitive species, but none have been located.

The riparian habitat along the river is generally in excellent condition, with the exception of a few small areas in the lower valley, where development has modified the riparian vegetation.

10/ Washington Department of Fisheries stream catalog, 1975.

Table F-11. Estimated Annual Habitat Production Capabilities for Anadromous Salmonids

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Chinook	NF	90	12,600	540
	Other	70	9,120	390
	TOTAL	160	21,720	930
Coho	NF	380	19,000	3,080
	Other	280	13,760	2,230
	TOTAL	660	32,760	5,310
Chum	NF	6,150	1,384,000	17,990
	Other	4,450	1,002,210	13,030
	TOTAL	10,600	2,386,210	31,020
Pink 1/	NF	9,570	1,148,000	25,260
	Other	6,930	831,310	18,290
	TOTAL	16,500	1,979,310	43,550
Steelhead	NF	620	10,600	920
	Other	450	7,675	670
	TOTAL	1,070	18,275	1,590
Sea-run Cuthroat	NF	620	10,600	920
	Other	450	7,675	670
	TOTAL	1,070	18,275	1,590
All 1/	NF	17,430	2,584,800	48,710
	Other	12,620	1,871,750	35,280
	TOTAL	30,050	4,456,550	83,990

1/ Olympic Peninsula pink salmon spawn only during odd years and, as such, the annual estimates shown are odd year numbers divided by two.

Recreation - Within the river corridor, the recreation use tends to fall within three groups; fishing-hunting, camping-picnicking associated with the existing road system, and hiking-camping in the unroaded areas.

The camping-picnicking occurs within the Recreation Opportunity Spectrum (ROS) classification of Roaded Natural. 11/ The hiking-camping occurs within two classification zones; Semi-Primitive Non-Motorized, and Primitive.

11/ ROS Users Guide, USDA Forest Service, Washington D.C.

Two developed recreation sites are found along the river. Interrorem picnic site (three units) with a trailhead to the popular fish viewing site at Ranger Hole. Collins Campground (16 units) is located at R.M. 5.3, within one mile of the Duckabush Trailhead. Developed site recreation use, capacity and potential are shown in Table F-12.

Table F-12. Developed Recreation Sites

Site	ROS	Capacity PAOT	Managed Season Days	1988 Use RVDs	Projected Capacity
Interrorem	Semi-Primitive Motorized	15	90	200	15
Collins	Semi-Primitive Motorized	80	110	2,900	80

The projected increase in Clallam and Jefferson Counties are shown below. 12/ These may be somewhat conservative in the high use Hood Canal drainages.

Activity	1983-1990	1990-2000
Picnicking	9	8
Developed Site Camping	7	13

Opportunities for rafting or any other types of river floating are minimal. The extensive areas of cascades, boulder-strewn channels, steep river gradients, and other hazards with only short stretches of smooth water, make any floating of this river extremely hazardous.

There are no new campgrounds proposed along the Duckabush. Upgrading of the facilities at Collins Campground will be programmed as use increases and funding is available. Interpretation of the historic guard station at Interrorem will enhance the experience at that site.

Because of the limited opportunities along the Duckabush road, very few undeveloped recreation sites exist.

The primary trail within the river corridor is the Duckabush Trail, which generally follows the river from the trailhead to the head of the drainage, a distance of 22.5 miles. Approximately 6.2 miles of this is within Olympic National Forest; the remainder within Olympic National Park. The National Forest portion of this trail has been upgraded to accommodate horse use and adequate parking at the trailhead.

12/ Washington Statewide Comprehensive Outdoor Recreation Plan (SCORP), Fifth Edition, 1979, and Sixth Edition, 1985.

Other trails are the Ranger Hole Trail (0.8 mile at Interrorem Guard Station), short segments of the North Fork Skokomish, and the LaCrosse Pass trails linking into the Duckabush in the headwaters of the drainage. No additional trails are planned within the river corridor at this time. Upon designation as a Wild and Scenic river, a riverside trail may be constructed from Collins Campground to the Duckabush trailhead.

Table F-13. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	3,100	3,600
Undeveloped Recreation	38,000	43,800
Boating (flatwater, whitewater)	--	Light
Water Play (swim, wade)	Light	Light
Fishing	Moderate	High
Hunting	Moderate	Moderate
Camping: Undeveloped	Light	Moderate
Hiking	Moderate	Moderate-High
Picnicking	Light	Moderate
Viewing Scenery	Moderate	Moderate
TOTAL	41,100	47,400

A distinctive value along the Duckabush are the scenic qualities. Many of these are associated with the geology of the Olympics, of which the Duckabush is an outstanding example. Snowfields and glaciers upon and below Mt. Duckabush, Mt. Steel, Mt. Hopper, The Brothers, Mt. LaCrosse, Mt. Elk Lick, White Mountain, and numerous lesser peaks flank the Duckabush Valley. Cascading water and waterfalls are typical of the upper Duckabush and its tributaries. As the river drops into the lower elevations, major river gorges occur at Big Hump and Little Hump. From the top of Big Hump, the vista of cliffs, canyons and the Big Hump Gorge is spectacular. The trail itself passes over, under, and around rock ledges, cliffs and rock outcrops. Old-growth forests of Douglas-fir, western hemlock and Pacific silver fir are found along the trail and river. The river itself has an ever-changing character made up of waterfalls, cascades, riffles, and deep, still pools.

Historical/Cultural - Prehistoric use is likely to have occurred. Fishing for salmon in the lower 2.5 miles probably took place, as it was easily accessible from the mouth of the river. No sites have been found in this stretch of the river.

Early settlement along the lower river was typical of many valleys; small homesteads with a limited agriculture base, followed by logging of the virgin forests. The Forest Service Guard Station at Interrorem, a log structure, was built in 1907 as the "Rangers" residence, and is the original Administrative Headquarters for the Olympic Forest Reserve. It is the oldest extent structure on the Olympic National Forest and, ostensibly in the Pacific Northwest Region. It remains in use to this day as a "working" example of a historical structure. It meets the criteria for listing as a National Historic structure, and nomination is in progress.

Minerals/Energy - There is no history of mining within the Duckabush River corridor. The National Forest lands are open to mineral exploration and leasing, except for the area within the Wilderness and administrative sites.

Based on the limited mineralization of the Olympics, and a low oil and gas potential, it is unlikely that any significant mineral or energy deposits occur within the river corridor.

Timber - Timber types, standing volume, and potential yield on all National Forest land tentatively suitable within the river corridor, are displayed in the following tables.

Based on the most recent Insect and Disease Survey (1987), there were no significant insect and disease problems within the river corridor. The potential for any significant outbreak is low.

Table F-14. Summary of National Forest Acres

Wilderness	1,440
Tentatively Suitable	1,048
Unsuitable	81
TOTAL	2,569

Table F-15. Tentatively Suitable Acres by Site and Age Class

Site/Productivity	BG Bare Ground (0.1-2.9"DBH)	SS Seedling-Sapling (3.0-4.9"DBH)	PL Poles (5.0-8.9"DBH)	MS Small Saw (9.0-20.9"DBH)	LS Large Saw (21+"DBH)
High					201
Medium			24	726	
Low				97	
Low, Natural					
TOTAL			24	823	201

Table F-16. Tentatively Suitable Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High	201	8.98	1,805	7,852								
Medium					726	6.09	4,421	19,231	24	3.09	74	322
Low					97	3.84	372	1,618				
TOTAL	201		1,805	7,852	823		4,793	20,849	24		74	322

Summary: 6,672 MCF or 6.7 MMCF
29,023 MBF or 29.0 MMBF

Table F-17. Tentatively Suitable Land Potential Yield by Site and Elevation 1/

Winter Range (<1500')				
Site/Produtivity	CF/Acre/Year	Acres	MCF/Year	MBF/Year
High	176.88	201	35.55	154.64
Medium	130.74	750	98.06	426.56
Low	74.56	97	7.23	31.45
TOTAL		1,048	140.84	612.65

1/ No summer range involved.

Transportation/Roads - The major access to the Duckabush River Valley from Highway 101 is via County Road 3 to Interrorem Guard Station and its extension, Forest Road 2510. The county road is a narrow, two-lane paved facility. Forest Road 2510 is a gravel-surfaced, one-lane road with turnouts. Limited access to the river can be made from the continuation of this road, which roughly parallels the south bank of the river from R.M. 6.3 to 2.5.

The use of these roads is about equally divided between timber haul and recreational use. The existing road is adequate to accommodate the existing and projected use without any unacceptable conflicts. No additional road crossing of the river is anticipated. Additional temporary roads may approach the river in conjunction with harvesting timber from private lands.

NON-FEDERAL LANDOWNERSHIP AND USES

Within the National Forest boundary, State Department of Natural Resources lands are being managed for timber production with the required constraints and mitigation adjacent to the Duckabush River. These State lands are scheduled for acquisition by the Forest Service through land exchange. Private lands within the National Forest boundary are a mixture of small residential acreages and larger tracts of lands owned by timber companies. Timber management is practiced on these lands within requirements of the Washington State Forest Practices Act. 13/

Outside of the National Forest, the lands are predominantly privately owned. Acreages by ownership varies from individual lots to large tracts owned by a large timber company. Within the river corridor, individual residences are located primarily within the river segment up to R.M. 1. This residential development was accomplished with moderate impact on the river edge.

The existing and projected landownership and use pattern is consistent with the classification of Recreational River.

13/ State of Washington 1974.

FUNDING NEEDS IF DESIGNATED AS WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

The following are expected funding needs for the Duckabush River for the first 5 years following a designation as a Wild and Scenic River:

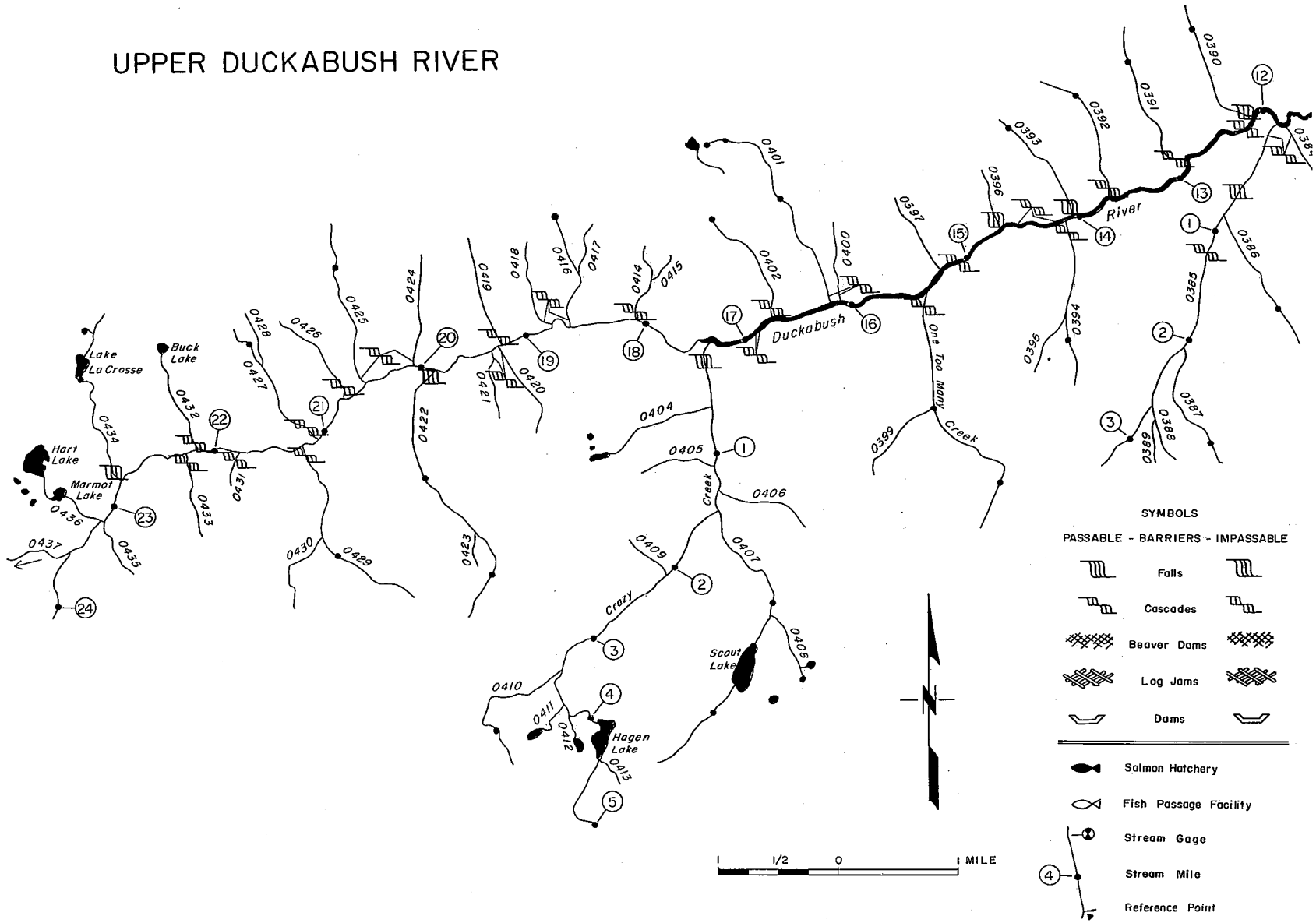
Table F-18. Estimated Cost of Management If Designated as a Wild and Scenic River

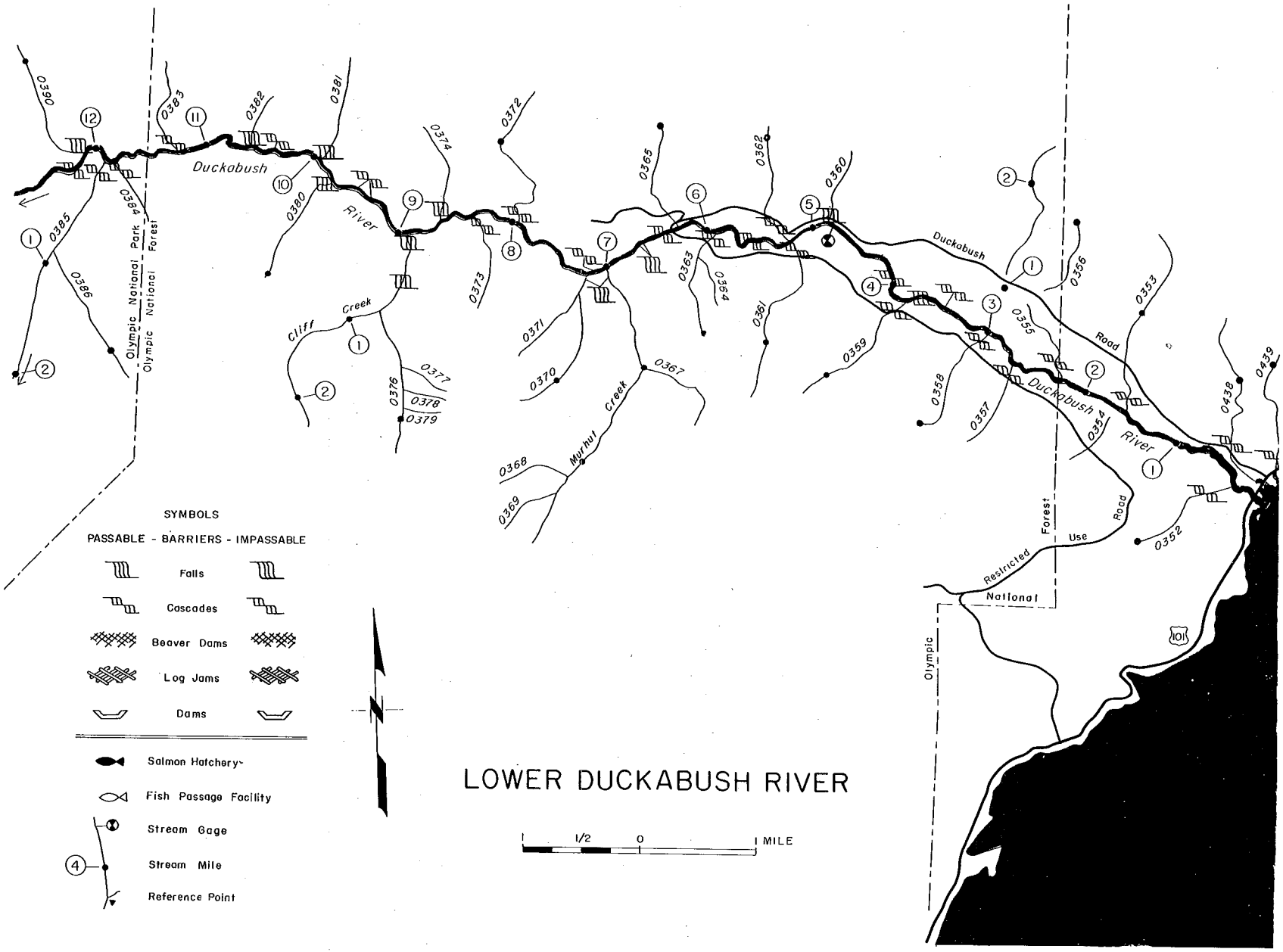
Annual Costs	General Administration Operation and Maintenance	$17,500 72,500
	TOTAL	$90,000
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan 1/ Acquisition and development costs	$13,000 30,000 55,000
	TOTAL	$98,000
	TOTAL COST--FIRST FIVE YEARS	$188,000

1/ Costs primarily in years 1 and 2.

General administration, and operation and maintenance costs are estimated to continue at $16,300 annually.

Note: If all eligible segments were designated, the total five-year funding requirements expected would be $271,000. Annual general administration, and operation and maintenance costs would be $26,000.


UPPER DUCKABUSH RIVER
Duckabush River
One Too Many Creek
Crazy Creek
Lake La Crosse
Buck Lake
Hart Lake
Marmot Lake
Echo
Scout Lake
Hagen Lake
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1 MILE


LOWER DUCKABUSH RIVER
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1 MILE
Duckabush River
Cliff Creek
Murhut Creek
Duckabush River Road
Restricted Use Forest Road
Olympic National Park
Olympic National Forest
Olympic National Forest
101

DUNGENESS

GENERAL SETTING

The main stem of the Dungeness River from the confluence of Milk Creek and Heather Creek to the mouth, is 28.1 miles.

Slightly over one-half of this distance, 14.7 miles, is within the Olympic National Forest boundary. Except for one-half mile, which flows through private land, the entire distance within the boundary flows over National Forest land.

Outside the National Forest boundary, the river flows for 1.8 miles within State Department of Natural Resources land, and 11.3 miles within private land.

Acreage and mileage by ownership are summarized below. Acreage is based on a one-quarter mile corridor each side of the river on a Forest Plan map. The National Forest acres were extracted from the map data base.

Ownership	Miles	Acres
Olympic National Forest	14.2	4,540
State of Washington - DNR	1.8	580
State of Washington - Fisheries	0.3	100
Private		
within National Forest boundary	0.5	160
outside National Forest boundary	11.3	3,610
TOTAL	28.1	8,990

The Dungeness River is one of the principal river systems on the Olympic Peninsula. Flowing north from the point of it origin in the high country which divides the Dosewallips and Dungeness drainages, this system enters the Straits of Juan de Fuca at Dungeness Bay. The area is mountainous with coniferous forests covering the valley walls (sparsely near timberline), becoming dense in the lower valleys. Stream gradients are steep in the upper reaches with numerous sections of cascades and rapids. The Dungeness is accessible to anadromous fish, coho, spring chinook, early-run pink salmon, and steelhead. The upper mainstream is blocked to anadromous fish by a falls near R.M. 18.8, just above the mouth of Gold Creek.

The Dungeness pink salmon are unique in the Puget Sound Basin. Typical stocks approach maturity while in saltwater, and migrate through main stem or lower stream reaches requiring little strenuous swimming. Spawning normally commences upon arrival in the stream. In contrast, early Dungeness pink salmon enter the stream while still in prime condition. They move rapidly upstream to their spawning destination, where they remain in pools up to one month while completing maturity. The excellent condition of these fish permits them to ascend barriers that would stop many others.

From the confluence of the Gray Wolf and Dungeness to near R.M. 10, the gradient on the river is still rather steep and the river valley remains narrow with many canyon-like sections. Side slopes continue to be

heavily forested. Near R.M. 10, the valley opens abruptly into a broad lowland which has been farmed and is rapidly being developed with housing and small communities.

The Sequim Valley of the lower Dungeness lies in the "rain shadow" of the Olympic mountains, and has an extremely dry climate. This has resulted in extensive use of water from the lower Dungeness to irrigate the fields and pastures in the Sequim Valley. While the upper reaches of the Dungeness receives more rain than the Sequim Valley, it remains in the "rain shadow." High ridges are open, with sparse vegetation.

Recreationists from the Puget Sound Basin visit the Dungeness Valley to camp, hike, fish, view the scenery, and during the fall to hunt deer and mountain goats.

The Dungeness is being evaluated as a potential Wild and Scenic River as a result of public input during the identification of issues, concerns and opportunities.

ELIGIBILITY DETERMINATION - VALUES

Scenic - High, open ridges, excellent views of Olympics, snowfields, cascading water, narrow river canyons. **Outstandingly remarkable.**

Recreation - Hiking, camping, fishing, deer and goat hunting. **Above average.**

Geologic - Mountain peaks, narrow canyons, rock-faces, "rain shadow." **Above average.**

Fish - Chinook, coho and pink salmon. Unique early pink salmon run. Steelhead, sea-run cutthroat, resident fishery. **Outstandingly remarkable.**

Wildlife - Deer, mountain goats, elk, numerous smaller animals. **Average.**

Historical - Tubal Cain Mine located along Copper Creek, a tributary to the Dungeness. Well outside of river corridor. Early settlement of Sequim Valley was typical of the region. **Average.**

Cultural - Probable limited use by prehistoric man. No sites found within corridor. Sites have been located at nearby Slab Camp and at Deer Park and use use in the Dungeness Corridor was likely. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The river is free of dams and diversion structures from its source to near R.M. 11.2. From that point to near R.M. 2.7, there are a series of diversions and irrigation ditches constructed to provide water to the Sequim Valley. The City of Sequim also diverts water from the Dungeness for its municipal water supply. As a result, flows in the lower Dungeness may be quite low during the summer and fall months.

Shoreline Development - From the confluence of Heather and Milk Creeks (R.M. 28.1) which forms the Dungeness, to the road bridge near R.M. 24, the evidence of man's presence is limited to an occasional riverside trail camp or footbridge across the river.

Between the bridge at R.M. 24 and Silver Creek (R.M. 22.1), the shoreline of the Dungeness rapidly takes on a primitive setting. There is little evidence of human activity, except for occasional views of adjacent roads.

Just below Gold Creek, the Dungeness flows under a road bridge, passing East Crossing Campground at R.M. 17.5. Below R.M. 17.5 the river flows through a series of narrow canyonlike areas until it opens into the Sequim Valley near R.M. 10.5. Evidence of past and ongoing timber harvests can occasionally be seen in the background to R.M. 13.4. The river edge generally appears natural, with only limited evidence of human activity. From R.M. 13.4 to the State Fish Hatchery, evidence of past and ongoing timber harvest is readily apparent. From R.M. 10.5 to the mouth, the shoreline becomes increasingly more developed. Initially, this was pastureland and fields. However, with the Sequim Valley becoming known as a "retirement" community, residential development along the river has flourished.

Accessibility - The upper reaches of the Dungeness above R.M. 24 is accessible only by trail. From this point downstream to R.M. 13.4, the river is occasionally crossed by bridges and accessed by roads that approach the river. One short segment of the Dungeness (R.M. 22.1 to R.M. 19.3) is not readily accessible from existing roads, although there is a trail that parallels the river through this segment. From R.M. 13.4 to its mouth, the river is easily accessed by State, county and private roads.

Water Quality - From its mouth to Canyon Creek (R.M. 10.8), the Dungeness River is rated as a Class A, "excellent" water. Above Canyon Creek, the Dungeness and its tributaries are rated as Class AA, "extraordinary" waters by the State. Both classifications meet or exceed the criteria for aesthetics, use by fish and wildlife, and primary contact recreation (swimming).

Conclusion - The Dungeness meets the eligibility criteria from R.M. 10.5 to its source, a distance of 17.6 miles. The Dungeness has "outstandingly remarkable" scenic and fish values.

GENERAL DESCRIPTION OF RESOURCES

The Dungeness River originates from the interior of the Olympic Mountains. Its upper tributaries are fed from snowfields. Heather Creek and Milk Creek join in the upper Dungeness Valley to form the Dungeness River. The main stem of the Dungeness has a number of significant tributaries, the four largest being the Gray Wolf River, Gold, Silver and Royal Creeks.

Watershed cover, valley configuration, stream gradient and terrain are similar in the upper and middle reaches of the Dungeness. These areas are mountainous with dense coniferous forest cover which becomes sparse near timberline. The Douglas-fir-western hemlock zone is predominant. The upper Dungeness has minor amounts of the Douglas-fir plant association on steep, dry, well-drained slopes. The mountain hemlock-subalpine fir zone is found in the headwater areas of the Dungeness.

Stream gradient in the upper main branches and tributaries is steep and often precipitous above, approximately, the 2,500-foot elevation. Below this, the gradient remains steep, although patches of gravel are interspersed among the rubble and boulder substrate. The Dungeness River flows from 3,450 feet to sea level.

The Dungeness River enters the Strait of Juan de Fuca at Dungeness Bay. The deep, steep-walled upper section opens up at R.M. 10 into a broad, fertile lowland. Conifers, with hardwoods intermixed, line the river. The adjacent land has been farmed or settled by retirees. A transition from agriculture to residential use is occurring.

The upper reaches of the Dungeness are accessible by trail. The middle reach of the Dungeness is accessible by trail, and in places by a Forest Road. The lower Dungeness is accessed by State, county and private roads.

The lower Dungeness Trail is accessed from Forest Road 2860 in two places; near Gorge Camp, and the main trailhead near the mouth of Mueller Creek. The trail between Gorge Camp and the main trailhead is generally within the one-quarter mile corridor, with Forest Road 2860 paralleling about one mile to the west. The upper Dungeness trail is within the river corridor up to Camp Handy, about three miles from the trailhead, and then climbs away from the river up to Boulder Shelter. The trail then climbs northeasterly to Marmot Pass. From Boulder Shelter the Home Lake Trail contours above Home Lake to Constance Pass.

Forest Road 2860 follows the Dungeness River from Gorge Camp to East Crossing Campground, then ascends to the break above the river. The four miles of the river, within the National Forest below East Crossing Campground, has limited access and not easily accessible by road or trail.

North of the Forest Service boundary, the river is easily accessed by State, county and private roads. The river is crossed by five bridges.

The City of Sequim lies about two miles east of where the Dungeness River flows under U.S. Highway 101. The population of Sequim is 3,180. However, an additional 22,600 were counted in unincorporated areas in Clallam County.

Sequim and the Dungeness Valley lie in the Olympic "rain shadow," causing the area to be the driest coastal region north of southern California. The "rain shadow" is caused by the area's position with respect to the mountains and prevailing winds. As a result, the average annual precipitation in Sequim is only about 15 inches. This favorable climate, combined with spectacular scenery, has made the area a focal point for recreation and retirement. In fact, The Sequim Press, the area's weekly newspaper, proclaims that "The Sequim-Dungeness Valley is the Retirement Center of the Great Northwest." 14/

Water - The Dungeness River meets or exceeds the criteria for aesthetics, use by fish and wildlife, and primary contact recreation as defined in Water Quality Criteria, Federal Water Pollution Control Administration, April 1, 1968. The Dungeness above Canyon Creek and its tributaries are rated Class AA, "extraordinary." Below Canyon Creek, R.M. 10.8, to its mouth, the Dungeness River is rated Class A, "excellent."

As is characteristic for Western Washington, the Dungeness River exhibits minimum flows during the summer months when precipitation is least and snowpacks are depleted. Streamflow begins to increase in October, reaches a maximum base flow in December, and gradually decreases from January through the middle of March. Due to rising temperatures and snowmelt, runoff begins to increase in the latter part of March, and reaches a maximum in early June.

The total drainage area at the mouth of the Dungeness River is 197 square miles. The drainage area above the USGS Gauging Station at R.M. 11.8 is 156 square miles. Average annual flow is 388 cfs. Maximum flow recorded was 6,820 cfs on November 27, 1949; minimum flow recorded was 65 cfs on January 31, 1979.

The Dungeness River's water is used for irrigation, Sequim's water supply, individual domestic use and by a State fish hatchery.

Rights to the use of the water of the Dungeness River, and its tributaries, were adjudicated by the Superior Court of Washington on March 7, 1924. All adjudicated rights are irrigation rights. 15/

14/ Adelman 1980.
15/ Bergstrom 1985.

At least five diversion ditches exist between the Olympic National Forest (R.M. 13.4) and U.S. Highway 101 (R.M. 6.4). They are the Agnew Ditch at R.M. 11.2, the Highland & Eureka Ditch at R.M. 10.7, the Independent Ditch at R.M. 8.1, the Cline, Clallam & Dungeness Ditch at R.M. 7.3, and the Sequim Prairie Ditch at R.M. 6.8. All diversions, except the Agnew Ditch, consist of a wing dam and open ditch. The Agnew Ditch diverts water by means of a siphon tube.

Eleven irrigation companies and/or districts utilize the water. A head of each of these entities forms the Dungeness Water Users Advisory Board. The irrigation districts were adjudicated 576 cfs, which if used, could dry up the river much of the irrigation year. However, the Advisory Board coordinates use so that flow is maintained throughout the summer. The river is closed to future allocations.

The Dungeness River is a water supply for the City of Sequim, serving 3,300 people. The system's intake is across from the fish hatchery. Water is taken directly out of the river into the ground infiltration and then gravity fed. The city is allowed up to five cfs. Chlorination is the only treatment. 16/

Dungeness State Fish Hatchery is located at R.M. 10.5, as well as a satellite station at Hurd Creek (right bank at R.M. 2.9). Production includes spring and fall chinook and coho. The hatchery diverts as much as 25 cfs that bypasses the river for almost three-quarters of a mile.

The current allocations, November 1988, of water from the Dungeness River are as follows:

Irrigation, Stock Watering, Domestic Use	578.96 cfs
Power	150.00 cfs
Fish Propagation	40.00 cfs
Domestic, Municipal	1.40 cfs
Domestic, Single	0.01 cfs
TOTAL	770.37 cfs

The hydropower potential of the National Forest portion of the river is estimated at 330.6 Gigawatts per year at the 30% exceedance level. In September 1987 three hydroelectric proposals on the Dungeness River within the National Forest were either denied or dismissed. License applications had been filed with FERC by Olympus Energy, Inc., for two projects: Silver Creek and Tyler Peak. Hydro Resources had filed one license application for the Dungeness River. The projects are as follows:

FERC	Site	Applicant	Power-Megawatts	Status
5495	Dungeness	Hydro Resources	12.00	License application denied by FERC.
6617	Silver Creek	Olympus Energy	3.45	Dismissed by FERC due to lack of requested information.
6845	Tyler Peak	Olympus Energy	4.88	License application denied by FERC.

16/ Parker, Sequim Water System Superintendent.

A power withdrawal occupies a one-quarter mile strip on both sides of the Gray Wolf River.

Fish and Wildlife - The Dungeness River supports spring and fall chinook, coho and pink salmon. Pink salmon are the predominant species. Within Puget Sound, the pink salmon runs are unique, since they include an extremely early run and a normally-timed late run. The early run spawns are in the upper river above R.M. 9. The late run spawns are in the lower four miles of the river. Little or no overlap occurs in the timing or spawning area. Salmon access in the upper Dungeness is blocked at a falls just above the mouth of Gold Creek at R.M. 18.8.

Early-run pink, coho and spring chinook utilize the upper main stem to the falls. The pink salmon are unique in Puget Sound. It is a native wild stock with no hatchery influence. Fish migrate through main or lower stream reaches requiring little strenuous swimming. Normally, spawning occurs upon arrival in the stream. In contrast, these pink salmon enter the river in prime condition, move rapidly upstream to their spawning destination and remain up to one month in the pools. They negotiate rapids and small falls that would be barriers for other fish.

Based on the anadromous fish habitat, the Dungeness River and tributaries, including the Gray Wolf River, has an estimated annual production of approximately 137,100 adult fish. Approximately 52 percent of this habitat capability is within the Forest. Table F-19 summarizes the fisheries potential.

Resident trout occur in the Dungeness River well into its upper reaches.

Wildlife species typical of the east side of the Olympics are assumed to frequent the river corridors. Deer utilize the drainage bottoms for summer range. Areas below 1,500 feet in elevation and south slopes at higher elevations provide winter range. Bear, cougar and bobcats have been observed over most of the area. Mountain goats and the Olympic marmot may be seen in the headwater areas of these rivers. The northern bald eagle is the only threatened wildlife species known to inhabit the area.

Recreation - Developed recreation sites north of the National Forest are located near the mouth of the Dungeness River. None are actually within one-quarter mile of the river. They are located near, or on the Dungeness spit. The facilities are summarized in Table F-20.

Table F-19. Estimated Annual Habitat Production Capabilities for Anadromous Species

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Chinook	NF Other	150 190	20,920 27,140	900 1,160
	TOTAL	340	48,060	2,060
Coho	NF Other	560 720	27,750 36,000	2,780 3,600
	TOTAL	1,280	63,750	6,380
Chum	NF Other	310 410	70,440 91,380	700 910
	TOTAL	720	161,820	1,610
Pink 1/	NF Other	15,720 20,400	1,887,000 2,448,000	41,510 53,850
	TOTAL	36,120	4,335,000	95,360
Steelhead	NF Other	1,620 2,100	27,840 36,110	2,420 3,140
	TOTAL	3,720	63,950	5,560
Sea-run Cutthroat	NF Other	1,620 2,100	27,840 36,110	2,420 3,140
	TOTAL	3,720	63,950	5,560
All	NF Other	19,980 25,920	2,061,780 2,674,740	50,720 65,810
	TOTAL	45,900	4,736,520	116,530

1/ Olympic Peninsula pink salmon spawn only during odd years. As such, the annual estimates shown are odd year numbers divided by 2.

Two developed recreation sites, East Crossing and Dungeness Forks Campground, are located along the Dungeness River within the National Forest. Both campgrounds are popular fishing spots. These facilities are summarized in Table F-20.

Table F-20. Developed Recreation Sites

National Forest Sites					
Site	ROS Class	Capacity PAOT	Managed Season Days	1988 Use RVD's	Projected Capacity PAOT
Dungeness Forks Campground	Roaded	50	110	10,800	135
East Crossing Campground	Roaded	50	110	6,300	150
Other Agency Sites					
Site	Managing Agency	Acres	Camping Units	Boat Launch Site	1988 Annual Visits
Dungeness Recreation Area	Clallam Company	216	66		150,000
Dungeness Boat Launch	Port District	20		2	79,600
Cline Spit	Clallam Company	1		1	No Estimate
Dungeness National Wildlife Refuge	U.S. Fish & Wildlife	631			65,000

No new campgrounds are proposed within the National Forest portion of the river corridor. Both Dungeness Forks and East Crossing campgrounds are planned for expansion.

Trails accessing the Dungeness River on National Forest and National Park lands:

The main Dungeness trailhead is located on Forest Road 2860. The trail follows the river for about three miles to a shelter at Camp Handy. From there, it climbs to Boulder Shelter and then branches to Marmot Pass and Constance Pass. This trail is within the Buckhorn Wilderness. About one mile from the trailhead, a trail branches to Royal Basin in Olympic National Park. Hiking, hunting, and fishing access are the major uses of this trail system.

The lower Dungeness Trail generally follows the west side of the river for nearly 6 miles between Gorge Camp and the upper crossing of Forest Road 2860.

The scenery along the trail in the Wilderness is outstanding. The lower portions provide excellent examples of old-growth forests. The rivers are in a clean, natural state. The upper reaches of the trail provides spectacular mountain views.

Existing use estimates are summarized in Table F-21.

The Fifth Edition, 1979, and Sixth Edition, 1985, of SCORP, projects recreation use by counties. The Dungeness River lies in District One which includes Clallam and Jefferson Counties. Table F-22 lists the projected percent increase for selected activities based on data listed in SCORP. Please consider these figures with a "grain of salt." The east half of these counties differ considerably from the west half. 17/ An "activity occasion" is a standard unit of recreation use, consisting of one individual participating in one recreation activity, during any reasonable portion or all of one day. One individual participating in three different activities during the day is recorded as three "activity occasions." The percent increases listed below are based on "activity occasions" listed in SCORP.

17/ Adelman 1980.

Table F-21. Recreation Trail Use, 1988

Trail	Miles	RVDs	ROS
Dungeness	8.1 - trailhead to Marmot Pass	900	Semi-Primitive, Non-Motorized
Lower Dungeness	5.8 - Gorge Camp to upper trailhead	100	Roaded Modified

Table F-22. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	17,100	19,700
Undeveloped Recreation	33,100	37,200
Boating (flatwater, whitewater)	Light	Moderate
Water Play (swim, wade)	Light	Moderate
Fishing	Light	Moderate
Hunting	Moderate	High
Camping: Undeveloped	Moderate	High
Hiking	Moderate	High
Picnicking	Light	Moderate
Viewing Scenery	Light	Moderate
TOTAL	50,200	56,900

Historical/Cultural - There are no known historical or cultural sites along the Dungeness River. A prehistoric site has been inventoried and evaluated near Slab Camp.

Minerals/Energy - National Forest lands are open to mineral exploration and leasing, except within the Buckhorn Wilderness and administrative sites. No significant mining has occurred in the Dungeness River corridor with the notable exception of Tubal Cain on the Copper Creek Tributary. It is unlikely that any significant mineral or energy deposits occur within the river corridor.

Previous land allocation and use on the National Forest segments are described in the Canal Front Final Environmental Statement, 1979. In 1984, the Washington Wilderness Act allocated areas to the Buckhorn Wilderness. Land allocation from the Canal Front Plan is summarized below.

Table F-23. Land Allocation (Canal Front Plan)

Segment	Management
Confluence of Heather/Milk Creek to Royal Creek	Buckhorn Wilderness
Royal Creek to Cougar Creek	Special Management Area
Cougar Creek to Forest boundary	40% Timber Yield within the Streamside Management Unit

Timber/Land Allocation - Timber harvest is not permitted in the Buckhorn Wilderness. The Canal Front Plan placed the lands in the Dungeness River Special Management Area is in the marginal cut component, and it was not programmed for timber harvest. Management direction for this area is designed to protect resource values. This is done by permitting activities only when the area's response to that activity can be

reliably predicted, and that response is favorable. There are no disease or insect problems within the river corridors. The potential for significant outbreaks is low.

The following tables summarize acreage allocation and tentatively suitable acres characteristics.

Table F-24. Summary of National Forest Acres

Wilderness	1,060
Unsuitable	1,255
Tentatively Suitable	2,225
TOTAL	4,540

Table F-25. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1"-2.9"DBH)	SS Seedling-Sapling (3"-4.9"DBH)	PL Poles (5"-8.9"DBH)	MS Small Saw (9"-20.9"DBH)	LS Large Saw (21+" DBH)
High		21	65	40	
Medium	52	136	145	277	878
Low		46		40	175
Low, Natural			30	188	132
TOTAL	52	203	240	545	1,185

Table F-26. Tentatively Suitable Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High					40	8.98	359	1,562	65	4.56	296	1,288
Medium	878	8.98	7,884	34,295	277	6.09	1,687	7,338	145	3.09	448	1,949
Low	307	7.45	2,187	9,948	228	6.09	1,389	6,042	30	3.84	115	500
TOTAL	1,185		10,071	44,243	545		3,435	14,942	240		859	3,737

Summary: 14,465 MCF or 14.5 MMCF
62,922 MBF or 62.9 MMBF

Table F-27. Tentatively Suitable Land Potential Yield by Site and Elevation

	Elevation: < 1500' (Winter Range)				Elevation: > 1500' (Summer Range)			
Site/ Productivity	CF/Acre/ Year	Acres	MCF/Year	MBF/Year	CF/Acre/ Year	Acres	MCF/Year	MBF/Year
High	176.88	126	22.29	96.96				
Medium	130.74	194	25.36	110.32	121.24	1,294	156.88	682.43
Low					67.35	261	17.58	76.47
Low, Natural					39.75	350	13.91	60.51
TOTAL		320	47.65	207.28		1,905	188.37	819.41

Summary: 236.02 MCF/Year
1,026.69 MBF/Year

NON-FEDERAL LANDOWNERSHIP AND USES

Approximately 580 acres of the lower Dungeness River are managed by the State of Washington Department of Natural Resources. Between the Forest boundary and the State Fish Hatchery, most of the private lands are being managed for timber production. Timber Management practices on these private lands are governed by the State Forest Practices Act. Other uses were discussed in previous sections.

These are costs that are anticipated with designation of Segments 1-4, all within the National Forest, and are in addition to the existing costs associated with managing the river under the existing Canal Front Plan.

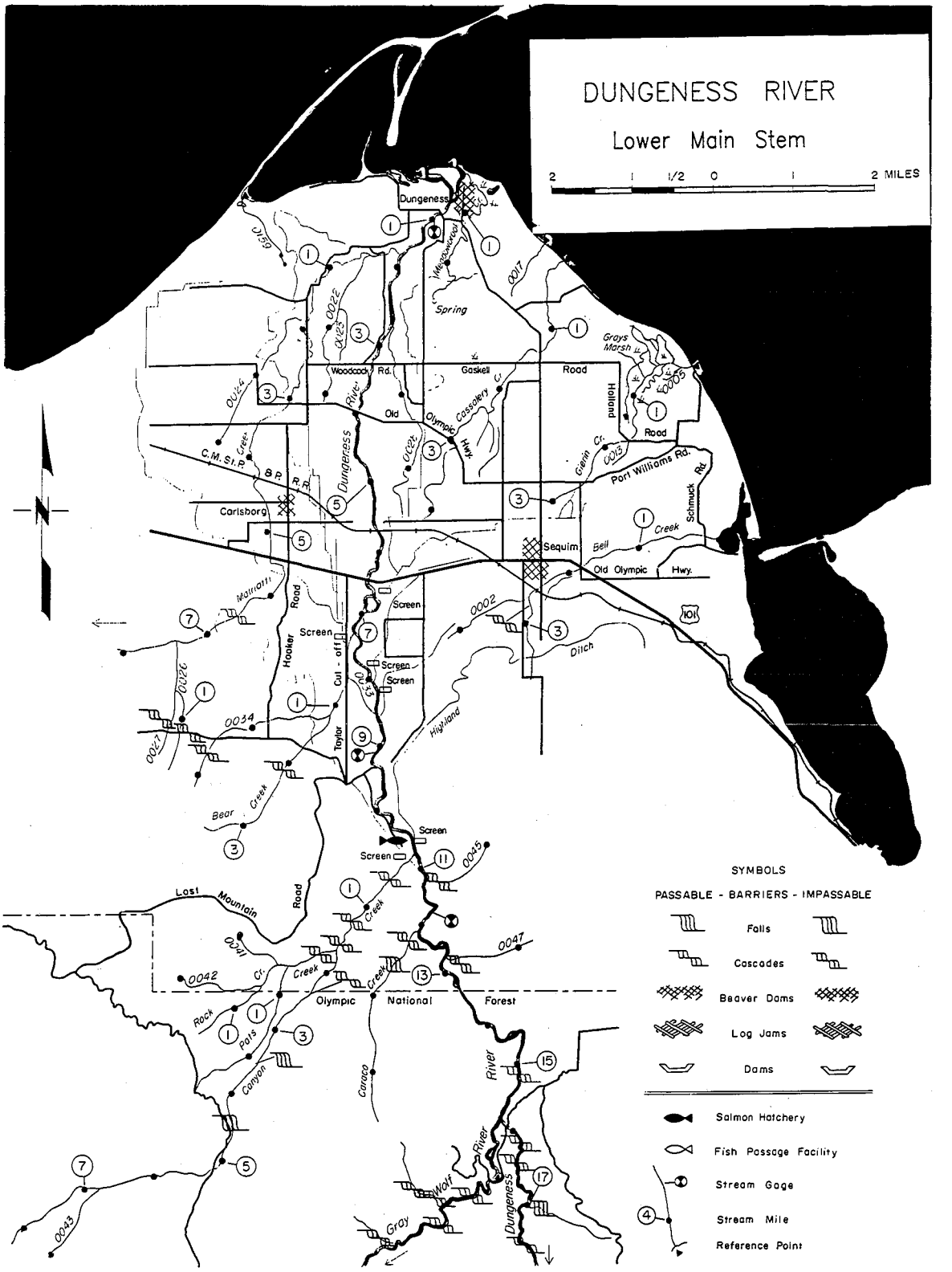
FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

The following are expected funding needs for the Dungeness River for the first 5 years following a designation as a Wild and Scenic River:

Table F-28. Estimated Cost of Management if Designated as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$26,000 68,800
	TOTAL	$94,800
Non-Recurring Costs	Cost of Implementation 1/ Preparation of Management Plan 1/ Acquisition and Development Costs	$14,000 30,000 95,000
	TOTAL	$139,000
	TOTAL COST--FIRST FIVE YEARS	$233,800

1/Costs primarily in years 1 and 2.


