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Final Environmental Impact Statement



**BONNEVILLE POWER
ADMINISTRATION**

**TRANSMISSION FACILITIES
VEGETATION MANAGEMENT
PROGRAM**

U.S. Department of Energy



August 1983

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August 1983

Responsible Official:
WILLIAM A. VAUGHAN
Assistant Secretary for
Environmental Protection, Safety,
and Emergency Preparedness



COVER SHEET

Responsible Agency: Department of Energy, Bonneville Power Administration

Cooperating Agencies: U. S. Environmental Protection Agency, USDA Forest Service, USDI Bureau of Land Management, and U. S. Fish and Wildlife Service.

Title of Proposed Action: Transmission Facilities Vegetation Management Program.

Title of Document: Final Environmental Impact Statement.

States Involved: Oregon, Washington, Idaho, Montana, Wyoming, California, Utah.

Abstract: The Proposed Program would manage vegetation on some 84,000 acres of rights-of-way and at 357 substations and other facilities throughout BPA's seven-state service area. On rights-of-way, tall-growing vegetation would be prevented from growing into transmission lines and from blocking access roads. At substations and microwave yards, all vegetation would be removed to prevent fire and safety hazards. Where appropriate, noxious weeds would be controlled in cooperation with local landowners. The Proposed Program would use manual, spot chemical, broadcast chemical, and biological methods to manage vegetation. Selection of treatments to use in specific management situations would be based on consideration of social, ecological, and economic consequences of using the various methods. Treatments would be implemented according to the constraints and mitigation measures provided by BPA's Transmission Line Maintenance Standard. This EIS examines potential impacts on public health, worker safety, water quality and fisheries, land uses, plants and animals, soils, and visual, cultural, and historical resources. In particular, the potential impacts of using herbicides in spot chemical and broadcast chemical treatments are examined. Identified potential adverse impacts would be avoidable through implementation of the BPA Transmission Line Maintenance Standard and other mitigation measures. Introductions of herbicides into environments of the Pacific Northwest would occur; however, these would not be toxicologically significant due to the low inherent toxicity of the herbicides proposed for use, due to their rapid degradation in soil and water, and due to their failure to accumulate in biological organisms. Mitigation measures such as stream buffer zones and drift control measures for broadcast applications and monitoring of herbicide residues in soil and water would minimize possibilities of adverse impacts.

No decision will be made until 30 days after the EPA filing notice has appeared in the FEDERAL REGISTER.

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SUMMARY



SUMMARY

Major Conclusions

Purpose of and Need for the Proposed Action. The Bonneville Power Administration (BPA) operates and maintains a regional electrical transmission system in the Pacific Northwest. This transmission system encompasses approximately 13,000 miles of transmission lines and 357 substations plus miscellaneous other facilities in the States of Oregon, Washington, and Idaho, and in parts of Montana, Wyoming, and California. BPA's underlying need for a vegetation management program is to ensure transmission system reliability.

Tall-growing plants must be prevented from growing into transmission lines on some 84,000 acres of rights-of-way. Access roads used for inspection and maintenance of transmission lines have to be kept clear of obstructing shrubs and trees. Within substations, switchyards, and microwave stations, all vegetation must be removed to prevent fire and safety hazards. Finally, where BPA's actions have caused and/or contributed to a noxious weed infestation, BPA cooperates with landowners and local Weed Control Districts to help eradicate or control noxious weeds. BPA's proposed vegetation management program also aims to achieve several other purposes, specifically public and worker safety, technical and economic efficiency, multiple use of rights-of-way, protection of environmental quality, and adherence to principles of Integrated Pest Management.

Alternative Vegetation Management Programs. A vegetation management program consists of a set of vegetation control methods available for use in various management situations. Methods used for control of vegetation can be categorized as spot chemical treatments (i.e. herbicide applications to individual plants), broadcast chemical treatments (i.e. herbicide applications to broad areas of existing vegetation or potential vegetation), manual treatments (i.e. using hand-operated tools and equipment), mechanical treatments (i.e. using mechanized power equipment), or biological methods (i.e. using biological organisms).

The various vegetation control methods are described in detail in Chapter 3 of this Environmental Impact Statement (EIS). Different control methods are suitable for use in different BPA management situations. Broadly speaking,

these situations are right-of-way brush control, right-of-way noxious weed control, wooden pole protection, and substation weed control. The suitability of a particular control method to a particular situation depends on factors such as type of vegetation to be controlled, density and height of vegetation, expected vegetation growth rates, topography and site accessibility, transmission conductor height, proximity of a site to restricted or sensitive areas, special agreements with landowners or land managing agencies, treatment cost, and constraints on vegetation management practices contained in BPA's Transmission Line Maintenance Standard.

In general, manual control methods would be suitable for control of low-density brush on rights-of-way and for control of brush in stream buffer zones, cropland buffer zones and roadside screens. Spot chemical methods would be suitable, generally, for control of low-density brush on rights-of-way; for control of brush in stream buffer zones, cropland buffer zones, and roadside screens; for noxious weed control; for wood pole protection; and for substation weed control. Broadcast chemical methods would be suitable, generally, for control of high-density brush on rights-of-way in inaccessible sites away from streams and susceptible crops, for control of substation weeds, and for control of noxious weeds. Mechanical methods, generally, would be suitable for right-of-way brush control at accessible sites on gentle slopes or level ground and on nonerodible soils. Biological methods for control of right-of-way brush are experimental at this time; however, the use of introduced insects to control a noxious weed (i.e. tansy ragwort) is operational and would be used by BPA. In addition, BPA may enter into multiple use agreements with landowners whereby landowners agree to control brush on transmission line rights-of-way.

A vegetation management program may rely on just one method of vegetation control or on a combination of control methods (see Chapter 4). BPA's preferred alternative program includes the use of spot chemical, broadcast chemical, manual, and biological methods. Treatment methods for individual control projects would be selected based on consideration of environmental and economic consequences, and management criteria; treatment implementation would be guided by the BPA Transmission Line Maintenance Standard and other mitigation measures. The preferred alternative and other combinations of control methods (e.g. exclusive use of manual methods, use of manual and mechanical methods, use of all methods except broadcast chemical, etc.) are evaluated

and compared using environmental criteria (both social and biophysical), economic criteria, and management criteria (see Chapter 4).

Evaluation criteria were developed based on three sources of information. First, in late 1980, BPA solicited letters of comment from the public and agencies during the scoping process for this EIS. These scoping comments indicated that health and safety, land use patterns, water quality and fisheries, nontarget plants and animals, and procedures for control treatment selection were high-priority concerns. Secondly, public and agency comments on previous environmental documents (EA's and EIS's) covering BPA's vegetation management program were reviewed; these comments indicated similar types of concerns. Finally, BPA vegetation management personnel have primary concerns for treatment effectiveness, treatment cost, operational flexibility, and legal compliance, as well as environmental concerns. Based on the above sources, 14 evaluation criteria were established. Eight of these criteria were given high importance ratings: public health, worker safety, public acceptability, water quality and fisheries, treatment cost, legal compliance, treatment effectiveness, and operational flexibility (see Chapter 4). The program alternatives were evaluated relative to the public acceptability criterion after comments were received on the Draft EIS (see Chapter 4 and Chapter 12).

Among 11 alternative programs evaluated in Chapter 4, five alternatives were ranked favorably (i.e. having the least adverse or most beneficial potential impacts) for the 14 evaluation criteria. These alternatives were: (1) exclusive use of manual methods (Alternative 2), (2) exclusive use of spot chemical methods (Alternative 3), (3) use of spot chemical and broadcast chemical methods (Alternative 6), (4) the preferred alternative (Alternative 10 -- use of manual, biological, spot chemical, and broadcast chemical methods), and (5) use of biological, manual, and spot chemical methods (Alternative 11). Based on paired comparisons among these five most favorable alternatives, the preferred alternative ranks as equal to or better on all high importance criteria. The other four alternatives rank lower than the preferred alternative on two or more high importance evaluation criteria (see Table 4-4).

The preferred alternative, if selected for implementation by BPA, would incorporate a number of mitigation measures and management requirements or guidelines to be implemented to minimize potential adverse impacts and hazards to the public and the environment. Under these guidelines, manual methods would be used primarily on low-density right-of-way brush

stands on accessible sites and where treatment of individual plants is appropriate (e.g. riparian areas, visual screens). Spot chemical methods would be used primarily in similar situations where sprouting plant species are a problem but with precautions (e.g. buffer zones) to protect water quality. Broadcast chemical methods would be used in inaccessible sites, on high-density brush, and where little hazard to public health, water quality, or adjacent land use is involved. Current experimental studies of biological methods would continue. Treatment selection guidelines that would be used under the preferred alternative are discussed in Chapter 5.

Among mitigation measures described in the BPA Maintenance Standard and included in the preferred alternatives are:

1. Compliance with all pertinent state and federal regulations;
2. Promotion of multiple-use agreements with landowners;
3. Use of only EPA-registered herbicides;
4. Strict observance of herbicide application rates and application techniques as specified on EPA-approved label instructions;
5. Exclusive use of licensed herbicide applicators or licensed supervisors as specified by state law;
6. Strict observance of buffer zones along water bodies (e.g. 100 feet for broadcast aerial applications);
7. Observance of wind and weather limitations for broadcast applications to minimize drift, volatilization, and runoff;
8. Use of positive placement measures to control spray drift during broadcast applications;
9. Monitoring of herbicide residues in soil and water;
10. Strict observance of all laws and regulations governing herbicide handling, storage, disposal, and spill cleanup;
11. Inspection of rights-of-way immediately before broadcast application of herbicides;

12. Avoiding use of oil carriers for foliar herbicide applications;
13. Continued research into new vegetation control methods, including biological and chemical treatments, and documentation of study designs and results; and
14. Training of herbicide applicators to insure proper application rates and herbicide placement are used; inspection of herbicide operations to insure proper implementation.

Other mitigation measures identified in this study but not included in the preferred alternative are:

1. Greater documentation of procedures used for selection of treatments on individual vegetation control projects;
2. Work to establish memoranda of agreement with state and local land use planning entities concerning generic compatibility of routine vegetation management;
3. Encoding of locations of cultural sites and threatened and endangered species (particularly plants) into the ROWDATA inventory system, if known on BPA rights-of-way;
4. Monitoring the fate of herbicides (in groundwater and surface water) used at high application rates for substation weed control;
5. Greater restrictions on use of 2,4-D esters where possibility of contaminating aquatic ecosystems exists; and
6. Other measures to further reduce the likelihood of stream contamination by aerial herbicide applications.

Environmental Consequences. Implementation of the proposed program (i.e. BPA's preferred alternative) would result in some adverse impacts on the environment of the Pacific Northwest (see Chapter 7). Given implementation of the BPA Transmission Line Maintenance Standard and other mitigation measures, these impacts would be limited. Potential adverse impacts resulting from herbicide contamination of bodies of water and other nontarget areas, and occupational exposures

to herbicides, would be minimized or avoided by implementation of mitigation measures already incorporated in the preferred alternative which govern spot and broadcast applications, and through training of workers. Minor introductions of herbicides into environments of the Pacific Northwest would be unavoidable, but these would not be toxicologically significant due to the low inherent toxicity of the herbicides proposed for use, limited application rates, rapid degradation in soil and water, lack of bioaccumulation, and careful adherence to application procedures (see Chapter 7 section on Public Health).

Irretrievable commitments of resources would be limited to the direct and indirect consumption of fossil fuels used in the production and application of various vegetation control techniques. The long-term productivity of transmission rights-of-way would be maintained.

Areas of Controversy

BPA published the Draft EIS in September 1982 and received written comments on the Draft EIS during October and November 1982. A total of 68 comment letters were received during the 60-day comment period (see Chapter 12). Analysis of the content of the comment letters indicated that nine major areas of controversy exist concerning BPA's proposed program. The following sections indicate the nine subjects of concern, the percentages of all comment letters expressing each concern, and a summary of the general response to each concern (see Chapter 12).

Use More Biological Methods in BPA's Program (25 percent of all commentors). These commentors felt that biological methods should be used whenever feasible due to less potential for adverse environmental impacts as well as more potential for long-term control of target vegetation. In adhering to the principles of Integrated Pest Management, BPA endeavors to use biological methods where they are feasible and effective. An introduced insect is being used to control a noxious weed. Although biological methods of brush control are not currently operational, BPA is conducting a multi-year research study of such methods. The result of BPA's vegetation management activities, whether manual, spot chemical, or broadcast chemical, is the creation and maintenance of low-growing vegetation on rights-of-way. This occurs because all methods, as applied by BPA, are implemented to remove tall-growing species while retaining low-growing vegetation. BPA will continue to study the

effectiveness, cost, and environmental consequences of biological control methods and to adopt them where they prove feasible.

Use More Manual Methods (24 percent of all commentors). Commentors expressing this concern desired that BPA use additional manual methods in order to minimize the use of herbicides and to provide more employment opportunities. Manual methods have advantages and disadvantages for vegetation control, as described in Chapter 3. A primary advantage is their selectivity in treating individual plants. Disadvantages include high likelihood of worker safety hazards in certain situations (e.g. remote areas, steep topography, dense vegetation), inefficiency in treating dense vegetation, and impracticality for substation weed control or noxious weed control. Most BPA vegetation management effort is contracted, under federal contracting regulations (e.g. no convict labor). Contracts must be performed in accordance with contract specifications and federal safety regulations. Over the 10-year period, 1973-1982, BPA has used manual methods on approximately 9 percent of treated right-of-way acres. BPA would continue to use manual methods in accessible locations of low-density brush, within stream buffer zones, adjacent to susceptible crops, and where vegetation screens are maintained.

Protect Water Quality from Potential Herbicide Impacts (19 percent of commentors). These commentors expressed concern for the quality of waters used for human consumption and of waters providing habitat for anadromous fish and other aquatic organisms. Some commentors specifically requested BPA to observe larger stream buffer zones than those proposed in the Draft EIS. BPA's proposed program incorporates a number of mitigation measures that will prevent or minimize impacts on water quality from herbicide use (e.g. buffer zones, monitoring of weather conditions, drift control measures, stream monitoring). BPA's stream monitoring program over more than 10 years has shown that where herbicides have been detected in streams, contamination was highly localized, occurred at very low levels, and quickly decreased. These results indicate that the stream buffer zones observed by BPA are effective at minimizing water contamination by herbicides. A worst-case analysis of potential human exposures to herbicides in streams (see Chapter 7 section on Public Health) shows that BPA's program poses minimal public health hazard. This conclusion is based on the low levels of potential human exposures, the high levels of known toxicity thresholds for herbicides proposed for use by BPA, the lack of bioaccumulation among

these herbicides, and the patterns of use proposed by BPA. A number of mitigation measures have been identified that would further reduce the likelihood of potential water quality impacts (e.g. monitoring of groundwater at BPA substations, flagging stream buffer zones, and restrictions on use of 2,4-D esters).

Use More Multiple-Use Agreements with Landowners (15 percent of commentors). These commentors saw multiple-use agreements as a way to lessen BPA's use of herbicides as well as a way to provide landowners the option of selecting vegetation control methods to be used on their lands. BPA establishes such agreements with landowners but provides no cost reimbursement for maintenance work performed. BPA's experience with the agreements is variable; many landowners default on agreements, thereby requiring BPA to perform brush control. Other utilities that provide cost-sharing under such agreements have found little interest by landowners in fulfilling the agreements. BPA will continue its present policy of establishing multiple-use agreements where requested by landowners.

Adopt the Additional Mitigation Measures Not Included in the Proposed Action or Alternatives (13 percent of commentors). A number of mitigation measures were identified in the Draft EIS that could further reduce the likelihood of adverse impacts from BPA's proposed program (see Table 4-5). These commentors supported some or all of the identified measures. After reviewing the Final EIS and public and agency comments, BPA will issue a Record of Decision indicating which of these additional mitigation measures have been adopted and why those not adopted, were not.

Mimimize Use of Broadcast Chemical Methods (12 percent of commentors). Eight commentors expressed opposition to use of broadcast chemical methods by BPA, citing in particular the potential for adverse impacts to stream water quality and to adjacent land uses. BPA proposes to use broadcast applications in situations where potential for damage to sensitive resources is minimal and where other vegetation control methods are inefficient. Broadcast aerial applications would be used at least 100 feet from streams or bodies of water, with drift control measures, and when weather conditions are suitable to minimize drift, volatilization, or runoff. Aerial applications would be carefully monitored by BPA inspectors. Over the 10-year period, 1973-1982, BPA used aerial applications on approximately 19 percent of its

treated right-of-way. Aerial broadcast methods are highly efficient (compared to other available methods) for treatment of dense target vegetation in remote sites of steep topography. Mitigation measures presently incorporated in the proposed program will minimize potential impacts. Additional identified mitigation measures could further reduce the likelihood of adverse impacts from broadcast treatments.

Provide Additional Documentation and Notification for BPA Vegetation Management (9 percent of commentors). Commentors desired additional documentation by BPA to show the basis for selection of treatments in particular right-of-way sites. Several commentors wanted BPA to notify all landowners whenever herbicides were to be used on rights-of-way. BPA currently documents the implementation of control treatments through Daily Brush and Weed Control Reports and through inspectors and foremen signing off on these documents and Working Instructions (in the case of Force Account Work). Selection of treatments is accomplished through a careful five-step process considering many factors such as vegetation condition, environmental constraints, and economic costs (see Chapter 5 section on Development of Vegetation Management Prescriptions). Documentation of treatment selection rationale could show for the record that an Integrated Pest Management decision process had been followed. BPA routinely notifies landowners when two herbicides carrying grazing restrictions are used. Landowners may establish agreements to be notified by BPA on an individual basis. A BPA policy to notify all landowners would be extremely costly and difficult to administer (see General Response G - Chapter 12).

Minimize Use of Picloram Herbicide (7 percent of commentors). These commentors cited the recent invalidation of previous testing results by EPA, recent assertions of carcinogenicity of picloram, picloram's known soil persistence and mobility in water, and picloram's "restricted-use" classification. The "restricted-use" classification is due to picloram's potential to damage nontarget vegetation by movement through soil; the classification requires it to be applied by certified applicators. EPA and other organizations have concluded that due to the high doses required to induce effects in animal studies and due to the small potential for human exposure picloram does not pose a significant carcinogenic risk. Further testing is under way to resolve some deficiencies of previous studies. A worst-case analysis of possible human exposures to BPA's proposed use of picloram shows that minimal public health hazard would exist based on

current knowledge. This results from the proposed pattern of use in conjunction with picloram's low order of acute or chronic toxicity and lack of bioaccumulation.

Minimize Use of 2,4-D Herbicide (7 percent of commentors). These commentors cited recent assertions of 2,4-D's carcinogenic potential as the basis for restrictions on its use by BPA. Previous carcinogenicity studies have been found to be inadequate in terms of methodology. Manufacturers of 2,4-D are currently conducting additional chronic toxicity testing. The reliable scientific evidence available at this time indicates that, at levels of exposure possible from uses of 2,4-D in vegetation management, negligible hazard to public health exists. A worst-case analysis of possible human exposures to 2,4-D from BPA's proposed uses shows that, in most cases, substantial safety factors would occur. Although 2,4-D esters may adversely affect aquatic organisms if accidentally deposited on stream habitats in high concentrations, the initial damaging concentrations would rapidly decrease due to hydrolysis, dilution, adsorption, and other natural processes. Adverse impacts would be limited in extent and short-lived. A mitigation measure to further reduce the likelihood of adverse aquatic impacts would be to eliminate use of 2,4-D esters wherever a possibility of contaminating aquatic ecosystems exists.

For further details on these areas of controversy, see the General Responses in Chapter 12.

Issues to be Resolved

BPA will select a vegetation management program from among the alternative programs evaluated and compared in this EIS. Selection of a program is the major issue to be resolved. Subsidiary to the major issue are a number of other issues that also need to be resolved:

1. Whether to use all the herbicides proposed for use and examined in this EIS;
2. Whether to investigate ways to use additional manual and biological methods of vegetation control;
3. Whether to increase the width of buffer zones adjacent to streams and other water bodies;

4. Whether to monitor the fate of herbicides applied for substation weed control;
5. Whether to further document the procedures and rationale by which control treatments are selected (a mitigation for any perceived impacts);
6. Whether to more actively promote multiple use brush control agreements with landowners (a method to reduce vegetation management undertaken directly by BPA);
7. Whether to eliminate the use of 2,4-D ester formulations where any danger of contaminating water bodies exists; and
8. Whether to adopt other mitigation measures identified by this EIS (see Table 4-5).

Final decisions with respect to these issues will be made upon completion of the Final EIS and will be documented in the Record of Decision.

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INTRODUCTION



Chapter 1

INTRODUCTION

Study Objectives

The Bonneville Power Administration (BPA) operates and maintains an electrical transmission system encompassing 200,000 acres of rights-of-way and transmission facilities in the Pacific Northwest. Some 84,000 acres of this system require a program to periodically manage the growth of vegetation to maintain electrical service reliability. This Environmental Impact Statement (EIS) is prepared pursuant to the requirements of the National Environmental Policy Act (NEPA). As a multidisciplinary study, it considers environmental consequences of alternative vegetation management programs, consisting of various combinations of vegetation control methods. Based on this EIS, BPA intends to make an environmentally well-informed decision in selecting a future vegetation management program.

The approach taken by the analysis contained in this EIS is generic in the sense that the EIS examines the environmental impacts of general classes or types of control methods. The EIS is a program EIS in that it considers the environmental consequences of several alternative programs consisting of combinations of control methods to be used throughout the BPA service area. This program EIS provides basic background information for "tiering" of project-specific analyses, in accordance with Council on Environmental Quality regulations. By tiering subsequent analyses, BPA will be able to incorporate, by reference, the findings of this EIS and concentrate on issues specific to particular sites and projects. For further discussion of the process of tiering environmental analyses as a means for satisfying requirements of NEPA, see Chapter 8, ENVIRONMENTAL REQUIREMENTS.

It must be emphasized that this program EIS analyses environmental effects, constraints, and mitigation measures that apply to BPA's vegetation management program throughout its six-state service area. BPA will select a vegetation management program from among the several alternative programs considered in this EIS. Subsequently BPA contemplates the preparation of four environmental analyses that will be tiered to the program EIS.

Relationship of the Program EIS to Subsequent Environmental Analyses

The subsequent environmental analyses will summarize and/or incorporate by reference the issues discussed in the program EIS. Each will evaluate a specific major action included within the entire BPA vegetation management program. Each will concentrate on those issues specific to the major action being examined.

The major actions to be evaluated in the four tiered environmental analyses are:

1. Vegetation Management at Substation and Microwave Yards -- East of the Cascades.
2. Vegetation Management at Substation and Microwave Yards -- West of the Cascades.
3. Vegetation Management on Transmission Line Rights-of-Way and Access Roads -- East of the Cascades.
4. Vegetation Management on Transmission Line Rights-of-Way and Access Roads -- West of the Cascades.

The scope of these tiered documents is determined by geographical and climatological considerations (east or west of the Cascades), and by type of transmission facilities (substations versus rights-of-way). Upon completion and issuance of the tiered analyses, decisions will be made with respect to future vegetation management actions falling within the scope of each.

Organization of the EIS

The essential content of the EIS is provided in Chapters 2, 3, and 4. Chapter 2 describes the underlying need for and purposes of BPA's proposed vegetation management program. Chapter 3 identifies and characterizes the methods available to control transmission facilities vegetation; available methods include various chemical, manual, mechanical, and biological techniques. Certain of these techniques are proposed for use by BPA.

Chapter 4, the heart of the EIS, describes, evaluates and compares the alternative vegetation management programs, some of which consist of exclusive reliance on one particular method of control, while others consist of a combination of various methods of control. Evaluations and comparisons are based on social, environmental, economic, and management criteria. BPA's preferred alternative is

identified and measures to mitigate the potential adverse impacts of the proposed program are described and evaluated.

Supportive information for the evaluation and comparison of alternative programs is provided in Chapters 5, 6, and 7. Chapter 5 describes BPA's management situation including the organization of its vegetation management activities, procedures by which management prescriptions are developed, and the historical pattern of BPA's vegetation management effort in the Pacific Northwest.

Chapter 6 briefly characterizes the affected environment of the proposed action, while Chapter 7, Environmental Consequences, provides the analytical basis for the evaluation and comparison of alternative programs in Chapter 4. Chapter 7 analyzes the specific environmental effects of the available vegetation control methods that comprise alternative management programs. Potential environmental effects are described both with and without the mitigation measures incorporated in the proposed program. Impact areas of wide public concern include public health, worker safety, and water quality.

Due to the great concern over use of pesticides in our society, this EIS includes detailed analyses of the herbicides proposed for use by BPA. Background Statements describing the environmental behavior and toxicological properties of 14 herbicides, 2 herbicide additives, and diesel oil (an herbicide carrier) are contained in Appendix A.

The Council on Environmental Quality specified the standard EIS format in their regulations at 40 CFR 1502.10. This EIS includes all sections indicated by those regulations. Chapters 1, 3, 5, and 8, however, are in addition to the standard EIS chapters. These additional chapters are appropriate due to the type of EIS and due to the complexity of the EIS subject matter. Chapters 1 and 5 provide details of the programmatic EIS process; Chapter 3 describes the methods available for control of vegetation; Chapter 5 outlines the organization and previous history of BPA's vegetation management effort; and Chapter 8 discusses the applicability of federal environmental statutes and regulations to vegetation management. We believe these additional chapters will enhance the reader's understanding of both the EIS subject matter and the EIS decision-making process.



PURPOSE AND NEED



Chapter 2

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

Background

Bonneville Power Administration (BPA) operates and maintains a regional electrical transmission grid in the Pacific Northwest. BPA was established by Congress in 1937 to market and distribute electrical energy generated at Bonneville Dam. Since that time, BPA's responsibilities have expanded until today it markets the energy generated at 31 federal hydroelectric facilities in the Columbia River Basin. Together with BPA's transmission system, these federal hydroelectric facilities, constructed and operated by the Corps of Engineers and the Bureau of Reclamation, comprise the Federal Columbia River Power System. The power generated by this system and transmitted by BPA constitutes approximately 50 percent of the electrical energy consumed in the Pacific Northwest.

Starting in the 1950s, BPA began to provide transmission facilities for wheeling nonfederal power. Wheeling is the transmission of large blocks of electricity over the BPA system from nonfederal hydro and/or thermal generating plants to points of use by utilities owning or purchasing the output of such plants.

To perform its marketing, transmission, and wheeling functions, BPA operates and maintains an extensive network (grid) of high voltage transmission facilities (Figure 2-1). The BPA network serves as the main power grid for the Pacific Northwest, providing about 70 percent of the region's bulk power transmission capacity. BPA distributes electrical power to 147 wholesale customers in Oregon, Washington, Idaho; Montana and Wyoming west of the Continental Divide; and to small areas of northern California, Nevada, and Utah. The BPA transmission network includes approximately 12,300 structure miles (13,300 circuit miles) of transmission lines, 357 substations and switchyards, a microwave communications and control system, and associated access roads, maintenance buildings, and support facilities. (Transmission lines having multiple circuits cause the number of circuit miles to be greater than the number of structure miles.)

Underlying Need for Action

The Federal Columbia River Transmission System Act (P.L. 93-454), as amended, directs the BPA administrator to operate and maintain the federal transmission system within the Pacific Northwest as required to ensure the electrical stability and electrical reliability of the federal system (IG USC 838b). The underlying need to which BPA is responding with its proposed action is the need to ensure reliable operation of the federal transmission system. To meet this underlying need, BPA proposes to manage vegetation on transmission line rights-of-way, substation yards, microwave stations, and along microwave beam paths and access roads.

Generally, the term "reliability" refers to the ability of an item to perform a required function under stated conditions for a stated period of time. In a power system, reliability refers to the ability of the system to continue operation. Expressed in other terms, the reliability of an electric power system is a measure of the dependability with which electricity is supplied to customers. Transmission reliability is concerned with the reliability of the transmission component of an electric power system.

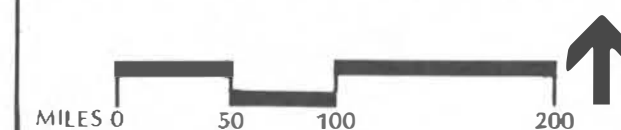
Transmission reliability depends on the availability of reserve transmission capacity, transmission facility design, location of facilities, and operation and maintenance practices (a more complete discussion of transmission reliability appears in BPA's Draft Role EIS, DES -77-21, Appendix B - BPA Power Transmission, Chapter III). Maintenance contributes to transmission reliability by helping to ensure that facilities continue to operate as they were intended. With reduced maintenance, greater redundancy of transmission facilities (i.e., multiple facilities) would be required to maintain the same overall degree of reliability. If no maintenance were performed at all, the transmission system would deteriorate until it was totally unreliable (i.e., nonfunctional).

In order to ensure reliable operation of the federal transmission system, BPA undertakes routine and preventative maintenance of its transmission facilities to avoid outages and damage to equipment. Vegetation management is a major part of the maintenance program. Vegetation management is defined as the manipulation of plant communities to achieve certain specific objectives in various management situations. The specific objectives, although they differ in their particulars, all contribute to satisfying the underlying need of ensuring reliable operation of the federal transmission system. These specific objectives and their relationships to the underlying need are discussed below.

Figure 2-1

B.P.A. Service Area & Transmission Facilities

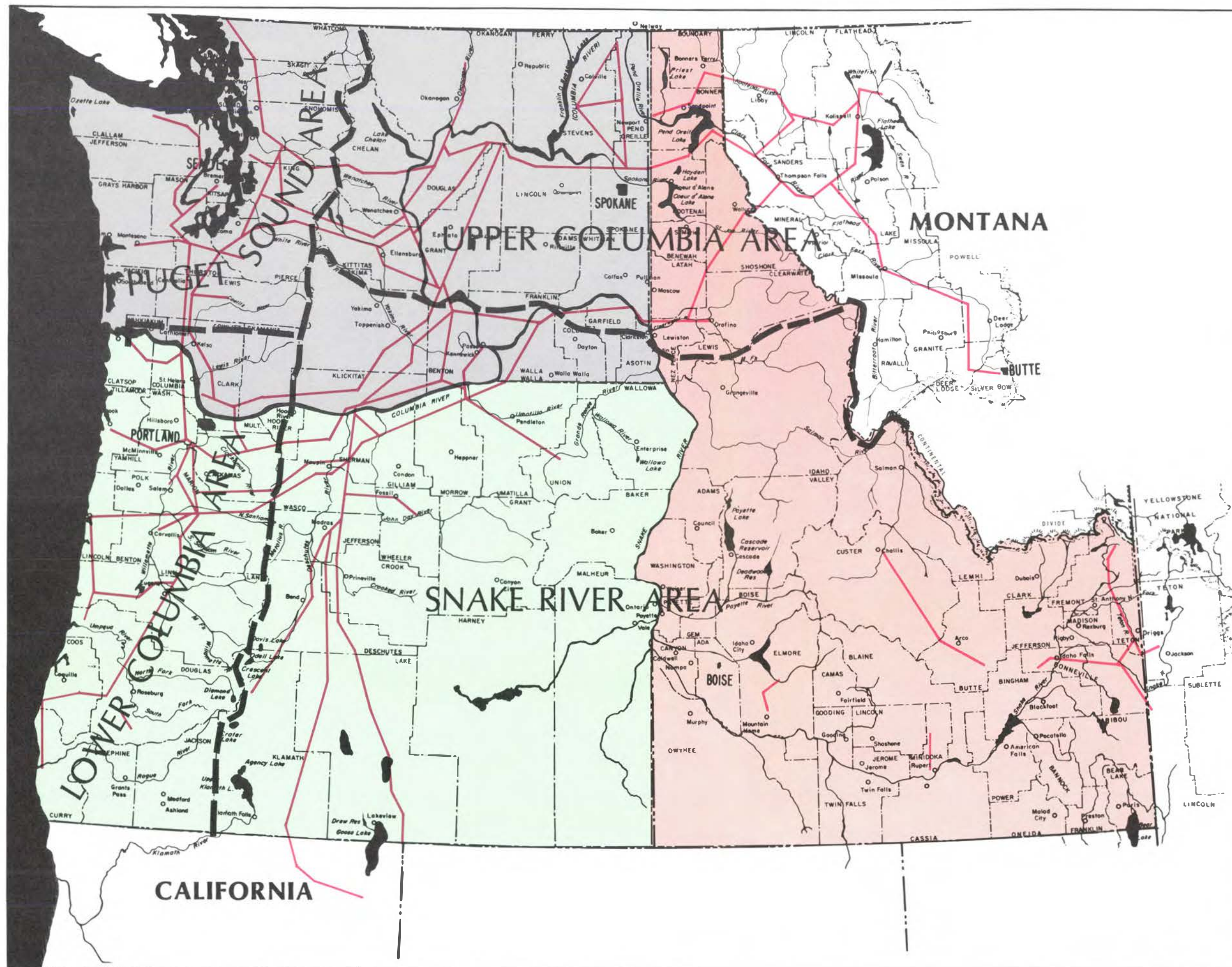
BONNEVILLE POWER ADMINISTRATION Vegetation Management EIS



LEGEND

- Idaho
- Oregon
- Washington
- Power Transmission Line Route

Note: Power transmission line routes are intended to show general areas through which transmission lines are located. Routes may represent one or many transmission lines. The routes shown do not represent specific locations of specific lines.



Prevention of Operations Hazards

In forested areas, BPA controls tall-growing trees on its transmission line rights-of-way so they do not grow into contact with transmission lines, thereby short-circuiting the electrical conductors and causing an outage. Throughout BPA's service area, approximately 84,000 acres require vegetation management to control such tall-growing vegetation. Trees on land adjacent to rights-of-way may present a danger of falling into the lines due to windstorm, leaning, decay, insect infestation, or other causes of instability. Such hazardous, unstable trees must be removed. Microwave beam paths also must be managed so that tall-growing trees do not interfere with or block the microwave signals that are essential in monitoring and controlling the system.

Access for Maintenance and Repair

In the interest of ensuring the reliable operation of the federal system, it is essential that BPA have access to its transmission facilities. System reliability criteria require unimpaired access to rights-of-way and transmission structures for routine inspection and maintenance, and emergency repairs. Access roads (especially when not heavily used) can become overgrown at the edges and become impassable or dangerous. Access roads to transmission facilities, therefore, are managed to keep them clear of vegetation. Similarly, areas around transmission structures are kept free of trees, shrubs, and poisonous plants to allow safe working space for crews during routine maintenance and emergency repairs.

Protection of Facilities from Fire

Within substations, switchyards, and microwave stations, vegetation is managed in order to minimize the possibility of electrical short circuits and fire. Removal of ground vegetation in these areas (and prevention or control of its regrowth) thereby reduces the potential for safety hazards to workers, damage to equipment, and outages.

In certain rangeland areas, transmission lines carried by woodpole structures are susceptible to damage by rapidly spreading ground fires. These fires can burn away the bases of transmission structures causing them to fall. In these situations, vegetation is cleared from around the bases of the structures to prevent their being ignited by ground fires.

Control of Noxious Weeds

Noxious weeds are plants which may be injurious to crops, livestock, or other property, and are included for purposes of control on county noxious weed lists. Weed control districts may officially designate certain weeds as noxious under state law. Noxious weeds do not affect the reliable operation of the federal system. Noxious weed infestations are attributable to a number of factors and can be exacerbated in some situations by the establishment of a transmission line corridor. Therefore noxious weed control is conducted as part of BPA's vegetation management program.

Where active weed control campaigns are being conducted by landowners and weed control district personnel, and where BPA's actions have caused and/or contributed to the problem of noxious weed infestation, BPA cooperates with landowners and Weed Control Districts to help eradicate or control noxious weeds. Noxious weed control is therefore more appropriately viewed as a mitigation measure undertaken in cooperation with others.

In addition to officially declared noxious weeds, other plants may be a problem to individual landowners. All plants are weeds when growing in locations where they are not wanted. BPA may control vegetation around its structures in agricultural areas when requested to do so by the land-owner. These control measures are done on a case-by-case basis.

Purposes of BPA's Vegetation Management Program

While satisfying the underlying need (which is to ensure reliable operation of the federal transmission system), the proposed vegetation management program also will aim to achieve a number of auxiliary or additional purposes. The purposes are summarized below.

Public and Worker Safety

To design and implement a vegetation management program which will minimize health or safety hazards to maintenance workers and the public.

Technical and Economic Efficiency

To develop a program that will manage vegetation in a manner which is technically effective and economically efficient.

Multiple Use

To encourage multiple use of BPA's transmission line rights-of-way. In the context of transmission line rights-of-way, multiple use means the preservation or establishment of land use patterns which are inherently compatible with transmission lines, thereby minimizing the need for active vegetation management. Examples of multiple use include row crops, pasture, and Christmas tree farms.

Protection of Environmental Quality

To plan and implement the proposed action in such a manner that environmental quality is protected as required by the National Environmental Policy Act (Section 101). Specifically, attributes of environmental quality such as water quality, maintenance of soil productivity, wildlife habitat diversity, and visual quality are to be considered in planning and implementing a vegetation management program.

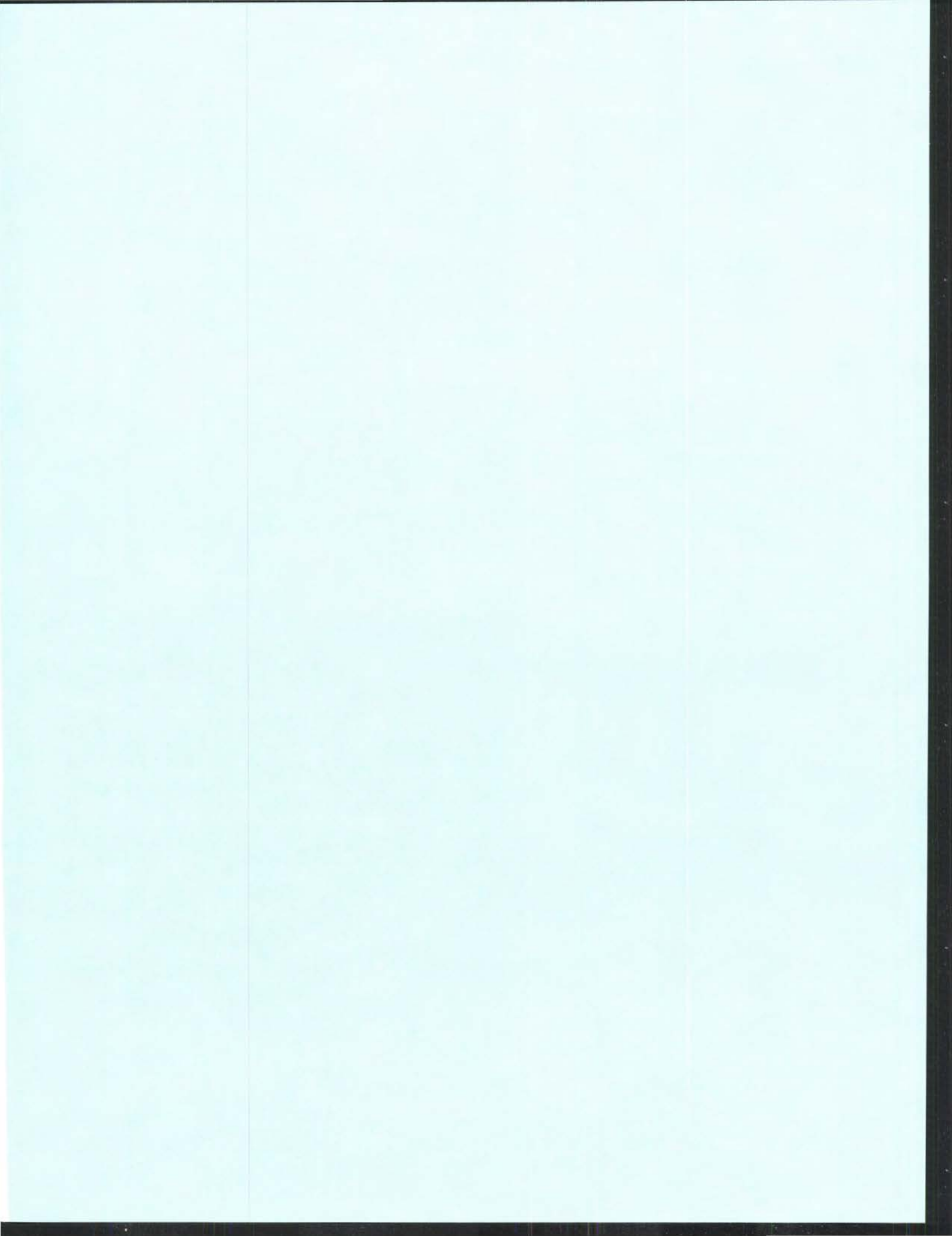
Adherence to Principles of Integrated Pest Management

To plan and implement a program which employs the principles of Integrated Pest Management (IPM). IPM is a systematic decision-making process for the selection and implementation of pest control methods based on predictions of sociological, economic, and ecological consequences (Council on Environmental Quality 1979). IPM strives for maximum use of naturally-occurring controls. Artificial, biological, physical, and chemical controls are also used. Selections of control methods to use in particular situations are based upon consideration of the consequences of no control or management in contrast with the ecological, economic, and sociological costs of using available control methods.

The proposed action, and the alternatives to the proposed action, will be analyzed and evaluated in terms of (1) their ability to satisfy the underlying need, and (2) their ability to achieve the above additional purposes. Their respective abilities to satisfy the underlying need, while simultaneously achieving the additional purposes (realizing that some of the purposes conflict with one another and require tradeoffs), will be the basis for comparing the proposed action and its alternatives, and, ultimately, making a decision with respect to future vegetation management.



ALTERNATIVE METHODS OF VEGETATION MANAGEMENT



Chapter 3

ALTERNATIVE METHODS OF VEGETATION MANAGEMENT

Vegetation management involves the selection and implementation of methods to control or manipulate target vegetation in order to meet specified management objectives. A variety of vegetation control methods are available for vegetation management on transmission line rights-of-way and at associated facilities. Additional methods are experimental and currently are being tested for their usefulness. The following discussions apply only to management of existing transmission rights-of-way in general and to management of BPA rights-of-way in particular; they do not apply to construction of new transmission lines. Vegetation control methods proposed for use by BPA are identified and described; additional methods not proposed for use by BPA are described also.

Target Vegetation

Target vegetation is defined precisely by the objectives of BPA's vegetation management program. Program objectives are defined, in turn, by BPA's underlying need for vegetation management (see Chapter 2). Specifically, target vegetation is the following:

1. Tall-growing or otherwise hazardous trees in situations where they might grow into or fall onto transmission conductors or block microwave beam paths (Figure 3-1),
2. trees, shrubs or poisonous plants blocking or inhibiting access within 30 feet of transmission structures or blocking use of access roads,
3. all vegetation within substations, switchyards, and microwave stations and around the bases of wooden transmission structures (in areas susceptible to ground fires) (Figure 3-2), and
4. noxious weeds as designated by local Weed Control Districts and for which active control campaigns are being pursued in the vicinity of BPA rights-of-way.

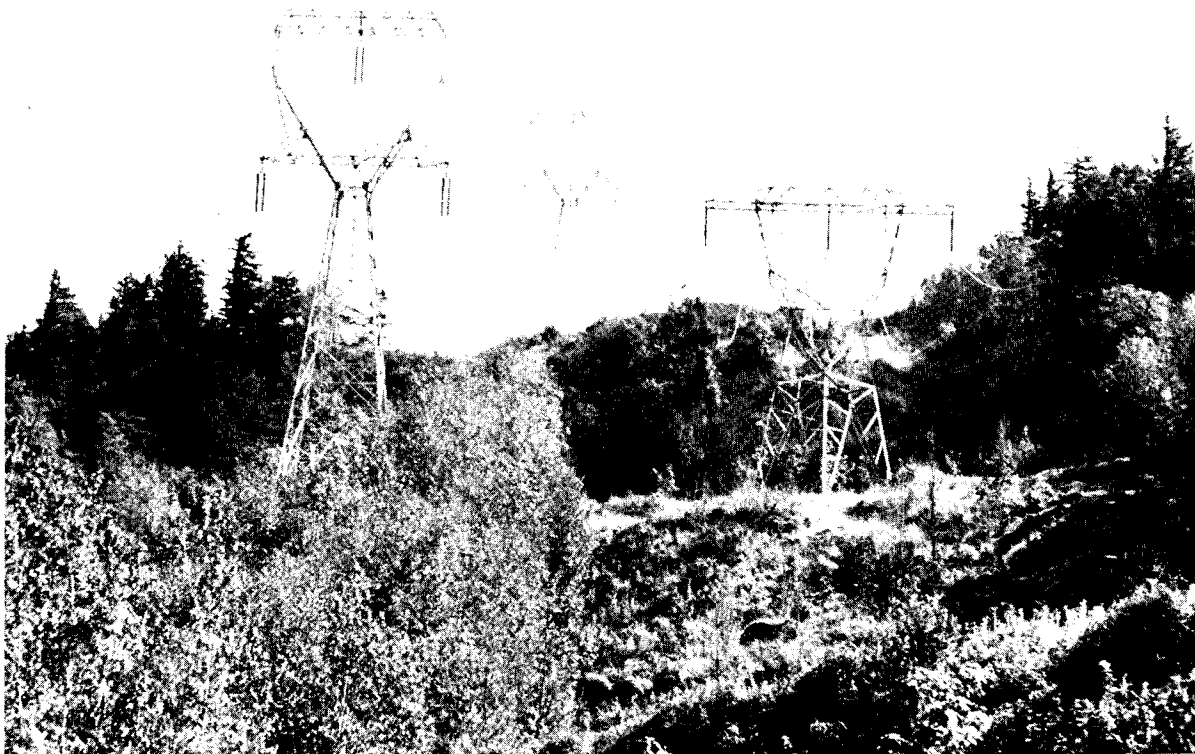


FIGURE 3-1. Tall-Growing Trees May Grow into Transmission Conductors and Thereby Cause Electrical Outages.

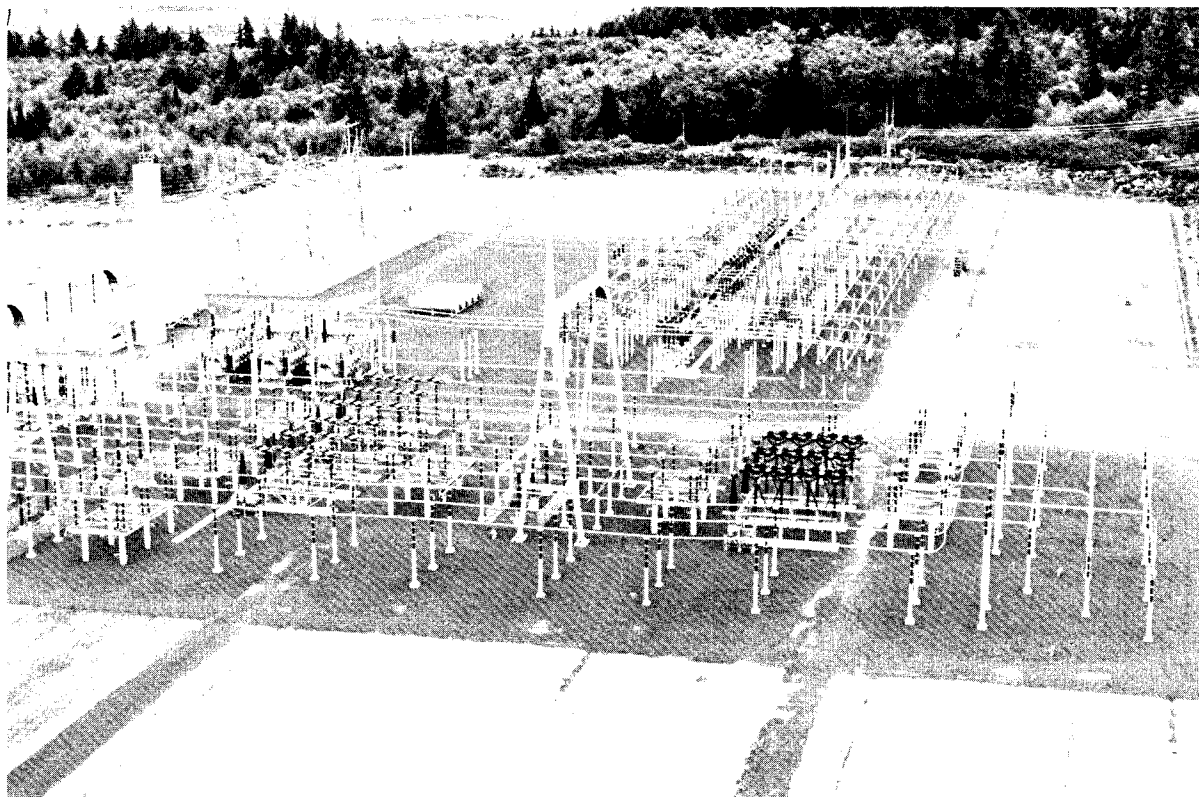


FIGURE 3-2. In Substation Switchyards, Vegetation is Removed to Enhance Safety and Prevent Fire Hazards.

BPA also controls undesirable plants in ornamental plantings, in lawns, and in other appropriate locations (e.g., sidewalks) at support and administrative facilities.

In vegetation management terminology, target vegetation is considered to be either "brush" or "weeds". Brush refers to unwanted woody plants, including shrubs, hardwoods, and conifers. Brush may be tall-growing trees under transmission lines or access-blocking shrubs around transmission structures. Weeds are herbaceous plants growing where they are not wanted. For BPA's purposes, weeds include noxious weeds on rights-of-way and both grasses and broadleaf herbs in substation yards.

BPA's service area can be separated into two climatic/geographic regions, the moist, mild coastal region west of the Cascade Mountains and the drier, cooler region east of the Cascades. Tall-growing vegetation presents a much greater management problem west of the Cascades where precipitation, temperature, and soil fertility, are often optimum for rapid tree growth. In forested areas west of the Cascades, control of tall-growing vegetation normally is required every 3-5 years while in forested areas east of the Cascades, treatments at 10-12 year intervals normally are sufficient. Many areas east of the Cascades do not support tall-growing vegetation; little vegetation management is required (Figure 3-3).

Tall-growing target tree species are listed in Table 6-2 (see Chapter 6 section on Vegetation). West of the Cascades, red alder, big-leaf maple, and conifers such as Douglas-fir are by far the most common target species; they are pioneer species able to establish and grow rapidly in forest openings (e.g., transmission line corridors) on productive sites.