DUNGENESS RIVER
Lower Main Stem
2 1 1/2 0 1 2 MILES
Dungeness
Spring
Grays Marsh
Woodcock Rd.
Gaskell
Road
Holland
Road
Old Olympic Hwy.
Cassalery Cr.
Gerrin Cr.
Port Williams Rd.
Schmuck Rd.
C.M.St.P. & P. R.R.
Dungeness River
Carlsborg
Sequim
Bell Creek
Old Olympic Hwy.
Matriott
Hooker Road
Screen
Cut - off
Taylor
Highland
Ditch
Bear Creek
Lost Mountain Road
Rock Pats Canyon
Olympic National Forest
Canoe
Wolf
Gray
Dungeness River
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point

EAST FORK HUMPTULIPS

GENERAL SETTING

The East Fork of the Humptulips, from its source to the confluence with the West Fork to form the main stem of the Humptulips, is nearly 31 miles in length. The upper 17.5 miles, from its source to R.M. 13.4, is within the boundary of Olympic National Forest. Throughout this section, the river is bordered entirely by National Forest lands. From the National Forest boundary downstream to the confluence with the West Fork, the river is bordered by private and Grays Harbor County lands; nearly all of which is being managed for timber production.

Acreage and mileage by ownership are summarized below. The acreage is based on a corridor one-quarter mile wide on each side of the river. The National Forest acres were extracted from the planning map data base.

Ownership	Miles	Acres
Olympic National Forest	17.5	5,600
Grays Harbor County	2.6	830
Private land	10.8	3,460
Total	30.9	9,890

Located in the southwest corner of the Olympic Peninsula, the East Fork of the Humptulips is a major tributary to the Humptulips-West Fork System. The East Fork of the Humptulips rises within the Olympic National Forest. It is similar to other rivers along the flanks of the Olympic Mountains in that it does not have a major snowfield or glacier at its source. For nearly all of its length, the slopes adjacent to the river are forested with dense stands of coniferous vegetation. Occasional flats and gravel bars will be covered with hardwoods, predominately alder, big leaf maple and black cottonwood. Over the first two miles, the river drops rapidly through narrow canyons, cascading down over waterfalls and steep gradients. By R.M. 28, the stream gradient has moderated, and a pattern of riffles and pools interspersed with sections of steep gradients becomes the norm. Occasional coho salmon and steelhead are found as far upstream as R.M. 26. Coho salmon and steelhead gain access to the river above R.M. 17.1 with the laddering of the falls below Flatbottom Creek.

The lower reaches of the East Fork (below R.M. 17) contain a good balance of pools and riffles; stream cover contains a higher percentage of hardwoods than found in the upper reaches. Below the National Forest boundary, R.M. 13.4, the slopes are predominately forested with a young, coniferous forest.

Chinook salmon are known to spawn in the main channel as far upstream as R.M. 15.0. They are not known to spawn in any of the tributaries. Chum salmon useage is probably confined to the lower nine miles on the East Fork and the lower reaches of the tributaries. The anadromous fish runs in the East Fork of the Humptulips, are a contributor to the regionally significant runs in the greater Humptulips system.

Recreational use within the river corridor is primarily fishing and hunting. There are no developed campgrounds or trails within the corridor. Response to the Pacific Northwest Rivers Study 18/ gave the river a high rating for resource characteristics (hydraulics, challenge, solitude), and rated sections of the river above average for white water boating and high for white water kayaking. The "Paddlers Guide to the Olympic Peninsula" rates the East Fork Humptulips as A+, "the white water gem of the Olympic Peninsula." Little white river boating or kayaking is currently being done due in part to the very limited and difficult access, except at road crossings. For the skilled and determined kayaker, the East Fork provides runs through "super-natural fantasy gorges."

The East Fork Humptulips was evaluated as a potential Wild and Scenic River because the issue was surfaced by the public during the scoping process, and its recognition as a significant river on the Olympic Peninsula.

ELIGIBILITY CONSIDERATION - VALUES

Scenic - Cascading water, deep pools, river canyons, and old-growth Douglas-fir, western hemlock, and true fir forests. Generally typical of the rivers and river valleys along the flanks of the Olympic Mountains. **Above average.** This river was evaluated by Washington State Parks for inclusion in the State's Scenic Rivers system.

Recreational - For experienced kayakers, the whitewater gem of the Peninsula. Beautiful gorge sections. Chutes and rapids. Limited steelhead and salmon fishing. No developed, and few undeveloped, recreation sites. **Outstandingly remarkable.**

Geologic - Similar to many other rivers on the outer flanks of the Olympic Mountains, the river rises from springs and wet meadows within the Pacific silver fir forest. Limited areas of canyons and waterfalls. Typical river valley configuration. **Above average.**

Fish - Supports fall runs of coho, chinook, and chum salmon and steelhead. The major tributary to the Humptulips, a regionally significant producer of anadromous fish. **Above average.**

Wildlife - Elk, bear, deer, and other game and non-game species. Bald eagles occasionally sighted. Typical of west side Olympic drainages. **Above average.**

Historical - Limited evidence of splash dams associated with early logging. Little, if any, evidence of early settlement. Early day hunting, trapping, and prospecting occurred but nothing of significance. **Below average.**

Cultural - Apparently limited use by American Indians. Use, probably incidental hunting and fishing, along the lower river corridor. No known sites. **Below average.**

Conclusion - In addition to the "Outstandingly Remarkable" recreation values, white water kayaking, the East Fork of the Humptulips and its adjacent river corridor contain a number of above-average values. The East Fork of the Humptulips is eligible for Wild and Scenic River consideration.

18/ BPA 1985.

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The full length of the East Fork of the Humptulips is free of impoundments, diversions, or major channel modification.

Shoreline Development - From its source to near Stovepipe Creek, R.M. 24.5, timber harvesting has taken place on one or both sides of the stream for approximately 50 percent of its length. Extensive ongoing timber harvesting may be seen from the river. From Stovepipe Creek to the Forest boundary, the evidence of timber harvesting is not as visible as the riverbanks are frequently quite high, often perpendicular through gorge sections. Timber harvesting has generally been above the break in topography or screened by hardwoods and conifers adjacent to the river.

Between the National Forest boundary and the confluence with the West Fork, evidence of past and ongoing timber harvesting can be seen in the background. Timber harvesting has occurred in the foreground. However, the river bank generally appears natural as viewed from the river. Evidence of timber harvesting is frequent and ongoing.

Accessibility - From its source to near R.M. 25, the river is generally accessible by short cross-country hikes from the Forest roads on both the north and south sides of the river. From that point to the 22 Road crossing, access is very difficult due to the extremely rugged terrain. Downstream from the 22 Road crossing to the confluence, access is limited to two private logging road crossings and a few points where logging roads approach the river.

Water Quality - From its source to the confluence with the West Fork, the water quality is **extraordinary**, State Class AA. This class meets State and Federal standards for aesthetics, fish and wildlife propagation, and primary contact recreation (swimming).

Conclusion - The East Fork of the Humptulips meets the classification criteria for inclusion in the Wild and Scenic Rivers System. There is an **outstandingly remarkable** recreation value. The Pacific Northwest Rivers Study indicated that the scenic value was outstanding. This rating for the corridor is too high. The key components to scenic values, mountains, cascading water, forests and the river itself, are at best, typical of this physiographic province. However, from the river itself, especially within the gorge section, the scenery is outstanding. Other recreational use is primarily linked to the fishery and wildlife resources and is very seasonal. This is typical of this province.

GENERAL DESCRIPTION OF RESOURCES

Lying entirely within the Olympic Mountains section of the Pacific Border Province, the East Fork of the Humptulips rises in the lower flanks of the southwest corner of the Olympic Peninsula. Elevations vary from near 3,200 feet at its source, to near 200 feet at its confluence with the West Fork. Within two miles of its source, the river gradient becomes moderate and the sidewalls of the valley pull back from the river's edge, leaving a valley bottom nearly one-half mile wide. This valley bottom widens to nearly one mile across near the National Forest boundary.

Stands of Pacific silver fir mixed with Alaska yellow cedar with an understory of huckleberry and devilsclub, are typical of the silver fir zone found in the very upper reaches of the river corridor. The river drops rapidly out of this zone and upon reaching the point where the river gradient moderates, is well within the western hemlock zone. Western hemlock, western redcedar, Douglas-fir and Sitka spruce are the major conifer component of the stand. Red alder, big leaf maple, and black cottonwood occur primarily along the river edge and in wet lowlands. Huckleberry, vine maple, devilsclub, salal, Oregon grape, salmonberry, and western thimbleberry are typical understory shrubs.

The entire length of the East Fork of the Humptulips is somewhat accessible by road. In its lower reaches, a number of private roads reach or approach the river. Upstream from the 22 Forest Road bridge (R.M. 15.2), Forest Roads 22, 2206, 2206100, 2281 and 228140 access the river corridor.

Depending upon the segment of the river to be visited, the East Fork of the Humptulips can be as close as 27 miles, or as distant as 40-plus miles from Aberdeen and Hoquiam. From Olympia, it is 60-plus miles while Seattle is 145 miles away. Chehalis-Centralia is about 110 miles or a 2-hour plus drive.

Fishing, hunting, camping, and day use are the primary uses within the river corridor. Floating the river in association with fishing, is a significant use. Recreation boating, especially kayaking, is an increasing use. Referred to as the "whitewater gem of the Olympic Peninsula," this rugged and difficult to access river provides an outstanding quality experience for the experienced kayaker. Narrow canyons, chutes, still pools and rain forest vegetation give it a fantasy-like setting.

Within the Olympic National Forest boundary, the Quinault Unit Plan has allocated the majority of the area as available to timber production on a sustained yield basis. Special management practices are required for timber harvesting near the river to protect the qualities of the riparian areas.

Outside of the National Forest boundary, the private and county lands are being managed for timber production. Management practices are regulated by the State Forest Practices Act.

Water -Maximum flows on the East Fork of the Humptulips are generally associated with warm "chinook" rains that follow early snows in November, December, and January. While there is no gauging station on the East Fork of the Humptulips, the station 3.3 miles downstream from the confluence provides information on the range of flows. The maximum flow at the gauging station occurred on January 22, 1935, with a flow of 33,000 c.f.s. The minimum flow of 82 c.f.s. occurred on September 11, 1944. This is typical of the timing of low flows late in the summer or early fall, following an extended period without rainfall.

While these represent the extremes, the more typical high and low flows would be in the range of 18,000 c.f.s. to 19,000 c.f.s., and 130 c.f.s. to 150 c.f.s.

There are no recorded water rights (allocations) within the East Fork of Humptulips river corridor. 19/

Hydropower potential of the National Forest portion of the river is estimated to be 98.1 Gigawatts per year at the 30% exceedance level. No hydropower sites or diversions have been proposed on the East Fork of the Humptulips.

Water quality is **extraordinary**, State Class AA, from the source to the National Forest boundary. From the National Forest boundary to the mouth, it is **excellent**, State Class A.

Generally, the waters are so clear that the river bottom can be seen except in the deepest pools. During periods of high rainfall or rapid snowmelt, the river will become murky to a shade of brown, depending upon the intensity of the rainfall or rapidity of the snowmelt. Water temperatures are generally cool, except for two to three months during the summer when the water temperatures rise adequately to permit swimming and water play. Thus temperature, not water quality, is the limiting factor for primary contact use. Because the water quality is so good, fish and wildlife dependent upon the East Fork of the Humptulips and its environs thrive and can often be seen by visitors to the river and river corridor.

19/ Department of Ecology, February 1989

Fish and Wildlife - Coho, chum, and chinook salmon, sea-run cutthroat trout, steelhead, plus resident cutthroat trout, utilize the East Fork of the Humptulips system and many of its tributaries. Chinook, chum and coho spawn in the main channel; chum to about R.M. 9 and chinook to near R.M. 15. Coho, steelhead and sea-run cutthroat will pass the falls at Flatbottom Creek and utilize the river up to the vicinity of R.M. 26.

Based on the anadromous fish habitat, the East Fork of the Humptulips system has an estimated annual production of nearly 11,200 adult fish. Approximately 58 percent of this habitat capability is within the National Forest boundary. The remaining 42 percent is outside the National Forest on private and county ownerships. See Table F-29 for potential production capabilities.

Table F-29. Estimated Annual Habitat Production Capabilities for Anadromous Salmonids - 1984 1/

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Chinnook	NF Other	180 130	25,260 18,300	1,090 780
	TOTAL	310	43,560	1,870
Coho	NF Other	970 700	35,890 25,980	2,870 2,080
	TOTAL	1,670	61,870	4,950
Steelhead	NF Other	840 620	14,470 10,480	1,260 910
	TOTAL	1,460	24,950	2,170
Cutthroat	NF Other	840 620	14,470 10,480	1,260 910
	TOTAL	1,460	24,950	2,170
All	NF Other	2,830 2,070	90,090 65,240	6,480 4,680
	TOTAL	4,900	155,330	11,160

1/ Estimates only apply to the East Fork Humptulips River, i.e., estimates for the accessible habitat in the West Fork or the mainstem Humptulips are **not** included.

Generally, all of the wildlife species found on the west side of the Olympic Peninsula can be found as residents of, or visitors to, the river corridor. Some of the more common large animals are Roosevelt elk, black-tailed deer, black bear, cougar, coyote and bobcat. Smaller mammals include raccoon, mink, beaver, mountain beaver, rabbit and skunk.

The valley bottoms, south slopes and river corridors provide winter range for big game, mainly elk and deer, from the vicinity of Stovepipe Creek, R.M. 24.5, downstream.

Blue grouse, ruffed grouse and pigeons are common game birds found in the area. Ducks, ospreys, eagles, kingfishers and a variety of water birds inhabit the water edge and adjacent river corridor. The

northern bald eagle is the only threatened wildlife species known to inhabit the area. The old-growth timber in the upper east fork and adjacent Moonlight Dome Special Management Area are suitable habitat for the northern spotted owl, a sensitive species.

The riparian habitat in nearly all reaches is generally in excellent condition, with only a few areas where the habitat has been significantly modified by timber harvesting.

Recreation - Recreational use on the river and within the river corridor, tends to fall into three use areas. One group is directly dependent upon the river for fishing, both from the shore and, to a lesser degree, by drift boat. An emerging use is the whitewater kayaker. While access to the river is limited or difficult, the quality of the experience has developed a user group from those experienced and skilled kayakers looking for a quality run. Another group is associated with the river but not dependent upon it, such as for camping, picnicking, hiking and other day use. The third user group would probably occur even if the river wasn't there, i.e., hunting, mushroom picking, and driving for pleasure. Within the East Fork Humptulips river corridor, most of these activities will occur within the ROS classification of Roaded Modified.

Currently there are no developed recreation sites or boat launches adjacent to the river corridor. A few undeveloped, informal camping, picnicking, general day use and boat launch sites exist along the river.

Opportunities for drift boating, rafting, canoeing and other forms of river floating is suppressed due to the lack of river oriented facilities and the basic land forms along the river, (i.e., cliffs, canyon, etc.)

Developed boat launch facilities along the East Fork of the Humptulips should be developed at selected locations. Currently three specific runs have been identified:

The Narrows Run	5 miles, Class III	Scenery rated A+	R.M. 19-R.M. 14
The Falls Section Run	5 miles, Class III	Scenery rated A-	R.M. 17-R.M. 12
The Gorge Run	10 miles, Class III+	Scenery rated A+	R.M. 12-R.M. 2

Public access to the put in and take out points is desirable. Improvement of the "launch site" would depend on the terrain at the site. For the put in for the Narrows Run, this would consist of improved parking and trail to the river.
There are no trails that follow the river edge, except the occasional boot-worn fisherman trails that have come into existence through use over a number of years. If designated as a Wild and Scenic River, a trail along all or selected segments would be desirable.

Historical/Cultural - Knowledge of use by Indians is very limited. It is known that fishing for salmon and steelhead along the lower reaches of the main Humptulips was done by bands and members of the Humptulips. While permanent villages probably existed along the lower Humptulips, not much is known about any specific sites. Considering the extremely rugged terrain, severe cliffs, and sidewall canyons, it would not seem likely that significant use occurred very far upstream, especially since resources were plentiful for many river miles downstream to Grays Harbor. The existence of any sites is even less likely for the East Fork.

Settlement along the lower Humptulips began in the mid 1890's, and progressed upstream with homesteading in the upper Humptulips and lower West Fork during the late 1800's. Many of these early

subsistence homesteads eventually failed and were ultimately returned to timber production. Homesteading on the lower East Fork was even more limited.

During calendar year 1988 there was an estimated 2,300 undeveloped use recreation visitor days of use within the East Fork of the Humptulips Drainage. Estimated use within the National Forest segments of the river corridor are shown in Table F-30.

Table F-30. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
Undeveloped Recreation	2,300	2,700
Boating (flatwater, whitewater)	Light	Light
Water Play (swim, wade)	Light	Light
Fishing	Light	Moderate
Hunting	High	High
Camping: Undeveloped	Light	Moderate
Hiking	Light	Light
Picnicking	Light	Light
Viewing Scenery	Light	Light
TOTAL	2,300	2,700

Timber - Within the boundaries of the Olympic National Forest, nearly 80 percent of the river corridor acres are tentatively suitable for intensive timber management. If designation occurs, timber harvest will be allowed in the scenic and recreational segments. The harvest would be designed to maintain and enhance the scenic and recreational values of the river.

Volume of Allowable Sale Quantity (ASQ)

	ASQ---------->		
Total Timber Volume	Potential Harvest With Legal Requirements	Forest Preferred Alternative	Designated as Wild and Scenic River as Classified
99.9 MMBF	2.2 MMBF	1.92 MMBF	1.69 MMBF

Minerals/Energy - Following the outbreak of World War II and the increase in demand for manganese, a flurry of minerals exploration occurred within the Humptulips Drainage. There is little evidence that any of this activity spread into the East Fork Drainage. No claims were patented and any mining claim activity is dormant. The potential for any locatable minerals is extremely low.

Oil and gas exploration in the Grays Harbor area dates back to 1901 and has continued on an intermittent basis since that time. In 1922 a well was drilled near R.M. 3.5 of the Humptulips River nearly 25 miles downstream from the confluence of the East and West Forks of the Humptulips. A trace of natural gas was found. While other drilling has occurred within the general area, none has been within the river corridor. 21/

In the early 1980's a renewed interest resulted in leases being issued for nearly all of the National Forest lands within the East Fork of the Humptulips Drainage. Following limited seismic exploration, nearly all of the leases were allowed to lapse. Due to the geologic formation within this area, the potential for future exploration and possible production remains fairly speculative.

Common variety mineral material utilized for crushed road rock, is a valuable resource found within the river corridor. Within the National Forest four existing rock sources are located on the river terraces within the corridor. These are key in providing surfacing for roads in the area. A number of similar sites exist on State and private lands outside of the Forest boundary.

Transportation/Roads - The existing network of county and private roads that parallel, cross, and access the river and its corridor is adequate to meet the objectives of a Scenic and Recreational River. Acquiring and providing public boat launch facilities needs to be evaluated in detail throughout the West Fork from Stovepipe Creek to its mouth.

Nearly all roads within or accessing the river corridor have a mix of timber haul and recreational traffic. The existing roads are generally adequate to accommodate the current and projected use without any unacceptable conflicts.

NON-FEDERAL LANDOWNERSHIP AND USES

Grays Harbor County, timber companies and private individuals own land adjacent to the East Fork Humptulips River outside of the National Forest boundary. These lands are managed for timber production and maximum return to the county and companies while meeting Forest Practice Act requirements. ITT-Rayonier owns the majority of the land adjacent to the river. Limited activity has occurred along the riverbanks. Thus, riparian vegetation is in very good condition. The existing and projected landownership pattern and uses are consistent with the classification requirements for a Recreational River.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

The following are expected funding needs for the East Fork Humptulips River for the first 5 years following a designation as a Wild and Scenic River:

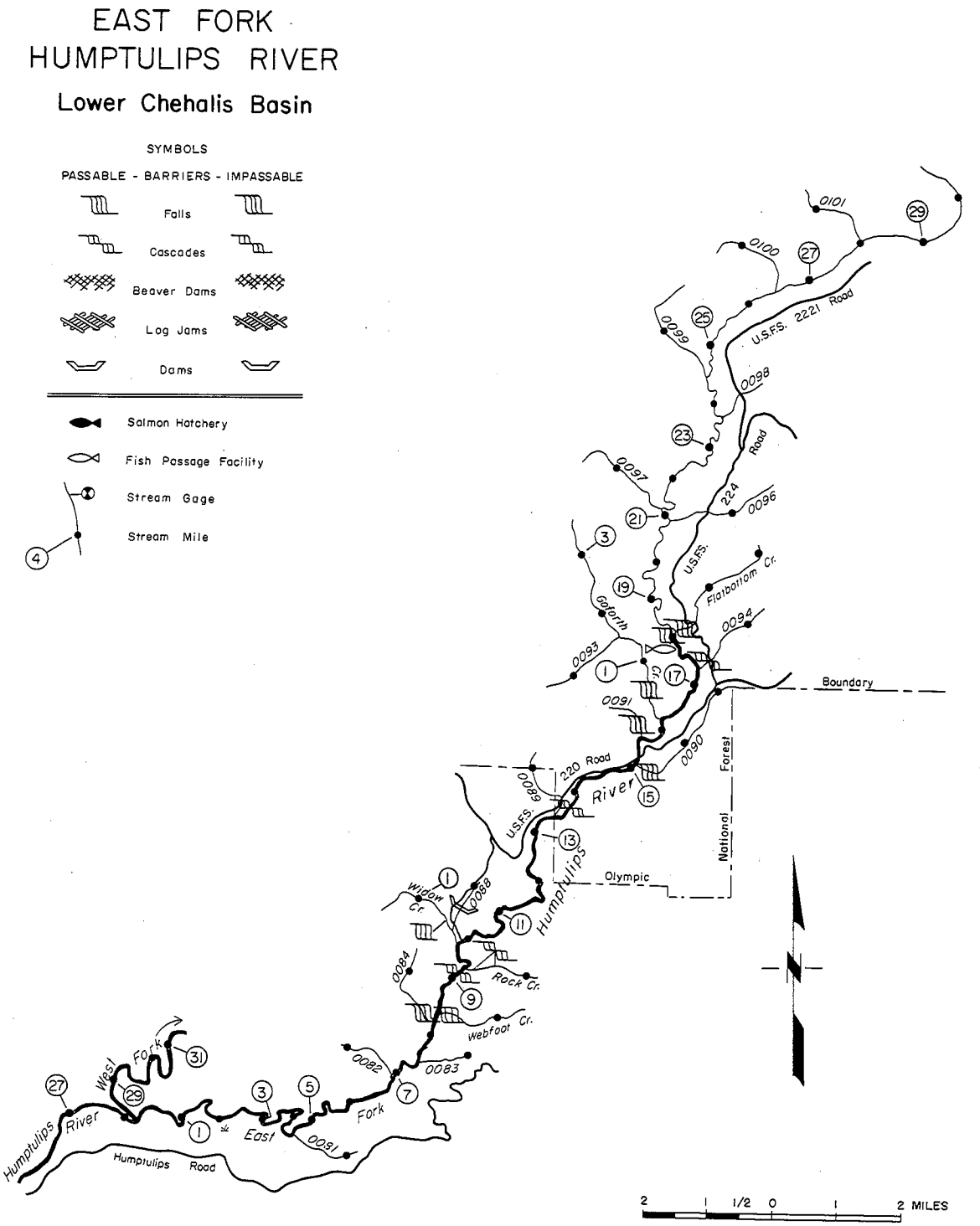
Table F-31. Estimated Cost of Management as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$13,500 19,500
	TOTAL	$33,000
Non-Recurring Costs	Cost of Implementation 1/ Preparation of Management Plan 1/ Acquisition and Development Costs	$5,000 20,000 26,000
	TOTAL	$51,000
	TOTAL COST--FIRST FIVE YEARS	$84,000

1/ Costs primarily in years 1 and 2.

The projected annual general administration and operation and maintenance costs would continue at an estimated $7,000 per year.

If all eligible segments were designated as additions to the Wild and Scenic Rivers System, the estimated funding needs for the first five years would be $170,000. Annual general administration and operation and maintenance costs would be an estimated $14,000.


EAST FORK
HUMPTULIPS RIVER
Lower Chehalis Basin
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Boundary
National Forest
Olympic
U.S.F.S. 2221 Road
U.S.F.S. 224 Road
U.S.F.S. 220 Road
Flatbottom Cr.
Gaforth Cr.
Widow Cr.
Rock Cr.
Webfoot Cr.
Humptulips River
West Fork
East Fork
Humptulips Road
2 1/2 0 1 2 MILES

GRAY WOLF RIVER

GENERAL SETTING

The Gray Wolf River is 17.4 miles in length; 9.4 miles of this is within the Olympic National Park and 8.0 miles within the Olympic National Forest.

Acreage and mileage by ownership for the Gray Wolf is summarized below.

Ownership	Miles	Acres
Olympic National Park	9.4	3,010
Olympic National Forest	8.0	2,560
TOTAL	17.4	5,570

The Gray Wolf River makes up one of the principal river systems on the Olympic Peninsula. Flowing north from the point of their origin in the high country which divides the Dosewallips and Dungeness Drainages, the Gray Wolf merges with the Dungeness. The area is mountainous with coniferous forests covering the valley walls (sparsely near timberline), becoming dense in the lower valleys. Stream gradients are steep in the upper reaches with numerous sections of cascades and rapids. The Gray Wolf is accessible to anadromous fish, coho, spring chinook, early-run pink salmon, and steelhead to about R.M. 9.

The Gray Wolf pink salmon are unique in the Puget Sound Basin. Typical stocks approach maturity while in saltwater, and migrate through main stem or lower stream reaches requiring little strenuous swimming. Spawning normally commences upon arrival in the stream. In contrast, early Dungeness pink salmon enter the stream while still in prime condition. They move rapidly upstream to their spawning destination, where they remain in pools up to one month while completing maturity. The excellent condition of these fish permits them to ascend barriers that would stop many others.

The Sequim Valley of the lower Dungeness lies in the "rain shadow" of the Olympic mountains, and has an extremely dry climate. While the upper reaches of the Gray Wolf receives more rain than the Sequim Valley, it remains in the "rain shadow." High ridges are open, with sparse vegetation.

Recreationists from the Puget Sound Basin visit the Gray Wolf Valley to camp, hike, fish, view the scenery, and during the fall to hunt deer and mountain goats.

The Gray Wolf is being evaluated as a potential Wild and Scenic River as a result of public input during the identification of issues, concerns and opportunities.

ELIGIBILITY DETERMINATION - VALUES

Scenic - High, open ridges, excellent views of Olympics, snowfields, cascading water, narrow river canyons. **Outstandingly remarkable.**

Recreation - Hiking, camping, fishing, deer and goat hunting. **Above average.**

Geologic - Mountain peaks, narrow canyons, cliffs, rock-faces, "rain shadow," waterfalls, and whitewater cascades. **Outstandingly remarkable.**

Fish - Chinook, coho and pink salmon. Unique early pink salmon run. Steelhead, sea-run cutthroat, resident fishery. **Outstandingly remarkable.**

Wildlife - Deer, mountain goats, elk, numerous smaller animals. **Average.**

Historical - A few trails and trail camps that date back to the CCC days. **Below average.**

Cultural - Probable limited use by prehistoric man. No sites found within corridor. There is some potential that sites may be found since sites have been located at nearby Slab Camp and Deer Park. **Below average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The river is free of dams and diversion structures. There are no current proposals for any dams or diversions on the Gray Wolf.

Shoreline Development - The evidence of man's presence is limited to an occasional riverside trail camp or footbridge across the river, from its source to the road bridge at R.M. 1 on the Gray Wolf.

Once below the bridge (R.M. 1.0), until it joins the Dungeness, the evidence of past and ongoing timber harvests and roads can occasionally be seen in the background. The river edge generally appears natural, with only limited evidence of human activity.

Accessibility - The upper reaches of the Gray Wolf above R.M. 1.2 are accessible only by trail. From this point downstream, the river is not readily accessible from existing roads until it flows past Dungeness Forks Campground.

Water Quality - From its source to its mouth, the Gray Wolf is rated as Class AA, "extraordinary" waters by the State. Both classifications meet or exceed the criteria for aesthetics, use by fish and wildlife, and primary contact recreation.

Conclusion - The Gray Wolf meets the eligibility for its full length, 17.4 miles. It has **"outstandingly remarkable"** scenic, geologic, and fish values.

GENERAL DESCRIPTION OF RESOURCES

The Gray Wolf River originates from the interior of the Olympic Mountains. Upper tributaries are fed from snowfields. The Gray Wolf has three major upstream branches; Grand and Cameron Creeks plus the main stem, which meet at "Three Forks" in Olympic National Park. The Gray Wolf River enters the Dungeness River near Dungeness Forks Campground.

Watershed cover, valley configuration, stream gradient and terrain in the Gray Wolf are similar to the upper and middle reaches of the Dungeness and all of the Gray Wolf. These areas are mountainous with dense coniferous forest cover which becomes sparse near timberline. The Douglas-fir-western hemlock zone is predominant. The upper Dungeness has minor amounts of the Douglas-fir plant association on steep, dry,

well-drained slopes. The mountain hemlock-subalpine fir zone is found in the headwater areas of the Dungeness.

Stream gradient in the upper main branches and tributaries is steep and often precipitous above, approximately, the 2,500-foot elevation. Below this, the gradient remains steep, although patches of gravel are interspersed among the rubble and boulder substrate. The Gray Wolf River originates in Cedar Lake at about 5,250 feet elevation, and enters the Dungeness at 1,100 feet.

Other than the very lower reaches, all of the Gray Wolf is accessible by trail. Three major trailheads serve the Gray Wolf. One is at Deer Park, in the Olympic National Park which provides access to the upper reaches in the Three Forks area. The mid section is accessed via the Slab Camp Trail, which reaches the Gray Wolf near Camp Tony. The lower reaches are accessed from the trailhead where Forest Road 2870 crosses the Gray Wolf. The Gray Wolf Trail is, for the most part, within the one-quarter mile river corridor.

The Gray Wolf and the Dungeness Valleys lie in the Olympic "rain shadow," causing the area to be the driest coastal region north of southern California. The "rain shadow" is caused by the area's position with respect to the mountains and prevailing winds. As a result, the average annual precipitation in Sequim is only about 15 inches. While the Gray Wolf River receives a higher annual precipitation, it has typical "rain shadow" characteristics.

Water - The Gray Wolf River meets or exceeds the criteria for aesthetics, use by fish and wildlife, and primary contact recreation as defined in "Water Quality Criteria", Federal Water Pollution Control Administration, April 1, 1968. The Gray Wolf waters are rated Class AA, "extraordinary."

As is characteristic for Western Washington, the Gray Wolf River exhibits minimum flows during the summer months when precipitation is least and snowpacks are depleted. Streamflow begins to increase in October, reaches a maximum base flow in December, and gradually decreases from January through the middle of March. Due to rising temperatures and snowmelt, runoff begins to increase in the latter part of March, and reaches a maximum in early June.

The total drainage area above the mouth of the Gray Wolf River is 76 square miles. There is no gauging stations on the Gray Wolf. Maximum and minimum flows are unknown as is the average annual flow. There are no diversions or water use directly from the Gray Wolf River. There are no current proposals for water use or diversion from the Gray Wolf.

Hydropower potential of the National Forest portion of the Gray Wolf River is estimated to be 125 Gigawatts per year at the 30% exceedance level. This development would be largely located within the Buckhorn Wilderness. A power withdrawal occupies a one-quarter mile strip on both sides of the Gray Wolf River.

Fish and Wildlife - Little or no overlap occurs in the timing or spawning area.

Most early-run pink, coho and spring chinook utilize the Gray Wolf River to about R.M. 8.0, with a few individuals ascending to about R.M. 9.0. The pink salmon are unique in Puget Sound. It is a native wild stock with no hatchery influence. Fish migrate through main or lower stream reaches requiring little strenuous swimming. Normally, spawning occurs upon arrival in the stream. In contrast, these pink salmon enter the river in prime condition, move rapidly upstream to their spawning destination and remain up to one month in the pools. They negotiate rapids and small falls that would be barriers for other fish.

Based on the anadromous fish habitat, the Gray Wolf River and tributaries have estimated annual production of approximately 20,600 adult fish. Nearly all of this habitat capability is within the Forest. Table F-32 summarizes the fisheries potential.

Resident trout exists in the Gray Wolf River well into the Olympic National Park.

Wildlife species typical of the east side of the Olympics are assumed to frequent the river corridors. Deer utilize the drainage bottoms for summer range. Areas below 1,500 feet in elevation provide some winter range. A small herd of elk can be found in the Gray Wolf drainage. Bear, cougar and bobcats have been observed over most of the area. Mountain goats and the Olympic marmot may be seen in the headwater areas of these rivers. The northern bald eagle is the only threatened wildlife species known to inhabit the area.

Recreation

Table F-32. Potential Annual Habitat Production Capabilities for Anadromous Species

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Chinook	NF	60	8,480	360
Coho	NF	220	11,250	1,120
Chum	NF	130	28,560	290
Pink 1/	NF	6,380	765,000	16,830
Steelhead	NF	660	11,280	980
Sea-run Cuthroat	NF	660	11,280	980
All	NF	8,110	835,850	20,560

1/ Olympic Peninsula pink salmon spawn only during odd years. As such, the annual estimates shown are odd year number divided by 2.

One developed recreation site, Dungeness Forks Campground, is located along the Gray Wolf River at its confluence with the Dungeness River. This campground is a popular fishing spot. A summary on this campground is in Table F-33.

Table F-33. Developed Recreation Sites

National Forest Sites					
Site	ROS Class	Capacity PAOT	Managed Season Days	1988 Use RVDs	Projected Capacity PAOT
Dungeness Forks Campground	Roaded	50		10,800	135

No new National Forest campgrounds are proposed within the Gray Wolf River corridor. Expansion of Dungeness Forks Campground to nearly 3 times its existing capacity is planned in the future.

Trails access the Gray Wolf River on National Forest and National Park lands. The Gray Wolf Trail is accessed from trailheads on Forest Roads 2870 and 2875, or from Deer Park in Olympic National Park. The Forest Service section basically follows the river for 9.1 miles to the Park boundary. All but the first two miles of the trail are within the Buckhorn Wilderness. Once inside the Park, the trail continues along the Gray Wolf for about two miles to Three Forks. From there the trail branches three directions; up the main stem of the Gray Wolf, up Cameron Creek, or uphill to Deer Park. Hiking and fishing access are the major uses along the trails. Existing use estimates are summarized in table F-34.

The scenery along the trails in the Wilderness portion and within the Park, is outstanding. The lower portions provide excellent examples of old-growth forests. The rivers are in a clean, natural state. The upper reaches of the trails in the Forest and Park provide spectacular mountain views.

Table F-34. Recreation Trail Use, 1988

Trail	Agency	Miles	RVDs 1/	ROS		Trail	Agency	Destination	Visitor Nights 2/
Gray Wolf	ONF	9.1	500	Roaded Modified		Gray Wolf	ONP	Park Boundary to	
				--Mile 0 - 2.5				Three Forks	4
				Primitive				Three Forks	281
				--Mile 2.5 - 9.1				Cedar Lake	181
								Royal Lake	943

1/ National Forest Data
2/ National Park Data

Table F-35. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	10,800	12,500
Undeveloped Recreation	13,500	15,800
Boating (flatwater, whitewater)	Light	Moderate
Water Play (swim, wade)	Light	Light
Fishing	Moderate	High
Hunting	Moderate	High
Camping: Undeveloped	Moderate	High
Hiking	Moderate	High
Picnicking	Light	Light
Viewing Scenery	Light	Moderate
TOTAL	24,300	28,300

Historical/Cultural - There are no known historical or cultural sites along the Gray Wolf River. A prehistoric site has been identified near Slab Camp and use probably occurred within the river corridor.

Minerals/Energy - National Forest lands are open to mineral exploration and leasing, except within the Buckhorn Wilderness and at administrative sites. No significant mining has occurred within the Gray Wolf River corridor. It is unlikely that any significant mineral or energy resources occur within the river corridor.

Timber/Land Allocation - The Canal Front Plan, 1979, established the land allocation and use on the National Forest segments within this area. In 1984, the Washington Wilderness Act allocated areas to the Buckhorn Wilderness along all but the reaches of the Gray Wolf River. Land allocation on the National Forest is summarized in Table F-36. The non-Wilderness allocations have been superceded by the management directions in this Forest Plan.

Table F-36. Land Allocation

Segment	Management
Forest/Park boundary to 2 1/2 miles above confluence with Dungeness	Buckhorn Wilderness
R.M. 2.5 - R.M. 1.0	Special Managment Area (Canal Front Plan)
R.M. 1.0 - Mouth	General Forest

Timber harvest is not permitted in the Buckhorn Wilderness. As directed in the Canal Front Plan, the Gray Wolf Special Management Area is in the unregulated cut component, wherein timber sales will not be planned, and timber will not normally be cut. However, salvage or sanitation operations are permitted, if essential to public health and safety or protection of the resources. There are no disease or insect problems within the river corridors. The potential for significant outbreaks is low.

The following tables summarize acreage allocation and tentatively suitable acres characteristics.

Table F-37. Summary of National Forest Acres

Wilderness	1,760
Unsuitable	354
Tentatively Suitable	446
TOTAL	2,560

Table F-38. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1"-2.9" DBH)	SS Seedling-Sapling (3"-4.9" DBH)	PL Poles (5"-8.9" DBH)	MS Small Saw (9"-20.9" DBH)	LS Large Saw (21+" DBH)
High	40	49	6		
Medium			68	175	108
Low					
Low, Natural					
TOTAL	40	49	74	175	108

Table F-39. Tentatively Suitable Standing Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High									6	4.56	27	117
Medium	108	8.98	970	4,220	175	6.09	1,066	4,637	68	3.09	210	914
TOTAL	108		970	4,220	175		1,066	4,637	74		237	1,031

Summary: 2,273 MCF or 2.3 MMCF
9,888 MBF or 9.9 MMBF

Table F-40. Tentatively Suitable Land Potential Yield by Site and Elevation

	<1,500' (Winter Range)				>1,500' (Summer Range)			
Site/ Productivity	CF/Acre/ Year	Acres	MCF/Year	MBF/Year	CF/Acre/ Year	Acres	MCF/Year	MBF/Year
High	176.88	95	16.80	73.08				
Medium	130.74	311	40.66	176.87	121.24	40	4.85	21.10
TOTAL		406	57.46	249.95		40	4.85	21.10

Summary: 62.31 MCF/Year
271.05 MBF/Year

NON-FEDERAL LANDOWNERSHIP AND USES

All of the lands within the National Forest segments of the Gray Wolf river corridor are in National Forest ownership.

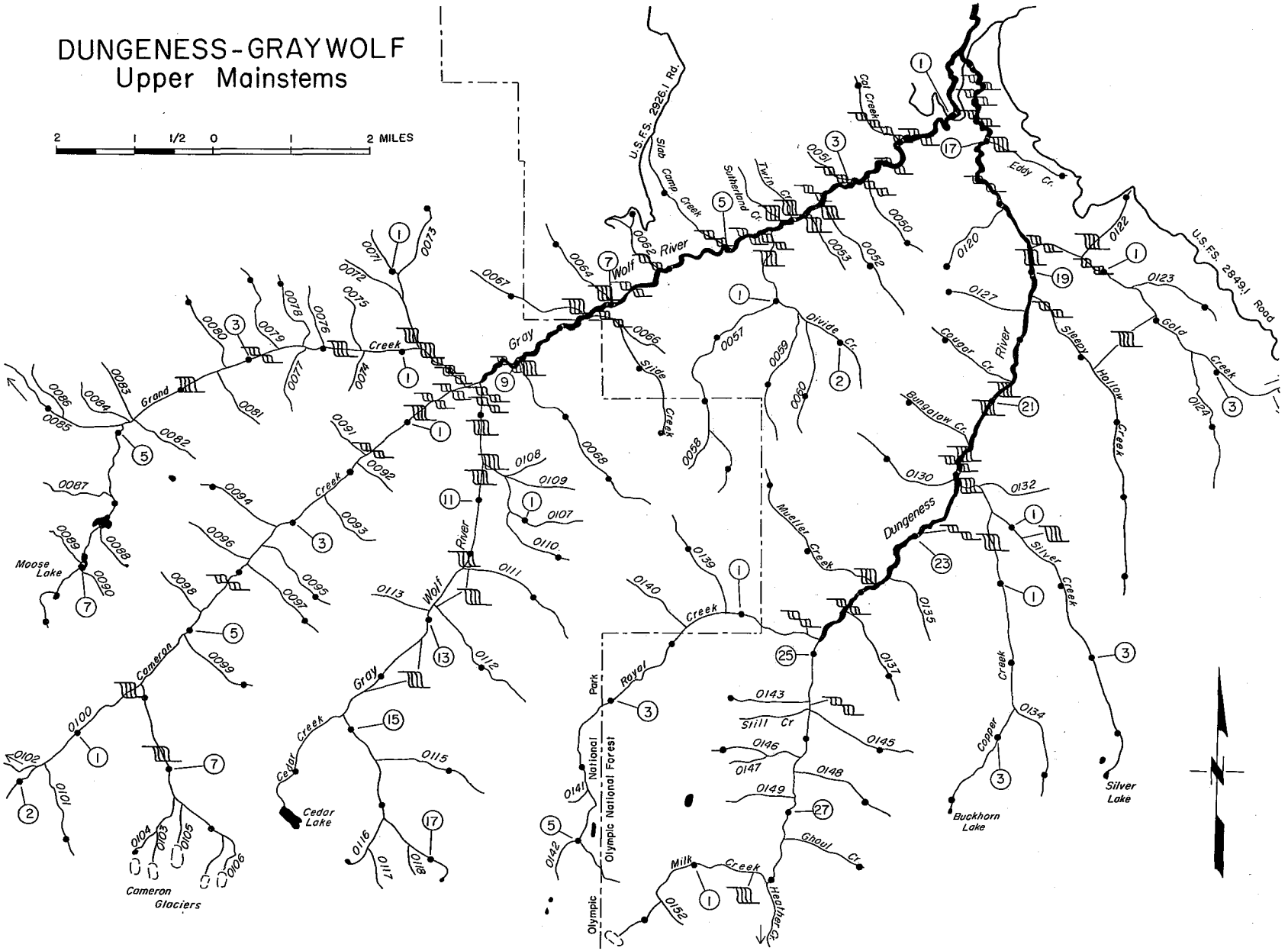
FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

The following are expected funding needs for the Gray Wolf River for the first five years following a designation as a Wild and Scenic River:

Table F-41. Estimated Cost of Management if Designated as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$7,800 37,300
	TOTAL	$45,100
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan 1/	$5,000 16,500
	TOTAL	$21,500
	TOTAL COST--FIRST FIVE YEARS	$66,000

1/ Costs primarily in years 1 and 2.