Both big-leaf maple and red alder sprout vigorously from stumps when cut. Recent reports have suggested that sprouting in these species may be reduced by precise timing of when trees are cut (see section on Manual Methods below).

Beneath transmission lines, BPA has endeavored to control tall-growing tree species when they are most easily suppressed with the least disturbance to the environment and with least safety hazard to workers. Typically this means treatment of tall-growing species when they are in the seedling and sapling stages (i.e., up to about 10 feet tall and 3-inch diameter at breast height).

Many types of special situations exist, however, where tall-growing species can be allowed to grow for longer

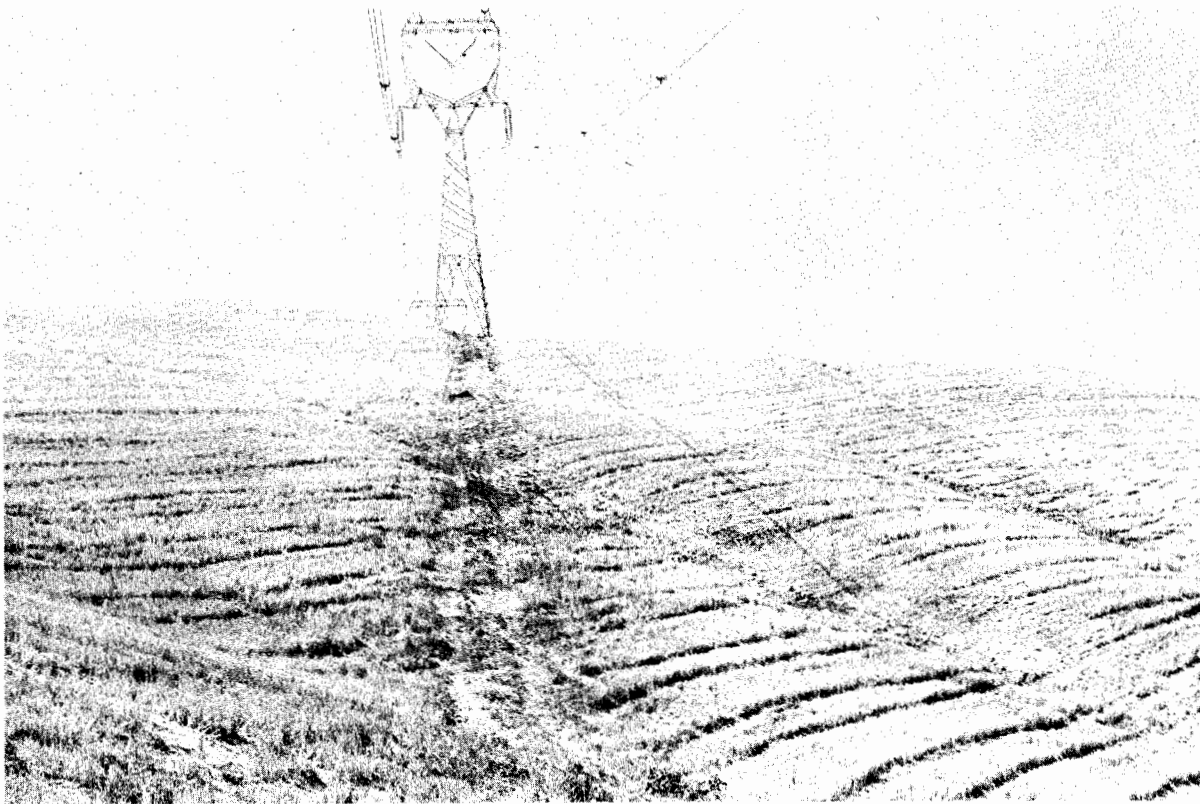


FIGURE 3-3. In Grassland and Shrubland Areas East of the Cascade Mountains, Little Vegetation Management is Required.



FIGURE 3-4. These Stream-side Trees are Retained Beneath the Transmission Lines Because Their Species and Location Insure They Will Not Violate Conductor Clearance Criteria. They Also Provide Riparian Wildlife Habitat.

periods of time. Trees can be left on transmission rights-of-way whenever a safe distance can be maintained between treetops and conductors. This may occur in valleys, ravines, depressions, where towers are very tall, or where trees, because of species or site conditions, will not become tall (Figure 3-4).

Trees have been allowed to grow to maturity in deep canyons where there is no possibility of their approaching transmission conductors (Figures 3-5 and 3-6). Also, trees are maintained for longer periods of time in visually sensitive areas such as at road and stream crossings (Figures 3-7 and 3-8). However, more intensive management (e.g., monitoring of height growth) is necessary to prevent violation of conductor clearance criteria in such situations.

Overall BPA policy is to allow all vegetation to grow on rights-of-way with the least amount of control sufficient to maintain service reliability. In general, this means that to the extent feasible, treatments are selected and designed to control only target plants, without damaging or removing nontarget vegetation. Typically, this results in the creation of low-growing plant cover on rights-of-way as tall-growing plants are removed.

Low-growing vegetation on rights-of-way will be stable if tall-growing species are unable to regenerate and grow up through the low-growing plant cover. Shading and soil moisture depletion (also called "plant competition") may prevent trees from establishing beneath shrubs. If trees do successfully emerge above low-growing cover, they will require control as needed to maintain system reliability.

Where tall-growing vegetation is scattered among low-growing plants, selective vegetation control methods can be used efficiently to control only the tall-growing plants. Where tall-growing trees establish in high density stands, chemical control methods can be designed to selectively control the tall-growing species without damaging other nonsusceptible species.

Descriptions of Alternative Methods

Vegetation control methods can be classified in four broad categories: chemical, manual, mechanical, or biological. Also, various techniques from different categories can be mixed. An indirect method of performing vegetation control is by establishing multiple use agreements whereby land-owners agree to maintain vegetation under BPA transmission lines. The following sections of this chapter describe technical characteristics of control methods available for use in transmission system vegetation management.



FIGURE 3-5. Where Transmission Conductors are Suspended High Over Canyons, Trees Can be Allowed to Grow to Maturity.



FIGURE 3-6. In Areas of High Ridges and Deep Valleys, the Proportion of a Right-of-Way on Which Tall-Growing Trees are Controlled May be Small.



FIGURE 3-7. Trees on a Roadside Have Been Retained to Screen the Transmission Right-of-Way From View.



FIGURE 3-8. Where Roadside Screens are Maintained, Tree Height Growth Must be Monitored to Prevent Violation of Conductor Clearance Criteria.

Chemical Methods

Chemical control methods involve the application of herbicides to target plants or to sites where target plants potentially may grow (e.g., substation yards). Herbicides are chemicals that kill or damage plants (phytotoxicity) by inhibiting or disrupting basic plant processes. Various herbicides affect plants in different ways, including inhibition of photosynthesis, altering hormonal balances, distorting normal plant growth, inhibiting seed germination, or causing other physiological effects. Details on the phototoxic activities of herbicides are provided in Herbicide Background Statements (see Appendix A).

A wide variety of herbicide formulations and application techniques are available for vegetation management purposes. The use of herbicides in vegetation management in general, and in BPA's proposed program in particular, can be divided into two major categories based on the type of coverage desired: spot or broadcast.

Spot Herbicide Applications. Spot herbicide treatments involve the application of herbicides by ground-based manual or mechanical means to individual plants (e.g., to stems or cut stumps of individual trees), to clumps or small groups of plants (e.g., sprouts and saplings with the potential to develop into large trees), or to small areas of ground with particular vegetation problems (e.g., noxious weeds growing in rights-of-way or hazardous weeds growing at substation facilities). These treatments are also commonly referred to as "directed" herbicide applications. Spot treatments are aimed at controlling specific target plants. Nonproblem vegetation growing nearby is not treated. Treatment effectiveness is good depending on rate of application and placement of herbicide on the target plant (e.g., cut stump, injection, or foliage).

Spot treatments permit a high degree of selectivity; only target plants are treated. As a result, however, greater time and labor expenditure is required to treat a given number of acres in comparison to broadcast treatments (see below). Use of spot treatments may be constrained by vegetation conditions (e.g., density and height of brush may limit applicator access to target plants) and, to some extent, by topography (e.g., foot access on steep slopes). Therefore, spot treatments are most appropriate when target plants are relatively few in number, reasonably accessible, or are difficult to control by other means.

Broadcast Herbicide Applications. Broadcast herbicide treatments are applied to large areas (generally greater than 0.1 acre) containing a relatively dense and uniform cover (or potential cover in the case of substation facilities) of problem vegetation. Methods of broadcast application include a variety of ground-based mechanical and aerial equipment. Herbicide formulations applied by broadcast techniques can be selective in controlling just certain types of vegetation (e.g., effective on certain problem brush species growing in rights-of-way without damaging grasses or other nonsusceptible shrub species), or they can be nonselective (e.g., total vegetation control as needed at substation facilities whereby all plant species are damaged or killed). The degree of treatment selectivity depends upon the type of vegetation involved, type of herbicide and formulation used, rate of application and season of application.

Treatment effectiveness depends on proper selection of herbicide formulations for target species present and proper timing of application. Target species, especially larger or resistant individuals, are usually not killed completely by broadcast applications but are suppressed for some period of time (Newton and Norris 1976).

Broadcast treatments are efficient for treatment of medium dense to dense stands of target vegetation. With aerial applications in particular, large areas can be treated using relatively few people. In areas having low density of target species, however, broadcast applications are relatively inefficient. These relationships derive from the fact that the unit of treatment in vegetation management is an individual plant. In high density stands, high labor and material (e.g. herbicide) costs of broadcast applications are spread across many individual plants, resulting in low relative unit costs. If broadcast applications are used on low density stands, costs are spread across few individual plants, resulting in high relative unit costs.

Vegetation conditions (e.g. inaccessible brush stands) and topography (e.g. steep slopes) do not constrain aerial broadcast treatments as they may constrain the use of spot treatments (see previous section). Therefore, aerial treatments are particularly useful on sites with difficult access.

BPA requires positive placement measures to be used during all broadcast herbicide applications. Measures such as thickening agents and Microfoil booms act to produce larger spray droplets, thereby minimizing the possibility of spray drift in broadcast applications. Commercial thickening

agents that have been used by BPA are Lo-Drift and Nalco-trol (identical products) and Norbak. A Background Statement is contained in Appendix A examining public health and environmental impacts of these drift control additives.

Techniques for Herbicide Application. A wide variety of techniques and equipment is available to apply herbicides to target vegetation. BPA has selected certain of these for use in its proposed program, based on its vegetation management experience. Application techniques consist of both ground-based and aerial approaches. Ground-based techniques can be used for either spot or broadcast treatments. Aerial application can be used only for broadcast treatments. Techniques and equipment proposed for use by BPA are listed in Table 3-1; use in either spot or broadcast treatments is indicated.

Ground-based equipment ranges from portable hand-held sprayers and spreaders to high-volume hydraulic hose-type sprayers mounted on four-wheel-drive trucks. Aerial application is accomplished with the use of helicopters equipped with modified R-511 or Microfoil boom-type sprayers. Thickening agents such as Norbak or similar drift-reduction materials are used with conventional boom equipment. Brief descriptions of application techniques proposed for use by BPA follow.

Ground-Based Techniques.

1. **Cut-Stump Treatments:** Herbicide is applied to freshly-cut stumps of hardwood trees and shrubs to prevent resprouting (Figure 3-9). A coarse-droplet, low-pressure spray; a liquid stream; or a crystal/granule formulation is applied to either: (a) the entire surface of the stump from groundline to the top of the cut surface, or (b) the cambial ring around the circumference of the stump. Placement depends upon the type of herbicide product and mixture used. Devices employed consist of a variety of portable sprayers and dispensers (see Table 3-1).
2. **Basal-Stem Frill, Notch or Injection Treatments:** Herbicide is injected into the sapwood at a convenient height around the bases of individual trees using tubular injectors (e.g., Jim-Gem). Alternatively, herbicide is squirted or sprayed into frills, notches or cups chopped around the base of individual trees at a convenient height (e.g., hack-and-squirt technique). Hatchets and

Table 3-1. Techniques for Application of Herbicides Proposed
for Use by BPA in Right-of-Way and
Substation Vegetation Management

Application Techniques and Equipment (See text for descriptions)	Treatments in Which Used	
	Spot Chemical Treatments	Broadcast Chemical Treatments
GROUND-BASED TECHNIQUES		
o Portable Sprayers:		
- Backpack/knapsack sprayers	x	x
- Hand-held tank-type sprayers	x	
- Exact delivery hand-gun sprayers	x	
- Sprinkling Cans	x	x
o Portable Spreaders:		
- Hand-held granule/pellet dispensers	x	
- Hand-operated cyclone spreaders		x
- Pushcart spreaders		x
- Shaker cans	x	
- Hand distribution	x	
o Single-Stem Treatments:		
- Tubular tree injectors	x	
- Hack-and-Squirt	x	
o Cut-Stump Treatments:		
- Hand-held liquid/crystal dispensers	x	
- Squeeze bottles	x	
- Portable sprayers (see above)	x	
o Mechanized Ground Sprayers:		
- High-volume hydraulic hose sprayers (recirculating tank, high-pressure pump, directed nozzle)	x	x
AERIAL TECHNIQUES		
- Helicopter with boom-type spray equipment		x



FIGURE 3-9. In This Spot Chemical Treatment, Herbicide is Being Applied to Cut Stumps of a Shrub to Prevent Resprouting; Herbicide is Being Applied With a Backpack Sprayer.



FIGURE 3-10. A High-Volume Hydraulic Hose Sprayer is Used to Apply Herbicides to the Foliage of Target Vegetation, Either in Spot or Broadcast Treatments.

a variety of portable herbicide dispensers (e.g., squeeze bottles, trigger-type oil cans, spray bottles) are commonly used. These treatments can be accomplished in any season provided the weather is dry.

3. **Basal-Stem Spray:** Herbicide is applied to the lower stems and root collars of individual trees or clumps of shrubs. Herbicide is usually mixed with an oil carrier to enhance penetration through the bark. It is applied using portable or mechanized spray equipment (see Table 3-1) to the point of runoff. These treatments are generally done during the dormant season, but also are effective during the active growing season.
4. **Spot or Broadcast Foliage Spray:** Herbicide is applied to the foliage of individual plants, to clumps of plants, or to larger areas of vegetation during the growing season (Figure 3-10). Herbicide is mixed with water, and thickening agents are added where necessary to control drift. Both portable and mechanized spray equipment are used (see Table 3-1).
5. **Soil and Vegetation Surface Treatments:** Herbicides are applied directly to bare soil or to the surface of existing "weeds" (i.e. herbaceous plants such as grasses and broadleaf forbs). These treatments prevent emergence of new weeds and/or control existing weeds, thereby maintaining weed-free conditions. As such, these treatments are primarily used: (a) at substations, towers and other facilities where safety, accessibility and appearance are high-priority concerns, and (b) around the bases of wooden power poles where protection from wildfires is needed. These treatments are also used to control noxious weeds along transmission line rights-of-way in agricultural areas. Application methods consist of a variety of portable and mechanized equipment (see Table 3-1).
6. **Spot Treatments with Herbicide Pellets or Granules:** Solid forms of herbicides are applied to the soil surface beneath the driplines of individual plants and as close to tree trunks or stem bases as possible. This technique is used primarily where other treatments are restricted or ineffective, or as a follow-up treatment to control individual trees or shrubs that were missed in previous treatments. Application is made just prior to the end of the wet season so that sufficient moisture is available to dissolve and carry the herbicide into plant root zones.

Aerial Techniques. Aerial applications of herbicides are confined to rights-of-way where dense, tall-growing vegetation poses a threat to transmission lines and where alternative methods are unsuitable (Figure 3-11). Applications are conducted during the growing season using water carriers; no oil carriers are used in aerial applications.

Aerial application of herbicides is done exclusively by contractors using specially-licensed helicopters. Spray equipment mounted on helicopters must be capable of meeting BPA's "aerial spray delivery specifications". The spray delivery system proposed for use by a contractor must successfully pass rigorous pattern and drift control tests: for example, in calm air and at a spraying altitude of at least 100 feet, the system must deposit at least 100 drops of spray mixture on a 3.875-inch by 12-inch card in the spray zone, while no drops can be deposited on a card 10 feet beyond the edge of the spray zone. Virtually all spray drops must strike the ground within a 15-second interval. Finally, the system must be able to go from "off" (no drops) to "on" (100 drops per card), and from "on" to completely dripless "off", within a 50-foot distance in the direction of travel. Both the modified R-511 boom with Norbak drift-control additive and the 0.028-inch Microfoil boom are capable of meeting the above delivery requirements.

BPA personnel monitor weather conditions (i.e., wind, temperature, precipitation, humidity) at all aerial spray projects to minimize possibilities of off-target drift, volatilization, runoff, or leaching of applied herbicides (see section of Chapter 4 on Mitigation Measures and BPA Transmission Line Maintenance Standard).

On-site monitoring of spray delivery performance is performed by BPA inspectors; one person is stationed at each end of a specific unit to be sprayed while the third person is moving to the far end of the next site to be sprayed. The BPA inspectors are responsible for ensuring that herbicides are sprayed only within the designated spray zones. For example, the inspectors monitor wind speed, humidity, temperature, and likelihood of precipitation to determine if conditions are suitable for aerial spraying. If wind speeds are greater than 5-6 mph, no spraying is allowed.

To monitor the precise distribution of spray drops on a right-of-way, the BPA inspectors lay out lengths of paper (adding machine) tape perpendicular to and across the edge of the next swath to be sprayed. After a pass by the helicopter, spray drops appear immediately on the paper tape. If drops are deposited outside of the designated



FIGURE 3-11. A Helicopter is Used in Aerial Broadcast Applications of Herbicides.



FIGURE 3-12. Power Chainsaws are the Most Common Tools Used for Manual Cutting of Tall-Growing Trees.

spray swath, the inspectors halt the spray operations until weather conditions are appropriate and the contractor's performance can be improved. These paper tape tests are used on inner swaths of multiple-swath rights-of-way before outer swaths are sprayed. If inner swath performance is unsatisfactory, outer swaths are not sprayed.

Herbicide Products Approved for Use by BPA. Numerous herbicide products and formulations are used in vegetation management in agriculture, forestry, right-of-way management, lawns and gardens, and other uses. Following testing for effectiveness and suitability, BPA approves herbicides for use in its vegetation management program. BPA's procedures for testing and approval of new herbicides and new herbicide uses are described in Chapter 5.

Herbicide products approved by BPA and proposed for use are listed in Table 3-2. Herbicides are listed in alphabetical order by the common name of active ingredients. Both general specifications for use as provided on commercial product labels and the particular manner in which herbicide is to be used by BPA are indicated. All products are registered by the U.S. Environmental Protection Agency (EPA) for the target vegetation, application sites, and uses shown in Table 3-2.

The herbicides listed in Table 3-2 do not include all the types, brands or formulations of herbicides currently registered by EPA for noncrop, right-of-way uses. The ones mentioned in Table 3-2 and subsequent tables have either been adopted for use by BPA, or are given as examples for particular types of herbicides (e.g., 2-4-D amine and 2,4-D ester).

Additional information on BPA-approved herbicides is provided in Appendix B: Table B-1 lists manufacturers, EPA registration numbers, formulation types, and ingredient percentages for each herbicide. Table B-2 presents specifications for application of BPA-approved herbicides, including type of mixture, placement of herbicide on target plants, rates of application proposed for use by BPA, and time (season) of application. Rates of application are approved by EPA and published on herbicide labels or otherwise provided by EPA; these rates are the basis for calculating the potential exposures of the environment to herbicide chemicals as used by BPA (see Herbicide Background Statements in Appendix A).

Table 3-2. Herbicides Approved and Proposed for Use by BPA, With General Specifications
for Use and Manner in Which to be Used by BPA¹

Common Name	Trade Name ²	Target Vegetation Listed on Product Label	Pertinent Application Sites Recommended on Product Label	Specific BPA Use ³	BPA Application Procedures, Equipment and Techniques	Types of Coverage Achieved in BPA Applications
Ammonium sulfamate	Ammate® X-NI	Herbaceous plants (annuals and perennials) and woody plants (shrubs, hardwoods and conifers).	Non-crop areas such as rights-of-way and industrial plant sites.	Control of brush beneath transmission lines. Primarily used in situations near streams, ponds and other bodies of water.	Ground: Portable sprayers; high-volume hydraulic hose sprayers; single-stem treatment devices; cut-stump treatment devices.	Spot
Atrazine	Aatrex® 80W Aatrex® Nine-0®	Annual and peren- nial grasses and broadleaf forbs.	Non-crop areas, industrial sites and conifer plantings.	Control of weeds at substations (e.g., along fence rows).	Ground: Portable sprayers.	Broadcast or Spot
Bromacil	Hyvar® X-L	Herbaceous plants (annuals and per- ennials) and woody plants (shrubs and hardwoods).	Non-crop areas such as rights-of-way and industrial plant sites.	Control of weeds and brush around poles and at substations.	Ground: Portable sprayers; high-volume hydraulic hose sprayers.	Broadcast or Spot
Bromacil + Diuron	Krovar® I	Annual and per- ennial grasses and broadleaf forbs.	Non-crop areas such as roadsides and plant sites.	Control of weeds at substations.	Ground: Portable sprayers.	Broadcast or Spot
Dicamba	Banvel® 4-0.S. ⁴	Broadleaf herba- ceous plants (annuals and per- ennials) and woody plants (shrubs, hardwoods and conifers).	Non-crop areas and rights-of-way.	Control of brush beneath transmission lines and towers.	Ground: Portable sprayers; high-volume hydraulic hose sprayers.	Broadcast or Spot
	Banvel® 4-W.S.	As above.	As above.	As above.	Ground: High-volume hydraulic hose sprayers; single-stem treatment devices. Aerial: Helicopters with boom-type sprayers.	Broadcast or Spot

Table 3-2. (Cont'd.)

Common Name	Trade Name ²	Target Vegetation Listed on Product Label	Pertinent Application Sites Recommended on Product Label	Specific BPA Use ³	BPA Application Procedures, Equipment and Techniques	Types of Coverage Achieved in BPA Applications
Dicamba	Banvel® XP ⁴ Banvel® 5G	As above.	As above.	As above.	Ground: Portable spreaders.	Spot
Dicamba + 2,4-D	Banvel® 520	As above.	As above.	Control of weeds and brush beneath transmission lines.	Ground: High-volume hydraulic hose sprayers.	Spot
	Banvel® 720	As above.	As above.	As above.	Ground: High-volume hydraulic hose sprayers. Aerial: Helicopters with boom-type sprayers.	Broadcast or Spot
Dichlobenil	Casoron® G-4	Annual and perennial grasses and broadleaf forbs.	Woody ornamentals.	Control of weeds in ornamental plantings (e.g., shrubbery) at substations.	Ground: Portable spreaders.	Broadcast or Spot
Glyphosate	Roundup®	Herbaceous plants (annuals and perennials) and woody plants (deciduous shrubs and hardwoods).	Non-crop areas such as industrial plant sites and rights-of-way, and ornamental plantings.	Control of weeds and brush (e.g., poison oak) beneath transmission lines and towers, around poles and at substations.	Ground: Portable sprayers.	Spot
Monuron	Telvar® ⁴ Monuron 80 WP	Annual and perennial grasses and broadleaf forbs.	Non-crop areas such as utility rights-of-way and industrial plant sites.	Control of weeds at substations.	Ground: Portable sprayers.	Spot

Table 3-2. (Cont'd.)

Common Name	Trade Name ²	Target Vegetation Listed on Product Label	Pertinent Application Sites Recommended on Product Label	Specific BPA Use ³	BPA Application Procedures, Equipment and Techniques	Types of Coverage Achieved in BPA Applications
Picloram	Tordon® 10K Amdon® 10K	Woody plants (shrubs, hardwoods and conifers).	Utility rights-of-way and industrial sites.	Control of brush be- neath transmission lines and towers, around poles and at substations.	Ground: Portable spreaders.	Broadcast or Spot
Picloram + 2,4-D	Tordon® 101 Amdon® 101	Annual and per- ennial broadleaf forbs and woody plants (shrubs, hardwoods and conifers).	Non-crop areas in- cluding industrial sites and rights-of- way.	Control of weeds and brush beneath trans- mission lines and towers, around poles and at substations.	Ground: Single-stem treatment devices; cut- stump treatment devices; high-volume hydraulic hose sprayers. Aerial: Helicopters with boom-type sprayers.	Broadcast or Spot
Prometon	Pramitol® 25E	Annual and per- ennial grasses and broadleaf forbs.	Non-crop areas and industrial sites such as rights-of-way and roadways.	Control of weeds at substations.	Ground: High-volume hydraulic hose sprayers; portable sprayers.	Broadcast
Prometon + Simazine + Sodium chlorate + Sodium metaborate	Pramitol® 5PS	As above.	As above.	As above.	Ground: Portable spreaders.	Broadcast or Spot

Table 3-2. (Cont'd.)

Common Name	Trade Name ²	Target Vegetation Listed on Product Label	Pertinent Application Sites Recommended on Product Label	Specific BPA Use ³	BPA Application Procedures, Equipment and Techniques	Types of Coverage Achieved in BPA Applications
Sodium chlorate + Sodium metaborate + Bromacil	Oxy Ureabor®	Annual and perennial grasses and broadleaf forbs.	Non-crop areas such as industrial sites and roadsides.	Control of weeds at substations.	Ground: Portable spreaders; portable sprayers.	Broadcast or Spot
Tebuthiuron	Spike® 1G Spike® 5G	Annual and perennial grasses and broadleaf forbs.	Non-crop areas such as utility substations, transmission towers and around poles.	Control of weeds at substations and around poles.	Ground: Portable spreaders.	Broadcast or Spot
	Spike® 80W	As above.	As above.	As above.	Ground: Portable sprayers.	As above
2,4-D amine	Formula 40®	Annual and perennial herbaceous forbs and woody plants (hardwoods and conifers).	Non-crop areas.	Control of weeds (e.g., noxious weeds) and brush beneath transmission lines and towers.	Ground: Portable sprayers; high-volume hydraulic hose sprayers; single-stem treatment devices. Aerial: Helicopters with boom-type sprayers.	Broadcast or Spot
2,4-D ester	Esteron® 99® Concentrate	Annual and perennial herbaceous shrubs and woody plants (shrubs, hardwoods and conifers).	Non-crop areas such as rights-of-way and roadsides.	Control of weeds (e.g., noxious weeds) and brush beneath transmission lines and towers.	Ground: Portable sprayers; high-volume hydraulic hose sprayers. Aerial: Helicopters with boom-type sprayers.	Broadcast or Spot

Table 3-2. (Cont'd.)

Common Name	Trade Name ²	Target Vegetation Listed on Product Label	Pertinent Application Sites Recommended on Product Label	Specific BPA Use ³	BPA Application Procedures, Equipment and Techniques	Types of Coverage Achieved in BPA Applications
2,4-DP + 2,4-D	Weedone® 170	Woody plants (shrubs, hard- woods and conifers).	Non-crop areas such as utility rights-of- way.	Control of brush be- neath transmission lines and towers.	Ground: High-volume hydraulic hose sprayers; portable sprayers; single-stem treatment devices.	Broadcast or Spot

¹Information presented in this table is based on label specifications and BPA use patterns as of May 1, 1983. Since product labels change periodically, the most current label should be consulted for appropriate use patterns. Furthermore, the use patterns described in this table should not preclude other use patterns if not prohibited by the label, and if they are appropriate for BPA vegetation management situations.

²Products listed in this table are intended to serve as examples of materials currently used by BPA as of May 1, 1983. This list does not endorse the use of such products to the exclusion of other brands or formulations if registered and appropriate to the BPA vegetation management program.

³The term "weeds" throughout this table refers to unwanted herbaceous plants. The term "brush" refers to unwanted woody plants, including shrubs, hardwoods and conifers.

⁴No longer manufactured as a commercial product.

Summary of Herbicide Use Patterns Proposed by BPA. The herbicides proposed for use by BPA, target vegetation, application procedures, and types of coverage (i.e., spot vs. broadcast) are listed in Table 3-3. Inspection of Table 3-3 indicates which herbicides are used for particular types of target vegetation and with which particular application technique. For example, six herbicide products are used for brush control on transmission line rights-of-way and are applied by broadcast techniques to vegetation foliage (i.e., dicamba; dicamba + 2,4-D; picloram + 2,4-D; 2,4-D amine; 2,4-D ester; and 2,4-DP + 2,4-D).

Manual Methods

Manual methods use hand labor to remove or control target plants. High selectivity results from treatment of individual target plants. As with spot chemical treatments, time and labor requirements are high. Also, manual methods are constrained by vegetation conditions (e.g., density) and topography.

Cutting. The most common manual method is cutting target plants with power saws (Figure 3-12). Other manually-operated tools such as axes, machetes, and clippers are also used. This technique is highly effective on species that do not resprout. Conifers must be cut below the lowest live limb to prevent regrowth from upturned branches, but they do not resprout. Most hardwood trees and shrubs, however, do resprout and must be treated with herbicides (i.e., cut stump treatment) to prevent regrowth.

Big-leaf maple and red alder tend to sprout vigorously from stumps when cut. Big-leaf maple is known to consistently sprout from cut stumps, regardless of size or time of cutting (Roberts 1980). Information from the Washington Department of Natural Resources, however, suggests that big-leaf maple resprouting may be reduced by cutting in May and June when flowering and leaf development occur (Anderson pers. comm.). This suggestion has not been documented with rigorous field experiments. Further studies are needed to determine if such a relationship between flowering period and resprouting exists and if it can be used in vegetation management.

Small diameter red alder trees (less than 4-6 inches diameter at breast height) also sprout consistently when cut. Stems greater than six inches diameter and stems cut during the summer drought period (July-August) may be less prone to sprouting. These relationships are unpredictable;

Table 3-3. Summary of Herbicide Use Patterns Proposed by BPA for its Vegetation Management Program ¹

Common Name		Trade Name ²		Target Vegetation at:					Application Procedures						Types of Coverage		Application Mixture				Herbicide Placement			
				Transmission Lines and Towers ³			Substations ⁴		Ground				Aerial				Formulated Product				Cut Surfaces			
				Weed Control	Brush Control	Power Pole Protection	Weed Control	Brush Control	Portable Sprayers	Portable Spreaders	Single-stem Treatments	Cut-Stump Treatments	Mechanized Ground Sprayers	Helicopter	Broadcast	Directed	Aqueous	Oil	Oil-Water	Soil Surface	Foliage	Stems	(Stems or Stumps)	
Ammonium sulfamate	Ammate®	X-NI		+								+			+		+			+			+	
Atrazine	Aatrex®	80W Aatrex® Nine-O®							+						+	+		+			+			
Bromacil	Hyvar®	X-L				+			+			+			+	+		+			+			
Bromacil + Diuron	Krovar®	I							+						+	+		+			+			
Dicamba	Banvel®	4-O.S. Banvel® 4-W.S. Banvel® XP Banvel® 5G										+			+	+			+			+		
Dicamba + 2,4-D	Banvel®	520 720	+		+							+			+			+			+			
Dichlobenil	Casoron®	G-4							+						+	+		+			+			
Glyphosate	Roundup®				+		+		+						+			+			+			
Monuron	Telvar®								+						+			+			+			
Picloram	Tordon®	10K Amdon® 10K			+		+					+			+	+		+			+			
Picloram + 2,4-D	Tordon®	101 Amdon® 101			+		+					+			+	+		+			+			
Prometon	Pramitol®	25E							+			+			+			+			+			
Prometon + Simazine + Sodium chlorate + Sodium metaborate	Pramitol®	5PS							+						+	+		+			+			
Sodium chlorate + Sodium metaborate + Bromacil	Oxy Ureabor®								+			+			+	+		+			+			
Tebuthiuron	Spike®	1G Spike® 5G Spike® 80W							+						+	+		+			+			
2,4-D amine	Formula	40®	+		+				+			+			+	+		+			+			
2,4-D ester	Esteron®	99® Concentrate	+		+				+			+			+	+		+			+			
2,4-DP + 2,4-D	Weedone®	170			+				+			+			+	+		+			+			

¹This summary covers BPA herbicide use patterns as of May 1, 1983. Since both product registrations and BPA-approved materials change periodically, the most current labels and appropriate BPA authorities should be consulted.

²Products listed in this column are intended to serve as examples of materials currently used by BPA as of May 1, 1983. This list does not endorse the use of such products to the exclusion of other brands or formulations if registered and appropriate to the BPA vegetation management program.

³"Brush control" at transmission lines and towers generally involves suppression of tall-growing vegetation. "Weed control" activities involve control of noxious weeds. Protection of power poles involves eliminating all vegetation in a small area around each pole to protect it from damage during wildfires.

⁴"Weed control" and "brush control" at substations are generally designed to eliminate all vegetation in order to facilitate safe working conditions at these facilities. Herbicides are also used occasionally to protect the shrubbery planted at these facilities for aesthetic appeal.

additional research is needed. For example, vegetation management on transmission line rights-of-way will normally preclude red alder from reaching six inches diameter since trees of this size may surpass 60 feet in height.

Researchers at Washington Department of Natural Resources have reported that red alder sprouting may be reduced by cutting during certain phases of the moon. This report, however, has not been substantiated by reliable scientific studies. Studies are under way by the USDA Forest Service, Oregon State University, and other organizations to further clarify the sprouting characteristics of red alder.

Without herbicide treatment after cutting, sprouts may rapidly resurge to original height within several years and at much greater density than the original stems (Newton and Dost 1981). Access for subsequent manual treatments is thereby hindered. General BPA practice is to use cut stump herbicide applications on the stumps of resprouting species following cutting.

Manual cutting operations by BPA are sometimes followed by slash disposal techniques designed to reduce fire hazard or to improve aesthetic appeal. The slash is lopped and scattered uniformly across the treated area (thereby hastening natural decomposition). Small trees are limbed on one side so they lie flat on the ground. Alternatively, branches and small trees are fed into a mechanical chipper; chips are spread over the right-of-way or deposited in piles. Stems too large for chipping are lopped and scattered within the right-of-way as the situation requires.

Girdling. Girdling involves manually cutting away bark and cambial tissues around the trunk of target trees. Conifer species are killed by this treatment, but hardwoods frequently will resprout below the girdle unless the cut is treated with herbicide. Girdling results in standing dead trees (i.e., snags) which are left to decompose and fall on their own. It is rarely practiced by BPA but may be appropriate where large trees cannot be safely felled by cutting.

Topping and Pruning. Topping involves cutting a tree at some height up the trunk to prevent it from growing into transmission lines or microwave beam paths without felling the whole tree. Pruning is the removal of selected branches from tree trunks for the same purposes. These highly labor-intensive techniques are used by BPA in special situations where it is desirable to leave trees in place as visual screens (e.g., along roads or stream).

Hand Pulling and Hoeing. Substation weed control, right-of-way noxious weed control, and wooden pole protection theoretically can be accomplished by hand pulling and hoeing. Weeds that resprout from rootstocks or root fragments in the soil are not controlled by these methods. Such manual treatments are extremely labor intensive, are not practical for large areas such as substation switchyards, and are not used by BPA.

Mechanical Methods

Mechanical methods employ machines to remove or control target vegetation. These are nonselective methods in that all plants on a site are affected. Use of machines may be restricted, however, to patches of target plants. Mechanical methods may be highly effective at controlling brush on gentle topography with few site obstacles. Most mechanical equipment is not safe to operate, however, on slopes over 30-35 percent. These methods are also constrained where soils are highly susceptible to compaction or erosion. Site obstacles such as rocks, stumps, or logs also reduce their efficiency. Because of these limitations, BPA does not propose to use mechanical methods in its vegetation management program.

Scarification. Crawler tractors equipped with brush blades or rakes may be used to physically uproot woody plants. By a combination of cutting and lifting action, roots are ripped out and buried or pushed to brush piles, where they may be later burned. Disruption of the soil surface is severe; erosion may be a subsequent problem.

Chopping, Cutting or Mowing. Mechanized, heavy equipment with high-speed rotary blades may be used to cut, chop, flail, or shred woody vegetation on rights-of-way. Vegetation is typically cut off near ground level, leaving low ground cover of grasses and other herbaceous plants. Examples of this type of equipment are known as bush-hog, Track-Mack, and Hydro-Ax. The equipment available at the present time, however, is not capable of performing safely, neatly, or efficiently on the steep topography characteristic of most BPA rights-of-way where woody vegetation is a problem.

Biological Methods

Biological treatments employ various types of biological organisms to control or compete with target vegetation. BPA

is currently conducting multi-year experimental studies of several methods.

Control of Weeds by Introduced Insects. Weed control through the use of natural biological agents, such as microorganisms, insects, or other animals is theoretically attractive. Advantages of this approach include potential effectiveness, selectivity for only particular target species, and ability to be self-sustaining, energy efficient, and inexpensive over the long term (Huffaker 1971, Batra 1982). However, development of suitable and successful control agents can involve considerable time and expense. Control agents must be host-specific (i.e., attack only the target species) to prevent cross-over damage to desirable crops or vegetation. This requirement limits the likelihood of controlling the wide variety of weed species encountered in natural environments. Unforeseen side effects of introduced agents are possible. To date, most successful uses of this method have involved control of exotic weeds.

Biological control of weeds using insects has had some outstanding successes (see Huffaker 1981, Andres 1980, Batra 1982). St. Johnswort or Klamath weed (Hypericum perforatum) has been controlled in California by Chrysolina quadrigemina beetles. In India and Australia, prickly pear cactus (Opuntia spp.) has been controlled by scale insects (Dactylopius opuntiae), moths (Cactoblastis cactorum) and coreid bugs (Chelinidea spp.). The range weed, Lantana camara, has been controlled in Hawaii by several foliage feeding insects. Most successful examples involve control of exotic weeds established outside their natural ranges and therefore not held in check by a complex of natural enemies.

BPA participates with state agencies and local Weed Control Districts in a program using the cinnabar moth (Tyria jacobaea) and a flea beetle (Longitarsus jacobaea) to control tansy ragwort (Senecio jacobaea), an introduced noxious weed poisonous to livestock. Colonies of these herbivorous insects are introduced on infested rights-of-way in attempts to establish them as self-sustaining predators on the ragwort. This program has had variable success depending on the ability of introduced colonies to survive in local conditions (Shon pers. comm.). In general, results using this technique to control ragwort in Oregon, Washington and California have been mixed (Hawkes 1968).

In western Montana, biological weed control research using introduced insects began in 1948 to control St. Johnswort (Hypericum perforatum). Similar research to control spotted

knapweed (Centaurea maculosa) and musk thistle (Carduus mutans) began in 1973 and 1974, respectively. Insect populations have become established on each of these weeds, with successful control observed on St. Johnswort and musk thistle (Nicholson pers. comm.).

Introduced insects also provide viable biological control for rush skeletonweed (Chondrilla juncea), diffuse knapweed (Centaurea diffusa), musk thistle (Carduus mutans) and Dalmatian toadflax (Linaria dalmatica) in eastern Washington (Gorman pers. comm.).

BPA has not participated in biological control efforts other than for tansy ragwort. However, if a weed is the object of an active weed control campaign and BPA's actions have contributed to the weed problem, BPA will cooperate with the biological control efforts of local Weed Control Districts.

Establishment of Stable, Low-Growing Plant Species. The long-term goal of right-of-way brush control is the establishment and maintenance of low-growing vegetation that does not interfere with transmission lines or hamper access. Traditional methods (i.e., chemical, manual, and mechanical) for achieving this goal are corrective in that they act to remove tall-growing plants that have already established on a site. A biological method of brush control is to plant and encourage low-growing species that will occupy growing space and compete with target species. This method is preventative in that favored low-growing species act to prevent the establishment of tall-growing plants.

Various shrub, fern and grass species will successfully out-compete tree seedlings over long periods of time. Salmonberry, ceanothus, blackberry, bracken fern, and pine grass are examples of the many common problem species for timber regeneration in the Pacific Northwest. Mechanisms of successful competition are usually shading and depletion of soil moisture and nutrients (Taber 1977).

Some plant species may inhibit the growth of other species through the effects of metabolic by-products. This type of detrimental biochemical interaction between plant species is known as allelopathy. In the eastern United States, golden-rod (Solidago spp.), bracken fern, and several grass species are known to inhibit tree establishment by means of allelopathy. Tillman (1982) has recommended research to identify allelopathic species and to develop means for regenerating such species as a method of preventing tree establishment on rights-of-way.

Several studies have investigated the allelopathic potential of plant species in the Pacific Northwest. Stewart (1975) demonstrated allelopathic effects of western bracken (Pteridium aquilinum) on several shrub species. Del Moral and Cates (1971) showed that vine maple (Acer circinatum) inhibits certain plant species through allelopathy. No studies, however, have investigated specifically allelopathy as a means of right-of-way vegetation management. Further research is needed.

In the northeastern United States, stable shrub communities on transmission rights-of-way have resisted tree invasion for at least 15 years (Niering and Goodwin 1974). Richards (1973) has described stable meadow vegetation in New York state; perennial meadow grasses form dense sod and heavy mats of dead tops (after the growing season) to prevent tree seeding establishment.

University of Washington researchers have studied the success of tree regeneration on forest sites to which wastewater treatment sludge had been applied in 1974 (Taber et al. 1982). Perennial and annual rye grasses were seeded initially to dry out the sludge. Over the past eight years, Douglas-fir seedlings were planted on the sites several times but have suffered 100 percent mortality. Douglas-fir mortality was attributed at least partially to successful competition by grasses for moisture, light, and nutrients and to chemical inhibition (i.e. allelopathic interference) by the rye grasses. Research on the potential of sludge applications and rye grass seedings for right-of-way management has been suggested by Taber et al. (1982).

The Vegetation Management Department at British Columbia Hydro and Power Authority (BC Hydro) has recently initiated measures to enhance the ability of low-growing plant species to prevent the establishment of tall-growing problem species on rights-of-way (Miller pers. comm.). Wherever feasible, tall-growing plants are selectively removed and low-growing species are maintained on right-of-way sites (similarly to BPA's policy). On some sites on Vancouver Island, shrubs such as salmonberry (Rubus spectabilis), salal (Gaultheria shallon), and huckleberry (Vaccinium spp.) form stable plant cover that is not invaded by tree species over the long term.

BC Hydro has established experimental plots in coastal areas where red alder (Alnus rubra) is predicted to become a problem species. On these plots, the understory shrub vegetation will be protected during construction and salal will be planted in order to prevent establishment and growth of alders. In general, it is desirable to develop

prescriptions for clearing of right-of-way before construction; low-growing species that cast heavy shade would be retained to discourage tree establishment on the rights-of-way.

BC Hydro is considering fertilization to enhance the vigor of low-growing species; however, it has determined that planting of low-growing species is too expensive at this time (Miller pers. comm.)

Prescribed Grazing. Domestic livestock can be effective at controlling vegetation in certain situations. Goats have proved to be an effective tool for control of brush regrowth on chaparral fuelbreaks in southern California (Green and Newell 1982). They consume a wide variety of plant species and are relatively nonselective on first-year brush regrowth. Goats, however, cannot be expected to control tall, mature brush due to its low palatability and inaccessibility. Effective fuelbreak clearing requires sufficient goat stocking to eat all leaves from all brush species two or three times per year. Problems associated with goat management are road access during wet weather, fencing, herding, water and supplemental feeding, protection from predators, disease, and poison plants (Green and Newell 1982). The applicability of goats to control right-of-way brush in the Pacific Northwest has not been studied.

National forests in Oregon and California have conducted trials of brush control with herded sheep (see Newton and Dost 1981). This technique depends on the ability of a herdsman to control bands of sheep on areas to be treated. Fencing is a viable but expensive alternative to herding. Sheep can consume large amounts of newly sprouted woody and herbaceous vegetation at certain times of the year when plants are palatable (Newton and Dost 1981).

Palatability of target vegetation on rights-of-way also varies among plant species. BPA recently funded a simulation study by Washington State University to test the feasibility of sheep grazing for brush control (BPA Contract No. 14-03-7311n). Vegetation inventories on rights-of-way were compared to vegetation utilization by domestic sheep on similar areas; simulation models were developed based on these data. Results of the study were variable depending on vegetation type and target species palatability (Zamora and Nelson n.d.).

In general, the simulation study predicted that grazing by sheep at moderate stocking levels would not cause rapid or

significant changes in the rate of target tree establishment. Primary target species, red alder and Douglas-fir, are very low in palatability to sheep. The study did predict moderate reduction in tree regeneration in the grand fir forest type. At high stocking densities, sheep grazing would likely promote soil erosion yet would not substantially control conifer regeneration in the western hemlock or western red cedar forest types.

BPA plans no additional studies of prescribed grazing for right-of-way brush control at this time.

Wildlife Management. Various wildlife species feed on and destroy tree seedlings. Dense meadow grasses provide optimum habitat for meadow voles; high populations of voles can prevent tree establishment by consuming seeds and by girdling seedlings and saplings (i.e., eating the bark around the stem). Black-tailed deer commonly browse on shoot tips and buds of palatable tree species (e.g. Douglas-fir). In a study of sludge fertilization of forest soils near Seattle, voles and deer have helped cause 100 percent mortality of planted Douglas-fir seedlings over an eight-year period (Taber et al. 1982).

BPA, the City of Seattle Department of Water, and scientists at the University of Washington have developed cooperatively a study to test the feasibility of using herbivorous wildlife species (especially voles and black-tailed deer) to control target species on rights-of-way (BPA Solicitation No. DE-RP79-81BP29315). High populations of these species will be promoted by various techniques to enhance their habitats. The research project will build on 10 years of study by the University of Washington on Seattle watershed lands. Study goals are to create environments where target trees do not regenerate, to establish low maintenance plant communities, and to promote high wildlife values (Taber et al. 1982). The study will run through late 1983.

The study design includes mechanical scarification to remove woody species and prepare sites for planting, fertilization, seeding of grasses and clovers in the center areas of rights-of-way, and promotion of fruit-producing shrubs along right-of-way margins. Exclosure plots will be constructed to compare the impacts of different types of wildlife on tree regeneration. Wildlife use and tree seedling survival will be monitored. The overall study objective is to determine optimal combinations of plant species, soil preparation, and fertilization that will enhance wildlife use and thereby tree regeneration failure.

Preliminary results of the wildlife management study indicate that it is a useful method for maintenance of right-of-way vegetation on some types of sites. A dense grass cover has been established on the study areas through mulching and fertilization; ungulate use of these areas is three to four times the use of control areas (West pers. comm.). On moist sites, a dense grass sod has been produced that is resistant to tree invasion and therefore stable over the long term. On drier sites, periodic mulching may be necessary to maintain the dense sod. Because mechanical equipment is necessary to apply mulch, this method would be limited to gentle terrain.

Multiple Use Arrangements with Landowners

Most BPA rights-of-way are acquired through easements for construction, operation and maintenance of transmission lines only. Title to the right-of-way for all other uses is retained by the landowner. Of the 84,000 acres of BPA right-of-way requiring brush control, only 2 percent (about 1,700 acres) is owned in fee by BPA. Approximately 27 percent (22,700 acres) is administered by various state and federal land management agencies. More than 70 percent (58,800 acres) of BPA right-of-way is owned by private individuals or corporations. Ultimately, decisions regarding multiple use reside with the landowner or land manager.

It is BPA policy to promote the development of compatible and mutually beneficial uses of BPA rights-of-way by landowners. Many uses of rights-of-way eliminate potentially tall-growing vegetation. Intensive agriculture (e.g., row and field crops, orchards, pasturelands) and recreation facilities (e.g., playfields, managed parklands) are multiple uses having long-term compatibility with transmission lines (Figures 3-14, 3-15, and 3-16). The total area of BPA right-of-way is about 200,000 ac. Approximately 116,000 ac (58 percent) of the total is occupied by compatible uses and therefore does not require vegetation management by BPA.

On the 58,800 right-of-way acres held by private owners and requiring brush control, BPA pursues its policy of promoting compatible uses. One means of promoting multiple use is through establishing multiple use agreements with landowners. Under such agreements, landowners agree to maintain right-of-way vegetation in a manner that does not interfere with transmission lines or block access to transmission structures. In turn, BPA agrees to relinquish all vegetation control rights on the respective ownership while the agreement is in force. BPA provides no reimbursements to landowners for maintenance work. "Christmas Tree Agreements" pertain to Christmas tree plantations (Figure 3-13)



FIGURE 3-13. Christmas Tree Plantations are Established on Transmission Line Rights-of-Way Under "Christmas Tree Agreements" Between BPA and Landowners.



FIGURE 3-14. Intensive Agriculture Such as Irrigated Row Crops is a Land Use Compatible with Transmission Lines.

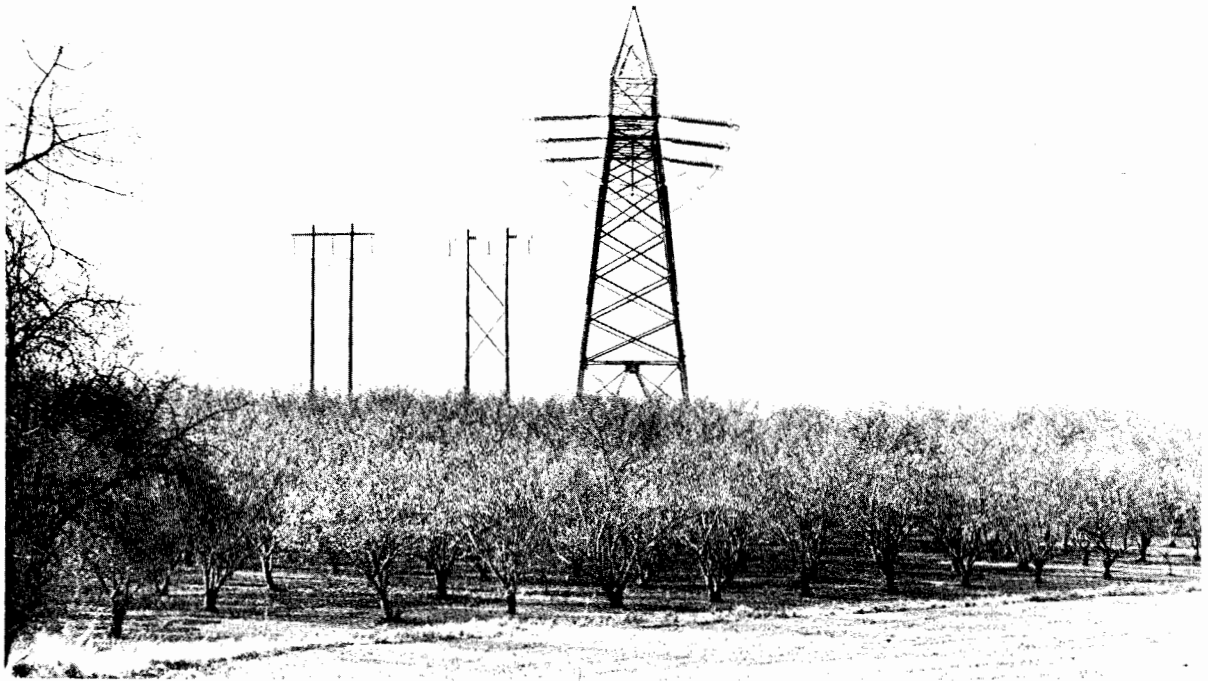


FIGURE 3-15. Fruit Orchards are Also an Agriculture Use Compatible With Transmission Line Operation.

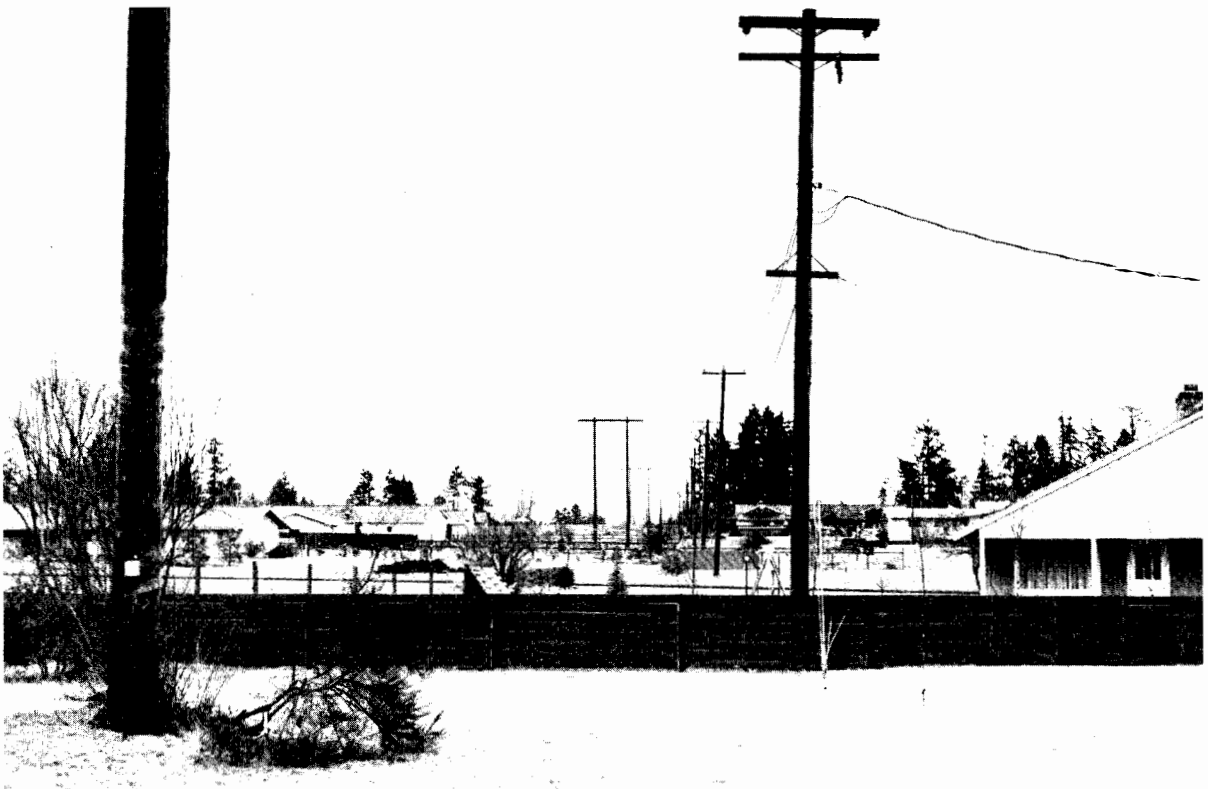


FIGURE 3-16. In Residential Areas, Transmission Line Rights-of-Way are Frequently Used for Playfields and Parklands.

while "Tree and Brush Control Agreements" pertain to lands managed for other purposes. If landowners fail to maintain vegetation as specified by the agreements, BPA is required to give written notice. After 60 days, BPA may act to remove or control trees or brush as necessary to maintain system reliability.

The success of multiple use agreements depends on the stability of the vegetation as managed under the agreement. Because Christmas tree plantations are comprised of potentially tall-growing species, they are very unstable, are often abandoned by landowners, and eventually require control by BPA. In contrast, crops and pasture in productive agricultural areas are highly stable due to the financial incentives for the landowner.

BPA's success with Tree and Brush Control Agreements is highly variable. In the Puget Sound Area, agreements are established with more than 100 landowners. Less than 5 percent of the agreements are defaulted, requiring BPA control of trees or brush (Borter pers. comm.). In the Lower Columbia (Portland) Area, nearly 100 percent of Christmas tree agreements are defaulted (Acton pers. comm.).

BPA's enabling legislation limits its activities to power acquisition, marketing, and distribution and thereby precludes ancillary commercial enterprises such as agricultural activities or Christmas tree plantations on its own lands.

Several utilities in the eastern United States have attempted to set up cost-sharing programs to stimulate maintenance of rights-of-way by landowners. Cost-sharing levels are limited by long-term maintenance expenditures of utilities since costs above this level would have to be passed on to consumers.

The Tennessee Valley Authority (TVA), in conjunction with the Tennessee Wildlife Resources Agency, devised a periodic cost-sharing scheme whereby landowners would be paid only for completed right-of-way maintenance and wildlife habitat improvement work (Fowler et al. 1976). TVA would inspect each cooperating land ownership during regularly scheduled maintenance to ensure rights-of-way are kept in a condition compatible with electrical transmission. Cost-sharing payments would be 75 percent of the cost to TVA to reclear rights-of-way if landowners default on their agreements.

TVA and the Tennessee Wildlife Resources Agency promoted the cost-sharing program extensively, but the promotional effort was relatively unsuccessful. Only one landowner signed an agreement under the program and he defaulted on his agreement

after one treatment rotation (Hudson pers. comm.). In general, landowners were not receptive to performing the vegetation control work in exchange for TVA cost-sharing.

TVA also conducts a "one-time" cost-share program with landowners in forested areas where TVA vegetation management is otherwise required. Under this program TVA will reimburse 50 percent (up to TVA's vegetation control cost of \$85 per acre) of a landowner's expenses to convert brushland or forested right-of-way to pasture or cropland uses. No TVA cost-sharing is available for subsequent maintenance of the parcel. Over the ten-year life of this program, approximately 300 acres have been converted to compatible uses and no longer require TVA vegetation management (Hudson, pers. comm.). TVA maintains vegetation on about 26,000 acres of right-of-way each year.

In West Virginia, landowners may enter into Landowner Maintenance Agreements (LMA) with transmission utilities. Inspections of ownerships by utilities are made at regular treatment intervals. If vegetation is maintained compatibly with electrical transmission, landowners are compensated an amount equal to the cost of aerial herbicide application (Tillman et al. 1982). A handbook has been published to instruct landowners in right-of-way maintenance procedures, tools, safety, and establishment of LMAs (Kimmel et al. 1982).

The Appalachian Power Company headquartered in Roanoke, Virginia participates in LMAs with landowners along its 43,000 miles of right-of-way. Approximately 125,000 acres of this right-of-way requires regular vegetation management. In four years of the LMA program, about 30 landowners have established LMAs with Appalachian Power Company (Caldwell pers. comm.). Less than 10 percent of these landowners have maintained right-of-way vegetation according to the agreements. In 1982, landowners received about \$160 per acre when vegetation was maintained satisfactorily.

Other Methods

Prescribed Fire. Prescribed fire involves the use of closely-managed burning at periodic intervals to maintain low-growing vegetation characteristic of early stages of plant succession. Woody vegetation is consumed while regrowth of grasses and forbs is promoted.

BPA currently prohibits prescribed burning for right-of-way vegetation management. Technical constraints include the lack of safe, effective, and aesthetically-acceptable

methods to conduct prescribed burns; difficulties of managing fires on narrow, linear rights-of-way; and problems of smoke management.

Additional Chemical Methods. Additional chemical formulations now exist or may be developed in the near future for use in utility right-of-way management. Some have not yet been registered for right-of-way use by EPA (pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act, as amended) or by state agencies. Others are registered for this use but have not been approved by BPA.

Research and pilot testing are on-going BPA activities designed to develop and test improved herbicide formulations and herbicide application techniques (see Chapter 5). Once tested and proved to be feasible, new chemical techniques may be approved by BPA for use. Studies are also under way to compare the relative effectiveness of chemical and manual methods.

The following herbicides are currently scheduled for testing by BPA during the period of 1982-1986.

<u>Trade Name</u>	<u>Common Name</u>
Hyvar	Bromacil
Spike	Tebuthiuron
Roundup	Glyphosate
Garlon	Triclopyr
Krovar	Diuron and bromacil
Pramitol	Prometone
Krenite	Fosamine ammonium
Weedone	2,4-D and 2,4-DP

Some of these herbicides are currently on the BPA approved list but will be tested in different combinations, and in alternative patterns of use and application techniques. Two (i.e., Garlon and Krenite) are not currently on BPA's approved list. Other products may also be tested, as additional chemicals, formulations, or application techniques become available.

Typical Costs and Longevity of Treatments

Efforts to compile comparative cost data for vegetation management treatments are difficult. Many interacting variables affect cost including brush type, brush height and density, topography, accessibility, weather conditions, contractor experience, herbicide product and rate of application. Ground-based methods (e.g., spot chemical and manual) are strongly influenced by brush density, brush height, and accessibility. Costs can vary from less than \$100 per acre to more than \$200 per acre.

Aerial spraying of herbicides is little influenced by these factors and unit costs per acre have been consistent (Ellsworth pers. comm.). All aerial treatments are contracted out by BPA; therefore, downtime caused by unsuitable weather conditions is not reflected in added cost to BPA. An exception is that aerial treatment inspectors are BPA personnel whose labor cost is incurred during weather-caused downtime.

Based on past BPA experience, typical cost estimates for the major types of treatments are presented in Table 3-4 along with the expected duration of each treatment before a repeat treatment is needed. Broadcast aerial application tends to be the least expensive treatment, followed by ground-based and spot sprays of foliage and basal-stems. Manual cutting treatments tend to be the most costly (because of the labor requirements involved) and also need to be repeated more frequently (because of resprouting by hardwood and shrub species).

The data presented in Table 3-4 represent typical costs for both "force account" vegetation management projects and "contract" projects. The cost factors contributing to the overall per acre rate are somewhat different, however, for the two types of projects.

Force account projects are those performed by BPA personnel directly. Roughly 20 percent of BPA vegetation management is performed on force account (Ellsworth pers. comm.). Costs for these projects include direct costs such as wages and materials, indirect costs such as tools and shop maintenance, and travel costs (estimated at 30 percent of direct costs).

Contract projects constitute roughly 80 percent of the vegetation management effort of BPA (Ellsworth pers. comm.). The primary element of BPA's cost per acre for these projects is the contractor's bid; this bid includes wages, tools, transportation, insurance (BPA requires bonded

Table 3-4. Typical Costs and Longevity of Treatments for BPA
Right-Of-Way Vegetation Management Activities¹

Treatment Method	Typical Cost/Acre (\$)	Duration of Treatment (Years) ²	
		West of Cascades	East of Cascades ³
Chemical			
o Spot			
- Foliage spray	125	5	10
- Basal-stem spray	150	4	-
- Cut-stump treatment with manual cutting, lop, and scatter	150-200	4	10-12
o Broadcast			
- Aerial application by helicopter	70	4	10 ⁴
Manual			
o Cutting with lop and scatter	175	3	10

FOOTNOTES:

¹Values provided in this table represent current (1983) costs for typical BPA vegetation management contracts. The variance around all of the figures is quite large, due to variations in factors such as brush density, brush height, accessibility, contractor experience, etc. (The only exceptions to this are the costs of aerial spraying, which tend to be relatively uniform because they are independent of many of these factors). The information in this table was obtained by personal communication from BPA Branch of Transmission Line Maintenance personnel, W. S. Acton, D. P. Ellsworth, A. Tvrz, and B. Tyree.

²Duration of treatment refers to the length of time before another cycle of treatments is needed. Eastside areas include the Upper Columbia and Snake River BPA areas located east of the Cascade Mountains. Westside areas include the Puget Sound and Lower Columbia BPA areas located west of the Cascade Mountains.

³Treatments are frequently needed more often in the Columbia Gorge.

⁴Aerial application is used only in remote areas or where extensive brush problems occur (e.g., dense, uniform stands of alder; abandoned Christmas tree plantations).

contractors), measures to comply with Occupational Safety and Health Administration regulations, and training of licensed herbicide applicators (where required).

In addition to the contract cost itself, BPA incurs a number of other costs in contracting work out; these include contract administration (preparing specifications, issuing the solicitation, showing treatment sites to bidders, reviewing and selecting bids, making the award, etc.) and contract inspection (to insure performance of work according to specification). For example, BPA stations one or two inspectors on every manual contract project to ensure that target species are treated properly (e.g. conifers cut off below the lowest limb). The additional costs incurred by BPA in administering and inspecting contract projects result in similar overall treatment costs per acre for the two types of projects (Ellsworth pers. comm.).

Summary

BPA has a number of underlying needs for vegetation management identified in Chapter 2, NEED FOR AND PURPOSE OF THE PROPOSED ACTION. In Table 3-5, the applicability of the alternative control methods described in the present chapter to those underlying needs is indicated. Different alternative methods are appropriate for control of high density and low density brush on rights-of-way, related primarily to differential efficiency where accessibility and number of target stems are high or low. Low density brush can be efficiently controlled with spot chemical methods or manual cutting. High density brush can only be efficiently controlled with broadcast chemical methods or mechanical methods (not proposed for use by BPA).

For substation maintenance, only chemical methods are appropriate; hand pulling and hoeing could be practiced but are exceedingly labor intensive and are not proposed for use by BPA.

The status of each alternative control method in BPA's proposed vegetation management program is also shown in Table 3-5. Chemical methods, manual methods, biological control of a noxious weed by insects, and multiple use agreements with landowners are proposed for operational use. A biological method and alternative chemical methods have experimental status.

Table 3-5. Applicability of Alternative Vegetation Control Methods to BPA's Vegetation Management Needs

Method/Technique	Applicability to Vegetation Management Needs						Status in BPA's Program	
	R-O-W Maintenance			Substation Maintenance				
	Brush Control ¹		Noxious Weed Control	Pole Protection	Brush Control	Weed Control	Operational	Experimental
	High Density Brush	Low Density Brush						
CHEMICAL								
Spot Ground-based Application	+	++	++	++	++	++	x	x
Broadcast Ground-based Application	++	+	++	-	++	++	x	x
Broadcast Aerial Application	++	+	++	-	-	-	x	x
MANUAL								
Cutting	+	++	-	-	+	-	x	-
Hand Pulling and Hoeing	-	-	+	+	-	+	-	-
Topping and Pruning	-	+	-	-	-	-	x	-
Girdling	-	+	-	-	-	-	x	-
MECHANICAL								
Scarification	++	+	-	-	-	-	-	-
Chopping, Cutting, and Mowing	++	+	-	-	-	-	-	-
BIOLOGICAL								
Establishment of Low-growing Plants	x		-	-	-	-	-	x
Prescribed Grazing	x		-	-	-	-	-	-
Wildlife Management	x		-	-	-	-	-	x
Biological Control by Insects	-		x	-	-	-	x	-
Multiple Use Agreements with Landowners	x		x	-	-	-	x	-

NOTES:

¹Chemical, manual, and mechanical methods can be characterized as corrective measures for control of tall-growing species; that is, they act to remove tall-growing plants that have established successfully and that will grow to threaten conductor clearance criteria. These corrective measures have differential suitability for treatment of high or low density stands of brush, as indicated in this column. Biological methods can be characterized as preventive measures for control of tall-growing species; that is, they act to prevent establishment of seedlings of these species. Therefore, there is no differential suitability for treatment of high or low density brush. When these preventive measures are not successful, however, corrective measures must be used.

²Key to Symbols

- + = applicable but with low efficiency
- ++ = applicable with moderate to high efficiency
- = not applicable
- x = applicable but efficiency undetermined

ALTERNATIVES INCLUDING THE PROPOSED PROGRAM



Chapter 4

ALTERNATIVE VEGETATION MANAGEMENT PROGRAMS, INCLUDING THE PROPOSED PROGRAM

A vegetation management program consists of a set of one or several vegetation control methods available for use in various management situations. The previous chapter described in detail vegetation control methods that can be used in vegetation management. In this chapter, those control methods are aggregated into a series of alternative management programs. Some alternative programs rely exclusively on one type of control method, while others have several types of control methods available for use. Distinctions between the alternative programs in terms of social, environmental, economic, and management consequences derive from the particular control methods comprising each program. BPA will select one of the alternative programs to best satisfy the needs and purposes of transmission facilities vegetation management.

Description of Alternative Programs

Five major types of vegetation control methods were described in Chapter 3: spot chemical, broadcast chemical, manual, mechanical, and biological. The following alternative programs are comprised of various combinations of these types.

Alternative 1: "No Action". Under this alternative, BPA's underlying need for system reliability is not satisfied, and a vegetation management program would not be undertaken.

Alternative X: Biological. Only biological methods are available for vegetation control.

Alternative 2: Manual. Only manual methods are available.

Alternative Y: Mechanical. Mechanical methods alone are available for vegetation management.

Alternative 3: Spot Chemical. Only spot chemical methods are available.

Alternative 4: Broadcast Chemical. Only broadcast chemical methods are available.

Alternative 5: Manual and Mechanical. This alternative relies on manual and mechanical methods; where mechanical methods are not appropriate, manual methods are available.

Alternative 6: Spot and Broadcast Chemical. Both types of chemical control methods are available; where broadcast methods are not appropriate, spot chemical methods are available.

Alternative 7: Biological, Manual, and Mechanical. The three nonchemical methods comprise this program alternative.

Alternative 8: Biological, Manual, Mechanical and Spot Chemical. All methods except broadcast chemical are available for use.

Alternative 9: Biological, Manual, Mechanical and Broadcast Chemical. All methods except spot chemical are available; manual methods are used on sites where mechanical or broadcast chemical methods are not appropriate.

Alternative 10: Biological, Manual, Spot Chemical, and Broadcast Chemical. All methods except mechanical are available for vegetation management in this, BPA's preferred, program alternative. For any specific vegetation management project, methods would be selected and implemented on a site-specific basis in accordance with BPA's Transmission Line Maintenance Standard, the auxiliary purposes of BPA vegetation management (see Chapter 2), and the constraints and mitigation measures identified in this chapter (see below). A major auxiliary purpose of BPA vegetation management incorporated in this alternative is adherence to the principles of Integrated Pest Management (IPM).

Alternative 11: Biological, Manual, and Spot Chemical. Biological, manual, and spot chemical methods are available for vegetation management. (Note: This alternative has been added for evaluation in the Final EIS in response to several comments on the Draft EIS.)

Deletion of Inadequate Alternatives

The various program alternatives were examined for their technical capability to meet BPA's underlying need for vegetation management as identified in Chapter 2 (i.e., to ensure reliable operation of the Federal transmission system). Satisfying this underlying need requires brush control on transmission line rights-of-way, keeping access roads clear, and control of weeds at substations (see Chapter 2 and Table 3-5). Alternative X (Biological) and Alternative Y (Mechanical) are technically unable to satisfy the underlying need. They are deleted from further detailed study for the following reasons.

Alternative X: Biological. Biological methods for right-of-way brush control are currently under study by BPA-funded researchers (see Chapter 3). Results of studies on feasibility, effectiveness, cost, and environmental impacts are not expected for several years. Even if proven effective and cost-efficient in some situations, general ability to provide needed brush control in all situations is doubtful.

A biological technique using introduced insects is operational (with variable success) in controlling infestations of a noxious weed, tansy ragwort, on BPA rights-of-way. Other introduced insects are used successfully for biological control of weeds by other organizations in the BPA Service Area. To date, BPA has not been asked to participate in these other biological control efforts. No biological techniques are available for weed or brush control at substations (see Table 3-5).

Alternative Y: Mechanical. Mechanical methods can effectively control right-of-way brush but only on obstacle-free slopes less than 30 percent without seriously endangering equipment operators or adversely affecting soil and water quality. Mechanical methods are not available for noxious weed control, pole protection, or substation weed control (see Table 3-5).

Evaluation and Comparison of Alternative Programs

Evaluation Process

The process for evaluating the alternative programs involved (1) establishing a set of evaluation criteria, (2) establishing a scale on which to rate the alternatives, and (3) determining a potential impact rating for each alternative against each evaluation criterion.

Evaluation Criteria. Evaluation criteria were developed to be used as standards in evaluating the various beneficial and adverse effects produced by each of the program alternatives. The Alternative Evaluation Team (identified in Chapter 10) considered three sources of information in developing evaluation criteria: scoping comments for this EIS, comments on previous BPA EISs and environmental assessments, and concerns of BPA vegetation management personnel.

In late 1980, BPA solicited letters of comment from local, state and federal agencies, from special interest groups, and from individuals to indicate significant issues that should be addressed in this EIS. The 75 comment letters received by BPA were reviewed carefully. A total of 244 distinct issues or concerns were identified; these are tabulated in Table 4-1. Issues mentioned in 10 percent or more of the comments were health and safety (of both the public and workers), land use patterns potentially affected by vegetation management, water quality and fisheries, plants and animals, and procedures for selection of vegetation control methods at the project level. In citing these concerns, many commentators were interested primarily in the potential impacts of herbicide use in vegetation management.

In 1980, BPA prepared an EIS on its fiscal year 1981 construction and maintenance program, including vegetation management. During 1981, BPA prepared an environmental assessment on its proposed transmission facilities vegetation management program for fiscal year 1982. The comments received on these two environmental documents were dominated by concerns about public health, worker safety, and water quality impacts of herbicide use. Other substantive concerns related to impacts on land use patterns, impacts on plants and animals, treatment cost and effectiveness, and the procedures used by BPA for selection of treatments (e.g., Integrated Pest Management).

BPA vegetation management personnel are responsible for controlling vegetation to satisfy system reliability

Table 4-1. Issues and Concerns Identified in 75 Scoping
Comment Letters Received by BPA in Late 1980

Type of Issue of Concern	Number of Comments	Percent of Total Comments
. Health and safety: - public health, worker safety, persistence and fate of herbicides	63	26
. Land use patterns: - land use plans and policies, multiple use of rights-of-way, adjacent land uses	29	12
. Visual quality, and historical and cultural resources	5	2
. Water quality and fisheries	33	14
. Air quality	2	1
. Soil productivity	4	2
. Plants and animals - plant and wildlife habitat, rare and endan- gered plants and animals, domestic animals	34	14
. Treatment effectiveness and cost	12	5
. Employment opportunities	8	3
. Energy consumption	1	-
. Procedures for selection of treatments at project level	35	14
. Mitigation measures and environmental safe- guards	<u>18</u>	<u>7</u>
TOTALS	244	100

criteria. Over the years, they have accumulated considerable knowledge and experience in vegetation management. Primary concerns expressed by these persons include treatment effectiveness, treatment cost, operational flexibility, and legal compliance, as well as environmental impacts. Treatment effectiveness is the duration of control of target vegetation available with the control methods comprising a vegetation management program. Treatment cost is the total cost required to satisfy vegetation management needs using the control methods available.

Operational flexibility refers to the range of control methods available for use in the many types of situations where vegetation must be managed. Where any one type of control method is not feasible due to technical, environmental, or social considerations, other methods must be available in order to maintain system reliability. Legal compliance refers to the ability of the vegetation management program to comply with pertinent laws and regulations; a management program that is not in legal compliance will not be able to maintain system reliability.

The issues and concerns indicated by the sources discussed in the previous paragraphs were examined carefully to identify criteria for evaluating the program alternatives. Four general areas of concern were identified; these were organized into four general types of evaluation criteria: social, biophysical, economic, and management. Within the four general types, the Alternative Evaluation Team identified 14 distinct and separable criteria to represent the breadth of concerns shown by the public, by agencies, and by BPA vegetation managers.

Because the concerns varied considerably in importance to both the public and to management, a relative ranking of high, moderate, or low importance was given to each criterion. The following paragraphs describe each of the 14 criteria, indicate major considerations under each, and set forth the bases for the importance ratings.

Social Criteria.

1. Public Health: allegations of or known potential for hazards to the public from direct applications of herbicides, or, indirectly, from herbicide contamination of soils, water (surface or subsurface), vegetation, or animals; possibility of public health hazards from other control methods. Based on public input received during the scoping period for this EIS and during the comment periods for previous BPA environmental documents, this

is the public's concern of highest priority. Maintenance of public health is also one of the purposes of BPA's vegetation management program (see Chapter 2). Public health is therefore a high importance evaluation criterion.

2. **Worker Safety:** potential for occupational hazards to vegetation management workers including herbicide toxicity hazards, tool/equipment hazards, site hazards, and travel hazards. Worker safety was a concern that was also mentioned frequently in comments from the public and agencies. It also is a purpose of BPA's proposed program. This criterion is given high importance in evaluating the program alternatives.
3. **Land Uses:** potential effects on land uses on or adjacent to managed rights-of-way (e.g., agriculture, grazing, timber production, recreation), potential conflicts with local or state land use controls, potential coordination problems with public land management agencies. Concern about land use problems has been expressed by a substantial number of commentators in the past. Potential herbicide effects on uses of both rights-of-way and of adjacent lands is the most important specific element of this concern. Public health aspects of herbicide use are covered by criterion No. 1. Promotion of multiple uses of rights-of-way is a purpose of BPA's proposed program (see Chapter 2). This criterion is rated of moderate importance.
4. **Visual, Historical, and Cultural Resources:** potential effects on visual quality, and historical and cultural resources on or near managed rights-of-way. A minor amount of concern has been expressed in the past about these social resources. Certain federal regulations protect historical, cultural, and recreation resources (see Chapter 8). There are no known National Register historical or cultural sites situated on BPA facility sites or rights-of-way. Existing transmission facilities (e.g., towers, substations) already dominate local landscapes in the immediate areas of the facilities; therefore, visual impacts of vegetation management activities usually would be incrementally small. However, in some forest situations, the contrast between cleared right-of-way and adjacent forest may be more visible than transmission structures. This criterion was established to evaluate potential effects on these resources, but it was judged to be of low importance relative to other criteria.

5. Public Acceptability: potential for problems of public acceptance of the overall vegetation management program or of individual control projects. Public acceptance is an important concern for all public entities pursuing programs of a potentially controversial nature. BPA's proposed program is potentially controversial as is shown by comments received on previous environmental documents and during the scoping period and comment period for this EIS. Without public acceptance, a program may be unable to satisfy its objectives. This criterion is rated as having high importance.

The 68 comment letters received on the Draft EIS revealed nine major areas of controversy regarding BPA's proposed program (see Chapter 12) as follows:

- o Use more biological methods (25 percent of commentors)
- o Use more manual methods (24 percent)
- o Protect water quality from potential herbicide impacts (19 percent)
- o Use more multiple-use agreements (15 percent)
- o Adopt the additional mitigation measures identified in the Draft EIS (13 percent)
- o Minimize use of broadcast chemical methods (12 percent)
- o Provide additional documentation and notification (9 percent)
- o Minimize use of picloram herbicide (7 percent)
- o Minimize use of 2,4-D herbicide (7 percent).

Five comment letters (7 percent) expressed explicit support for BPA's preferred Alternative 10.

Based on the pattern of comments on the Draft EIS, an alternative having high public acceptability would incorporate substantial use of biological and manual methods of vegetation control and would avoid adverse impacts on water quality. In contrast, a program alternative having low public acceptability would rely exclusively on broadcast chemical methods and would potentially cause adverse impacts on water quality.

Overall public acceptability is difficult to gauge due to that fact that certain segments of the public have commented on this EIS, while other segments with possibly different overriding concerns have not commented. The predominant concern of those not commenting is probably treatment cost (as it might affect costs of BPA electrical service). Therefore the ideal program in terms of public acceptability would be conceivably the one that avoids any cost increase (above the present program) while avoiding use of chemical methods.

Biophysical Criteria.

6. Water Quality and Fisheries: potential for effects such as sedimentation, elevated stream temperatures, herbicide contamination, or oil contamination on water quality and fisheries. Water quality and fisheries were concerns expressed by many persons during previous scoping and comment periods. In particular, herbicide effects on surface and subsurface drinking water quality were a major issue. Protection of environmental quality (including water quality) is a purpose of BPA's proposed program (see Chapter 2). Because of the high level of public concern as well as its high priority with BPA management, this criterion is of high importance.
7. Plants and Animals: potential effects on nontarget plants, animals, vegetation diversity, and wildlife habitat on transmission line rights-of-way. Based on current literature and information supplied by U.S. Fish and Wildlife Service Endangered Species Offices, no currently listed or proposed, threatened or endangered plant or animal species will be adversely affected by BPA's vegetation management program (see Chapter 7). Even so, a substantial number of commentors (both agencies and individuals) during the scoping period expressed concern about management impacts on plant and animal habitats. This criterion was, therefore, judged to be of moderate importance.
8. Soil Productivity: potential effects such as soil disturbance and compaction, erosion, nutrient loss, and increased runoff. Relatively few comment letters in the past have expressed concern for effects of vegetation management on soils. Typically, BPA rights-of-way occupy small proportions of any particular watershed, thereby minimizing any potential effects. Most rights-of-way will remain dedicated to transmission line uses and other compatible uses (e.g. agriculture, Christmas tree plantations, wildlife habitat) for the foreseeable

future. Even so, long-term maintenance of soil productivity is important in case of eventual removal of transmission lines or of changes in land use beneath existing lines. Because of these considerations, soil productivity is given a moderate importance rating.

Economic Criteria.

9. Treatment Cost: relative costs of satisfying vegetation management needs using the control methods available within each program alternative. Treatment cost is an expressed concern of both the public and BPA management, primarily the latter. BPA must satisfy its program objectives within certain budgetary constraints; economic efficiency is a stated purpose of BPA's proposed program. The public is generally interested in cost-effective control methods being used. Treatment cost is a high importance evaluation criterion.
10. Employment Opportunities: relative labor requirements needed to satisfy vegetation management objectives using control methods available within each program alternative. Concern about employment was expressed by relatively few individuals during the scoping period for this EIS. The degree of labor intensity of various methods of control does influence cost, however. As a result, this criterion is rated of moderate importance. Employment opportunities associated with each program alternative are estimated relative to the number of workers required for BPA's present vegetation management program.
11. Energy Efficiency: relative energy requirements to satisfy vegetation management needs on rights-of-way using the control methods available under each program alternative. Few comments on this issue were received by BPA during the scoping period or during periods for comment on previous environmental documents. Energy efficiency of vegetation control treatments is a low priority concern of the public. Federal agencies are required to evaluate their energy consumption patterns to identify conservation opportunities. This evaluation criterion compares relative energy requirements among program alternatives; it has a low importance rating.

Management Criteria.

12. Legal Compliance: ability to comply with all relevant federal, state, and local laws and regulations. Chapter 8 of this EIS examines 16 federal environmental

requirements for their relevancy to BPA's vegetation management program. Legal compliance is a criterion of high importance.

13. Treatment Effectiveness: relative duration of vegetation control available with each combination of control methods. For example, spot chemical treatments afford more complete control than broadcast chemical, manual, or mechanical methods (see Chapter 3). Treatment effectiveness is a major determinant of treatment cost over several treatment periods. The shorter the period of control, the more frequently treatments need to be applied. Based on economic efficiency as a purpose of BPA's proposed program, this criterion is rated of high importance.
14. Operational Flexibility: relative ability to select the most appropriate control method for each treatment site based on considerations of the social, economic, and environmental consequences of all available methods. A range of different kinds of control methods must be available in order to employ an Integrated Pest Management (IPM) decision process, a purpose of BPA's proposed program (see Chapter 2). Although naturally-occurring controls are most preferred where feasible under IPM, artificial types of controls are used where appropriate for social, ecological, or economic reasons. Public comments during the scoping period for this EIS and in review of previous BPA environmental documents have urged BPA to employ an IPM treatment selection process. Operational flexibility therefore is a high importance evaluation criterion.

Potential Impact Ratings. A five-category scale of potential impacts was used to evaluate the program alternatives against the evaluation criteria. The five categories of the scale were (A) major beneficial impact, (B) beneficial impact, (C) no or negligible impact, (D) adverse impact, and (E) major adverse impact. A potential adverse impact rating indicates that the control methods included in a program alternative have potential adverse impacts which cannot be avoided by substituting another control method in that program. A key to rating potential impacts was to determine which control methods are applicable to satisfy BPA's various vegetation management needs (Table 3-5). The environmental consequences of the control methods available within each program alternative then were assessed (see Chapter 7) to determine the overall potential impacts of the program alternative.

Before rating each alternative, a possible range of impacts was determined. For example, alternatives were allowed to have a possible range of "no impacts" to "major adverse impacts" on the following evaluation criteria: public health; worker safety; land uses; visual, historical, and cultural resources; water quality and fisheries; soil productivity; treatment cost; and energy efficiency. For criteria of public acceptability, plants and animals, employment, legal compliance, treatment effectiveness, and operational flexibility, program alternatives could have either beneficial or adverse impacts.

Evaluation of Alternatives

An evaluation matrix is presented in Table 4-2. The 11 program alternatives are arrayed on the horizontal axis and the 14 evaluation criteria are arrayed on the vertical axis. In each cell of the matrix, a potential impact category is indicated. Rationale for each of the assigned impact categories are provided in Table 4-3. Impact ratings are based on the analyses of environmental consequences contained in Chapter 7.

Comparison of Alternative Programs

In the previous section, alternative programs were identified along with 14 evaluation criteria. Eight criteria are rated high in importance because they are priority concerns of the public, agencies, or BPA management. These eight will be considered key criteria in comparing the program alternatives.

For each evaluation criterion, a range of potential impact categories is possible among the various alternatives (see Table 4-2). For example, for the public health criterion, categories of C (no or negligible potential impact) or D (potential adverse impact) are appropriate. For the water quality and fisheries criterion, categories of C, D, or E (the latter represents a potential major adverse impact) are possible. Major beneficial and beneficial impacts (categories A and B, respectively) are possible for criteria such as employment opportunities and treatment effectiveness.

In the rating scheme employed in this analysis, each alternative was assigned to one of five categories (A-E), based on an evaluation of its relative impact for a given criterion. Thus, it is possible for several of the alternatives to be assigned to the same category, if they are likely to have similar potential impacts for that criterion.

Table 4-2. Evaluation Matrix of Program Alternatives and Evaluation Criteria

Evaluation Criteria	Importance Rating	Program Alternatives										
		1	2	3	4	5	6	7	8	9	10	11
		No Action	Manual	Spot Chem.	Brd. Chem.	Mech. and Manual	Spot Chem. and Brd. Chem.	Manual, Mech., Biol.	Manual, Mech., Biol., Spot Chem.	Manual, Mech., Biol., Brd. Chem.	Manual, Biol., Spot Chem. Brd. Chem.	Manual, Biol., Spot Chem.
Social criteria												
Public health	High	C	C	C	D	C	C	C	C	C	C	C
Worker safety	High	C	E	E	D	E	D	E	E	D	D	E
Land use	Moderate	C	C	D	E	C	D	C	C	C	C	C
Visual, historical and cultural resources	Low	C	C	C	E	D	C	D	C	D	C	C
Public acceptability	High	E	C	E	E	C	D	C	C	B	B	C
Biophysical criteria												
Water quality and fisheries	High	C	C	C	E	D	C	D	D	D	C	C
Plants and animals	Moderate	D	B	B	D	D	C	C	C	C	C	B
Soil productivity	Moderate	C	C	C	C	D	C	D	D	D	C	C
Number of times each alternative was assigned to the most favorable impact rating category:												
Subtotal for environmental criteria		NA	6	5	2	2	5	2	3	4	7	6
Economic criteria												
Treatment cost	High	C	E	E	E	E	D	E	E	D	D	E
Employment	Moderate	E	A	A	D	A	C	A	B	C	C	A
Energy efficiency	Low	C	E	E	E	E	D	E	E	D	D	E
Management criteria												
Legal compliance	High	E	A	A	E	A	A	A	A	A	A	A
Treatment effectiveness	High	E	B	A	B	B	A	B	A	B+	A	A
Operational flexibility	High	E	D	D	D	C	B	B	B	B	A	B
Number of times each alternative was assigned to the most favorable impact rating category:												
Total for all criteria		NA	8	8	2	4	9	4	5	7	12	9

NOTE:

Cell entries are potential impact ratings:

A = major beneficial impact
 B = beneficial impact
 C = no or negligible impact
 D = adverse impact
 E = major adverse impact
 NA = not applicable

Table 4-3. Rationale for Potential Impact Ratings Shown in Evaluation Matrix (Table 4-2)

<u>Social Evaluation Criteria</u>	<u>Potential Impact Category¹</u>	<u>Rationale</u>
PUBLIC HEALTH		
Alternative 1	(C)	No impacts would result from the no-action alternative.
Alternative 2	(C)	Little or no impacts to public health would result from exclusive reliance on manual control methods.
Alternative 3	(C)	Exclusive reliance on spot chemical methods would result in little or no potential impacts; losses of herbicides into the environment to contaminate air, water, nontarget vegetation, or animals would be minimal; there would be virtually no likelihood of direct or indirect public exposure to herbicides at a toxicologically-significant level.
Alternative 4	(D)	Exclusive reliance on broadcast chemical methods would have some potential for adverse impacts on public health. Losses of herbicides to the non-target environment including air, water, vegetation, and animals could be large. Other control methods are not available to substitute in sensitive situations (e.g., near streams, in residential areas). Because herbicides proposed for use by BPA in broadcast applications have low levels of mammalian toxicity, potential direct and indirect public exposures to herbicides would not result in major adverse impacts.
Alternative 5	(C)	Reliance on manual and mechanical methods would pose no potential impacts on public health.
Alternative 6	(C)	Use of both spot and broadcast chemical methods allows substitution of spot herbicide applications in areas where broadcast applications might result in significant public exposure via contamination of the nontarget environment.
Alternative 7	(C)	No impacts on public health are expected from use of current manual, mechanical, and biological methods. Although large numbers of manual workers in the field may increase bacterial inputs to streams, proper sanitation practices will prevent adverse impacts.
Alternative 8	(C)	No impacts on public health are expected due to this combination of manual, mechanical, biological, and spot chemical methods (see Alternative 3).
Alternative 9	(C)	Broadcast chemical methods are included in this alternative. The availability of manual, mechanical, and biological methods allows these methods to be substituted where broadcast methods are inappropriate. With strict observance of all mitigation measures, little or no adverse impacts to public health are anticipated.
Alternative 10	(C)	This program alternative is identical to Alternative 9, except that mechanical methods are deleted and spot chemical methods are added. Little or no adverse impacts to public health are foreseen (see Alternative 9), assuming mitigation measures for spot and broadcast chemical methods are observed. Broadcast chemical methods would be used primarily in inaccessible, high density brush stands.
Alternative 11	(C)	No impacts on public health due to this combination of biological, manual, and spot chemical methods are expected (see Alternative 3).
WORKER SAFETY		
Alternative 1	(C)	No impacts on safety of vegetation management workers. However, safety of transmission line repair crews would be imperiled without clear access to transmission towers.
Alternative 2	(E)	Exclusive reliance on manual control methods would have major adverse impacts on worker safety (see Table 7-13). Manual methods involve substantial site, tool/equipment, and travel hazards. Without spot herbicide treatments (i.e., cut-stump applications) to follow-up cutting of sprouting species, frequent retreatment would be required. Necessity of treating inaccessible, high density brush stands with manual methods would expose workers to major site and travel hazards.

¹ See Table 4-2 for key to potential impact categories.

Table 4-3. Cont'd.

<u>Social Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 3	(E)	Spot chemical methods involve somewhat fewer occupational hazards to workers than manual methods. However, for treatment of inaccessible, high density stands, site hazards and travel hazards would be substantial for spot chemical methods as well. Potential major adverse impacts could thus result from exclusive reliance on spot chemical methods. Herbicide toxicity hazards to workers are expected to be minimal, given strict observance of label instructions and safety measures.
Alternative 4	(D)	Broadcast chemical methods pose minor potential for occupational hazards provided standard safety practices are followed for operating equipment and handling chemicals (see Table 7-13); ground support crews including tank truck operators, mixer/loaders, and inspectors would be exposed to travel hazards on mountainous roads. Herbicides would pose minimal occupational hazards, given strict observance of label instructions and safety measures.
Alternative 5	(E)	Mechanical and manual methods, those available under this alternative, both would pose substantial occupational hazards to workers (see Table 7-13).
Alternative 6	(D)	Broadcast chemical methods would be available for treatment of inaccessible, dense brush stands, thereby reducing the overall likelihood of adverse safety impact to workers if spot chemical methods had to be used to control such stands.
Alternative 7	(E)	Occupational hazards of manual and mechanical methods can be substantial; biological methods are experimental and will not be used to any significant extent for at least several years; this program alternative could have major adverse impacts on worker safety.
Alternative 8	(E)	Manual, mechanical, biological, and spot chemical methods comprise this alternative. Mechanical methods could be used for high density stands in accessible sites on gentle terrain. Manual or spot chemical methods would have to be used for all inaccessible, steep terrain sites, including high density stands. Site, tool/equipment, and travel hazards are likely to be substantial. Potential worker safety impacts could be major with this program alternative.
Alternative 9	(D)	Broadcast chemical methods are available to treat inaccessible, high density brush stands. Manual methods would have to be used where mechanical, biological, or broadcast chemical methods are not appropriate. Over-all worker safety impacts are expected to be adverse but not major.
Alternative 10	(D)	The preferred alternative would also have adverse impacts on worker safety; but a low overall hazard is anticipated if appropriate precautions are taken. Dense, inaccessible sites could be treated with low-risk broadcast chemical methods. Spot chemical and manual methods could be used on accessible and low density sites, and in sensitive areas such as stream buffer zones. Safety measures described in the BPA Transmission Line Maintenance Standard would have to be strictly observed, as well as herbicide label instructions.
Alternative 11	(E)	Potential impacts on worker safety are similar to those of a combination of Alternative 2 (manual) and 3 (spot chemical). The major sources of impact would be site, equipment, and travel hazards associated with reliance on manual and spot chemical methods for control of inaccessible, high-density brush standards. Biological methods for prevention of high-density brush in inaccessible sites are not available for use at this time.
LAND USES		
Alternative 1	(C)	The no-action alternative would have no impacts on land uses.
Alternative 2	(C)	Reliance on manual methods alone would have negligible adverse impacts on land uses. Potential adverse impacts could result from use of chainsaws in residential areas (i.e., temporary noise disturbance), but these would be slight enough to be ignored. No conflicts with land use controls or land management agencies are anticipated.

Table 4-3. Cont'd.

<u>Social Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 3	(D)	This alternative would rely exclusively on spot chemical methods. Some forms of spot herbicide application (e.g., granules, pellets) could result in phytotoxic concentrations of herbicides persisting in soils; translocation or leaching of these herbicides to adversely impact adjacent crops is possible. However, the likelihood of this being a major impact can be minimized by careful observance of herbicide label instructions as to season and rate of application and soil types to avoid. No conflicts with land use controls or land management agencies are anticipated.
Alternative 4	(E)	Exclusive reliance on broadcast chemical methods might result in major adverse impacts with regard to land uses. Use of broadcast methods adjacent to sensitive crops could cause nontarget losses of commercial value. No other control methods would be available for substitution in such sites. Treatment of noxious weeds on rights-of-way in agricultural areas could not be conducted without substantial risk to crops on or adjacent to rights-of-way. Major conflicts with land management agencies could arise since these agencies restrict broadcast applications in sites where resource values such as wildlife habitat quality, stream habitat quality, and visual quality have high priority. Exclusive reliance on broadcast methods could cause depreciation of visual quality in areas of high scenic value.
Alternative 5	(C)	This alternative would rely on a combination of manual and mechanical control methods. On sites where mechanical methods would be inappropriate (e.g., steep slopes, erodible soils) due to potential impacts to land uses (e.g., erosion onto adjacent cropland, erosion into National Forest streams), manual methods could be used. Negligible adverse impacts to land uses or conflicts with land management agencies are foreseen.
Alternative 6	(D)	Adverse impacts to adjacent land uses would be possible from drift, leaching, or translocation of phytotoxic amounts of herbicides to adjacent croplands. Several mitigation measures could minimize these impacts (e.g., use drift control measures, observe herbicide label instructions strictly). Where sensitive crops occur, spot chemical methods would be available. Where land management agencies restrict use of broadcast aerial methods, spot methods could be used.
Alternative 7	(C)	Similarly to Alternative 5, this program alternative is expected to have negligible impacts or conflicts with land uses or land management.
Alternative 8	(C)	With the inclusion of spot chemical methods, some potential for phytotoxic contamination (e.g., by leaching of persistent herbicides) of adjacent land would exist. Proper herbicide application rates and seasons of use can minimize potential impacts. Potential impacts can be avoided by substituting manual methods on sensitive sites. Otherwise this alternative is similar to Alternative 5.
Alternative 9	(C)	Similarly to Alternative 8, some minor adverse impacts could occur. On sites where broadcast chemical methods might cause damage to adjacent crops or conflicts with land management agencies, manual control methods would be available. Broadcast applications at high rates (e.g., at substations) could result in leaching of persistent herbicides to adjacent lands. Potential impacts can be avoided by substituting manual methods on sensitive sites.
Alternative 10	(C)	The preferred alternative would have negligible impacts on land uses, provided that methods are selected and implemented according to BPA's Transmission Line Maintenance Standard and that mitigation measures are strictly observed. For example, broadcast herbicide applications would be prohibited adjacent to susceptible crops. Herbicide label instructions as to application rates, weather conditions, and soil types would be carefully observed to minimize potential impacts to adjacent land uses. Also, multiple use agreements could be established with landowners or land management agencies to specify control methods to be used on specific sites.
Alternative 11	(C)	This program alternative would have negligible potential to adversely affect adjacent land uses or to conflict with land use controls or land management agencies (similar to Alternative 8). Potential land use impacts of the experimental biological methods for brush control are unknown at this time.

Table 4-3. Cont'd.

<u>Social Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
VISUAL, HISTORICAL AND CULTURAL RESOURCES		
Alternative 1	(C)	No impacts will occur, because there would be no site disturbance.
Alternative 2	(C)	Only negligible impacts are anticipated. Manual methods would not damage unknown subsurface historical or cultural sites. Manual methods could be applied in a manner that maintains visual screens (to enhance near views) and feathers right-of-way edges (to enhance far views) in high sensitivity landscapes (see Chapters 6 and 7 sections on <u>Visual Resources</u> for definition of high sensitivity landscapes); therefore adverse impacts on visual resources could be avoided.
Alternative 3	(C)	Similar to Alternative 2. Spot chemical treatments can be applied selectively to avoid adverse impacts on visual resources.
Alternative 4	(E)	Exclusive reliance on broadcast chemical methods could cause major adverse impacts to visual quality. Brown-outs (although temporary phenomena) could be extensive after broadcast treatments. No method would be available to maintain visual screens or feathered right-of-way edges in high sensitivity landscapes. In low sensitivity landscapes, inability to maintain screens or create feathered edges would not cause adverse impacts. No damage to unknown historical or cultural resources on rights-of-way would occur.
Alternative 5	(D)	Mechanical methods such as scarification that disturb the soil surface could damage unknown subsurface historical or cultural sites. Mechanical methods could also seriously depreciate visual quality. However in both situations of rights-of-way previously unsurveyed for archeological sites and of high sensitivity landscapes, manual methods could be substituted. If these substitutions are made, potential adverse impacts would be minor.
Alternative 6	(C)	Potential adverse impacts would be negligible since spot chemical treatments could be substituted for broadcast treatments in high sensitivity landscapes (see Alternative 2 above). Temporary brown-outs from broadcast applications could be limited to low sensitivity landscapes. No impacts to unknown archeological sites would occur.
Alternative 7	(D)	Similar to Alternative 5.
Alternative 8	(C)	Similar to Alternative 5, except that spot chemical methods, in addition to manual methods, would be available for substitution in place of mechanical methods.
Alternative 9	(D)	Similar to Alternative 5. Manual methods would be the only methods available to substitute for either mechanical or broadcast chemical treatments in high sensitivity landscapes or on rights-of-way unsurveyed for archeological sites.
Alternative 10	(C)	Negligible impact is anticipated. Mechanical methods would not be used. Both manual and spot chemical methods could substitute for broadcast chemical methods in high sensitivity landscapes.
Alternative 11	(C)	Similarly to Alternatives 2 and 3, no impacts on visual, historical, and cultural resources would occur. Potential impacts of biological methods have not been investigated.
PUBLIC ACCEPTABILITY		
Alternative 1	(E)	"No action" would incur major public opposition since electrical system reliability would be sacrificed.
Alternative 2	(C)	Exclusive use of manual control methods would result in major acceptance by some segments of the public, but major opposition by other segments. Acceptance would come from persons preferring complete avoidance of chemical methods; opposition would come from persons sensitive to the costs of vegetation management (exclusive use of manual methods would be exceedingly costly; see rationale under Treatment Cost evaluation criterion). The relative balance of acceptance and opposition cannot be estimated; therefore, a neutral (no impact) rating is given to this alternative.

Table 4-3. Cont'd.