DUNGENESS-GRAYWOLF
Upper Mainstems
2 1 1/2 0 1 2 MILES
U.S.F.S. 2926.1 Rd.
Slab Camp Creek
Wolf River
Sutherland Cr.
Twin Cr.
Col Creek
Eddy Cr.
U.S.F.S. 2849.1 Road
Gold Creek
Sleepy Hollow Creek
Cougar Cr.
Bungalow Cr.
Divide Cr.
Gray Wolf River
Slide Creek
Grand Creek
Moose Lake
Cameron Creek
Cameron Glaciers
Cedar Creek
Cedar Lake
Royal Creek
Park
Olympic National Forest
Milk Creek
Hatchery Cr.
Ghoul Cr.
Still Cr
Muellel Creek
Dungeness River
Silver Creek
Copper Creek
Buckhorn Lake
Silver Lake

HAMMA HAMMA RIVER

GENERAL SETTING

The Hamma Hamma is one of the shortest of the major rivers on the Olympic Peninsula, with a total length from source to the mouth 17.8 river miles. With its origin at Murdock Lake, the river flows easterly for 12.0 miles within the National Forest boundary, exiting at R.M. 5.8. In the remaining distance to Hood Canal, the river flows through 3.5 miles of State Department of Natural Resources lands, and 2.8 miles of private land.

Mileage and acreage by ownership are summarized below. Acreage is based on a one-quarter mile corridor each side of the river. The National Forest acres were extracted from the planning map data base.

Ownership	Miles	Acres
Olympic National Forest	11.5	3,680
State of Washington DNR		
within National Forest Boundary	0.5	160
outside National Forest Boundary	3.0	960
Private		
outside National Forest Boundary	2.8	900
TOTAL	17.3	5,700

Rising within the Sawtooth Range on the eastern flanks of the Olympic Mountains, the Hamma Hamma River descends rapidly through steep mountain terrain cutting through a narrow, steep-walled valley with forested side slopes. Small waterfalls, cascades and rapids, with sections of pools and riffles, are found throughout the river. Water quality is excellent. With a series of cascades, steep gradients and waterfalls between R.M. 2.7 and 2.0, anadromous fish are limited to the lower two miles of the river. While access of the main stem area is limited in length, it is offset by its exceptional quality. It is heavily spawned by chum and pink salmon, and to a lesser degree by chinook and coho.

Recreational use is high within the drainage with access to the Mt. Skokomish Wilderness, Mildred Lakes, Lena and Upper Lena Lakes. Recreationists throughout the South Puget Sound Basin travel to the Hamma Hamma for the camping, hiking, and mountain climbing activities.

The Hamma Hamma is being evaluated as a potential Wild and Scenic River because of the identification of Wild and Scenic Rivers as an issue, and because of its inherent qualities.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Vistas of mountains within Sawtooth Range, waterfalls and cascades. **Outstandingly remarkable.**

Recreational - Camping and picnicking along the river, sightseeing, fishing and hiking. **Above average.**

Geologic - Rugged peaks, narrow river canyons. **Above average.**

Fish - Anadromous species in lower two miles. Resident trout fishery above. **Above average.**

Wildlife. Deer, elk, bear and smaller game and nongame species. Bald eagles reside in lower reaches during winter months. **Average.**

Historical - Limited settlement by pioneers. Forest Service Hamma Hamma Guard Station (original summer headquarters for Forest Supervisor). The CCC era Guard Station, which replaced earlier versions has been evaluated and is eligible for the National Register of Historic Places. **Above average.**

Cultural - No known sites. Probable use by prehistoric people tied to anadromous fishery in lower river. Culturally modified trees and isolated artifacts have been found on tributaries of the Hamma Hamma. This evidence occcurs a substantial distance into the interior and similar use, or evidence of use, may someday be located in the upper reaches of the Hamma Hamma. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The Hamma Hamma is estimated to have a hydropower production potential of 5.23 Gigawatts per year at the 30% evaluation level.

Currently there are no impoundments or diversion structures on the Hamma Hamma. However, there is, and has been a series of run-of-the-river hydropower projects proposed on the Hamma Hamma and its tributaries. The only one that remains active is the lower Hamma Hamma, near R.M. 2.7 where a license application has been submitted to the Federal Energy Regulatory Commission (FERC).

Five additional project applications have been dropped and three denied by FERC. See Table F-41 for a summary of projects and locations.

Shoreline Development - From its source at Murdock Lake, through the Mt. Skokomish Wilderness to R.M. 14.5, the shoreline lacks any evidence of human activity. There are no trails through this area. From R.M. 14.5 to the mouth of Lena Creek at R.M. 8.9, the shoreline is largely primitive with only limited evidence of human activity. The evidence of early logging is seen only if one looks closely. A concrete bridge spans the river at R.M. 14.4. Downstream from R.M. 8.9, the level of development in the river corridor increases significantly. Lena Creek Campground is located at R.M. 8.8, Hamma Hamma Campground at R.M. 7. Dispersed recreation sites are found throughout this section. Evidence of timber harvesting is not readily apparent. From the National Forest boundary, R.M. 5.8 to the mouth, evidence of timber harvesting is readily apparent, sometimes well within the river corridor.

Accessibility - Upstream from R.M. 14.5, access to the river is by cross-country travel, as trails have never been constructed adjacent to the river within this area. Near R.M. 14.4, a concrete bridge spans the river to reach the trailhead on the south side. Downstream from this point to R.M. 8.9, the Hamma Hamma road roughly parallels the river up to one-quarter mile away. From R.M. 8.9 to 7.3, the Hamma Hamma road is immediately adjacent to the river. At R.M. 7.3, a concrete bridge spans the river resulting in a road along

both sides to near R.M. 5.5, when both roads pull away from the river. Access to the river from this point to Highway 101 (R.M. 0.2), is by local roads across private and State land.

Water Quality - The Hamma Hamma is rated as a Class AA, "extraordinary" water by the State. This meets or exceeds Federal criteria for aesthetics, propagation of fish and wildlife, and primary contact recreation.

Conclusion - The entire length of the Hamma Hamma River meets the classification criteria for either Wild, Scenic or Recreational River. In addition to its "outstandingly remarkable" scenic values, the Hamma Hamma has high recreational, geological and fish values. Therefore, the Hamma Hamma should receive further evaluation as an addition to the Wild and Scenic Rivers System.

GENERAL DESCRIPTION OF RESOURCES

The headwaters of the Hamma Hamma River flow through some of the most scenic areas on the Olympic Peninsula. Flanked by some of the major peaks on the Canal Front, the Hamma Hamma has carved a course through the Sawtooth Range in its descent to Hood Canal. Side slopes are very steep to precipitous, with only slight moderation occurring prior to the confluence of Cabin Creek. This coincides with the transition from the Olympic Mountains to the Puget trough sections of the Pacific border province. Dropping from slightly over 6,000 feet to sea level in less than 18 miles, the Hamma Hamma has one of the steepest river gradients on the Olympic Peninsula.

Descending rapidly, the Hamma Hamma River flows through the subalpine, mountain hemlock and silver fir vegetation zones for its first two miles. The remaining distance to Hood Canal is within the western hemlock zone. Huckleberry, rhododendron, vine maple and salal are typical understory vegetation. Devilsclub is commonly found in wet, marshy areas. Red alder and cottonwood line the edge of the river and its larger tributaries.

Located within 55 miles of Seattle, (assuming crossing Puget Sound by ferry) and 80 miles from Tacoma, the Hamma Hamma is within two hours driving time of the largest metropolitan population in the Northwest. Olympia (50 miles), Bremerton (55 miles) and Port Angeles (80 miles) are other cities within two hours of the river corridor. The Hamma Hamma road, Forest Road 25, is the primary access into the Hamma Hamma Drainage.

Public access to the river, up to R.M. 5, is limited due to private landownership and the distant proximity of the Hamma Hamma road. From that point to the end of the road at R.M. 14.4, the Hamma Hamma road generally follows along the north bank, never more than one-quarter mile distant. Access to the river through this section is quite easy. Only in the area between R.M. 9.5 and 12.5 is the river out of sight from the road. Above the bridge at R.M. 14.4, the access to the river is via cross-country travel through extremely difficult terrain.

Camping, fishing and viewing scenery are the principal uses within the Hamma Hamma River corridor. Deer and grouse hunting are seasonal and secondary uses of the area. Although short stretches of the river between the mouth of Lena Creek, R.M. 8.9, and the mouth of Jefferson Creek, R.M. 5.8, may be suitable for floating, the inherent problems with log jams and hazardous boulder-strewn areas makes it a questionable venture.

Use figures within the river corridor are not available. Recreational use in the Hamma Hamma Valley will be discussed later.

Within the Canal Front Plan, 1979, the area upstream of R.M. 14.5 was designated for further planning. This was later included within the Washington Wilderness Act as the "Mt. Skokomish Wilderness." The two existing developed recreation sites were reserved for developed recreational use.

The State of Washington Department of Natural Resources lands are managed under a philosophy of providing the maximum return to the State. Within this area, the State lands are all designated for timber production.

Private lands outside of the National Forest boundary are predominantly in timber production. Timber harvest practices on private land must comply with the State Forest Practices Act. A few residences are located in the vicinity of the river mouth but away from the river edge.

Water - Based on a long-term record (over 40 years), the average annual discharge as measured at the USGS gauging station at R.M. 0.5 is 244,000 acre-feet per year or 337 cfs.

Maximum flows occur during the late fall-early winter period when early snows at mid and lower elevations are followed by warm "chinook" rains. The peak discharge recorded at the gauging station was 5,810 cfs, November 3, 1955. 22/ A low flow of 37 cfs was recorded in September of 1930. Low flows historically have occurred in late summer or early fall, and are in direct relationship to the seasonal rainfall and the length of any "drought period."

The Hamma Hamma has been identified as a potential municipal water source for the City of Bremerton. The projected annual use is 17,000 gallons per day. 150 cfs has been allocated for this use. 23/ Other allocated uses are: 24/

0.15 cfs for Forest Service Campgrounds,
0.13 cfs for fish propagation (private),
260.00 cfs for proposed hydropower projects,
0.20 cfs for irrigation.

With the steep gradient on the Hamma Hamma and its tributaries, the potential for hydroelectric production has long been recognized. A potential hydroelectric site near R.M. 2.7, and a pump storage site at Lena Lake were estimated to produce 20.1 megawatts and 2,000 megawatts. 25/ Recent proposed projects within the Hamma Hamma Drainage and their status are shown in Table F-42. While many of these projects have been dropped, it is more a function of the projected reduction in demand and power rates, rather than a physical constraint or other land-use conflict. If the projected demand for power increases substantially and/or the economics become more favorable, these same projects and others will likely become active proposals again.

Water quality in the Hamma Hamma is excellent throughout its length. The clarity of the water is so good that the bottom of the river can be seen, except in the deepest pools. Only during periods of high runoff, late fall and winter storms, does the river become discolored.

22/ Pacific Northwest River Basins Commission, Appendix XII, 1971.
23/ Pacific Northwest River Basins Commission, Appendix VI, 1971.
24/ Bergstrom 1985.
25/ Pacific Northwest River Basins Commission, Appendix IX, 1971.

Table F-42. Hydroelectric Projects Proposals and Status as of 1/18/88

Project Name	Location	Type	Status
Hamma Hamma	R.M. 14.5	Run-of-the-River	Dropped
Hamma Hamma	R.M. 12.5	Run-of-the-River	Dropped
Lower Hamma Hamma	R.M. 2.7	Run-of-the-River	License application filed with FERC
Boulder Creek	Boulder Creek	Run-of-the-River	Dropped
Lena Creek	Lena Creek	Run-of-the-River	License application filed with FERC
Cabin Creek	Cabin Creek	Run-of-the-River	Denied by FERC
Washington Creek	Washington Creek	Run-of-the-River	Dropped
Jefferson Creek	Jefferson Creek	Run-of-the-River	Denied by FERC
Watson Creek	Watson Creek	Run-of-the-River	Dropped

Water temperatures are cool, except for late summer when the combination of lower flows and warmer days brings the water temperature up to a point where wading, water play and swimming is tolerable.

Because the water quality is so good and free of pollutants, fish and wildlife dependent upon the Hamma Hamma and the adjacent riparian areas thrive and are often seen by visitors to the area.

Fish and Wildlife - Within the lower reaches (R.M. 0.0-2.7), the Hamma Hamma is utilized by four species of salmon, steelhead and sea-run cutthroat trout. The steep gradient beginning at R.M. 2.0, and the large falls at R.M. 2.7 block anadromous fish from the upper river. The lower two miles of the river is heavily used by spawning chum and pink salmon, and moderately used by chinook and coho. Pink, chinook, and chum salmon spawn simultaneously during September. A late chum salmon run spawns in the main stem and intertidally during December. Coho production is limited by available rearing area. Spawners in this drainage normally total about 100 fall chinook, 500 coho, 11,000 chum and 5,000 pink salmon. All of the accessible anadromous fish habitat is outside the National Forest boundary. No data is available at this time for estimated fisheries production capabilities. A good resident cutthroat trout fishery exists in the upper river and adjacent beaver ponds.

Most of the wildlife species typical of the east flank of the Olympics, either live within or pass through the river corridor. Deer, elk, black bear, and cougar are representative of the larger wildlife species. Numerous small game species such as raccoon, coyote, skunk, mink, beaver, squirrel and bobcats thrive along the river.

Various small water birds, ducks, kingfishers, grouse and woodpeckers are found along the river. Significant numbers of bald eagles (10-20) have been counted near the mouth of the river, where they roost and feed during the fall and winter months when the salmon are spawning.

The riparian habitat along the river is typical of the east Olympics, with a mixture of conifers and hardwoods to the river edge. The habitat is in excellent condition.

Recreation - The Hamma Hamma Valley is one of the more popular recreation destinations on the east side of the Olympic Penninsula. Camping and picnicking occurs primarily within the two developed recreation sites, Hamma Hamma and Lena Creek, and at pulloffs adjacent to the river. (ROS classification--Roaded Natural.)

Hiking and associated camping opportunities can be found within the Lena Lake Special Management Area and the Mt. Skokomish Wilderness within Olympic National Forest and the Lake of the Angels Basin within Olympic National Park. (ROS classifications Primitive and Semi-Primitive Non-Motorized.) The Mildred Lakes Basin is the primary destination within the Mt. Skokomish Wilderness.

Fishing and hunting occur within the river corridor and close to the road, as well as in the more remote areas. Table F-43 summarizes the various activities and which ROS class they are associated with.

Table F-43. ROS Classification, Hamma Hamma River Corridor

River Mile	Classification	Probable Activities
0.0 - 5.8	Roaded Modified	fishing, hunting
5.8 - 8.9	Roaded Natural	auto camping, hiking, viewing scenery, fishing, water play
8.9 - 15.0	Roaded Natural	viewing scenery, fishing, hiking
15.0 - 16.0	Semi-Primitive Non-motorized	viewing scenery, hiking, backpack camping
16.0 - 17.8	Primitive	viewing scenery, hiking, backpack camping.

Hamma Hamma and Lena Creek are the two existing developed campgrounds within the river corridor. Both campgrounds are extremely popular, with opportunities for fishing, hiking, water play and viewing scenery nearby. No new campgrounds are planned in the river corridor. However, Hamma Hamma Campground is planned for expansion.

Developed recreation use and capacity are displayed in Table F-44.

Table F-44. Developed Recreation Sites

National Forest Sites					
Site	ROS Class	Capacity PAOT	Managed Season Days	1988 Use RVDs 1/	Projectd Capacity PAOT
Lena Creek	Roaded, Natural	70	150	6,860	190
Hamma Hamma	Roaded, Natural	75	150	8,300	175

1/ RIM, 1988.

Existing trails within the river corridor are very limited. The Tirnell Trail leads to the beaver ponds near R.M. 11.0, and the trailheads for the Lena Lake, Mildred Lakes and Putvin Trail all lead to destinations out of the river corridor.

Rafting or floating of the Hamma Hamma is very limited, due to the relative short segments of the river that are suitable for floating. Between Lena Creek (R.M. 8.9) and the mouth of Jefferson Creek, some floating may be possible. However, it is actively discouraged due to the inherent hazards of log jams, boulder-strewn reaches, and the potential of going too far downstream and going over the falls.

A trail is proposed from Lena Creek Campground to provide historical interpretation of this drainage and offer an alternate day hike from the campground.

Table F-45. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	15,160	17,500
Undeveloped Recreation	56,500	68,900
Boating (flatwater, whitewater)	Light	Light
Water Play (swim, wade)	Moderate	Moderate
Fishing	Moderate	Moderate
Hunting	Moderate	Moderate
Camping: Undeveloped	High	High
Hiking	High	High
Picnicking	Moderate	Moderate
Viewing Scenery	Moderate	High
TOTAL	71,660	86,400

The distinctive value of the Hamma Hamma is its scenic qualities, especially in the upper reaches. Nearly encircled at its source by Mt. Pershing, Mt. Cruiser, Mt. Henderson, Mt. Stone, Mt. Gladys, Mt. Lincoln and Mt. Skokomish, the Hamma Hamma has carved a notch through the north end of Sawtooth Ridge. Cascading through this canyon, the river is a series of waterfalls, tumbling white water and isolated, deep pools. Cliffs, rock outcrops and waterfalls can be seen along the walls. Once out of this upper valley, the river gradient moderates, and short reaches of swiftly flowing, smooth water is interspersed between rapids and cascades. Steep, sometimes precipitous slopes, covered with a hodgepodge of old-growth-second growth conifers, cover the valley wall along Jefferson Ridge to the south. Cottonwood and alder-covered flats occur intermittently along the river between Lena Creek and Hamma Hamma Campgrounds.

Historical/Cultural - Knowledge of use by Indians within the Hamma Hamma Corridor is sketchy, at best. There are no known sites within the river corridor, although it is likely there were fishing camps along the lower reaches of the river. Incidental hunting and gathering of herbs, roots and berries probably occurred within the lower valley areas. Currently modified and isolated artifacts have been found on tributaries of the Hamma Hamma. It is likely that use occurred far into the interior.

Pioneer settlement in the Lower Hamma Hamma Valley was typical of the river valleys along Hood Canal. Most of the homesteads were "marginal subsistence agriculture" that eventually gave way to timber. The Forest Service Hamma Hamma Guard Station is an excellent example of CCC construction. It is in the process of being nominated to the National Register of Historic Places. A predecessor structure served as the summer headquarters for the Forest Supervisor of Olympic National Forest. Evidence has been found and there is some documentation of pioneer hunting, trading and prospecting in this drainage although this historic use is not considered significant.

Minerals/Energy - There is a very limited history of mineral prospecting within the Hamma Hamma Drainage. A few individual claims have been filed. None have developed beyond the annual assessment work, and the removal of an incidental amount of ore for assay purposes. The National Forest lands are open to mineral exploration and leasing, except for the area within the Wilderness and Administrative Sites.

Based on the limited mineralization of the Olympics and a low oil and gas potential, it is unlikely that any significant mineral or energy deposits occur within the river corridor.

Timber - Timber types, standing volume, and potential yield on all National Forest lands within the river corridor that are classed as tentatively suitable, are displayed in the following Tables.

Table F-46. Summary of National Forest Acres

Wilderness	1,056
Tentatively Suitable	2,070
Unsuitable	554
TOTAL	3,680

Table F-47. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1-2.9" DBH)	SS Seedling-Sapling (3.0-4.9" DBH)	PL Poles (5.0-8.9" DBH)	MS Small Saw (9.0-20.9" DBH)	LS Large Saw (21+"DBG)
High	6			410	
Medium		46	1,085	434	9
Low					3
Low, Natural		28		49	
TOTAL	6	74	1,085	893	12

Table F-48. Tentatively Suitable Standing Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High					410	6.09	2,497	10,862				
Medium	9	8.98	81	352	434	6.09	2,643	11,497	1,085	3.09	3,353	14,586
Low & Low Natural	3	7.45	22	96	49	6.09	298	1,296				
TOTAL	12		103	448	844		5,140	22,359	1,085		3,353	14,586

Summary: 8,894 MCF or 8.9 MMCF
38,689 MBF or 38.7 MMBF

Table F-49. Tentatively Suitable Land Potential Yield by Site and Elevation

	<1,500' Elevation (Winter Range)				>1,500' Elevation (Summer Range)			
Site/ Productivity	CF/Acre/ Year	Acres	MCF/Year	MBF/Year	CF/Acre/ Year	Acres	MCF/Year	MBF/Year
High	176.88	416	73.58	320.07				
Medium	130.74	1,177	153.88	669.38	121.24	397	48.13	209.37
Low	74.56	3	.22	.96				
Low, Natural					39.75	77	3.06	13.31
TOTAL		1,596	227.68	990.41		474	51.19	222.68

Summary: 278.87 MCF/Year
1,213.09 MBF/Year

Based on the most recent Insect and Disease Survey, there are no significant insect and disease problems within the river corridor. The potential for any significant outbreak is low.

Transportation/Roads - The major access route into the corridor is the Hamma Hamma road, Forest Road 25, from Highway 101 to the upper valley at R.M. 14.4. This road is double-lane paved for the first 1.5 miles, and single-lane paved from that point to the junction with Forest Road 2480. Right-of-way has been acquired to permit eventual two-lane construction to the vicinity of Hamma Hamma Campground.

Based on 1981-1984 use figures from traffic count at milepost 2 on the Hamma Hamma road, the average daily traffic for April through September exceeded 110 vehicles. The mix of traffic is 9 percent timber haul, 82 percent recreation use and 9 percent administrative use. Above Cabin Creek, recreation use accounts for 88 percent of the total traffic, timber haul 4 percent and administrative traffic 8 percent.

The existing road is adequate to accommodate the existing and projected use without any unacceptable conflicts. The continuation of the asphalt surfacing to Lena Creek Campground would reduce problems with dust and a rough-road surface to this popular campground and trailhead.

Additional temporary roads may approach the river in conjunction with timber harvesting from State Department of Natural Resources and private lands.

NON-FEDERAL LANDOWNERSHIP AND USES

State of Washington Department of Natural Resources lands, both within and outside of the National Forest boundary, are being managed for timber production with required constraints and mitigation adjacent to the Hamma Hamma River. The Department of Natural Resources lands within the National Forest boundary are tentatively scheduled for acquisition by the Forest Service through land exchange. Acreages within private ownership are primarily large tracts owned by a local timber company. Timber management is practiced on most privately owned lands within the requirements of the State Forest Practices Act.

The limited residential development and timber harvesting activities have modified the natural character of the river corridor, but has had a minimum effect on the immediate river edge.

The existing and projected landownership and use pattern is consistent with the classification of Recreational River. The outstanding scenic values found within the river corridor are found in the mid and upper valley, well above State and private lands.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

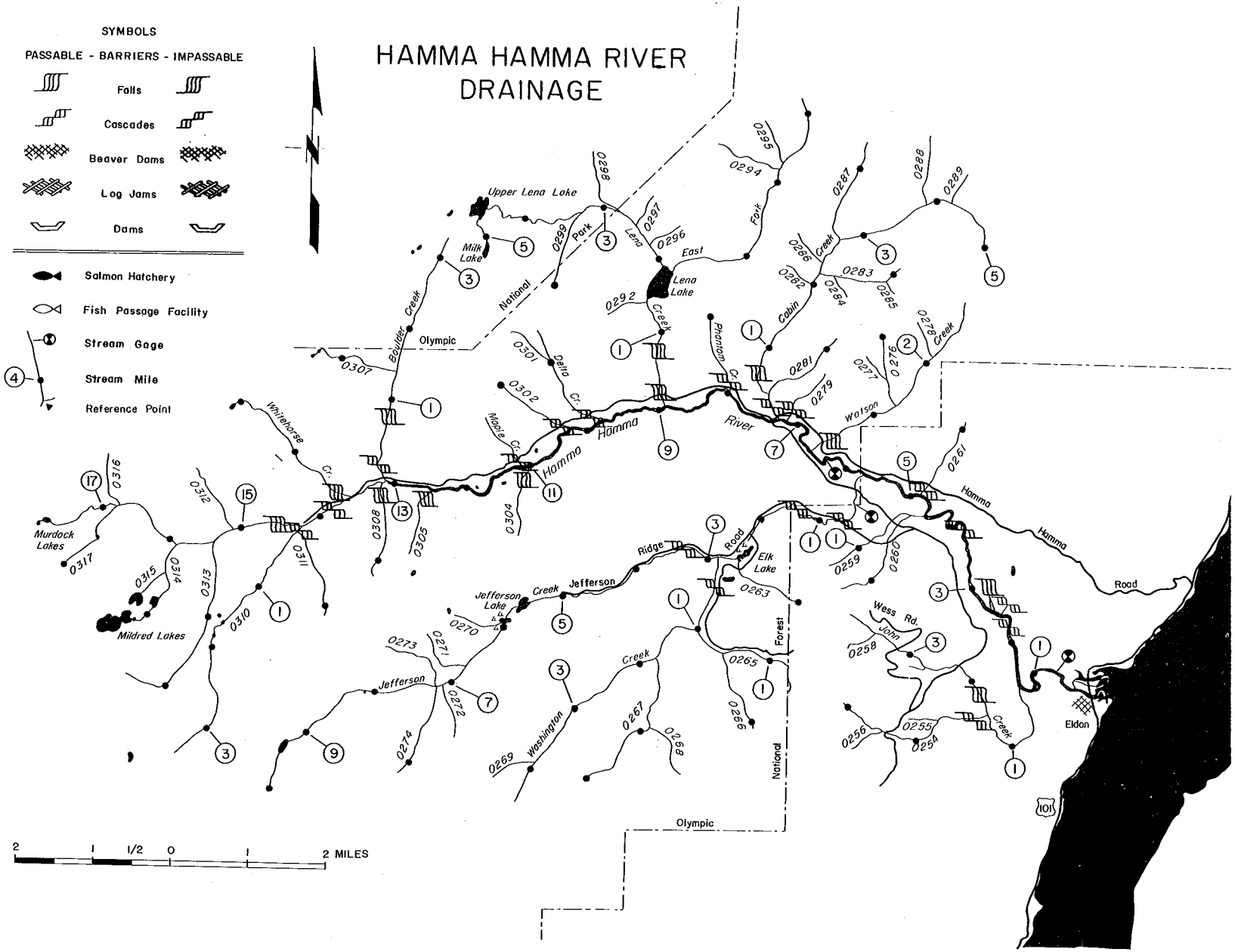
The following are expected funding needs for the Hamma Hamma River for the first five years following a designation as a Wild and Scenic River:

Table F-50. Estimated Cost of Management if Designated as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$18,000 92,100
	TOTAL	$110,100
Non-Recurring Costs	Cost of implementation Preparation of Management Plan 1/ Development costs 1/	$14,000 27,000 28,000
	TOTAL	$69,000
	TOTAL COST--FIRST FIVE YEARS	$179,100

Annual costs of administration, operation and maintenance is estimated at $8,200.

1/ Initial costs occurred in first 1 to 3 years following design


HAMMA HAMMA RIVER DRAINAGE
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Upper Lena Lake
Milk Lake
Lena Lake
Elk Lake
Jefferson Lake
Murdock Lakes
Mildred Lakes
Hamma Hamma River
Olympic National Forest
Eldon
2 1 1/2 0 1 2 MILES

MAIN STEM AND WEST FORK HUMPTULIPS

GENERAL SETTING

The combination main stem and West Fork Humptulips, is 60.8 miles in length from its source to its mouth. The upper 20 miles, from its source to R.M. 40.7, is within the National Forest boundary. For 18.5 miles of this distance, it flows through National Forest land. The remaining 1.6 miles is bordered by private land. Outside of the National Forest, the river flows through a variety of private ownerships in scattered parcels, State Department of Natural Resources, Washington Department of Wildlife, miscellaneous other State, and County lands. River mileage within the State Department of Natural Resources lands is 1.6 miles. Private ownership along the west fork is in large tracts, predominately being managed for timber production. Along the corridor of the main stem, the land ownership immediately adjacent to the river is generally in small tracts and individual ownership. Back from this "river front" the ownership shifts to a mix of small and large tracts, with the large tracts becoming about one-half of the acreage.

Acreage and mileage by ownership are summarized below. Acreage is based on a corridor one-quarter mile wide each side of the river. The National Forest acres were extracted from the planning map data base.

	West Fork		Main Stem	
Ownership	Miles	Acres	Miles	Acres
Within Forest Boundary				
National Forest	18.5	5,920		
Private	1.6	510		
Outside Forest Boundary				
National Forest	0.2	60		
State of Washington DNR	1.6	510		
Other State			1/ 2.8	450
County	0.1	30	1/ 0.4	50
Private	10.7	3,430	26.5	8,490
TOTAL	32.7	10,460	28.1	8,990

1/ Ownership on one side only.

Located in the southwest corner of the Olympic Peninsula, the Humptulips is the southernmost river on the west side of the Peninsula that flows directly into saltwater. The Humptulips is one of the few major rivers that rises in the Olympic Mountains, is entirely outside of the National Park, and does not have a major snowfield or glacier at its source. For much of its length, the slopes adjacent to the river are forested with dense stands of coniferous vegetation. Only in the very upper reaches of the West Fork is the stream gradient steep. By R.M. 57, the stream gradient has moderated to the extent that the river develops a meandering course, and some of the more hearty of the anadromous fish species reach this point. At R.M.

46, the river passes through the West Fork Humptulips Gorge. The combination of a narrow channel, rapids, and cascades through this section restricts the passage of most anadromous species. The East Fork of the Humptulips joins the West Fork to form the main stem at R.M. 28.1. From this point to its mouth, the river meanders through a broad, gentle-sloping plain. The river gradient is low. Long, gentle pools alternate with short riffle sections. Chinook and chum salmon spawn in the main stream and its many tributaries. Coho salmon utilize the tributaries. The Humptulips is significant regionally for its anadromous fish production. Fishing and associated uses make up the primary recreation use on the river, and within the river corridor. Hunting is a major seasonal use.

The Humptulips and West Fork are undergoing consideration as a Wild and Scenic River because it is on the Nationwide Rivers Inventory list, it was included in previous legislation and was identified during the scoping process.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Rushing waters, old-growth rain forest, visual variety generally common, except distinctive in upper reaches, extensive timber harvesting. This river was evaluated by Washington State Parks for inclusion in the State's Scenic Rivers system. **Average.**

Recreational - Camping and day use, limited hiking, extensive fishing (both bank and drift), hunting. **Above average.**

Geologic - West Fork Gorge (locally significant), meandering river system, steep, rugged mountains. **Above average.**

Fish - Regionally significant, three species of salmon, steelhead and sea-run cutthroat. Nearly 58 miles of the main stem and West Fork utilized by various species of anadromous fish. **Outstandingly remarkable.**

Wildlife - Elk, bear, deer and other game and nongame species. Bald eagles sighted throughout the year. Typical of west side Olympic drainages. **Above average.**

Historical - Limited evidence of splash dams associated with early logging. Early settlement in lower Humptulips Valley typical of region. Some mining in upper West Fork. **Average.**

Cultural - Use by American Indians prior to arrival of white man. Use typically along lower river corridor. No known sites. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The full length of the main stem and West Fork of the Humptulips are free of impoundments, diversions or major channel modification.

Shoreline Development - From its source to R.M. 58.1, timber harvesting has taken place on one or both sides of the stream for approximately 50 percent of its length. Extensive ongoing timber harvesting may be seen from the river. Campbell Campground is located at R.M. 57.5. From R.M. 58.1 to near R.M. 45, the evidence of timber harvesting is not as visible, as the riverbanks are quite high, often nearly perpendicular. Timber harvesting has generally been above the break in topography, or screened by hardwoods and conifers adjacent to the river.

Between R.M. 45 and R.M. 40.7, the National Forest boundary, evidence of past and ongoing timber harvesting can be seen in the background. Timber harvesting in the foreground has been planned to reduce the visual impacts. Below R.M. 40.7, evidence of timber harvesting is frequent and ongoing. From the confluence with the East Fork near R.M. 28 to its mouth, the ownership pattern becomes one of many small acreages. Houses, fields, pastureland, and small rural communities are evident.

Accessibility - From its source to R.M. 58.1, the river is readily accessible from the West Fork road which crosses the river near R.M. 60, and parallels it along the north side to near Campbell Campground. From R.M. 58 to the National Forest boundary,

R.M. 40.7, the main line roads are some distance from the river and generally out of sight. Access to the river is by spur roads that approach, but seldom reach the river. There is one bridge across the river at the gorge, but access to the river is nearly impossible at that point. From the National Forest boundary (R.M. 40.1) to its mouth, the river is readily accessible from State, county and private roads.

Water Quality - From its source to the National Forest boundary (R.M. 40.7), the water quality is "extraordinary," State Class AA. From that point to its mouth, the quality drops slightly to State Class A "excellent," due to the level of development and use along the river edge. Both classes meet State and Federal standards for aesthetics, fish and wildlife propagation and primary contact recreation (swimming).

Conclusion - The Humptulips and the West Fork meet the classification criteria for inclusion in the Wild and Scenic Rivers System. There is an "outstandingly remarkable" fish value. The Nationwide Rivers Inventory indicated that the scenic and recreational values were also outstandingly remarkable. These ratings are definitely too high. The key components to scenic values, mountains, cascading water, forests and the river itself, are at best, typical of this physiographic province. Recreational use is primarily linked to the fishery and wildlife resources, and is very seasonal. Again it is typical of this province. Other uses are seasonal (May-October) with recreational areas filled on weekends and holidays.

GENERAL DESCRIPTION OF RESOURCES

Lying entirely within the Olympic Mountains section of the Pacific Border Province, the Humptulips rises in the lower flanks of the southwest corner of the Olympic Peninsula. Elevations vary from near 3,200 feet at its source, to sea level where it enters Grays Harbor. Within four miles of its source, the river gradient becomes moderate and the sidewalls of the valley pull back from the river's edge, leaving a valley bottom nearly one-half mile wide. This valley bottom widens to over two miles across, near the National Forest boundary, and exits over a broad plain which extends to the ocean. The river has developed a meandering character throughout most of its length with areas of high, nearly vertical banks where it undercuts the slopes.

Stands of Pacific silver fir mixed with Alaska yellow cedar with an understory of huckleberry and devilsclub, are typical of the silver fir zone found in the very upper reaches of the river corridor. The river drops rapidly out of this zone, and upon reaching the point where the river gradient moderates, is well within the western hemlock zone. Western hemlock, western redcedar, Douglas-fir and Sitka spruce are the major conifer component of the stand. Red alder, big leaf maple, and black cottonwood occur primarily along the river edge and in wet lowlands. Huckleberry, vine maple, devilsclub, salal, Oregon grape, salmonberry and western thimbleberry are typical understory shrubs.

The entire length of the Humptulips is readily accessible by road. In its lower reaches, U.S. Highway 101, State Highway 109 and various county roads parallel, cross and recross the river. Numerous private roads reach or approach the river. Upstream from Highway 101 (R.M. 23.7), Forest Roads 22, 2204, 2208, 2208043, 2220, and numerous logging roads on private and State land access the river corridor.

Depending upon the segment of the river to be visited, the Humptulips can be as close as 10 miles, or as distant as 45 miles from Aberdeen and Hoquiam. From Olympia, it is 75-plus miles while Seattle is 135 miles distant. Chehalis-Centralia is about 100 miles, or a two-hour-plus drive.

Fishing, hunting, camping and day use are the primary uses within the river corridor. Floating the river, in association with fishing, is a significant use. Recreational boating, canoeing and rafting is an increasing use primarily downstream from Forest Road 22.

The Colonel Bob Wilderness Study Area became the Colonel Bob Wilderness as part of the Washington Wilderness Act. The south boundary of the Wilderness is within the river corridor in the vicinity of Tea Creek.

The private land within the National Forest boundary is being managed for timber production. Outside of the National Forest, the ownership and management along the river corridor is predominantly one of timber production, especially upstream from Highway 101 and the community of Humptulips. Downstream from that point to the river mouth, the pattern is one of rural and residential housing on small acreages, and individual lots with scattered parcels owned by various timber companies. The State Department of Wildlife has minor acreage within the corridor, as does the State Department of Natural Resources and Grays Harbor County.

Water - Based on a long-term record (over 50 years), the average annual discharge as measured at the USGS gauging station at R.M. 24.6, 3.3 miles downstream from the confluence of the east and west forks is 975,900 acre-feet per year, or 1,347 cfs. The drainage area upstream from the gauging station is 130 square miles. The total river drainage area is 245 square miles.

Maximum flows on the Humptulips are generally associated with warm "chinook" rains that follow early snows in November, December and January. The maximum flow at the gauging station occurred on January 22, 1935, with a flow of 33,000 cfs. The minimum flow of 82 cfs occurred on September 11, 1944. This is typical of the timing of low flows, late in the summer or early fall, following an extended period without rainfall.

While these represent the extremes, the more typical high and low flows would be in the range of 18,000 cfs to 19,000 cfs, and 130 cfs to 150 cfs.

Water for fish propagation is the major allocated use of the water from the Humptulips and West Fork. Other significant allocations have been made for domestic use and commercial-industrial use (see Table F-51).

Table F-51. Allocation of Water

Use Group	West Fork	Main stem
Fish propagation	--	62.47
Domestic		20.07
Commercial/Industrial		4.47
Irrigation		1.96
Recreation	0.10	
TOTAL	0.10	88.97

Hydropower potential for the National Forest portion of the river has been estimated to be 88.9 Gigawatts at the 330% exceedance level. One site in the West Fork Gorge, R.M. 46, has been identified. A proposal

by the City of Ocean Shores for a run-of-the-river project was dropped following application for a preliminary permit. No hydropower projects have been proposed on the main stem of the Humptulips.

Water quality is "extraordinary," State Class AA, from its source to R.M. 40.7. The increased level of development from R.M. 40.7 to the mouth of the river, has resulted in a reduction of the water quality to "excellent," State Class A. Generally, the waters are so clear that the river bottom can be seen except in the deepest pools. During periods of high rainfall or rapid snowmelt, the river will become murky, to a shade of brown, depending upon the intensity of the rainfall or rapidity of the snowmelt. Water temperatures are generally cool, except for two to three months during the summer when the water temperatures rise adequately to permit swimming and water play. Thus temperature, not water quality, is the limiting factor for primary contact use. Because the water quality is so good, fish and wildlife dependent upon the Humptulips and its environs thrive, and can often be seen by visitors to the river and river corridor.

Fish and Wildlife - Coho, chum, and chinook salmon, sea-run cutthroat trout, steelhead plus resident cutthroat trout, utilize the Humptulips system and many of its tributaries. Large numbers of chinook, chum and coho spawn in the main channel up to the lower end of the gorge.

Steelhead and possibly coho salmon will pass through the gorge, and utilize the river up to the area of Campbell Campground at R.M. 57.7.

Based on the anadromous fish habitat, the Humptulips and the West Fork systems have the estimated annual production of nearly 80,000 adult fish. Approximately 18 percent of this habitat capability is within the National Forest boundary. The remaining 82 percent is outside the National Forest on State, private and other ownerships. See Table F-52 for potential production capabilities.

Table F-52. Estimated Annual Habitat Production Capabilities for Anadromous Salmonids

Potential Parameters	Chinook	Coho	Steelhead	Sea-run Cutthroat
Spawning Populations				
National Forest	400	2,150	1,870	1,870
Private & Other	2,200	11,900	10,400	10,400
TOTAL	2,600	14,050	12,270	12,270
Smolt Production				
National Forest	56,000	80,000	32,000	32,000
Private & Others	311,000	444,000	178,000	178,000
TOTAL	367,000	524,000	210,000	210,000
Adult Production				
National Forest	2,410	6,370	2,800	2,800
Private & Others	10,980	29,020	12,760	12,760
TOTAL	13,390	35,390	15,560	15,560

NOTE: Production data for chum salmon is not included due to insufficient information.

Generally, all of the wildlife species found on the west side of the Olympic Peninsula can be found as residents of, or visitors to the river corridor. Some of the more common large animals are Roosevelt elk, black-tailed deer, black bear, cougar, coyote and bobcat. Smaller mammals include racoon, mink, beaver, mountain beaver, rabbit and skunk.

The valley bottoms, south slopes and river corridors provide winter range for big game, mainly elk and deer, from the vicinity of Campbell Tree Grove, R.M. 57.5, downstream.

Blue grouse, ruffed grouse and pigeons are common game birds found in the area. Ducks, ospreys, eagles, kingfishers and a variety of water birds inhabit the water edge and adjacent river corridor. The northern bald eagle is the only threatened wildlife species known to inhabit the area. The old-growth timber in the upper west fork, adjacent Moonlight Dome Special Management Area and the Colonel Bob Wilderness, is suitable habitat for the northern spotted owl, a sensitive species.

The riparian habitat in the reaches upstream from Highway 101 is generally in excellent condition, with only a few areas where the habitat has been significantly modified. Downstream from Highway 101, the riparian zone tends to become increasingly modified as the acreages become smaller, and individual building lots increase.

Recreation - Recreational use on the river, and within the river corridor, tends to fall into three use areas. One group is directly dependent upon the river for fishing, both from the shore and by drift boat. Another group is associated with the river but not dependent upon it, such as for camping, picnicking, hiking and other day use. The third user group would probably occur even if the river wasn't there; i.e., hunting, mushroom picking and driving for pleasure.

Within the Humptulips River corridor, most of these activities will occur within the ROS classification of Roaded Modified. Only in the lower reaches, does the level of development increase to the extent that the recreation opportunity would be classified as Rural.

Nine developed sites occur along the river. The Department of Wildlife has six boat launch sites with launch and parking facilities. Campbell Tree Grove Campground, within the Olympic National Forest, provides a rustic camping opportunity. (See Table F-53.)

Table F-53. Developed Recreation Sites

National Forest Sites:					
Site	ROS Class	Capacity PAOT	Managed Season Days	1988 Use RVD's	Projected Capacity PAOT
Campbell Tree Grove	Roaded	60	191	1300	125
Other Agency Sites (Boat Launch Sites):					
Site	Managing Agency	Approximate River Miles	Boat Launch	Comments	
Wilderness	WDW	6.2	1	Parking	
Dike Road	ITT	7.9	1	Rough launch/parking	
Damon Creek	GH	10.3	1	Rough launch/limited parking	
Gravel Bunker	WDW	12.2	1	Rough launch/no parking	
Weyerhauser	WTC	13.4	1	Rough launch/limited parking	
Walker Road	WDW	16.8	1	Limited parking	
Railroad Bridge	WDW	23.0	1	Parking	
East Humptulips Road	WDW	24.8	1	Rough launch/limited parking	
Brittain Creek	GH	25.7	1	Rough launch/limited parking	

Numerous undeveloped, informal camping, picnicking, general day use and boat launch sites exist along the river. In 1988 there was an estimated 4,500 Recreation Visitor Days (RVDs) of dispersed recreation use in the National Forest segments of the west fork corridor.