<u>Social Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 3	(E)	Exclusive use of spot chemical methods would, on balance, be opposed by most segments of the public for the following reasons. No manual or biological methods would be available to lessen the use of herbicides. At the same time, however, overall costs of vegetation management would be high due to the lack of an efficient control method for dense, remote stands of right-of-way brush.
Alternative 4	(E)	Exclusive use of broadcast chemical methods would incur major public opposition.
Alternative 5	(C)	This alternative would result in a pattern of public acceptability similar to Alternative 2; some persons would support it for its absence of herbicide use, while others would oppose it due to the cost factor (only manual methods would be available for treatment of mountainous terrain and sensitive sites).
Alternative 6	(D)	Alternative 6 would incur much public opposition due to its exclusive reliance on chemical methods. Cost-wise, this alternative would be comparable to BPA's present program and would not enjoy increased public support on this basis.
Alternative 7	(C)	This alternative would be similar to Alternative 5; public support would derive from avoidance of herbicide use while public opposition would derive from increased costs. The availability of biological methods would not alter this pattern since they are not operational for right-of-way brush control. The relative balance of support and opposition cannot be gauged; therefore, a neutral rating is given to this alternative.
Alternative 8	(C)	This inclusion of spot chemical methods in this alternative would neither lose much public support (from the nonchemical interests) nor gain much support (from the cost-conscious segment of the public). Spot chemical methods are relatively expensive for treatment of dense, remote stands of right-of-way brush.
Alternative 9	(B)	Alternative 9 would probably gain moderate public acceptance. Overall costs of BPA's vegetation management program would be similar to the present program. Although broadcast chemical methods would be used where appropriate, manual methods would be used in environmentally-sensitive sites (e.g., stream buffer zones); thus, impacts on water quality would be minimal. Biological methods would be available for continued research and operational uses where appropriate.
Alternative 10	(B)	Moderate public acceptance would result from adoption of Alternative 10. Biological and manual methods would be available; research into additional biological methods would continue. Broadcast methods would be used in sites where minimal hazard to water quality, the environment, or public health would occur. Overall treatment costs would be similar to those of the present program.
Alternative 11	(C)	This alternative would be similar to Alternative 8 in terms of public acceptability. Although broadcast chemical methods would not be used, treatment costs would be high.
<u>Biophysical Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
WATER QUALITY AND FISHERIES		
Alternative 1	(C)	Lack of vegetation management on rights-of-way would have negligible beneficial impact on water quality and fisheries due to the small proportion of a watershed typically occupied by a transmission right-of-way.
Alternative 2	(C)	Exclusive reliance on manual methods would have a negligible adverse impact on water quality because of the minor amount of vegetation removed (see Chapter 7). Retention of adequate shading cover over streams and removal of all cut trees and limbs from water bodies would prevent any serious impacts to aquatic life.

Table 4-3. Cont'd.

<u>Biophysical Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 3	(C)	Spot chemical methods alone are expected to have negligible impact on water quality and fisheries. Herbicides applied by these methods have little chance of moving to surface or groundwaters (see Chapter 7). Amounts of vegetation cover removed would be minor, leaving adequate vegetation to interrupt precipitation and retain water on treatment sites, thereby preventing erosion and sedimentation. Adequate shading would be left over streams.
Alternative 4	(E)	Major adverse impacts are possible if broadcast chemical methods were relied upon exclusively. Stream buffer zones could not be observed and direct herbicide deposition in streams would be probable. Initial concentrations of some herbicides in small slow-moving streams or water bodies could be sufficient to have toxic effects on aquatic organisms (2,4-D esters, in particular) (see Chapter 7). Stream shading could not be retained.
Alternative 5	(D)	Use of mechanical and manual methods could have potentially adverse impacts primarily due to effects of mechanical methods on soil compaction, erosion, and sedimentation. These mechanical effects could be mitigated by use of manual methods on steep slopes, erodible soils, and near streams.
Alternative 6	(C)	Use of both spot chemical and broadcast chemical methods would have negligible effects on water quality. Restrictions on use of broadcast methods in stream buffer zones and other sensitive areas would be observed. Spot chemical methods substituted in these situations would have virtually no potential for degrading water quality or adversely affecting fish.
Alternative 7	(D)	Potential impacts would be adverse with this alternative, similarly to Alternative 5. Biological methods are experimental at this time. Since the biological techniques being tested require mechanical site preparation for initiation, their impacts would be similar to those of mechanical methods. Manual methods would be available for use on sensitive sites (e.g., steep slopes, erodible soils, and near streams).
Alternative 8	(D)	Potential impacts would be similar to those of Alternative 7, except that spot chemical methods in addition to manual methods could be substituted for mechanical methods on sensitive sites. Therefore, the additional reduction in use of mechanical methods would further minimize impacts on water quality and fisheries, but some adverse impacts could still occur.
Alternative 9	(D)	Overall impact rating is similar to that for Alternative 8: availability of broadcast chemical methods would allow substitution for mechanical methods for treating high density brush stands. Manual methods would be available for treatment of sensitive sites (e.g., stream buffer zones, steep slopes).
Alternative 10	(C)	Negligible impacts on water quality and fisheries would be expected. Mechanical methods would be eliminated from use, causing a significant reduction in potential adverse impacts. Broadcast chemical methods would be restricted to dense brush stands in inaccessible sites. Spot chemical and manual methods would be available for treatment of sensitive sites such as stream buffer zones and domestic water supply watersheds.
Alternative 11	(C)	Similar potential impacts to a combination of Alternatives 2 and 3. Potential impacts of experimental biological methods (e.g., wildlife management and establishment of low-growing vegetation) have not been studied; adverse impacts may occur if mechanical equipment is necessary for site preparation or mulch application.
PLANTS AND ANIMALS		
Alternative 1	(D)	No management of vegetation on rights-of-way in forested areas would allow gradual succession of relatively open right-of-way vegetation to dense mature forest. Wildlife species requiring open or edge habitats, or using the higher production of forage, browse, and mast plants found in open habitats would be adversely affected. Both wildlife diversity and abundance would decrease in local areas. In agricultural areas where vegetation management is required, overall effects on wildlife are more difficult to predict.

Table 4-3. Cont'd.

<u>Biophysical Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 2	(B)	Exclusive reliance on manual methods would have generally beneficial impacts on plants and animals. Manual methods would have negligible direct effects on nontarget species, including forage, browse, and mast-producing plants. Virtually no reduction in total vegetation cover would occur. Vegetation diversity and wildlife habitat diversity would be affected variably, depending primarily on sprouting behavior of plant species that are treated. Over the short term, sprouts produced by manual cutting would provide valuable browse for deer and elk. Over the long term, however, repeated manual cutting of sprouting species over several treatment rotations could lead to the formation of dense, uniform stands of sprout clumps, eventually producing low habitat diversity for wildlife. Where sprouting species were not dominant, habitat diversity (i.e., intervening patches of grasses and forbs, low shrubs, and taller shrubs) would be maintained more easily with repeated manual treatments. Manual methods would have no adverse impacts on riparian habitats or special habitat components. Overall impacts to wildlife and nontarget vegetation would be beneficial.
Alternative 3	(B)	A program using only spot chemical methods would have impacts similar to one using only manual methods. No impacts on nontarget plants or animals; on total vegetation cover; on forage, browse, and mast plants, on riparian habitats, or on special habitat components are expected. However, spot chemical methods would provide better maintenance of habitat diversity due to their ability to more effectively control sprouting species, thereby preventing formation of dense sprout stands of low wildlife value. Overall impacts to wildlife and plants would be beneficial. Direct adverse impacts of herbicides on animals would not be likely because of low exposure to herbicides applied by spot methods, because of low inherent toxicity, and because the herbicides do not bioaccumulate to any significant degree (see Chapter 7).
Alternative 4	(D)	Broadcast chemical methods, used exclusively, would have potential adverse impacts on vegetation and wildlife, depending on the selectivity of herbicide formulations and application rates used. Where herbicides and rates highly selective for target species (whether tall-growing trees or noxious weeds) were used, little adverse impact on nontarget plant species or habitat diversity would be expected to occur. However, if relatively broad spectrum herbicide applications were used, adverse impacts to these could be substantial. For example, important nontarget species such as browse and mast-producing plants may be removed and uniform stands of grasses and ferns may be produced by repeated aerial herbicide applications (see Chapter 7). In addition, broadcast herbicide applications would adversely affect riparian habitats since stream buffer zones could not be maintained under this alternative. No direct impacts of herbicides on animals would be expected due to the low levels of toxicity inherent in herbicides proposed for use by BPA, and due to the fact that these herbicides do not accumulate in animal organisms (see Chapter 7).
Alternative 5	(D)	Overall, the alternative using a combination of mechanical and manual methods would affect plants and animals adversely. Mechanical methods would: 1) reduce structural diversity of vegetation and thereby habitat diversity, 2) reduce or eliminate vegetation cover substantially on treated sites, 3) unnecessarily treat nontarget plants, and 4) reduce special habitat components. Mechanical methods would be used to initiate the biological method for control of right-of-way brush through wildlife habitat management (see Chapter 3). In this case, however, the mechanical methods would be applied in a manner that assures improved wildlife habitat, and would be followed up with other habitat improvement measures (e.g., seeding, fertilization). Manual methods would be used in riparian habitats and other sensitive sites.
Alternatives 6, 7, 8, 9 and 10	(C)	These alternatives constitute various combinations of methods appropriate for treating both low density and high density brush on rights-of-way. Overall effects on plants and animals would be adverse or beneficial depending on the manner in which the methods were applied. In general, if nonselective methods (e.g., mechanical methods and broadcast chemical methods using broad spectrum herbicides) were used only on dense, uniform stands of target species, impacts would be beneficial. This would occur because vegetation structural diversity and habitat diversity thereby would be enhanced and growing space for nontarget plants including forage,

Table 4-3. Cont'd.

<u>Biophysical Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
		browse, and mast species would be provided. On the other hand, if non-selective methods were applied to mixed, patchy stands of target and nontarget species, impacts would be adverse. If selective methods were used on sensitive sites (e.g., riparian zones) and to produce special habitat components (e.g., snags) wildlife would be benefitted. The evaluation matrix (Table 4-2) shows potential impact ratings for these alternatives as none or negligible: either adverse or beneficial impacts would be possible depending on the manner in which the alternatives were implemented in specific vegetation management projects.
Alternative 11	(B)	Similar to combination of Alternatives 2 and 3. Wildlife management (a biological method for control of vegetation) would also benefit wildlife if it becomes operational in BPA's program.
SOIL PRODUCTIVITY		
Alternative 1	(C)	There would be no impact because there would be no disturbance of vegetation or soils.
Alternative 2	(C)	Exclusive reliance on manual methods would cause negligible impacts on soils (see Chapter 7).
Alternative 3	(C)	Similar to Alternative 2. Use of persistent granular or pelletized herbicides may decrease soil productivity for a year or more. However, where future conversion of right-of-way lands to commodity production is possible, substitution of nonpersistent herbicides can prevent adverse impacts.
Alternative 4	(C)	Exclusive use of broadcast chemical methods would have no impact on right-of-way soils. No soil disturbance would occur. Plentiful cover of non-susceptible vegetation, plant litter, and standing stems of treated plants would remain to protect the soil surface. Nonpersistent herbicides could be used where persistent herbicides might affect future commodity production.
Alternative 5	(D)	Use of mechanical methods would have potential for adverse impacts to soil productivity (see Chapter 7). Use of manual methods in sensitive sites (i.e., steep slopes, erodible soils, near streams), however, could prevent the overall impacts of this alternative from being major.
Alternative 6	(C)	Only negligible impacts on soils would be possible, similarly to Alternatives 3 and 4.
Alternative 7	(D)	Similar to Alternative 5. Biological methods are experimental at this time and would have limited use over the near future. Therefore no substantial substitution for mechanical methods would be possible.
Alternative 8	(D)	Similar to Alternative 7, except that spot chemical methods would be available to reduce the extent to which mechanical methods were used and to substitute for mechanical methods in sensitive sites.
Alternative 9	(D)	Similar to Alternative 8. However, broadcast methods would be available for treatment of high density brush stands, allowing further reductions in use of mechanical methods. Some adverse impacts to soils would still be possible, even with minimal use of mechanical methods.
Alternative 10	(C)	Negligible impacts on soil productivity are anticipated from the preferred alternative. No mechanical methods would be used by BPA.
Alternative 11	(C)	Similar to a combination of Alternatives 2 and 3. Some biological methods may enhance soil productivity through fertilization and mulching (see Chapter 3).
TREATMENT COST		
Alternative 1	(C)	No action incurs no treatment costs.
Alternative 2	(E)	Exclusive reliance on manual methods alone would result in high total costs to treat and maintain transmission facility vegetation. Manual treatments are among the most costly for right-of-way brush control (see Table 3-4). The costs shown in Table 3-4 are for use of manual methods in relatively low density brush stands; costs to manually treat high density brush stands would be much higher. In addition, costs of manual methods available for noxious weed control, power pole protection, and substation weed control (i.e., hand-pulling and hoeing) are unknown but would probably be very high.

Table 4-3. Cont'd.

<u>Economic Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 3	(E)	Spot chemical treatments are also relatively expensive for right-of-way brush control (see Table 3-4). As with manual methods, BPA's experience is based on use of spot chemical treatments in low density brush stands. Costs for treatment of high density stands would be much higher. Spot chemical methods are relatively cost-efficient for treatment of noxious weeds and for power pole protection; use for substation weed control would be significantly cheaper than use of manual methods.
Alternative 4	(E)	Exclusive use of broadcast chemical treatments would be relatively costly. Although these methods are cost-effective for dense stands of target vegetation, they are cost-ineffective for low density stands.
Alternative 5	(E)	Cost data are not available for use of mechanical methods in right-of-way brush control, but it can be presumed to be relatively expensive compared to broadcast chemical methods. In addition, mechanical methods would not be applicable to BPA's need for weed control on rights-of-way and at substations (see Table 3-5). Therefore, very expensive hand-pulling and hoeing would be required on these sites.
Alternative 6	(D)	This alternative would allow use of broadcast chemical methods for high density brush control, for noxious weed control (i.e., where infestations are extensive), and for substation weed control. Spot chemical methods would be available for low density brush control, for power pole protection, and also for substation weed control. This combination of available methods would be relatively cost-efficient.
Alternative 7	(E)	Similar to Alternative 5. Although biological methods may be cost-efficient over the long run because of reduced frequency of maintenance, their experimental status would preclude cost estimation or extensive use in the near future.
Alternative 8	(E)	This alternative constitutes a combination of Alternatives 3 and 7, both relatively expensive in terms of treatment costs.
Alternative 9	(D)	The availability of broadcast chemical methods would allow cost-efficient treatment of high density brush stands, extensive noxious weed infestations, and substation yards. Manual methods would be used in sensitive sites and for low density brush. These would not be excessively costly applications for manual methods.
Alternative 10	(D)	The preferred alternative includes all treatment methods except mechanical. This broad availability of methods would allow selection of the most cost-effective treatment for each specific vegetation management project, given absence of other social, environmental, or management constraints.
Alternative 11	(E)	Similar to Alternatives 2 and 3. Cost and efficiency data are not available for biological methods; BPA research studies may provide such data in the near future.
EMPLOYMENT		
Alternative 1	(E)	No action would require no workers, causing a major adverse impact on the number presently employed by BPA in vegetation management.
Alternative 2	(A)	Exclusive reliance on manual methods would require substantially more workers than presently employed.
Alternative 3	(A)	Relative to present labor requirements, exclusive use of spot chemical methods would require substantially more labor.
Alternative 4	(D)	Use of broadcast chemical methods alone would require fewer workers than are now employed by BPA in vegetation management.
Alternative 5	(A)	Use of only manual and mechanical methods would require substantially more workers. Although mechanical methods involve fewer man-hours per acre treated than manual methods, the total acreage able to be treated mechanically would not be substantial. For example, sensitive sites (common in BPA's service area) as well as noxious weed infestations and substation yards would require manual treatments. Many more workers than are presently employed would be needed.
Alternative 6	(C)	This alternative, a combination of spot and broadcast chemical methods, would require approximately the same amount of labor as presently employed.

Table 4-3. Cont'd.

<u>Economic Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 7	(A)	Similar to Alternative 5. Long-term labor requirements of biological methods are unknown.
Alternative 8	(B)	Additional but not substantially more workers would be required for this alternative. Mechanical methods could be used to treat high density brush on gentle terrain and nonerodible soils. Spot chemical methods would be somewhat more efficient than manual methods, especially on sprouting species where more frequent retreatment by manual methods would be necessary.
Alternative 9	(C)	This mix of control methods would require approximately the same number of workers as at present. Broadcast chemical methods would be available for high density brush stands. Other high density stands could be treated with mechanical methods.
Alternative 10	(C)	Labor requirements of this, the preferred alternative, would be very similar to those of the present program.
Alternative 11	(A)	Similar to a combination of Alternatives 2 and 3. No data are available on employment impacts of biological methods.
ENERGY EFFICIENCY		
Alternative 1	(C)	No impact would occur since no energy would be expended or conserved.
Alternative 2	(E)	Manual methods would be fairly energy-efficient in low density brush stands where treatment units consisted of individual brush stems and access to each treatment unit was easy. In high density stands, the treatment unit would consist of the area occupied by target plants. Manual methods would have very low productivity rates in such stands, and many return trips into a given area would be required. Thus, with respect to BPA's overall management needs, manual methods exclusively would be expected to have high energy requirements (see Chapter 7).
Alternative 3	(E)	Spot chemical treatments using water carriers for herbicide mixtures would be highly energy-efficient for control of low density brush stands where individual stems were treated. If herbicides were applied in oil carriers, more than twice as much energy would be used. For high density brush stands, spot chemical treatments would be highly inefficient. To meet all BPA's vegetation management needs, this alternative would not be energy-efficient.
Alternative 4	(E)	If relied on exclusively, a program of only broadcast chemical methods would also be energy-inefficient. In high density brush stands (where a treatment unit is a unit of area), broadcast methods, whether aerial or ground-based, would be relatively efficient (see Chapter 7). However, where the unit of area is not fully occupied with target stems (i.e., a low density stand), broadcast methods would be inefficient because they waste energy in treating intervening areas with target plants. Low density stands would be more efficiently treated with spot chemical or manual treatments.
Alternative 5	(E)	In this alternative, manual methods would be available for treatment of low density stands and mechanical methods would be available for treatment of high density stands. Mechanical methods would be energy-inefficient for treatment of such stands, and could not be used on steep slopes or erodible soils. Manual methods would be inefficient for treatment of high density stands on these sensitive sites.
Alternative 6	(D)	Broadcast chemical methods would be energy-efficient in treating high density brush stands while spot chemical treatments using water carriers would be efficient for low density stands. Overall, this program alternative would have relatively low energy requirements.
Alternative 7	(E)	This combination of manual, mechanical, and biological methods would be similar to Alternative 5. Biological methods are experimental; their energy requirements over the long term are unknown at this time.
Alternative 8	(E)	This alternative would not have an energy-efficient method for treating high density stands. Spot chemical and manual methods would allow relatively efficient control of low density stands and sites where mechanical methods were not appropriate. Overall energy requirements would be high.
Alternative 9	(D)	Broadcast chemical methods would be available for efficient treatment of high density stands; manual methods would be available for relatively efficient treatment of low density stands and sensitive sites. Overall program energy requirements would be low.

Table 4-3. Cont'd.

<u>Management Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 10	(D)	Relatively energy-inefficient mechanical methods would not be available under this alternative. All other methods would be available and could be used in the manner that minimizes energy requirements (given that no other social, environmental, or economic constraints exist).
Alternative 11	(E)	Similar to a combination of Alternatives 2 and 3. Energy efficiency of biological methods is not known at this time.
LEGAL COMPLIANCE		
Alternative 1	(E)	The no-action alternative would fail to comply with the Federal Columbia River Transmission System Act which directs BPA to operate and maintain a reliable electrical transmission system for the Pacific Northwest (see Chapter 2).
Alternative 2	(A)	A program relying exclusively on manual methods could fully comply with all relevant federal, state and local laws.
Alternative 3	(A)	Full legal compliance would be possible, given that the BPA Transmission Line Maintenance Standard is observed (e.g., disposal of herbicide containers according to state and federal laws).
Alternative 4	(E)	Exclusive reliance on broadcast chemical treatments would not allow compliance with or would make compliance difficult with the following federal environmental requirements (see Chapter 8, ENVIRONMENTAL REQUIREMENTS): Endangered/Threatened (Plant) Species (if newly listed species were found on rights-of-way), Fish and Wildlife Conservation (conservation of riparian habitats and habitat diversity in general), Heritage Conservation (maintenance of visual quality near protected sites), Coastal Management Program Consistency (protection of visual quality and water quality in Coastal Zone), Wetlands (herbicide contamination), Farmlands (agricultural productivity adjacent to rights-of-way), Recreation Resources (visual quality at recreation sites), Permit for Right-of-Way on Public Lands (compliance with MOUs with public land management agencies), Clean Water Act (water quality), and Safe Drinking Water Act (water quality).
Alternative 5	(A)	Full legal compliance would be possible: manual methods could be substituted for mechanical methods at any sensitive sites subject to restrictions (e.g., endangered species locations, riparian habitats, wetlands, erodible soils or visual settings of recreation sites).
Alternative 6	(A)	Similar to Alternative 5; full legal compliance would be possible. Where broadcast chemical methods were restricted by federal, state or local regulations, spot chemical methods could be substituted.
Alternative 7	(A)	Similar to Alternative 5; full compliance would be possible.
Alternative 8	(A)	Similar to Alternatives 3 and 5.
Alternative 9	(A)	Similar to Alternatives 5 and 6; wherever broadcast chemical or mechanical methods were restricted, manual methods could be substituted.
Alternative 10	(A)	Full legal compliance would be possible, in that manual and directed chemical methods could be substituted wherever broadcast chemical methods were restricted.
Alternative 11	(A)	Similar to Alternatives 2 and 3.
TREATMENT EFFECTIVENESS		
Alternative 1	(E)	No action affords no control of vegetation.
Alternative 2	(B)	Exclusive use of manual methods would have low effectiveness at controlling vegetation, due to resprouting behavior of many target woody species. Also, many perennial weeds are capable of resprouting from root crowns or root pieces..
Alternative 3	(A)	Exclusive use of spot chemical methods would provide the most effective control among the available methods because these methods prevent resprouting. In addition, spot chemical application techniques (e.g., cut-stump, injection, basal-stem spray) would be highly efficient delivering herbicide to target plants (i.e., all applied herbicide reaches target plants).

Table 4-3. Cont'd.

<u>Management Evaluation Criteria</u>	<u>Potential Impact Category</u>	<u>Rationale</u>
Alternative 4	(B)	Use of only broadcast chemical methods would be less effective than use of spot chemical methods, due primarily to inadequate coverage by application equipment and due to resistance of certain target species to this form of herbicide treatment.
Alternative 5	(B)	This alternative would have low-to-moderate effectiveness because of lack of control of resprouting species by manual and mechanical methods.
Alternative 6	(A)	High effectiveness would be possible due to availability of spot chemical methods.
Alternative 7	(B)	Similar to Alternative 5. Effectiveness of biological methods is unknown at this time.
Alternative 8	(A)	Similar to Alternative 6. Spot chemical methods would be available.
Alternative 9	(B+)	Similar to Alternatives 4 and 5. Without spot chemical methods available, this program would lack a highly effective control method, especially for sprouting species and species resistant to aerial sprays.
Alternative 10	(A)	Similar to Alternative 6.
Alternative 11	(A)	Similar to Alternative 3; highly effective due to the availability of spot chemical methods. Long-term effectiveness of biological methods is not known; research has been underway for a relatively few years.
OPERATIONAL FLEXIBILITY		
Alternative 1	(E)	No action would be equivalent to having no methods available.
Alternative 2	(D)	No flexibility due to availability of manual methods only.
Alternative 3	(D)	No flexibility.
Alternative 4	(D)	No flexibility.
Alternative 5	(C)	Negligible flexibility; no efficient method would be available for control of substation or noxious weeds.
Alternative 6	(B)	Limited flexibility; only chemical methods would be available for use.
Alternative 7	(B)	Limited flexibility. Biological methods, either natural or artificial would be available. A partial complement of methods would be available for an integrated pest management strategy. Limited operational flexibility would exist.
Alternative 8	(B)	Similar to Alternative 7.
Alternative 9	(B)	Similar to Alternative 8.
Alternative 10	(A)	High operational flexibility due to availability of a full complement of control methods. Full IPM process would be possible.
Alternative 11	(B)	Limited operational flexibility. Manual and spot chemical methods are not well suited for high-density brush. A partial complement of methods would be available for an IPM strategy.

For example, for the legal compliance criterion, all action alternatives except Alternative 4 could fully comply with all legal requirements; thus, these nine alternatives were assigned to the most favorable category for that evaluation criterion (see Table 4-2). Alternative 4 (exclusive use of broadcast chemical methods) would not allow compliance with a number of federal laws because there would be no means to precisely control target vegetation at sensitive sites (see Table 4-3).

The number of times each alternative was assigned to the most favorable category for the various evaluation criteria is shown at the bottom of Table 4-2. A subtotal is shown for the number of times each alternative was assigned to the most favorable category for the environmental criteria (i.e., social and biophysical evaluation criteria).

On three evaluation criteria -- worker safety, treatment costs, and energy efficiency -- the No Action alternative alone was assigned to the most favorable category. The implementation of no vegetation management endangers no workers, entails no treatment cost, and requires no energy expenditure. However, the No Action alternative fails to meet BPA's underlying need for vegetation management, and thereby fails to comply with the Federal Columbia River Transmission System Act. Because of these deficiencies, the No Action alternative will not be compared further to the 10 action alternatives in the following discussions.

Five alternatives were assigned to the most favorable category eight or more times (out of the 14 evaluation criteria). Alternative 2 achieved this category eight times (of these, three on key evaluation criteria); Alternative 3 also achieved the most favorable category eight times (four on key criteria); Alternative 6 achieved it nine times (six on key criteria). Alternative 10 was assigned to the most favorable category 12 times with eight of these for the eight key evaluation criteria. Alternative 11 achieved the most favorable category nine times with four of these on key criteria. These five alternatives (2, 3, 6, 10, and 11) will be compared in detail in the following paragraphs. The other five action alternatives (i.e., 4, 5, 7, 8, 9) were assigned to the most favorable category fewer times (seven or less) for the 14 evaluation criteria.

The number of assignments to most favorable categories also can be used to identify the most environmentally preferable alternative. As recommended by CEQ (46 FR 18028), the alternative that causes least damage to biophysical resources and that best protects social resources is

environmentally preferable. In Table 4-2, social and biophysical criteria together constitute environmental evaluation criteria.

Three alternatives, 2, 10 and 11, were assigned to the most favorable categories (for the eight environmental criteria) a total of six or more times each. Alternative 2 was assigned to the most favorable category for two of the four key criteria, public health and water quality and fisheries. Alternative 10 was assigned to the most favorable category for all four key criteria, public health, water quality and fisheries, worker safety, and public acceptability. Alternative 11 was assigned to the most favorable category for two of the key criteria, public health and water quality and fisheries. Alternative 10 is judged, therefore, the environmentally preferable program alternative.

Alternative 10, the preferred alternative, was assigned to the most favorable category the highest number of times for all evaluation criteria (i.e., environmental plus economic and management criteria). Paired comparisons between Alternative 10 and each of Alternatives 2, 3, 6, and 11 are shown in Table 4-4. The vertical columns of Table 4-4 represent high, moderate, and low importance evaluation criteria. For each of Alternatives 2, 3, 6, and 11, the three horizontal rows indicate the criteria for which Alternative 10 was placed in more favorable, equal, or less favorable categories in the evaluation matrix (Table 4-2). Using this display, we can identify for what criteria Alternative 10 may be preferable, for what criteria no preference is evident, and for what criteria other alternatives may be preferable.

A common procedure for comparing alternatives in an environmental assessment document is to multiply weightings by impact scores and then to add the products across all evaluation criteria for each alternative. Such an arithmetic procedure for comparing alternatives has a number of problems associated with it. It is of questionable validity to sum weighted impacts across different types of criteria (e.g., worker safety and energy efficiency). Such a procedure also tends to conceal or diminish individual types of impacts in the overall impact aggregation process. Finally, an arithmetic procedure substitutes values of the alternative evaluation team for those of decision makers.

In this EIS, the number of times each alternative is assigned to the most favorable impact category (Table 4-2) is used as the basis for identifying alternatives to be compared in detail (Table 4-4). Ideally, the most preferable alternative would be the alternative that is assigned

Table 4-4. Comparison of Alternative 10 to Alternatives 2, 3, 6 and 11
Showing Evaluation Criteria for Which Alternative 10 is More
Preferred, Equally Preferred, or Less Preferred

Compared to:	Alternative 10 (Manual, Biological, Spot Chemical, and Broadcast Chemical Methods)		
	High Importance (Key) Evaluation Criteria	Moderate Importance Evaluation Criteria	Low Importance Evaluation Criteria
Alternative 2 (Manual Methods Only)	<u>More Preferred</u> Worker safety Public acceptability Treatment cost Treatment effectiveness Operational flexibility		Energy efficiency
	<u>Equally Preferred</u> Public health Water quality and fish Legal compliance	Land use Soil productivity	Visual, historical and cultural resources
	<u>Less Preferred</u>	Plants and animals Employment	
Alternative 3 (Spot Chemi- cal Methods Only)	<u>More Preferred</u> Public Acceptability Treatment cost Operational flexibility	Land use	Energy efficiency
	<u>Equally Preferred</u> Public health Worker safety Water quality and fish Legal compliance Treatment effectiveness	Soil productivity	Visual, historical and cultural resources
	<u>Less Preferred</u>	Plants and animals Employment	
Alternative 6 (Spot Chemi- cal and Broad- cast Chemical Methods)	<u>More Preferred</u> Public health Public acceptability Operational flexibility	Land use	
	<u>Equally Preferred</u> Worker safety Water quality and fish Treatment cost Legal compliance Treatment effectiveness	Plants and animals Employment Soil productivity	Visual, historical and cultural resources Energy efficiency
	<u>Less Preferred</u>		
Alternative 11 (Manual, Biological, and Spot Chemical)	<u>More Preferred</u> Worker safety Public acceptability Treatment cost Operational flexibility		Energy efficiency
	<u>Equally Preferred</u> Public health Water quality and and fish Legal compliance Treatment effectiveness	Land use Soil productivity	Visual, historical and cultural resources
	<u>Less Preferred</u>	Plants and animals Employment	

to the most favorable impact categories for all evaluation criteria. Five alternatives were assigned to the most favorable category for eight or more of the 14 criteria; these are the subjects of detailed comparisons.

The comparison procedure of Table 4-4 shows explicitly the evaluation criteria and the relative impact categories for which the program alternatives are similar and for which they differ. Reviewers and decisionmakers can see clearly the trade-offs in types and extent of potential impacts that are involved in selecting one program alternative over another.

In comparison to Alternative 2 (the program based exclusively on manual methods), Alternative 10 is preferable for key criteria of worker safety, public acceptability, treatment cost, treatment effectiveness, and operational flexibility (Table 4-4). The two alternatives are equal for key criteria of public health, water quality and fisheries, and legal compliance. Alternative 2 is not preferable to Alternative 10 on any key criterion. Alternative 2 is preferable to Alternative 10 on two criteria of moderate importance (i.e., plants and animals, and employment). Alternative 2 is not preferable to Alternative 10 on any of the low importance criteria. The equivalence of these alternatives for criteria of public health, and water quality and fisheries assumes all chemical methods (Alternative 10) would be used in strict accordance with instructions and constraints in the BPA Transmission Line Maintenance Standard.

Alternative 10 is preferable to Alternative 3 (the alternative based exclusively on spot chemical methods) on key criteria of public acceptability, treatment cost, and operational flexibility. The two alternatives are equal on public health, worker safety, water quality and fisheries, legal compliance and treatment effectiveness. Alternative 3 is more preferred than Alternative 10 only with respect to criteria of moderate importance (i.e., plants and animals, and employment).

In comparison to Alternative 6 (based on a combination of broadcast chemical and spot chemical methods), Alternative 10 is superior with respect to public health, public acceptability, and operational flexibility among the eight key criteria; the two alternatives are equal for the other five key criteria. Alternative 6 is not preferable to Alternative 10 on any of the criteria.

Alternative 10 is preferable to Alternative 11 (manual, biological, and spot chemical methods) on key criteria of

worker safety, public acceptability, treatment cost, and operational flexibility. The two alternatives are equally preferred on other key criteria. Alternative 11 is preferable to Alternative 10 on two criteria of moderate importance (i.e. plants and animals and employment).

This paired comparative analysis supports the selection of Alternative 10 as BPA's preferred vegetation management program. Alternative 10 is the use of manual, biological, spot chemical, and broadcast chemical methods according to the instructions and constraints described in BPA's Transmission Line Maintenance Standard, with site-specific method selection according to the principles of Integrated Pest Management. Given that the Maintenance Standard and IPM principles are strictly observed, Alternative 10 is superior or equal to the four next best alternatives on all eight key evaluation criteria and on most of the moderate and low importance criteria.

On two criteria of moderate importance, plants and animals, and employment, Alternative 10 is less preferable. Alternative 10 is less preferable with respect to plants and animals primarily due to its potential adverse impacts on nontarget plants and therefore on wildlife habitat on rights-of-way (Alternative 10 has no known adverse impacts on Threatened or Endangered plants or wildlife). If vegetation control methods are selected and implemented to maintain and enhance the occurrence of nontarget plants on rights-of-way and thereby enhance wildlife habitat, Alternative 10 would be equally preferable to Alternatives 2, 3, and 11 for this criterion.

Under Alternative 10, nontarget plants can be maintained and enhanced in several ways. Most importantly, use of broadcast chemical methods can be restricted to dense, uniform stands of target shrub or tree species and can be used only with narrow-spectrum herbicides to which only target species are susceptible. If this is done, only target species would be controlled, and nontarget species of grasses, broadleaf forbs, and shrubs would be favored. Habitat diversity would increase for wildlife; space would be produced for growth of nontarget plants.

The level of employment provided by Alternative 10 can be increased by increasing the use of manual and spot chemical methods and decreasing the use of broadcast chemical methods. Increased use of manual methods may result in decreased worker safety unless manual methods are carefully implemented to minimize hazards (e.g., use manual methods only on accessible sites, increase worker safety instruction). Increased use of both manual and spot chemical

methods would result in increased treatment costs which would have to be balanced against BPA budget limitations for vegetation management.

Mitigation Measures

Mitigation measures are taken to avoid, compensate for, rectify, or reduce the identified adverse impacts of a proposed action. A number of measures to mitigate potential impacts of BPA's vegetation management program are incorporated in the preferred alternative and are described in BPA's Transmission Line Maintenance Standard. These measures minimize identified potential impacts of BPA's vegetation control methods (e.g., hazards to public health and water quality). In the preceding evaluation and comparison of alternatives, it is assumed that mitigation measures described in the Maintenance Standard will be implemented in conjunction with BPA vegetation management.

In addition to the mitigation measures already incorporated in the preferred alternative, other mitigation measures not included in the proposed action or alternatives, but which could further reduce the likelihood of adverse impacts, have been identified. Both types of mitigation measures are listed in Table 4-5. Mitigation measures are listed by the types of alternative control methods to which they apply. For example, some measures apply to the overall manner in which the vegetation management program is conducted; therefore, they apply to all control methods. Other measures apply specifically to one type of control method.

Each mitigation measure pertains to one or more potential impacts as identified in Table 4-5. A number of the measures would mitigate all potential program impacts by making vegetation management by BPA unnecessary (e.g., multiple use agreements with landowners) or by requiring more documentation of program decision making. Where mitigation measures are applicable to particular types of impacts, additional information is available in the respective sections of Chapter 7, ENVIRONMENTAL CONSEQUENCES. The types of potential impacts indicated in Table 4-5 also correspond to the evaluation criteria used in the previous section.

The mitigation measures not included in the proposed action or alternatives are denoted by asterisks in Table 4-5. The following paragraphs discuss these identified measures and evaluate their effectiveness in mitigating potential impacts.

Table 4-5. Mitigation Measures Incorporated in the Preferred Alternative and Other Mitigation Measures Identified by this Study, (but not Included in the Proposed Action or Other Alternatives)¹

DESCRIPTION OF MITIGATION MEASURES AND MANAGEMENT REQUIREMENTS:		Potential Impacts to Which Mitigation Measure Applies
<u>ALL METHODS:</u>		
1. Follow all applicable federal and state laws and regulations in conducting vegetation management treatments. (See MS ²).		o All
2. Allow vegetation to grow on rights-of-way that does not conflict with BPA's underlying need for vegetation management; for example, allow tall-growing plants in canyons where no possibility exists for violation of transmission line clearance criteria (see MS).		o All
3. Select treatments for specific sites based on consideration of sociological, economic, and ecological consequences; that is, use an IPM decision-making process; high importance concerns are public health, worker safety, water quality, and treatment cost; also important are adjacent land uses and wildlife habitat. (See Chapter 2 section on <u>Purposes of EPA's Vegetation Management Program</u>).		o All
4. Coordinate vegetation control activities with managers and administrators of parks, recreation areas, scenic areas, historical sites, and other high public use areas in proximity to transmission facilities (see MS).		o Land Uses o Visual Resources o Historical & Cultural Resources
5. Establish Memoranda of Agreement with land management agencies whose lands are crossed by transmission facilities to cooperatively develop vegetation management plans. (See Chapter 8 section on <u>Permit for Right-of-Way on Public Land</u>).		o All
6. Establish agreements with landowners to facilitate compatibility of vegetation management activities with landowner objectives; for example, where appropriate, agreements may specify exclusion of all herbicides, type or application technique of herbicide treatments, type of other control methods, timing of control treatments, or notification before herbicide applications; agreements may be formal (see below) or informal (see MS).		o All
7. Establish multiple use agreements with landowners (e.g., "tree and brush control agreements", "Christmas tree agreements") to formally designate landowners responsible for right-of-way vegetation management subject to BPA clearance and access criteria (see Chapter 3 and MS).		o All
8. Maintain right-of-way vegetation at highway crossings and recreation sites (e.g., stream crossings) with appearance as high priority objective; maintain vegetation screens at such critical viewpoints, use topping or pruning of trees as appropriate (see MS).		o Visual Resources o Land Uses
9. Cooperate with adjoining landowners and local Weed Control Districts to control and/or eradicate noxious weed infestations on rights-of-way in accordance with landowner agreements, and federal, state and local laws (see MS).		o Land Uses
10. Prepare Daily Brush and Weed Control Reports (BPA Form No. 307) for all vegetation management projects to record all data necessary to document control treatments (e.g., treatment site location; control method; herbicide formulation, application rate, and application technique; weather conditions; unusual conditions) (see MS).		o All

¹Mitigation measures not included in the proposed action or alternatives are indicated by asterisks.

²For details of this measure, see BPA Transmission Line Maintenance Standard.

Table 4-5. Cont'd.

	DESCRIPTION OF MITIGATION MEASURES AND MANAGEMENT REQUIREMENTS:	Potential Impacts to Which Mitigation Measure Applies
<u>ALL METHODS:</u>		
11.	Strictly observe all safety instructions in the BPA Transmission Line Maintenance Standard; conduct worker safety instruction for BPA workers (especially for use of manual methods) (see MS).	o Worker Safety
12.	Provide opportunity for public review of BPA's transmission facilities vegetation management program by means of public and agency review of this program EIS as well as environmental assessments tiered to the program EIS (see Chapter 1). The public involvement effort included an extensive direct mailing of the environmental documents, use of the news media to announce the availability of the program EIS, and the establishment of public information centers during the review period for the program EIS.	o Public Acceptability
13.	Continue research and field tests of new control methods and new herbicides; document study design, before and after site evaluations, and effectiveness on vegetation; maintain documentation in a form suitable for public review; in particular, document frequency of treatment required for each method or herbicide tested (see MS).	o All
14.	Continue periodic contact with U. S. Fish and Wildlife Service Endangered Species Offices to monitor additions to Threatened/Endangered Species lists and new locations or habitats of previously listed species that may be affected by vegetation management activities.	o Plants and Animals
*15.	Use properly-sized equipment and motor vehicles and keep it in proper adjustment to minimize energy requirements (see Chapter 7 section on <u>Energy Requirements</u>).	o Energy Requirements
*16.	Improve management guidelines for selection of treatment methods for each management unit; document guidelines in instructional memoranda between Branch of Transmission Line Maintenance and Area Operations and Maintenance Managers; for each treatment method, herbicide formulation, herbicide application rate, and herbicide application technique, indicate generic situations where each method, etc. is appropriate, where it is not appropriate, and where it may be appropriate given special circumstances or precautions (see discussion in Chapter 4).	o Public Acceptability
*17.	Document rationale for selection of treatment method for each management unit (see discussion in Chapter 4).	o Public Acceptability
*18.	Investigate feasibility of establishing a cost-sharing program whereby landowners are reimbursed for maintaining right-of-way vegetation on their lands, in order to stimulate greater participation of landowners in multiple use agreements (see Chapter 3).	o All
*19.	Work to establish Memoranda of Agreement with state and local land use planning entities; in cooperation with them, explore possibility of determining generic compatibility of routine, on-going vegetation management activities with land use plans, policies, and controls (e.g., coastal zone management) (see Chapter 8).	o Land Use Plans, Policies and Controls
*20.	Encode information regarding locations of threatened and endangered species (particularly plants) into ROWDATA inventory system and other appropriate planning tools if such species become known on BPA rights-of-way; encode information regarding locations of cultural resource sites into ROWDATA system to ensure protection during vegetation management activities.	o Plants and Animals o Historical and Cultural Resources
<u>CHEMICAL METHODS:</u>		
21.	Follow all applicable federal and state laws including EPA - and state-approved herbicide labels; for example, follow mixing instructions on herbicide labels carefully (see MS).	o Public Health o Worker Safety o Land Use o Water Quality o Plants and Animals o Legal Compliance

Table 4-5. Cont'd.

DESCRIPTION OF MITIGATION MEASURES AND MANAGEMENT REQUIREMENTS:		Potential Impacts to Which Mitigation Measure Applies
<u>CHEMICAL METHODS:</u>		
22. Allow herbicides to be applied only by licensed applicators or under the <u>direct supervision</u> of licensed applicators as required by state law (see MS).		- o Public Health - o Worker Safety - o Land Use - o Water Quality - o Legal Compliance
23. Mix all herbicides on rights-of-way, within substations, or at other acceptable sites to minimize risks of inadvertent spills (see MS).		o As Above
24. Strictly observe buffer zones at all bodies of water (e.g., streams, ponds, wetlands, springs, seeps) as follows (see MS).		- o Water Quality - o Plants and Animals (Riparian Habitat) - o Legal Compliance
<u>Method of Application</u>	<u>Buffer Zone to Water Body (minimum horizontal distance)</u>	
Spot Chemical		
- Basal-stem spray	10 feet	
- Cut-stump treatment	10 feet	
- Frill or injection	10 feet	
- Pellets or granules	10 feet	
- Foliage spray	50 feet	
Broadcast Chemical		
- Ground-based foliage spray	50 feet	
- Aerial foliage spray	100 feet	
25. Carefully monitor weather conditions (i.e., wind, precipitation, temperature, humidity) before and during herbicide applications to prevent drift, volatilization, leaching, or surface runoff of applied herbicides (see MS).		- o Public Health - o Worker Safety - o Land Use - o Water Quality - o Legal Compliance
26. Monitor herbicide residues in soil and water when requested appropriately by land management agencies, landowners, and the Areas to identify patterns of herbicide persistence and mobility at sensitive sites (see MS).		- o Water Quality - o Land Use - o Public Health
27. Strictly observe all Maintenance Standard and label instructions for handling, storage, and disposal of herbicides and herbicide containers (see MS).		- o Public Health - o Water Quality - o Land Use - o Worker Safety - o Legal Compliance
28. Strictly observe Maintenance Standard instructions for handling of "minor" spills and "major" spills; for major spills, follow specified procedures for cleanup, disposal, notification of landowner and state and federal agencies, and certification of compliance from agencies (see MS).		- o Public Health - o Water Quality - o Land Use - o Worker Safety - o Legal Compliance

Table 4-5. Cont'd.

DESCRIPTION OF MITIGATION MEASURES AND MANAGEMENT REQUIREMENTS:		Potential Impacts to Which Mitigation Measure Applies
<u>CHEMICAL METHODS:</u>		
29. Carefully consider land uses adjacent to treatment sites (e.g., commercial crops, recreation grounds) when prescribing and implementing chemical treatments (see MS).		o Public Health o Land Uses
30. Inspect right-of-way prior to herbicide application for presence of domestic animals if herbicide label restricts grazing, if such herbicides are planned for use, notify landowners prior to application to allow confinement of livestock away from right-of-way (see MS).		o Land Use
31. Do not use oil carriers in foliar herbicide applications to avoid oil hazards to wildlife (small birds and mammals, in particular) and to reduce energy requirements of chemical methods (see Chapter 7).		o Plants and Animals o Energy Requirements
32. Conduct herbicide applicator training to ensure proper application rates and herbicide placement are used; inspect herbicide operations to ensure proper implementation.		o Public Health o Water Quality o Land Uses
*33. Monitor the fate of herbicides in groundwater and surface water at substations where herbicides are used at high application rates; also, several of the herbicides used at substations for total weed control are persistent in soil and mobile in waters; where substations are located over water supply aquifers (e.g., Spokane Valley - Rathdrum Prairie Sole Source Aquifer) depths to the groundwater table should be established and soil permeability analyzed in order to estimate likelihood of groundwater contamination (see Chapter 7 section on Public Health).		o Public Health o Water Quality o Land Use
<u>BROADCAST CHEMICAL METHODS:</u>		
34. Strictly observe all requirements and measures to minimize drift and volatilization from broadcast applications (both aerial and ground-based) including monitoring of weather conditions (wind, temperature humidity, and likelihood of precipitation) and use of drift control measures (see MS).		o Water Quality o Land Use o Public Health
35. Inspect aerial applicators and applications to ensure BPA's spray delivery specifications are satisfied by contractors (see MS).		o Public Health o Water Quality o Land Use
36. Inspect right-of-way immediately prior to broadcast applications (especially aerial) to disclose presence of people (e.g., ORV operators, hunters, hikers, berry pickers, woodworkers) (see MS).		o Public Health
37. Observe 10-foot buffer zones between broadcast (aerial) applications and right-of-way edges to minimize impacts on adjacent vegetation (see MS).		o Land Use
38. Avoid broadcast applications adjacent to susceptible crops or ornamental plantings where any likelihood of nontarget damage exists (see MS).		o Land Use
39. Avoid use of broadcast applications in high sensitivity landscapes where temporary brown-out of vegetation is unacceptable (see MS).		o Visual Resources
40. Restrict use of broadcast chemical methods primarily to remote areas with limited access, where no possibility of water supply contamination exists, and where vegetation brown-out is acceptable (see MS).		o Public Health o Water Quality o Visual Resources
*41. Flag edges of stream buffer zones to ensure that helicopter operators recognize their presence during aerial applications; monitor a sample (e.g., 10 percent) of stream buffer zone edges using spray deposit paper to evaluate observance of edges by aerial applicators (see Chapter 7 section on <u>Water Quality and Fisheries</u>).		o Water Quality o Public Health o Land Use

Table 4-5. Cont'd.

DESCRIPTION OF MITIGATION MEASURES AND MANAGEMENT REQUIREMENTS:	Potential Impacts to Which Mitigation Measure Applies
<u>BROADCAST CHEMICAL METHODS:</u>	
*42. To ensure no aerial application within 100-foot stream buffer zone, require shutoff of spray delivery system 150 feet from stream (spray delivery specifications allow 50 feet for system to achieve dripless shutoff) (see Chapter 3 and Chapter 7 section on <u>Water Quality and Fisheries</u>).	o Water Quality
*43. Use broadcast chemical methods primarily on high density, uniform stands of target species in order to minimize energy requirements per target stem treated, in order to avoid treatment of nontarget plants, and in order to diversify wildlife habitat conditions (also see MS) (see Chapter 7 sections on <u>Energy Requirements</u> and <u>Wildlife</u>).	o Energy Requirements o Plants and Animals
*44. Eliminate use of 2,4-D ester formulations where any danger of contaminating water bodies exists, due to toxic effects on aquatic organisms (see Chapter 7 section on <u>Water Quality and Fisheries</u>).	o Water Quality
<u>SPOT CHEMICAL METHODS:</u>	
45. Avoid application of granular or pelletized herbicides to ground that may be subsequently planted to crops (see MS).	o Land Use
46. Avoid soil surface applications of herbicides where water table is high, where leaching or surface runoff is possible, when ground is frozen, or when heavy precipitation is expected (see MS).	o Water Quality o Land Use
*47. Use primarily on accessible, low-density stands or target species in order to maximize energy efficiency and worker safety (see Chapter 7 sections on <u>Public Health and Occupational Safety</u> and <u>Energy Requirements</u>).	o Energy Requirements o Worker Safety
*48. In riparian areas, retain adequate shading of streams to prevent elevated stream temperatures (see Chapter 7 section on <u>Water Quality and Fisheries</u>).	o Water Quality and Fisheries
*49. Where spot chemical methods are used to control high density target vegetation (e.g., in stream or cropland buffer zones), implement treatment in a way that enhances wildlife habitat diversity (see Chapter 7 section on <u>Wildlife</u>).	o Plants and Animals
<u>MANUAL METHODS:</u>	
50. When cutting shrubs, cut short, flat stumps to minimize worker hazards of tripping and puncture wounds (see MS).	o Worker Safety
51. Use spark arresters on equipment and have fire suppression equipment accessible during all cutting treatments (see MS).	o Worker Safety
52. Chip or lop-and-scatter debris from cutting treatments to prevent fire hazard and to improve visual quality (see MS).	o Visual Resources o Land Use
53. Remove all felled trees and limbs from streams or watercourses (see MS, page 2-8).	o Water Quality
*54. In riparian areas, retain adequate shading of streams to prevent elevated stream temperatures.	o Water Quality and Fisheries
*55. Implement manual treatments in a way that enhances wildlife habitat diversity (e.g., use cut-stump herbicide treatments to prevent dense sprout stands from forming).	o Plants and Animals

Energy Conservation Potential. As identified in the Chapter 7 section on Energy Requirements, a major focus for energy conservation should be to ensure properly-sized and properly-maintained vehicles and equipment are used in vegetation management. This will also enhance equipment safety and reliability.

Treatment Selection Guidelines. Documentation is important when a public agency is undertaking actions that a significant segment of the public perceives as potentially hazardous, even if they are not. By documenting what factors and reasoning led an agency to take a particular action, as opposed to alternative actions, it can avoid or lessen the impact of its actions on public acceptability.

Public acceptability of BPA's vegetation management activities may be enhanced by further documentation of how individual treatments are selected. At the program level, documentation can be provided by the institution of management guidelines for treatment selection, showing generically the types of situations for which each treatment method is appropriate, or conditionally appropriate given special circumstances or precautions. Management guidelines can be developed by BPA's Branch of Transmission Line Maintenance and issued in the form of a memorandum of procedures to Area vegetation management personnel. The guidelines would incorporate the provisions of BPA's Maintenance Standard and the mitigation measures listed in Table 4-5. (Present guidelines as provided for in the Maintenance Standard are described in Chapter 5.)

The guidelines need not limit the flexibility of BPA's vegetation management program more than is necessary to protect social, environmental, and economic concerns of the public. They would document, however, generally how treatment selections are made, and thereby show that method selection is rational and predictable, and not arbitrary.

Treatment Rationale for Specific Projects. On the site-specific project level, treatment selection can be documented easily using BPA's ROWDATA computer-based information system (see Chapter 5). A coding system can be developed to indicate what condition of target vegetation (e.g., high density hardwoods, low density conifers), or what environmental, social, or economic constraints triggered selection of a particular control treatment. This would document that an IPM decision process is being implemented on a site-specific basis in BPA's vegetation management program. (See Chapter 2 for definition of IPM decision making.)

Maintenance Cost-Sharing. Utilities in some parts of the United States have undertaken programs whereby cost-sharing payments are made to landowners for maintenance of right-of-way vegetation (see Chapter 3). Such programs may be successful in increasing the number and decreasing the defaulted proportion of multiple use agreements. Payments to landowners would be limited by BPA's typical costs for vegetation control less an amount necessary to administer the program. Investigation of the feasibility of such a cost-sharing program may be an appropriate mitigation for perceived impacts.

Agreements with Land Use Planning Entities. BPA's routine vegetation management activities can be implemented in a way that is fully compatible with existing land use plans, policies, and controls. To avoid the necessity of annual determinations of consistency by land use planning entities, BPA might establish memoranda of agreement documenting generic compatibility of its vegetation management program with state and local land use plans (e.g., local comprehensive plans under state coastal zone management legislation) (see Chapter 7, Land Use Plans, Policies and Controls).

Endangered and Threatened Species. A number of plant and animal species are currently being studied for possible future designation as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS). Also, new locations for presently listed species may be found. To avoid potential impacts to newly listed species or newly found habitats, BPA will continue periodic contact with USFWS Endangered Species Offices. In the eventuality that a newly-listed plant or animal is found on BPA rights-of-way, information on its location and critical habitat may be encoded on the ROWDATA system for the particular management units involved (see Chapter 5).

Water Monitoring at Substations. The surface and ground-water fate of herbicides used for substation weed control has not been studied. Several of the herbicides used for these treatments are not only persistent in soil (a desirable feature for total vegetation control) but are also mobile in water (see Chapter 7, Public Health). Substation weed control requires high herbicide application rates. Although no cases of public health or water quality hazards are known, more study is required to determine the fate of these herbicides in surface and groundwater. Particular attention needs to be given to substations located over water supply aquifers. Depths to water tables may be

determined and likelihood of herbicide leaching to water tables may be estimated. For example, subsoil materials can be analyzed to study permeability rates to groundwater levels, given sufficient time for downward migration under the range of possible climatic conditions (e.g. maximum post-application precipitation). Likewise, the patterns of surface water flow to adjacent lands need to be studied.

Flagging of Water Buffer Zones. Accidental direct broadcast application to water bodies is the primary route for herbicide contamination of water (see Chapter 7, Water Quality). To minimize this possibility, edges of 100-foot-wide stream buffer zones might be flagged during aerial applications to ensure that helicopter operators recognize their presence. Observance of buffer zone edges can be evaluated using spray deposit cards on a random sample (e.g., 10 percent) of the edges. BPA inspection personnel may be suitable to perform this mitigation measure, depending on accessibility to flagging points and buffer zone edges.

Aerial Spray System Shutoff. BPA aerial spray delivery specifications for all aerial application contracts require complete system shutoff within 50 feet in the direction of helicopter travel (see Chapter 3). To avoid spray deposition within stream buffer zones, system shutoff may be required 150 feet from the stream or water body. This measure would further minimize any possibility of accidental direct application to water bodies.

High Density, Uniform Brush Stands. Energy efficiency of broadcast methods is maximized when treatment sites are fully occupied by target brush species (see Chapter 7, Energy Requirements). Broadcast treatment of sites occupied only partially by target species expends unnecessary energy in treating intervening nontarget plants. Broadcast chemical methods should be used primarily on high density, uniform brush stands. Such stands have low habitat diversity and therefore support low wildlife species diversity and abundance. Control by broadcast methods will open up growing space for nontarget plants, increasing habitat diversity (see Chapter 7, Wildlife).

2,4-D Ester Formulations. Herbicide formulations containing 2,4-D esters as active ingredients may be toxic to aquatic organisms if directly applied to slow-moving streams or water bodies (see Chapter 7, Water Quality and Fisheries). Accidental direct applications are highly unlikely, given

strict observance of stream buffer zones. An additional protection measure, however, is to avoid use of 2,4-D esters where there is any possibility of contaminating water bodies.

Low-Density Brush Stands. Spot chemical methods are relatively energy efficient when used to control low-density stands of target species, particularly if oil carriers are not used in foliar applications of herbicides. These methods are energy inefficient if used to treat high density stands (see Chapter 7, Energy Requirements). In addition, occupational hazards of spot chemical methods (e.g., site hazards) are greater in treating high density stands, particularly if inaccessible sites requiring much travel on poor roads are treated. Thus, impacts of spot chemical methods on energy requirements and worker safety can be mitigated by limiting their use to accessible, low-density stands of target species.

Stream Shading. Under current BPA practice, spot chemical methods and manual methods are used where it is necessary to control vegetation within stream buffer zones left untreated by broadcast chemical methods. To avoid excessive sunlight exposure and therefore elevated water temperatures, adequate vegetation shade may be retained over small streams.

Habitat Diversity. In various types of sensitive sites (e.g., stream or cropland buffer zones) where use of broadcast chemical methods is restricted, spot chemical or manual methods would be required to treat high density target vegetation. In these situations, these methods can be used in a manner that enhances wildlife habitat diversity. Specifically, they may be used to break up high density stands into patches of tall shrubs, low shrubs, grasses, and broadleaf forbs. Particularly where sprouting species are controlled, measures may be taken (e.g., cut-stump applications) to prevent uniform resprouting and thereby re-creation of dense, monotypic, inaccessible brush stands (see Chapter 7, Wildlife).

Other Mitigation Measures

In addition to the mitigation measures described in the preceding section, several other measures have been considered by this study.

Elimination of phenoxy herbicides (i.e., 2,4-D and 2,4-DP) and elimination of picloram from BPA's vegetation management

program have been suggested. Careful analysis of their toxicological properties, their pattern of use by BPA, the constraints on their use incorporated in the BPA Maintenance Standard, and the additional mitigation measures suggested in this section indicates that their elimination is not justified. Both the two phenoxy herbicides proposed for use by BPA, as well as picloram have low orders of toxicity and do not accumulate in the environment (see Appendix A, Herbicide Background Statements). In addition, observance of use constraints and mitigation measures ensures minimal likelihood of exposing streams, off-site areas, or nontarget organisms.

"Feathering" has been suggested as a mitigation measure for the creation and maintenance of "unnatural" right-of-way edges in forested high-sensitivity landscapes (see Chapter 7 section on Visual Resources). BPA may practice "feathering" of right-of-way edges in exceptional situations. However, as a generally-practiced mitigation measure, "feathering" is not included in BPA's proposed vegetation management program for several reasons: (1) more frequent inspection and treatment is necessary to prevent violation of conductor clearance criteria by trees left along right-of-way edges, (2) wider rights-of-way are required to allow creation of open areas projecting into adjacent forest (adjacent landowners may object to this if the land is in timber production), and (3) selective control techniques (i.e. spot chemical and manual treatments) necessary to create and maintain feathered edges are inefficient and impractical in the remote areas typical of high sensitivity landscapes.

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MANAGEMENT SITUATION



Chapter 5

MANAGEMENT SITUATION

Organization of Vegetation Management Effort

The BPA system is separated into four Areas for purposes of administration and implementation of operations and maintenance activities (see Figure 2-1). The Puget Sound Area (headquartered in Seattle) and the Lower Columbia Area (headquartered in Portland) administer BPA's facilities west of the Cascade Mountains crest. The Upper Columbia Area (headquartered in Spokane, Washington) encompasses most of eastern Washington, the northern third of Idaho, and Montana west of the Continental Divide. The Upper Columbia Area will also extend east of the Continental Divide if a proposed transmission line to Garrison, Montana is built. The Snake River Area (headquartered in Walla Walla, Washington) administers BPA facilities in southeastern Washington, eastern Oregon, southern Idaho, two counties of Wyoming, and the extreme northeastern corner (Modoc County) of California.

BPA's vegetation management program is conducted under the direction of the four Area offices located in Seattle, Portland, Spokane, and Walla Walla. The Transmission Maintenance Superintendent in each Area office is responsible for the design and implementation of vegetation management activities. Each superintendent is assisted by a right-of-way maintenance specialist, trained in vegetation management.

The Branch of Transmission Line Maintenance (BTLM), a subdivision of BPA's Division of Maintenance, located in Vancouver, Washington is responsible for vegetation management research and testing, program standards, and guidelines for development of Area management programs. The BTLM staff provides technical assistance in various aspects of vegetation management and develops the BPA Transmission Line Maintenance Standard (No. 63040-50), designed as a field manual for carrying out right-of-way maintenance. The standard describes approved vegetation management practices, the manner in which they shall be conducted, and measures to be taken to protect the environment, the public, and maintenance workers.

Development of Vegetation Management Prescriptions

Vegetation management prescriptions specify the techniques, timing, and constraints for vegetation control activities on each specific segment of right-of-way or at each substation. BPA's Area right-of-way management specialists are responsible for selecting management prescriptions and for overseeing their implementation in accordance with the BPA Maintenance Standard. The BTLM assists in developing management prescriptions.

Tiered environmental analyses, prepared subsequently to this EIS, will examine in greater detail the environmental effects of specific kinds of management prescriptions. A tiered environmental analysis will be prepared on each of the following:

1. right-of-way vegetation management east of the Cascades,
2. right-of-way vegetation management west of the Cascades,
3. substation vegetation management east of the Cascades, and
4. substation vegetation management west of the Cascades.

For details of the process by which the environmental analyses are "tiered" onto this program EIS, see Chapter 1 and the Chapter 8 section on the National Environmental Policy Act.

Development of management prescriptions is a five-step process as described in the following paragraphs.

1. Field Inspections. At periodic intervals, helicopter observers fly aerial surveys of transmission lines to observe any developing problems with tall-growing vegetation and to monitor potential danger trees on lands adjacent to the right-of-way. Once per year, a BPA ground patrol traverses all rights-of-way for on-the-ground observations.

2. Use of Low-Level Photography, ROWDATA System, and Plan-and-Profile Drawings. These technical aids enable the right-of-way maintenance specialist to develop precise site-specific management prescriptions. Low-level oblique aerial photography is taken at a low altitude above the transmission line and parallel to it with one-to-several

exposures of the area between each set of transmission line structures. The low-level photography shows right-of-way vegetation, as well as buildings, gardens, streams, and other bodies of water. In particular, the relationship of tree height to conductor height may be observed. A set of low-level photography is flown the year before each treatment rotation (i.e., approximately every 3-4 years west of the Cascades and every 10 years east of the Cascades).

The ROWDATA System is a computer-based data storage and retrieval system for right-of-way vegetation management information. An individual ROWDATA record entry corresponds to each right-of-way management unit; a management unit is a section of right-of-way that can be treated as homogeneous in the development and implementation of management prescriptions. At the present time, approximately 84,000 acres of BPA right-of-way require regular vegetation management to control tall-growing vegetation. This acreage is comprised of approximately 42,000 management units averaging about two acres each.

ROWDATA management unit information includes the specific location of the unit; its dimensions and area; its ownership; the date and method (and application rate if an herbicide) of last treatment; and the unit's land classification. The land classification indicates the potential of the unit to grow tall trees and shrubs. For example, units classified as having "high brush growth potential" are conducive to rapid growth of tall-growing vegetation and generally require retreatment at least every five years. The land classifications also indicate units for which control methods are restricted by regulation, agreement, or policy. For example, stream buffers and roadside screens are management units requiring special treatment. Management units under Tree and Brush Control Agreements, Christmas Tree Agreements, or other multiple use agreements are also indicated by land classifications.

Plan-and-profile drawings illustrate topographic features, ownership, and major engineering specifications of the transmission line itself (e.g., structure locations and conductor heights above ground).

The right-of-way maintenance specialist reviews the various technical aids to identify management units requiring treatment in the following year. The low-level photography is instrumental in developing prescriptions specific to management unit conditions. The ROWDATA record provides ready access to treatment history and treatment constraints.

3. Contract Development and Implementation. With the treatment prescription prepared and treatment methods selected for each management unit, the Right-of-Way Maintenance Specialist develops Working Instructions or Work Statements to implement the prescription. For work to be performed by BPA's own Force Account personnel, treatment prescriptions for various sections of right-of-way are described in detailed Working Instructions. The BPA foreman overseeing the Force Account work is responsible for ensuring that the Working Instructions are adhered to and signs them off upon their successful completion.

For work performed by contract (e.g. aerial broadcast treatments), treatment prescriptions for various sections of right-of-way are described in detail in Work Statements, which are incorporated into the contracts. An inspector is assigned to the contract by the appropriate BPA Area office. The contract inspector is responsible for overseeing the performance of the contract and ensuring that the treatment prescriptions are implemented as spelled out in the Work Statements. The inspectors fill out Daily Brush and Weed Control Reports (BPA Form No. 307), bearing witness to contract compliance.

4. Landowner Notification. Among the herbicides proposed by BPA for use on rights-of-way, two (dicamba and picloram) have restrictions on their EPA-approved labels pertaining to livestock grazing. When these herbicides are planned for use on lands showing evidence of grazing (e.g., pasture lands), BPA Area personnel notify landowners. Landowners are requested to remove livestock from the right-of-way for a specified period of time during and after the herbicides are applied.

5. Monitoring. The response of vegetation to control treatments is monitored regularly during subsequent periodic aerial or ground inspections of the rights-of-way. BPA also monitors the persistence and movement of herbicide residues in soil and water following herbicide applications.

For example, BPA's three automatic water samplers (Figures 5-1 and 5-2) are installed at sensitive sites in the Puget Sound and Lower Columbia Areas when appropriately requested by land management agencies, landowners, or the Areas. The water samplers are not used in the Upper Columbia or Snake River Areas due to the fact that generally herbicides are not aerially-applied and due to the general low level of herbicide use in those Areas (see Appendix C). When monitoring with the water samplers has not been requested by

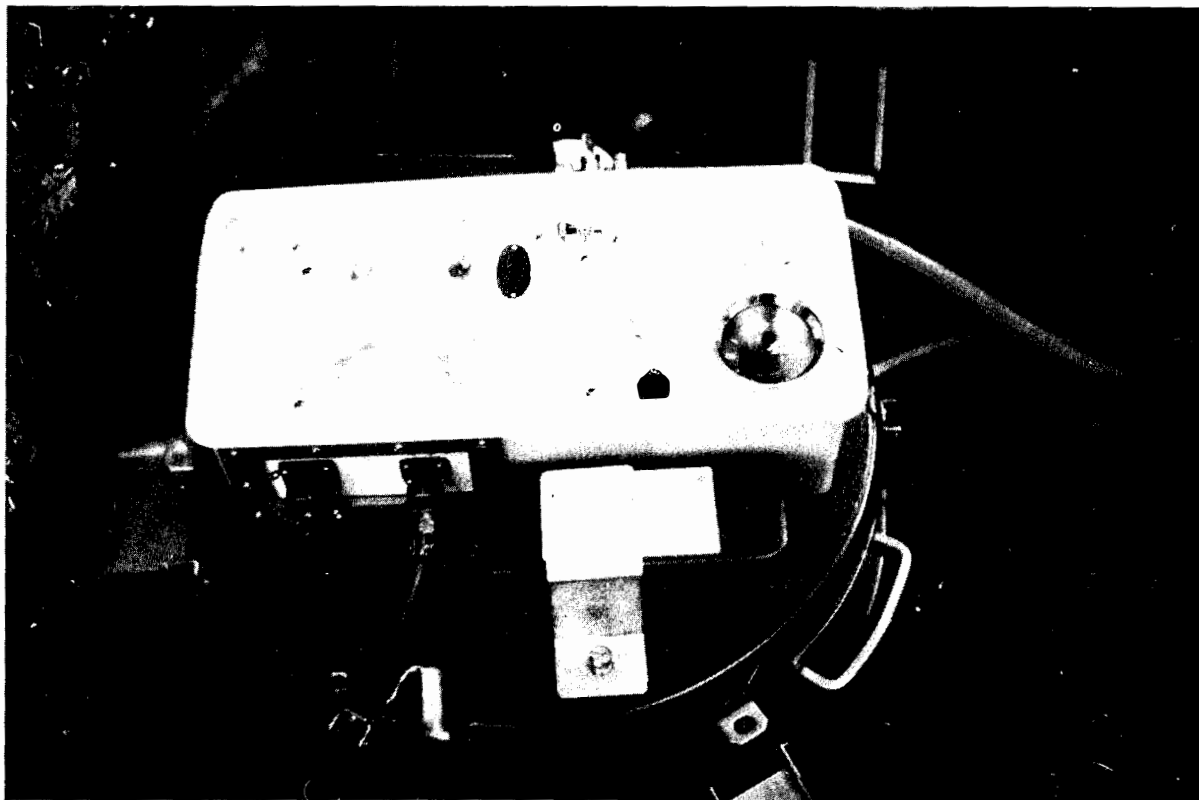


FIGURE 5-1. BPA's Automatic Water Samplers are Used at Sensitive Sites to Monitor the Fate and Persistence of Herbicides in Surface Waters.



FIGURE 5-2. Automatic Water Samplers Can Take Up to 28 Samples Over a 2-Week Period.

others, BTLM will install the samplers near aerial spray projects of its own choosing. Generally, the three water samplers are fully-employed throughout the aerial spray season.

Grab samples of soil, foliage, or water are taken for analysis where specific complaints of herbicide contamination have been made.

Methods for control of noxious weeds are selected somewhat differently. Each state agricultural department has identified a list of methods that are suitable (i.e., legal, effective) for control of each officially-declared noxious weed. Where an active weed control program is in effect, BPA negotiates with the local weed control extension agent and the landowner to decide which control method (from the state-approved methods) will be used. Each infestation site is evaluated on a case-by-case basis to identify what needs to be done by BPA to implement its weed control policy. Control treatments may be performed by BPA's contractor, or alternatively, BPA may provide a landowner with a specified quantity of herbicide to treat the identified weed infestation according to label instructions.

Treatment Selection Guidelines

Once a management unit is identified as requiring treatment (i.e., brush control, weed control, or wood pole protection), many factors can influence the decision about which specific vegetation control method to use on the particular unit. Among these factors are line voltage (which determines conductor clearance criteria), proximity of the unit to restricted or sensitive areas, type and density of vegetation, expected growth rates, effectiveness of possible treatments, special agreements with the landowner or land managing agency, accessibility, weather, and herbicide use regulations. A great deal of judgment on the part of Area Right-of-Way Maintenance Specialists and Area Line Maintenance Superintendents necessarily comes into play.

Acknowledging the many factors and great amount of judgment involved, general guidelines used in selecting treatments for individual management units can be outlined. General guidelines presented in Table 5-1 apply to management units where special public uses (e.g., parks) or restrictive agreements with landowners do not exist.

In Table 5-1, the first column identifies types of vegetation management needs and types of constraints on control methods used (e.g., distance from water, proximity to susceptible crops) in a particular management unit. The

Table 5-1. Treatment Selection Guidelines Used by BPA to Select Vegetation Control Treatments for Individual Vegetation Control Projects¹

Type of Vegetation Management Need and Situation	Typical Treatments for Given Management Need and Situation			
	Control Methods	Treatments and Techniques ²	Herbicide Placement ³ (if Chemical Method)	Herbicides ⁴ (if Chemical Method)
<u>Brush Control on Rights-of-Way</u>				
. Within 10 feet of stream or water body	. Manual . Chemical	. Cutting or girdling . Spot treatment	. Cut stump . Single stem	. Ammonium sulfamate (without corrosion inhibitor)
. 10-50 feet from stream or water body	. Manual . Chemical	. Cutting or girdling . Spot treatment	. Cut stump . Single stem . Basal stem spray . Pellets/granules ⁵ on soil surface	. Ammonium sulfamate . Dicamba . Dicamba + 2,4-D . Picloram . Picloram + 2,4-D . 2,4-D (amine, ester) . 2,4-D + 2,4-DP
. 50-100 feet from stream or water body	. Manual . Chemical	. Cutting or girdling . Spot treatment . Broadcast ground-based treatment	. Cut stump . Single stem . Basal stem spray . Pellets/granules ⁵ on soil surface . Foliage spray . Foliage spray	. Ammonium sulfamate . Dicamba . Dicamba + 2,4-D . Glyphosate . Picloram . Picloram + 2,4-D . 2,4-D (amine, ester) . 2,4-D + 2,4-DP
. Beyond 100 feet from stream or water body, accessible locations, low density brush	. Manual . Chemical	. Cutting . Spot treatments . Broadcast ground-based treatment	. Cut stump . Single stem . Basal stem spray . Soil surface . Foliage spray . Foliage spray	. Dicamba . Dicamba + 2,4-D . Glyphosate . Picloram . Picloram + 2,4-D . 2,4-D (amine, ester) . 2,4-D + 2,4-DP
. Beyond 100 feet from stream or water body, accessible locations, high density brush	. Chemical	. Broadcast ground-based treatment	. Basal stem spray . Foliage spray	. Dicamba + 2,4-D . Picloram + 2,4-D . 2,4-D + 2,4-DP
. Beyond 100 feet from stream or water body, inaccessible locations (also accessible locations in some cases) uniform and high density brush stands, not adjacent to susceptible crops or plantings, where extensive brownout is acceptable	. Chemical	. Broadcast aerial treatment	. Foliage spray	. Dicamba + 2,4-D . Picloram + 2,4-D

Table 5-1. Cont'd.

Type of Vegetation Management Need and Situation	Typical Treatments for Given Management Need and Situation			
	Control Methods	Treatments and Techniques ²	Herbicide Placement ¹ (if Chemical Method)	Herbicides ¹ (if Chemical Method)
• Adjacent to susceptible crops or plantings	• Manual • Chemical	• Cutting • Spot treatments	• Cut stump • Single stem • Basal stem spray • Foliage spray	• Ammonium sulfamate • Dicamba • Dicamba + 2,4-D • Glyphosate • Picloram • Picloram + 2,4-D • 2,4-D (amine, ester) • 2,4-D + 2,4-DP
• Lands that may be subsequently planted to crops or orchards	• Manual • Chemical	• Cutting • All treatments and techniques as permissible in these situations except pellets and granules		
• At scenic viewpoints such as highway crossings and recreation areas (to maintain vegetation screens) and	• Manual • Chemical	• Cutting and girdling • Topping and pruning • Spot treatment	• Cut stump • Single stem • Basal stem spray • Soil surface • Foliage spray	• Ammonium sulfamate • Dicamba • Dicamba + 2,4-D • Glyphosate • Picloram • Picloram + 2,4-D • 2,4-D (amine, ester) • 2,4-D + 2,4-DP
• In high sensitivity landscapes where temporary brownout of vegetation is unacceptable				
<u>Wood Pole Protection on Rights-of-Way</u>				
	• Chemical	• Spot treatment	• Foliage spray • Soil surface spray • Pellets or granules on soil surface	• Glyphosate • Picloram • Picloram + 2,4-D • Tebuthiuron
<u>Substation Weed and Brush Control</u>				
	• Chemical	• Spot treatment • Broadcast ground-based treatment	• Foliage spray • Soil surface spray • Pellets or granules on soil surface	• Atrazine • Bromacil + diuron • Dichlobenil • Glyphosate • Monuron • Prometon • Prometon + simazine + sodium chlorate + sodium metaborate • Sodium chlorate + sodium metaborate + bromacil • Tebuthiuron

Table 5-1. Cont'd.

Type of Vegetation Management Need and Situation	Typical Treatments for Given Management Need and Situation			
	Control Methods	Treatments and Techniques ²	Herbicide Placement ³ (if Chemical Method)	Herbicides ³ (if Chemical Method)
<u>Noxious Weed Control on Rights-of-Way</u>				
	. Biological	. Use of introduced insects to control tansy ragwort (success varies with local site conditions - see Chapter 3)		
. Within 10 feet of stream or water body	. Chemical	. Spot treatment	. Foliage spray	. Ammonium sulfamate (without corrosion inhibitor)
. 10-50 feet from stream or water body	. Chemical	. Spot treatment	. Foliage spray (from backpack sprayer)	. Dicamba + 2,4-D . 2,4-D (amine, ester)
. 50-100 feet from stream or water body	. Chemical	. Spot treatment . Broadcast ground-based treatment	. Foliage spray	. Dicamba + 2,4-D . 2,4-D (amine, ester)
. Beyond 100 feet from stream or water body	. Chemical	. Spot treatment . Broadcast ground-based treatment	. Foliage spray	. Dicamba + 2,4-D . 2,4-D (amine, ester)
. Adjacent to susceptible crops or plantings	. Chemical	. Spot treatment	. Foliage spray	. Dicamba + 2,4-D . 2,4-D (amine, ester)
. Beyond 100 feet from stream or water body, dense and extensive weed populations, inaccessible locations	. Chemical	. Broadcast aerial treatment	. Foliage spray	. Dicamba + 2,4-D . 2,4-D (amine, ester)

FOOTNOTES:

¹These guidelines indicate vegetation control prescriptions typically used in the indicated situations to satisfy particular vegetation management needs. Due to many factors, selection and implementation of actual management prescriptions for specific management units may necessitate deviations from these general guidelines.

²See Chapter 3 for descriptions of treatments, techniques, and herbicide placement.

³Common names of active ingredients are given. Herbicide use patterns are current as of May 1, 1983. Particular herbicides used in specific situations depend on types and species of plants to be controlled.

⁴Avoid soil surface applications of pellets or granules where water table is high, where leaching or runoff is possible, when ground is frozen, or when heavy precipitation is expected.

second column indicates the general types of vegetation control methods that BPA typically uses in the various situations identified in column one. Columns three and four show particular techniques, herbicide placement, and herbicide active ingredients that are typically used in the given management situations.

It is important to note that the herbicides indicated in Table 5-1 are those used as of May 1, 1983; particular herbicides may be added to or deleted from these lists in the future based on changes in EPA registrations or BPA use patterns.

The treatment selection guidelines (Table 5-1) are based on BPA's Transmission Line Maintenance Standard, the field manual used for carrying out right-of-way vegetation management. A number of measures to mitigate potential adverse environmental impacts are incorporated in these guidelines (see Chapter 4 - Mitigation Measures). Complete descriptions of the control methods, techniques, and herbicides listed in Table 5-1 are contained in Chapter 3 - ALTERNATIVE METHODS OF VEGETATION MANAGEMENT.

For management units in special or restricted areas, the guidelines of Table 5-1 do not apply. Such areas include experimental sites (e.g., treatment test plots), public use areas (e.g., recreation sites, parks), and lands on which control methods are restricted by agreement (e.g., municipal watershed lands). In these sites, treatment methods are selected on a case-by-case basis through negotiation with the other parties involved.

Testing and Approval of New Control Methods

A major function of BTLM is the evaluation of various methods of vegetation control. Vegetation management research is continually developing new methods for control and manipulation of vegetation. BTLM conducts field tests to determine the effectiveness and suitability of new methods for BPA's vegetation management needs. Once methods or herbicides are proved to be effective and otherwise suitable (e.g., environmental effects, cost, safety) they may be added to BPA's approved list and used in subsequent vegetation management programs.

Field test projects are initiated by the central staff of BTLM or by the four Area right-of-way maintenance specialists. Test designs include provisions for pre- and post-test evaluations and statistical reliability. Each study is designed on a case-by-case basis for the method or

herbicide being tested. Variables tested include effectiveness on target vegetation, economy, handling logistics (for herbicides), soil and water persistence (also for herbicides) and other environmental effects. Preferably, test plots are located on BPA fee-owned rights-of-way or on federal or state land. Once a test is completed and results have proven satisfactory, a method or herbicide use may be approved by the Chief of BTLM for addition to BPA's list of approved methods and herbicides.

Methods currently being studied include biological techniques using wildlife and competing vegetation to control tall-growing plants (see Chapter 3 ALTERNATIVE METHODS OF VEGETATION MANAGEMENT). Alternative herbicides will also be tested in the future (see Chapter 3).

Geographical Incidence of Vegetation Management Effort

Historical Pattern

The pattern of BPA's vegetation management effort over recent years can be used to indicate the geographic extent of the proposed program. Each year, BPA publishes a tabulation of vegetation management activities planned for the coming fiscal year. Such tabulations are available for the 10-year period, 1973 through 1982. The annual tabulation indicates the type of vegetation control method that was planned for use on each segment of right-of-way and at each substation. Control methods have been categorized in the past as hand cutting, aerial herbicide application, or spot herbicide application. Acreages planned for treatment are shown, as well as amounts (gallons or pounds) of herbicide to be applied in each treatment.

The annual tabulations have been programs proposed for the subsequent fiscal year. In some cases, due to changes in circumstances or due to changes in method (e.g., herbicide) availability, annual programs were not implemented as planned.

BPA's past annual programs have been listed in two major categories. The first program category, right-of-way management, includes brush control (i.e., control of unwanted trees and shrubs), weed control (e.g., noxious weed control), and wood pole protection. The second program category, station weed control, comprises control of unwanted vegetation within yards of substations and microwave stations.

Right-of-Way Management. Acreages of right-of-way proposed for treatment in each fiscal year and for each county of the

BPA service area have been totalled and averaged over the 10-year period for which data are available. In Appendix C, tabulations by county and by the three types of control methods (i.e., manual, aerial herbicide, spot herbicide) are provided for each of BPA's Areas. These tabulations indicate generally the geographic extent of past BPA vegetation management by counties. Future vegetation management activities will be similar in overall extent but may differ with respect to type of control method used.

Average number of right-of-way acres treated by all methods combined ranges from a high of 1,461 acres per year in King County, Washington to less than one acre per year in Teton County, Wyoming. In Table 5-2, counties of the BPA service area are classified in seven categories of average acres treated per year by all methods combined for the 10-year period, 1973 through 1982. Counties exhibiting the various levels of historical right-of-way management are depicted in the accompanying map of BPA's service area (Figure 5-3).

Several factors are responsible for the variations in treated acreage among counties:

1. Amounts of right-of-way in each county vary with both length and width of transmission line corridors.
2. Potential vegetation types (e.g., forest vs. grassland) and vegetation growth rates vary as functions of precipitation, temperature, soil types, etc.; these factors determine whether treatment is required and how often.
3. Prevailing land uses occupying transmission line corridors vary from agricultural operations (where little-to-no treatment is required) to forested wildlands (where BPA is responsible for the extensive treatment required).

Several strong correlations between amounts of acreage treated and variations in the above factors are evident in Table 5-2. The Puget Sound Area has many BPA facilities and is covered primarily by forest vegetation that exhibits high growth rates. In contrast, the Snake River Area is occupied, generally, by grassland and shrubland vegetation types requiring less management than the vegetation of the Puget Sound Area.

Station Weed Control. Station weed control is performed at substation switchyards and microwave stations to eliminate vegetation that might pose operational or safety hazards.

Table 5-2. Counties of BPA Service Area Classified by Historical Extent of Right-of-Way Vegetation Management¹

BPA Administrative Areas	Average Number of Right-of-Way Acres Programmed for Treatment Per Year by All Methods Combined for 10-Year Period 1973-1982													
	<10 ac/yr.		10-50 ac/yr.		50-100 ac/yr.		100-300 ac/yr.		300-500 ac/yr.		500-1000 ac/yr.		>1000 ac/yr.	
PUGET SOUND							Callam WA		Grays Harbor WA		Pierce WA		King WA	
							Jefferson WA		Mason WA		Thurston WA		Lewis WA	
							Kitsap WA		Snohomish WA					
							Pacific WA							
							Skagit WA							
							Whatcom WA							
LOWER COLUMBIA			Yamhill OR		Benton OR		Clatsop OR		Clackamas OR		Lane OR			
					Polk OR		Lincoln OR		Columbia OR		Cowlitz WA			
					Wahkiakum WA		Marion OR		Coos OR		Skamania WA			
							Multnomah OR		Curry OR					
							Tillamook OR		Douglas OR					
							Washington OR		Linn OR					
							Clark WA							
UPPER COLUMBIA	Granite MT		Columbia WA		Grant WA		Chelan WA		Kittitas WA					
	Mineral MT		Douglas WA		Lincoln WA		Pend							
			Ferry WA		Stevens WA		Oreille WA							
			Okanogan WA		Whitman WA		Spokane WA							
			Boundary ID		Bonner ID		Flathead MT							
			Clearwater ID		Lincoln MT									
			Kootenai ID		Sanders MT									
			Latah ID											
			Nez Perce ID											
			Shoshone ID											
			Deer Lodge MT											
			Lake MT											
			Missoula MT											
			Powell MT											
SNAKE RIVER	Franklin WA		Columbia WA		Klamath OR		Klickitat WA		Hood River OR					
	Walla WA		Yakima WA				Skamania WA							
	Walla WA		Deschutes OR				Wasco OR							
	Crook OR		Multnomah OR											
	Gilliam OR		Umatilla OR											
	Lake OR		Union OR											
	Marion OR		Bonneville ID											
	Morrow OR		Gallatin MT											
	Sherman OR		Modoc CA											
	Wheeler OR													
	Bingham ID													
	Cassia ID													
	Elmore ID													
	Fremont ID													
	Gem ID													
	Minidoka ID													
	Teton ID													
	Lincoln WY													
	Teton WY													

¹See Appendix C for average acres programmed for treatment per year by three types of control methods in each county.

The extent of station weed control is a function of the number and area of stations requiring treatment and a function of the speed with which weeds can colonize bare ground in a local area (determined to a large degree by precipitation and temperature).

The extent of station weed control that was programmed over the five-year period 1978-1982 is shown in Table 5-3 for each county of BPA's four Areas.

Future Pattern

In future years, BPA will construct additional transmission lines and associated facilities that will require vegetation management. For example, the Fiscal Year 1983 program shows approximately 1,240 miles of transmission lines under construction and approximately 330 miles of new construction to begin (see Main Grid Map - BPA Transmission Program for Fiscal Year 1983, dated September 30, 1981).

Counties where substantial amounts of this construction either are occurring presently or may occur in the near future are shown in Table 5-4. In all cases, except those of Custer County, Idaho and Modoc County, California, these counties already contain substantial lengths of BPA transmission line. Many of the lines under construction or proposed to begin construction in 1983 parallel existing lines. Vegetation management activities that would be required in the future in the counties shown in Table 5-4 would be similar in nature to vegetation management currently practiced on existing rights-of-way in those same counties.

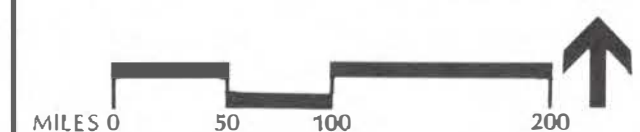
Historical Pattern of Herbicide Use

The historical pattern of BPA's use of herbicides also can be used to establish a perspective on its proposed vegetation management program. Data on herbicides planned for use in each coming fiscal year have been published in BPA's annual program statements. These data include pounds or gallons of each brand name herbicide product to be used on each segment of right-of-way or at each substation.

BPA's programmed pattern of herbicide use over the last five years (1978-1982 fiscal years) is presented in Table 5-5. Use patterns are shown for each of the active ingredients contained in the various trade-name formulations used by BPA. The trade-name formulations in which the active ingredients are contained and the years in which each herbicide was used for right-of-way management (i.e., brush control,

Figure 5-3
**Historical Patterns
 of R-O-W
 Vegetation
 Management
 1973-1982**

**BONNEVILLE POWER
 ADMINISTRATION
 Vegetation Management EIS**



LEGEND

Ave. amt. of acreage treated / yr.

- < 10A/YR.
- 10-50A/YR.
- 50-100A/YR.
- 100-300A/YR.
- 300-500A/YR.
- 500-1000A/YR.
- > 1000A/YR.

Note: Power transmission line routes are intended to show general areas through which transmission lines are located. Routes may represent one or many transmission lines. The routes shown do not represent specific locations of specific lines.

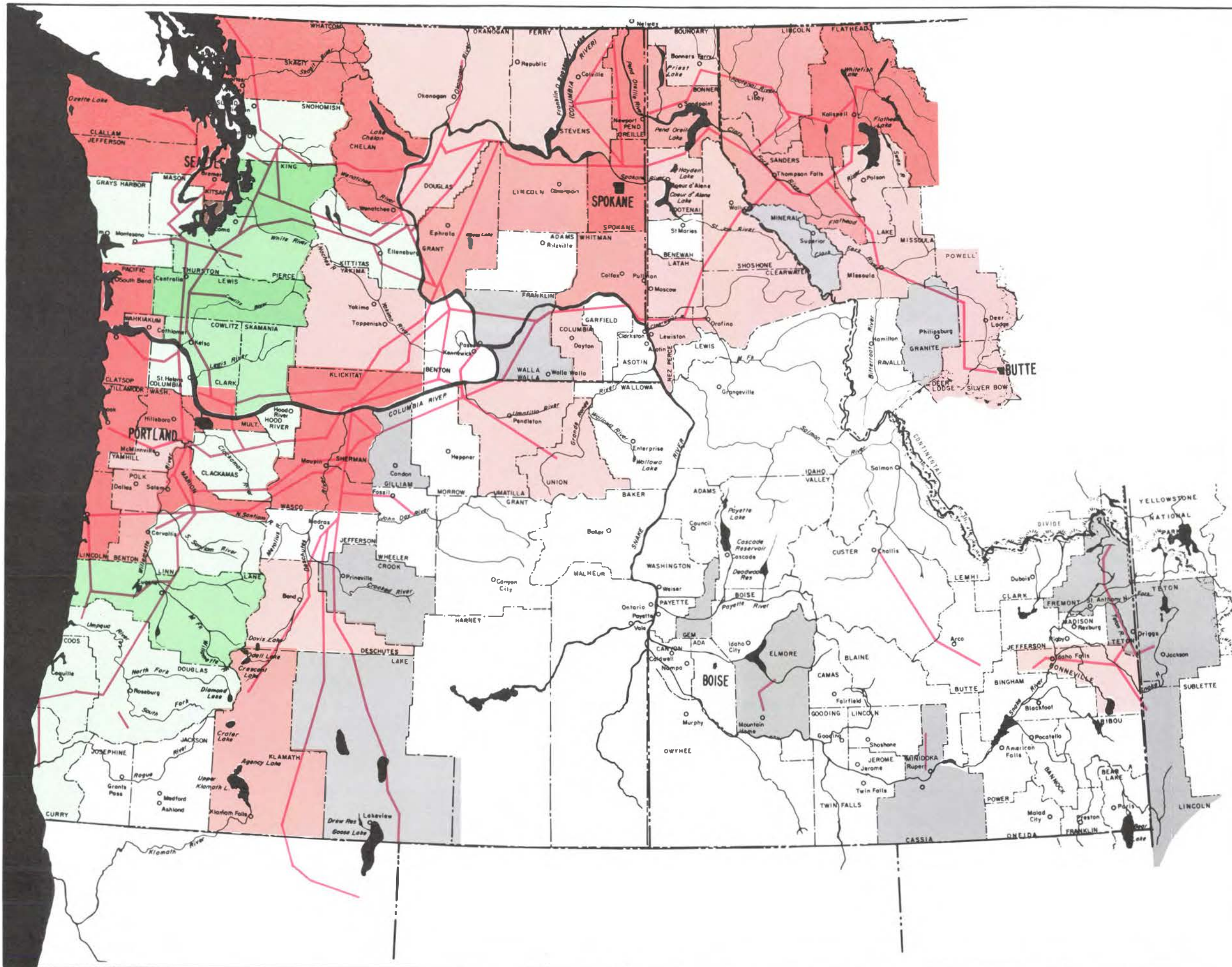


Table 5-3. Average Acreage of Station Weed Control Programmed
By BPA for Period 1978-1982

Puget Sound Area		Lower Columbia Area		Upper Columbia Area		Snake River Area	
State/County	Acres	State/County	Acres	State/County	Acres	State/County	Acres
Washington		Oregon		Washington		Oregon	
Clallam	9	Benton	<1	Adams	1	Crook	8
Grays Harbor	7	Clackamas	19	Chelan	10	Deschutes	13
Jefferson	4	Clatsop	7	Columbia	4	Gilliam	15
King	65	Columbia	19	Douglas	29	Harney	1
Kitsap	6	Coos	8	Ferry	<1	Hood River	7
Lewis	26	Curry	2	Garfield	6	Jefferson	16
Mason	7	Douglas	12	Grant	18	Klamath	31
Pacific	6	Lane	39	Kittitas	2	Lake	15
Pierce	13	Lincoln	3	Lincoln	1	Morrow	5
San Juan	<1	Linn	15	Okanogan	18	Sherman	3
Skagit	<1	Marion	26	Pend Oreille	8	Umatilla	15
Snohomish	50	Multnomah	14	Spokane	35	Union	1
Thurston	20	Polk	4	Stevens	5	Wasco	73
Whatcom	30	Tillamook	4	Whitman	12	Wheeler	1
TOTAL	243	Washington	20				
		Yamhill	4				
		Washington		Idaho		Washington	
		Clark	41	Bonner	3	Benton	75
		Cowlitz	17	Boundary	<1	Columbia	1
		Skamania	7	Clearwater	10	Franklin	20
		Wahkiakum	<1	Kootenai	<1	Klickitat	15
		TOTAL	261	Nez Perce	17	Skamania	1
				Montana		Walla Walla	17
				Deer Lodge	3	Yakima	10
				Flathead	12		
				Granite	1	Idaho	
				Lake	<1	Bonneville	1
				Lincoln	4	Butte	2
				Mineral	<1	Cassia	11
				Missoula	<1	Custer	1
				Powell	<1	Elmore	1
				Ravalli	<1	Fremont	4
				Sanders	11	Minidoka	2
				Silver Bow	2	Teton	1
				TOTAL	212	Wyoming	
						Teton	1
						California	
						Modoc	1
						Montana	
						Gallatin	1
						Utah	
						Box Elder	1
						TOTAL	182

Table 5-4. Counties of BPA Service Area Where Transmission Lines
are Proposed to be Constructed During Fiscal Year 1983

<u>Puget Sound Area</u>		<u>Lower Columbia Area</u>	
Grays Harbor	WA	Clark	WA
King	WA	Cowlitz	WA
Kitsap	WA	Columbia	OR
Mason	WA	Coos	OR
Snohomish	WA	Lane	OR
Thurston	WA	Marion	OR
 <u>Upper Columbia Area</u>		 <u>Snake River Area</u>	
Ferry	WA	Crook	OR
Grant	WA	Deschutes	OR
Lincoln	WA	Jefferson	OR
Okanogan	WA	Klamath	OR
Spokane	WA	Lake	OR
Stevens	WA	Umatilla	OR
Bonner	ID	Union	OR
Boundary	ID	Wasco	OR
Kootenai	ID	Bonneville	OR
Flathead	MT	Custer	ID
Granite	MT	Modoc	CA
Lincoln	MT		
Missoula	MT		
Powell	MT		
Sanders	MT		

Table 5-5. Amounts of Herbicide Active Ingredients Programmed for Use by BPA
for Years 1978-1982 and Proposed for Use in 1983 (lbs)

Common Name of Active Ingredient	Trade Name Formulations In Which Active Ingredient is Used	Years Used by BPA		Amount of Active Ingredient Programmed for Use in Each of Last Five Years (lbs.)						Amount Proposed for Use in 1983
		R-O-W Mgmt.	Substation Weed Control	1978	1979	1980	1981	1982	Average	
Atrazine	Antrex [®] 80W	1979	1981-1982	-	56	-	186	313	111	-
Ammonium Sulfamate	Ammate [®] X-NI	1978, 1981	-	342	-	-	114	-	91	-
Bromacil	Krovar [®]	1978	1978-1982	1,031	1,041	1,537	1,433	186	1,046	190
	Ureabor [®]									
Dicamba	Banvel [®] 40S	1978-1982	1982	16,024	16,752	8,224	17,480	14,933	14,683	11,950
	Banvel [®] 4WS									
	Banvel [®] XP									
	Banvel [®] 520									
	Banvel [®] 720									
Dichlobenil	Casoron [®] G-4	-	1981, 1982	-	-	-	26	58	42 (n=2)	-
Diuron	Krovar [®]	-	1981-1982	-	-	-	103*	186*	145 (n=2)	230
Glyphosate	Roundup [®]	1980	1982	-	-	4,156	-	16	1,391 (n=3)	12
Monuron	Telvar [®]	1979-1982	1978-1982	918	9,173	2,388	1,000	114	2,719	1,370
Picloram	Tordon [®] 10E	1978-1982	1978, 1981	2,432	3,982	5,254	3,562	2,513	3,549	-
	Tordon [®] 101									
Prometon	Pramitol [®] 50S	-	1978-1982	7,453	8,477	6,724	6,904	2,267	6,365	3,059
	Pramitol [®] 25E									
Simazine	Pramitol [®] 5PS	-	1978-1982	1,032	1,181	855	730	317	823	459
Sodium Chlorate	Pramitol [®] 5PS	1978	1978-1982	79,599	88,306	79,571	68,306	18,138	66,784	24,473
	Ureabor [®]									
Sodium Metaborate	Pramitol [®] 5PS	1978	1978-1982	119,442	130,514	129,181	111,089	22,673	102,580	30,591
	Ureabor [®]									
Tebuthiuron	Spike [®] 1G									
	Spike [®] 5G	1982	1982	-	-	-	-	2,042	2,042 (n=1)	1,714
	Spike [®] 80W									
2, 4-D	Banvel [®] 520									
	Banvel [®] 720	1978-1982	1982	51,248	60,315	56,712	48,486	48,162	52,981	1,954
	Tordon [®] 101									
	2, 4-D Amine									
2,4-D P	Weedone [®] 170	1978-1982	1982	2,380	8,865	476	1,040	4,566	3,465	-
	Weedone [®] 170									

NOTE: *In 1981 and 1982 an additional 148 and 40 pounds, respectively, of Diuron were programmed for use as the commercial formulation Kamex[®]; this commercial product has been removed from BPA's approved list of herbicides and is no longer used.

weed control, power pole protection) or substation weed control are indicated.

Finally, an average number of pounds used per year over the five-year period was calculated. In four instances, the herbicide has been in use by BPA for less than five years; therefore, the average was calculated only for the period since use began.

Another source of information on BPA's historical use of herbicides is central warehouse inventory data. Most of the herbicides used by BPA are processed through its central warehouse in Vancouver, Washington. Inventory data show total amounts of herbicides received by the warehouse and, in turn, requisitioned and shipped to field location.

BPA central warehouse inventory data have been compiled for years 1978-1981 (Table 5-6). These data show amounts of herbicides requisitioned and shipped to field locations each year. Herbicide amounts have been converted to pounds of each active ingredient, totalled for all herbicide formulations in which the active ingredient is contained.

Discrepancies are evident between inventory data and programmed herbicide use (Table 5-6). Of the 16 active ingredients, four showed inventory requisitions greater than programmed use while 11 were programmed at a higher use than was actually requisitioned. In one case, dicamba, requisition and programmed data closely approximated each other.

Reasons for discrepancies between inventory data and programmed herbicide use include the following: Not all herbicide purchases go through the central warehouse in Vancouver, Washington. Also, some herbicides with relatively long shelf lives may be stored for some time in field locations prior to actual use. The storage time in the field, in various instances, may exceed the period of time for which data are shown in Tables 5-5 and 5-6.

The major reason for discrepancies identified in Table 5-6 is that, in practice, BPA often uses less herbicide than has been programmed. Programmed herbicide use is estimated as much as two years in advance of actual implementation of the program. In planning in advance, certain assumptions are made with respect to expected vegetation growth rates and required herbicide application rates. At the time of actual implementation, less than planned amounts of herbicide may be needed. Specifically, fewer acres may require vegetation control treatments and application rates may be lower than recommended on product labels. In addition, significant portions of an Area's vegetation management program may be deferred until a subsequent fiscal year.