Opportunities for drift boating, rafting, canoeing and other forms of river floating is extensive. Put-in sites are available along the river, up to the concrete bridge on Forest Road 22 (R.M. 36.5).

Because of the flat gradient, there is only limited white water. No extensive skills are required to float the river. Additional developed boat launch facilities along the lower West Fork and main stem Humptulips should be developed to accommodate potential use.

A 3-mile section of the old West Fork Trail between the West Fork shelter remains to this day. It basically follows the river edge and provides a river oriented experience. No other riverside trails exist except the boot-worn fisherman trails that have come into existence through use over a number of years. One access trail, the Lower Petes Creek Trail, reaches the river near R.M. 53.6. There is a proposal to extend the West Fork Trail by an additional 10 miles, utilizing any remains of the old West Fork Trail that fit into the system. This will ultimately provide a trail from the West Fork Gorge to the West Fork slide, a total of 14 miles of riverside trail.

Table F-54. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	1,300	1,600
Undeveloped Recreation	41,500	47,400
Boating (flatwater, whitewater)	Light	Light
Water Play (swim, wade)	Light	Light
Fishing	Light	Light
Hunting	High	High
Camping	Light	Moderate
Hiking	Light	Moderate
Picnicking	Light	Moderate
Viewing Scenery	Light	Moderate
TOTAL	5,800	7,100

Historical/Cultural - Knowledge of use by Indians is very limited. It is known that fishing for salmon and steelhead along the lower reaches of the Humptulips was done by bands and members of the Humptulips. While permanent villages probably existed along the lower Humptulips, not much is known about any specific sites. Considering the extremely rugged terrain, severe cliffs and sidewall canyons, it would not seem likely that significant use occurred very far upstream, especially since resources were plentiful for many river miles downstream to Grays Harbor.

Early logging, in the West Fork Drainage (about 1909), utilized splash dams to assist in transporting logs down the West Fork and Humptulips Rivers. Little evidence remains of these structures. 26/

Minerals/Energy - Following the outbreak of World War II and the increase in demand for manganese, a flurry of minerals exploration occurred within the Humptulips Drainage. The historic Campbell Mine is a remnant of this effort. No claims were patented and current mining activity is dormant. The potential for any locatable minerals of commercial value is extremely low.

Oil and gas exploration in the Grays Harbor area dates back to 1901, and has continued on an intermittent basis since that time. In 1922, the first well within the river corridor was drilled near R.M. 3.5. A trace of natural gas was found. While other drilling has occurred within the general area, none has been within the river corridor. 27/

In the early 1980's, a renewed interest resulted in leases being issued for nearly all of the National Forest lands within the Humptulips Drainage. Following limited seismic exploration, nearly all of the leases were allowed to lapse. Due to the geologic formation within this area, the potential for future exploration and possible production remains fairly speculative.

Common variety mineral material, utilized for crushed road rock, is a valuable resource found within the river corridor. Within the National Forest, four existing rock sources are located on the river terraces within the corridor. These are key in providing surfacing for roads in the area. A number of similar sites exist on State and private lands outside of the Forest boundary. Most of these are sited on gravel bars or old river terraces.

26/ Olympic National Forest 1978.
27/ McFarland 1983.

Timber - Timber types, standing volumes and potential yields from all National Forest lands tentatively suitable within the river corridor, are displayed in Tables F-56, F-57 and F-58. Acres of timber-producing lands within private and State of Washington ownership are discussed later and displayed in Table F-59.

The potential for any significant insect or disease outbreak is low. The 1987 Insect and Disease Survey indicated there were no significant problems within the river corridor at this time.

Transportation/Roads - The existing network of Federal, State, county, and private roads that parallel, cross, recross and access the river and its corridor is adequate to meet the objectives of a Recreational River. Acquiring and providing public boat launch facilities needs to be evaluated in detail throughout the main stem and lower West Fork.

Nearly all roads within, or accessing the river corridor has a mix of timber haul and recreational traffic. The existing roads are generally adequate to accommodate the current and projected use without any unacceptable conflicts.

Table F-55. Summary of National Forest Acres

Wilderness	80
Unsuitable	1,674
Tentatively Suitable	4,166
TOTAL	5,920

Table F-56. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1-2.9" DBH)	SS Seedling-Sapling (3.0-4.9" DBH)	PL Poles (5.0-8.9" DBH)	MS Small Saw (9.0-20.9" DBH)	LS Large Saw (21+" DBH)
High	297	185	527	55	1811
Medium	76	251	97	164	452
Low					251
TOTAL	373	436	624	219	2514

Table F-57. Tentatively Suitable Standing Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High	1,811	11.50	20,826	90,593	55	6.92	381	1,657	527	4.56	2,403	10,453
Medium	452	11.50	5,198	22,611	164	6.92	1,135	4,937	97	3.09	300	1,305
Low	251	7.45	1,870	8,134								
TOTAL	2,514		28,894	121,338	219		1,516	6,594	624		2,703	11,758

Summary: 32,113 MCF or 32.1 MMCF
139,692 MBF or 139.7 MMBF

Table F-58. Tentatively Suitable Land Potential Yield by Site and Elevation

	<1,500' Elevation (Winter Range)				>1,500' Elevation (Summer Range)			
Site/ Productivity	CF/Acre/ Year	Acres	MCF/Year	MBF/Year	CF/Acre/ Year	Acres	MCF/Year	MBF/Year
High	172.14	2,672	459.96	2,000.83	200.51	203	40.70	177.04
Medium	121.24	825	100.02	435.09	139.43	215	29.98	130.41
Low	67.35	139	9.36	40.72	77.43	112	8.67	37.71
TOTAL		3,636	569.34	2,476.64		530	79.35	345.16

Summary: 648.69 MCF/Year
2,821.80 MBF/Year

NON-FEDERAL LANDOWNERSHIP AND USES

State of Washington DNR lands within the river corridor are being managed to maximize timber production and return to the State, while meeting constraints and mitigation required adjacent to a major river such as the Humptulips. The majority of private ownership is within large timberland holdings. Timber management on these lands, and many of the smaller ownerships, is the predominant use. A limited agriculture base, along with large residential tracts and individual lots, comprise the remainder of the land uses except for a few commercial sites and public recreational facilities. A summary is displayed in Table F-58.

The existing and projected landownership pattern, and uses within the river corridor upstream from U.S. Highway 101 is consistent with the classification of Recreational River. Over time, it would be desirable to obtain the private timber lands within the National Forest boundary.

Downstream from the Highway 101 bridge, the existing ownership and use pattern currently is consistent with the classification of Recreation River. Due to its proximity to the Grays Harbor communities and potential for development, a use pattern inconsistent with a Recreation River could develop in the foreseeable future. Acquisition to provide public access to the river, or to reduce potential conflicts, would be very expensive.

Table F-59. Non-Federal Landownership Estimated Land Use by Percent 1/

	Residential Lots	Acreage/ Agriculture	Timberlands	Other
Within N.F. boundary				
Timber companies			100	
Outside N.F. boundary				
Private				
Individuals	5	20	74	1
Timber companies 2/			100	
State				
DNR			100	
Other State				100
County/Municipal				100

1/ Data based on 1979 Metskers Atlas and Grays Harbor County Assessors Office records.
2/ Including holding companies.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

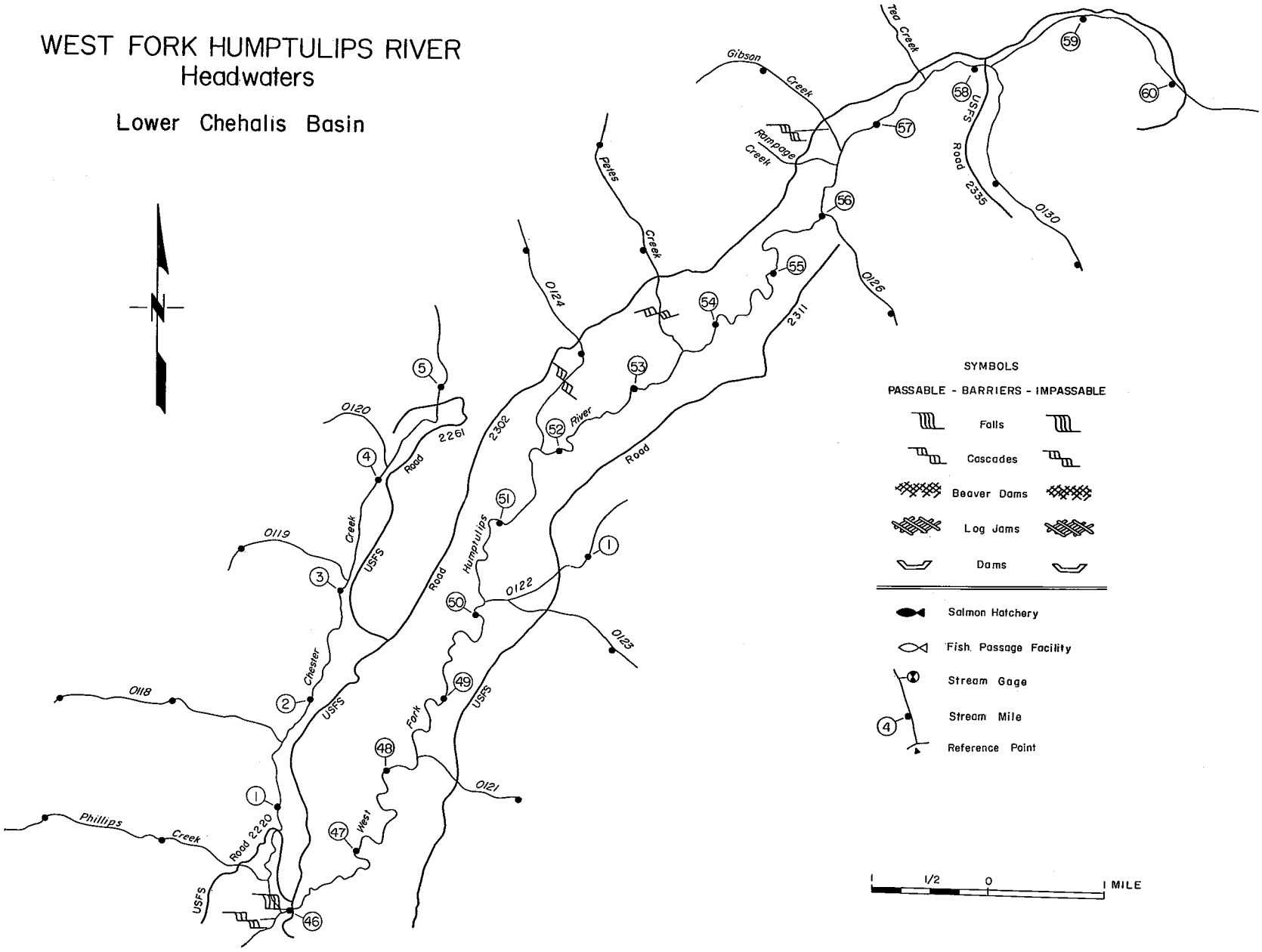
The following are expected funding needs for the Main Stem and West Fork of the Humptulips for the first five years following a designation as a Wild and Scenic River:

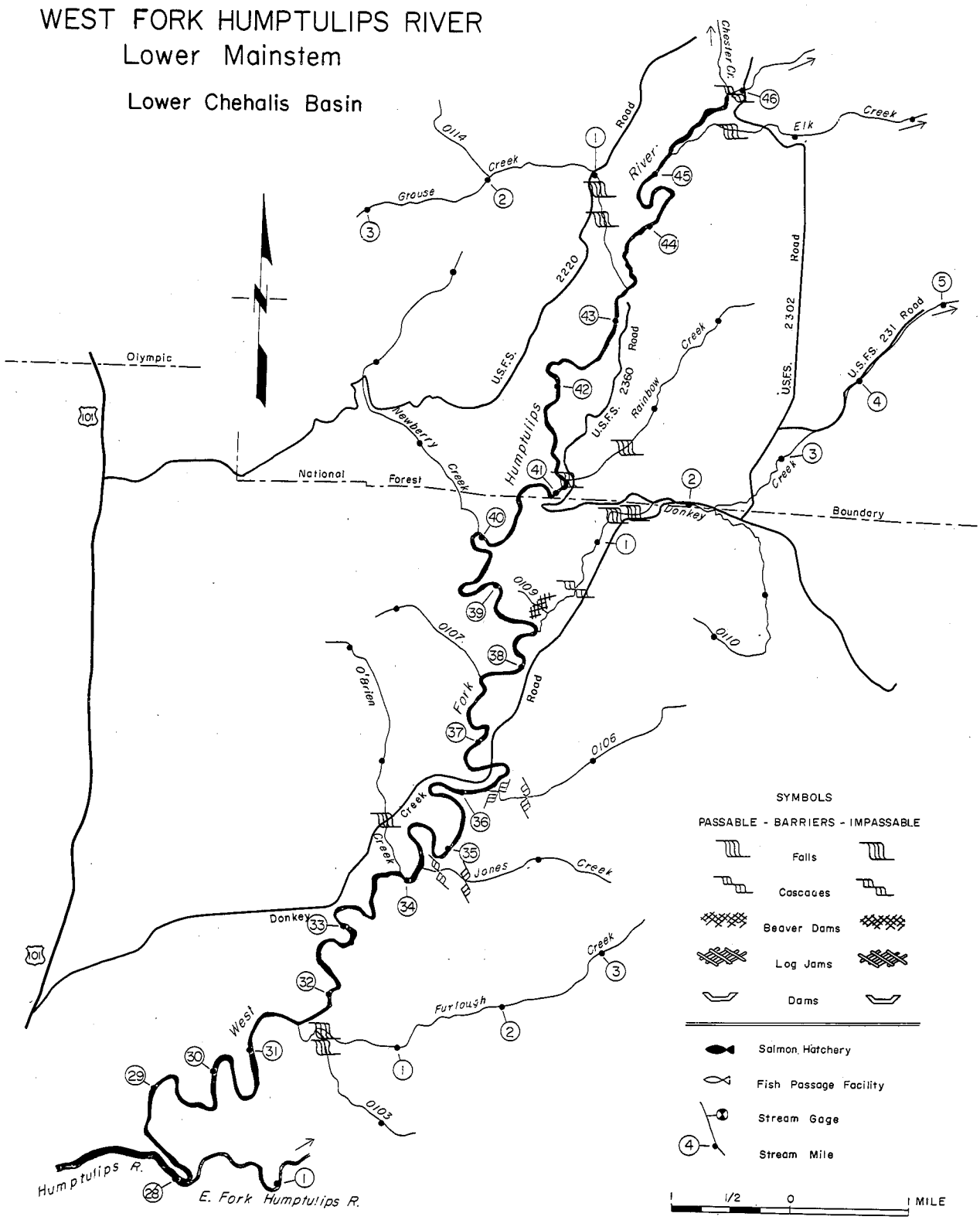
Table F-60. Estimated Cost of Management if Designated as a Wild and Scenic River

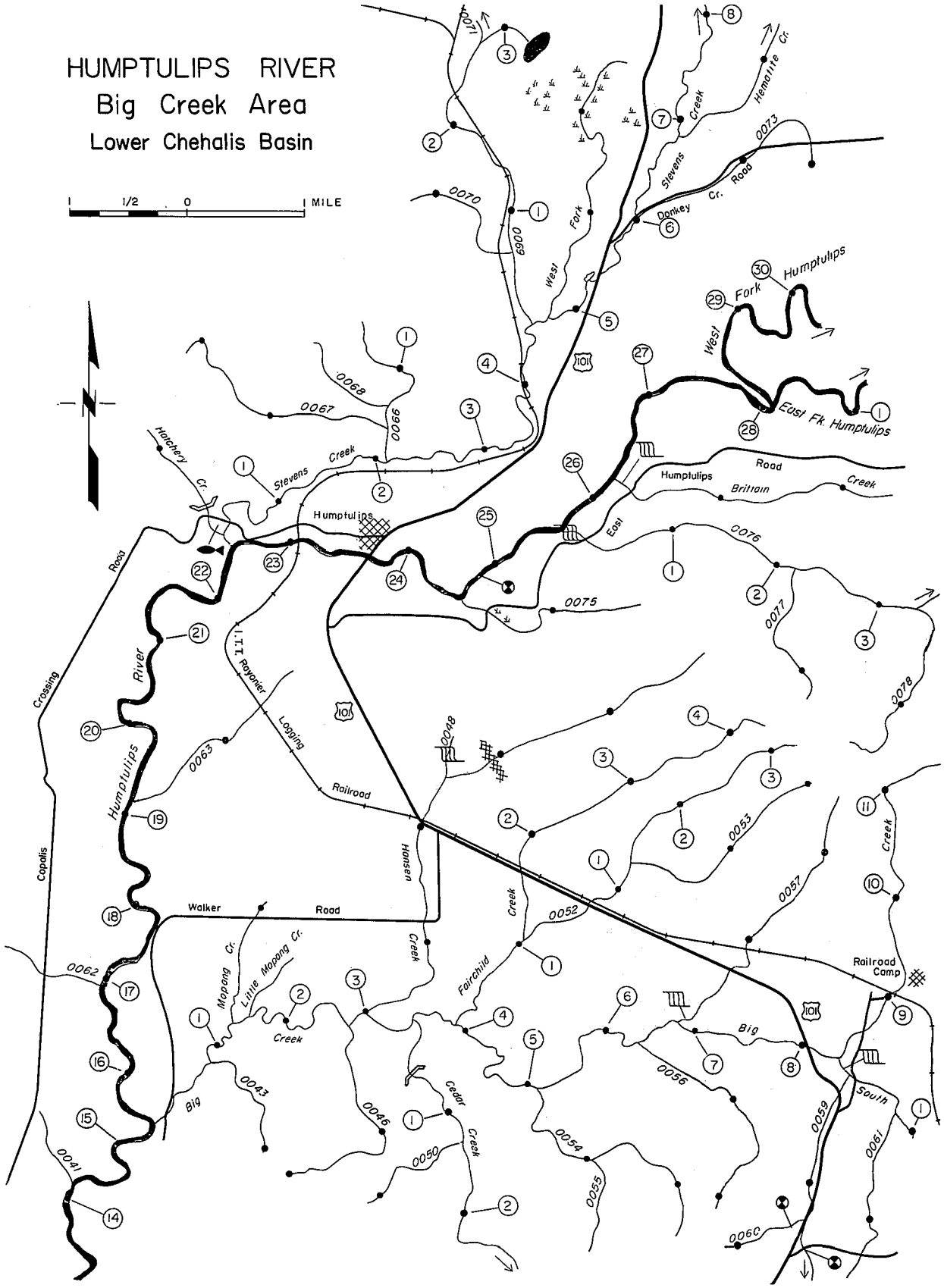
Annual Costs	General Administration Operation and Maintenance	$18,000 39,500
	TOTAL	$57,500
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan 1/ Development costs	$10,000 22,000 123,000
	TOTAL	$155,000
	TOTAL COST--FIRST FIVE YEARS	$212,500

1/ Costs primarily in years 1 and 2.

The projected, annual, general administration, and operation and maintenance cost would continue at an estimated $7,500 per year.


WEST FORK HUMPTULIPS RIVER
Headwaters
Lower Chehalis Basin
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1 MILE
Tea Creek
Gibson Creek
Rampage Creek
Pates Creek
USFS Road 2335
0130
0126
2311
0124
0120
2261
Road
2302
River
Road
0119
Creek
USFS
Humptulips
0122
0123
Chester
0118
USFS
Fork
USFS
0121
Phillips Creek
Road 2220
West
USFS


WEST FORK HUMPTULIPS RIVER
Lower Mainstem
Lower Chehalis Basin
Olympic
National Forest Boundary
Chester Cr.
Elk Creek
Road
River
Grouse Creek
0114
2220
U.S.F.S.
2360 Road
Rainbow Creek
2302 Road
U.S.F.S. 231 Road
Newberry Creek
Humptulips
Donkey Creek
0109
0107
0110
O'Brien Creek
Fork Road
0106
Jones Creek
Furlough Creek
West
0103
Humptulips R.
E. Fork Humptulips R.
101
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
1 1/2 0 1 MILE


HUMPTULIPS RIVER
Big Creek Area
Lower Chehalis Basin
1/2
0
1 MILE
Hatchery Cr.
Stevens Creek
Humptulips
Road
Crossing
Copalis
River
Humptulips
Walker Road
Mopang Cr.
Little Mopang Cr.
Big Creek
Hansen Creek
I.T.T. Rayonier Logging Railroad
Fairchild Creek
Cedar Creek
Donkey Cr.
Stevens Creek Road
West Fork Humptulips
East Fk. Humptulips
East Humptulips Road
Britain Creek
Hemline Cr.
Big South Creek
Railroad Camp

SOLEDUCK

GENERAL SETTING

With a total length of 64.9 miles, the Soleduck is one of the longest rivers on the Olympic Peninsula. From its source in the Mt. Appleton-High Divide-Seven Lakes Basin area, to its merger with the Bogachiel to form the Quillayute River, there are 13.9 miles within the Olympic National Park, (5.3 miles where the river is the boundary between Olympic National Park and Olympic National Forest, 11.1 miles fully within the National Forest). The remaining 34.6 miles flows through private and State Department of Natural Resources lands, with approximately 65 percent private and 35 percent State.

Mileage and acreage by ownership are summarized below. Acreage is based on a corridor one-quarter mile each side of the river. River mileages and associated acreages were developed from: a catalog of western streams, Metskers atlas of Clallam County, Olympic National Forest Map Base and Clallam County Records.

Ownership	Miles	Acres
Olympic National Park	16.6	5,300
Olympic National Forest	7.5	2,430
State of Washington DNR		
within National Forest boundary	2.1	670
outside National Forest boundary	12.2	3,920
Other State and County	0.2	50
Private		
within National Forest boundary	4.2	1,330
outside National Forest boundary	22.1	7,070
TOTAL	64.9	20,770

The Soleduck River, and its tributaries, form one of the major river systems within the northwest corner of the Olympic Peninsula. Rising near the heart of the Olympics, the Soleduck initially flows northwesterly towards the Strait of Juan de Fuca. The stream gradient is steep, with numerous falls and cascades within the upper watershed. The stream gradient moderates below Soleduck Falls. Upon reaching the Soleduck Valley, R.M. 51 28/, the river bends to the west and river gradients moderate further. Near the community of Sappho, R.M. 32, the river bends to the southwest for its remaining distance to the Quillayute River, just 5.6 miles from the ocean.

Known regionally and nationally for its salmon and steelhead production, the Soleduck River and its tributaries are utilized by all five species of salmon. Fishermen from throughout the northwest travel to the Soleduck to try their luck.

During the summer months, campers and hikers from near and far visit the Olympic Peninsula, the Rain Forest and the Soleduck River Valley.

28/ All river miles (R.M.) are expressed from the mouth of the Quillayute River. This is 5.6 miles downstream from the confluence of the Soleduck and Bogachial.

The Soleduck River is being evaluated as a potential addition to the Wild and Scenic Rivers System because of identification as an issue early in the process, its inclusion as a river in the HCRS inventory, and its inclusion in previous Wild and Scenic River legislation.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Generally common landscape features except in upper reaches. Limited vistas of rugged interior of Olympics. Rain forest, typical of west side of Olympic Peninsula. **Average.** This river was identified by Washington State Parks for evaluation for inclusion in the State's Scenic Rivers system.

Recreational - Most use associated with seasonal camping and hiking visits to the Olympic Rain Forest. Similar to other rain forest drainages on Olympic Peninsula. Sol Duc Hot Springs known regionally. Drift fishing on the Soleduck. Limited rafting. **Above average.**

Geologic - Sol Duc Hot Springs at R.M. 62.3. Well known; of regional significance. **Above average.**

Fish. Known regionally, if not nationally, for its winter steelhead. Utilized by all five species of salmon. Major contributor to salmon production. **Outstandingly remarkable.**

Wildlife - Significant populations of Roosevelt elk are found throughout the river corridor. Eagles are seen occasionally. **Above average.**

Historical - Settlement similar to other coastal and cascade valleys, except that it occurred later. No specific historical significance. Early recreation use of Hot Spring and associated hotels and construction of recreation facilities is important and unique to this area. **Average.**

Cultural - American Indian use prior to settlement of the area by white man. Sites probably exist throughout river corridor. Some noteworthy sites have been located by the National Park Service in Seven Lakes Basin. **Above average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - The Soleduck River is entirely free of impoundments.

Shoreline Development - From its source, to near R.M. 63.6, the river corridor is essentially primitive with little or no evidence of man's activities. Downstream from this point to near R.M. 56.6, there is some evidence of human activity primarily associated with the facilities at Sol Duc Hot Springs (R.M. 62.3) and Soleduck Campground. Between R.M. 56.6 and 51.3, evidence of timber harvesting can be seen to the west of the river. Little, if any timber harvesting has occurred within the river foreground within recent years. From the point where the river enters the Soleduck Valley, approximately R.M. 51, and turns westerly, the mix of private, State Department of Natural Resources and National Forest lands creates a mosaic of land ownership and uses. Residential lots and homes are in greater number in the segment from the National Forest boundary to the Highway 101 bridge (R.M. 40.2 28.8) and, to a lesser degree, near the confluence of the Soleduck and Bogachiel. Evidence of human activity is frequently seen; individual houses, clusters of houses and commercial structures, campgrounds and boat launch facilities. Evidence of past or ongoing timber harvest may be seen in the distance, as well as within the river corridor. Fields and farm outbuildings can be seen in a few locations.

Accessibility - Access beyond the end of the National Park road (R.M. 63.6) is by trail. From R.M. 63.6 to R.M. 54.5, the road to Sol Duc Hot Springs is along the east bank of the river and often visible. A Forest

road spans the river less than a half mile above the point where Goodman Creek enters the Soleduck. This road follows the river along the west bank until it crosses the South Fork of the Soleduck, near R.M. 54.5, then it turns away from the main stem of the Soleduck.

Downriver from R.M. 51 to its confluence with the Quillayute, the river is immediately adjacent to, crossed by, or accessed from Highway 101, other State highways, County, National Forest, State Department of Natural Resources, and private roads.

Water Quality - The water quality of this river is rated Class AA, "extraordinary," from its source to its mouth.

Conclusion - The Soleduck River has an "outstandingly remarkable" fish value. This river meets classification criteria from its source to the mouth. The Soleduck is eligible for Wild and Scenic River classification.

GENERAL DESCRIPTION OF RESOURCES

The Soleduck River originates from many small tributaries in the ridges, which divide the Soleduck from the Bogachiel and Elwha watersheds. From its source, the river flows in a series of falls and cascades through a narrow valley to Soleduck Falls. Below Soleduck Falls, the gradient moderates and the river contains numerous riffles and pools. The largest tributaries in the headwaters area are North Fork Soleduck, South Fork Soleduck and Alckee Creek.

From the South Fork Soleduck River to the vicinity of Littleton, the Soleduck River is primarily confined to a narrow valley. It is composed of a mixture of pools and riffles with occasional rapids. Major tributaries in this reach include Snider, Kugel, Camp, and Goodman Creeks.

The Soleduck continues flowing in a narrow channel composed of pools and riffles with occasional rapids, down to its confluence with the Bogachiel River. Only one major tributary, Gunderson Creek, exists in the first 18 river miles. Numerous tributaries flow into the Soleduck above R.M. 18. Adjacent land in the lower reaches is quite flat.

Some activity has occurred near the Soleduck, however, generally good streambank cover is provided throughout. The subalpine zone occurs at the headwaters. The river then flows through the Pacific fir zone, the Douglas-fir-western hemlock zone, and finally the coastal spruce zone below about 800 feet elevation. Hardwoods and understory vegetation are thick, especially in the lower reaches.

Access to the Soleduck River is provided by National Forest, Park, county, and State roads, U.S. Highway 101 and trails. Within Olympic National Park, the upper reaches are accessed by trails. From U.S. Highway 101 to the Soleduck resort, the Park road parallels the east side of the river. A Forest road follows the east side of the river, then crosses over near R.M. 53.5.

It follows the west side up to about R.M. 56, where it turns south. U.S. Highway 101 follows the river from R.M. 50 to 18, crossing the river five times. State and private roads also access the river through this portion. The Quillayute and LaPush roads are the major access routes in the lower reaches of the Soleduck.

The Soleduck River is quite remote. The largest town in the vicinity is Forks, population 3,000. Forks has named itself the "Logging Capital of the World." Port Angeles, population 17,000, lies 60 miles east of Forks. Aberdeen and Hoquiam lie about 110 miles to the south. A drive from the Seattle area to the Forks vicinity takes about three to four hours.

Fishing, hiking, camping, and picnicking are the primary uses on the Soleduck River. Deer and elk hunting also occur. Primary river use involves drift boat fishing and a very minor amount of rafting and floating. The river receives international attention by salmon, and especially steelhead fisherman. Fly-fishing is popular.

Olympic National Park manages the Soleduck's upper reaches. Maintenance of the natural ecosystem, for enjoyment by the people, summarizes the Park's objectives.

Streamside management protection for a Class I stream would apply. 29/ Since the HCRS inventory, National Forest lands within the corridor have been managed so as not to preclude its potential inclusion in the Wild and Scenic Rivers System.

Below the National Forest to the confluence with the Bogachiel, the corridor ownership includes the State, ITT Rayonier, Peninsula Plywood, and private individuals. Very little cutting or other activity has occurred adjacent to the river, and few activities are visible.

Water - Water quality in the Soleduck River is rated Class AA, "extraordinary," by the State Water Pollution Control Commission. During summer low flows, water clarity is outstanding. Clarity is reduced during heavy winter rains. Water temperature is cool throughout the year.

Two gauging stations, located at R.M. 13.6 and 54.6, provide streamflow data for the Soleduck River. Pertinent data from these stations are listed below.

Table F-61. Streamflow Data

River Mile	Drainage Acres Square Miles	Average Annual Flow, cfs	Maximum Flow cfs and Date	Minimum Flow cfs and Date
13.6	219.0	1,380	30,100 - 12/17/49	
9				193 - 10/15/79
54.6	83.8	621	23,500 - 11/26/49	51 - Unknown

Generally, drainages exhibit two peak flows. However, on west side drainages such as the Soleduck, the peaks blend into one, long peak. Maximum flows occur in December and January. Average annual precipitation in Forks is 117 inches.

No significant water use occurs on the Soleduck. A State salmon hatchery lies at R.M. 29.8, left bank. The Olympic National Park facilities utilize a small amount. Incidental use on private land also occurs.

Hydropower potential for the river portion within the Olympic National Forest boundaries has been estimated to be 185.9 Gigawatts per year at the 30% exceedance level. However, currently no hydroelectric power proposals have been filed for the Soleduck River.

Geology - The Soleduck River flows southwest through a valley cut in marine sedimentary "core" rocks of the Western Olympic Lithic Assemblage (formational names after Tabor and Cady, 1978). At R.M. 66, the Soleduck flows into a broad valley underlain by glaciofluvial (outwash) deposits. The river passes

29/ USDA Forest Service, FSM 2526, 1980.

Sole Duc Hot Springs, one of two known geothermal occurrences on the Olympic Peninsula, at R.M. 62.5. Just downstream from R.M. 58, the Soleduck crosses the Calawah Fault, along which Olympic "core" rocks were thrust beneath volcanic and volcaniclastic "peripheral" rocks. Downstream from R.M. 58, volcanic sandstone and mudstone in the valley walls are part of the Blue Mountain Unit. At R.M. 56, the Soleduck crosses a fault into a wedge of undifferentiated sedimentary "core" rocks. At R.M. 52, the river crosses another fault where it leaves the glaciofluvial and alluvial deposits filling the valley bottom and is cutting a narrow canyon through sedimentary rock. Half a mile downstream, the Soleduck crosses the Hurricane Ridge Fault (a thrust fault similar to the Calawah Fault) back into the Blue Mountain Unit, and then leaves the canyon and flows into a broad valley underlain by continental glacial deposits. The river approximately follows the contact between rock and continental glacial deposits until R.M. 50, where it flows north and west out into the center of the valley. The Soleduck meanders back and forth across the broad valley to R.M. 45, where it is directed due west by Crescent basalts on Snider Ridge. At Snider Work Center (R.M. 44) the river turns south, flows around the end of a knife-edge ridge of coarse-grained sedimentary rock, and then follows a meandering course to its confluence with the Quillayute.

Fish and Wildlife - Chinook, coho, pink, sockeye and chum salmon inhabit the Soleduck River and its major tributaries. The Soleduck watershed contains 262 miles of stream, of which over 118 miles are presently used by salmon species.

Chinook, a major run of pink and some chum, use the lower 13 miles for spawning and rearing. Excellent salmon-producing areas occur from R.M. 19 to 43, particularly between Tassel Creek and Lake Creek. Good salmon habitat extends to R.M. 64.9, Soleduck Falls. Upstream migration can be impeded by Salmon Cascades at R.M. 56.5 during both high and low flows.

Summer run coho deserve special mention. These coho come in early and spawn early. Also of interest, landlocked Dolly Varden occur in the upper Soleduck. Resident trout also inhabit the Soleduck River and its major tributaries.

Based on the anadromous fish habitat, the Soleduck River and its tributaries have the estimated capability to produce 66,200 adult fish annually. Approximately 35 percent of this habitat capability is within the National Forest. Table F-62 summarizes potential fish production.

Generally, all of the wildlife species found along the west slopes of the Olympics inhabit the Soleduck drainage and periodically use the river corridors. Roosevelt elk are a popular game species utilizing river bottoms in winter. The Columbian black-tailed deer is the most abundant game species. Black bear, cougar, coyote, bobcats, and small nongame animals also inhabit the corridor. The northern bald eagle is the only threatened species known to inhabit the area.

Riparian habitat along the Soleduck River is generally in excellent condition. Little active development has occurred adjacent to the river. A few scattered residences are located along the streambank, primarily in the lower reaches. More development has occurred adjacent to tributaries of the Soleduck. This development consists mostly of logging and road construction.

Table F-62. Estimated Annual Habitat Production Capabilities for Anadromous Salmonids

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Spring chinook	NF Other	500 930	70,000 130,000	3,010 5,590
	TOTAL	1,430	200,000	8,600
Fall chinook	NF Other	860 1,600	120,400 223,600	5,180 9,620
	TOTAL	2,460	344,000	14,800
Coho	NF Other	1,400 2,600	51,800 96,200	4,140 7,690
	TOTAL	4,000	148,000	11,830
Chum	NF Other	700 1,300	157,500 292,500	1,420 2,640
	TOTAL	2,000	450,000	4,060
Steelhead	NF Other	3,160 5,870	54,130 100,530	4,710 8,750
	TOTAL	9,030	154,660	13,460
Cutthroat	NF Other	3,160 5,870	54,130 100,530	4,710 8,750
	TOTAL	9,030	154,660	13,460
All	NF Other	9,780 18,170	507,960 943,360	23,170 43,040
	TOTAL	27,950	1,451,320	66,210

Recreation - Campgrounds and boat launch sites provide many recreation opportunities along the Soleduck River. The headwaters area is accessed by trails. Hunter and fisherman trails also occur throughout the river corridor. Primary contact use, for the most part, involves drift boat fishing in the middle and lower stretch of river. A very minor amount of rafting occurs, due to the rough character of the river. It is only marginally suited for even the most serious kayakers due to large rocks, and other hazards, especially in the upper reaches. Tables F-63 a. and F-63 b. summarize the campgrounds and boat launch facilities within the river corridor. Sol Duc Hot Springs, one of two geothermal occurrences on the Olympic Peninsula located near R.M. 62.3, is within the National Park. A National Park concessionaire operates Soleduck Resort. Cabins, a snack bar, and groceries are available. Pools at the resort are a major attraction. Hot Springs water, mixed with natural water fill three small pools to different temperatures. A larger pool of natural water is also at the resort.

Table F-63. Developed Recreation Sites

Table F-63 a. Campgrounds

National Forest Sites					
Site	ROS Class	Capacity PAOT	Managed Season Days	1988 Use RVDs	Projected Capacity PAOT
Klahowya	Roaded	275	180	19,000	475
Other Agency Sites					
Site	Managing Agency	Acres	Camping Units	Managed Season	1988 Use: Camping Visits
Soleduck	ONP	42	84	5/11 - 11/15	14,470
Bear Creek	DNR	10	10	Year Round	1,950
Tumbling Rapids	ITT 1/	5	10	Year Round	850

Table F-63 b. Boat Launch Sites

Site	Managing Agency	Approximate River Miles	Boat Launch	Comments
Klahowya	ONF	43.8, left	1	Parking, within campgroud
Soleduck Hatchery	WDF	30, left	1	Visitor Center
Iverson Access	WDW	23, right	2	Parking
Soleduck Salmon Hatchery	WDW, WDF	30, right	1	Parking, rough boat launch
Soleduck River Access	WDW	39, right	1	
Soleduck River Access	WDW	13, right	1	Rough boat launch
Soleduck River Access	WDW	19, left	1	Parking
Lyendecker	WDW	6, left	1	Parking, rough boat launch

1/ ITT--Rayonier

Expansion of Klahowya Campground is planned as use levels currently indicate a need for additional units. Timing will depend upon priorities and funding. ITT-Rayonier plans to expand their Tumbling Rapids site in the foreseeable future. Washington State Parks is currently in the planning stage for a new park, Soleduck Corridor, near the community of Sappho. The site is approximately 466 acres in size. If designated as Wild and Scenic, an additional public access should be provided near R.M. 51. Estimated use within the National Forest segments of the river corridor are shown in table F-64.

Trails adjacent to the Soleduck Campground begin at the resort and at the end of the Park road. The "Lovers Lane" trail starts at the resort and continues 2.8 miles to Soleduck Falls. The main trail along the river begins at the end of the road, and travels .7 miles to Soleduck Falls and 8.5 miles to High Divide. Soleduck Falls is a popular spot for viewing salmon in the fall. The latest use figures showed over 2,300 visits were recorded at the Soleduck trailhead. No other trails exist within the river corridor. However, a 6-mile trail is planned along Highway 101 from the Snider area to the Littleton area.

Table F-64. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1986	2000
National Forest Developed Sites	19,000	22,000
Undeveloped Recreation	700	1,000
Boating (flatwater, whitewater)	Moderate	High
Water Play (swim, wade)	Light	Light
Fishing	High	High
Hunting	High	High
Camping: Undeveloped	Light	High
Hiking	Light	Moderate
Picnicking	Light	Moderate
Viewing Scenery	Moderate	High
TOTAL	19,700	23,000

Historical/Cultural - Evidence of use by Indians is scarce. No known sites or evidence of sites have been found along the river although they likely existed. Sites deep in the interior of the National Park have been located at Seven Lakes Basin.

Four buildings at the Snider Work Center have been found eligible for nomination to the National Register of Historic Places. A shop, warehouse, residence and equipment and storage building exemplify CCC (Civilian Conservation Corps) tongue-in-groove, clapboard-sided construction.

Considerable homesteading and early pioneering took place along the Soleduck, although the preponderence occurred outside of the Forest boundary. Historic and noteworthy recreation use occurred in association with hotels and cabins built to take advantage of the hotspring attractions.

Minerals/Energy - National Forest lands are open to mineral exploration and leasing, except within the Buckhorn Wilderness and administrative sites. No significant mining has occurred in the Dungeness River corridor with the notable exception of Tubal Cain on the Copper Creek Tributary. It is unlikely that any significant mineral or energy deposits occur within the river corridor.

Timber - The following tables depict acre and volume information on National Forest lands in the Soleduck corridor.

Table F-65. Summary of National Forest Acres

Tentatively Suitable Unsuitable	2,254 176
TOTAL	2,430

Table F-66. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1-2.9" DBH)	SS Seedling-Sapling (3-4.9" DBH)	PL Poles (5-8.9" DBH)	MS Small Saw (9-20.9" DBH)	LS Large Saw (21+" DBH)
High Medium	17	118 24	247	1,106 529	213
TOTAL	17	142	247	1,635	213

Table F-67. Tentatively Suitable Standing Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High Medium Low	213	11.50	2,450	10,658	1,106 529	6.92 6.92	7,654 3,661	33,295 15,925	247	4.56	1,126	4,898
TOTAL	213		2,450	10,658	1,635		11,315	49,220	247		1,126	4,898

Summary 14,891 MCF or 14.9 MMCF
64,776 MBF or 64.8 MMBF

Table F-68. Tentatively Suitable Land Potential Yield by Site and Elevation

<1,500' Elevation (Winter Range)				
Site/Productivity	CF/Acre/Year	Acres	MCF/Year	MBF/Year
High Medium	172.14 121.24	1,701 553	292.81 67.05	1,273.72 291.67
TOTAL		2,254	359.86	1,565.39

The 1985 Insect and Disease Survey showed no significant insect or disease problems occurring within the river corridor. The potential for any significant outbreak is low.

NON-FEDERAL LANDOWNERSHIP AND USES

Washington State DNR, timber companies and private individuals own land adjacent to the Soleduck River, within and outside the National Forest boundary. DNR lands are managed for timber production and maximum return to the State, while meeting Forest Practice Act constraints. The timber companies' and some of the lands owned by private individuals, are also managed for timber production. ITT Rayonier and DNR are the major non-Federal land owners with lands adjacent to the river, with nearly 50% of the corridor acres. Very little activity has occurred immediately adjacent to the riverbanks. Thus, riparian vegetation is in very good condition. The DNR lands within the National Forest boundary are being considered for exchange to the Forest Service. The existing and projected landownership pattern and uses are consistent with the classification requirements for a Recreational River.

There are approximately 13,000 acres of non-Federal lands within the river corridor. All of these are within the segments classified as Recreational. Based on the potential yield from similar National Forest lands, this would indicate a potential yield of approximately 9.0 mmbf/year. While timber harvesting is compatible with the Recreational classification, extensive harvesting may not be fully compatible.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

The following are expected funding needs for the Soleduck for the first five years following a designation as a Wild and Scenic River:

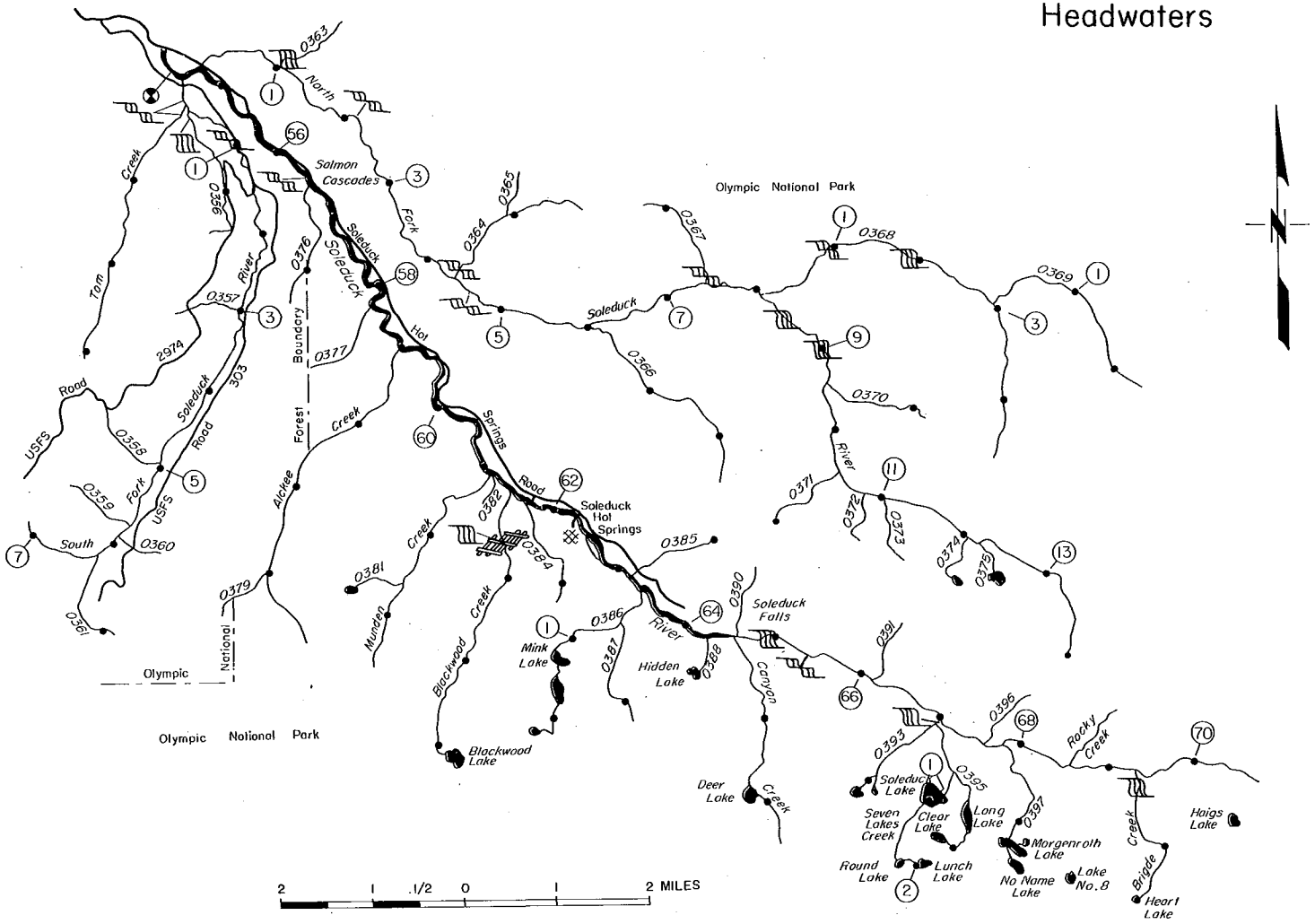
Table F-69. Estimated Cost of Management If Designated as a Wild and Scenic River

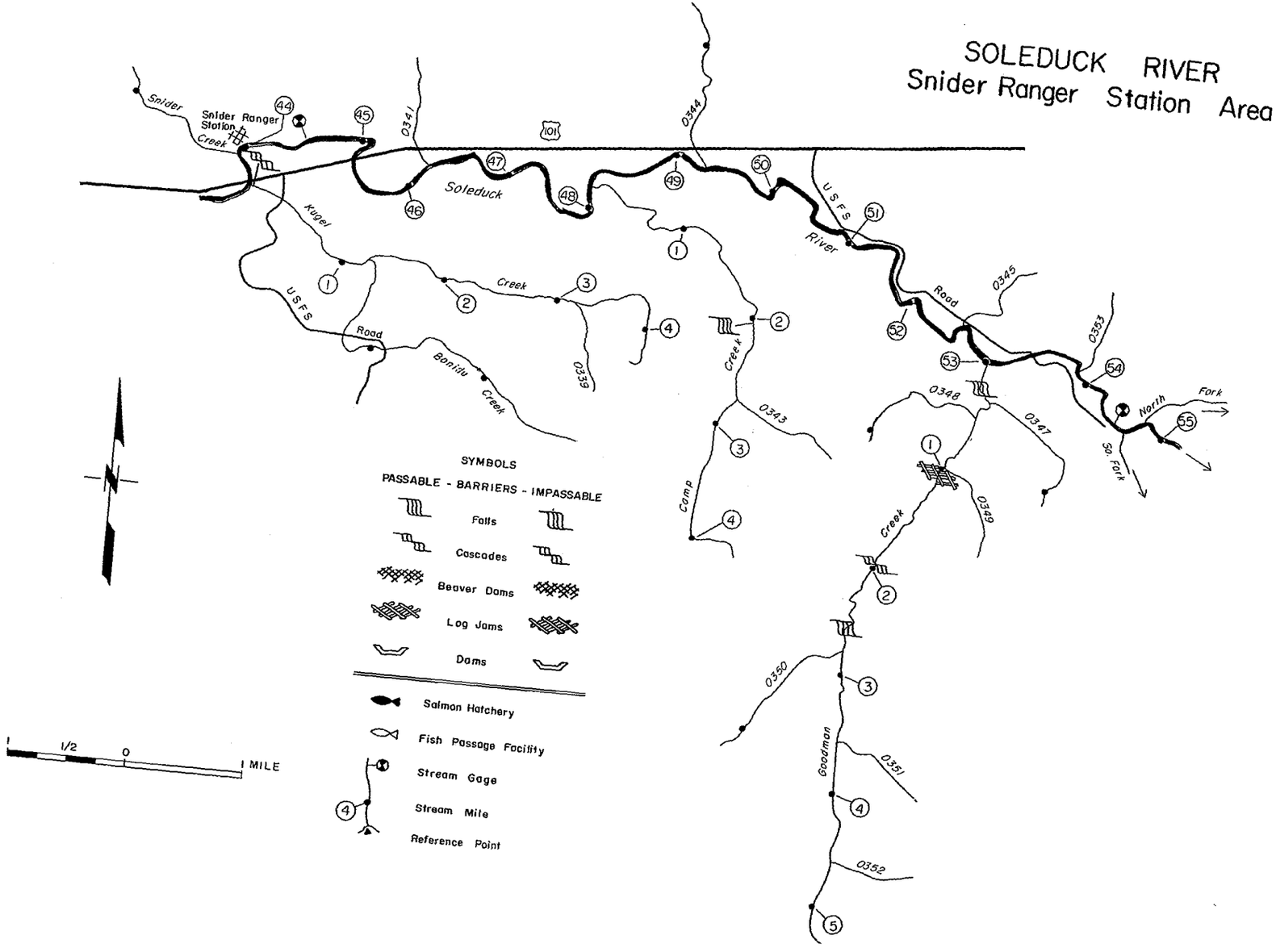
Annual Costs	General Administration Operation and Maintenance	$18,500 144,000
	TOTAL	$162,500
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan 1/ Acquisition and development costs	$17,000 32,000 23,000
	TOTAL	$72,000
	TOTAL COST--FIRST FIVE YEARS	$234,500

1/ Costs primarily in years 1 and 2.

The projected annual general administration, and operation and maintenance cost would continue at an estimated $9,000 per year.

SOLEDUCK RIVER
Headwaters

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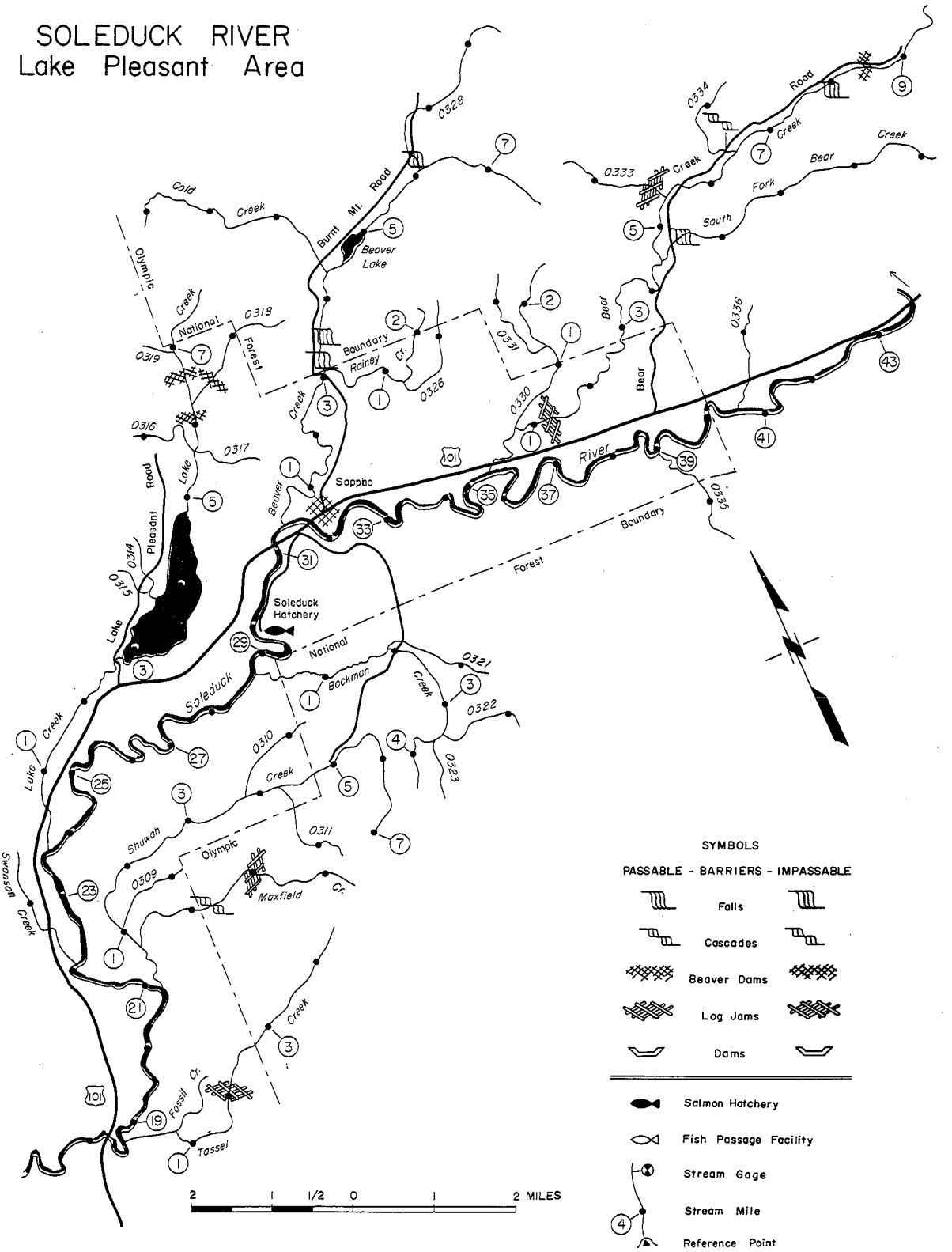
Snider Ranger Station Area
Snider Creek
Snider Ranger Station
Soleduck
River
Kugel
Creek
Bonilu Creek
USFS Road
0341
0344
0339
0343
0345
0347
0348
0349
0350
0351
0352
0353
Camp Creek
Goodman Creek
North Fork
So. Fork
101
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1 MILE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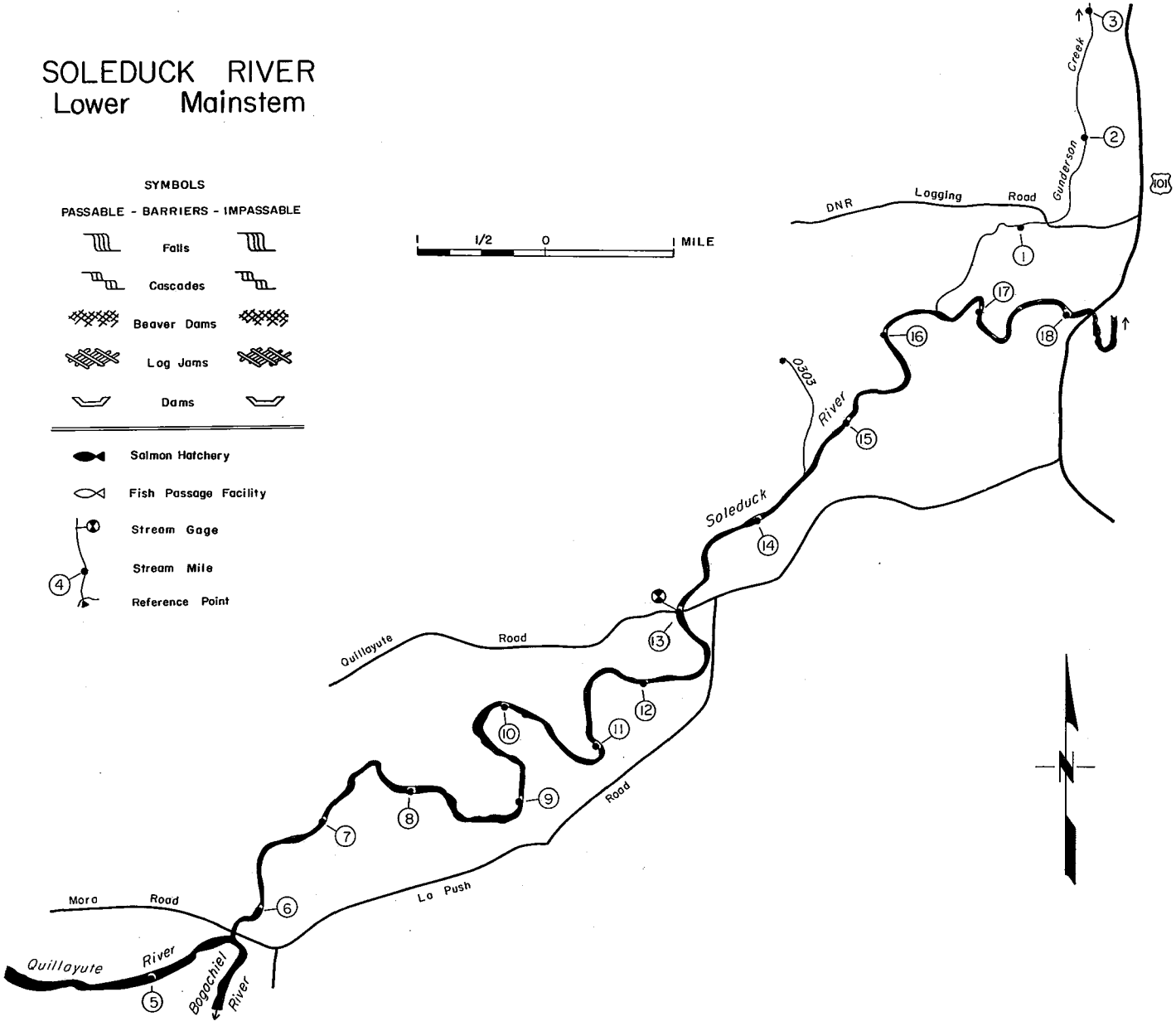
Lake Pleasant Area
Cold Creek
Burnt Mt. Road
Beaver Lake
Olympic National Forest Boundary
Rainey Cr.
Sappho
Beaver Creek
Lake Pleasant Road
Lake Creek
Soleduck Hatchery
Soleduck River
Bear Creek
South Fork Bear Creek
Road Creek
Bear Creek
Bockman Creek
Shuwah Creek
Maxfield Cr.
Swanson Creek
Fossil Cr.
Tassel Creek
0328
0334
0333
0331
0330
0326
0336
0335
0321
0322
0323
0310
0311
0309
0318
0319
0316
0317
0314
0315
101
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
2 1 1/2 0 1 2 MILES


SOLEDUCK RIVER
Lower Mainstem
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
MILE
DNR
Logging
Road
Gunderson
Creek
101
0303
River
Soleduck
Quillayute
Road
La Push
Road
Mora
Road
Quillayute
River
Bogachiel
River
1
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SOUTH FORK SKOKOMISH RIVER

GENERAL SETTING

Mileages and acreages by ownership for the South Fork Skokomish River are summarized below. Acreage is based on a corridor one-quarter mile wide on each side of the river.

Ownership	Miles	Acres
Olympic National Park	1.1	350
Olympic National Forest	18.4	6,150
Private	8.0	2,300
TOTAL	27.5	8,800

(Note: The Main Stem Skokomish was evaluated and found ineligible. It will not be referenced in this summary.)

The South Fork Skokomish River originates near Sundown Pass in Olympic National Park. It drops rapidly as it flows southeasterly into the Olympic National Forest to near Rule Creek (R.M.23.9), where its gradient lowers from there to the head of the "Gorge" at R.M.9.8. It then flows within the confines of the relatively narrow, deep gorge for 6.3 miles to the National Forest boundary at R.M.3.5. The lower 3.5 miles of the river are of relatively low gradient to its confluence with the North Fork Skokomish. The two rivers merge to form the Skokomish River which then flows easterly into Hood Canal.

The entire length of the river after it leaves the National Park lies within the the boundaries of the Shelton Cooperative Sustained Yield Unit (SCSYU). Under the provisions of this agreement between the U.S Forest Service and the Simpson Timber Co. the lands of both parties are managed as a single unit for the sustained yield of forest products. This agreement will remain in effect until 2046.

Beginning in the 1970's, concern for the effects of concentrating the harvest on the National Forest portion of the unit in the South Fork began to surface. As a result of these concerns alternative management proposals were made that assigned different management priorities to some portions of the area. Some of these proposals were included in the Timber Management Plan for the area implemented in 1977. Other proposals are to be addressed in the Forest Plan. This Wild and Scenic Rivers evaluation is one of the proposals being explored.

The South Fork of the Skokomish has a locally significant fish run of particular concern to the Skokomish Indians whose reservation lies at the mouth of the Skokomish River. Prior to the time that the Cushman Dam project was installed in the North Fork of the Skokomish the North Fork was the main producer of fish in the system. The South Fork and main stem of the river are now the major, though reduced in quantity, producers of fish in the area.

The South Fork drainage is also a regionally significant recreational area providing water and forest oriented recreation in the summer and hunting and snowplay opportunity in the appropriate seasons.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Stands of large Douglas-fir and western redcedar timber mixed with bigleaf maple, cottonwoods and young stands of red alder, all in a near rainforest setting, stretch the entire length of the upper valley, with a backdrop of rugged ridges and peaks. The chasm of the South Fork Gorge stretches for over 6.0 miles as the river cuts its way to the lower valley. This value is considered **Outstandingly remarkable.**

Recreational - Much of the river corridor is accessible by road but access to the immediate river edge is primarily by trail except in the portions of the river identified as Recreational in classification. A range of camping opportunities ranging from developed sites in the Browns Creek Campground to semi-primitive sites with only trail access are available. A large potential development site at the Oxbow awaits future development but is utilized now as an undeveloped facility. The quality of present and potential recreation opportunity in the area is **Above average.**

Geologic - The South Fork Gorge, viewed from the High Bridge, is a locally renowned geological and scenic feature. In the upper valley the surrounding ridges and peaks are both geologically interesting and scenic features. **Above average.**

Fish - The fish runs of the South Fork and the water it supplies for the fishery in the lower main river are important to the Skokomish Indians. However, the fisheries value of the river is only considered to be **Average** with respect to the region as a whole.

Wildlife - The area supports most of the indigenous species that occur in the eastern part of the Olympic Peninsula. It is a popular area for hunting. It is considered **Average** for its wildlife values.

Historical/Cultural - The lower reaches of the Skokomish were settled by early pioneers and much of the present day private land found its origin through homesteads. This same lower area of the Skokomish River was also traditionally used by Twana peoples and the Skokomish Indian Reservation was established as a result.

Mssrs. Bretherton and Church made a side trip down the South Fork in conjunction with the primary mission of the O'Neil Expedition. These gentlemen made note of a few hunting and trapping cabins and what may have been some unsuccessful and failed attempts at homesteading approximately 12-15 miles up the South Fork. No evidence of these homestead efforts have ever been found.

Some historic railroad logging occurred up the South Fork but little evidence remains of this activity as well. One notable exception is the High Steel Bridge over the South Fork, and this structure has been placed on the National Register of Historic Places.

Prehistoric use by Indians no doubt occurred. Fairly intensive professional surveys have only resulted in finding one lithic isolate in the headwater area. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resource Development - The full length of the South Fork Skokomish is free of any impoundments, diversions or major channel modifications.

Shoreline Development - From its source to near Rule Creek, the river corridor is in a natural condition except where trail footlogs span the stream. From R.M. 24, to near R.M. 13.5, evidence of timber harvesting exists but is screened from view from the river.

Downstream from Lebar Creek, R.M. 13.5 to R.M. 9.8, evidence of past and ongoing timber harvesting can be seen in the background. Brown Creek Campground is on the east bank at R.M. 13.0. The shoreline and adjacent riparian area in this Segment, are in very good condition. From R.M. 9.8 to R.M. 1.0 the river is predominantly within the South Fork Gorge. The shoreline is undeveloped. From R.M. 1.0 to its mouth, the ownership pattern is predominantly small acreage tracts. Houses, fields and pasture land are within the river corridor.

Accessibility - From its source to near Rule Creek (R.M. 23.9) the river corridor is accessed only by trail or cross-country travel. From Rule Creek to Lebar Creek (R.M. 13.5) there are roads on the slopes along the east side of the river which generally parallel the river from 1/4 to 1/2 mile from the river. The South Fork Skokomish trail is located within the river corridor, frequently near the river edge.

Downstream from Lebar Creek to the mouth of the Gorge (R.M. 9.8) the river corridor and river is easily reached by a series of access roads. Through the Gorge (R.M. 9.8 - 3.2) the river is nearly inaccessible.

Below the Gorge to its mouth, the river corridor is again accessible by a number of access roads and user created trails.

Water Quality - The water quality of this river is rated class AA, "extraordinary" from its source to its mouth.

Conclusion - The entire length of the South Fork Skokomish River meets the classification for either Wild, Scenic or Recreational River. In addition to its "outstandingly remarkable" scenic values, it has above average recreational and geologic values.

GENERAL DESCRIPTION OF RESOURCES

Lying entirely within the Olympic Mountains section of the Pacific Border Province, the South Fork Skokomish rises in the lower flanks of the southeast corner of the Olympic Peninsula. Elevations vary from near 4,000 feet at its source, to near 50 feet at its confluence with the North Fork. Within five miles of its source, the river gradient slackens. Within another mile the sidewalls of the valley pull back from the river's edge, leaving a valley bottom nearly one-half mile wide. This valley bottom remains like this to the upper end of the Gorge. Once through the Gorge, it quickly meets the North Fork in the lower Skokomish Valley. The river has developed a meandering character through the broader valley areas with high, nearly vertical banks where it undercuts the slopes.

Stands of Pacific silver fir mixed with Alaska yellow cedar with an understory of huckleberry and devilsclub, are typical of the silver fir zone found in the very upper reaches of the river corridor. The river drops rapidly out of this zone, and upon reaching the point where the river gradient moderates, is well within the western hemlock zone. Western hemlock, western redcedar, Douglas-fir and Sitka spruce are the major conifer components of the stand. Red alder, big leaf maple and black cottonwood occur primarily along the river edge and in wet lowlands. Huckleberry, vine maple, devilsclub, salal, Oregon grape, salmonberry and western thimbleberry are typical understory shrubs.

The mid section of the South Fork Skokomish is readily accessible by road. In its lower reach, county and Forest Road 23 parallel the river. In the mid section, Forest Roads 23, 2353, 2355, 2361 and numerous spur roads access the river corridor.

Depending upon the segment of the river to be visited, the South Fork Skokomish can be as close as 30 miles, or as distant as 50 miles from Olympia. Seattle is 100 miles distant.

Fishing, hunting, camping and day use are the primary uses within the river corridor. Recreational boating, canoeing and raftng is very limited due to the Gorge reaches.

Within the Olympic National Forest boundary, the Shelton Sustained Yield Unit Timber Management Plan had allocated the majority of the area as available to timber production on a sustained yield basis. The area adjacent to the mouth of Brown Creek was allocated to developed recreation. The upper Skokomish Valley, above Rule Creek, was within a Special Management Area allocated to dispersed recreation.

The private land within the National Forest boundary is being managed for timber production. Outside of the National Forest, the ownership and management along the river corridor is predominantly one of timber production, except below river mile 1.0 where the pattern is one of rural and residential housing on small acreages.

Mineral and Energy Resources Development - Following the outbreak of World War II and an increase in demand for manganese, a flurry of minerals exploration occurred in the South Fork Skokomish drainage. No claims were patented and current mining activity is dormant. The potential for development of locatable minerals is low.

Common variety mineral material, utilized for crushed road rock, is a valuable resource found within the river corridor. Currently none of the inventoried rock sources located within the river corridor have been developed.

Water Resources Developments - As of February 1989, there were no water rights or allocations on file with the State of Washington Department of Ecology for water from the South Fork Skokomish.

Due to periodic flooding of the lower valley of the Skokomish River there has been interest expressed for development of flood control impoundment somewhere in the South Fork Skokomish drainage. To date no specific proposals have been made.

Hydropower potential for the National Forest portion of the river is estimated to be 190.2 Gigawatts per year at the 30% exceedance level. There are no current water resource developments on the South Fork Skokomish but for several decades there has been a proposal for a high dam at the upper end of the South Fork Gorge. This was last investigated by Mason County P.U.D. in the early to mid-1980's but the proposal was dropped. A number of other run-of-the-river hydropower projects have been proposed for various tributaries of the South Fork during this same time period. These were all denied or dropped.

Designation of the river under Wild and Scenic legislation forecloses its development for hydropower.

Transportation Facilities - One developed site, Brown Creek Campground, is on the river. This campground provides 20 camping units with tables, fire rings, a well with pitcher pump and vault toilets. A number of proposed future sites are located within the river corridor. Two of these, Oxbow and South Fork Campgrounds, would receive special emphasis if designation should occur. Oxbow is currently programmed near the end of the current five-year capital investment planning period.

The existing network of County, National Forest and private roads that parallel, cross and access the river and its corridor are adequate to provide access. Nearly all roads within, or accessing, the river corridor have a mix of timber haul and recreational traffic. The existing roads are generally adequate to accommodate current and projected use without unacceptable conflicts, except that the segment of the main access route, Forest Road 23, should be upgraded from the county road to the Fir Creek reload. Other local roads will need improvement to provide all-weather access and parking.

Numerous undeveloped camping, picnicking and general day use sites exist along the river.
Nearly 15 miles of trail traverses the river corridor from Brown Creek Campground to Olympic National Park. A number of short, connecting trails provide access to this mainline trail from existing roads.

Recreational Activities - Recreational use on the river and within the river corridor falls in three use categories: activities that are directly dependent upon the river such as fishing and water play; activities associated with the river but not dependent upon it, such as camping, picnicking, hiking and other day use; and activities that would probably occur independently of the river, i.e., hunting, mushroom picking and driving for pleasure.

Opportunities for drift boating, rafting, canoeing and other forms of river floating are restricted to the areas above the gorge. Put-in sites are limited and generally consist of locations at road crossings and provide rough approaches to the river.

Viewing the magnificent and varied stands of trees along the river corridor is associated with other uses; i.e., camping, hunting, fishing or through day hikes along the river bottoms or into more canyon-like areas of the upper river. These stands of gigantic Douglas-fir, western redcedar, western hemlock, bigleaf maple and black cottonwood contain examples of the largest and finest individuals of these species in the southern Olympics.

Table F-70. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	10,900	15,000
Undeveloped Recreation	41,300	70,000
Boating (flatwater, whitewater)	Light	Moderate
Water Play (swim, wade)	Moderate	High
Fishing	Moderate	High
Hunting	High	High
Camping	High	High
Hiking	Light	High
Picnicking	Moderate	Moderate
Viewing Scenery	Moderate	High
TOTAL	52,200	85,000

Wildlife and Fisheries - Coho, chum, and chinook salmon, sea-run cutthroat and steelhead trout and resident cutthroat trout, utilize the South Fork Skokomish system and many of its tributaries. Large numbers of chinook, chum and coho spawn in the main channel below the lower end of the gorge.

Some steelhead and coho pass through the gorge and utilize the river up to the area of Cedar Creek at R.M. 18.0.

Based on its anadromous fish habitat, the South Fork Skokomish has a potential annual production capability of nearly 59,000 adult fish. Approximately 35% of this habitat capability is within the National Forest boundary. The remaining 65% is outside the National Forest on private ownerships.

Generally, all wildlife species found on the west side of the Olympic Peninsula occur as residents of, or visitors to, the river corridor. Some of the more common large animals are Roosevelt elk, black-tailed deer, black bear, cougar, coyote and bobcat. Smaller mammals include raccoon, mink, beaver, mountain beaver, rabbit, skunks and river otters.

The valley bottoms, south slopes and river corridor provide winter range for big game, mainly elk and deer downstream from the vicinity of Steel Creek at R.M. 22.9.

Blue grouse, ruffed grouse and pigeons are common game birds found in the area. Ducks, ospreys, eagles, kingfishers and a variety of water birds inhabit the water edge and adjacent river corridor. The northern bald eagle is the only threatened wildlife species known to inhabit the area. The old-growth timber in the upper valley is suitable habitat for the northern spotted owl, a sensitive species.

The riparian habitat, in the reaches upstream from the South Fork's confluence with the North Fork Skokomish to the vicinity of R.M. 1, is generally in good condition with only a few areas where it has been significantly modified. Upstream from R.M. 1 to the source, the riparian habitat is in excellent condition.

Streamflow - Based on a long-term record (42 years), the average annual discharge measured at the discontinued U.S. Geological Survey (USGS) gauging station at R.M. 3.2 was 732 cfs.

Maximum flows on the South Fork Skokomish are generally associated with warm "chinook" rains that follow early snows in November, December, and January. The maximum flow at the gauging station was 21,600 cfs. A minimum flow of 62 cfs has been recorded. This is typical of low flows late in the summer or early fall following an extended period without rainfall.

Water quality is "Extraordinary," State Class AA, from its source to the confluence with the North Fork Skokomish.

Geology - The South Fork Skokomish River originates near Sundown Pass, then flows southeastward through a glacially-carved valley in "southeastern core rock" metasedimentary strata and basalt intrusives. Near Snowfield Creek, the river crosses what Tabor and Cady have interpreted as the Southern Fault Zone along which metasedimentary "core rocks" have been thrust beneath volcanic and volcaniclastic "peripheral rocks." Between Snowfield and Rule Creeks, the South Fork Skokomish flows through a valley cut by alpine glaciers through folded and overturned sandstone. Below Rule Creek the valley is cut in Crescent basalt flows (formation names after Tabor and Cady, 1978). Downstream from Rule Creek the floor of the valley is buried by deep alpine glacial and glaciofluvial deposits. Below LeBar Creek alpine glaciers flowed into continental glaciers and continental deposits, made up of fragments of rock foreign to the Olympic Peninsula, underlie the valley floor. Near Rock Creek the South Fork has cut through the floor of the glacial valley and is eroding a rock canyon in Crescent basalt. This canyon (the gorge) extends downstream to near the Fir Creek Guard Station where the river flows onto a broad fluvial plain, remaining on it to its confluence with the North Fork Skokomish.

Cultural Resources - Knowledge of use by prehistoric peoples is somewhat limited. It is known that fishing for salmon and steelhead along the Main Stem Skokomish was done by individuals of the Twana culture. While permanent villages probably existed along the main river, they have apparently been lost to movement of the river channel and development of the shoreline.

Settlement along the Skokomish began in the mid-1800's and progressed upstream to the extent of the suitable lands. Marginal homesteads failed and were ultimately returned to timber production.

The high steel bridge across the South Fork Gorge is listed in the National Register of Historic Places. It is a former railroad bridge converted to a road bridge.

Timber - The segments within Olympic National Forest average about 90% tentatively suitable lands available for intensive timber management. If designation occurs, timber harvest will be allowed in the scenic and recreational segments. The harvest would be designed to maintain and enhance the scenic

and recreational values of the river. No timber harvest would be permitted within the segments classified as Wild.

Table F-71. Volume of Allowable Sale Quantity (ASQ)

	ASQ---------->		
Total Timber Volume	Potential Harvest With Legal Requirements	Forest Preferred Alternative	Designated as Wild and as Scenic River Classified
149.0 MMBF	3.32 MMBF	2.49 MMBF	1.73 MMBF

NON-FEDERAL OWNERSHIP AND USES

With nearly 29% of the river length in non-Federal ownership (approximately 2,600 acres), there is a potential for impact on non-Federal landowners. Approximately 2,000 acres of this is timberland with a potential yield of about 1,130 MBF/year. Any modification of timber harvesting could reduce this potential yield.

Simpson Timber Company's land within the National Forest boundary is being managed for timber production. Outside the National Forest, ownership and management along the river corridor is predominantly for timber production by Simpson Timber Company as part of the Shelton Cooperative Sustained Yield Unit agreement with the Forest Service.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

The following are expected funding needs for the South Fork Skokomish River for the first five years following a designation as a Wild and Scenic River:

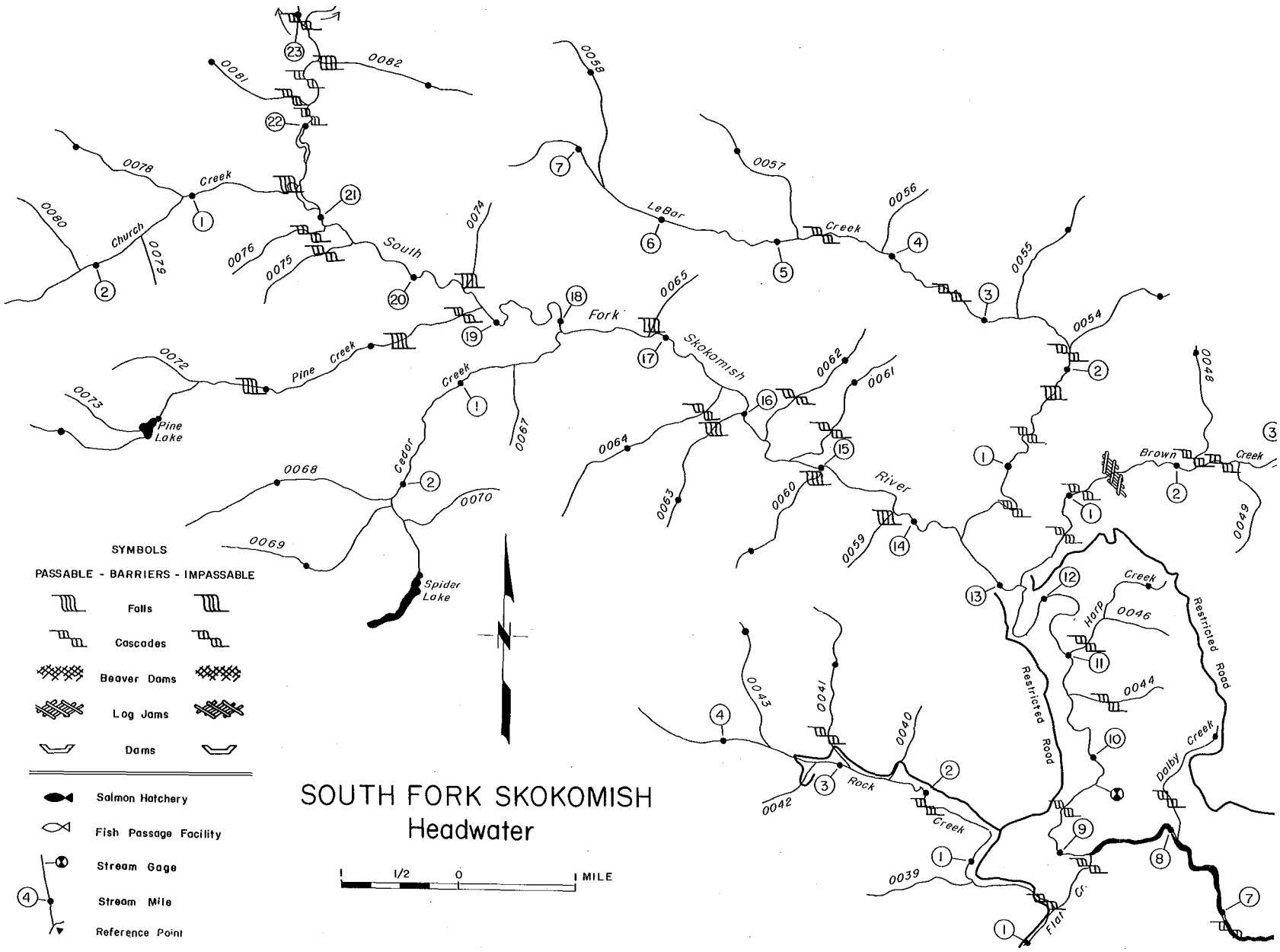
Table F-72. Estimated Cost of Management if Designated as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$9,000 21,500
	TOTAL	$30,500
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan 1/ Development costs	$21,000 30,000 83,000
	TOTAL	$134,000
	TOTAL COST--FIRST FIVE YEARS	$164,500

1/ Costs primarily in years 1 and 2.

General administration and operation and maintenance costs are estimated to continue at $23,000 annually.

Note: If **all** eligible segments of the South Fork Skokomish are designated as Wild and Scenic River, the total funding needs are $630,000. The continued annual administration, and operation and maintenance fund needs would be $42,100.


SOUTH FORK SKOKOMISH
Headwater
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Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1 MILE
Church Creek
Pine Creek
Pine Lake
Cedar Creek
Spider Lake
South Fork Skokomish River
LeBar Creek
Brown Creek
Harp Creek
Rock Creek
Dalby Creek
Flat Cr.
Restricted Road
Restricted Road

WYNOOCHEE RIVER

GENERAL SETTING

Mileage and acreage by ownership for the Wynoochee River are summarized below. Acreage is based on a corridor one-quarter mile wide on each side of the river.

Ownership	Miles	Acres
Olympic National Park	1.2	380
Olympic National Forest	10.7	3,420
Corps of Engineers		
within National Forest boundary 1/	5.1	1,630
outside National Forest boundary	2.4	770
State of Washington Dept. of Wildlife		
outside National Forest boundary	0.7	220
City of Aberdeen		
Outside National Forest boundary	0.3	100
Grays Harbor County		
outside National Forest boundary	0.3	100
Private		
within National Forest boundary	1.5	480
Outside National Forest boundary	41.0	13,120
TOTAL	63.2	20,220

1/ While the river mileage for the Corps of Engineers was based on the length of Wynoochee Reservoir at full pool, the acreage of the corridor that they have jurisdiction over is only at their administrative site and dam.

The Wynoochee River headwaters are in the steep mountains on the south flank of the Olympic Mountains. Flowing in a southerly direction, the river drops rapidly to Wynoochee Falls at R.M. 58.2. Below this point, the river gradient lessens and a broader river basin is encountered. Excellent pools and riffles are found in the river from this point to its mouth.

Wynoochee Dam, at R.M. 50, created a reservoir which is five miles in length during high pool. This dam is a barrier to adult fish passage upriver and juvenile fish downriver. Chinook, chum and coho salmon utilize the Wynoochee River and its tributaries below Wynoochee Dam, as do steelhead and sea-run cutthroat trout.

An industrial diversion at R.M. 8.1 diverts a portion of the riverflow into Lake Aberdeen.

Timber management is the primary use of land within the river corridor above R.M. 21, with the exception of the administrative and recreation complex at Wynoochee Dam. Below R.M. 21, acreages vary from small, rural tracts to some fairly large farms.

The anadromous fish runs in the Wynoochee River are regionally significant.

Recreational use is associated with camping in the Wynoochee Reservoir area and fishing in the river, primarily below Wynoochee Dam and in the reservoir itself.

The Wynoochee River was evaluated because of identification of the Wild and Scenic River issue during the early public meetings on issues, concerns and opportunities.

ELIGIBILITY DETERMINATION - VALUES

Scenic - Generally typical of the flanks of the Olympics. Reduced below the natural condition due to the extensive timber harvesting and road construction. **Average.** The Wynoochee was identified by Washington State Parks for evaluation as a potential addition to the State's Scenic Rivers system.

Recreational - High potential primarily associated with Wynoochee Reservoir and river use. Moderate, but growing, demand. **Above average.**

Geologic - No special geologic formations or attractions. **Average.**

Fish. Regionally significant fish values, similar to other major coastal and Puget Sound rivers. Three species of salmon, steelhead, and sea-run cutthroat trout. **Outstandingly remarkable.**

Wildlife - Elk, deer, bear, bald eagles, numerous smaller and non-game species typically found throughout west side Olympic drainages. **Above average.**

Historical - No significant historic events or structures are associated with the river or its corridor. Settlement of lower valley typical of other valleys in the region. Some unsuccessful homesteading attempts were made south of present day Wynoochee Dam. Integrity of evidence is minimal. **Average.**

Cultural - Lower river used by ancestors of the Chehalis tribe. No known existing sites within the river corridor. **Average.**

ELIGIBILITY DETERMINATION - CLASSIFICATION

Water Resources Development - An existing low dam diversion structure exists at R.M. 8.1 for diversion of water to Lake Aberdeen and the industry in Grays Harbor.

The Wynoochee Dam, an existing high dam with a five-mile-long lake is located at R.M. 50. The City of Aberdeen currently has a license from the Federal Energy Regulatory Commission (FERC) for the installation of power generation facilities at this dam.

A fish gather station, including a low dam and diversion, is located at R.M. 47.8.

Shoreline Development - From its source near Wynoochee Pass to R.M. 62, the shoreline is essentially primitive with little evidence of man's activities. Below R.M. 62 to Clark Creek, R.M. 59.7, past timber harvesting has been extensive within the river corridor. From Clark Creek to the head of Wynoochee Reservoir (R.M. 55), evidence of past and ongoing timber harvesting is readily apparent. From Wynoochee Reservoir, a panorama of accelerated timber harvesting and associated road construction is visible. The Corps of Engineers administrative site, and Forest Service Coho Campground are located near the dam on the west bank.

From the Wynoochee Dam complex at R.M. 49.9 downstream to the Forest boundary, R.M. 44.7, evidence of past and ongoing timber harvest is visible, but not to the extent of that at and above Wynoochee Reservoir. From the Forest boundary to near river Anderson Creek, R.M. 16.8, the adjacent lands are generally managed for timber production. Evidence of timber harvesting may be seen frequently. Houses or other improvements are seldom seen. From R.M. 16.4 to the mouth of the river, there is an increasing frequency of housing on or near the riverbank as the distance to Highway 12 decreases. Farmlands, fields and pastures are adjacent to the riverbank. A number of gravel pits are located at or near the river edge.

Accessibility - The upper one mile is accessible only by trail. From R.M. 62 to 55, Forest Service roads parallel the river on both sides. Two bridges span the river in this section. Access is readily available. While there is a road system around Wynoochee Reservoir, access to the reservoir via spur roads that lead to or approach the river generally are not signed. From R.M. 24 to the mouth, access is available from a county road. Beginning just downstream from Anderson Creek, R.M. 16.8, there is county or other access on both sides of the river.

Water Quality - From its source to the Forest boundary, the river has a State water quality rating of AA, "Extraordinary." Downstream from the Forest boundary to its mouth, it has a water quality rating of A, "Excellent." Both classifications meet or exceed Federal and State standards for aesthetics, wildlife and fish propagation, and primary contact recreation (swimming).

Conclusion - The Wynoochee River possesses an "Outstandingly Remarkable" fish value. This river should receive additional consideration as part of the Wild and Scenic River System.