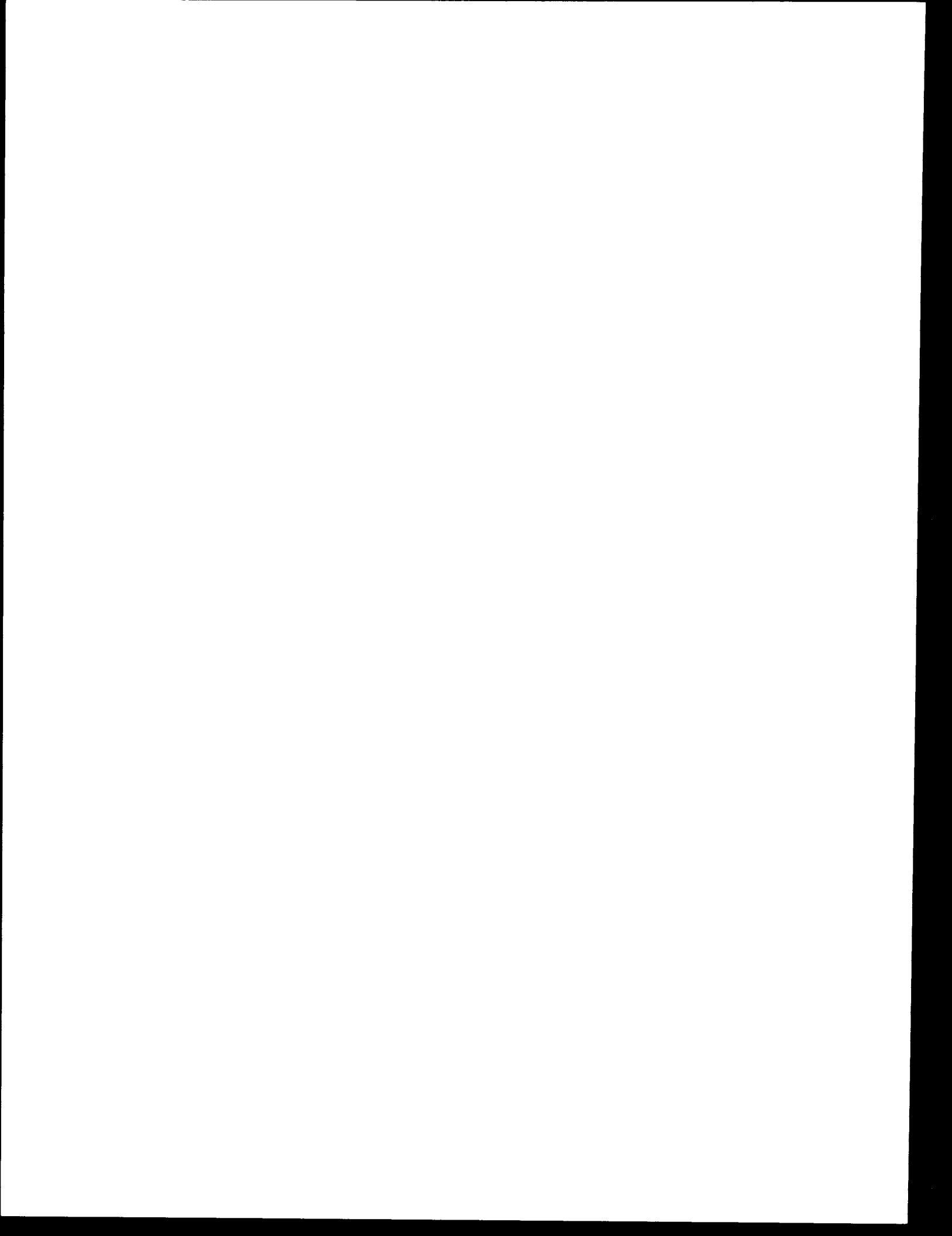
Table 5-6. Amounts of Herbicide Active Ingredients Requisitioned from Central Inventory in Comparison to Amounts Programmed for Use in Annual Program Statements, 1978-1981 (lbs)

Herbicide Active Ingredients ¹	Fiscal Year								Total for 4-Year Period*	
	1978		1979		1980		1981		Requisitioned from Inventory	
	Requisitioned from Inventory	Programmed	Requisitioned from Inventory	Programmed	Requisitioned from Inventory	Programmed	Requisitioned from Inventory	Programmed	Requisitioned from Inventory	Programmed
Atrazine	-	-	4	56	64	-	64	186	132	242*
Ammonium sulfamate	228	342	-	-	513	-	228	114	969*	456
Bromacil	846	1,031	778	1,041	672	1,537	369	1,433	2,665	5,042*
Dicamba	17,505	16,024	13,460	16,752	14,255	8,224	13,290	17,480	58,510*	58,480
Dichlobenil	130	-	116	-	100	-	192	26	538*	26
Diuron	-	-	-	-	202	-	340	103	542*	103
Glyphosate	740	-	100	-	460	4,156	500	-	1,800	4,156*
Monuron	360	918	480	9,173	80	2,388	160	1,000	1,080	13,479*
Picloram	968	2,432	303	3,982	4,961	5,254	7,473	3,562	13,705	15,230*
Prometon	2,931	7,453	5,000	8,477	6,447	6,724	3,363	6,904	17,741	29,558*
Simazine	410	1,032	700	1,181	861	855	464	730	2,435	3,798*
Sodium chlorate	40,367	79,599	55,570	88,306	58,570	79,571	27,085	68,306	181,592	315,782*
Sodium metaborate	66,815	119,442	84,513	130,514	82,290	129,181	34,422	111,089	268,040	490,226*
Tebuthiuron	-	-	-	-	185	-	1,386	-	1,571*	-
2,4-D	24,020	51,248	21,038	60,315	54,650	56,712	22,354	48,486	122,062	216,761*
2,4-DP	90	2,380	-	8,865	1,600	476	200	1,040	1,890	12,761*

FOOTNOTES:

¹Trade name formulations in which active ingredients are used are shown in Table 5-5.

*Asterisks indicate the greater of requisitioned or programmed amounts over the 4-year period.



AFFECTED ENVIRONMENT



Chapter 6

AFFECTED ENVIRONMENT

Physiographic Regions and Soils

BPA's transmission system traverses a vast area, exhibiting a landscape which is both diverse and complex. Five major physiographic regions and a number of subregions can be identified in BPA's service area (Figure 6-1). Each region or subregion comprises a distinct geomorphic and geologic area having a significant degree of internal homogeneity.

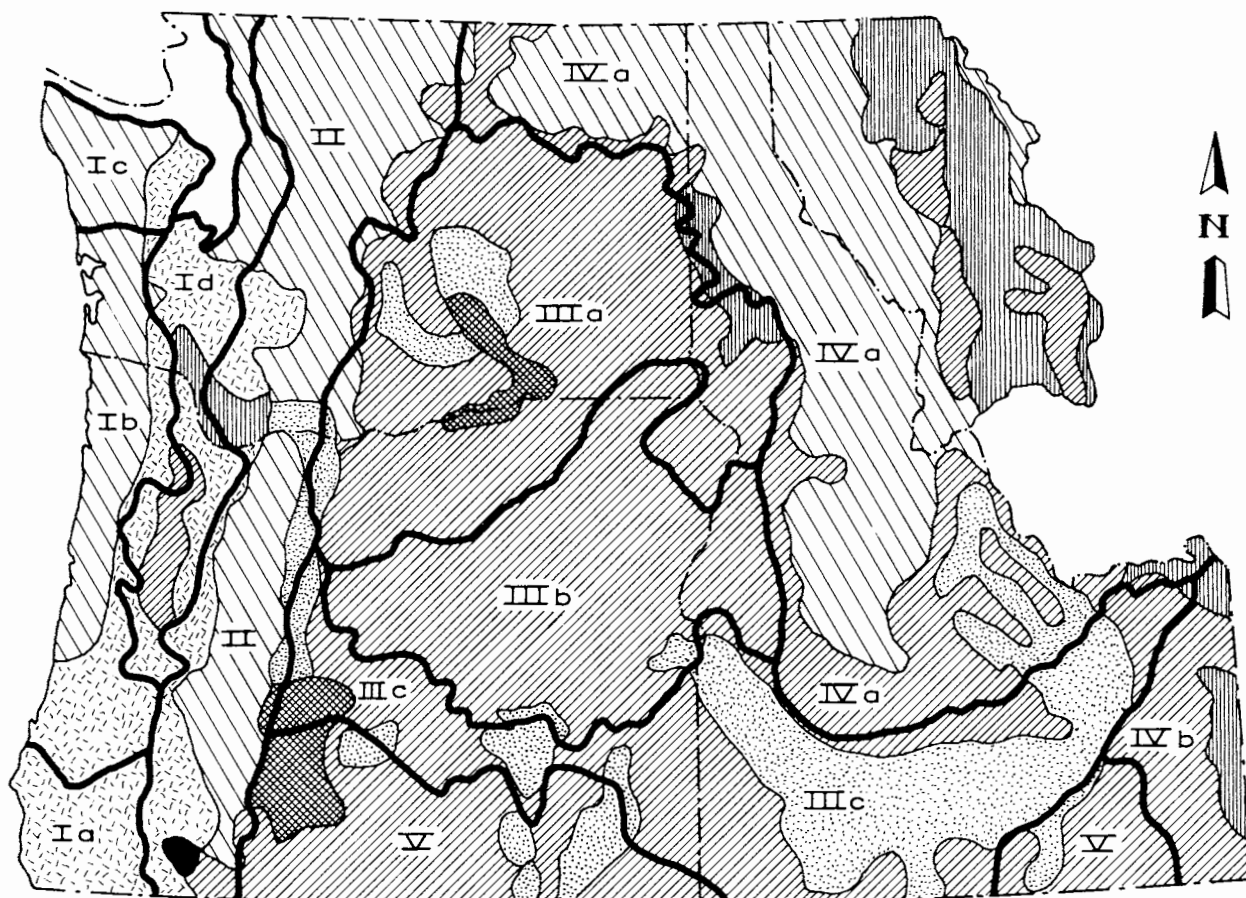
Selected physical characteristics of each physiographic region or subregion are listed in Table 6-1. Those portions of the BPA service area in Wyoming and California (not shown on Figure 6-1) lie within the same physiographic region and have characteristics similar to the adjacent areas of Idaho and Oregon, respectively.

Major geologic units range from the expansive recent basalt flows of the Columbia Basin and High Lava Plains, to the complex metamorphic rocks of the rugged Klamath-Siskiyou Mountains and the granitic Idaho Batholith of the Northern Rockies. Average annual precipitation ranges from well over 120 inches in the Olympic Mountains to less than 10 inches over much of the Columbia Intermontane and Basin/Range Regions. The percentage of this moisture occurring as snowfall is equally variable.

The great diversity in major soil-forming factors (i.e., climate, relief, parent material, vegetation, and time) has given rise to heterogeneous soil types. Ten soil orders are recognized by the current system of soil classification within BPA's service area; seven are of sufficient mappable extent to be shown at the scale of Figure 6-1.

Vegetation

The BPA service area exhibits great diversity in climate, soils, topography, and extent of disturbance by fire and humans. A highly complex pattern of natural and induced vegetation has resulted. Three aspects of vegetation are relevant to BPA's vegetation management program: regional vegetation types, endangered and threatened plant species, and noxious weeds. Each of these is described in the following sections.



- LEGEND -

SOILS			
	ALFISOLS		ENTISOLS
	ARIDISOLS		INCEPTISOLS
	MOLLISOLS		ULTISOLS
	VERTISOLS		

PHYSIOGRAPHIC REGIONS

I - PACIFIC BORDER REGION

- a. KLAMATH-SISKIYOU MOUNTAINS
- b. COAST RANGE
- c. OLYMPIC MOUNTAINS
- d. WILLAMETTE VALLEY - PUGET SOUND LOWLANDS

II - CASCADE MOUNTAINS

III - COLUMBIA INTERMOUNTANE REGION

- a. COLUMBIA BASIN
- b. CENTRAL MOUNTAINS
- c. HIGH LAVA PLAINS

IV - ROCKY MOUNTAINS

- a. NORTHERN ROCKIES
- b. CENTRAL ROCKIES

V - BASIN AND RANGE

SOURCE: BPA 1977; SCS 1975;
HIGHSMITH AND
KIMERLING 1979

**FIGURE 6-1 . PHYSIOGRAPHIC REGIONS
AND MAJOR SOIL ORDERS OF BPA'S
SERVICE AREA**

Table 6-1. Selected Physical Characteristics of the BPA Service Area,
by Physiographic Region and Subregion¹

	Pacific Border Region					Columbia Intermontane Region			Rocky Mtn. Region		Basin and Range Region
	Olympic Mts.	Coast Range	Klamath - Siskiyou Mts.	Willamette - Puget Sound Lowlands	Cascade Region	Columbia Basin	Central Mts.	High-Lava Plains	Northern Rockies	Middle Rockies	
Surficial Geology ²	V,S	S,MS,V	MS,MV,UM	A,S,V	MS,V	V	S,MS,G,UM	V	G,MI,MS	S,MS	V
Relief	Steep	Steep	Steep	Rolling	Steep	Rolling	Moderately Steep	Rolling to Steep	Steep	Steep	Rolling to Steep
Average Total Annual Precipitation, inches	100-160	60-100	40-80	40-50	20-110	6-20	10-35	6-15	25-50	15-40	6-20
Average Annual Snow, inches	<24	<24	<24	<12	40-400	<40	20-100	<40	40-200	50-150	10-40
Dominant Vegetation ³	CF	CF	CF	CF,G,O	CF	G/S	G/S,CF	G/S	CF	CF	G/S

FOOTNOTES:

¹Adapted from Highsmith and Kimerling (1979).

²A = alluvium

G = granitic rocks

MI = meta-igneous rocks

MS = metasedimentary rocks

MV = metavolcanic rocks

S = sedimentary rocks

UM = ultramafic rocks

V = volcanic rocks

³CF = coniferous forest

G = grassland

O = oak woodland

G/S = grass/shrub (primarily sagebrush)

Vegetation Types of the BPA Service Area

Vegetation types are defined on the basis of the physiognomy (i.e., gross appearance) of dominant plant species under average, natural conditions. When conditions are disturbed by natural forces (e.g., fire, windstorm) or by humans (e.g., logging, cultivation, herbicides), special variations in the vegetation types are caused. Variations in species composition and vegetation structure are functions of the extent, intensity, and types of disturbance patterns. Disturbance patterns are often functions of the goals of resource management activities (e.g., timber management, agricultural clearing, r-o-w management).

Regional differences in climate have determined the distribution of three broad vegetation provinces in the Pacific Northwest: Forest, Shrub/Steppe (i.e., combinations of shrubland and grassland) and Alpine (Highsmith and Kimerling 1979). Forests predominate from the Cascades west to the Pacific Ocean and at moderate to high elevations in the Blue Mountains and Northern Rocky Mountains. Shrub/Steppe vegetation is dominant throughout the intermountain basins, valleys, and plateaus while Alpine vegetation occurs at the highest elevations. Extensive vegetation management is required on BPA rights-of-way only in forested areas.

Forest vegetation types of the BPA service area are characterized in Table 6-2. The regional distribution of each type is indicated along with typical dominant species both without disturbance and in regenerating stands after disturbance (e.g., after clearing of transmission rights-of-way). Productivity and growth rates in each type are shown as high, medium, or low; these rates indicate the frequency with which vegetation control is required and primarily are a function of moisture and temperature relationships. Moisture relationships include atmospheric moisture (e.g. precipitation, fog) and soil moisture (e.g. as influenced by soil depth and texture). In Table 6-2, major tall-growing species requiring control on BPA rights-of-way are indicated by asterisks.

Vegetation structure in these forest types can be characterized by the number, density, and arrangement of vegetation layers. Dense, mature forests have multiple layers including tall conifers, sparse understory shrubs, and a ground layer of ferns and broad-leaved herbs. Where disturbance has removed the overstory trees, dense herbaceous and shrub layers with hardwoods and regenerating conifers are typical. This latter arrangement is that typically created by right-of-way clearing and vegetation management under existing transmission lines.

Table 6-2. Forest Types of the BPA Service Area Characterized by
Regional Distribution, Typical Dominants, and Productivity

Vegetation Zone	Regional Distribution	Typical Dominants Without Disturbance	Typical Dominants After Disturbance	Productivity and Typical Growth Rates (H, M, L)	Typical on Wet Sites (e.g., riparian)
Sitka spruce	Coastal Oregon and Washington	Sitka spruce*, western hemlock*	Red alder*, salmon- berry, elderberry, Douglas-fir*	H	Red alder*, western redcedar*, huckle- berry, salal
Western hemlock	Coast ranges, western Cascade range	Douglas-fir*, western hemlock*, incense-cedar* (southern Oregon), western white pine* (Puget Sound area), shore pine* (Puget Sound area)	Red alder*, bigleaf maple*, snowbrush ceanothus, Douglas- fir*, vine maple, salmonberry, huckle- berry	H	Red alder*, western redcedar*, bigleaf maple*, Oregon ash*, willows
Cascade subalpine Forest	Subalpine areas of Cascade and Olympic ranges	Silver fir, mountain hemlock, western white pine, noble fir*	Subalpine fir*, lodgepole pine*, huckleberry, salmon berry, elderberry	L-M	Black cottonwood*, Sitka alder, quaking aspen*, thimbleberry
Grand fir and Douglas-fir	Eastside Cascade Range, mid-eleva- tions of Blue Mountains and Rocky Mountains (No. Idaho, W. Montana)	Grand fir*, Douglas- fir*, western larch, ponderosa pine, white fir*	Lodgepole pine*, western larch, mountain maple, huckleberry, ceanothus, elder- berry	M	Black cottonwood*, paper birch, quaking aspen*, Sitka alder, mountain ash
Ponderosa pine	Lower eastside of Cascade range, lower elevation of Blue Moun- tains and western Rocky Mountains	Ponderosa pine*, bitterbrush, snow- brush, chokecherry, Idaho fescue, Oregon white oak* (eastern Cascades)	Bunchgrasses, ceanothus, black- hawthorn	L	Quaking aspen*, lodgepole pine*
Western redcedar	Rocky Mountains of northern Idaho, (mid-elevations)	Western redcedar, western hemlock, western white pine	Grand fir*, Douglas- fir*, birches*, western larch, Sitka alder, thimbleberry	M-H	Western redcedar*, devil's club, Sitka alder, willows, black cottonwood*

Table 6-2. Cont'd.

Vegetation Zone	Regional Distribution	Typical Dominants Without Disturbance	Typical Dominants After Disturbance	Productivity and Typical Growth Rates (H, M, L)	Typical on Wet Sites (e.g., riparian)
Rocky Mountain Subalpine Forest	subalpine areas of northern Rocky Mountains, Blue Mountains and Okanogan Highlands	Englemann spruce, subalpine fir, subalpine larch, mountain hemlock	Lodgepole pine*, Oregon boxwood, Englemann spruce, rusty menziesia, huckleberry	L	Black cottonwood*, Sitka alder, elderberry, mountain ash, paper birch*
Mixed Conifer-Mixed Evergreen Forest	Siskiyou Mountains of southwestern Oregon	Douglas-fir*, incense-cedar*, sugar pine, white fir*, tanoak, madrone	Ceanothus, manzanita, tanoak, Douglas-fir*	L-M	Oregon ash*, white alder*, bigleaf maple*
Willamette Forest-Prairie	Willamette Valley of western Oregon	Oregon white oak*, Douglas-fir*, grand fir*	Oregon white oak*, poison-oak, blackberry	H	Black cottonwood*, Oregon ash*, red alder*, willows

NOTE: *indicates major tall-growing species requiring control on BPA rights-of-way.

SOURCE: Highsmith and Kimerling 1979; Franklin and Dyrness 1975.

Endangered and Threatened Plants

Three plants officially designated as endangered by the U.S. Fish and Wildlife Service occur in the BPA service area (Table 6-3). These three species are known to occur in Oregon and Idaho. No endangered, threatened, or proposed plants are listed in Washington, Wyoming, or Montana. Although a number of officially-designated plants are listed in California, none is known from Modoc County, the sole California county in which BPA rights-of-way are situated.

Of the three officially-listed plants found in Oregon or Idaho, one occurs in a county in which BPA transmission lines are located. This species, McDonald's rockcress, occurs in the interior southeast corner of Curry County, Oregon. Its habitat is open areas of ultramafic serpentine soils within mixed evergreen forests of Douglas-fir, tanoak, manzanita, and ceanothus. The nearest BPA transmission lines are in the northwestern corner of Curry County, extending south along the coast to Gold Beach, Oregon.

In addition to listed and proposed species, there is a large number of "candidate" plant species that occur in the six states of BPA's service area. Candidate species are those which currently are under review by the U.S. Fish and Wildlife Service for consideration as endangered or threatened. They do not receive protection under the Endangered Species Act of 1973. Many candidate species have had listing packages (i.e., information supporting official designation) prepared by U.S. Fish and Wildlife staff; other listing packages will be completed in the future. It is not known when or if candidates will be proposed officially and subsequently listed.

Noxious Weeds

Noxious weeds are plants officially determined to be injurious to crops, livestock, public health, or property. Local Weed Control Districts are organized to combat infestations of noxious weeds in agricultural, range, and other lands. Weed control activities within each state are regulated by state Weed Control Boards. State weed control policies are aimed at preventing the establishment and spread of noxious weeds, at eradicating economically-important weed infestations, at providing technical assistance to local Weed Control Districts and at conducting research into control methods.

Table 6-3. Federal Endangered and Threatened
Plants in BPA's Service Area

Species	Status	BPA Service Area Occurrence		Habitat Description	Sensitivity to BPA Vegeta- tion Management Program
		State	County		
McDonald's rock-cress (<u>Arabis macdonaldiana</u>)	FE	OR	Curry	Ultramafic soils, open areas within mixed ever- green forests.	None - known population is in southeastern Curry County, transmission line is along the coast.
MacFarlane's four o'clock (<u>Mirabilis macfarlanei</u>)	FE	OR, ID	None	Grasslands	None - no BPA rights-of- way in counties of occur- rence (Wallowa County, OR and Idaho County, ID).
Malheur wire-lettuce (<u>Stephanomeria malheurensis</u>)	FE	OR	None	Arid, desert-like habitat; barren with some grasses.	None - no BPA lines in County of occurrence (Harney County).

NOTE: This information current as of May 15, 1983.

Noxious weeds are economically important because they occupy growing space in crop and grazing lands, because they contaminate commercial seed production, or because they poison livestock. Common noxious weeds at which active control programs are aimed include tansy ragwort, Canadian thistle, leafy spurge, and musk thistle.

Tansy ragwort is widespread west of the Cascades, in particular on heavily grazed pastures. A major control effort by local, state, and federal agencies is aimed at preventing the spread of ragwort eastward across the Cascades. BPA participates actively in a biological control program using the introduced insect, the cinnabar moth, to combat ragwort infestations on its rights-of-way.

Water Quality and Fisheries

Water quality parameters in the BPA service area are determined by watershed geology, precipitation patterns, and human activities causing soil disturbance or pollution in the watershed. The areas of watersheds requiring vegetation management by BPA generally are characterized by low density human populations. Major municipal discharges occur in the region, but usually do not affect water quality parameters in the areas of watersheds requiring vegetation management. Many municipalities obtain domestic and industrial water from surface water in forested watersheds. The Spokane Valley-Rathdrum Prairie Aquifer in Washington and Idaho is perhaps the largest source of groundwater utilized by a municipal entity; the aquifer depends on its watershed for recharge (Drost and Seitz 1978).

Two major runoff patterns occur in the region. The Columbia River Basin is the major watershed, draining the bulk of northern and eastern Oregon, southern and eastern Washington, and nearly all of Idaho. Most precipitation falls as snow at higher elevations and the Columbia River and its tributary watersheds are characterized by peak runoff after late spring snowmelt.

The second major runoff pattern is found in the numerous coastal rivers and streams. These are generally small drainage basins experiencing large amounts of precipitation in the winter, but experiencing dry summers. Runoff peaks closely follow periods of peak precipitation.

Fishery resources in the region include migratory and resident species. Anadromous fish spawn in freshwater, but migrate to the sea after hatching and grow to maturity before returning to spawn. Anadromous fish include salmon,

steelhead, cutthroat trout and sturgeon. Resident fish occupy most lakes and streams. Some waters have self-sustaining populations, but most lake and stream populations are augmented by stocked populations. The quality of fish habitat is influenced by: (1) access to the ocean for anadromous species; (2) water temperature; (3) water quality; and (4) character of the riparian vegetation.

The most notable fish species in the region, both commercially and recreationally, are the salmonids (i.e., salmon and trout). These species require cold water of good quality. Warmwater fish species in the region include perch, bullhead, crappie, largemouth bass, and sunfish. These species are generally more tolerant of reduced water quality.

Aquatic and riparian vegetation are major inputs at the base of the aquatic food chain. Streams and lakes at higher elevations generally harbor less aquatic vegetation because of steep stream gradients, cold water, and lower concentrations of nutrients. Riparian vegetation is therefore a critical food source in higher elevation streams and lakes because it contributes the majority of plant matter to the aquatic community. Protozoans, rotifers, cladocerans (waterfleas), copepods (microscopic crustaceans), mites, midges, amphipods (scuds, sideswimmers), stoneflies, and mayflies are important converters of plant detritus into a food course for rainbow, brook, and cutthroat trout.

Food webs of small streams at mid and low latitudes also are dependent primarily on detritus derived from the watershed. Larger streams and rivers carry more nutrients, and food webs rely more on periphyton (attached algae) and phytoplankton (microscopic, floating algae). Stoneflies, caddisflies, and mayflies in riffles and tubificid worms in pools convert plant matter into food for coho salmon, chinook salmon, rainbow trout, cutthroat trout, whitefish, sculpin, squawfish, suckers, and stickleback.

Wildlife

Endangered and Threatened Wildlife

A number of federally-designated endangered or threatened wildlife species occur in states served by BPA. One species has been officially proposed for endangered status. The status of each and its distribution by state and county of the BPA service area are indicated in Table 6-4. In several cases, a species occurs in a state served by BPA but in none of the counties of that state where BPA has transmission

Table 6-4. Federally-Listed Endangered and Threatened Wildlife Species¹

Species	Status ²	BPA Service Area Occurrence		Residency Status	Habitat
		State ³	County ⁴		
INVERTEBRATES					
Oregon silver-spot butterfly (<u>Speyeria zerene hippolyta</u>)	FT	WA	Pacific?	Resident	Salt spray meadows, grassy balds; dependent on the violet (<u>Viola adunca</u>)
	FT	OR	Lane (critical habitat), Yamhill (Mt. Hebo)		
FISH					
Kendall Warm Springs dace (<u>Rhinichthys osculus thermalis</u>)	FE	WY	None	Resident	Found in tributary of the Green River in small thermal pools
Borax Lake chub (<u>Gila boraxobius</u>)	FE	OR	None	Resident	Warm water in Borax Lake with hot springs and high salt concentrations
BIRDS					
American peregrine falcon (<u>Falco peregrinus anatum</u>)	FE	WA	All 34 counties	Resident with numbers increasing in winter	Uses a wide variety of habitats, nests on cliffs, usually near water; not found in heavily forested areas; frequents marshy areas in winter
	FE	OR	All 29 counties	Resident with numbers increasing in winter	
	FE	ID	Bonneville, Fremont	Migrant	
	FE	MT	Deer Lodge, Flathead, Granite, Lake, Lincoln, Mineral, Missoula, Powell	Migrant, possible nesting	
	FE	WY	Lincoln, Teton	Migrant, possible nesting	
Arctic peregrine falcon (<u>Falco peregrinus tundrius</u>)	FE	WA	Clallum, Grays Harbor, Jefferson, Pacific	Migrant (winter)	Coastal strand and coastal wetlands
Aleutian Canada goose (<u>Branta canadensis leucopareia</u>)	FE	WA	Grays Harbor, Pacific	Migrant	Wet meadows, agricultural (grain) fields flood-irrigated and nonirrigated land, bays, inlets
	FE	OR	Clatsop, Coos, Curry, Douglas, Lane, Lincoln, Tillamook		
California brown pelican (<u>Pelecanus occidentalis californianus</u>)	FE	WA	Clallum, Grays Harbor, Jefferson, Pacific	Migrant	Coastal bays and inlets
	FE	OR	Clatsop, Coos, Curry, Douglas, Lane, Lincoln, Tillamook		
Whooping crane (<u>Grus americana</u>)	FE	ID	Bonneville, Fremont	Summer resident	Marshy areas, shallow with soft bottoms, bulrush, cattail, sedge
	FE	MT	None	Migrant	Tall grass prairies, marshes, sand or gravel bars in rivers and lakes
	FE	WY	None	Migrant	Tall grass prairies, marshes, sand or gravel bars in rivers and lakes

Table 6-4. Cont'd.

Species	Status ²	State ³	BPA Service Area Occurrence		Residency Status	Habitat
				County ⁴		
Bald eagle (<u>Haliaeetus leucocephalus</u>)	FT	WA	All 34 counties; nests in Clallum, Cowlitz, Ferry, Grays Harbor, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, Skagit, Skamania, Snohomish, Stevens, Thurston, Wahkiakum, Whatcom, Yakima		Resident breeding population (coastal and in Puget Sound and San Juan Islands); numbers increase with influx of northern birds in winter	Forested areas near water; nest mainly in large coniferous trees
	FT	OR	All 29 counties; nests in Clatsop, Columbia, Coos, Curry, Deschutes, Douglas, Jackson, Jefferson, Klamath, Lake, Lane, Lincoln, Tillamook, Umatilla		Resident (both coastal and interior populations)	
	FE	ID	Bonner, Bonneville, Cassia, Clearwater, Elmore, Gem, Minidoka, Nez perce		Resident	
	FE	MT	Deer Lodge, Flathead, Granite, Lake, Lincoln, Mineral, Missoula, Powell		Resident	
	FE	WY	Lincoln, Teton		Resident	
MAMMALS						
Gray wolf (<u>Canis lupus</u>)	FE	WA	Ferry, Okanogan, Pend Oreille, Stevens		Resident	Uses a variety of habitats, depending on availability of prey items and season of year
	FE	OR	Douglas?			
	FE	ID	Clearwater, Fremont			
	FE	MT	Deer Lodge, Flathead, Granite Lake, Lincoln, Mineral, Missoula, Powell			
	FE	WY	Teton?			
Grizzly bear (<u>Ursus arctos horribilis</u>)	FT	WA	Chelan, Ferry, Okanogan, Pend Oreille, Skagit, Stevens, Whatcom		Resident	Forested areas, wetlands, riparian areas
	FT	ID	Bonner, Boundary, Fremont			
	FT	MT	Flathead, Lake, Lincoln, Missoula, Powell			
	FT	WY	Teton			
Columbian white-tailed deer (<u>Odocoileus virginianus leucurus</u>)	FE	WA	Clark, Cowlitz, Wahkiakum		Resident	Riparian woodland, meadows, bottomlands, oak woodland
	FE	OR	Clatsop, Columbia, Douglas, Multnomah			

Table 6-4. Cont'd.

Species	Status ²	BPA Service Area		Residenc	Status	Habitat
		State ³	Occurrence County ⁴			
Black-footed ferret (<i>Mustela nigripes</i>)	FE	MT	None	Resident		Grassland communities

FOOTNOTES:

¹The information presented in this table has been verified with U. S. Fish and Wildlife Service Endangered Species Offices in Billings, Montana; Boise, Idaho; and Olympia, Washington as of December 15, 1982.

²FE = Federally endangered

FT = Federally threatened

³WA = Washington

OR = Oregon

ID = Idaho

MT = Montana

WY = Wyoming

⁴? = Presence not confirmed

facilities. The residency status of each species is noted as well as the species habitat characteristics. In the Chapter 7 section on Wildlife, these data will be compared to evaluate potential impacts of vegetation management on the designated species.

Wildlife Habitat

Wildlife species composition and abundance on existing transmission line rights-of-way vary with the distribution and abundance of each species' requirements for food, cover, and water. Vegetation management activities may alter the distribution and abundance of these requirements. The habitat of a wildlife species is the complex of environmental factors that meet the needs of that species (Thomas 1979). These habitat requirements may include aspects of vegetation structure and composition as well as special habitat components that are not part of the living vegetation on a site. Special habitat components include snags, dead and downed logs, and litter.

Vegetation structure is the horizontal and vertical arrangement of plants on a site. It is defined by the number of vegetation layers; the proportion of cover in each layer contributed by grasses, forbs, shrubs, hardwood trees, or conifer trees; the total cover by all plants; plant density; and plant height. For wildlife, vegetation structure represents the distribution of foraging substrates (e.g., canopy foliage, understory shrubs), nesting sites, hiding cover, and thermal cover. For example, vegetation structure determines the distribution and abundance of forage, hiding cover, and thermal cover for elk and deer (Thomas et al. 1979). Many bird species appear to select habitats based on the form and density of vegetation layers (Thomas et al. 1975, also see review in Balda 1975).

Plant species composition may be important to some wildlife species. Forage and browse plants vary in palatability and digestibility to herbivores; some are more highly preferred while others are avoided. Hardwood shrubs and trees produce nuts, berries, fruits, catkins, and buds that may be essential to various wildlife species at certain times of the year. In northwestern California, 44 species of birds and mammals utilize mast (i.e., nuts, seeds, berries) and buds of deciduous plants (Marcot 1979).

Special habitat components that may occur on rights-of-way are snags (i.e., standing dead trees), downed logs, and plant litter. These components provide special requirements for certain wildlife species. Cavity nesting birds and

mammals require snags for reproduction and cover. Woodpeckers require snags as foraging sites for insects. Logs and other woody debris such as stumps, bark, and piles of branches provide habitat for species such as rodents, squirrels, grouse, woodpeckers, salamanders, reptiles, and many invertebrates. Plant litter on the soil surface provides important foraging and cover habitat to small mammals, amphibians, and reptiles.

Wetlands, riparian woodlands, and "edge" habitats are of high value because they support high wildlife species diversity and abundance and because they provide special requirements for certain species. Wetlands are highly productive of forage for herbivorous species (e.g., wet meadows provide late summer forage) and support great numbers of migratory birds. Likewise, riparian areas are highly productive throughout the dry season and often support herbaceous and shrub forage species that do not occur in adjacent forests, shrublands or grasslands.

For example, riparian areas in the Northern Rocky Mountains provide critical food resources for grizzly bears during spring, early summer, and late autumn (Lee and Jonkel 1981). During these seasons, the bears require riparian forage to recover from the strains of denning and to support reproductive activities.

Increased plant production in riparian areas often leads to increased plant diversity and layering (both elements of habitat diversity). The linear shape of typical riparian strips maximizes the development of edge with adjacent vegetation types. Riparian microclimates are delicate (cool, moist) and may be altered radically by removal of overstory trees, thus changing stream temperatures and understory plant species composition. Finally, riparian areas often function as corridors for wildlife between other habitat types.

"Edge" habitats occur where different vegetation types (e.g., conifer forests and sagebrush shrublands) or different successional stages (e.g., mature forest and cutover forest) abut and intermingle. Wildlife species are typically greater in diversity and abundance in "edge" habitats than in adjoining uniform vegetation types. This occurs, first, because many species of both adjoining vegetation types will use the edge for one or more habitat functions, and second, because the edge provides special habitats for certain species. For example, a number of species prefer mixtures of shrubs and forest areas, or shrubs and grassland areas within their home ranges. Forest-shrubland edges provide optimal habitat for elk

because of the provision of forage, hiding cover, and thermal cover within close proximity. Birds such as the goshawk, pygmy owl, hairy woodpecker, and pine grosbeak, and mammals such as northern flying squirrels and porcupines also use forest edges.

Public Health and Occupational Safety

Considerable controversy has developed over the past decade regarding the use of pesticides in general, and herbicides in particular. The controversy originated and is sustained by four central issues. First, certain pesticides, notably some insecticides and dioxin-contaminated herbicides, are known or suspected of being agents of serious health problems. These chemicals (e.g., DDT) were used for many years before their hazards were detected and publicized. Issues of concern about these pesticides include human health (e.g., potential of causing cancer, birth defects, abortions, skin ailments), water contamination, hazards to fish and wildlife, contamination of human food sources, and detrimental effects on soil productivity. Concerns over use of the pesticides having known or suspected hazardous properties have been extended to all herbicides in general.

Secondly, members of the public are increasingly frustrated and concerned about losing control over their own environments. In general, this frustration is fueled by the inherently impersonal nature of large government and business entities. Specifically, this frustration is stimulated by the suspicion that herbicides used near one's house, water supply, food supply, or domestic animals by government or industry may be contaminating one's environment. Data indicating that many herbicides are not toxic, that concentrations found after application pose slight risk of exposure to humans or animals, that most do not bioaccumulate in biological organisms, offer little relief to this frustration about chemicals in one's environment.

The third source of concern relates to the difficulty of showing scientifically that a cause-and-effect relationship exists between herbicide exposure and health problems, whether short-term or long-term. The scientific method assumes that two test groups (i.e., exposed and not exposed) are no different before exposure, and differ only in having been exposed or not exposed. If, after exposure, a significantly greater number of exposed individuals show a particular kind of symptom, then some relationship exists, although it may not be cause-and-effect. The rigorous and esoteric nature of scientific inquiry can lead to a sense of uncertainty or distrust on the part of the lay public. Results of valid scientific studies may be discounted.

Finally, true cause-and-effect relationships between herbicide exposures and human health hazards can be shown most conclusively only by controlled experiments on humans. For ethical and sociological reasons, such studies can rarely be conducted. As a result, virtually all available data are from non-human test subjects. Simple extrapolations of data from non-human test animals to humans have many theoretical difficulties (e.g., do both types of organisms react to a chemical in the same way?). In addition, the language of toxicology is extremely technical and the general public has no easy method to obtain data on its own. As a result, the available scientific data have been inadequate to fully relieve public fears and concerns about herbicide use.

Given the above pesticide controversy and problems of scientific research, public health as well as safety of BPA workers are critical aspects of the social environment of BPA's service area. To evaluate these important concerns, the toxicology and environmental fate of all herbicides proposed for use by BPA have been investigated (see Appendix A). In addition to analysis of herbicide effects on health and safety, occupational safety aspects of other vegetation control methods have been described to the extent that available information allows (see Chapter 7 ENVIRONMENTAL CONSEQUENCES - Public Health and Occupational Safety).

Visual Resources

The visual resources of the BPA service area are composed of patterns of distinct landscape elements. Visual patterns are viewed in terms of the form, line, color and texture of the landscape's component parts.

The visual character of each landscape setting is a result of the historic interaction between man and the environment. The landscape elements which define the visual character are landform, vegetation and cultural features. These elements are used because of their relationship to transmission line rights-of-way and substation visibility, viewer position, visual quality and potential visual contrast.

Landscape Setting Types

Landscape setting types found within the BPA service area are shown in Figure 6-2. Each of these settings possesses a distinct visual character and ability to absorb visual impacts related to vegetation management techniques used on

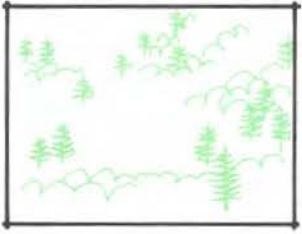
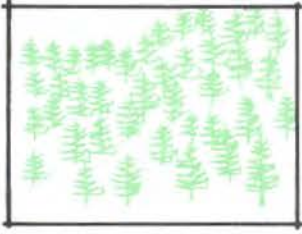
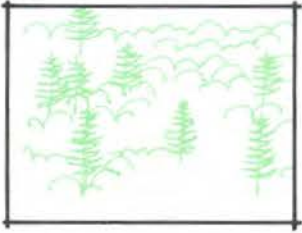
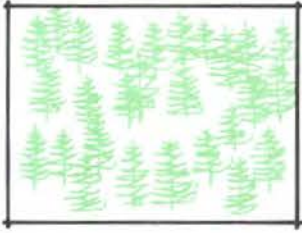
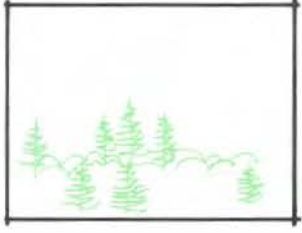
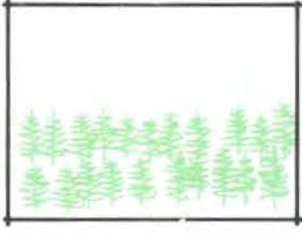
	Grassland	Open Forest	Closed Forest
Flat			
ROW Visibility:	◦ Not distinct	◦ Mod. Distinct	◦ Distinct
Visual Contrast:	◦ None	◦ Low to Mod.	◦ High
Viewer Position:	◦ Level	◦ Level	◦ Level
Veg. Management:	◦ None	◦ Low to Mod.	◦ High
Valley Floor			
ROW Visibility:	◦ Not distinct	◦ Mod. Distinct	◦ Distinct
Visual Contrast:	◦ None	◦ Low to Mod.	◦ High
Viewer Position:	◦ Level or Above	◦ Level or Above	◦ Level or Above
Veg. Management:	◦ None	◦ Low to Mod.	◦ High
Hillside			
ROW Visibility:	◦ Not distinct	◦ Mod. Distinct	◦ Distinct
Visual Contrast:	◦ None	◦ Low to Mod.	◦ High
Viewer Position:	◦ Below	◦ Below	◦ Below
Veg. Management:	◦ None	◦ Low to Mod.	◦ High
Ridgeline			
ROW Visibility:	◦ Not distinct	◦ Mod. Distinct	◦ Distinct
Visual Contrast:	◦ None	◦ Low to Mod.	◦ High
Viewer Position:	◦ Below	◦ Below	◦ Below
Veg. Management:	◦ None	◦ Low to Mod.	◦ High

Figure 6-2. Landscape Setting Types of the BPA Service Area.

BPA right-of-way. Several vegetation types will require little or no vegetation management. Those landscapes which do not require extensive right-of-way vegetation management include range, agricultural, grassland and open forest vegetation types as well as areas of slow vegetational growth.

In general, the landscape setting types are defined by broad vegetation and landform descriptors. The BPA service area can be divided into three generalized vegetation classes: grassland and shrubland occurring throughout most of eastern Oregon and Washington, and southern Idaho; open forest, common on the lower east side of the Cascades and on the southern and eastern exposures of the Northern Rockies; and closed forest (primarily coniferous), which covers most of the Cascades and the Olympics and much of the Northern Rockies. Agricultural land falls into either of the first two categories, depending upon the amount of tree cover or the presence of orchards, woodlots or hedgerows. The three vegetation classes can be considered as three broad visual character classes. Within each class, the vegetation has similar life forms, visual characteristics and visibility potential.

Four landform classes are used to delineate various regions within the BPA service area. The classes are flatland, valley floor, hillside, and ridge. These classes possess distinct visual characteristics and visibility potentials.

The visual character of landscape setting types is portrayed in Figure 6-2. The general distribution, character, and visibility potential of each type is described in Appendix D.

In addition to land form and vegetation visual descriptors, atmospheric clarity and seasonal variation play a major role in right-of-way visibility. Haziness exists even on the clearest of days because the atmosphere is not perfectly transparent. This results in increasing reduction of visibility and visual contrast at greater distances.

Seasonal variation, particularly in regard to snow cover, can play a major role in the level of visual contrast between a right-of-way and the surrounding vegetation. A critical snow cover factor is the relationship between the height of right-of-way vegetation and the depth of snow cover. The amount of vegetation which appears above the snow cover influences the magnitude of contrast between the right-of-way and the surrounding vegetation.

High Sensitivity Landscapes

High sensitivity landscapes are defined as landscapes visible to concentrations of viewers having expectations of high scenic quality. The BPA service area contains many areas of high scenic quality; within these, points of viewer concentration occur. In these areas, viewers are generally sensitive to the introduction of human-made elements that contrast with the surrounding natural landscape character. Areas of high viewer concentration and therefore high sensitivity include parks, recreation areas, lakes, wild and scenic rivers, national trails, historical sites, and scenic highways.

High sensitivity landscapes can occur in any of the landscape setting types shown in Figure 6-2. However, open forests and closed forests on valley floor, hillside, and ridgeline landforms commonly constitute high sensitivity landscapes (i.e. they are visible to many viewers with high-quality scenic expectations).

In contrast, low sensitivity landscapes are those visible to few viewers or to viewers with low expectations of scenic quality. Low sensitivity landscapes can also occur in all landscape setting types but most commonly where grasslands or forests occupy flat landforms.

Historical and Cultural Resources

Resources Located on Existing Rights-of-Way

Since 1974, BPA has conducted surveys to identify historical and cultural sites on proposed rights-of-way prior to construction of transmission facilities. Presumably, transmission facilities constructed since that time either do not contain such sites, or where such sites have been identified, they are now marked and protected. At identified sites on rights-of-way, BPA may enter into agreements with landowners or other agencies to use special management methods in order to prevent adverse impacts to the sites. Similar protective measures may be used at sites discovered prior to or since the construction period survey.

On rights-of-way occupied prior to 1974, unknown and unidentified historical or cultural sites may exist (e.g., burial grounds or lithic scatters in remote regions). If BPA maintenance activities should lead to discovery of such a site, the Historic Preservation Office of the state in which the site is located will be contacted immediately.

Resources Located Near Existing Rights-of-Way

BPA transmission lines may pass near a site or structure that has been identified as historically or culturally significant. At such sites, federal agencies are required to consult with State Historic Preservation Offices regarding actions that might alter the visual settings of the sites (see Chapter 8 ENVIRONMENTAL REQUIREMENTS).

Land Use

Commodity Production

Commodity production in the form of agriculture, forest management, and range management occupies much of BPA's service area. Agricultural land uses occur throughout the region on sites where soils, precipitation (or irrigation), temperature, and topography are appropriate. Approximately one-tenth of BPA's service area is suitable for cultivated crops such as row crops, field crops, berries, and orchards.

Productivity is the critical controlling factor for agricultural land use. Large investments are made to enhance the natural productivity of the land through irrigation, fertilization and weed control. An important economic consideration is the effect of noxious weeds on crop yields, crop quality, or livestock production.

Typically, where cultivation adjoins a transmission right-of-way, it also occupies the right-of-way itself, utilizing all land except the transmission structure sites. The landowner often makes an agreement with BPA to control vegetation as necessary to meet BPA's vegetation management objectives.

Forest management is common throughout western Oregon and western Washington, a region where precipitation and temperature are optimum for tree growth. The coniferous forests of the region west of the Cascade crest are some of the most productive in the world, exhibiting high growth rates and large tree sizes. Because of less precipitation east of the Cascades, timber management is limited to the more moist and colder higher elevations. Here tree growth rates are slower due to the less optimum conditions.

Under intensive management, forestlands are planted, competing species are controlled, and crop trees are harvested on short rotations. Maintaining site productivity and high tree growth rates is of high priority. Because timber crop

trees are not compatible with conductor clearance criteria, timber management does not occupy transmission rights-of-way. An exception is where conductors cross canyons with sufficient clearance for mature tree heights.

Christmas tree plantations occupy corridors below transmission lines on some sites. BPA allows this type of production on condition that the landowner or plantation manager agrees to harvest trees before they violate conductor clearance criteria. BPA's experience with this type of land use, however, indicates that such plantations often are abandoned and ultimately require control at BPA's expense.

Range management involves management of grazing lands for livestock production. This activity occurs predominantly east of the Cascades where rainfall is too low to support forests or, throughout the region, where forests have been cleared to provide livestock forage. Grazing lands are found primarily in the intermountain region at moderate elevations where there is sufficient moisture to support regrowth of forage after grazing, or at lower elevations where irrigation is available. Grazing areas also occur west of the Cascades, but there they often are intermingled with forestry and agricultural land uses.

Noxious weeds are economically important on grazing lands since they may poison livestock or detrimentally affect the quality of livestock products. Where grazing lands occur, they typically extend throughout the transmission rights-of-way they adjoin.

Urban/Residential

Urban and residential land uses are of greater and more concentrated incidence west of the Cascades. In these areas, businesses, homes and other properties adjoin rights-of-way immediately while lawns, gardens, playgrounds, bike paths, and parking lots may extend beneath transmission lines. Often BPA establishes multiple use agreements with landowners or managing agencies to permit activities on rights-of-way on condition of appropriate control of the vegetation present.

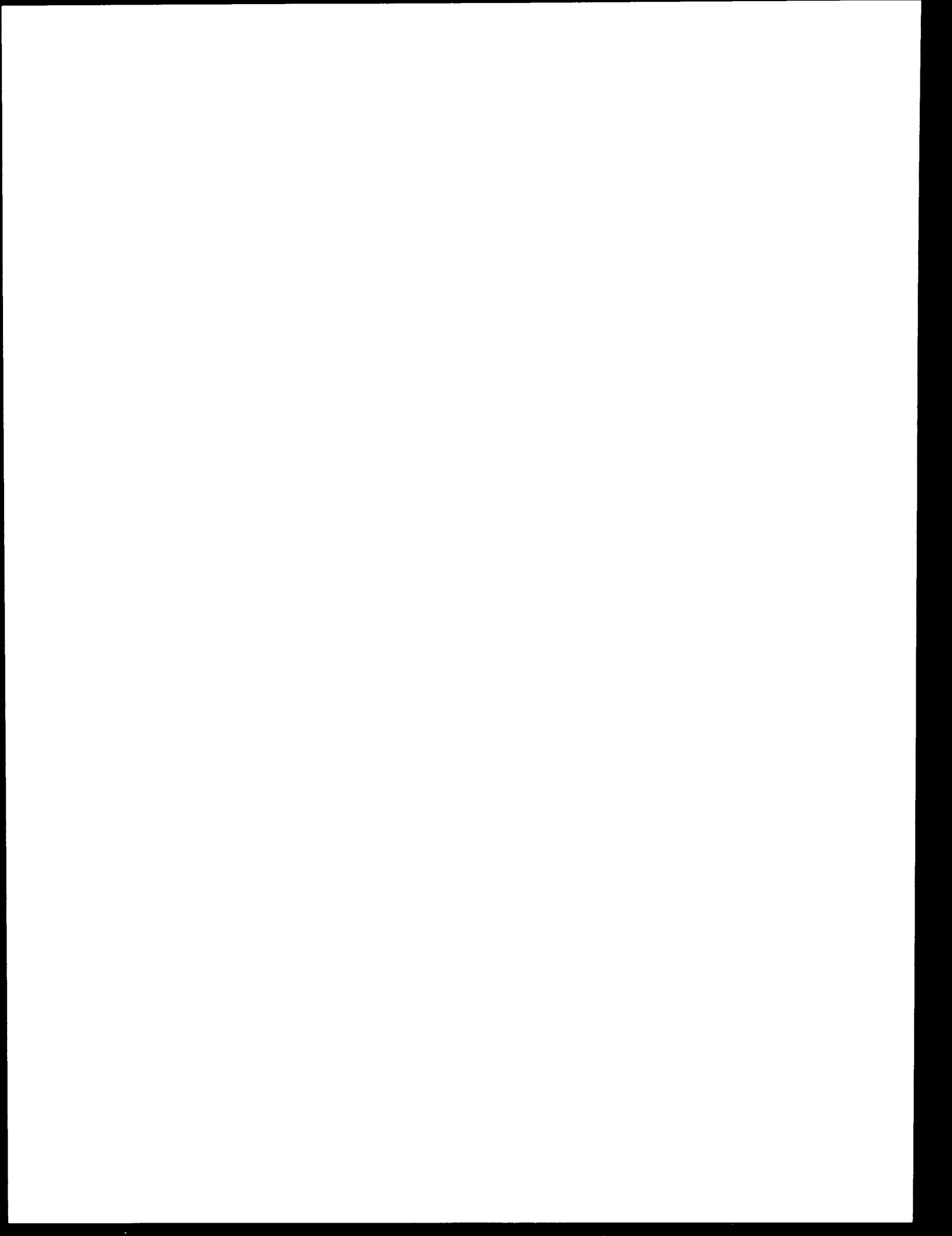
Residential/Scenic

Recreational and scenic lands are distributed widely throughout BPA's service area. Frequently, these uses are concentrated in locations such as the Columbia Gorge or

mountain passes that also are traversed by BPA transmission lines. In these and other locations, BPA rights-of-way may cross parklands themselves or may impact the visual quality of a scenic view from highways or vista points. Where parklands are crossed, BPA may agree to use certain vegetation control methods in order to cooperate with park management objectives.