GENERAL DESCRIPTION OF RESOURCES

Lying entirely within the Olympic Mountains section of the Pacific Border Province, the Wynoochee rises in the lower flanks of the southwest corner of the Olympic Peninsula. Elevations vary from near 3,500 feet at its source, to near sea level where it enters the Chehalis river. Within eight miles of its source, the river gradient becomes moderate, and the sidewalls of the valley pull back from the river's edge, leaving a valley bottom nearly one mile wide. This valley bottom widens to over two miles across near the National Forest boundary, and exits through lowlands and rolling hills which extend to the Chehalis river. The river has developed a meandering character throughout most of its length with areas of high, nearly vertical banks where it undercuts the slopes.

Stands of Pacific silver fir mixed with Alaska yellow cedar with an understory of huckleberry and devilsclub, are typical of the silver fir zone found in the very upper reaches of the river corridor. The river drops rapidly out of this zone, and upon reaching the point where the river gradient moderates, is well within the western hemlock zone. Western hemlock, western redcedar, Douglas-fir and Sitka spruce are the major conifer components of the stand. Red alder, big leaf maple and black cottonwood occur primarily along the river edge and in wet lowlands. Huckleberry, vine maple, devilsclub, salal, Oregon grape, salmonberry and western thimbleberry are typical understory shrubs.

Nearly the entire length of the Wynoochee is accessible by road. In its lower reaches, county roads parallel the river. Numerous private roads reach or approach the river. Upstream from the end of the county road, approximately R.M. 24.5, Forest Roads 22, 2270, 2294, 2270760, 2275100 and numerous logging roads on private land access the river corridor.

Depending upon the segment of the river to be visited, the Wynoochee can be as close as 10 miles, or as distant as 45 miles, from Aberdeen and Hoquiam. From Olympia, it is 45-plus miles, while Seattle is 105 miles distant. Chehalis-Centralia is about 50 miles to the lower reach of the river.

Fishing, hunting, camping and day use are the primary uses within the river corridor. Floating the river in association with fishing is a significant use. Recreational boating, canoeing and rafting is an increasing use, as the Wynoochee becomes better known.

The private land within the National Forest boundary is being managed for timber production. Outside of the National Forest, the ownership and management along the river corridor is predominantly one of timber production, especially upstream from Anderson Creek, R.M. 16.8. Downstream from that point to the river mouth, the pattern is one of rural and residential housing on small acreages, and individual lots with scattered parcels owned by various timber companies. The State Department of Wildlife has minor acreage within the corridor, as does the U.S. Army Corps of Engineers, City of Aberdeen, and Grays Harbor County.

Geology - The Wynoochee River originates near Wynoochee Pass flowing southward through a valley cut in "southeastern core rock" metasedimentary strata and basalt intrusives (after Tabor and Cady, 1978). The river flows southwestward to a confluence with an unnamed tributary about a mile south of the Jefferson/ Grays Harbor County line, and then flows southeastward through a canyon cut through folded and overturned sandstone and basalt along the flanks of the fold another 3/4 mile south. (Both are designated as part of the "periferal" Crescent Formation by Tabor and Cady, 1978). Below the stream confluence, the valley floor widens and is underlain by alpine glaciofluvial deposits. From Clark Creek to downstream from the Wynoochee Falls Campground, the Wynoochee carves a narrow gorge in Crescent basalt. Below the campground, the canyon widens; the valley bottom is underlain by glaciofluvial deposits and the near-vertical valley walls are carved from basalt and sedimentary interbeds. Downstream from the west fork, the valley widens and sideslopes become relatively more gentle. The deep glaciofluvial and lacustrine sediments bury older stream channels and lake basin. The existing channel at the Wynoochee Dam is cut in basalt atop a buried ridge, some 300 feet higher than the bottom of an older channel southwest of the dam. The older channel is filled to the top with, and buried by, glaciolacustrine silts and clays.

Water - Based on a long-term record (over 50 years), the average annual discharge as measured at the USGS gauging station at R.M. 5.9, 0.3 miles upstream from the mouth of Black Creek is 929,500 acre-feet per year or 1,283 c.f.s. The drainage area upstream from the gauging station is 155 square miles.

Maximum flows on the Wynoochee are generally associated with warm "chinook" rains that follow early snows in November, December and January. The maximum flow at the gauging station occurred on January 19, 1968, with a flow of 25,500 cfs. The minimum flow of 3 cfs occurred on August 26-30, 1967. This is typical of the timing of low flows late in the summer or early fall, following an extended period without rainfall.

While these represent the extremes, the more typical high and low flows would be in the range of 18,000 cfs to 19,000 cfs, and 130 cfs to 150 cfs.

Water for power production is the major allocated use of the water from the Wynoochee. Other significant allocations have been made for commercial- industrial/domestic-municipal and irrigation use. (See Table F-73.)

Table F-73. Allocation of Water

Use Group	CFS	Acre-Feet/Year
Power propagation Domestic-municipal/commercial-industrial Irrigation	1,400 300 7.55	70,000
TOTAL	1,707.55	70,000

Hydropower potential of the National Forest portion of the river is estimated to be 218.0 Gigawatts per year at the 30% exceedance level. The City of Aberdeen currently has a license for installation of a 10.8 megawatt hydropower plant in the existing Wynoochee Dam. The construction of this project is projected to start during the winter of 1989-1990. No other hydropower projects are currently proposed on the Wynoochee river.

Water quality is "Extraordinary," State Class AA, from its source to R.M. 44.7, the Forest boundary. The increased level of development from R.M. 44.7 to the mouth of the river, has resulted in a reduction of the water quality to "Excellent," State Class A.

Generally, the waters are so clear that the river bottom can be seen except in the deepest pools. During periods of high rainfall or rapid snowmelt, the river will become murky to a shade of brown, depending upon the intensity of the rainfall or rapidity of the snowmelt. Water temperatures are generally cool, except for two to three months during the summer when the water temperatures rise adequately to permit swimming and water play. Thus temperature, not water quality, is the limiting factor for primary contact use. Because the water quality is so good, fish and wildlife dependent upon the Wynoochee and its environs, thrive, and can often be seen, by visitors to the river and river corridor.

Fish and Wildlife - Coho, chum, and chinook salmon, sea-run cutthroat trout, steelhead, plus resident cutthroat trout, utilize the Wynoochee system and many of its tributaries. Large numbers of chinook and coho spawn in the main channel up to the fish gathering station at R.M. 47.8. Most chum salmon spawning is below R.M. 40.0. Utilization of the reaches above Wynoochee Reservoir has lost much of its value due to inability to successfully pass the juveniles through the dam on their way downstream.

Steelhead and sea-run cutthroat utilize the river up to the fish gathering station.

Based on the anadromous fish habitat, the Wynoochee system has the potential annual production of nearly 94,600 adult fish. Approximately 14 percent of this habitat capability is within the National Forest boundary. The remaining 86 percent is outside the National Forest on State, Army Corps of Engineers, county, private and other ownerships. See Table F-74 for potential production capabilities.

Table F-74. Estimated Annual Habitat Production Capabilities for Anadromous Salmonids 1/

Species	Landownership	Spawning Population	Smolt Production	Total Adult Production
Chinook	NF Other	270 1,660	37,800 232,200	1,630 10,010
	TOTAL	1,930	270,000	11,640
Coho	NF Other	1,310 8,050	48,470 297,740	3,880 23,820
	TOTAL	9,360	346,210	27,700
Steelhead	NF Other	2,590 15,910	44,440 272,990	3,870 23,770
	TOTAL	18,500	317,430	27,640
Cutthroat	NF Other	2,590 15,910	44,440 272,990	3,870 23,770
	TOTAL	18,500	317,430	27,640
All	NF Other	6,760 41,530	175,150 1,075,920	13,250 81,370
	TOTAL	48,290	1,251,070	94,620

1/ Production data for chum salmon is not included due to insufficient information.

Generally, all of the wildlife species found on the west side of the Olympic Peninsula can be found as residents of, or visitors to, the river corridor. Some of the more common large animals are Roosevelt elk, black-tailed deer, black bear, cougar, coyote and bobcat. Smaller mammals include raccoon, mink, beaver, mountain beaver, rabbit and skunk.

The valley bottoms, south slopes and river corridors provide winter range for big game, mainly elk and deer, from the vicinity of Wynoochee Falls, R.M. 58.2, downstream.

Blue grouse, ruffed grouse and pigeons are common game birds found in the area. Ducks, ospreys, eagles, kingfishers and a variety of water birds inhabit the water edge and adjacent river corridor. The northern bald eagle is the only threatened wildlife species known to inhabit the area. The old-growth timber in the upper valley is suitable habitat for the northern spotted owl, a sensitive species.

The riparian habitat in the reaches upstream from Anderson Creek, R.M. 16.8, is generally in excellent condition, with only a few areas where the habitat has been significantly modified. Downstream from Anderson Creek, the riparian zone tends to become increasingly modified as the acreages become smaller and farming and other developments are common along the river's edge.

Recreation - Recreational use on the river and within the river corridor, tends to fall into three use areas. One group is directly dependent upon the river for fishing, both from the shore and by boat. Another group is associated with the river but not dependent upon it, such as for camping, picnicking, hiking and other day use. The third user group would probably occur even if the river wasn't there; i.e., hunting, mushroom picking and driving for pleasure.

Within the Wynoochee river corridor, most of these activities will occur within the ROS classification of Roaded Modified. Only in the lower reaches, does the level of development increase to the extent that the recreation opportunity would be classified as Rural. The very upper reaches within the Olympic National Park would be classified as semi-primitive.

Six public access sites occur along the river. The Department of Wildlife has four sites, three with boat launch and parking facilities. Two "undeveloped" sites are provided on Simpson Timber Company lands. Coho and Chetwoot Campgrounds are located on Wynoochee Reservoir, as is the Army Corps of Engineers day use facilities. (See Tables F-75 a. and 75 b. for a summary of sites.)

Numerous undeveloped, informal camping, picnicking, general day use and boat launch sites exist along the river. Additional public access and boat launch facilities would be desirable.

Opportunities for drift boating, rafting, canoeing and other forms of river floating is extensive. Put-in sites are available along the river, up to the vicinity of Wynoochee Falls.

Because of the flat gradient below Save Creek, R.M. 38.7, there is only limited white water. No extensive skills are required to float these lower reaches of the river. Above Save Creek to the fish collection facility, there are excellent reaches of white water. Additional developed boat launch facilities along the Wynoochee should be developed to accommodate potential use.

Table F-75. Developed Recreation Sites

Table F-75 a. Campgrounds

National Forest Sites					
Site	ROS Class	Capacity: PAOT	Managed Season: Days	1988 Use RVDs	Projected Capacity PAOT
Coho	Roaded	290	150	22,500	290
Chetwoot	Roaded	40	200	100	40
Chakchak (P)	Roaded	-	-	-	200
Eena (P)	Roaded	-	-	-	90
Moollak (P)	Roaded	-	-	-	200
Wynoochee Falls (P)	Roaded	-	-	-	120

Table F-75. b. Boat Launch and Public Access Sites

Site	Managing Agency	Approximate River Mile	Boat Launch	Comments
Highway 12	WDW	1.7	No	Access/limited parking.
Black Creek	WDW	5.6	1	Parking.
Wynoochee	WDW	8.5	1	Rough boat launch/no parking.
White Bridge	WDW	16.0	1	Rough boat launch/parking.
Schafer Creek	STC 1/	28.6	1	Rough boat launch/limited parking.
Neil Creek	STC	31.0	1	Rough boat launch/limited parking.
Coho	USFS	50.5	2	Coho Campground/Wynoochee Reservoir.
Kokanee (P)	USFS	50.7	1	Currently rough boat launch/limited parking.

(P) Proposed. To be constructed as needed and funding is available.
1/ Simpson Timber Company

There are no trails that follow the river edge, except the boot-worn fisherman trails that have come into existence through use over a number of years. The Wynoochee Lake Shore Trail traverses the forests and lake environment around Lake Wynoochee. If designated as a Wild and Scenic River, a riverside trail from the head of Wynoochee Reservoir to Wynoochee Falls, 3.0 miles, would be constructed. Additional trails along selected segments of the lower river would also be desirable.

During 1988 there was an estimated 25,500 recreation visitor days (RVD's) use within the undeveloped areas of the National Forest portions of the river corridor. Based on current trends, improved access roads, and the "discovery" of the recreational opportunities in the upper Wynoochee Valley, this use is projected to exceed 41,000 RVD's by the year 2000. This greatly exceeds the projection by SCORP. However, because of the localized situation, it is a truer representation of projected growth and use. Use within the National Forest segments of the river corridor has been estimated and is shown in table F-76.

Table F-76. Recreational Activities (Estimated Recreational Use - RVDs and Trends)

	1988	2000
National Forest Developed Sites	22,600	34,000
Undeveloped Recreation	25,500	41,000
Boating (flatwater, whitewater)	Moderate	High
Water Play (swim, wade)	Moderate	Moderate
Fishing	Moderate	High
Hunting	High	High
Camping: Undeveloped	Moderate	High
Hiking	Light	Moderate
Picnicking	Moderate	Moderate
Viewing Scenery	Moderate	Moderate
TOTAL	48,100	75,000

Historical/Cultural - Knowledge of use by Indians is somewhat limited. It is known that fishing for salmon and steelhead along the main stem Wynoochee was done by bands and individuals of the Chehalis tribe. While permanent villages probably existed along the lower Wynoochee, well outside the National Forest boundary not much special data and information is available. No prehistoric sites have been discovered on National Forest land despite professional work associated with construction of the Wynoochee Reservoir.

Settlement along the lower Wynoochee began in the mid 1870's and progressed upstream with homesteading in the mid and upper Wynoochee Valley during the late 1800's. Many of these early subsistence homesteads eventually failed and were ultimately returned to timber production. Early old survey records indicate homestead efforts in this area and one specific site was inventoried and evaluated. The site had no integrity and evidence is scarcely noticeable.

Minerals/Energy - The potential for any locatable minerals is extremely low. There is little or no history of mining activities within the Wynoochee Valley.

Oil and gas exploration in the Grays Harbor area dates back to 1901, and has continued on an intermittent basis since that time. In 1925, the first well within the river corridor was drilled near R.M. 2.0. A trace of natural gas was found. Other drilling has occurred within the general area; some has been within the river corridor. 31/ The most "upstream" locations were near R.M. 16.5.

In the early 1980's, a renewed interest resulted in leases being issued for nearly all of the National Forest lands within the Wynoochee Drainage. Following limited seismic exploration, nearly all of the leases were allowed to lapse. Due to the geologic formation within this area, the potential for future exploration and possible production remains fairly high.

Common variety mineral material, utilized for crushed road rock, is a valuable resource found within the river corridor. Within the National Forest, there are no existing rock sources located within the river corridor. A number of significant rock source sites exist on private lands outside of the Forest boundary.

Timber - Timber types, standing volumes and potential yields from all National Forest lands tentatively suitable within the river corridor, are displayed in the following tables. Acres of timber-producing lands within other Federal, State of Washington, and private ownership are discussed later.

Table F-77. Summary of National Forest Acres (Eligible Segments)

Tentatively Suitable	2,090
Unsuitable	410
TOTAL	2,500

31/ McFarland 1981.

Table F-78. Tentatively Suitable Acres by Age Class and Site

Site/Productivity	BG Bare Ground (0.1-2.9" DBH)	SS Seedling-Sapling (3.0-4.9" DBH)	PL Poles (5.0-8.9" DBH)	MS Small Saw (9.0-20.9" DBH)	LS Large Saw (21+" DBH)
High	100	233	115	98	808
Medium	18	180	139	-	387
Low	-	9	-	-	-
Low, Natural	-	-	-	-	3
TOTAL	118	422	254	98	1,198

Table F-79. Tentatively Suitable Standing Volume by Site and Age Class

	Large Sawtimber				Small Sawtimber				Young Stands			
Site/ Productivity	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF	Acres	MCF/ Acre	MCF	MBF
High	808	11.50	9,292	40,420	98	6.92	678	2,949	115	4.56	524	2,279
Medium	387	11.50	4,450	19,358								
Low	3	7.45	22	96					139	3.09	430	1,870
TOTAL	1,198		13,764	59,874	98		678	2,949	254		954	4,149

Summary: 15,396 MCF or 15.4 MMCF
66,972 MBF or 67.0 MMBF

Table F-80. Tentatively Suitable Land Potential Yield by Site and Elevation

	<1,500' Elevation (Winter Range)				>1,500' Elevation (Summer Range)			
Site/ Productivity	CF/Acre/ Year	Acres	MCF/Year	MBF/Year	CF/Acre/ Year	Acres	MCF/Year	MBF/Year
High	172.14	1,300	223.78	973.44	200.51	54	10.83	47.11
Medium	121.24	455	55.16	239.95	139.43	269	37.51	163.17
Low					77.43	9	0.70	3.04
Low, Natural					39.75	3	0.12	0.52
TOTAL		1,755	278.94	1,213.39		335	49.16	213.84

Summary: 328.10 MCF/Year
1,427.23 MBF/Year

The potential for any significant insect or disease outbreak is low. The 1987 Insect and Disease Survey indicated there were no significant problems within the river corridor at this time.

Transportation/Roads - The existing network of State, county, Forest Service, and private roads that parallel, cross, recross and access the river and its corridor is adequate to meet the objectives of a Recreational and Scenic River. Major access routes include Grays Harbor County Wynoochee Valley Road and its extension, Forest Road 22, plus Forest Roads 2270, 2270760, 2294, and 2275100, all in the Lake Wynoochee area. Acquiring and providing public access and boat launch facilities needs to be evaluated in detail throughout the length of the river.

Nearly all roads within or accessing the river corridor has a mix of timber haul and recreational traffic. The existing roads are generally adequate to accommodate the current and projected use without any unacceptable conflicts. The exception is the Forest Service 22 Road from the end of the county's Wynoochee Valley Road to the Wynoochee Reservoir area. This should be brought up to full double lane standard with appropriate surfacing.

NON-FEDERAL LANDOWNERSHIP AND USES

Private timber lands within the river corridor are being managed to maximize production and return, while meeting constraints and mitigation required adjacent to a major river such as the Wynoochee and the State forest practices. The majority of private ownership is within large timberland holdings. A significant agriculture base, along with large residential tracts and individual lots, comprise the remainder of the land uses, except for a few commercial sites and public recreation facilities.

The existing and projected landownership pattern and uses within the river corridor upstream from R.M. 0.0 to R.M. 44.7 is consistent with the classification of Recreational River.

Upstream from the Forest boundary, the existing ownership and use pattern of the eligible segments is currently consistent with the classification of Recreation River. Acquisition of the private (Simpson Timber Company) lands between the Forest boundary and the fish gathering station would be desirable. This could be accomplished through land exchange.

It is estimated that nearly 80 percent of the private lands within the river corridor is being managed as timberlands. Approximately 15 percent is agriculture. The remaining 5 percent is residential and other. Assuming the private timber lands are at least as productive as National Forest lands, they have the capability to produce over 7.0 mmbf per year.

Washington Department of Wildlife and Army Corps of Engineer lands within the river corridor is being managed for wildlife, with emphasis for big game winter as an offset for winter range lost with the flooding of the valley behind Wynoochee Dam.

FUNDING NEEDS IF DESIGNATED AS A WILD AND SCENIC RIVER (NATIONAL FOREST SEGMENTS ONLY)

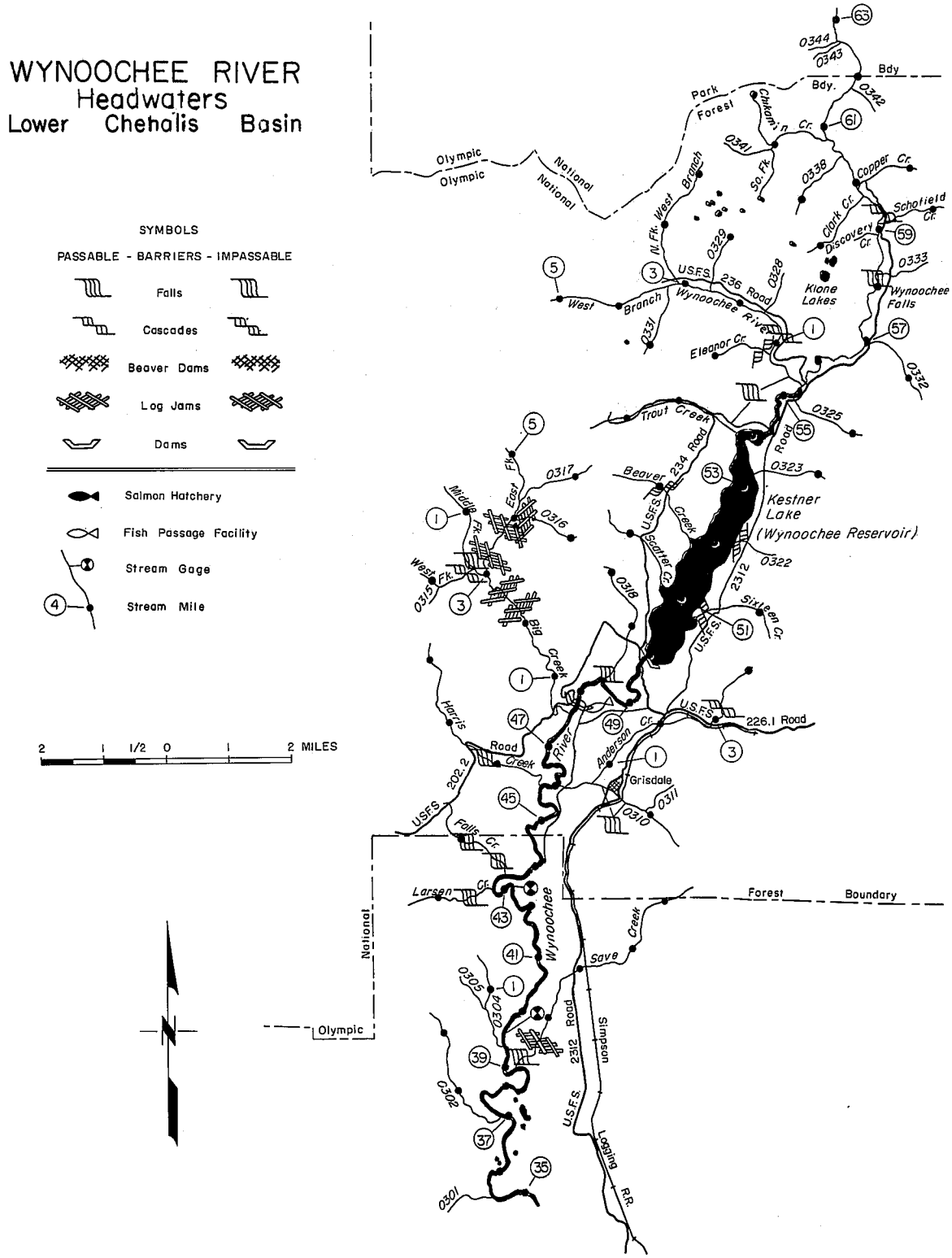
The following are expected funding needs for the Wynoochee River for the first five years following a designation as a Wild and Scenic River:

Table F-81. Estimated Cost of Management if Designated as a Wild and Scenic River

Annual Costs	General Administration Operation and Maintenance	$18,500 24,000
	TOTAL	$42,500
Non-Recurring Costs	Cost of implementation 1/ Preparation of Management Plan 1/ Development costs	$16,000 22,000 83,500
	TOTAL	$133,000
	TOTAL COST--FIRST FIVE YEARS	$223,400

1/Costs primarily in years 1 and 2.

Most of these costs are incurred in the first 2 to 4 years. General administration and operation and maintenance costs would continue at an estimated $9,000 per year. If **all** eligible segments were designated as Wild and Scenic River, the estimated five year costs would be $453,000.


WYNOOCHEE RIVER
Headwaters
Lower Chehalis Basin
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
2 1 1/2 0 1 2 MILES
Olympic National Park
Olympic National Forest
Bdy
Bdy.
Chikamin Cr.
So. Fk.
N. Fk. West Branch
West Branch
Copper Cr.
Schofield Cr.
Clark Cr.
Discovery Cr.
Klone Lakes
Wynoochee Falls
Wynoochee River
U.S.F.S. 236 Road
Eleanor Cr.
Trout Creek
Beaver Creek
U.S.F.S. 234 Road
Kestner Lake (Wynoochee Reservoir)
Sadler Cr.
Sixteen Cr.
U.S.F.S. 226.1 Road
Middle Fk.
East Fk.
West Fk.
Big Creek
Harris Creek
Road
Anderson Cr.
Grisdale
U.S.F.S. 202.2
Falls Cr.
Larsen Cr.
Save Creek
Forest Boundary
Olympic National Forest
U.S.F.S. 2312 Road
Simpson Logging R.R.

SUITABILITY ANALYSIS

The suitability of each of the ten eligible rivers to be analyzed is based on the following:

1. Representation of the Puget Trough and Olympic Mountains sections of the Pacific Border Province.
2. Compatibility with existing uses.
3. Impacts on non-Federal land.
4. Cost of land acquisition or an interest in the land to be administered.
5. Values foregone or foreclosed if the river is designated.
6. Support or opposition by the public, State and local government.
7. Representation of the major ecosystems on the Olympic Peninsula.

DUCKABUSH RIVER

1. Within the Olympic Mountains section, except for the lower reaches which is in the Puget Sound trough section. The area in Olympic Mountain section equal to Dosewallips, greater than Hamma Hamma. Puget trough section similar to Dosewallips, greater than Hamma Hamma. **High suitability.**
2. Wild segment within Olympic National Park and The Brothers Wilderness. Scenic segment includes Collins Campground and Interrorem Guard Station and picnic ground. Little or no conflict with other uses. **High suitability.**
3. Approximately 800 acres of non-Federal land within the river corridor. Nearly 90 percent of this is within Recreational River classification outside the National Forest boundary. Timber harvest generally compatible with Recreational classification. **High suitability.**
4. Cost of land acquisition should be minimal. Little, if any, of the non-Federal land needs to be acquired. **High suitability.**
5. Minimal values foregone. Slightly over 1,000 acres of National Forest lands tentatively suitable for timber management with a potential annual yield of 6.19 MBF acre/year. Actual yield would be much less because of mitigation for riparian management and visual quality objectives. **High suitability.**
6. Local landowners have expressed opposition to any Wild and Scenic River proposal in the area. Supported by State Department of Fisheries and State Department of Game. Supported by local and regional conservation groups and local American Indian tribes. Recommended as a study river in the Canal Front Plan. Previously supported by Congressman Don Bonker. **High suitability.**
7. Excellent representative of range of ecosystems found on the Canal Front of the Olympic Mountains. **High suitability.**

DOSEWALLIPS RIVER

1. Flows through the Olympic Mountains section, except near the mouth where it flows through the Puget Sound trough section. Olympic Mountains section equivalent to Duckabush River; better representation than Hamma Hamma. Puget Trough section similar to Duckabush; better than Hamma Hamma. **High suitability.**

2. The Wild segment is within Olympic National Park. The Scenic segment is from Dosewallips Campground to the National Forest-private land boundary. Elkhorn Campground is found within this section. Recreational use, scenic quality and retention of the fish habitat have been emphasis areas throughout this section. The Recreational River classification from the Forest boundary to the mouth of the river is consistent with the pattern of timber harvest and scattered development. Generally compatible with existing uses. **High suitability.**

3. Approximately 1,900 acres of private land is located within the river corridor. Approximately 75 percent of this is outside the National Forest boundary. Most of the adjacent private lands are forested. Minor river- front development has occurred. Only minor additional constraints on timber harvesting or development would be anticipated. Generally, the existing private land use pattern is consistent with the Scenic and Recreational River classifications. **High suitability.**

4. Cost of land acquisition should be minimal. Little, if any, non-Federal lands would need to be acquired. **High suitability.**

5. Nearly 90 percent of non-Wilderness National Forest lands within the river corridor is tentatively suitable for timber production. The potential timber yield from these lands is nearly 91 MBF/year. Actual programmed yield is significantly less because of the mitigation for riparian management, and maintenance of the visual quality objectives. There could be minor disruptions or opportunities foregone for timber harvest on private lands.

   The Elkhorn Hydropower project, located between Elkhorn Campground and the Olympic National Park boundary would be foregone with a Scenic River classification in that area. A Recreational River classification would permit a low diversion structure and small impoundment. Congress specifically described the boundary of The Brothers Wilderness to provide for this proposed project. **Medium suitability.**

6. Local landowners have previously expressed strong opposition to the inclusion of the Dosewallips as a National Wild and Scenic River. There is support from the State Department of Game, local and regional conservation organizations, and local American Indian tribes. The Dosewallips has been supported as a Wild and Scenic River by former Congressman Bonker through the introduction of Legislation in 1980. **Medium suitability.**

7. Excellent representation of a range of ecosystems found within the "east flank" of the Olympic Mountains. **High suitability.**

GRAY WOLF RIVER

1. This river system is located entirely within the Olympic Mountains section of the Pacific Border Province. A very good representation of this section. **High suitability.**

2. Primarily within the Wild classification, only the short segment (approximately one mile) of the Gray Wolf from the confluence with the Dungeness to the bridge on Road 2870 is currently available for

timber harvesting. The remainder of the Wild classification is within the Olympic National Park, the Buckhorn Wilderness, or the Gray Wolf special management area. **High suitability.**

3. There are no non-Federal lands involved. **High suitability.**

4. No non-Federal lands would need to be acquired. **High suitability.**

5. Approximately 380 acres of land tentatively suitable for timber production is located within the river corridor adjacent to the Scenic segments. This has a potential yield of approximately 270 MBF/year. A reduction in this potential yield has been made to meet visual quality objectives and for management within the riparian zone. Little, if any, additional reductions would have to be made to meet the management objectives for a Scenic River. **High suitability.**

6. There has been significant expressed support for the addition of the Gray Wolf to the Wild and Scenic River System. There should be limited, if any, opposition. It would be supported by local and regional conservation groups, local American Indian tribes, the State Department of Game and the State Department of Fisheries. **High suitability.**

7. Excellent representative of a range of ecosystems found in the rain shadow of the Olympic Mountains. **High suitability.**

DUNGENESS RIVER

1. This river system is located entirely within the Olympic Mountains section of the Pacific Border Province. A very good representation of this section. **High suitability.**

2. Primarily within the Wild classification, only the short segment (approximately one mile) of the Dungeness from the mouth of Royal Creek to the bridge on Road 2825 is currently available for timber harvesting. The remainder of the Wild classification is within the Olympic National Park, and the Buckhorn Wilderness. The Scenic classification is within an area with a visual quality objective of Partial Retention. Outside of the Forest boundary, future timber harvest adjacent to the river corridor may be consistent with a Recreational river. **High suitability.**

3. Approximately 580 acres of State of Washington DNR lands and 510 acres of private land are adjacent to the eligible segments of the Dungeness River. This segment of the river is classified as Scenic. Generally compatible. Limited modification of timber harvest schedules or prescriptions would be required to meet the Scenic criteria. Minor reductions in timber harvest volumes could occur. **High suitability.**

4. Four miles of trail right-of-way across non-Federal lands would need to be acquired. Selected scenic easements could be considered in selected river segment. **High suitability.**

5. Approximately 2,200 acres of land tentatively suitable for timber production is located within the river corridor adjacent to the Scenic segments. This has a potential yield of approximately 1.0 MMBF/year. A reduction of approximately 24 percent in this potential yield has been made to meet visual quality objectives and for management within the riparian zone. An additional 10 percent reduction would have to be made to meet the management objectives for a Scenic River.

   The potential timber yields per acre on non-Federal lands are approximately the same as on National Forest lands, or about 42 MBF/year. To meet the objectives of a Scenic River, this could be reduced by 10-25 percent.

Periodically run-of-the-river hydroelectric projects are proposed on the Dungeness River. These would not be compatible with the Scenic River classification. **Medium suitability.**

6. There has been significant expressed support for the addition of the Dungeness River to the Wild and Scenic River System. There should be limited resistence by adjacent non-Federal owners and hydropower developers. It would be supported by local and regional conservation groups, local American Indian tribes, the State Department of Game and the State Department of Fisheries. **High suitability.**

7. Excellent representative of a wide range of ecosystems found in the "rain shadow" of the Olympic Mountains. **High suitability.**

SOLEDUCK RIVER

1. Located entirely within the Olympic Mountains section of the Pacific Border Province, the Soleduck is the longest river on the Olympic Peninsula. **High suitability.**

2. Compatibility with the existing uses is very good. The Wild segment is entirely within the undeveloped portion of Olympic National Park. Development and activities including limited timber harvest may occur within the Scenic segment. These will normally be consistent with the classification. The existing and envisioned development and activities through the Recreational section should be compatible with that classification. **High suitability.**

3. The primary non-Federal land use within the river corridor is timber management. There is approximately 13,000 acres of non-Federal land within the river corridor. Nearly all of this is within the Recreational River segment based on the potential yield from similar National Forest lands. This would indicate a potential yield of approximately 910 MBF/year. While timber harvesting is compatible with a Recreational River classification, the extent of harvest activities may not be fully compatible. **Medium suitability.**

4. Acquisition for river-oriented recreational activities could include boat launch facilities, parking areas, viewpoints and possible day use facilities. Acquisition of lands to protect key scenic or geologic sections may be necessary. Costs could be significant. **Medium suitability.**

5. Over 90 percent of the National Forest acres within the river corridor are tentatively suitable for timber production. These lands have a potential timber yield of 197 MBF/year. Most of these lands are currently being managed for their scenic quality and to meet riparian objectives. Little reduction in yield is anticipated.

   With the extensive private timber lands within the river corridor the scheduling of timber harvesting and silvicultural prescriptions could be modified to meet the Scenic, and to a lesser degree the Recreational River classification. **Medium suitability.**

6. There is significant support from regional environmentalists, the State Department of Game, the State Department of Fisheries, and local American Indian tribes. There is very strong opposition by most landowners within the river corridor, the City of Forks, and the west end of Clallam County in general. **Low suitability.**

7. The Soleduck corridor provides a very good representation of the ecosystems found along the west side of the Olympic Mountains. **High suitability.**

HUMPTULIPS AND WEST FORK

1. Located on the west flank of the Olympic Mountains, the Humptulips River system is entirely within the Olympic Mountains section of the Pacific Border Province. **Medium suitability.**

2. Compatibility with the existing uses is generally good. The river corridor within the National Forest is being managed to meet the visual quality objective of Partial Retention. This is consistent with a Scenic classification. Existing development and activities within the Recreational River corridor are generally compatible, except recent and planned timber harvesting along the 42 miles of non-Federal ownership could result in extensive evidence of timber harvesting. **Medium suitability.**

3. With nearly 70 percent of the river corridor in non-Federal ownership, approximately 13,400 acres, there is a potential for a significant impact on the non-Federal landowner. Approximately 11,000 acres of this is timber lands with a potential yield of nearly 800 MBF/year. Any modification of timber harvesting would reduce this potential yield.

   Residential housing development along the lower river would be impacted. **Medium suitability.**

4. Acquisition of land for boat launch facilities, parking, viewpoints and day use sites would be required. Limited acquisition of corridor lands or scenic easements necessary to maintain scenic quality and/or to protect geologic features could be anticipated. Acquisiton costs would be moderate. **Medium suitability.**

5. Minor timber values will be foregone on National Forest lands as the river corridor is currently being managed to maintain the visual qualities. The opportunity to maximize timber values on the non-Federal lands may be reduced if the Recreational River classification will be met. A 10-15 percent reduction may be anticipated. This would reduce the potential yield from approximately 800 MBF per year to approximately 700 MBF/year.

   The opportunity for full residential and commercial development along the lower river may be reduced. Extraction of rock from the riverbed would be limited. **Medium suitability.**

6. Support for a Wild and Scenic River classification is primarily with the State Department of Fisheries and regional conservation organizations. This support has been somewhat limited in scope.

   Significant opposition has been expressed by adjacent landowners and communities. **Medium suitability.**

7. The Main Stem and West Fork of the Humptulips provides a rather limited representation of the ecosystems found along the west slopes of the Olympic Mountains. The upper elevation mountain hemlock and alpine zones are not represented within the river corridor. **Medium suitability.**

HAMMA HAMMA RIVER

1. The Hamma Hamma is located primarily within the Olympic Mountains section, except for the very lower reaches located within the Puget Sound trough section. The segment within the Olympic Mountains section is significantly shorter than that of the Dosewallips and Duckabush. The Puget Sound trough section is similar to the Duckabush and Dosewallips. **Medium suitability.**

2. The Wild River segment is entirely within The Brothers Wilderness. The Scenic segment is currently being managed with a visual quality objective of Partial Retention. The Recreational River segment

within the National Forest is being managed for its recreational values and scenic qualities. Timber harvesting and development on private land is generally consistent with the management objectives for a Recreational River. **High suitability.**

3. Approximately 2,200 non-Federal acres are within the river corridor. Most of these are timber management lands. All of these are within the Recreational River segment and timber harvesting is generally compatible with this classification. **High suitability.**

4. Cost of land acquisition should be negligible. Acquisition for one or two viewpoints and limited scenic easements might be necessary along the lower river. **High suitability.**

5. Little, if any, timber values would be foregone on National Forest lands. The potential yield of 121 MBF/year from tentatively suitable lands has already been reduced to meet riparian management and visual quality objectives. Further reduction should not be necessary. The non-Federal lands have a potential yield of approximately 150 MBF/year. A reduction of 10-20 percent could be anticipated to fully meet the objectives of a Recreational River classification.

   Three run-of-the-river hydropower projects have been proposed on the Hamma Hamma River. The opportunity for these would be foreclosed with a Scenic River classification and seriously in doubt on a Recreational River. **Medium suitability.**

6. Opposition to a Wild and Scenic River designation on the Hamma Hamma is primarily from landowners along the river. Support for such a designation is from local and regional conservation organizations, local American Indian tribes, the State Department of Game and State Department of Fisheries. Neither support nor opposition has been very strong. **Medium suitability.**

7. A good representation of the range of the major ecosystem and vegetation zones found on the east side of the Olympics, except for limited or no representation in the mountain hemlock and the subalpine fir vegetation zones. **Medium suitability.**

WYNOOCHEE RIVER

1. Located on the south flank of the Olympic Mountains, the Wynoochee River System is entirely within the Olympic Mountains Section of the Pacific Border Province. A typical representative of rivers within this section. **Medium suitability.**

2. Compatability with existing uses is generally good. The river corridor within the National Forest is managed to retain the riparian area values. This is generally consistent with the classification of recreational river and somewhat meets the requirements of a scenic river classification. Timber management activities, farming and scattered rural residences within the non-federal segments of the river may be consistant with the recreational river classification. **Medium suitability.**

3. With 69 percent of the river corridor in non-federal ownership, approximately 14,000 acres, there is the potential for a significant impact on the non-federal landowner. The majority of these non-federal lands are being managed for timber production. Any modification of timber management practices, especially harvesting activities could reduce potential yields. Current farming activities within the lower river corridor are generally consistent with a recreational river classification. Impacts on the farming operations should be minor. **Medium suitability.**

4. Acquisition of land for additional public access and boat launch facilities, parking, day use facilities and trails would be required. It is not anticipated that acquistion of scenic easements would be necessary. Total acquisition costs would be moderate. **Medium suitability.**

   Limited timber values would be foregone within the National Forest segment of the river. The potential for development of the Oxbow Hydropower Project would be foreclosed.

5. On non-federal lands within the river corridor, the opportunity to maximize timber production may be reduced if the recreational river standards are met. **Medium suitability.**

6. Support for the addition of the Wynoochee River to the Wild and Scenic System is given by Regional Conservation Organizations, Washington Department of Fisheries, and the Washington Department of Wildlife.

   Opposition has been expressed by the adjacent landowners, local communities and local elected officals. **Medium suitability.**

7. The Wynoochee River flows through lands which represent a typical ecosytem find along the mid and lower ecavations fo the western slopes of the Olympic Mountains. **Medium suitability.**

SOUTH FORK SKOKOMISH RIVER

1. Flowing off the southeastern flank of the Olympic Mountains, the South Fork Skokomish is entirely within the Olympic Mountains section of the Puget Sound Province. Quite similiar to other rivers within this Province. **Medium suitability.**

2. From its source to Rule Creek the River flows through the Olympic National Park and the Upper Southfork Non-Motorized Recreation Area. Both are highly compatible with a wild river classification. From Rule Creek to Le Bar Creek the River flows through the South Fork corridor where timber entry and development has been limited. Very compatible with a scenic classification. The activities and uses within the sections from Le Bar Creek to the Gorge and below the Gorge are consistent with the recreational classification. The undeveloped Gorge Section fully meets the wild classification. **High suitability.**

3. Just over one quarter, 2300 acres, of the river corridor is in non-federal ownership. Where suitable, most of this is being managed for timber production. 190 acres are within the scenic classification, the remainder is within the recreational classification. Timber harvesting is generally compatible with these classifications. **High suitability.**

4. Acquistion costs will be associated with rights-of-way for an extension of the trail system. **High suitability.**

5. If designated as a Wild and Scenic river, the ASQ would be 760 MBF less than that in the preferred alternative. Approximately 2,000 acres of the non-federal lands are being managed for timber production. Any modification in harvesting activities could reduce this potential yield.

   Designation as a Wild and Scenic river would foreclose the option of the potential hydropower project near the mouth of the Gorge. **Medium suitability.**

6. Support for a Wild and Scenic river classification is primarily from the Skokomish Indians, Washington Department of Fisheries, and Regional Conservation Organizations.

Opposition is from adjacent landowners and residents in the lower valley who would like to see flood control measures constructed. **Medium suitability.**

7. A good representative of the major ecosystems found at the mid and lower elevations of the Olympic Mountains section of the Pacific Border Province. **Medium suitability.**

EAST FORK HUMPTULIPS RIVER

1. Located on the west flank of the Olympic Mountains, the East Fork Humptulips River is entirely within the Olympic Mountains Section of the Pacific Border Province. A typical representation of this section. Quite similiar to the West Fork of the Humptulips. **Medium suitability.**

2. Compatibility with the existing use is good. The river corridor within the National Forest is being managed to meet the visual quality objective of partial retention. This is consistent with a scenic classification. Existing development and activities between Stovepipe Creek and the forest boundary are compatible with a scenic classification. Downstream from the forest boundary, past timber harvesting and associated activities are generally compatible with a recreational classification. **High suitability.**

3. Approximately 43 percent, 4,290 acres, of the river corridor is in non-federal ownership. Nearly all of these lands are being actively managed for timber production. Any modification of timber management practices, especially harvesting activities, would reduce potential yields. **Medium suitability.**

4. Acquistion of land for boat launch facilities, parking, day use facilities and trails would be required. Limited acquistion of corridor lands or scenic easements necessary to maintain scenic quality and/or to protect geologic features could be anticipated. Acquistion costs would be moderate. **Medium suitability.**

5. Limited timber values would be foregone within the National Forest segment as the river corridor is currently being managed to maintain visual qualities and provide protection of the riparian areas. The opportunity to maximize timber values on the non-federal lands may be reduced if the recreational river standards are met. **Medium suitability.**

6. Support of a Wild and Scenic river classification is primarily with Regional Conservation Organizations, Washington Department of Fisheries, and Washington Department of Wildlife.