Municipal Watershed

Many municipalities in BPA's service area manage watershed lands as municipal water supplies. For example, the City of Seattle manages the Cedar River drainage for this purpose. On such lands, human activities are regulated closely to prevent deterioration of water quality due to soil erosion or pollutants.



ENVIRONMENTAL CONSEQUENCES



Chapter 7

ENVIRONMENTAL CONSEQUENCES

Soils

Potential impacts to soils and soil productivity may result from physical disturbance and removal of protective vegetation and litter cover. The following sections briefly describe the nature and import of potential soil impacts and discuss their relationships to vegetation management. Public health implications of vegetation control methods using herbicides (e.g., soil persistence) are discussed later in this chapter (section on Public Health and Occupational Safety).

The discussion is heavily oriented toward mountainous forest lands. This is because most vegetation management occurs on such lands, and this is where the relatively greatest impacts on soil may occur. While large areas of the BPA system, such as the arid plateaus of much of eastern Oregon, Washington and southern Idaho, are susceptible to wind erosion, comparatively little vegetation management is practiced in these areas because of the lack of tall-growing species to interfere with power lines. Where such lands are grazed or farmed, as is usually the case, this dominant use will generally mask any impacts of BPA's limited activities.

Description of Potential Impacts

Soil Erosion and Mass Movement. Increased rates of soil erosion are the primary concern associated with forest land management. Accelerated erosion reduces site productivity, can hamper revegetation efforts, and results in larger discharges of unwanted sediment to lakes and streams. Although the mechanisms of soil erosion are now well understood, quantitative predictive tools are still of limited applicability in mountainous forest lands. This is because of the complex geology, landforms and soil patterns which prevail over much of the mountains of the western U.S.

Primary soil characteristics which have been shown to have a direct relationship to soil erosion are those which affect water transmission and aggregate stability: surface and subsoil texture, structure, stoniness, parent material, depth, infiltration capacity, and permeability. Additional site characteristics used to help predict the hazard of

increased soil erosion include slope, vegetation and litter cover, climatic erosivity, and microtopography. For any given site and planned management activity, the examination of these factors will allow an assessment of the erosion hazard to be made.

Accelerated erosion is most pronounced where appreciable on-site disturbance or removal of protective vegetation occurs, such as with mechanical clearing. When nonmechanical treatments are utilized, the chances of increased soil erosion will be minimal. Vegetation management as practiced by BPA favors the retention and vigor of low-growing vegetation. Thus, little effective loss of protective cover occurs.

Mass movement of soil, such as sliding or slumping, may be induced whenever the subsurface flow of water is altered. Cut-slopes and drainage modifications resulting from road construction are of primary concern in this regard. The chances of inducing mass movement will be greatest on steep slopes, on fine textured soils, and on those rock types of low competence such as decomposed granite, shale and fractured metasediments, and sediments with bedding planes oriented parallel to the slope.

Another mechanism of induced mass movement is increased flow of water through the soil due to the removal of water-consuming plants. This should not be a significant concern to BPA, however, because most vegetation is left undisturbed.

Soil Displacement, Compaction and Infiltration Loss. These impacts are discussed together because typically they are associated only with mechanical clearing operations. One exception to this is that fire, when used either as a clearing tool or for slash disposal, can result in the formation of a nonwetable soil surface which greatly retards water infiltration. Soil displacement involves the actual movement of soil from one point to another, as when bulldozers push soil around a site. This practice leaves soil unevenly distributed, and can increase rates of surface erosion over the entire site. Adverse effects of soil compaction include reduced infiltration capacity, reduced water holding capacity and a higher degree of surface runoff.

Nutrient Loss. Removal of vegetation cover on the soil surface may lead to loss of soil nutrients. Maintenance of adequate ground cover will allow absorption of nutrients made available by treatment of target vegetation. Slash burning can lead to volatilization of some nutrients and leaching of others.

Increased Soil Temperature. Increases in soil temperature can occur when the soil surface is exposed to increased amounts of incident radiation. Elevated soil temperature hastens drying of the upper profile, making revegetation more difficult. This impact is more likely to occur during and immediately after initial construction of power lines, when a significant amount of vegetation is removed and large areas are left barren. For continuing management this should only be a problem where large areas are cleared. Rapid revegetation of the site with appropriate ground covers should effectively eliminate this hazard.

Increased Surface Runoff. Increased rates of surface runoff lead to both more rapid soil erosion and more effective delivery of the eroded particles to waterways. This impact will be most evident where mechanical clearing has taken place. In areas where surface runoff has been or is expected to be increased significantly, it may be necessary to install diversion structures such as water bars or sediment traps to minimize downstream water quality impacts.

Consequences of Alternative Methods

The relationship between potential soil impacts and the alternative control methods is summarized in Table 7-1 and discussed below.

Broadcast Chemical Methods. Aerial application of herbicides has virtually no soil impacts except at heliport loading sites. Broadcast applications using ground-based equipment have potential for slight impacts due to use of right-of-way access roads by maintenance crews and equipment. Only certain plant species are susceptible to broadcast herbicides (see Vegetation section of this chapter); therefore, adequate ground cover is maintained to prevent adverse soil impacts.

Spot Chemical Methods. These methods may have slight soil impacts due to use of access roads by application equipment and maintenance crews. Abundant ground cover generally remains on rights-of-way after spot treatments to protect the soil surface.

Manual Methods. Slight impacts may ensue from use of access roads by maintenance crews. As with spot chemical treatments, abundant vegetation cover is retained.

Table 7-1. Probable Environmental Consequences of Alternative Methods on Soils,
with Range of Potential Impacts Shown

Note: The lower number of the range indicated is the potential impact of a mitigated implementation of the respective control method; the upper number is the potential worst-case impact when mitigation measures are not observed or fail to operate as planned.

Potential Soils Impact	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Soil Erosion and Mass Movement	0 ^a -1	0 ^a -1	0 ^a -1	0 ^{b-1c} -2	0 ^{ad-1c} -2
Soil Displacement, Compaction and Infiltration Loss	0 ^a -1	0 ^a -1	0 ^a -1	1 ^{bc} -2	0 ^{ad-1c} -2
Nutrient Loss	0	0	0	0 ^b -2	0 ^d -2
Increased Soil Temperature	0	0	0	0 ^b -2	0 ^d -2
Increased Surface Runoff	0	0	0	1 ^b -2	0 ^d -2

NOTES:

Key to Ratings: 0 = Virtually no impact
1 = Potentially slight impact
2 = Potentially significant impact

Letter superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating.

Key to Letter Superscripts: a = Minimize travel on r-o-w access roads; maintain access roads in good condition.
b = Use only mechanical mowing or flailing equipment.
c = Avoid use of mechanical scarification on slopes over 20-30 percent depending on soil erodibility and stability.
d = Avoid use of mechanical scarification.

Mechanical Methods. These methods have potential for significant impacts to soils. Mechanical scarification is detrimental to soils by increasing the potential for erosion, compaction, displacement, infiltration loss, nutrient loss, temperature increase, and increased runoff. Mechanical mowing and cutting equipment have reduced impacts but still may cause soil compaction, infiltration loss, and increased runoff.

The initial construction of power lines and the development and maintenance of access roads have far more potential impact on soils than does continuing management of vegetation. Maintenance of unsurfaced access roads alone probably results in more erosion than do all vegetation management activities.

Mechanical clearing should not be practiced on slopes over 30 to 35 percent as a general rule. Slopes over 20 percent should be avoided where unstable geologic units are encountered. Similarly, heavy machinery should not be used on areas of highly erodible, shallow, rocky or wet soils. Mechanical clearing should always be performed during the dry season to minimize the danger of soil compaction and puddling.

Biological Methods. Biological control using domestic or wild grazing animals may cause slight soil impacts; animals may bare the soil of vegetation and cause soil compaction and erosion on small sites. If biological control projects require soil scarification for initial grass establishment, impacts will be similar to those of mechanical methods (see Chapter 3).

Vegetation

Description of Potential Impacts

The dynamics of vegetation-change-over-time create the necessity for periodic control of transmission line vegetation. Natural succession in areas supporting forest vegetation leads to the successional replacement of low-growing grasses, forbs, and shrubs by tall-growing hardwood and conifer trees. The primary objectives of vegetation management on rights-of-way are to prevent tall-growing plants from interfering with transmission conductors, to maintain clear working spaces around transmission structures, and to keep access roads free of brush. As such, these objectives are aimed at establishing and

maintaining an appropriate vegetation structure on rights-of-way. The long-term impact of management on vegetation is therefore the temporary and not irreversible achievement of this structure. Various short-term impacts result from the application of control methods to achieve the long-term objective.

Reduction in Structural Diversity. The particular methods and manner with which tall-growing and access-restricting vegetation is controlled create variations in vegetation structure on rights-of-way. Basic differences in structure result from whether control methods are applied in a broadcast (nonselective) or a spot (selective fashion). Non-selective methods will establish relatively homogeneous vegetation structures (e.g., only grasses and ferns) while selective methods will allow the development of heterogeneous plant communities comprised of all nontarget plants (e.g., grasses, broadleaved herbs, shrubs).

Structurally-diverse plant communities have high wildlife values due to "edge effects" among different plant forms such as tall shrubs, low shrubs, grasses, broadleaved herbs, and ferns (see following section on Wildlife). They also may have high visual quality value by blending right-of-way vegetation with the vegetation on adjacent lands (see section on Visual Resources below).

Reduction in Total Vegetation Cover. Vegetation control practices may temporarily reduce total plant cover on a site. Where all vegetation is removed, exposed soils will be subject to erosion until plants reestablish. Exposed soils also may provide suitable sites for the establishment and thus spread of noxious weeds.

Loss or Reduction in Nontarget Plant Species. Target species are those capable of producing plants that are tall-growing in relationship to overhead transmission conductor height, or species capable of blocking access to structure sites and access roads. Ideally, these target species are eliminated from sites where they would constitute operational or safety hazards. This shift in species composition from tall-growing to low-growing plant forms is a direct and long-term objective and impact of vegetation management. However, it is not irreversible; vegetation will regrow after management is discontinued.

The species diversity of managed rights-of-way may be enhanced compared to that for native coniferous forests.

Dense forest conditions generally exclude species characteristic of more open habitats. Openings created by rights-of-way may allow a greater diversity of plant species to co-exist.

Loss or reduction in nontarget species may occur where control methods are applied in a broadcast and nonselective fashion. When nonselective methods are used, species with no potential for becoming hazardous plants may be eliminated or reduced unnecessarily, although temporarily. Reductions in nontarget species are of concern because nontarget species may have high value on rights-of-way as wildlife forage, wildlife cover, erosion control, or visual amenity. Moreover, if threatened, endangered or otherwise sensitive plant species occur on rights-of-way, nonselective methods may cause their reduction or elimination.

Loss or Reduction of Endangered and Threatened Plants. No plants designated as endangered or threatened by the U.S. Fish and Wildlife Service are known to occur along BPA's transmission lines (see Table 6-3). The only listed plant identified in the same county as a BPA transmission line is McDonald's rock-cress in Curry County, Oregon. The known population of this species is in the southeastern corner of the county; the nearest BPA transmission line is located along the coast running north from Gold Beach to Bandon. The plant's habitat in the southeastern corner of the county (serpentine soils derived from peridotite) is unlike that found along the coast.

The differences in habitat type and geographical location make it unlikely that other populations of McDonald's rock-cress might be found on the existing BPA right-of-way.

Consequences of Alternative Methods

Probable environmental consequences are summarized in Table 7-2 and described in the following sections.

Broadcast Chemical Methods. The impacts of broadcast chemical methods on vegetation are determined by the susceptibility of plants in a treated area to the herbicide formulation used, its application rate, and the time of year when treatment occurs. Certain herbicides are described as selective in that they affect the growth and survival of only certain plant types or species. Nonselective herbicides are effective on relatively broad spectrums of plant species.

Table 7-2. Probable Environmental Consequences of Alternative Methods on Vegetation
with Range of Potential Impacts Shown

Note: The lower number of the range indicated is the potential impact of a mitigated implementation of the respective control method; the upper number of the range is the potential worst-case impact when mitigation measures are not observed or fail to operate as planned.

Potential Vegetation Impacts	Vegetation Control Methods				
	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Reduction in Structural Diversity	1 ^a - 2	0	0	0 ^c - 2	0
Reduction in Total Vegetation Cover	0 ^{ab} - 1	0	0	0 ^d - 2	0
Loss or Reduction of Nontarget Plant Species	0 ^{ab} - 2	0	0	1 ^c - 2	0
Loss or Reduction of Endangered or Threatened Plant Species	No federal endangered or threatened plant species or ones proposed for these designations occur on or near BPA rights-of-way; no adverse impacts will occur.				

NOTES:

Key to Ratings: 0 = Virtually No Impact
1 = Potentially Slight Impact
2 = Potentially Significant Impact

Letter Superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating.

Key to Letter Superscripts: a - Use Herbicides Highly-selective for Target (tall-growing) Plant Species.
(see text for explanation) b - Restrict Broadcast Application to Monotypic, Uniform Stands of Susceptible Target Species, Employ Drift Control Measures.
c - Avoid Application of Mechanical Methods Uniformly Across Large Right-of-Way Areas.
d - Avoid Mechanical Scarification Techniques; Use Only Mowing or Flailing Machines.

BPA applies any of three combinations of herbicides as broadcast foliage sprays by helicopter in late spring or summer: dicamba plus 2,4-D; picloram + 2,4-D; and 2,4-D ester. The relative susceptibilities of common right-of-way plant species to these herbicide combinations at the rates applied by BPA are shown in Table 7-3.

In general, conifer species listed are highly susceptible at the rates and timing of application used. An exception is ponderosa pine which has a pronounced peak of resistance during part of the typical broadcast treatment season. Among hardwood trees, susceptibilities vary among the herbicide combinations. Several of the most common target species, red alder, black cottonwood, and quaking aspen, are highly susceptible to all combinations. Other species (e.g., bigleaf maple, Oregon white oak, and cascara) are slightly or moderately susceptible to each of the combinations.

Among shrubs, many species are resistant or slightly susceptible to the broadcast herbicides. For example, typical shrub communities of the western Cascades are virtually unaffected by broadcast applications of 2,4-D. Grasses and ferns are resistant to all herbicide combinations; broadleaf forbs are moderately-susceptible to the dicamba and picloram combinations while they are highly-susceptible to 2,4-D.

Broadcast aerial applications would cause the loss or suppression of the conifer species component of right-of-way vegetation, a desired management goal. Hardwood species are affected variably, shrubs are little affected, and grasses and ferns are unaffected. Broad-leaved forbs are eliminated or suppressed to some extent. Where right-of-way vegetation is a diverse mixture of susceptible and nonsusceptible species, low-to-moderate loss in species and structural diversity will occur. Where susceptible species are dominant, species and structural diversity will be enhanced by removal of homogeneous stands of target species. For example, dense, uniform stands of red alder will be eliminated by broadcast applications; species and structural diversity will develop as other plant forms establish and grow in the space created by removal of the uniform alder stands.

Similarly, a temporary reduction in total plant cover may occur if treated vegetation is uniformly comprised of susceptible species. Typically, however, abundant cover of shrubs, grasses, and ferns remains or establishes quickly after broadcast applications.

Table 7-3. Relative susceptibility of common plant species found along BPA transmission line rights-of-way to various herbicides applied as broadcast foliage sprays by helicopter in late spring and summer at conventional rates of application used by BPA.

Species ¹	Herbicide Products ²		
	Dicamba + 2,4-D	Picloram + 2,4-D	2,4-D ester
	(Banvel® 720)	(Tordon® 101)	(Esteron 99)
	(Banvel® 4-W.S. + 2,4-D)	(Amdon® 101)	(Esteron 99)
	-----Relative Susceptibility ³ -----		

CONIFERS

<u>Abies grandis</u> (grand fir)	H	H	H
<u>A. lasiocarpa</u> (subalpine fir)	H	H	H
<u>A. procera</u> (noble fir)	H	H	H
<u>Libocedrus decurrens</u> (incense-cedar)	H	H	H
<u>Picea engelmannii</u> (Engelmann spruce)	H	H	H
<u>P. sitchensis</u> (Sitka spruce)	H	H	H
<u>Pinus contorta</u> (lodgepole pine)	H	H	H
<u>P. ponderosa</u> (ponderosa pine)	H	H	H
<u>Pseudotsuga menziesii</u> (Douglas-fir)	H	H	H
<u>Thuja plicata</u> (western redcedar)	H	H	H
<u>Tsuga heterophylla</u> (western hemlock)	H	H	H

Species ¹	Herbicide Products ²		
	Dicamba + 2,4-D	Picloram + 2,4-D	2,4-D ester
	(Banvel® 720)	(Tordon® 101)	(Esteron 99)
	(Banvel® 4-W.S. + 2,4-D)	(Amdon® 101)	(Esteron 99)
	-----Relative Susceptibility ³ -----		

HARDWOODS

<u>Acer macrophyllum</u> (bigleaf maple)	S	M	M
<u>Alnus incana</u> (mountain alder)	H	H	H
<u>A. rubra</u> (red alder)	H	k	H
<u>Arbutus menziesii</u> (Pacific madrone)	M	H	M
<u>Castanopsis chrysophylla</u> (golden chinkapin)	M	M	M
<u>Cornus nutallii</u> (Pacific dogwood)	S	M	S
<u>Fraxinus latifolia</u> (Oregon ash)	S	M	S
<u>Lithocarpus densiflorus</u> (tanoak)	S	S	M
<u>Populus tremuloides</u> (quaking aspen)	H	H	H
<u>P. trichocarpa</u> (black cottonwood)	H	H	H
<u>Prunus emarginata</u> (bitter cherry)	M	H	M
<u>Q. garryana</u> (Oregon white oak)	M	M	M
<u>Rhamnus purshiana</u> (cascara)	S	M	S
<u>Salix spp.</u> (willow)	M	M	M

Table 7-3 (contd)

Species ¹	Herbicide Products ²		
	Dicamba + 2,4-D (Banvel® 720)	Picloram + 2,4-D (Tordon® 101)	2,4-D ester (Esteron 99)
	Relative Susceptibility ³		
SHRUBS AND VINES			
<u>Acer circinatum</u> (vine maple)	S	M	S
<u>Arctostaphylos</u> spp. (manzanita)	H	H	H
<u>Ceanothus</u> spp. (ceanothus)	M	H	M
<u>Corylus cornuta</u> (western hazel)	S	M	M
<u>Gaultheria shallon</u> (salal)	R	R	R
<u>Holodiscus discolor</u> (oceanspray)	S	M	M
<u>Rhododendron macrophyllum</u> (Pacific rhododendron)	R	R	R
<u>Rhus diversiloba</u> (poison oak)	S	M	S
<u>Rubus parviflorus</u> (thimbleberry)	S	S	S
<u>R. procerus</u> (Himalayan blackberry)	S	H	S
<u>R. spectabilis</u> (salmonberry)	S	M	S
<u>R. ursinus</u> (trailing blackberry)	S	M	S
<u>Sambucus</u> spp. (elderberry)	M	H	S
<u>Symphoricarpos</u> spp. (snowberry)	R	S	S
<u>Vaccinium</u> spp. (huckleberry)	S	S	S

Species ¹	Herbicide Products ²		
	Dicamba + 2,4-D (Banvel® 720)	Picloram + 2,4-D (Tordon® 101)	2,4-D ester (Esteron 99)
	(Banvel® 4-W.S. + 2,4-D)	(Amdon® 101)	
-----Relative Susceptibility ³ -----			

¹Within each broad taxonomic group, species are arranged in alphabetical order according to their scientific name.

²Dicamba, picloram, 2,4-D amine, and 2,4-D ester formulations are rarely, if ever, applied separately as aerial foliage sprays to BPA transmission line rights-of-way. They are usually applied in some form of mixture as indicated in the table. Therefore, the relative species susceptibilities given in the table represent responses of these plants to the designated herbicide mixture, rather than to individual herbicides.

³Relative susceptibilities are primarily based on information provided in Newton, M. and F. B. Knight (1981. Handbook of weed and insect control chemicals for forest resource managers. Timber Press, Beaverton, OR), coupled with professional experience. Other pertinent sources are: Oregon State University Extension Service (1982) and Gratkowski (1981). Code is translated as follows:

H = Highly susceptible (e.g., complete kill or long-term control).

M = Moderately susceptible (e.g., temporary defoliation or die-back of terminal portion of plant).

S = Slightly susceptible (e.g., partial defoliation or terminal injury).

R = Resistant (e.g., manifesting few, if any, visual symptoms of herbicide injury).

Broadcast herbicide impacts on nontarget species depend on the relative selectivity of the herbicide formulation used. As is evident in Table 7-3, the broadcast herbicide combinations used by BPA are relatively selective for tall-growing target species (i.e., conifers and some hardwoods). Nontarget species affected are some shrub species and broad-leaved forbs in general. Broad-leaved forbs may include noxious weeds and therefore they may also constitute target plant species during weed control projects. Alternatively, broad-leaved forbs could be important forage species for elk and deer.

Where dense stands of tall-growing target species occupy rights-of-way, treatment with broadcast chemicals will enhance the occurrence of nontarget shrub, grass, and forb species. Typically, there is a surge in herbaceous cover on sites opened up by removal of dense tree or shrub overstories (Newton and Dost 1981). Species whose seeds are carried by wind or birds generally will be the first to colonize new growing spaces.

Depending on the relative selectivity of herbicides used in broadcast applications, the long-term result will be the establishment of low-growing communities (grasses and shrubs in particular) of nonsusceptible plant species. As practiced by BPA, not all tall-growing plants can be controlled by broadcast applications, necessitating manual or spot chemical treatments at periodic intervals (every third or fourth treatment rotation, i.e., every 10-20 years west of the Cascades). Broadcast applications often only stunt or set back tall-growing plants (especially conifers) due to variability in individual plant and species susceptibility to a given chemical, rate of application, and timing of application. As a result, some tall-growing plants will survive typical broadcast applications.

At the most extreme, potential impacts of broadcast chemical methods are the establishment of single-layer plant communities of grasses and ferns, the removal of all vegetation cover where all species present are susceptible, or substantial losses of susceptible nontarget plant species. These impacts can be mitigated substantially through incorporation of several measures. Herbicides used in broadcast applications should be highly-selective for the tall-growing or other problem species on a site. This measure would allow maximum retention of nonproblem shrubs, providing structural diversity, maximum retention of nonproblem vegetation cover, and minimum impact to nontarget plant species.

Where mixed species stands of susceptible target species and susceptible nontarget species occur, the use of broadcast

chemical methods should be minimized, due to potential impacts to nontarget plants. Broadcast applications should be restricted to uniform, monotypic stands of susceptible target species. If used in these situations, a potential beneficial impact should result since suppression of the dominant target species may allow the development of stands with greater structural and species diversity.

Spot Chemical Methods. Spot herbicide methods are selective in that only individual plants or clumps of plants are treated. Long-term reductions in structural and species diversity can be limited to the extent necessary to meet vegetation management objectives. Virtually no long-term reductions in total plant cover occur, as long as understory vegetation is present or establishes quickly beneath treated trees or shrubs.

Nontarget species may increase in number and density as additional growing space is created. The long-term impact of spot chemical methods is the establishment and maintenance of heterogeneous low-growing communities of nontarget species.

Manual Methods. Manual treatments also are selective since only target species are removed. Virtually no impacts to vegetation are anticipated beyond that necessary to meet management objectives. Nontarget species presence may be enhanced by removal of target species. Alternatively, if removed target plants are sprouters, and if they are not treated with herbicides to prevent sprouting, dense monotypic sprout stands may develop. In western Oregon and Washington, manual cutting of sprouting species results in rapid resurgence of sprouts to near original height, sometimes within two years after treatment. Sprout density may be up to five times that of the original stand (Newton and Dost 1981).

Mechanical Methods. These treatments have significant potential to adversely affect vegetation in several ways. Mechanical treatments are nonselective in that all plants in a treated area are removed, either by scarification of the soil surface or by mechanized mowers and brushcutters. Vegetation is totally removed or reduced to low ground cover of grasses, forbs, and shrub stumps. Structural diversity of vegetation is severely reduced for the period of time necessary for substantial regrowth of a mixture of plant types and sizes (i.e., several or more years).

Newton and Dost (1981) report that following scarification for timber site preparation in western Oregon and Washington, 70 percent of brush plants are killed. Exposure of bare mineral soil is favorable for germination of light-seeded species such as grasses and alder. Some shrubs resprout from surviving root systems. The result is an open stand of woody plants surrounded by dense cover of grasses and forbs for up to four years after scarification. Dominant woody plants are large hardwoods whose stumps could not be removed, germinating shrubs such as elderberry, and shrubs propagating from root pieces (e.g., salmonberry and blackberry).

On some sites, grass cover establishing after scarification is resistant to invasion by seedlings of woody plants. More typically, however, grasses grow poorly on acidic, nutrient-deficient forest soils; such sites provide favorable seedbeds for establishment of tall-growing tree seedlings (Taber 1977).

Mechanical cutting or flailing of right-of-way vegetation induces abundant sprouting and root suckering by many woody species (Newton and Dost 1981). For example, maples, blackberries, and salmonberry thrive on repeated cutting by machines. Dense hedges of sprouts are produced, dominated by the species with the most rapid growth rates (e.g., big-leaf maple).

Mechanical methods in general cause substantial reductions in structural diversity for a period of years, and remove nontarget as well as target species. Reductions in plant cover are nearly total with scarification, while, with cutting or flailing, residual ground cover is limited to grasses, forbs and brush stumps.

Adverse impacts of mechanical methods could be mitigated. Reductions in structural diversity and nontarget species can be minimized by avoiding uniform mechanical treatments on large areas; these techniques can be limited to patches or predominantly target vegetation scattered along rights-of-way. Intervening patches can be maintained with other treatment methods. Reductions in total plant cover can be avoided by use of mowing and flailing machines instead of scarification techniques.

Biological Methods. Biological methods entail the use of biological organisms and natural vegetation dynamics to prevent the establishment of tall-growing target species. When this preventative strategy is not totally successful and tall-growing plants establish, manual or spot chemical treatments must be used.

Prescribed grazing using sheep or goats has the following effects: sprouts and low top-growth of several species of woody hardwoods and shrubs are removed, tall and less palatable species are left, and palatable grasses and forbs are consumed. The success of this method depends on the palatability and therefore the relative control of tall-growing target species. For some species, palatability may be limited to a brief period in spring when new growth begins. Simulation modeling of sheep grazing on BPA rights-of-way has indicated that limited control of target species would occur, primarily due to low palatability of tall-growing conifers and red alder (Zamora and Nelson n.d.).

The general tendency under grazing is for brush to be controlled, to some extent, and for herbaceous cover to increase (Newton and Dost 1981). On dry sites, dense herb cover will inhibit establishment of conifer seedlings. On wet sites, dense herb cover will inhibit invasion by light-seeded shrubs and hardwoods. In western Washington, however, bigleaf maple grows so rapidly that sprouts are out of reach of grazers by the end of the first year after cutting.

Establishment of stable, low-growing stands of vegetation is an experimental biological method aimed at accelerating the general tendency of right-of-way vegetation under chemical and manual methods. Where tall-growing species are consistently removed, low-growing communities remain. The stability of these communities can be enhanced by management activities favoring low-growing species that resist tree invasion through competition for space, light, and moisture or through allelopathic by-products (i.e., chemicals produced by some species that inhibit the growth of other species). Certain grass and shrub species have these effects and can be favored by planting, fertilizing, and selective removal of taller species.

Wildlife management as a right-of-way maintenance technique involves a combination of the previous two methods, except that wild herbivores (deer, elk, rodents) provide grazing control instead of domestic livestock. Again, spot chemical or manual methods must be relied upon for control of tall-growing plants that escape biological control (Taber 1981).

Biological control impacts on vegetation would be virtually nil; structural diversity is limited only insofar as necessary to efficiently meet clearance criteria, dense vegetation cover is generally maintained, and nontarget species are favored in order to inhibit target species.

Water Quality and Fisheries

The following sections describe the probable environmental consequences of alternative vegetation control methods on water quality and fisheries.

Features of Watersheds that Modify Impacts

Several watershed features may magnify impacts on water quality and aquatic communities. Coarse, rocky soils have low water-retention capability, are readily leached, and are easily disturbed. Disturbed soils are highly susceptible to wind and water erosion; any reductions in vegetation cover can exacerbate erosion. Steep slopes increase the quantity of surface runoff and decrease retention time, thereby concentrating any sediment or chemical runoff into a shorter time span.

Other watershed features may tend to minimize or reduce the impacts of vegetation management practices. A soil matrix high in organic matter typically binds many chemical compounds, preventing the movement of chemicals away from application sites. Continuous ground cover of vegetation and plant litter minimizes surface runoff and reduces soil erosion. Finally, high aeration of soil and high organic matter contents foster growth of soil microbes and fungi which can biodegrade chemicals. Soil fungi are important to water quality because of their role in nutrient and solute retention (U.S. Environmental Protection Agency 1977).

The orientation and slope of a right-of-way in relation to a water body also plays a major role in modifying impacts on water quality and fisheries. If a right-of-way is perpendicular to a stream, environmental effects initially reach the stream in a localized area, and the intensity of the effects often depends on the slope. On the other hand, a right-of-way running parallel to a stream may influence the stream over a longer distance, depending on the slope of the terrain and right-of-way distance from the stream.

Description of Types of Potential Impacts

Water Quantity. Reduction in plant biomass increases soil moisture and thereby surface runoff and water yield by reducing plant consumption and transpiration losses. However, the surface area affected on a watershed by right-of-way vegetation management is usually very small, and actual yield of additional water is probably insignificant.

Sedimentation and Streambank Erosion. Vegetation on a watershed is an important factor in reducing soil erosion because roots act to bind soils, and above-ground plant structures reduce the rate of flow of surface water and the movement of soil particles. Riparian vegetation stabilizes streambanks. Removal or alteration of vegetation on a watershed may incrementally increase soil erosion rates, and thereby sediment deposition in water courses. Removal of vegetation along streams may encourage in some cases indiscriminate stream crossings by off-highway vehicles.

Sediments deposited into streams or lakes as the result of accelerated soil erosion may adversely affect water quality and aquatic life in several ways. Turbidity caused by suspended sediments reduces light penetration, thereby reducing photosynthesis and aquatic plant production. Fish depend on aquatic insects for food; these insects trap and feed on fragments of plant material grown in the stream or blown or washed into the stream. Above normal amounts of sediment not only interfere with plant growth but with the ability of aquatic insects to capture plant fragments. Sediment may act as an abrasive or bury sedentary and tube-dwelling insects. These events typically reduce production throughout the food chain.

An important example of the effects of accelerated erosion concerns the production of salmon and steelhead trout. Many salmonid fishes spawn only in areas where bottom gravels are of appropriate size and lacking in fine sediments. Excessive depositions of fine sediments reduce the flow of water and oxygen through bottom gravels, suffocating eggs and lowering spawning success. Large quantities of fine sediments may clog fish gills, leading to oxygen deficiency and death. Careless timber harvest, road construction and urbanization can be major causes of accelerated erosion.

Elevated Stream Temperatures. A small stream generally has a low resistance to air temperature changes because its surface area to volume ratio is sufficiently high to provide little heat-holding capacity. The removal of riparian vegetation along a stream allows exposure to direct solar radiation. A number of studies have shown that stream temperatures rise when relatively short sections of stream are exposed to direct sunlight (West Virginia University 1978). For example, Brown et al. (1971) found a temperature increase of 7.2°C (13°F) after exposing 46 meters (150 feet) of a small Oregon stream to direct solar radiation. Excessively elevated stream temperatures affect the metabolism of aquatic organisms, inhibit reproduction in some species, and may kill cold-water species such as trout and salmon.

Herbicide Contamination. Herbicides are generally considered to be less threatening to water quality and fisheries than insecticides. This is because the processes of plant growth and metabolism that herbicides are designed to affect are substantially different from the processes of insect and animal growth and metabolism. Nevertheless, herbicide contamination of surface water and ground water is of concern, especially when water is diverted to irrigation or domestic use downstream of the application site.

Impacts of herbicides on water quality and fisheries are mediated by several factors. Herbicides do not depend on large numbers of small drops for coverage of target areas. Unlike with insecticide applications, broadcast herbicide equipment minimizes small drops, and off-target movement (i.e., drift) is limited. A certain level of toxicity is inherent to each chemical, but the degree of hazard is not. Herbicide toxicity, and duration and amount of exposure determine the level of risk or the hazard to fish and other aquatic life.

Interactions between a chemical and the stream environment alter the degree of hazard to aquatic life. Streamside cover may intercept spray droplets and reduce the amount of chemical reaching a stream surface. Depth of water and not surface dimensions of the water body determines chemical concentration. Sprays are intended to cover a unit of surface area, but concentration in water is volume-dependent. Toxicity for aquatic organisms is dependent on concentration of the chemical.

Stream sediments and organic detrital matter provide sites for chemical adsorption. Adsorption reduces the effective concentration in water, and adsorbed molecules are not biologically active. Adsorptive capacity is affected by turbulence, velocity and the amount of suspended sediment and organic matter in the stream. On the other hand, adsorption means that a chemical persists in an area for a longer period of time, even if effective concentration in the water is reduced.

The velocity of a stream greatly influences the duration of exposure to the initial concentration. The temperature, chemistry, and oxygen content of the stream affects the rate of biodegradation of the chemical.

Herbicides are not purposefully applied by BPA to aquatic vegetations, and therefore rarely appear in water at detectable levels. The most common impacts of silvicultural herbicide use on water quality and fisheries result from changes in leaf and litterfall, insect populations, and

perhaps stream shading (U.S. Environmental Protection Agency 1977). In silviculture, extensive areas of watershed may be treated. In right-of-way maintenance activity, however, those impacts are usually insignificant because of the small land surface areas involved.

The routes of herbicide movement from application sites into water have been studied in detail. Thorough reviews have been prepared by U.S. Environmental Protection Agency (1977), Ghassemi et al. (1981) and Norris (1981). Direct application, chemical drift, and translocation are major routes of potential contamination.

Direct Application and Chemical Drift -- BPA has established guidelines and standards for herbicide application to minimize the probability of direct application of herbicides to water surfaces. The precautions, however, do not eliminate the potential for direct contact with water surfaces because very small streams, ephemeral stream beds, and seep areas may be hidden from view, especially during aerial application. Mobilization of residues of persistent herbicides in ephemeral stream channels can occur when a stream is charged by surface runoff. Unusual microscale wind currents and accidental applications or spills may result in chemicals reaching water surfaces. Direct application and drift to surface waters or ephemeral stream channels are the most important routes of herbicidal contamination of water bodies, even for the phenoxy herbicides (e.g., 2,4-D) which are relatively mobile in soil (Norris 1981).

Chemical Translocation -- A less common route for herbicide contamination of water occurs when a chemical is transported by water and soil from an application site to a water body. Soil erosion is probably the major route of herbicide translocation because most herbicides are readily adsorbed to soil particles and do not leave the application site unless the soil itself is removed. Surface runoff may translocate certain herbicides, particularly those in pellet or granular form.

Leaching through groundwater may occur after use of herbicides which are not readily adsorbed to soil particles, especially when the water table is close to the surface. Norris (1981) found that herbicide applications to marshy areas can lead to higher than expected levels of contamination in nearby streams, particularly after a heavy rainfall (Norris 1976). A more detailed discussion of potential for herbicide contamination is contained in the section on Public Health and Occupational Safety later in this chapter.

Oil Carrier Contamination. Some techniques for ground-based herbicide applications use fuel oil or diesel oil as herbicide carriers. BPA does not use oil carriers in broadcast herbicide applications, although they are used in spot spray or single-stem treatments. If sufficient quantities of oil contaminate water bodies due to spills or accidental applications, a film of oil may reduce oxygen exchange between the water and the atmosphere. Insect larvae which come to the surface for metabolic gas exchange may be killed. Concentrations of oil in solution as low as 0.1 mg/l (0.1 ppm) may cause tainting of fish flesh (Kopperdahl et al. 1975), with off-flavor detected in trout held for 24 hours in test contaminations of 10 ppm. A background statement on diesel oil is contained in Appendix A.

Consequences of Alternative Methods

The following sections discuss the potential impacts on water quality and fisheries which could be expected from each vegetation control method under consideration. Potential impacts are summarized in Table 7-4; mitigation measures to minimize or avoid adverse effects are noted.

Broadcast Chemical Methods. After broadcast chemical applications, abundant ground cover of nonsusceptible plants (see Vegetation section of this chapter) and litter would remain to prevent erosion and sedimentation. Minor erosion could occur from use of access roads by ground-based broadcast equipment. If these methods were used to control riparian vegetation, streambank erosion could occur. Both sediment inputs to streams and streambank erosion will be absent where streamside buffer zones are observed.

Growth of nonsusceptible plant cover remaining on treatment sites takes up nutrients made available from gradual decomposition of killed plants. This will minimize nutrient and detritus burdens on streams. Stream buffer zones as observed by BPA would further reduce any burdens on stream ecosystems. Finally, treated areas on rights-of-way constitute small proportions of any one watershed; only if a right-of-way parallels a water body for a substantial distance would treated vegetation be a major source of total detritus input. Broadcast chemical techniques would not cause elevated stream temperatures so long as streamside vegetation is not treated.

Accidental broadcast application directly to water bodies is likely to pose a greater threat to water quality and

Table 7-4. Probable Environmental Consequences of Alternative Methods on Water Quality and Fisheries
With Range of Potential Impacts Shown

Note: The lower number of the range indicated is the potential impact of a mitigated implementation of the respective control method; the upper number is the potential "worst-case" impact when mitigation measures are not observed or fail to operate as planned.

Potential Impacts on Water Quality and Fisheries	Vegetation Control Methods				
	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Sedimentation and Stream- bank Erosion	0 ^a - 1	0 ^a - 1	0 ^f - 1	0 ^{fi} - 1 ^j -2	0 ^f - 1 ^j - 2
Nutrient and Detritus Burdens	0 ^a - 1	0 ^a - 1	0 ^g - 1	0 ^{ij} - 2	0 ^{jk} - 2
Elevated Stream Temperatures	0 ^a - 1	0 ^f - 1	0 ^f - 1	0 ^f - 1	0 ^f - 1
Herbicide Contamination	0 ^{abode} - 2	0 ^{ae} - 2	0	0	0
Oil Contamination	0 ^a - 1	0 ^a - 1	0 ^h - 1	0 ^h - 1	0

NOTES: Key to Ratings: 0 = Virtually no impact
1 = Potentially slight impact
2 = Potentially significant impact

Letter Superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating. Key to Letter Superscripts: a - Strictly observe buffer zones along all water bodies (100 ft for aerial, 50 ft. for ground-based broadcast, 10 ft. for directed chemical).
b - Use drift control measures (i.e., herbicide additives, special equipment weather restrictions).
c - Avoid broadcast methods if any danger of contaminating domestic water supplies exists.
d - Reduce application rates or avoid use of 2,4-D ester formulations for broadcast applications where any danger of contaminating stream ecosystems exists.
e - Avoid applications of picloram or dicamba in watersheds where water is diverted for irrigation of crops or surface water flow may reach off right-of-way vegetation.
f - Retain adequate vegetation cover along streams to prevent erosion and water temperature increase.
g - Remove all cutting debris from water bodies.
h - Avoid accidental spills of fuels near or in water courses.
i - Use only mechanical mowing or flailing equipment; do not operate equipment in water courses.
j - Do not use mechanical scarification on slopes over 20-30 percent.
k - Prevent livestock grazing in riparian areas.

fisheries than drift or translocation from intentional application sites. The amount of chemical reaching a unit area of stream surface is reduced by dispersal and adsorption during drift or translocation. Herbicides adsorbed to eroded soil are usually not biologically available to aquatic organisms, and effective concentrations remain low. Broadcast sprays applied from the ground are less likely to be directly applied or drift to a water body because buffer zone requirements are more readily observed, and ephemeral stream channels and small streams are more readily avoided.

To evaluate the potential consequences of broadcast chemical methods for water quality and fisheries under "worst-case" conditions, direct (accidental) aerial application to a water surface at the highest effective application rate proposed by BPA will be assumed. It further will be assumed that streamside cover does not intercept the spray, (i.e., the aerial application is made directly to an exposed body of water), and that adsorption does not occur in the stream. Since toxicity in water is a function of effective concentration, the depth of the water is critical. For example, an effective application of 500 mg/m^2 to water 10 cm deep (about 4 inches) will result in an initial theoretical concentration of 5 mg/l or 5 ppm. Increasing the depth to 30 cm (about 12 inches) reduces the initial concentration to about 1.7 ppm. Table 7-5 lists the calculated initial concentration in water 10 cm deep when herbicides at the highest proposed application rates are directly applied in "worst-case" situations.

The initial concentration, whether theoretical (Table 7-5) or occurring during an actual field operation, will quickly decrease because of dilution and adsorption of the chemical to organic detritus and sediment surfaces (see Herbicide Background Statements in Appendix A). The rates of dilution of the chemical by movement downstream and elution (i.e., the eventual removal of adsorbed chemical) is a function of stream size, stream velocity and physical properties of the chemical. Small, rapidly flowing streams self-cleanse rapidly after a pulse of contamination (U.S. EPA 1977). Standing water (e.g. a stock pond with no inflow or outflow) is most likely to show detectable levels of contamination initially and over a period of time.

Issues relative to the nature of the herbicides proposed for use by BPA are covered in detail in the Herbicide Background Statements (see Appendix A). Of particular concern are the toxicity of herbicides to aquatic species and the persistence and mobility of the compound. Known acute toxic concentrations for aquatic species are summarized in Table 7-5 for those chemicals proposed for aerial application.

Table 7-5. Initial "Worst-Case" Concentrations of Herbicides Applied Accidentally to Open Water During Aerial Broadcast Applications (at Highest Rates Proposed for Use by BPA) and Associated "Worst-Case" Hazards to Aquatic Environments; Herbicides Listed are Those Proposed by BPA for Aerial Application

Herbicide		Highest Application Rate (Active Ingredient) Proposed by BPA	Calculated Initial Concentration in 10 cm Deep Water	Reported Levels of Acute Toxicity (96 hr. LC50) ¹		Source	Instantaneous "Worst-Case" Hazard to Aquatic Environment
Trade Name	Active Ingredient			Invertebrates	Vertebrates		
Banvel® 4-W.S.	Dicamba (dimethylamine salt)	(3 lbs/ac) 336 mg/m ²	<3.4 ppm	-	Rainbow trout 35 ppm (48 hr.); bluegill 130 ppm (48 hr.); small carp 465 ppm (48 hr.)	Ghassemi et al. 1981; WSSA 1979 ²	Low
Banvel® 720	Dicamba (dimethylamine salt)	(3 lbs/ac) 336 mg/m ²	<3.4 ppm	-	as above	as above	-
	2,4-D (dimethylamine salt)	(6 lbs/ac) 672 mg/m ²	<6.7 ppm	Freshwater amphipod >100 ppm	Bluegill 166 ppm (48 hr.); rainbow trout 100 ppm	Ghassemi et al. 1981; California Department of Food and Agriculture 1978	Low
Amdon® 101 and Tordon® 101	Picloram (triisopropanolamine salt)	(1.5 lbs/ac) 168 mg/m ²	<1.7 ppm	Daphnia >127 ppm (24 hr.) stonefly nymphs 120 ppm (24 hr.)	Rainbow trout 279 ppm (24 hr.); bluegill 26.5 ppm; bass 19.7 ppm (24 hr.)	Newton & Dost 1981 Ghassemi et al. 1981 U. S. EPA 1977	Low
	2,4-D (triisopropanolamine salt)	(6 lbs/ac) 672 mg/m ²	<6.7 ppm				
Formula 40®	2,4-D amine (alkanolamine salt)	(2 lbs/ac) 224 mg/m ²	<2.2 ppm		Bluegill 435 ppm (48 hr.); tadpoles 100 ppm	Ghassemi et al. 1981 Newton & Dost 1981 U. S. EPA 1977	Low
Esteron® 99%	2,4-D ester (propylene glycol butyl ether ester)	(4 lbs/ac) 448 mg/m ²	<4.5 ppm	Daphnia 0.1 ppm (48 hr.); crayfish 100 ppm (48 hr.)	Fingerling cut-throat trout 1 ppm; bluegill 3 ppm (48 hr.); rainbow trout 1 ppm	Ghassemi et al. 1981 Newton & Dost 1981 U. S. EPA 1977	High

FOOTNOTES:

¹Acute toxicity levels are based on 96 hr. IC50s unless otherwise noted; LC 50 denotes the concentration of toxicant necessary to kill 50 percent of the organisms being tested. A 96 hr. IC50 indicates that the test period extended for 96 hrs. Acute toxicity levels are taken from reviews as indicated, not from original reports.

²WSSA: Weed Science Society of America.

Ester formulations of 2,4-D (e.g., Esteron 99) are the most toxic of the proposed herbicides to fish (Newton and Dost 1981; U.S. EPA 1977), especially when butyl esters are involved in the formulation. The probability of excessive exposures of aquatic organisms is low due to the pattern of use of these herbicides. The possible harmful effects of accidental exposures would be localized and short-lived due to hydrolysis, dilution, elution, and environmental breakdown of the ester formulations.

Herbicides which are relatively persistent and mobile in soil and groundwater are most likely to contaminate groundwater and migrate to surface water. Picloram and dicamba are herbicides which may persist in soil or water at phytotoxic concentrations (Newton and Dost 1981). Picloram is among the more mobile herbicides in soil water (U.S. EPA 1977), and, when used on large areas of a watershed as in forest management, potentially can cause damage to downstream irrigated crops (Newton and Dost 1981). It is doubtful that concentrations likely to cause crop damage occur when picloram is used in right-of-way management, since the ratio of treated to untreated surface area in a watershed is usually sufficiently low to permit rapid dilution of any picloram entering water bodies.

Standards and guidelines for broadcast chemical methods have been established by BPA to minimize the possibility of herbicide contamination of surface waters. The "worst-case" concentrations described previously are highly unlikely to occur. These guidelines include the utilization of buffer zones (100 feet wide) along water bodies and adherence to weather condition restrictions. Drift control measures (drift control nozzles or spray adjuvants) are required during aerial application or ground broadcast with high-volume sprayers. Herbicide contamination is unlikely if buffer zones are strictly observed and drift does not occur. Additional protection can be obtained by reducing application rates or eliminating the use of ester formulations of 2,4-D during aerial applications, and prohibiting the ground application of herbicides in areas of known high water table.

BPA does not use oil carriers for aerial or ground-based broadcast applications. Observance of buffer zones during ground-based applications will prevent oil contamination of streams.

Spot Chemical Methods. Directed application of chemicals requires personnel and equipment on the right-of-way and access roads. Sedimentation and streambank erosion may increase slightly above background levels because of vehicle

traffic on unpaved surfaces and the right-of-way. Nutrient and detritus burdens are not expected to increase since only individual plants are killed. Observance of stream buffer zones (10 feet for basal, frill, or cut stump applications) would minimize nutrient inputs to streams.

Since buffer zones are significantly narrower when chemicals are applied directly to target plants (i.e., spot treatments), there is a potential decrease in the number of trees shading a stream. Whether this potential decrease is realized and results in increased exposure of surface water to direct solar radiation depends on the density and height of the vegetation retained in the buffer zone.

When herbicides are applied directly to individual target plants, they are unlikely to drift or fall directly onto surface water. Herbicide contamination of water bodies is more likely to occur by chemical translocation if at all. Translocation by surface runoff is unlikely to result in measurable contamination of water bodies by herbicides. Most herbicides are readily adsorbed to soil particles, and are generally not biologically active when adsorbed. Forest soils are generally rich in organic content, and have a high adsorptive capacity for chemicals and a high infiltration capacity for runoff (Norris 1981). Surface runoff may occur when soils are highly compacted or exposed, or when the water table is near the surface. If surface runoff were to occur, granular forms of herbicides would be the most susceptible to translocation by the runoff.

Translocation by leaching is unlikely to occur unless the water table is near the surface or if relatively mobile herbicides such as picloram or dicamba are used. Herbicides which are relatively persistent and mobile in soil and groundwater (see Appendix A) are more likely to contaminate groundwater and migrate to surface water. Leaching is more extensive in soils with relatively low organic content.

Because of the adsorptive capacity of soils and the low likelihood of direct application to a water body, herbicide contamination of the aquatic environment following spot application to target plants is not expected to reach the "worst-case" levels theoretically possible with direct contamination and oil contamination will be of slight possibility if buffer zones are strictly observed. Additional protection can be obtained by: (1) reducing the use, near water bodies, of herbicides relatively mobile in soil water; (2) prohibiting the use of granular forms on compacted or disturbed soils; and (3) prohibiting the use of herbicide sprays and granular forms in areas of known high water tables.

Manual Methods. Manual methods have little potential for causing sedimentation or streambank erosion since only individual plants are treated and the soil surface is not disturbed. Exceptions would occur if vehicle traffic should become excessive on poorly maintained access roads, if maintenance vehicles were operated across and through streamcourses, or if all vegetation were removed from streambanks. None of these practices would occur under BPA's vegetation management program.

Nutrient and detritus burdens would be insignificant unless felled trees or other cut vegetation are allowed to remain in water courses. BPA's maintenance standard strictly prohibits leaving of cutting debris in streams or water bodies. Elevated stream temperatures would occur only if substantial proportions of streamside vegetation are removed; this is unlikely to happen under manual treatments since only individual plants are removed. Oil contamination will occur only if accidental spills of fuel or lubricants enter water bodies.

Mechanical Methods. Mechanical scarification methods involve the uprooting of vegetation, significant exposure of bare soil, and widespread soil disturbance by heavy equipment. Soil erosion and subsequent sedimentation may increase significantly, in particular if slopes are greater than 20-30 percent, even though the right-of-way represents a narrow band of disturbance on a watershed. Because of the substantial disturbance of soil on a right-of-way, sedimentation impacts are likely to persist over time. Mechanical mowing or flailing would entail less disturbance to soils but would cause similar soil compaction impacts.

Nutrients and detritus burdens may be significantly altered by mechanical methods of vegetation management. Plant litter and soil nutrients will be transported to surface water by runoff from disturbed, compacted soils where scarification methods are used. Nutrients will continue to wash into surface waters and elevate nutrient burdens until soil erosion is impeded by new vegetation. Residual ground cover after mechanical mowing or flailing treatments would intercept and retain plant debris before it reaches stream course.