   Opposition has been expressed by the adjacent landowners along the Humptulips below the confluence of the East and West Fork. **Medium suitability.**

7. The East Fork of the Humptulips provides a typical representation of the ecosystems found along the mid and lower elevations of the west slopes of the Olympic Mountains. **Medium suitability.**

Table F-82. Summary of Suitability Analysis

	Duck-abush	Dose-wallips	Dung-eness	Gray Wolf	Sole-duck	Hump-tulips	Hamma Hamma	E Fk Hump.	Wyn-oochee	S Fk Skok.
1. Representation of physiographic provinces and section	H	H	H	H	H	M	M	M	M	M
2. Compatibility	H	H	H	H	H	M	H	H	H	H
3. Non-Federal impacts	H	H	H	H	M	M	H	M	M	H
4. Cost of acquisition	H	H	H	H	M	M	H	M	M	M
5. Values foregone	H	M	M	H	M	M	M	M	M	M
6. Support or opposition	H	M	H	H	L	M	M	M	M	M
7. Representation - major ecosystems	H	H	H	H	H	M	M	M	M	M
Summary: H (High)	7	5	6	7	3	-	5	1	-	2
M (Medium)	-	2	1	-	3	7	2	6	7	5
L (Low)	-	-	-	-	1	-	-	-	-	-

Based on the suitability analysis and the objective to add to the Wild and Scenic River System the Nation's best rivers representing a diversity of river types found within each physiographic province and section, the following rivers are recommended for addition to the Wild and Scenic Rivers System.

The Duckabush - Flowing through the Olympic Mountains, and Puget trough sections of the Pacific Border Province, the Duckabush is the best representative river flowing down the east flank of the Olympics. Rising above timberline and flowing to saltwater at Hood Canal, the river flows through a full range of vegetation zones typically found in the area.

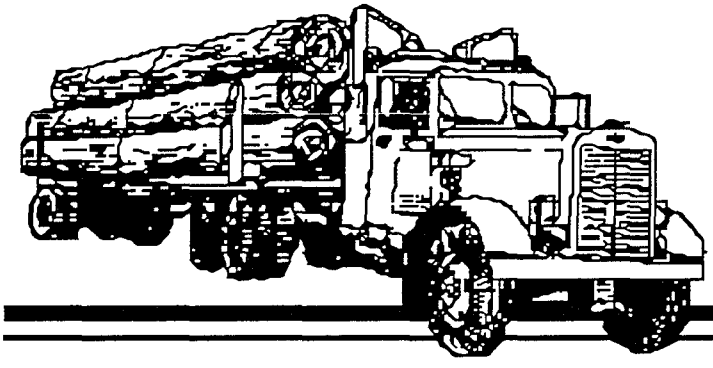
The Dungeness - Flowing north out of the Olympic Mountains, the Dungeness is located entirely within the Olympic Mountains section of the Pacific Border Province. This system is the best representative of a river system that flows out of the "Olympic Rain Shadow." Rising above timberline, this river system includes some of the most diverse and unusual ecosystems and vegetative zones on the Olympic Peninsula.

The Gray Wolf - A major tributary to the Dungeness, this river flows northeast out of the Olympic Mountains and is located entirely within the Olympic Mountains section of the Pacific Boarder Province. It is representative of the greater Dungeness River system, which flows out of the "Olympic Rain Shadow." Rising above timberline, this river system, similar to the Dungeness, contains some of the most diverse and unusual ecosystems and vegetative zones on the Olympic Peninsula.

West Flank, Rain Forest River - While the Soleduck, main stem of the Humptulips, West Fork of the Humptulips and East Fork of the Humptulips are eligible rivers that flow down the west flank of the Olympic Mountains within the Olympic Mountains section of the Pacific Border Province, there are three superior representatives to select from. These three river systems have long been recognized as the major rain forest rivers flowing from the heart of the Olympics to the ocean. They are: the Hoh, the Queets, and the Quinault upstream from Lake Quinault. As all three of these rivers are predominantly within Olympic National Park and have little or no lands within Olympic National Forest, the analysis and recommendation should be done by the National Park Service.

Appendix G

Selection of Harvest Cutting Methods



Olympic National Forest

APPENDIX G

SELECTION OF HARVEST CUTTING METHODS

HARVEST CUTTING METHODS

Harvest cutting methods include both even-aged and uneven-aged silvicultural systems. Even-aged harvest methods include clearcutting, shelterwood cutting, and seedtree cutting. Uneven-aged harvest methods include individual tree selection and group selection cutting. This appendix will give reasons for selection of the broad silvicultural system (even-aged or uneven-aged) to be applied on the Olympic National Forest. The specific harvest treatment methods (such as clearcutting, shelterwood, or group selection) will be selected on a site-specific basis as identified in project-level environmental analyses or in silvicultural prescriptions written or approved by certified silviculturists.

A description of the above-mentioned silvicultural systems as defined in Agriculture Handbook No. 445 (Burns, 1983) are as follows:

EVEN-AGED SYSTEMS

Clearcutting -- "Clearcutting is the harvesting in one cut of all trees on an area for the purpose of creating a new, even-aged stand. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as a separate age class... Regeneration is obtained through natural seeding, through sprouting of trees that were in or under the cut stand, or through planting or through direct seeding."

Shelterwood -- "In the shelterwood system, the mature stand is removed in a series of cuts. Regeneration of the new stand occurs under the cover of a partial forest canopy or shelterwood. A final harvest cut removes the shelterwood and permits the new stand to develop in the open as an even-aged stand. This provides a continuing cover of either large or small trees. It is especially adapted to species or sites where shade is needed for the new reproduction, or where the shelterwood gives the desired regeneration an advantage over undesired competing vegetation."

Seed tree -- "The seed-tree system involves harvesting nearly all the timber on a selected area in one cut. A few of the better trees of the desired species are left well distributed over the area to reseed the area naturally. When feasible, the seed trees are harvested after regeneration is established. This method applies mainly to shade tolerant species."

UNEVEN-AGED SYSTEMS

Individual tree selection -- "Individual (single) tree selection involves the removal of individual trees rather than groups of trees. In mixed stands it tends to lead to an increase in the proportion of shade tolerant species in the forest."

Group selection -- "Group selection can be used to maintain a higher proportion of less shade tolerant species in a mixture from indvidual tree selection... In some Western timber tapes where... the trees are very tall, the groups may be as large as an acre or two... the group selection system is distinguished from clearcutting in that the intent of group selection is ultimately to create a balance of age or size classes in intimate mixture or in a mosaic of small contiguous groups throughout the forest."

DISCUSSION OF EVEN-AGED VS. UNEVEN-AGED SELECTION CRITERIA

The criteria used for selection of harvest cutting methods were developed using selection criteria from the Regional Guide for the Pacific Northwest Region (1984), as well as direction from 36 CFR 219.27(b) for management involving manipulation of tree cover. A brief description of the criteria follows. These brief descriptions are intended as a guide. Refer to the regulations and Regional Guide for more precise interpretations.

SELECTION CRITERIA FROM THE REGIONAL GUIDE

1. The selected method must produce a volume of marketable trees that meet utilization standards and are designated for harvest.

2. The selected method must permit use of a logging method which can remove designated trees without excessive damage to the residual stand, while meeting other established land management objectives. The Regional Guide includes a display of the compatibility of logging systems with common harvest cutting methods. Generally, ground-based logging methods, helicopters, and cable methods using slack pulling carriages are appropriate for all harvest methods. Cable methods without slack pulling carriages and balloons are appropriate only for clearcuts.

3. The selected harvest method must be capable of providing special conditions required to meet resource management objectives. See the Regional Guide for a display of commonly used harvest methods which achieve desired forest character. Both even-aged and uneven-aged methods can meet desired forest character, with the exception of a variety of forest and opening, and maximum wildlife species diversity. Here, uneven-aged methods are not applicable. Single-tree selection is generally not applicable to maximizing tree species diversity.

4. The selected method must permit control of vegetation to establish desired numbers and growth rates of trees, as well as other vegetation needed to achieve special management objectives (see harvest cutting methods outlined in the Regional Guide). Generally, both even-aged and uneven-aged methods can be used in vegetation zones occurring on the Forest. However, uneven-aged methods are not applicable for wildlife forage production or optimum tree seedling and sapling growth. The uneven-aged method is not considered appropriate to the Sitka spruce vegetation zone. Group selection is considered the most applicable of the uneven-aged methods in the western hemlock zone.

5. The selected method must promote a stand structure and species composition minimizing serious damage risks from insects, disease, animals, and wildfire, while allowing for treatment of these. The Regional Guide includes displays of harvest cutting methods favorable to reducing damage risks, treating actual damage. Uneven-aged methods are not applicable where dwarf mistletoe and root disease present serious risks.

6. The selected method must meet multiple-use management objectives identified in the Regional Guide and Forest Plan.

SELECTION CRITERIA FROM 36 CFR 219.27(b)

The seven criteria identified in 36 CFR 219.27(b) directing management for manipulation of tree cover is summarized as follows:

1. Be best suited to multiple-use goals, considering biological, environmental, engineering, economics, and other impacts.

2. Assure that lands can be adequately restocked.

3. Not be chosen primarily because of the greatest dollar return or timber output, although these factors should be considered.

4. Consider the potential impacts on residual trees and adjacent stands.

5. Avoid permanent reduction of site productivity and ensure conservation of water and soil.

6. Provide the desired effects to meet special management objectives.

7. Be practical in terms of transportation and harvesting requirements and total costs of timber sale preparation, logging and administration.

COMBINED CRITERIA FOR SELECTION OF HARVEST CUTTING METHODS

The criteria identified in the Regional Guide and in 36 CFR 219.27(b) were combined to eliminate duplication of intent and simplify reasons for selecting the harvest cutting methods used in the Forest Plan. These seven combined criteria are summarized as follows:

1. The selected method must produce a volume of marketable trees that meet utilization standards and are designated for harvest (Regional Guide: Criterion 1).

2. The selected method must use available and acceptable logging methods (Regional Guide: Criterion 2, 36 CFR: Criterion 4).

3. The selected method must be capable of meeting special management and multiple-use objectives (Regional Guide: Criteria 3 and 6, 36 CFR: Criteria 1 and 6).

4. The selected method must permit control of vegetation to establish desired species composition, density, and rates of growth (Regional Guide: Criterion 4, 36 CFR: Criteria 4 and 6).

5. The selected method must promote a stand structure and species composition which minimizes risks from insects, disease, and wildfire (Regional Guide: Criterion 5).

6. The selected method must assure that lands can be adequately restocked (36 CFR: Criterion 2).

7. The selected method must be practical and economical in terms of transportation, harvesting, preparation and administration of timber sales (36 CFR: Criterion 7).

In addition, the harvest cutting method must not be selected primarily because it results in the greatest dollar return or provides the highest output of timber. Also, the selected method must not permanently reduce site productivity, and must assure conservation of water and soil resources (36 CFR: Criteria 3 and 5).

WORKING GROUPS/MANAGEMENT EMPHASIS AREAS

Both even-aged and uneven-aged harvest cutting methods were available and evaluated for selection within the Forest's tentatively suitable commercial forest lands.

WORKING GROUPS

The Olympic National Forest has six major vegetation zones 1/ (Henderson et al. 1989). The three highest vegetation/elevation zones (mountain hemlock - subalpine zone, and the alpine zone) do not contain tentatively suitable commercial forest lands due to the species of vegetation, soil characteristics and regeneration problems. The remaining three lower zones, which comprise tentatively suitable forest lands on the Forest, have been described by Henderson as follows:

The Sitka Spruce Zone is limited to the area of strong maritime influence along the western side of the Peninsula. It generally occurs where precipitation exceeds 100 inches and there is a summer fog effect. It also appears to be limited above 600 feet elevation. It is characterized by such species as Sitka spruce, western hemlock, western redcedar, salmonberry, salal, vine maple, red huckleberry, and Alaska huckleberry. Herbs include oxalis, swordfern, ladyfern, deerfern, and foamflower. Timber productivity is very high.

The Western Hemlock Zone occurs around the Peninsula from very wet to moderately dry habitats. It usually extends up in elevation to where the Silver Fir Zone begins, unless the precipitation is very low as in rainshadow areas, where it is often replaced by the Subalpine Fir Zone. In the wetter parts of the Peninsula, it may extend up to only about 2,000 feet, but in drier areas it may go to about 4,000 feet. Forest fires have been common in the Western Hemlock Zone, with large fires occurring at intervals of about 200 years for most places. Stands throughout most of the Western Hemlock Zone are dominated by Douglas-fir. Dominant trees are Douglas-fir and western hemlock, with lesser numbers of western redcedar, red alder, bigleaf maple, and black cottonwood. Shrubs include salal, vine maple, Oregongrape, red huckleberry, and rhododendron. Common herbs are swordfern, twinflower, beargrass, false solomon's seal, prince's pine, violets, and trailing blackberry.

1/(Refer to Henderson et al. 1989 for zone descriptions and definitions). These vegetation zones are based on climax tree species. The commercial species presently occupying these areas may be Douglas-fir, Western hemlock, Sitka spruce, Pacific silver fir, Western redcedar, and red alder, or a combination of these species.

The Silver Fir Zone dominates the mid-elevations and cool stream bottoms between about 2,000 and 3,500 feet elevation. The range is somewhat lower near Quinault Lake and higher near Quilcene. This zone is characterized by a snowpack on the ground through most of the winter and a cool, short summer growing season. Forest fires are not common in this zone. Dominant trees include Pacific silver fir and western hemlock. Douglas-fir and Alaska yellowcedar may also occur. Shrubs include several kinds of huckleberries, white rhododendron, fools huckleberry, and Oregongrape. Herbs include beargrass, five-leaved bramble, deerfern, twisted-stalk, bunchberry dogwood, and queenscup.

The species and species mixtures existing on the Forest may be categorized into three of the major forest types of the United States (Burns, 1983). These types are: (1) Western Hemlock-Sitka Spruce (Harris and Johnson, 1983); (2) Pacific Douglas-Fir (Williamson and Twombly, 1983) and (3) True Fir-Hemlock (Franklin et al. 1983).

Published literature indicates that, conceptually at least, these types could be managed through either even-aged or uneven-aged harvest methods. In general, even-aged management would either establish or at least favor the establishment of less tolerant species such as Douglas-fir, Sitka spruce and red alder. Uneven-aged management would favor the more tolerant western hemlock and silver fir and could greatly reduce the Douglas-fir component of the stands.

A second general statement is that only even-aged management has been applied in these types to date. Almost no empirical data is available for guidance in predicting sustained yields or developing specific stocking guides in uneven-aged management (Curtis 1981).

A third generalization about the stands on the Forest is that they are either even-aged or mixed-aged stands dominated by extremely old, large trees. The risk of damage to residual trees is extremely high when attempting to remove such large trees, particularly on steep slopes using cable logging methods.

A fourth generalization is that Regional standards for size and dispersal of openings is automatically met when using uneven-aged methods. Even-aged methods may place limitations on size of individual harvest areas and/or require special emphasis on timing of nearby harvests.

Because of their similarities in relation to a determination of the preferred harvest method, the three vegetation zones are considered one working group when analyzed with differing management emphasis. If a particular selection criteria appears to apply differently to a particular type, this will be described in the analysis.

MANAGEMENT EMPHASIS CATEGORIES

Of the thirteen management emphasis categories being used in the planning process, six include some degree of timber harvesting and were utilized for this analysis. See Chapter IV of the Forest Plan. They are as follows:

A2 - Scenic
A4A- Wild, Scenic and Recreational Rivers
A4B- River Corridors
E1 - Timber Management
F1 - Municipal Watersheds
F2 - Riparian Areas

RATIONALE FOR SELECTION OF HARVEST CUTTING METHODS

The following analysis provides rationale for selecting the harvest cutting method for each management emphasis area. The analysis is based on previously defined combined criteria.

MANAGEMENT EMPHASIS AREAS WITH PLANNED TIMBER HARVEST

SCENIC

The management goal in Scenic emphasis areas is to provide a pleasing visual experience as seen from selected major travel routes or recreation-use areas. Specific, minimum stand characteristics have been established to provide guides as to when the somewhat subjective goal of "a pleasing scenic experience" has been attained. The guides apply to specific areas as a whole, i.e., a particular travel corridor or designated recreation-use areas rather than an individual-area basis. The basic guideline consists of a target tree size which must be maintained on at least 30 percent of the area. The target tree size is the average tree size found within the characteristic landscape. An additional guide provides for a maximum percentage of an area which may contain trees less than twenty feet in height. Either even-aged or uneven-aged harvest methods may be applied to meet these goals. The individual tree selection method would result in target tree sizes existing on all areas, at all times maximizing the primary objective of this area (combined criteria 3). In contrast, clearcuts or shelterwoods exceeding 4 to 7 acres may not meet the goals, particularly in foreground areas. Large tree size, amount of defect, logging feasibility, susceptibility to logging damage in western hemlock and Pacific silver fir, and increased costs (combined criteria 2, 4, 5, and 7) are all limiting disadvantages to the selective cut method. Uneven-aged methods are not applicable to areas where dwarf mistletoe infects western hemlock (Russell 1976) (combined criteria 5).

Economic and physical feasibility would increase with the size of the harvest unit using even-aged methods. However, the visual management objective could not be met without restricting the unit sizes (combined criteria 3).

Even-aged methods with unit size limitations are selected for visual quality emphasis areas. Unit size limitations will be prescribed on a site-specific basis so that the primary objective is attained. It is expected that physical and economic factors will result in the use of the clearcut method as the most optimal for regeneration. Shelterwood/seed tree methods with long-term retention of shelter/seed trees is also a possibility and should be utilized where the clearcut method will not meet scenic management objectives. Forest Standards for wildlife trees shall be met whatever the selected method. This is expected to result in the retention of some green trees for up to two-thirds of the next rotation on some portions of the "clearcut." Alternative uneven-aged systems may be prescribed in those instances where minimum visual objectives cannot be obtained using even-aged methods.

SCENIC AND RECREATIONAL RIVERS

Primary objectives for this area are the same as for the previously described Scenic emphasis areas. However, some portions of the Recreational Rivers may allow for modification of the landscape (more and larger clearcuts) as well as retention or partial retention (few and very small clearcuts). Rationale for selection of harvest method is the same as in Scenic emphasis areas. Even-aged methods are selected for these emphasis areas, with unit size and shape limitations to be prescribed on a site-specific basis to meet objectives.

RIVER CORRIDORS (NATURAL AND GENERAL)

The primary objectives and rationale for selection of harvest methods are as described for the Scenic and Recreational Rivers. Even-aged methods are selected for these emphasis areas, with unit size and shape limitations to be prescribed on a site-specific basis to meet objectives.

TIMBER MANAGEMENT

The primary goals of management are high, continuous timber production and high economic returns. Timber production will be based on the most highly productive and efficient silvicultural systems developed for the best physical and vegetation characteristics of the site. Satisfactory growth rates should be maintained throughout the life of the stand emphasizing reduction of growth loss from windthrow, dwarf mistletoe, root diseases, and butt rots. Retention of the more intolerant and currently higher value species (i.e., Sitka spruce and Douglas-fir) is emphasized. Both even-aged and uneven-aged systems are biologically possible. The selection decision is weighted heavily by the successional trends of the Western Hemlock Zone, where the use of uneven-aged systems would result in reduction of the Douglas-fir portion in the stands (Franklin 1978) (combined criteria 4). Harvest activities for the next three to four decades will generally take place in stands of overmature, large timber. Uneven-aged systems would require extended time periods to convert stands to the density and diameter distributions for best growth (Ruth and Harris 1979). This may be difficult to achieve because of potential windthrow and logging damage during repeated partial removals of the extremely large timber (combined criteria 4 and 5). Steep slopes, difficult road construction conditions, and large timber size result in the use of long-span cable systems which are most practical and economical when used with even-aged systems (particularly clearcut) (combined criteria 1, 2, and 7).

Adequate reforestation may be assured using either even-aged or uneven-aged methods. In the drier Douglas-fir areas and the colder silver fir zone, harvest methods which provide sheltered conditions are most appropriate. This may be accomplished by small clearcuts, shelterwoods, group selection or selection systems. Logging feasibility, economics and windthrow potential are the three major considerations in selecting the method to use on a particular site (combined criteria 7). Relative impacts of the selected harvest method on emphasis other than timber varies with the emphasis (combined criteria 3). Uneven-aged methods are not considered appropriate for maximun forage production. Potential adverse impacts on soils, dispersed recreation, and visual quality are concentrated in time and space by even-aged methods. Uneven-aged methods tend to lessen the potential impacts at any one time, but require more entries and cover a larger proportion of the managed forest.

The objectives of high timber production, disease control, maintenance of less tolerant species and high economic returns are best obtained through even-aged clearcut methods. Management requirements for resources other than timber may also be attained with this method. Therefore, even-aged methods are selected for timber management emphasis areas. All even-aged methods, including clearcutting, will be

modified that snags and "green trees" will be maintained to the extent and time required to attain wildlife snag management objectives through future managed rotations.

MUNICIPAL WATERSHEDS

The primary management goal for these areas is to provide high quality water for long-term domestic use. Various portions of municipal watersheds may be managed with a secondary management emphasis, i.e., for riparian, scenic or timber management. The selected harvest system should be compatible with the secondary management goals, as long as they do not conflict with the primary goal of long-term quality water production (combined criteria 3). Guidelines established for municipal watershed areas provide that acreage harvested per decade does not generate sediment levels which exceed specific thresholds of concern. Such limitations do not conflict with the use of either even-aged or uneven-aged harvest methods. The selected method is the same as for the secondary management goal of the specific area. Generally, this will be even-aged management as selected in the analysis for other management emphasis areas.

RIPARIAN HABITAT

Management goals for these areas are to provide a diversity of vegetative cover to meet stream surface shading requirements and wildlife habitat. Water temperature standards are to be met, and woody debris is to be provided for instream fisheries habitat and streambed/bank stability. In addition, vegetation should provide for wildlife needs specific to the water/ground interface. Established wildlife travel routes along streams are to be protected. Timber will generally be managed for a continuous supply of large diameter mature trees. Less than maximum timber volume production is expected, but satisfactory growth rates should be maintained and stands protected from disease, insects, and windthrow.

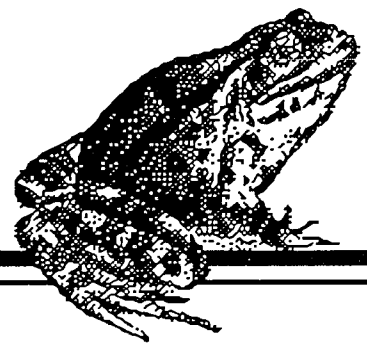
Both even-aged and uneven-aged methods are applicable. Even-aged methods are restricted in relation to size and distribution of harvested units due to the special management goals for shade, stream temperature and wildlife needs (combined criteria 3). Uneven-aged methods may be limited by diseases such as root rots, dwarf mistletoe, physical constraints for logging and costs (combined criteria 5).

Several factors existing in riparian areas on the Forest may result in difficult harvesting conditions regardless of whether even-aged or uneven-aged methods are utilized. Generally, the areas contain large, old-growth timber susceptible to windthrow. The areas are generally located distant from the road systems and are below areas of forest that are managed for timber production under even-aged systems. These factors influence logging system selection, harvest timing and economics (combined criteria 2, 4, 5, and 7).

Even-aged methods are selected for management of riparian areas because they are the most practical, economic and are compatible with adjacent management areas. Shelterwoods with retention of shorter trees may be utilized. Complete stand retention (no harvest) may be prescribed in areas closest to streams. Long-term retention of trees capable of providing large woody debris to the stream system is prescribed. Uneven-aged systems should be considered as an alternative in site-specific prescription determinations and selected where appropriate.

Appendix I

Analysis of Management Requirements



Olympic National Forest

APPENDIX I

ANALYSIS OF MANAGEMENT REQUIREMENTS

INTRODUCTION

This appendix presents information responding to decisions of the Chief of the Forest Service and the Deputy Assistant Secretary of Agriculture regarding Appeal Number 1770, brought by the Northwest Forest Resource Council on September 18, 1986. The appeal centered on direction from the Regional Forester to incorporate Management Requirements (MRs) into Forest Plan alternatives.

Appellants requested that the appropriateness of MRs be examined through the environmental impact statement process. The analysis contained in this appendix is intended to address the issue raised by the appellants. In the analysis, alternative ways of meeting management requirements are examined and the opportunity costs associated with them (losses in economic efficiency and timber available for harvest) are compared.

CHANGES FROM DRAFT TO FINAL

Several changes in the analysis of management requirements have been necessitated by events occurring since the original publication of this appendix. Changes in spotted owl management requirements and restructuring of the Forest's FORPLAN model have been the principal factors affecting the MR analysis. The principal revisions which have influenced the analysis presented in this appendix are summarized below.

- The analysis of MR opportunity costs has been redone, using updated resource information and the revised FORPLAN model. Some opportunity costs, especially those associated with spotted owl management, have changed significantly.

- The selected alternative for modeling the riparian/water quality MR has changed. The revised analysis of alternative means of implementing this MR has indicated that use of a timber yield falldown would be the most appropriate modeling strategy.

- Specifications for meeting the northern spotted owl MR have changed considerably. This has resulted in a substantial increase in the opportunity costs associated with this management requirement.

- The dead and defective tree habitat MR, which provides for viable populations of the cavity excavator species group, has been added to the group of MRs with PNV and/or LTSYC opportunity costs in excess of two percent. A detailed analysis of this MR is now included in this appendix.

BACKGROUND OF MANAGEMENT REQUIREMENTS

WHAT ARE MANAGEMENT REQUIREMENTS AND WHAT ROLE DO THEY PLAY IN FOREST PLANNING?

To assure that applicable laws and regulations are treated consistently in forest planning, Forest Service direction at the National and Regional levels identified substantive requirements of the regulations which must be met in all Forest Plan alternatives. The management requirements are the substantive requirements identified in 36 CFR 219.27. Some of these requirements are procedural and, therefore, are not dealt with here. Some were analyzed and subjected to public review in the Regional Guide Environmental Impact Statement (EIS) process; these too are not dealt with here. The management requirements which have not been fully dealt with elsewhere, and which require further analysis, are those covering water quality and riparian areas, timber harvest dispersion, and viable populations of existing native vertebrate species. Each of these is described in later sections of this appendix.

LEGAL REQUIREMENTS VS. IMPLEMENTATION METHODS

The management requirements derived from the National Forest Management Act (NFMA) and its implementing regulations are legal requirements. These represent "ends" which must be met during forest plan implementation. For example, the NFMA implementing regulations require that "fish and wildlife shall be managed to maintain viable populations of existing and desired nonnative vertebrate species in the planning area." It is mandatory that, regardless of the implementation methods chosen, this "end" (Management Requirement) be achieved.

Implementation methods are the "means" or "ways" in which the management requirements will be met. Using the pileated woodpecker as an example, the MR, or "end", is to provide habitat sufficient to maintain a viable population of pileated woodpeckers into the foreseeable future. The "means" or "ways" of providing this habitat involve designing and implementing a set of practices which will assure that nesting and feeding areas of a size suitable for the needs of the pileated woodpecker are available in the future. The selected "means" must also assure that these habitat areas are close enough together so that woodpeckers occupying adjacent habitat areas will be able to interact, thus assuring continued genetic diversity.

Unfortunately, the distinction between "ends" and "means" is not always clear. The NFMA and its implementing regulations clearly describe the "end" regarding viable populations of vertebrate species. In the case of the harvest dispersion MR, the "end" is not as well defined. NFMA specifies that harvest openings be limited to a prespecified size and be dispersed, but does not specifically state the reason (or end) to be accomplished by doing this. The implementing regulations and the Regional Guide comply with NFMA by specifying maximum unit sizes and describing how they are to be implemented to achieve a dispersal standard. Limiting the size and dispersal of harvest openings has no clear precedent regarding either "means" or "ends", though for the purpose of this analysis it is treated as though it were an "end" in itself.

The "means" (implementation methods) for meeting management requirements must be based on knowledge of the resources involved. In meeting the MR for viable populations of vertebrate species, for example, it is necessary to define the type of habitat required by the species, the size of habitat area needed to support a breeding pair, and the maximum distance between habitats which provides reasonable assurance of genetic interaction. Often, the pool of scientific knowledge is insufficient to provide the entire basis for defining the conditions or standards that will satisfy a MR. In such cases, it is necessary to consider the field experience and professional judgment of knowledgeable professionals, and to rely on monitoring and research to provide more complete information for future planning efforts.

ALTERNATIVE WAYS OF MEETING MANAGEMENT REQUIREMENTS

Usually there is more than one way a Management Requirement can be met. Different "means" are usually available for accomplishing the particular specifications that represent the "ends" associated with a given MR. When a variety of possible means is available, it is often necessary to assess and compare the effects each possibility may have on resource outputs and land uses. Consideration and analysis of different means (or ways) of meeting a specific MR is particularly important if there are potentially large opportunity costs involved.

HOW ALTERNATIVE WAYS OF MEETING MANAGEMENT REQUIREMENTS WERE DEVELOPED

The general process used in identifying alternative ways of meeting Management Requirements is as follows:

1. For each Management Requirement, the desired "end" is identified.

2. The existing pool of information about the resources addressed by the Management Requirement is assembled.

3. The information (from step 2) is analyzed to determine what conditions must exist on the ground to assure that the Management Requirement is met.

4. Ways (means) to provide the conditions identified in step 3 are developed. In most cases, it is necessary to simulate these conditions in the FORPLAN model.

5. The various ways of providing the desired conditions are analyzed as to their effects on economic efficiency (measured by changes in present net value (PNV)) and timber availability (measured by long-term sustained yield capacity (LTSYC)).

6. When the opportunity costs associated with the most efficient means of meeting a management requirement have been found to exceed two percent of the PNV or LTSYC of the maximum present net value benchmark (Benchmark 3), the analysis used to determine the optimum means is presented in this appendix. Two percent was selected as the threshold of significance with respect to opportunity costs. It is at this level of effect that the changes in outputs associated with management requirement attainment become truly meaningful.

Table I-1 presents the MRs subject to analysis of opportunity costs on the Olympic National Forest, and summarizes the specifications or standards that are indicators of achievement of the ends represented by each MR. More complete specifications for each MR are presented in the Forest Plan and Forest Plan FEIS.

Table I-1. Management Requirements Subject to Opportunity Cost Analysis

Ends	Summary of Specifications
Protect water quality, fish habitat quality, and wildlife habitat within riparian zones	Land approximately 200 feet from the edges of all perennial streams, lakes, and other bodies of water requires special attention to: - maintain streambank and stream channel stability - avoid unacceptable erosion and sedimentation - meet Clean Water Act standards - provide a continual source of large organic debris (essential for maintenance of fish habitat) - provide essential riparian habitat for wildlife
Habitat provided that maintains viable populations of existing native and desired nonnative vertebrate species	- Maintain old-growth and mature forest stands of sufficient size and adequate distribution to permit survival of and interaction among breeding pairs of dependent species. - For the spotted owl: provide habitat areas so that no more than 8 miles separate areas capable of supporting 3 or more owl pairs and no more than 2 miles separate areas capable of supporting less than 3 pairs. Each area must contain at least 3,000 acres of suitable spotted owl habitat. - For the pileated woodpecker: provide one habitat area for every 12,000 to 13,000 acres. Each area must contain at least 300 acres of old-growth or mature conifer habitat. 1/ - For the pine marten: provide one habitat area for every 4,000 to 5,000 acres. Each area must contain at least 160 acres of old-growth or mature conifer habitat. 1/ - For species dependent on dead and defective tree habitat: provide snag densities needed for at least a 40% potential population level within major drainages and at least a 20% level within individual 60-acre land areas.
Openings created by timber harvest activities are dispersed and limited in size	- Maximum created opening size of 60 acres (with some exceptions). - No more than 1/3 the perimeter and size of adjacent natural openings. - Corners of created openings may touch, but this is considered a single opening and cannot exceed 60 acres in size (with some exceptions). - Protect vegetation along edge of natural openings. - Site must be adequately stocked with trees 4 1/2 feet tall before it is no longer considered an opening.

1/ The combined requirements for pileated woodpecker and pine marten habitat are referred to as the "mature conifer" MR. Opportunity costs have been estimated for mature conifer specifications, as a whole, in this analysis.

In analyzing the effects of the means of meeting MRs on present net value and long-term sustained yield capacity, FORPLAN runs were made with and without the constraints used to simulate meeting management requirements. The maximum PNV benchmark (Benchmark 3) was used for this analysis. This benchmark identifies the mix of management activities which would result in the highest level of economic

efficiency (i.e., the highest PNV) in managing the resources of the Olympic National Forest. It also identifies the LTSYC associated with the most economically efficient mix of management activities. The PNV and LTSYC of Benchmark 3 were compared with those of Benchmark 7 (maximum PNV, but including constraints needed to reflect MR attainment) in order to evaluate opportunity costs.

Benchmarks were chosen for use in the with and without constraint comparison, rather than issue-based Forest Plan alternatives, because management practices necessary to meet the other objectives of any given alternative may partially or fully meet MRs as well. This would cloud any analysis of opportunity costs induced by the MRs alone. The true effect of MRs, when considered in the context of fully developed alternatives, is generally less than in benchmarks because the objectives of the alternatives often satisfy MRs to a large extent.

Table I-2 summarizes the findings of the constraint analysis. It displays the PNV and LTSYC of the maximum PNV benchmark, and shows the reductions in PNV and LTSYC resulting from application of the selected optimum means of meeting each of the MR's. Also displayed are the percent changes in PNV and LTSYC.

The reason for using LTSYC rather than first decade allowable sale quantity (ASQ) as a measure of opportunity cost is the interaction between Simpson Timber Company land and National Forest land within the Shelton Cooperative Sustained Yield Unit (CSYU). The combined ASQ from both ownerships is the key variable within the CSYU, and the National Forest component of this total can vary considerably from one FORPLAN run to another without having much effect on the overall total (given that the Simpson component varies in the opposite direction). Therefore, total first decade ASQ from National Forest land alone is an unreliable indicator of the opportunity costs of implementing MRs. LTSYC, being a measure of overall productive capacity, is a more useful indicator of effect in this assessment. Therefore, the changes in the LTSYC of National Forest land (both within and outside of the CSYU) resulting from attainment of each MR serve as the basis for this analysis.

In the case of Management Requirements for which the above evaluation indicates opportunity costs in excess of two percent, the analysis of alternative means of meeting MRs is presented in subsequent sections. This is done for the water quality/riparian zone, dead and defective tree habitat, and northern spotted owl MRs. As indicated by the analysis results shown in Table I-2, the mature conifer MR has been determined to have nonsignificant effects on LTSYC and PNV. The harvest dispersion MR has no discernible effect on LTSYC or PNV, although this MR does have an impact on the location of each decade's timber harvest program.

Table I-2. Approximate Change (Opportunity Cost) Associated with Meeting Management Requirements with Selected Optimum Implementation Method

	NF LTSYC (MMCF) 1/	Percent Change in NF LTSYC	PNV (MM$) 2/	Percent Change in PNV
Maximum PNV Benchmark	48.2	--	763.7	--
OPPORTUNITY COST				
Total Opportunity Cost of Meeting All Selected Management Requirements	9.4	19.5	171.6	22.5
Opportunity Cost of Meeting Riparian/Water Quality MR	1.15	2.4	26.2	3.4
Opportunity Cost of Meeting Viable Populations MRs:				
Northern Spotted Owl	6.4	13.3	104.1	13.6
Mature Conifer	0.3	0.6	5.8	0.8
Dead & Defective Tree	1.55	3.2	35.5	4.6
Opportunity Cost of Meeting Harvest Dispersion MR	Negligible effect on PNV and LTSYC			

1/ National Forest long-term sustained yield capacity (million cubic feet)
2/ Present net value (million 1982 dollars)

The following sections present, for the water quality/riparian zone, dead and defective tree habitat, and spotted owl Management Requirements, the information described below. Table I-3 summarizes the alternative means considered for meeting these MRs.

1. The source of the MR
2. A description of the MR
3. Alternative ways considered for meeting the MR
4. An opportunity cost analysis
5. Consequences of the different ways of meeting the MR
6. Rationale for the selected method
7. Implications for Forest Plan alternatives
8. A discussion of the role of monitoring and research

Table I-3 describes the alternative means considered for implementation of each Management Requirement for which opportunity costs exceed two percent of the long-term sustained yield capacity or present net value of the maximum present net value benchmark.

Table I-3. Alternative Means for Implementing MRs with Opportunity Costs Exceeding Two Percent

Management Requirement	Alternatives Considered
Protect water quality, fish habitat quality, and wildlife habitat within riparian zones	- Manage riparian areas with a mix of management prescriptions designed to respond to on-the-ground conditions in a flexible, site-oriented manner. In FORPLAN, this is represented by 8,120 acres of "no harvest" allocation and 19,901 acres of "extended rotation" allocation. - Manage riparian areas with emphasis on providing the largest possible acreage in full timber production (by use of "no harvest" prescriptions to attain MR goals). In this analysis, this is represented by 16,080 acres of "no harvest" allocation. - Manage riparian areas with emphasis on modified timber harvest practices throughout the riparian zone. In FORPLAN, this is represented by a falldown of 3.4% of full timber yield, applied to tentatively suitable timberland as a whole (equivalent to a 12% falldown in riparian zones).
Provide adequate suitable spotted owl habitat to assure maintenance of a viable population of northern spotted owls	- Manage SOHAs by dedication of 3,000 acres of suitable habitat per area as perpetual spotted owl habitat. Allow full yield timber management in areas adjacent to SOHAs (unless precluded by other objectives). - Manage SOHAs through use of extended rotations over an area larger than the minimum SOHA size (while assuring that at least 3,000 acres of suitable habitat is present at all times). In this analysis, managed SOHA areas consist of 6,000 acres on a 400-year rotation.
Provide for snag availability adequate to assure maintenance of viable populations of species dependent on dead and defective tree habitat	- Manage individual 60-acre harvest areas to assure that each contains adequate snag numbers and sizes through time. In FORPLAN, this is represented by a falldown averaging 4.6% of full timber yield. - Manage for "islands" of snags distributed to assure that all 60-acre areas have the appropriate snag availability. In this analysis, this was represented by 20,440 acres of "no harvest" allocation.

ALTERNATIVE MEANS OF MEETING THE RIPARIAN/WATER QUALITY MR

SOURCE OF THE MANAGEMENT REQUIREMENT

Direction for riparian zone management and maintenance of water quality comes from several sources. CFR Sections 219.23(d) and 219.27(e) of the National Forest Management Act implementing regulations deal with water quality and riparian zone management respectively. In addition, several sections of the Forest Service Manual (FSM 1561.5, FSM 2405.13, FSM 2526, FSH 2526, FSH 2633) cover these areas. Finally, extensive Regional planning direction has been developed to assist Forests in attaining management requirement objectives.

Regarding water quality, the key requirement of the regulations is compliance with the Clean Water Act. This is to be done through application of Best Management Practices (BMPs). Management within riparian zones is to be conducted to avoid detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment which seriously affect water conditions or fish habitat.

DESCRIPTION OF THE MANAGEMENT REQUIREMENT SPECIFICATIONS

The specifications or standards for achievement of the water quality and riparian area Management Requirement are oriented toward the protection and special treatment of lands adjacent to all perennial streams, lakes, and other bodies of water. On the Olympic National Forest, the riparian zone includes, on average, all land within 200 feet of streams and lakes. Within this zone, management is to be designed to:

1. Maintain streambank and stream channel stability, primarily by providing for streamside vegetation in amounts sufficient to forestall streambank failure.

2. Avoid unacceptable erosion and sedimentation, essentially by assuring that the riparian zone provides a buffer and filtration area for upslope runoff.

3. Meet Clean Water Act standards, primarily through use of Best Management Practices (BMPs) specified in the Memorandum of Understanding between the Forest Service and the State of Washington.

4. Provide an assured source of large organic debris (needed for maintenance of fish habitat). This can be achieved by maintaining sufficient numbers of mature and old-growth trees within 100 feet of fish-bearing streams. Such trees must be well distributed throughout the riparian zones of the Forest.

5. Provide essential riparian habitat for wildlife, both by maintaining an adequate distribution of old-growth and mature conifer stands and by retaining other riparian vegetation as appropriate.

The above specifications are rather general in nature, and represent a desired condition more than a strict set of criteria to be followed. In order to translate this desired condition into a quantified set of management strategies and limitations, it was necessary to develop a more precise approach to the management of riparian zones. This was then transformed into the modeling assumptions used in FORPLAN to reflect the anticipated on-the-ground pattern of management within riparian areas. This process is discussed in the following section.

ALTERNATIVE WAYS CONSIDERED FOR MEETING THE MANAGEMENT REQUIREMENT

The strategy for managing riparian zones during Forest Plan implementation will be centered around the use of Standards and Guidelines specified in the Plan. These have been designed to assure that the conditions needed to satisfy riparian zone and water quality MRs will occur, and that management activities within riparian zones will be consistent with MR goals. A key aspect of these standards and guidelines is that they call for site-specific interdisciplinary prescriptions to be developed for any ground-disturbing activity proposed within riparian zones. This is expected to assure that the on-the-ground conditions within these zones will be compatible with management goals. The end result of this approach will be a mosaic

of management intensities, with the management strategy for any given area reflecting both the individual characteristics of that area and overall riparian management objectives.

In developing a modeling approximation of the riparian management strategy, it was necessary to generate a quantified representation of the overall goals of the riparian management philosophy. Since this philosophy envisions use of a mix of management practices in meeting MR goals, this representation took the form of allocations of selected areas within riparian zones to "no harvest" and "extended rotation" prescriptions. The intent of this approach was to approximate the ground conditions that would be necessary to produce the desired results. It is not expected these riparian allocations will be implemented acre for acre on the ground, but rather that the Standards and Guidelines associated with riparian management will lead to the desired riparian condition which the modeling allocations are intended to represent.

The riparian management allocations used to represent riparian zone management requirements were developed by the Forest hydrologist and Forest fisheries biologist, and were based on both water quality and fish habitat needs. They vary by stream class and distance from stream, to reflect the relative sensitivity of the different components of the riparian zone. The requirements extend to a distance of 200 feet from the stream (as opposed to 100 feet specified in 36 CFR 219.27(e)) because, on the Olympic, this is the average distance over which vegetative management activities directly affect stream characteristics. They are expressed in terms of allocations to harvest prescriptions. For example: within 100 feet of a Class III stream, at least 10 percent of the acreage of tentatively suitable timberland must be allocated to "no harvest;" at most, 70 percent may be allocated to normal rotation prescriptions, and the remaining 20 percent may be allocated either to no harvest or an extended rotation equal to twice the normal rotation length.

Table I-4. Quantification of Riparian Zone Management Requirements

		Timber Harvest Allocation		
Stream Classification	Distance from Stream	No Harvest	2X Rotation 1/	Normal Rotation
Class I	0 - 100 ft 100 - 200 ft	50%	50% 50%	 50%
Class II	0 - 100 ft 100 - 200 ft	25%	75% 25%	 75%
Class III	0 - 100 ft 100 - 200 ft	10%	20%	70% 100%
Class IV	0 - 100 ft 100 - 200 ft	5%	10%	85% 100%

1/ Rotation twice the normal length

Once the above limitations had been developed, harvest allocations to be used in MR modeling were generated. These were compiled on a drainage-specific basis, using the Forest fish habitat inventory. Information in this inventory enabled estimation, by seral stage, of the acreage of riparian zone in each stream class within each drainage. Application of the above percentages to these acreage figures yielded the acreages needed to represent the riparian MR. The results indicated that allocation of 8.15 percent of the riparian areas to be managed for timber production to "no harvest" prescriptions and 19.96 percent

of such areas to "extended rotation" prescriptions would provide a sound modeling representation of the application of riparian Standards and Guidelines.

Once the basic requirements of riparian MR modeling had been established, it was necessary to determine the most reasonable approach to approximating, in FORPLAN, the implementation of the riparian management strategy. Three alternatives were considered, each of which involves a somewhat different approach to the FORPLAN modeling of riparian area management. The first envisions a definite pattern of management strategies throughout the riparian zone; in essence, a balanced mixture of no harvest, extended rotation, and full timber production areas. This approach reflects a direct FORPLAN representation of the riparian zone allocations discussed above. The other alternatives considered differ from the first approach. One involves expanding the area over which full timber production is to occur, with emphasis on the complete removal of a relatively small acreage from the harvest base as the means of meeting riparian management objectives. The other is based on a more generalized approach, essentially assuming that riparian zone management is best represented by modified timber harvest regimes throughout the zone rather than strict allocation of specific areas to no harvest or extended rotation prescriptions.

The first approach to riparian MR modeling involved translation of the "no harvest" and "extended rotation" proportions developed above into FORPLAN acreage constraints for modeling purposes. Such constraints were generated using the 8.15 percent no harvest and 19.96 percent extended rotation proportions reflecting riparian management standards. These constraints were then adjusted downward to reflect the estimated proportion of riparian allocations that would be included in other allocations in which timber harvest is limited. The resulting requirements--a total of 8,120 acres of no harvest allocation and 19,901 acres of extended rotation allocation--were then modelled as a possible FORPLAN MR for riparian area management. This is the modeling assumption that was used in the analysis of benchmarks and alternatives presented in the DEIS.

The alternative involving use of "no harvest" allocations exclusively to meet riparian management objectives is based on the notion that these goals could be met most efficiently by minimizing the area over which limitations on timber management activity are applied. The idea would be to select a pattern of key areas which provide the conditions necessary to meet management requirements, reserve these from harvest, and leave the remainder of the riparian zone open to full timber management.

To approximate this philosophy in quantified terms, it was assumed that the 19,901 acres of extended rotation in the above FORPLAN representation could be converted to a smaller acreage of "no harvest" allocations. Since one of the principal functions of the extended rotation prescriptions is to provide a stable acreage of stands 120 years or older (40 percent of the total extended rotation area will be in this age group at all times), the "no harvest" alternative can be quantified by precluding timber harvest on an acreage equal to 40 percent of the extended rotation allocation. This results in an addition of 7,960 acres to the "no harvest" area. The complete riparian MR representation thus becomes, in this alternative, 16,080 acres of "no harvest" combined with zero acres of extended rotation.

The alternative based on a more generalized approach to riparian management reflects the idea that management of the riparian zone would best be modeled by assuming slight modifications of normal timber harvest practices throughout the riparian zone. Under this approach, there would be no need to designate significant acreages for removal from the harvest base or extended rotation. MR objectives would instead be modeled to represent widespread use of practices such as partial cutting and patches of leave trees. In application, this approach best approximates the philosophy of the riparian MR implementation strategy (i.e., site-specific prescriptions for all activities within the riparian zone). This alternative was selected for use in modeling the riparian MR in the FEIS analysis.

Quantification of this alternative was accomplished by assuming that the best representation of this approach would be a uniform falldown in timber yield throughout areas allocated to full timber production.

The estimated falldown under this approach is 3.4 percent of full yield, applied to "full yield" timber yield tables Forest-wide. This falldown estimate was derived by converting the desired proportions of no harvest and extended rotation management to an estimate of riparian zone falldown. Assuming that extended rotations within the riparian zone would provide 80 percent of full timber yield, a yield adjustment of 12.14 percent (no harvest and extended rotation combined) for riparian zone harvest is appropriate. Since 28 percent of the Forest's timberland lies within the riparian zone, this is equivalent to an overall yield reduction of 3.4 percent. This reduction was modeled in FORPLAN by adjusting all timber yield tables associated with "full yield" timber management prescriptions.

Two of the three alternative means of meeting riparian zone MR specifications were analyzed in FORPLAN. The results of existing FORPLAN runs, especially Benchmarks 3 and 7, provided enough information to allow estimation of the effects of the "no harvest" alternative through manual calculation techniques. The opportunity costs associated with this alternative management requirement modeling strategy were, therefore, analyzed through extrapolation of existing information and results. The results of the opportunity cost analysis of the alternative riparian MR modeling strategies are presented in the next section.

OPPORTUNITY COST ANALYSIS

Table I-5 displays the opportunity costs associated with the alternative analysis assumptions considered in detail for meeting the riparian area/water quality management requirement. The "no harvest" modeling strategy would result in slightly greater reductions in both LTSYC and PNV than the remaining possibilities for meeting the riparian/water quality MR. The "allocation mix" and "yield reduction" strategies entail roughly equivalent PNV and LTSYC opportunity costs. At least in terms of these measures of opportunity cost, either of these approaches to modeling the riparian MR would be effective in minimizing MR-related tradeoffs.

Table I-5. Approximate Change (Opportunity Cost) Associated with Alternative Means of Meeting the Riparian Area/Water Quality Management Requirement

	NF LTSYC (MMCF) 1/	Percent Change in NF LTSYC	PNV (MM$) 2/	Percent Change in PNV
Maximum PNV Benchmark	48.2	--	763.7	--
OPPORTUNITY COST				
Opportunity Cost of Meeting Riparian/Water Quality MR Using "Allocation Mix" Approach	1.15	2.4	24.4	3.2
Opportunity Cost of Meeting MR Using Emphasis on "No Harvest" Allocations	1.4	2.9	28.3	3.7
Opportunity Cost of Meeting MR Using Generalized Timber Yield Falldown (Selected)	1.15	2.4	26.2	3.4

1/ National Forest long-term sustained yield capacity (million cubic feet)
2/ Present net value (million 1982 dollars)

CONSEQUENCES OF THE DIFFERENT WAYS OF MEETING THE MANAGEMENT REQUIREMENT

The approach to meeting the riparian/water quality MR selected for FEIS analysis results in LTSYC and PNV equivalent to or above those of the alternatives. Differences among the strategies in terms of nontimber output production are expected to be minor. Nonetheless, it is expected that the selected approach will provide the best mix of land management patterns for production of such outputs. The fact that this strategy best represents actual implementation conditions, combined with the variety and flexibility of treatments involved (and thus a variety of stand conditions), leads to this conclusion.

RATIONALE FOR THE SELECTED METHOD

Of the alternatives evaluated, the selected set of modeling assumptions was chosen because it best reflects the MR application strategy that will occur in actual implementation. It also provides the most accurate representation of the tradeoffs (LTSYC in particular) that can be expected. This is because the other alternatives, based as they are on fixed FORPLAN allocations, could potentially overconstrain Plan alternatives emphasizing nontimber outputs and underconstrain those emphasizing timber production. Use of a standard falldown, applicable only in areas allocated to full production timber management, assures that the yield adjustments necessitated by the riparian MR will be appropriately modeled. The slight reduction in PNV associated with the selected alternative in this analysis is more than justified by this increase in modeling accuracy.

IMPLICATIONS FOR FOREST PLAN ALTERNATIVES

The opportunity costs associated with meeting the riparian/water quality management requirement vary greatly among Forest Plan alternatives. In the case of alternatives with a strong emphasis on timber harvest (Alternative B-Departure (Modified)), the LTSYC opportunity cost may actually be somewhat greater than that determined from the comparison of the two maximum PNV benchmarks. This is because some areas excluded from the harvest base of the benchmarks for economic reasons are included in the base of timber emphasis alternatives. To the extent that this additional harvestable acreage is affected by the riparian MR, the LTSYC opportunity cost increases. The PNV opportunity cost, on the other hand, decreases as such areas are removed from the harvest base due to riparian MR specifications.

In the case of alternatives with moderate timber emphasis and allocations to timber harvest on the basis of contribution to PNV (Alternatives A-Current Direction (No Action) and C-Preferred (Modified)), opportunity costs (both LTSYC and PNV) will be somewhat lower than those presented in this analysis. Discretionary allocations (e.g., unroaded recreation) which reduce the harvest base in order to meet the specific objectives of these alternatives reduce the LTSYC and PNV opportunity costs of the riparian MR as well. To the extent that such allocations are included in the harvest base of Benchmark 7, opportunity costs of meeting riparian objectives decrease.

Alternatives which are strongly oriented toward nontimber resource outputs (Alternatives H (Modified) and I) entail little or no opportunity cost associated with the riparian MR. The objectives of such alternatives result in allocation of large areas to prescriptions unaffected by timber yield table adjustments. As a result, there is little additional effect on either LTSYC or PNV when the yield tables associated with full timber management are adjusted to reflect implementation of riparian MR specifications.

There is no opportunity cost associated with this MR in Alternative NC-No Change. This is because management requirements are not applied in this alternative.

ROLE OF MONITORING AND RESEARCH

Plans for implementation monitoring within riparian zones are presented in Chapter V and Appendix B of the Forest Plan. These focus on the planning, development, and implementation of project activities within riparian areas. Of particular importance in monitoring will be determination of the correlation between the modeling assumptions used to reflect riparian MR specifications and the pattern of management prescriptions that actually develops during implementation. If there is a significant divergence from the expected effects, it may be necessary to restructure the FORPLAN model and reassess the impact of the management requirement.

In addition to the above monitoring program, there is a need for both research and information gathering to aid in validating the riparian MR specifications currently in use. Research is needed to refine our understanding of the relationship between large organic debris availability and long-term fish habitat quality. More precise quantification of this relationship will lead to more reliable guidelines for establishing riparian vegetation management needs. In addition to research, detailed inventories of both current water quality conditions and current riparian vegetation characteristics are needed to provide more accurate baseline data to assist in evaluation of future management activities.

ALTERNATIVE MEANS OF MEETING THE NORTHERN SPOTTED OWL MR

SOURCE OF THE MANAGEMENT REQUIREMENT

Specific Regional direction for the northern spotted owl is found in the Record of Decision for the Final Supplement to the Environmental Impact Statement for an Amendment to the Pacific Northwest Regional Guide released in August, 1988. The Supplement was prepared, in response to an appeal of the R-6 Regional Guide, to address planning direction for spotted owl habitat management. Standards and Guidelines adopted as a result of the Supplement will be used by National Forests in the Region to meet the Management Requirement to maintain viable populations of spotted owls.

The Final Supplement was prepared after a series of public meetings and study of the nearly 42,000 comments received on the Draft Supplement issued in the summer of 1986. A summary of the analysis of public comments, substantive comments, and copies of letters received from government agencies and elected officials can be found in Appendix G of the Final Supplement.

DESCRIPTION OF THE MANAGEMENT REQUIREMENT SPECIFICATIONS

The Forest Service Preferred Alternative (F) presented in the Final Supplement provides that Spotted Owl Habitat Areas (SOHAs) shall contain variable amounts of suitable habitat, depending on physiographic province. Locations of SOHAs are to be based on both actual locations of owl pairs and distribution of suitable habitat on land unsuitable for timber production. The current distribution of habitat in areas not within the timber harvest base is to be evaluated for adequacy of distribution. Additional areas are then to be designated on lands suitable for timber production if needed to meet distribution standards.

The standards and guidelines for the Forest Service Preferred Alternative (as they apply to the Olympic National Forest) are summarized in the following discussion. Chapter II of the Final Supplement and the Record of Decision should be reviewed for a more detailed description of this management direction. These Regional standards and guidelines provide the specifications or standards for achievement of the management requirement for northern spotted owls.

1. **Amount of Suitable Habitat in Designated Habitat Areas**: Designated habitat areas within the Olympic Peninsula physiographic province shall contain the following amount of suitable habitat: 3,000 acres, which must be within 2.1 miles of the center of owl activity. Habitat areas will be developed as contiguous stands if possible. If this is not possible, stands with a minimum size of 60 acres will be used to make up the 3,000 acres. The largest stands available which are close to the center of owl activity will be used.

2. **Spacing of Designated Habitat Areas**: Designate habitat areas where more than 2 miles separates areas in reserved lands or lands unsuited for timber production that are capable of supporting less than three breeding pairs of spotted owls, or where more than 8 miles separates similar areas that are capable of supporting three or more pairs.

3. **Location of Designated Habitat Areas**: Designate habitat areas on lands suitable for timber production only if needed to meet spacing standards.

4. **Priority for Locating Designated Areas**: Priority for locating designated areas follows status of occupancy by spotted owls. Highest priority goes to locations with verified occupancy by breeding pairs of spotted owls; the next priority goes to locations with confirmed nonbreeding pairs of spotted owls; the next priority goes to locations with confirmed single spotted owl occupancy; the lowest priority goes to locations where only the suitability or potential suitability of habitat is known.

5. **Management of Habitat**: Habitat may be managed to meet the standard for amount of suitable habitat within a given area through prescriptions which preclude scheduled timber harvest or through prescriptions for uneven or even-aged harvest under an extended rotation. Prescriptions to be used and areas to which they will apply shall be specified in Forest Plans.

6. **Identification of Suitable Habitat**: Suitable habitat shall be identified in Forest Plans according to the general definition in the Final Supplement and with the concurrence of the Regional Forester.

ALTERNATIVE WAYS CONSIDERED FOR MEETING THE MANAGEMENT REQUIREMENT

The Forest considered two means of meeting the specifications for providing spotted owl habitat. One alternative is to "dedicate" the required number of acres of suitable habitat in each site. Such areas would not be managed for timber production, and would be expected to remain in suitable habitat through time. The second alternative is to manage timber stands with long rotations in order to produce replacement habitat areas over time. The Olympic National Forest has elected to provide spotted owl habitat by dedicating the required amount of habitat within each SOHA. Under the "dedication" habitat strategy, each acre of spotted owl habitat is withdrawn from timber production. Dedication of existing stands assures that desired structural characteristics will be available, but may risk loss of individual stands through catastrophe or decay. Recent literature regarding old-growth suggests this risk is much less significant than was once thought.

Under the "managed" habitat strategy, it is assumed that existing old-growth stands may be harvested as replacement stands reach the old-growth condition. Delay in harvest of existing old-growth stands would occur if replacement stands fail to develop desired structural characteristics on schedule. Harvest of original old-growth stands removes important old-growth structural features and may hasten the decline of the residual stand (Franklin and others 1981). The length of time required to develop the necessary characteristics in managed stands is uncertain, but it is estimated to be 200 years on this Forest.

An analysis comparing the effects of a variety of rotation ages is documented in the planning records, Forest Supervisor's Office, Olympia, Washington. The results of this analysis show that impact on LTSYC decreases as rotation length increases (due to the concurrent decrease in acreage managed on an extended rotation). In comparing the effects of "dedicated" and "managed" strategies, a 400-year rotation on twice the minimum necessary SOHA acreage was selected for analysis. This is felt to be the most effective combination of long rotation and acreage managed that can successfully be implemented.

OPPORTUNITY COST ANALYSIS

The Record of Decision for the Final Supplemental Environmental Impact Statement to the Regional Guide (for spotted owl habitat management guidelines) does not prescribe the number of designated habitat areas each Forest shall maintain. This is to be a function of applying the selected Standards and Guidelines in Forest Plans rather than a specification of the Regional Guide. Use of the Record of Decision direction for the Olympic National Forest results in a SOHA network consisting of thirty, 3,000-acre habitat areas. Table I-6 displays the opportunity costs associated with application of the "management" and "dedication" SOHA management strategies to this network.

Table I-6. Approximate Change (Opportunity Cost) Associated with Alternative Means of Meeting the Spotted Owl Habitat Management Requirement

	NF LTSYC (MMCF) 1/	Percent Change in NF LTSYC	PNV (MM$) 2/	Percent Change in PNV
Maximum PNV Benchmark	48.2	–	763.7	–
OPPORTUNITY COST				
Opportunity Cost of Meeting Spotted Owl Habitat MR Using "Dedication" Approach	6.4	13.3	104.1	13.6
Opportunity Cost of Meeting Spotted Owl Habitat MR Using "Management" Approach	7.3	15.1	121.5	15.9

1/ National Forest long-term sustained yield capacity (million cubic feet)
2/ Present net value (million 1982 dollars)

CONSEQUENCES OF THE DIFFERENT WAYS OF MEETING THE MANAGEMENT REQUIREMENT

Populations of spotted owls are not expected to differ under either of the means considered for meeting the management requirement. There are, however, differences in opportunity cost (see Table I-6). In addition, the "dedication" strategy entails less overall ground disturbance than the "managed" approach.

Managing for extended rotations would involve eventual timber harvest and road construction in numerous areas that would remain undisturbed under the "dedication" approach.

RATIONALE FOR THE SELECTED METHOD

The Olympic National Forest has chosen to provide spotted owl habitat by dedicating habitat sites. This alternative achieves retention of the desired habitat with the smallest effect on timber outputs and is an economically efficient way of meeting the management requirement. The dedicated habitat approach has the additional advantage that the locations of habitat sites do not change over time, making implementation less complicated than continuous relocation of habitat sites as stands are harvested and replaced.

IMPLICATIONS FOR FOREST PLAN ALTERNATIVES

Opportunity costs associated with meeting the spotted owl habitat management requirement vary greatly among Forest Plan alternatives. In the case of alternatives with a strong emphasis on timber harvest (Alternative B-departure (modified)), the LTSYC opportunity cost may actually be somewhat greater than that determined from the comparison of the two maximum PNV benchmarks. This is because some areas excluded from the harvest base of the benchmarks for economic reasons are included in the base of timber emphasis alternatives. To the extent that this additional harvestable acreage is included in SOHAs, the LTSYC opportunity cost increases. The PNV opportunity cost, on the other hand, decreases as such areas are removed from the harvest base due to spotted owl MR specifications.

In the case of alternatives with moderate timber emphasis and allocations to timber harvest on the basis of contribution to PNV (Alternatives A-Current Direction (No Action) and C-preferred (modified)), opportunity costs (both LTSYC and PNV) will be somewhat lower than those presented in this analysis. Discretionary allocations (e.g. unroaded recreation) which reduce the harvest base in order to meet the specific objectives of these alternatives contribute to the attainment of the spotted owl MR as well. In fact, direction in the Regional SEIS specifies that SOHAs are to be overlapped with such allocations wherever they meet habitat suitability and distribution requirements. As a result, and to the extent that such allocations include SOHAs within them, the opportunity costs of meeting spotted owl objectives decrease.

Alternatives which are strongly oriented toward nontimber resource outputs (Alternatives H (modified) and I) entail relatively minor opportunity cost (none in the case of Alternative I) associated with the spotted owl MR. The objectives of these alternatives result in allocation of large areas to prescriptions compatible with spotted owl MR attainment. As a result, there is only small additional effect on either LTSYC or PNV when allocations to spotted owl habitat are included.

There is no opportunity cost associated with this MR in Alternative NC-No Change. This is because management requirements are not applied in this alternative.

ROLE OF MONITORING AND RESEARCH

Plans for monitoring the attainment of spotted owl management requirement objectives are presented in Chapter V and Appendix B of the Forest Plan. These focus on developing and maintaining up-to-date information regarding spotted owl populations and tracking the availability and quality of spotted owl habitat.

The Final Supplemental Environmental Impact Statement to the Regional Guide (Appendix D) identifies specific monitoring and research needs and describes how the information will be obtained. Intensive inventory, monitoring, and research being conducted by the Spotted Owl Research, Development, and Application Program will provide new information. This should allow an opportunity to re-evaluate and possibly adjust management direction regarding the spotted owl within the next five years.

ALTERNATIVE MEANS OF MEETING THE DEAD AND DEFECTIVE TREE HABITAT MR

SOURCE OF THE MANAGEMENT REQUIREMENT

"A Report on Minimum Management Requirements for Forest Planning on the National Forests of the Pacific Northwest Region, USDA Forest Service," released by the Pacific Northwest Region in June, 1986, identified primary cavity excavators as an indicator species group for which Management Requirements would be necessary to assure maintenance of viable populations. Maintaining sufficient habitat to provide for viable populations of existing native vertebrate species is directed by NFMA Regulations (36 CFR 219.27(a)(6)). In order to maintain primary cavity excavator populations, a management strategy for providing an adequate level of dead and defective tree habitat is needed.

DESCRIPTION OF THE MANAGEMENT REQUIREMENT SPECIFICATIONS

The specifications or standards for achievement of the dead and defective tree habitat Management Requirement are oriented toward providing for continual and adequate availability of snag habitat on all National Forest land. Such habitat is to be well distributed throughout all conifer and broadleaf plant types that either currently contain or are capable of producing snags. In areas where it is necessary to ensure snag availability, management is to be designed to:

1. Provide, at a minimum, sufficient numbers and sizes of hard snags to maintain all primary cavity excavators at 20 percent of their potential population size. Procedures described in "Wildlife Habitats in Managed Forests, the Blue Mountains of Oregon and Washington" will be used in determining numbers, sizes, and distribution of hard snags needed.

2. Base distribution of dead and defective tree habitat on the goal of assuring that logical timber harvest units (in general, areas 60 acres in size) are managed to provide for snag maintenance at the 20 percent population level.

3. Recognize that the 20 percent population level is an absolute minimum, and that maintenance of populations at a higher level (e.g., 40 percent) is highly desirable.

The above specifications are rather general in nature, and represent a desired condition more than a strict set of criteria to be followed. In order to translate this desired condition into a quantified set of management strategies and limitations, it was necessary to develop a more precise approach to the management of dead and defective tree habitat. This was then transformed into the modeling assumptions used in FORPLAN to reflect the anticipated pattern of on-the-ground management of primary cavity excavator habitat. This process is discussed in the following section.

ALTERNATIVE WAYS CONSIDERED FOR MEETING THE MANAGEMENT REQUIREMENT

The strategy for managing dead and defective tree habitat during Forest Plan implementation will be centered around the use of Standards and Guidelines specified in the Plan. These have been designed to assure that the conditions needed to satisfy snag retention requirements will occur, and that management activities will be consistent with MR goals. These Standards and Guidelines call for retention of hard snags and large, green trees to provide replacement snags, with distribution of snags and green trees designed to provide each 60-acre area with adequate snag availability. This is expected to assure that on-the-ground conditions will be compatible with management goals.

In developing a modeling approximation of the dead and defective tree management strategy, it was necessary to generate a quantified representation of the overall goals of snag management. The basic goal of the Standards and Guidelines for snag management within timber harvest units is to assure that sufficient snags and green trees will be left to provide for the 20 percent population level through time. An additional goal is to assure that larger areas (each of the Forest's major drainages) will have, in total, a sufficient number of snags to provide for a cavity excavator population of at least 40 percent of the potential population.

In modeling attainment of these goals, two alternatives were considered. One strategy involves the allocation of specific areas to no harvest prescriptions, with the size, location, and total acreage of such allocations designed to represent the timber volume and acreage to be left in green trees for future snag recruitment. The second strategy entails use of a timber yield table falldown to represent the required snag management provisions. The first strategy envisions well-distributed "islands" of snags and green trees scattered throughout timber management areas, while the second reflects a more generalized distribution of snags and future snags. In practice, it is likely that a combination of islands, clumps, and individual trees and snags will result from implementation of the dead and defective tree MR.

The principal consideration in developing a means of modeling snag retention requirements is to assure that the appropriate numbers and sizes of green trees to be left are accounted for in the model representation. On the Olympic National Forest, an average of 3.7 green trees per acre (in an appropriate distribution of size classes 11 inches DBH and above) is needed to meet MR goals. Translated into quantified modeling parameters, this requirement generates either a timber yield table falldown averaging 4.6 percent (applicable to "full yield" prescriptions only) or a "no harvest" allocation of 20,440 acres.

The first of the above alternatives was evaluated directly in FORPLAN, using comparisons of Benchmarks 3 and 7 (the maximum PNV benchmarks). The effects of the second were evaluated through interpretation and extension of the results of other FORPLAN runs comparing these two benchmarks. Both alternatives include adjustments to assure that the modeling of snag retention requirements does not duplicate the modeling provisions associated with attainment of the riparian MR. It is assumed, for both alternatives, that snag management goals will be met within riparian zones through application of the riparian management strategy alone, and that no further provisions for snag retention are necessary within these zones.

OPPORTUNITY COST ANALYSIS

Table I-7 displays the opportunity costs associated with the alternative analysis assumptions considered in detail for meeting the dead and defective tree habitat management requirement. As can be seen, the "no harvest" modeling strategy would result in slightly greater reductions in both LTSYC and PNV than the "timber yield falldown" approach. Therefore, at least in terms of these measures of opportunity cost, use

of an adjustment to "full yield" timber yield tables in modeling this MR would be most effective in minimizing MR-related tradeoffs.

Table I-7. Approximate Change (Opportunity Cost) Associated with Alternative Means of Meeting the Dead and Defective Tree Habitat Magement Requirement

	NF LTSYC (MMCF) 1/	Percent Change in NF LTSYC	PNV (MM$) 2/	Percent Change in PNV
Maximum PNV Benchmark	48.2	--	763.7	--
OPPORTUNITY COST				
Opportunity Cost of Meeting Dead & Defective Tree Habitat MR Using Yield Reduction	1.55	3.2	35.5	4.6
Opportunity Cost of Meeting MR Using Emphasis on "No Harvest" Allocations	1.8	3.7	35.9	4.7

1/ National Forest long-term sustained yield capacity (million cubic feet)
2/ Present net value (million 1982 dollars)

CONSEQUENCES OF THE DIFFERENT WAYS OF MEETING THE MANAGEMENT REQUIREMENT

The approach to meeting the dead and defective tree habitat MR selected for FEIS analysis (yield table falldown) results in LTSYC and PNV slightly higher than that of the "no harvest" alternative. Differences between the strategies in terms of nontimber output production are expected to be minor. It is expected that the selected approach will provide the best mix of land management patterns for production of such outputs. The fact that this strategy best represents actual implementation conditions, combined with the variety and flexibility of treatments involved (and thus a variety of stand conditions), leads to this conclusion.

RATIONALE FOR THE SELECTED METHOD

Of the alternatives evaluated, the selected set of modeling assumptions was chosen because it best reflects the MR application strategy that will occur in actual implementation. It also provides the most accurate representation of the tradeoffs (LTSYC in particular) that can be expected. This is because the alternative approach, based as it is on fixed FORPLAN allocations, could potentially overconstrain Plan alternatives emphasizing nontimber outputs and underconstrain those emphasizing timber production. Use of a standard falldown, applicable only in areas allocated to full production timber management, assures that the yield adjustments necessitated by the dead and defective tree habitat MR will be appropriately modeled. This increase in modeling accuracy is another advantage of the selected approach.

IMPLICATIONS FOR FOREST PLAN ALTERNATIVES

The opportunity costs associated with meeting the dead and defective tree habitat management requirement vary greatly among Forest Plan alternatives. In the case of alternatives with a strong emphasis on timber harvest (Alternative B-Departure (Modified)), the LTSYC opportunity cost may actually be somewhat greater than that determined from the comparison of the two maximum PNV benchmarks. This is because some areas excluded from the harvest base of the benchmarks for economic reasons are included in the base of timber emphasis alternatives. To the extent that this additional harvestable acreage is affected by the MR, the LTSYC opportunity cost increases. The PNV opportunity cost, on the other hand, decreases as such areas are removed from the harvest base due to MR specifications.

In the case of alternatives with moderate timber emphasis and allocations to timber harvest on the basis of contribution to PNV (Alternatives A-Current Direction (No Action) and C-Preferred (Modified)), opportunity costs (both LTSYC and PNV) will be somewhat lower than those presented in this analysis. Discretionary allocations (e.g., unroaded recreation) which reduce the harvest base in order to meet the specific objectives of these alternatives reduce the LTSYC and PNV opportunity costs of the dead and defective tree habitat MR as well. To the extent that such allocations are included in the harvest base of Benchmark 7, opportunity costs of meeting snag management objectives decrease.

Alternatives strongly oriented toward nontimber resource outputs (Alternatives H (Modified) and I) entail little or no opportunity cost associated with the dead and defective tree habitat MR. The objectives of such alternatives result in allocation of large areas to prescriptions unaffected by timber yield table adjustments. As a result, there is little additional effect on either LTSYC or PNV when the yield tables associated with full timber management are adjusted to reflect implementation of snag retention specifications.

There is no opportunity cost associated with this MR in Alternative NC-No Change. This is because Management Requirements are not applied in this alternative.

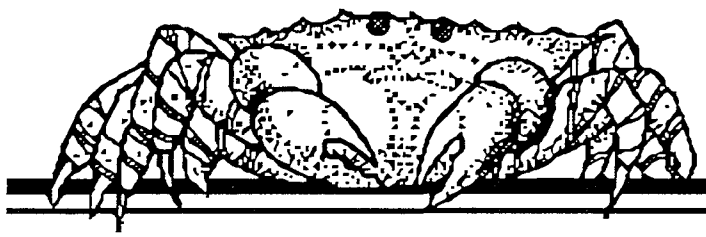
ROLE OF MONITORING AND RESEARCH

Plans for monitoring the implementation of snag Management Requirements are presented in Chapter V and Appendix B of the Forest Plan. Of particular importance in monitoring will be determination of the correlation between the modeling assumptions used to reflect dead and defective tree habitat MR specifications and the pattern of snag and green tree retention that actually develops during implementation. If there is a significant divergence from the expected results, it may be necessary to restructure the FORPLAN model and reassess the impact of the Management Requirement.

In addition to the above monitoring program, there is need for both research and information gathering to aid in validating the dead and defective tree habitat MR specifications currently in use. Research is needed to refine our understanding of the relationship between snag availability and cavity excavator population viability. More precise quantification of this relationship will lead to more reliable guidelines for establishing snag management needs. In addition to research, more detailed information regarding current snag availability is needed to provide more accurate baseline data to assist in evaluation of future management activities.

Appendix J

Best Management Practices



Olympic National Forest

APPENDIX J

BEST MANAGEMENT PRACTICES

INTRODUCTION

Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards (U.S. Environmental Protection Agency, 1987). BMPs will be selected and tailored for site-specific conditions to arrive at the project-level BMPs for the protection of water quality. The process for determining appropriate BMPs, and for ensuring their implementation at both the Forest Plan and Project level, is described in the following text which is a description of the methods and procedures that will be used to control or prevent nonpoint sources of pollution from resource management activities. This system is designed to ensure compliance with the following laws and related agreements:

CLEAN WATER ACT OF 1972, as amended (1977 and 1987). Section 319 of the Clean Water Act Amendments of 1987 requires that the States determine those waters that will not meet the goals of the Act, to determine those nonpoint source activities that are contributing pollution, and to develop a process of determining BMPs to reduce such pollution to the "maximum extent practicable." This Appendix is designed to fulfill the intent of the requirements of Section 319.

WASHINGTON ADMINISTRATIVE CODE (Chapters 173-201 and 202). Department of Ecology (DOE). Washington's Administrative Code contains water requirements for protection of various classes of surface waters.

MEMORANDUM OF UNDERSTANDING. This agreement is between the Washington State Department of Ecology and U.S. Department of Agriculture Forest Service (July, 1979), and is referred to in "Attachment A" of this Memorandum of Understanding (Implementation Plan for Water Quality Planning on National Forest Lands in the Pacific Northwest December, 1978).

The EPA has certified the Washington Forest Practices Rules and Regulations as BMPs. The State of Washington compared Forest Service and State practices and concluded that Forest Service practices meet or exceed State requirements. As State practices change, comparisons are made to ascertain that Forest Service practices meet or exceed these changes. Monitoring and evaluation will determine the need for changes in BMPs and/or State standards.

Forest Service management practices will meet, as a minimum, the substantive State BMP requirements, and other considerations required by the National Forest Management Act (NFMA), and other authorities, for the protection of the soil and water resources.

The general BMPs described herein are action-initiating mechanisms which call for the development of detailed, site-specific BMP prescriptions to protect beneficial uses and meet water quality objectives. They are developed as part of the NEPA process, with interdisciplinary involvement by a team of individuals that represent several areas of professional knowledge, learning, and/or skill appropriate for the issues and

concerns identified. BMPs also include such requirements as Forest Service manual direction, contract provisions, environmental documents, and Forest Plan Standards and Guidelines. Inherent in prescribing project-level management requirements is recognition of specific water quality objectives which BMPs are designed to achieve.

DEFINITIONS

Nonpoint sources refers to diffuse or unconfined sources of pollution where wastes can either enter into, or be conveyed by the movement of water to, public waters. Silvicultural sources, such as erosion from a harvest unit or surface erosion from a road, are considered nonpoint sources.

Best Management Practices are defined as "methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters." (40 CFR 130.2, EPA Water Quality Standards Regulation.)

Usually BMPs are applied as a *system* of practices rather than as a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility (EPA Interagency Nonpoint Task Force 1985).

BMPs are basically a preventative rather than an enforcement system. BMPs are a whole management and planning system in relation to sound water quality goals, including both broad policy and site-specific prescriptions.

BMP IMPLEMENTATION PROCESS

In cooperation with the State, the primary strategy for the prevention and control of nonpoint sources is based on the implementation of BMPs determined necessary for the protection of the identified beneficial uses.

The objective is to identify the most practical means of attaining water quality objectives. Water quality objectives include water quality measures that adequately reflect the needs of identified beneficial uses.

The Forest Service Nonpoint Source Management System consists of:

1. Selection and design of BMPs based on site-specific conditions, technical, economic and institutional feasibility, and the water quality standards of those waters potentially impacted;

2. Implementation and enforcement of BMPs;

3. Monitoring to ensure that practices are correctly applied as designed;

4. Monitoring to determine the effectiveness of practices in meeting design expectations and in attaining water quality standards;

5. Evaluation of monitoring results and mitigation where necessary to minimize impacts from activities where BMPs do not perform as expected;

6. Adjustment of BMP design standards and application when it is found that beneficial uses are not being protected and water quality standards are not being achieved to the desired level; evaluation of the appropriateness of water quality criteria to reasonably assure protection of beneficial uses; and consideration of recommending adjustment of water quality standards.

BMP SELECTION AND DESIGN - STEP 1

Scoping: Potential concerns are identified, e.g., water quality, as part of the NEPA process for environmental analysis. Public notices are dispersed inviting comment and participation in the process. Alternatives are developed to address potential problems and to accomplish project objectives.

Environmental Analysis: Each alternative is evaluated for its potential effect on different resources, including water. From this analysis, a preferred alternative is identified, along with the measures (BMPs) needed to reduce risk and increase the potential for success.

Documentation: An Environmental Assessment (EA) or Environmental Impact Statement (EIS) is developed with a decision notice and includes required measures (BMPs).

Water quality standards are used as objectives toward which practices are designed to protect beneficial uses.

Appropriate BMPs are selected for each project by an interdisciplinary team. BMP selection and design are dictated by water quality objectives, soils, topography, geology, vegetation, climate, economics, institutional constraints, etc. Environmental effects and water quality protection options are evaluated and a range of practices is considered. A final set of practices are selected that not only protect beneficial uses, but meet other resource needs. These final selected practices constitute the BMPs.

The selected BMPs, an estimate of their effectiveness, and a plan for monitoring them is included in the project EA or EIS. The site-specific BMP prescriptions are normally included in project implementation plans, but may also be included in the body or appendix of a project environmental document.

BMP IMPLEMENTATION AND ENFORCEMENT - STEPS 2 AND 3

The site-specific BMP prescriptions are taken from plan-to-ground by a combination of project layout and resource specialists (such as hydrology, fisheries, soil, and geology). Final adjustments to fit the BMP prescriptions to the site are made before implementing the resource activity.

When the resource activity (e.g., timber harvest or road construction) begins, timber sale administrators, engineering representatives, resource specialists, and others ensure that the BMPs are implemented according to plan. A similar implementation process is used for other resource activities (such as range management and mining) on National Forests.

BMP implementation monitoring is done before, during, and after resource activity implementation. This monitoring answers the question: Did we do what we said we were going to do? Some examples of implementation monitoring for a streamside management unit BMP prescription may be:

1. **Before project:** checking Stream Management Units (SMUs) along streams to see if layout meets the objectives of the BMP prescription, or if the road crossing of a stream is properly located and designed according to estimates made during the environmental analysis.

2. **During project:** during timber felling, the timber sale administrator checks to see if the timber fallers understand marking prescription for timber to be felled in the SMU. The timber sale administrator also observes on-going harvest operations to see if the activity meets the objectives defined in the project plan.

3. **After project:** measuring canopy stream shading to see if the amount specified in the BMP prescription was retained, or monitoring a beneficial use of the water to determine a change or trend in use.

Enforcement is carried out primarily through internal project reviews and contractual enforcement, e.g., timber sale contracts, grazing or special use permits.

Contract enforcement is a more formal method used to achieve desired results. Normally, each project is assigned a person as a contracting officer. For timber sales, that person is called a timber sale administrator. The project is routinely monitored to ensure that practices are being carried out in the manner and method prescribed in the contract, permit, etc. When a contractor or permittee is not in compliance, they can be held in breech with penalties (e.g., bond forfeiture) until remedies are implemented.

Often during the course of an activity, adjustments are made if it is determined that unsatisfactory results are currently resulting or may occur. This can often mean that a contract modification may be necessary (as in the case of a timber sale).

BMP MONITORING - STEP 4

Once BMPs have been implemented, further monitoring is done to evaluate their effectiveness. BMP "effectiveness monitoring" answers the question: Are BMPs effectively meeting management objectives for protection of water quality?

Water quality standards are the "yardstick" against which the effectiveness is tested. If, through objective monitoring, BMPs do not meet prescribed objectives, then information is available to modify either the BMPs for future managment, or the objectives, or both.

The natural variability of water quality under unmanaged conditions is an important factor that will be considered during the monitoring and evaluation. Additionally, effectiveness monitoring will include measurement against land management objectives as well as water quality objectives.

Some examples of the types of BMP effectiveness monitoring to be conducted are:

1. Measuring stream temperatures to see if the riparian prescriptions in a watershed are maintaining water temperature.

2. Storm period surveillance monitoring of a road system to see if road rocking is effectively preventing road surface erosion.

The "Monitoring and Evaluation" section of the Forest Plan, (Chapter IV), provides that monitoring of BMPs will be accomplished on an appropriate sample basis. Once a specific project is designed, a site-specific monitoring plan may be developed.

Results of monitoring should be shared with State and local agencies as well as available to the public. Monitoring design, sampling, and laboratory analyses will be coordinated.

BMP EVALUATION AND ADJUSTMENT - STEPS 5 AND 6

The technical evaluation/monitoring described above will determine how effectively BMPs protect and/or improve water quality. If the evaluation indicates that water quality objectives are not being met and/or beneficial uses do not appear to be receiving adequate protection, corrective action will consider the following three components:

1. **The BMP:** Is it technically sound? Is it really best, or is there a better practice which is technically sound and feasible to implement?

2. **The implementation program or processes:** Was the BMP applied entirely as designed? Was it only partially implemented? Were personnel, equipment, funds, or training lacking which resulted in inadequate or incomplete implementation?

3. **The water quality standards:** The water quality standards are established to protect the beneficial uses of water. They include numeric and narrative criteria that, when exceeded, are assumed to indicate detrimental impacts on beneficial uses. They are intended to provide a benchmark for evaluating harm to beneficial uses.

Assessing the applicability of the standards is a responsibility of the State. The Forest Service will provide information to the State to address the following types of questions.

- Do the standards describe the conditions necessary for protecting beneficial uses?

- Are standards higher or lower than that necessary for protecting beneficial uses?

- Do the standards reflect the natural variability occurring within the natural and human-affected ecosystem?

- Do the parameters and criteria that constitute water quality standards adequately reflect (are they sensitive enough) human-induced changes to water quality and beneficial uses?

"Validation" monitoring may be needed to make this assessment. The purpose of validation monitoring is to answer the question whether standards, coefficients, requirements, and guidelines are appropriate to meet objectives, e.g., protect beneficial uses.

Examples: (1) Did the change in water temperature impact the fish population?
(2) Did the soil compaction effect tree growth?

Validation Monitoring will need to be closely coordinated with or, in some cases, conducted by research. It may require the establishment of permanent plots or administrative studies. This kind of monitoring will be very limited and will require coordination to select projects with broad application and to prevent duplication. Only those coefficients and standards that are not reasonably validated by existing research or documentation should be candidates for this monitoring.

Corrective action may be initiated once the reason for failing to achieve the management objectives is determined. The management practice may have to be changed, the water quality objectives modified, or both.

TRAINING

National Forest personnel involved with project location, design, layout, administration, and maintenance activities will receive BMP training. The training will consist of BMP awareness, as well as the more technical aspects such as planning, implementation, monitoring, and evaluation.

GENERAL BEST MANAGEMENT PRACTICES AND EXAMPLES

Individual, general Best Management Practices are described in "General Water Quality Best Management Practices," Pacific Northwest Region, November, 1988. This provides guidance, but is not a direction document. Also included in this document is a description of the process, and limitations and use of these BMPs. Each BMP listed includes the Title, Objectives, Explanation, Implementation and Responsibility, and Monitoring. Evaluations of ability to implement and estimated effectiveness are made at the project level.

Not all of the general BMPs listed will normally apply to a given project, and there may be specific BMPs which are not represented by a general BMP in this document.

The sensitivity of the project determines whether the site-specific BMP prescriptions are included in the EA/EIS or in the sale/project plan, or in the analysis files.

Following is an example of a general BMP, as described in this document, along with an example of a site-specific BMP which is developed at the project level.

Examples:

General BMP

T-5. Title: "Limiting the Operating Period of Timber Sale Activities"

Objective: To ensure that the Purchaser conducts operations in a timely manner, within the time period specified in the Timber Sale Contract (TSC).

Explanation: The TSC specifies a Normal Operating Season, during which, operations may generally proceed without resource damage. Operations are permitted outside the Normal Operating Season only when they can be conducted without damage to soil, water, and other resources. Where determined to be necessary through the environmental analysis, the TSC will limit operations to specific periods or weather conditions. Operations are not permitted to continue if damage will occur.

Implementation and Responsibility: Limited operating periods are identified and recommended during the Timber Sale Planning Process by the interdisciplinary team and followed through the life of the timber sale primarily by the Sale Administrator.

Ability to Implement: Add at project level.

Effectiveness: Add at project level.

Monitoring: During implementation of timber sale activities by the Sale Administrator, Forest Service Representative (FSR), engineers, and watershed specialists. Also, see Chapter V of the Forest Plan for Soil and Water resource monitoring:

Specific BMP

PT-5. Title: "Limiting the Operating Period of Timber Sale Activities"

Objective: To ensure that the Purchaser conducts operations in a timely manner, within the time period specified in the Timber Sale Contract (TSC).

Explanation: The Ship Mountain Timber sale contains sensitive soils that are subject to soil compaction during tractor skidding, and a non-surfaced road that is not suitable for wet weather haul.

The normal operating season for the Forest will be enforced for the Ship Mountain Timber sale. All operations off road FR 10 (non-surfaced) will be halted at the onset of wet weather to prevent erosion and damage to the road. Tractor skidding on units 1-5 will be restricted if soil moisture is above the level established by the soil scientist. Other operations can continue outside the normal operating season if they can be conducted without damage to soil, water, and other resources.

Implementation and responsibility: For the Ship Mountain Timber sale the normal operating season for the Forest will be enforced. All operations off road FR 10 (non-surfaced) will be halted at the onset of wet weather to prevent erosion and damage to the road. Other operations can continue outside the normal operating season if they can be conducted without damage to soil, water, and other resources. The Forest watershed specialists will work with the timber sale administrators to evaluate the potential for resource damage if operating outside the normal operating season.

Ability to Implement: High

Effectiveness: High

Monitoring: During implementation of timber sale activities by the Sale Administrator, Forest Service Representative (FSR), engineers, and watershed specialists. Also, see Chapter V of the Forest Plan for Soil and Water resource monitoring.

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