Elevated stream temperatures would occur if streambank vegetation is removed, and streams are exposed to direct solar radiation. Elevated stream temperatures combined with increased sedimentation are likely to place severe stress on cold-water aquatic species. Herbicide contamination would not occur. Oil contamination may occur if fuels or lubricants are accidentally spilled near or into aquatic habitats.

Biological Methods. Most biological methods for control or right-of-way vegetation are experimental, and therefore have unknown impacts on water quality. The establishment of stable, low-growing vegetation may require extensive site preparation and fertilization, in which case initial impacts on water quality and fisheries may be similar to those described earlier for chemical, manual, or mechanical methods.

Prescribed livestock grazing may compact and lay bare soil along "trails", especially paths leading to stream crossings. Direct nutrient input to streams may also result from livestock wastes in or near streams. However, the potential for erosion and sedimentation is probably of more concern than temporarily elevated nutrient levels.

Wildlife management techniques generally involve planting and encouraging forage species in the right-of-way area. The impacts on water quality and fisheries are likely to be similar to those resulting from the establishment of stable, low-growing shrub species.

Wildlife

Endangered and Threatened Wildlife

Thirteen species of invertebrates, fish, birds, and mammals are federally-listed as endangered or threatened or are proposed for such status in the six states of the BPA service area (see Table 6-4). Three of these species, the Kendall Warm Springs dace and the Borax Lake chub (both fish), and the black-footed ferret (a small mammal), do not occur in counties in which BPA has transmission facilities. The following paragraphs discuss potential impacts of vegetation management on the ten species that occur in counties in which BPA facilities are located.

The Oregon silver-spot butterfly has a highly localized distribution in Lane and Yamhill Counties, Oregon. Critical habitat for the species has been designated by U.S. Fish and Wildlife Service (USFWS) at the mouth of Big Creek in Lane County. The Yamhill County population is located on Mt. Hebo in the northwestern portion of the county. Neither of these populations are near BPA transmission facilities. A small population of the species was known to exist near Willapa Bay on the Long Beach peninsula in Pacific County, Washington, about three years ago (Wallace pers. comm.). This population was of doubtful viability and it is not known whether it exists today. The Long Beach population was located near BPA's Long Beach substation but was not

affected by BPA maintenance activities. BPA's vegetation management program will not affect the butterfly or its habitat.

Two protected raptors (i.e., birds of prey), the bald eagle and the American peregrine falcon, occur widely throughout the states and counties of BPA's service area. The Arctic peregrine falcon occurs as a winter migrant along the coast of Washington. These three bird species are highly mobile and forage over wide areas. Vegetation management activities on existing rights-of-way will not alter the habitat of these species. Also, the fact that none of the herbicides used by BPA accumulates in animals or fish assures that herbicides or their degradation products will not affect these predators (see section on Public Health in this chapter).

A possibility exists that helicopters applying herbicides near bald eagle nests during the nesting season could affect eagle reproductive success. The incremental impact of this disturbance is insignificant; herbicide applications occur once every five years while routine aerial inspections of transmission lines are conducted monthly. Such disturbance is easily mitigated; bald eagle nest sites are generally well known and easily avoided by helicopter operations. Contact with USFWS Endangered Species offices should be made if any nests are known to be near transmission lines.

The California brown pelican and the Aleutian Canada goose use coastal wetlands and marine waters during migrations. Neither species uses habitats where vegetation management is necessary to any extent, and neither species will be affected by BPA's proposed program. The whooping crane is a summer resident in the Gray's Lake National Wildlife Refuge in Idaho. The population is experimental and resides at Gray's Lake from mid-April until October. The nearest BPA transmission line is 19 miles north of the refuge and no impacts on the whooping crane will result from vegetation management activities.

Three large mammal species, the gray wolf, grizzly bear, and Columbian white-tailed deer, are federally-protected and occur in counties where BPA has transmission facilities. All are mobile species; a BPA right-of-way would constitute only a small portion of any individual animal's home range.

Vegetation management on rights-of-way in heavily forested areas will enhance habitat for these species. Rights-of-way provide travel corridors for migration and daily movements. Because tall-growing trees are eliminated, shrubs and herbaceous vegetation are more abundant and vigorous on

rights-of-way than in adjacent forests. The Columbian white-tailed deer feeds almost exclusively on grasses and forbs (in contrast to black-tailed deer which browse on shrubs) although some browse may be required at certain times of the year. Grizzly bears forage on mast and berries of shrubs common on rights-of-way. Open areas of grasses and forbs on rights-of-way are productive habitats for rodents and lagomorphs (i.e., rabbits and hares), both important prey types for the gray wolf. Therefore, maintenance of rights-of-way vegetation as a low-growing mixture of grasses, broadleaf forbs, and shrubs will provide suitable habitat for these species, particularly in areas of dense forest.

A number of wildlife species occurring in BPA's six-state service area are currently under study by USFWS for future proposal for endangered or threatened designation and protection. These "candidate" species receive no legal protection until officially proposed. BPA staff maintain contact with USFWS personnel to determine any change in status of candidate species.

Description of Potential Impacts on Wildlife Habitat

Wildlife habitat requirements are closely related to vegetation structure and composition; habitat is largely a function of the food and cover plants available for each wildlife species in an area (see Chapter 6 section on Wildlife). As a result, vegetation management can alter the nature of wildlife habitat on transmission rights-of-way.

Before considering impacts of vegetation management itself, it is important to note that the mere presence of a transmission corridor can enhance habitat conditions substantially for some wildlife species. Such enhancement occurs where habitats produced on a rights-of-way are different or of higher value than those found in the adjacent local area. This happens in two kinds of situations.

Where a right-of-way traverses a heavily forested region, the right-of-way corridor provides open and edge habitats of importance to many species. Taber (1977) reviewed the beneficial impacts of rights-of-way on wildlife species diversity and abundance in forested mountains of Washington. He noted invasion of wildlife species not found in adjacent forest as well as increases in populations of some species normally found in forest habitats; the latter species apparently respond to the greater abundance and vigor of forage, browse, and mast-producing plants on rights-of-way in comparison to adjacent forest (Figures 7-1 and 7-2).

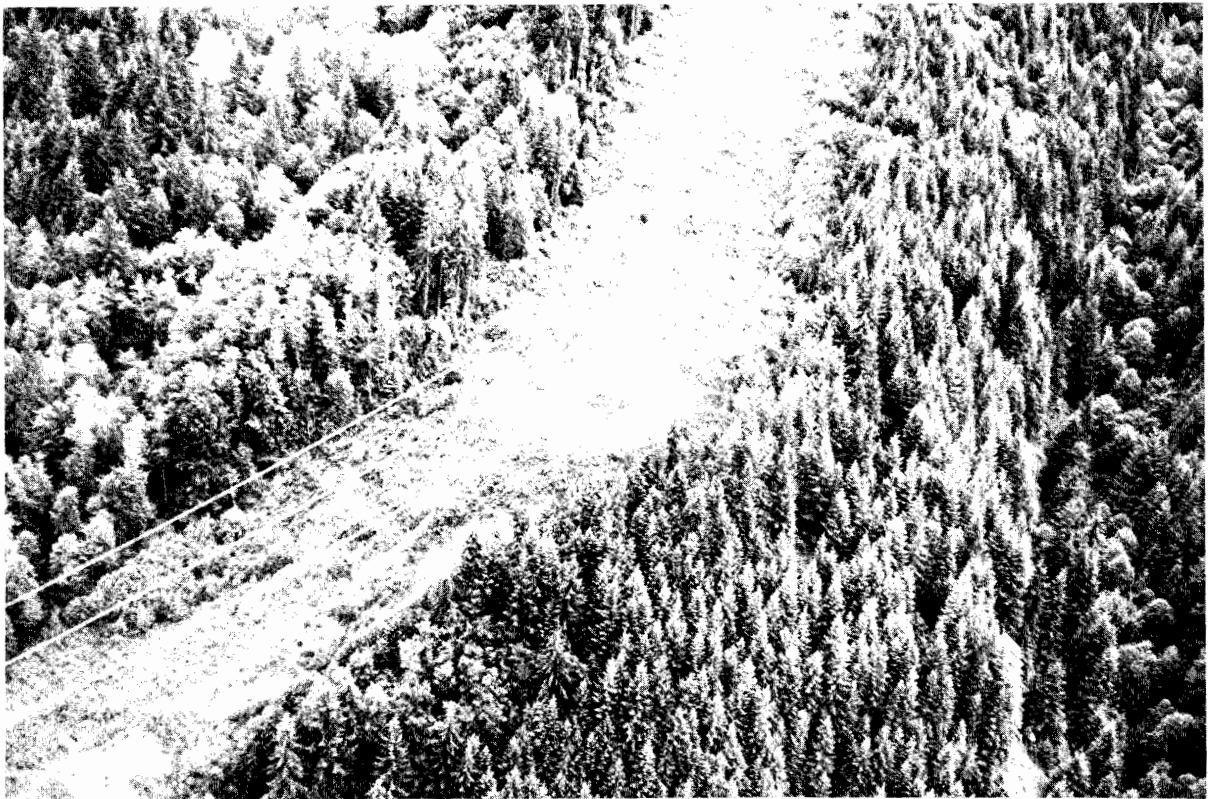


FIGURE 7-1. Transmission Line Corridors Through Regions of Dense Forest Provide Open and Edge Habitats of Importance to Many Wildlife Species.



FIGURE 7-2. This Transmission Corridor Through a Conifer Forest has Increased Habitat Diversity by Allowing Growing Sites for Deciduous Trees, Shrubs, Broadleaf Forbs, and Grasses.

Goodwin (1975) studied big game use of a BPA right-of-way in northern Idaho. Use by elk was heaviest during migration periods; use levels on individual study plots were directly proportional to the availability of forage plants. The presence of the right-of-way was found to be beneficial because it produced more forage than adjacent forests, especially during the spring migration period (Figures 7-3 and 7-4).

Where a right-of-way traverses an agricultural area, it may support herbaceous plants, shrubs, and small trees that provide habitat conditions in strong contrast to adjacent cropped fields or orchards. Typically, agricultural operations extend on to rights-of-way leaving no habitat available for wildlife. Where this is not the case, presence of somewhat wild vegetation on a right-of-way will provide important habitat (e.g., nesting cover, hiding cover, fruits and berries) in the local area for birds, small mammals, reptiles, and amphibians. In addition, the right-of-way may serve as a valuable travel corridor for wildlife through otherwise inhospitable areas.

Potential impacts described in the following sections pertain only to differential effects of alternative control methods on habitat conditions on existing rights-of-way. The discussion also is restricted to effects on wildlife habitats in forested regions; vegetation management is not practiced to an extent that alters wildlife habitats in nonforested regions.

Reduction in Habitat Diversity. Habitat diversity for wildlife is essentially analogous to structural diversity in vegetation. Structural diversity and habitat diversity denote that different types of foraging sites and different types of cover are available to support a large number of wildlife species. Also, an absence of a uniform canopy of trees or shrubs allows the development of vigorous mixed stands of grasses, broadleaf forbs, and shrubs to provide forage, browse, and mast.

Habitat diversity incorporates the concept of "edge effect"; wildlife species requiring different types of vegetation will be present as well as species requiring both types of plants occurring at the edge. In regions potentially supporting dense forests (e.g., western Oregon and Washington), habitat diversity will be a short-lived phenomenon without a periodic disturbance or management, lasting only until a uniform tree canopy is reestablished.

A study in New Hampshire (Cavanagh et al. 1976), compared wildlife species diversity (i.e., number of species) and

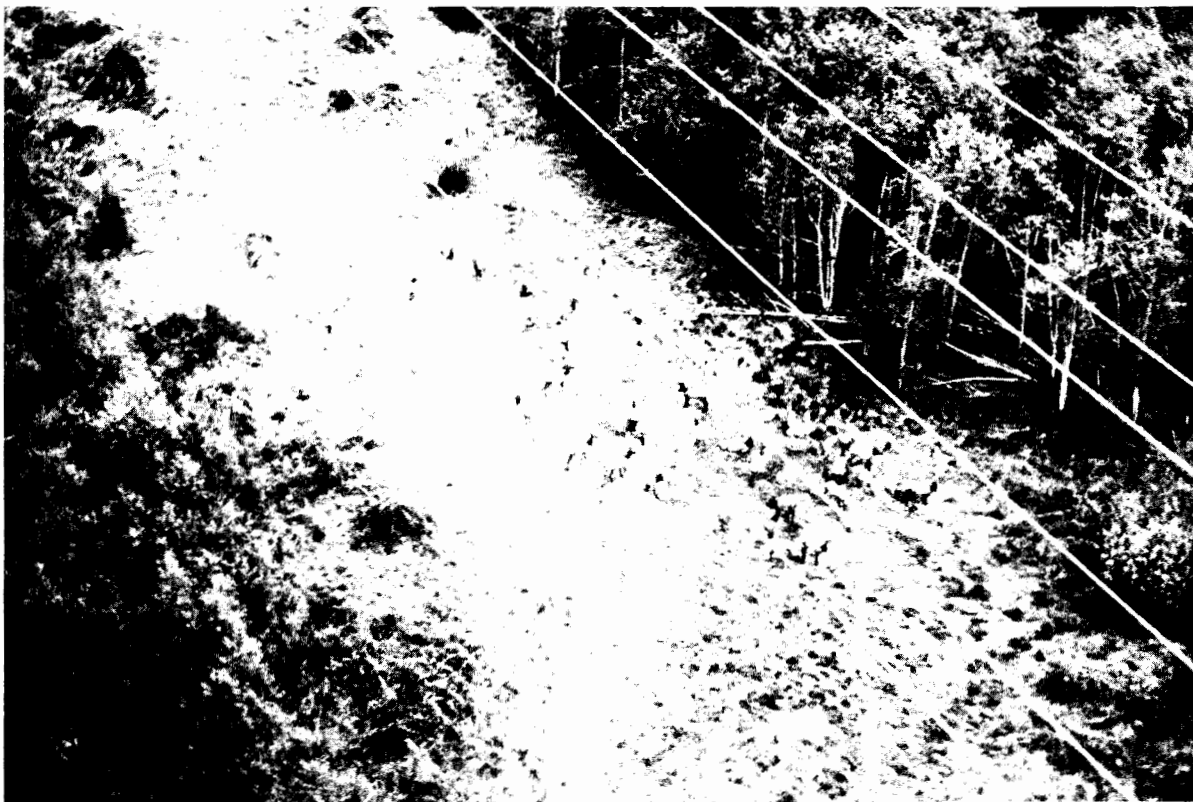


FIGURE 7-3. Transmission Rights-of-Way May be Heavily Used by Elk, Especially During Migration Periods.

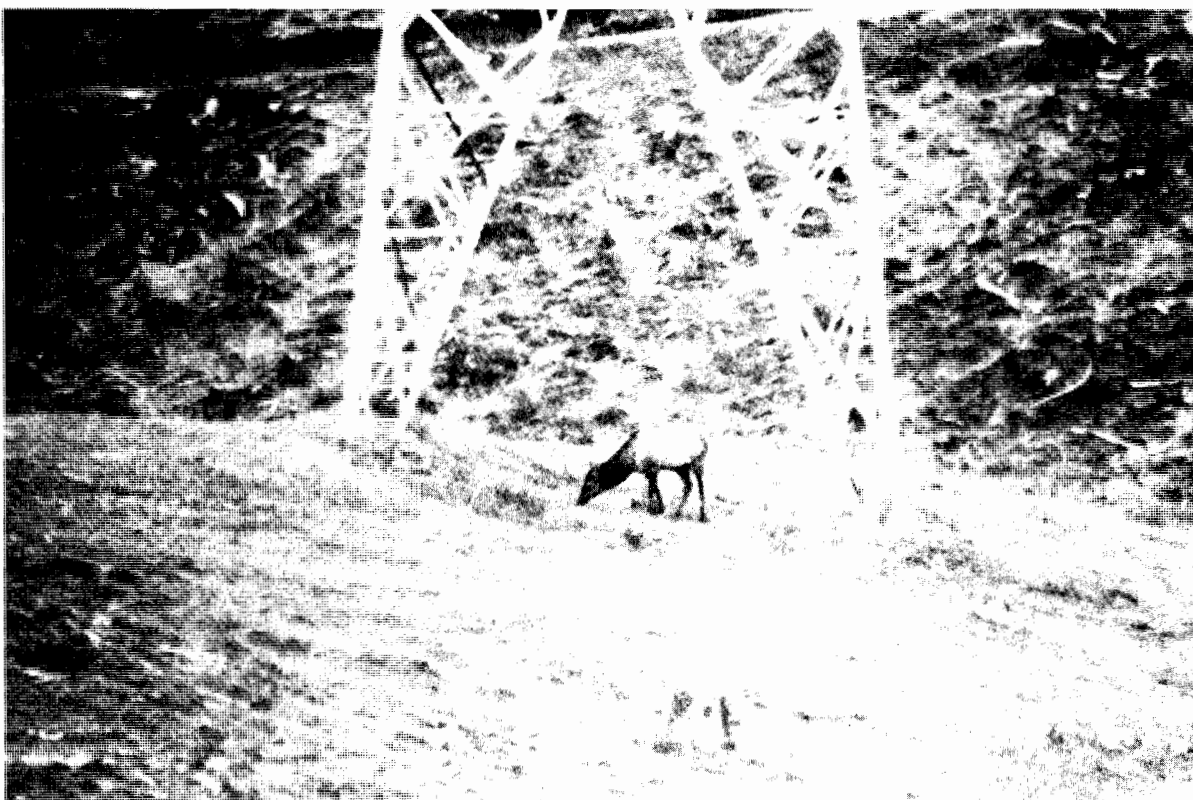


FIGURE 7-4. Forage Important to Elk is Often Produced in Greater Abundance and Vigor on Rights-of-Way Than in Adjacent Forest.

abundance (i.e., number of individuals) on rights-of-way maintained in four different ways. Greatest number of species and individuals were found on plots where maximum vegetation diversity was present. On these plots, tall trees were selectively removed 6-10 months previously while other vegetation was left intact. The plots lowest in wildlife diversity and abundance had been treated with herbicide foliage sprays over the previous several decades, producing a relatively homogeneous cover of grasses, ferns, herbicide-resistant shrubs, and scattered tree seedlings.

Parenthetically, if the first set of plots in the Cavanagh et al. (1976) study had been treated by only selective tall tree removal for the previous 10-20 years, a homogeneous vegetation structure would have developed there as well. This would have occurred as residual shrubs expanded their coverage to produce a dense, closed canopy gradually excluding any open patches of grasses and forbs.

The study of Cavanagh et al. (1976) found that the clumping of vegetation in irregularly-shaped patches with much edge between different types of patches was the most important feature of vegetation benefitting wildlife. They hypothesized that abundant forage plants were not used unless suitable cover of taller vegetation provided concealment and escape routes.

The importance of interspersion of foraging areas and cover has also been shown for deer and elk in the Pacific Northwest (Thomas et al. 1979). Open areas producing abundant deer and elk forage must be interspersed with dense tree stands providing cover to constitute optimum habitat.

Reduction in habitat diversity occurs as monotypic stands develop with one type of vegetation or one plant species. Monotypic stands may consist exclusively of grasses, ferns, and a few herbicide-resistant shrubs or may consist exclusively of tall, dense, impenetrable clumps of shrubs. The former are produced by repeated, heavy applications of broadcast herbicides while the latter may be produced by cutting of sprouting species without chemical treatment of stumps. For example, cutting without stump treatment of moderately-stocked red alder stands may lead to development of dense monotypic alder stands. Either type of monotypic vegetation has low habitat diversity and low value for many wildlife species.

Bramble et al. (1982) compared vegetation on rights-of-way maintained with aerial and spot chemical treatments in New York state. Areas maintained with spot chemical methods had

a greater diversity of shrub and tree species present. However, most species present on the rights-of-way (treated by either method) spread by rhizomes or other vegetative means; open spots of bare ground were not available for seed regeneration. Over time, vegetatively-spreading species (e.g., blackberries, goldenrod, bracken fern) tend to expand gradually to dominate large areas in relatively uniform stands.

Reduction in Forage, Browse and Mast Species. Many wildlife species rely heavily on plants as food sources. Forage of grasses and broadleaf herbs is used by rodents, elk, and white-tailed deer. Browse includes the leaves and shoot tips of woody plants, as used by black-tailed deer, for example. Mast is a broad term applying to all kinds of fruits, berries, nuts, and acorns eaten by many species of birds and mammals.

Vigorous production of nutritious forage, browse, and mast occurs where plants are exposed to abundant sunlight. Richter (1958: cited in Taber 1977) reported that fruit production was 3-9 times greater on a right-of-way in Pennsylvania than in adjacent forest. Taber (1977) estimated that exposure to sunlight may have greater effect on fruit production in the dense conifer forests of the Pacific Northwest.

To be utilized by deer, browse must be within reach and therefore not greater than 4-5 feet in height. Thus, tall shrubs have no value as browse. Periodic disturbance by cutting, fire, or herbicide applications may be necessary to keep browse plants within reach of deer and to reinvigorate sprout growth. In using herbicides for this purpose, however, susceptibility of browse species to the herbicide used (e.g., death or top-damage) and sprouting or nonsprouting response to damage must be analyzed carefully. Without such analysis, herbicide treatments may cause elimination of the most desirable browse species (see Lyon and Mueggler 1968).

Hardwood trees and both deciduous and evergreen broadleaved shrubs of the Pacific Northwest are abundant berry producers. Elderberry species produce fruit eaten by bears, coyotes, robins and pigeons; their foliage is preferred browse for some herbivores. Chokeberry produces abundant fruit, twigs, and foliage eaten by many wildlife species (Taber 1977).

Diversity of plant species composition is important to wildlife habitat quality because each plant species has a somewhat different seasonal schedule for growth, flowering,

fruiting, and dormancy (Taber 1977). Each plant species will tend to be used by wildlife when it is most palatable, nutritious, or ripe. Therefore, a high diversity of plant species will support a greater number of wildlife species throughout a greater proportion of the year than less diverse, monotypic stands of vegetation.

Reduction in Special Habitat Components. Special habitat components that may occur on rights-of-way are small snags, downed logs and branches, and plant litter. Snags may be present as short stubs remaining from previous forests or as dead skeletons of small trees killed by herbicides or girdling. The various vegetation control methods may have differential effects on these habitat components.

Reduction in Riparian or Wetland Habitat Quality. Riparian and wetland habitats have high value to many species of wildlife (see Chapter 6 section on Wildlife). Vegetation control using nonselective methods (e.g., broadcast chemical or mechanical) will severely reduce the quality of these habitats. Selective removal of only tall-growing target species as necessary to maintain conductor clearance criteria in riparian and wetland areas would maintain high quality habitats.

The BPA Transmission Line Maintenance Standard requires observance of 100-foot buffer strips along all water bodies, stream courses or wetlands during broadcast herbicide applications. Buffers of 10- and 50-feet widths are required for various spot herbicide treatments. Mechanical methods are not proposed for use by BPA. Given these features of BPA's proposed vegetation management program, significant reductions in riparian or wetland habitat quality are not expected to occur.

Description of Potential Herbicide Toxicity Impacts

BPA proposes to use six herbicide active ingredients in foliage or stem applications for brush or weed control on transmission rights-of-way (see Table 3-3). These active ingredients (ammonium sulfamate; dicamba; glyphosate; picloram; 2,4-DP, and 2,4-D) are the only ones with any possibility of being ingested by wildlife (on forage, browse, or mast) and the only ones with any possibility of being applied directly to animals, their nests, or eggs. Other herbicides used by BPA are applied to the ground around power poles or only within substation yards.

Herbicide Background Statements for the six herbicide active ingredients are contained in Appendix A. Review of the toxicological literature has indicated that these herbicides have a low order of toxicity to laboratory rats as well as to wildlife species that have been tested. None of the herbicides has shown evidence of accumulating in animal tissues to any significant degree.

For example, Somers et al (1978) studied the reproductive success of two generations of chickens hatched from eggs sprayed with 2,4-D and picloram herbicides. In general, the studies produced no evidence that spraying with 2,4-D or picloram affected domestic fowl reproduction through one generation and into the second. See the Herbicide Background Statements for reports of other toxicological studies.

Because they are eliminated rapidly, primarily by excretion, chronic toxicity is of very slight possibility. The rapid degradation of the herbicides in plants and soils further ensures that ingestion or skin absorption is minimal. The deterioration of foliage after treatment and rapid herbicide degradation limits possible animal exposure to a short period of time (Newton and Norris 1976).

The evidence available indicates that the herbicides proposed for use by BPA will not pose toxic hazards to wildlife. Of some concern, however, is the use of diesel oil or oil-water emulsions as carriers for certain spot herbicide applications to foliage and stems of target vegetation on rights-of-way. Mobile birds and mammals are unlikely to be affected. Small birds or mammals with limited home ranges or territories confined to treated areas may suffer indirect mortality (e.g., from hypothermia caused by loss of fur- or feather-insulating capacity) or reduced reproductive success (e.g., due to toxic poisoning by oil sprays on eggs).

Plants and animals differ fundamentally in physiology. As a result, herbicides are generally of low toxicity to animals. This principle is well illustrated by study of the susceptibility of honeybees to unintentional and unavoidable insecticide and herbicide exposures resulting from broadcast spray operations. Honeybees are among the insects more sensitive to insecticides (Pimentel 1971).

In areas where large numbers of honeybees are present such as orchards containing flowering fruit trees or other acreages of crops being pollinated, large scale losses of bees sometimes occur following insecticide applications. In sharp contrast, herbicides are of low toxicity to honeybees following ingestion and contact exposures (Johanson 1969).

The water-based sprays used by BPA have lower inherent toxicity than oil-based formulations (Moffett et al 1972). Small changes in foraging activity due to increases or decreases in pollen-producing plants are more significant consequences of vegetation management than direct toxic effects of herbicide use.

Consequences of Alternative Methods

Broadcast Chemical Methods. Potential impacts of chemical methods are determined by the susceptibilities of plants to a particular herbicide formulation, and its rate and time of application. Three herbicide combinations are used by BPA in broadcast applications, either by helicopters or by ground-based equipment. Relative susceptibilities of common plant species of the Pacific Northwest are shown in Table 7-3 (see section on Vegetation in this chapter).

Repeated broadcast herbicide applications will convert right-of-way vegetation to relatively monotypic stands of resistant plant species (especially grasses, ferns, some shrubs and hardwoods). The herbicide combination containing picloram appears to be the most broadly effective at damaging woody species; this combination therefore will be most likely to reduce habitat diversity if used repeatedly at heavy application rates.

Habitat diversity can be enhanced on rights-of-way if broadcast herbicides are applied to dense monotypic stands of shrubs or tree sprouts. Treatment of such homogeneous vegetation will open up space for establishment of other plant types, thereby diversifying previously uniform habitats. Treatment of tall, dense shrub stands will cause vigorous production of sprout shoots within the browsing height of deer.

Important forage, browse, and mast species include many grasses, broadleaf forbs, and shrubs, and can be considered nontarget vegetation on transmission line rights-of-way. Nontarget species should not be unnecessarily treated during broadcast applications. For example, a valuable browse plant, ceanothus, and a valuable fruit plant, elderberry, are both highly susceptible to the picloram herbicide combination. Broadleaf forbs are important forage for elk and white-tailed deer; these plants are highly susceptible to all three broadcast herbicide combinations. Loss of these or other nontarget species can be prevented by restricting broadcast application of herbicides to stands where susceptible target species are predominant in uniform stands.

BPA does not use oil carriers for broadcast herbicide applications.

Spot Chemical Methods. These methods will have little effect on habitat diversity since they are applied to individual target plants. However, if they are used in a way that allows development of uniform stands of shrubs, habitat diversity will decrease over time. For example, spot treatment and removal of Douglas-fir trees from among large blackberry clumps will allow development of low habitat diversity as well as present access problems for large wildlife species (as well as maintenance crews) in the future.

Spot chemical treatments can be applied selectively to large brush stands to produce openings for access and for establishment of other plant types (e.g., grasses and forbs), thereby enhancing habitat diversity. Also, single stem treatments (e.g., frilling) can be used to create small snags of value to small woodpeckers and other small hole-nesting species (e.g., chickadees, flying squirrels).

Manual Methods. Over the short term (i.e., a single treatment cycle), manual methods will cause no reduction in habitat diversity on forage, browse and mast species. However, over several treatment cycles, manual methods are likely to lead to development of uniform stands of shrubs and hardwood sprouts if they are not used in combination with cut-stump chemical treatments. Also, manual methods are not practical for treatment of dense shrub stands due to the large number of stems requiring treatment and problems of access to individual stems. Therefore, exclusive reliance on manual methods will cause reduction in habitat diversity over time. Girdling of trees without felling them would provide small diameter snags for woodpeckers and hole-nesting species. Cutting debris can be arranged in loose brush piles as wildlife habitat.

Mechanical Methods. Mechanical methods have the greatest potentials for adversely affecting wildlife habitats on rights-of-way. Potential impacts derive primarily from the nonselective application of these methods to large areas; vegetation is either totally removed (as in scarification) or reduced to residual stands of grasses, forbs, and shrub stumps (as in mowing or flailing). Habitat diversity would be severely reduced until vegetation regenerates. Nontarget forage, browse, and mast species are removed along with target plants. Finally, special habitat components (e.g.,

downed logs, plant litter) are removed or disturbed, depreciating their value to wildlife. Impacts can be mitigated by limiting treatments to scattered, uniform patches of right-of-way vegetation, thereby potentially enhancing habitat diversity, and by leaving piles of logs and branches as wildlife habitat.

Biological Methods. One of the experimental biological methods for control of rights-of-way vegetation seeks to enhance habitat for herbivorous wildlife species (specifically meadow voles, elk, and deer) to limit establishment and survival of tall-growing tree seedlings (see Chapter 3). Other biological methods will have variable but slight impacts on wildlife habitat, primarily due to the fact that they cannot be applied uniformly across large right-of-way areas.

Environmental consequences of alternative control methods on wildlife are summarized in Table 7-6. Wildlife habitat quality can be maximized by (1) using the control method most appropriate to maintain or enhance habitat diversity in any particular right-of-way situation, (2) avoiding treatment of nontarget forage, browse, and mast species, (3) retaining or producing special habitat components, and (4) avoiding oil carriers in foliar herbicide applications. Tradeoffs among these mitigation measures would be necessary in certain situations due to other constraints.

Public Health and Occupational Safety

Herbicide Hazard Assessment Summary

Detailed reviews of the properties and behavior of active ingredients in the herbicides proposed for use by BPA are provided in Herbicide Background Statements in Appendix A. Background statements also are included for two commercial herbicide additives and for diesel oil, an herbicide carrier. A general overview of principles and methods available for testing chemical toxicity is provided in the Introduction to Appendix A. The present section summarizes the findings of the appended Background Statements and assesses hazards to the public and to workers from the use of herbicides included in BPA's vegetation management program. A worst-case analysis of potential human exposures to four of the herbicides proposed for use by BPA in foliage applications on rights-of-way is also included.

Herbicides may be applied by a number of techniques that are described in detail in Chapter 3. In the spot application

Table 7-6. Probable Environmental Consequences of Alternative Methods on Wildlife with Range of Potential Impacts Shown

Note: The Lower Number of the Range Indicated is the Potential Impact of a Mitigated Implementation of the Respective Control Method; the Upper Number of the Range is the Potential Worst-Case Impact When Mitigation Measures are Not observed or Fail to Operate As Planned

Potential Wildlife Impacts	Vegetation Control Methods				
	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Reduction in habitat diversity	0 ^{a,b} -2	0 ^e -1	0 ^{e,f} -2	1 ^g -2	0
Reduction in forage, browse and mast species	0 ^{a,b} -2	0	0	1 ^g -2	0
Reduction in special habitat components	0	0	0	1 ^h -2	0
Reduction of riparian habitat quality	0 ^c -2	0	0	0 ^c -2	0
Diesel oil hazard	0	0 ^d -1	-	-	-

NOTES:

Key to ratings: 0 = Virtually no impact
1 = Potentially slight impact
2 = Potentially significant impact

Letter superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating.

Key to letter superscripts: a = Use herbicides highly-selective for target plant species
(see text for explanation) b = Use broadcast herbicide applications on monotypic, uniform stands of susceptible target species only
c = Strictly observe 100-foot buffer strips along all water bodies
d = Avoid use of oil carriers for foliar herbicide applications
e = Apply spot chemical or manual treatments in a manner that maintains and enhances habitat diversity
f = Use cut-stump chemical treatments on sprouting hardwood species
g = Limit use of mechanical methods to scattered patches of right-of-way vegetation
h = Leave piles of downed logs and branches as wildlife habitat

of herbicides, chemicals are applied to individual plants or plant groups that are designated targets, and therefore, losses of herbicide to the nontarget environment are minimal. Broadcast applications made to relatively dense and uniform vegetation using groundbased or aerial equipment may involve, in comparison to spot application, larger losses of herbicide to the nontarget environment, especially if appropriate precautions are not taken. In either spot or broadcast operations, a certain amount of human hazard is present, but the degree of hazard is related to the intrinsic toxicity of the herbicide and to the degree and nature of exposure (see worst-case analysis below).

Toxicity of BPA-Approved Herbicides. Toxicity of herbicides for particular laboratory animals is readily determined using well-established testing procedures. An important underlying assumption in such testing is that animals and humans respond in the same manner to excessive amounts of a toxic substance. The acute oral LD50 for rats, a statistical measure of the dosage required to kill half of a test population of rats, is the most frequently reported measurement of toxicity. Chemicals can be ranked according to their acute toxicities as a first approximation of their potential to cause harmful biological effects.

Acute Toxicity -- Among pesticides, herbicides generally have a low order of acute mammalian toxicity. This generalization is true of all herbicides used by BPA in vegetation management (Table 7-7) (also see Background Statement for each herbicide). In general, basic biochemical and physiological differences between plants and animals account for the relatively low toxicity of herbicides to animals. Herbicides are designed to interfere with vital plant processes such as seed germination, hormone (auxin)-mediated growth and development, and photosynthesis; these biological processes are not duplicated in representatives of the animal kingdom.

Additionally, extensive studies of the absorption, distribution, metabolism, and excretion of herbicides in animals have shown that herbicides and their metabolites are rapidly eliminated from animals; that is, they do not accumulate substantially in animal tissues. This further reduces the possibility that exposure will result in harmful consequences. Thus, as a class, herbicides have low potential for producing toxicity in animals and humans. Exceptions to this general statement include paraquat and dinitro which are not proposed for use by BPA.

Table 7-7. Acute Oral Toxicity in Laboratory Rat Populations of Herbicides Proposed for Use by BPA in Vegetation Management¹

Herbicide	Oral LD50 mg/kg ²			
	WSSA 1979	EPA 1977	Newton and Dost 1981	Ghassemi et al. 1981
Ammonium Sulfamate	3,900	-	-	-
Atrazine	3,080	1,750	3,100	3,800
Bromacil	5,200	-	-	-
2,4-D ³	1,960	375	666	> 570
Dicamba	1,100	1,040	>1,100	>1,028
Dichlobenil	4,500	-	-	-
Diuron	3,400	-	-	-
Glyphosate	5,600	-	-	4,320
Monuron	2,300 (to 3,700)	-	-	-
Picloram	8,200	8,200	>6,300	8,200
Prometone	2,980	-	-	-
Simazine	>5,000	5,000	-	>5,000
Sodium Chlorate	5,000	-	-	-
Sodium Metaborate	2,330	-	-	-
Tebuthiuron	644	-	-	-

FOOTNOTES:

¹Values were obtained from the review sources identified at the head of each column.

²In one method of interpreting toxicity data, it is presumed that acute (LD50) toxic doses for rats are similar to those for human populations. For comparative purposes, a 1,000 mg/kg dose is equivalent to a dose of 2.6 ounces for a 165-pound human. A LD50 value refers to the dose lethal to 50 percent of the test population.

³Variation in dosage levels probably due to variation in chemical formulation (e.g., acid, amine salt, ester) and in sensitivities of test strains of rats.

The Federal Insecticide, Fungicide, and Rodenticide Act designates the Environmental Protection Agency (EPA) as the governmental body responsible for the safety of all pesticides used in the United States. To be federally registered, a pesticide must not give evidence of unreasonable hazard to health or the environment when used according to the label. Thus, the EPA- and state-approved label represents valuable guidance for the safe and efficacious use of pesticides. The importance of the pesticide label is emphasized in BPA's Transmission Line Maintenance Standard.

Human Hazard Signal Words -- Herbicide labels include information that is important to worker safety. The Human Hazard Signal Words, Danger, Warning, and Caution, alert workers to the relative hazard of particular formulations. The signal word is determined by the results of animal toxicity testing including oral and dermal LD50s, inhalation LC50s (lethal concentration), and eye and skin effects. EPA criteria for establishment of the toxicity categories (40 CFR 162.10) are listed in Table 7-8.

The commercial herbicides used by BPA are predominantly classed in Toxicity Category III, and thus require the Human Hazard Signal Word "CAUTION" on the label (Table 7-9). Two of the herbicides which contain glyphosate and bromacil (i.e., Roundup and Hyvar X-L) are in Category II since they can cause skin and eye irritation. Oxy Ureabor is a Category I herbicide due to its corrosive effects on the eye and skin.

The example of Oxy Ureabor illustrates that the type and extent of different kinds of exposure are better determinants of overall hazard than is acute oral toxicity alone. Based only upon acute toxicity (LD50 for rats, 2710 mg/kg), Oxy Ureabor would be labeled "CAUTION" (Category III). When misused, this herbicide is corrosive and "causes eye damage"; therefore, the product is labeled "DANGER".

Oxy Ureabor is used by BPA for weed control at substations only; Hyvar X-L is used for substation weed control and wood power pole protection only. Roundup is used for substation weed control, as a spot foliage spray on rights-of-way, and for power pole protection (see Table 3-3).

Chronic Toxicity -- Chronic toxicity includes potential carcinogenic, teratogenic, or mutagenic effects of herbicide exposure in animals. Although classified as a chronic effect, mutagenicity is assessed by short-term testing. Among herbicides proposed for use by BPA, ammonium sulfamate and bromacil have shown no evidence of causing chronic

Table 7-8. EPA Criteria for Establishment of Pesticide Toxicity Categories

Hazard Indicators	Toxicity Categories and Human Hazard Signal Words			
	I Danger	II Warning	III Caution	IV Caution
Oral LD50	Up to and including 50 mg/kg	From 50-500 mg/kg	From 500-5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Up to and including .2 mg/liter	From .2-2 mg/liter	From 2-20 mg/liter	Greater than 20 mg/liter
Dermal LD50	Up to and including 200 mg/kg	From 200-2000	From 2000-20,000	Greater than 20,000
Eye Effects	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours

SOURCE: EPA Regulations for Enforcement of Federal Insecticide, Fungicide and Rodenticide Act. 40 CFR 162.10

Table 7-9. Toxicity Category and Human Hazard Signal Word for Herbicides Used in Vegetation Management by BPA

Trade Name Herbicide ¹	Active Ingredient(s)	Toxicity Category ²	Human Hazard Signal Word ³
Annate X-NI	Ammonium sulfamate	III	Caution
AAtrex 80W AAtrex Nine-0	Atrazine	III	Caution
Hyvar X-L	Bromacil	II	Warning
Krovar I	Bromacil + Diuron	III	Caution
Banvel 4-O.S. Banvel 4-W.S. Banvel XP Banvel 5G	Dicamba	III	Caution
Banvel 520 Banvel 720	Dicamba + 2,4-D	III	Caution
Casaron G-4	Dichlobenil	III	Caution
Roundup	Glyphosate	II	Warning
Telvar	Monuron	III	Caution
Tordon 10K Amdon 10K	Picloram	III	Caution
Tordon 101 Amdon 101	Picloram + 2,4-D	III	Caution
Pramitol 25E	Prometone	III	Caution
Pramitol 5PS	Prometone + Simazine + Sodium chlorate + Sodium metaborate	III	Caution
Oxy Ureabor	Sodium chlorate + Sodium metaborate + Bromacil	I	Danger
Spike 1G Spike 5G Spike 80W	Tebuthiuron	III	Caution
Formula 40	2,4-D amine	III	Caution
Esteron 99	2,4-D ester	III	Caution
Weedone 170	2,4-DP + 2,4-D	III	Caution

FOOTNOTES:

¹All commercial herbicide names are registered trademarks (see Table 3-2).

²See Table 7-8 for description of toxicity categories.

³Signal words prominently appear on pesticide label.

effects at dosages tested. Picloram is currently being retested by EPA because of inadequate laboratory procedures in earlier studies. Potential chronic toxicities that have been found are: carcinogenicity - diuron and monuron; teratogenicity - dicamba, diuron, and 2,4-D; and mutagenicity - atrazine and 2,4-D. No data are available for dichlobenil, glyphosate, sodium chlorate, and sodium metaborate. Presumably, registrants of these four herbicides have filed chronic toxicity data with EPA. However, public access to such data is precluded by restrictions designed to protect proprietary interests. For details on chronic toxicity, see Herbicide Background Statements.

The laboratory dosages at which potential chronic effects have been detected are much greater in concentration and duration of exposure than the levels found in the field during or after vegetation control applications. Also, all herbicides used by BPA are rapidly eliminated from animals and humans through metabolism and excretion; they do not bioaccumulate. Therefore, for the herbicides tested, their use at the application rates proposed by BPA poses no significant hazards of chronic toxicity to animals or humans. Table 7-10 summarizes the potential hazards of each herbicide active ingredient proposed for use by BPA. Potential hazards of diesel oil and drift control additives are also summarized.

Occupational Hazards from Herbicide Use. Of greatest concern in assessing the environmental consequences of the use of chemicals in vegetation management is occupational exposure to herbicides. Concentrated formulations and application equipment represent sources of potentially high exposure via dermal absorption, inhalation, and accidental ingestion. Safe work practices according to herbicide label instructions and good personal hygiene are effective means of minimizing the hazard. Safety measures are described in the BPA Transmission Line Maintenance Standard.

No injuries of BPA personnel have been reported as a result of the use of herbicides in vegetation management during the past five years (the period for which records are available) (A. Stanford pers. comm.). BPA worker experience is strong evidence of the use of safe work practices and good hygiene.

The most extensive investigations of occupational hazards from herbicide use have dealt with worker experience with 2,4-D. These studies are reviewed in the 2,4-D Background Statement (Appendix A) (also see Newton and Dost 1981). Due to the pattern of metabolism and rapid excretion of 2,4-D in urine, low hazard to workers is concluded, particularly when protective clothing and good hygienic practices are employed.

Table 7-10. Hazard Assessment Summaries for Herbicide Active Ingredients Used by BPA

Note: Summaries are Derived From Information Presented in
Herbicide Background Statements (Appendix A)

Ammonium Sulfamate

Use: At substations and on rights-of-way near water.

Occupational Hazard: Mild irritant upon inhalation of dust, mild eye irritant

Chronic Effects: Carcinogenicity, mutagenicity and teratogenicity not detected at test dosages.
Subjected to extensive testing because of potential fire-retardant properties.

Public Exposure: Low; exposure levels far below that identified with irritant properties.

Environment: Low toxicity to fish and wildlife. Degradation products can be used as nutrients.

Atrazine

Use: At substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Carcinogenicity and teratogenicity not detected at test dosages. Limited mutagenic properties have been found in fruit flies and plants, but not in several other test systems.

Public Exposure: Unlikely because of restricted access and minimal use at substations.

Environment: Application site, application rate and lack of bioaccumulation result in minimal risk to fish and wildlife.

Bromacil

Use: At substations and around poles. Oxy Ureabor used at substations only.

Occupational Hazard: Skin and eye irritant, especially as formulated in Oxy Ureabor.

Chronic Effects: Carcinogenicity, mutagenicity and teratogenicity not detected at test dosages.
Subjected to extensive mutagenic testing because of known mutagenicity of a similar compound.

Public Exposure: Low; exposure levels far below that identified with irritant properties.

Environment: Low toxicity and lack of bioaccumulation result in minimal risk to fish and wildlife.

Dicamba

Use: Extensive use on rights-of-way.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Carcinogenicity and mutagenicity not detected at test dosages. Limited teratogenic properties have been found in rabbits at doses over 10 mg/kg/day.

Public Exposure: Low; exposure unlikely, but could occur from aerial drift and movement in groundwater.

Environment: Moderate risk of translocation. Application rate and lack of bioaccumulation result in minimal risk to fish and wildlife.

Dichlobenil

Use: Ornamental plantings at substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Teratogenicity not detected at test dosages. Carcinogenicity and mutagenicity studies are not available.

Public Exposure: Unlikely because of restricted access and minimal use at substations.

Environment: Application site and lack of bioaccumulation result in minimal risk to fish and wildlife.

Diuron

Use: At substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Carcinogenic and teratogenic properties at high, albeit sublethal doses. No evidence of carcinogenicity or teratogenicity at moderate or low dosage. Mutagenicity studies are not available.

Public Exposure: Unlikely because of restricted access and minimal use at substations.

Environment: Application site and lack of bioaccumulation result in minimal risk to fish and wildlife.

Glyphosate

Use: Limited use on rights-of-way, around poles and at substations.

Occupational Hazard: Skin and eye irritant.

Chronic Effects: Teratogenicity not detected at test dosages. Carcinogenicity and mutagenicity studies are not available.

Public Exposure: Low; exposure unlikely because of minimal use.

Environment: Low toxicity and lack of bioaccumulation result in minimal risk to fish and wildlife.

Monuron

Use: At substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Carcinogenicity is suspected, but conflicting results prohibit conclusions until current studies are completed. Teratogenicity not detected at test dosages. Mutagenicity studies are not available.

Public Exposure: Unlikely because of restricted access and minimal use at substations.

Environment: Application site and low toxicity result in minimal risk to fish and wildlife. Moderately toxic to bees.

Picloram

Use: On rights-of-way and at substations.

Occupational Hazard: Inhalation of dust may be irritating; mild skin irritation; moderate eye irritation.

Chronic Effects: Carcinogenicity studies are being conducted. Mutagenicity and teratogenicity not detected at test dosages.

Public Exposure: Low; picloram is relatively persistent in soil, but exposure levels are far below that identified with irritant properties. Incidents of very low levels in well water have occurred because of movement in groundwater.

Environment: Persistent, moderate risk of translocation. Low toxicity and lack of bioaccumulation minimize hazards from translocation.

Prometone

Use: At substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Mutagenicity not detected at test dosages. Carcinogenicity and teratogenicity studies are not available.

Public Exposure: Unlikely because of restricted access.

Environment: Application site, low toxicity and lack of bioaccumulation result in minimal risk to fish and wildlife.

Simazine

Use: At substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Mutagenicity not detected at test dosages. Carcinogenicity and teratogenicity studies are not available.

Public Exposure: Unlikely because of restricted access.

Environment: Application site and low toxicity result in minimal risk to fish and wildlife.

Sodium Chlorate and Sodium Metaborate

Use: Extensive use at substations.

Occupational Hazard: Strong skin and eye irritants, especially as formulated in Oxy Ureabor.

Chronic Effects: Studies are not available. Cases of chronic chlorate toxicity are unknown. Chlorate and borate ions are unlikely to be harmful at low or moderate concentrations.

Public Exposure: Unlikely, unless off-site transport occurs.

Environment: Persistent. Application site and low toxicity result in minimal risks to fish and wildlife.

Tebuthiuron

Use: Around towers and poles and extensive use at substations.

Occupational Hazard: None identified when handled per label instructions.

Chronic Effects: Teratogenicity not detected at test dosages. Carcinogenicity studies are being evaluated. Mutagenicity studies are not available.

Public Exposure: Low; primary use is at substations.

Environment: Application site and low toxicity result in minimal risk to fish and wildlife.

2,4-D and 2,4-DP

Use: Extensive use on rights-of-way and at substations.

Occupational Hazard: None when handled per label instructions, but toxic effects can be experienced following accidental spillage, sustained contact, or other negligent handling activity.

Chronic Effects: Carcinogenicity not detected at test dosages. Teratogenic at dosages near acute lethal doses. Conflicting data have resulted from mutagenicity studies. Probably one of the most thoroughly studied herbicides.

Public Exposure: Low; exposure from BPA operations insignificant compared to agricultural operations. Risk is negligible.

Environment: Ester formulations may be of moderate hazard to fish and aquatic organisms, low toxicity of amine salt formulation and lack of bioaccumulation minimizes risk to fish and wildlife.

Diesel Oil

Use: As a carrier in spot sprays and single-stem treatments.

Occupational Hazard: Fire.

Chronic Effects: Unknown. Detectable and repulsive at levels far below those known to cause ill effects.

Public Exposure: Low; exposure levels far below that identified with ill effects.

Environment: Application technique, application rate, and lack of bioaccumulation minimizes risk to fish and wildlife.

Torbak

Use: As a drift control agent in spraying operations.

Occupational Hazard: Slippery when spilled or sprayed on hard surfaces.

Chronic Effects: Have not been studied because it is not an herbicide.

Public Exposure: Low; probably short term due to assumed rapid degradation.

Environment: Low toxicity and lack of bioaccumulation result in minimal risk to fish and wildlife.

Co-Drift and Nalco-trol

Use: As a drift control agent in spraying operations.

Occupational Hazard: Slippery when spilled or sprayed on hard surfaces.

Chronic Effects: Have not been studied because it is not an herbicide.

Public Exposure: Low.

Environment: Low toxicity and lack of bioaccumulation result in minimal risk to fish and wildlife.

Public Health Hazards. The potential exposure of the general public to herbicides is less likely than exposure of the work force, and the level of exposure is likely to be significantly lower. Sources of possible public herbicide exposures are "nontarget" losses to air, water, and soil. These exposures are unintentional or, in some cases, unavoidable exposures which result from the inefficiency of any particular technique for herbicide applications.

Even though some herbicides have been used for nearly 40 years, available environmental monitoring studies as reviewed in the Herbicide Background Statements (Appendix A) and below have shown that herbicides are not concentrating in any components of the environment or in humans. Dilution by natural forces and chemical degradation by biological and nonbiological processes act to limit unintentional and unavoidable exposures of the public, and reduce exposure levels. The various pathways by which the public might be exposed to herbicides are briefly reviewed.

Air -- Air is the medium through which virtually all proposed BPA herbicide applications are made (exceptions would be spot chemical treatments such as stem injections and frill treatments among BPA procedures). Occupational exposure, nontarget plant damage resulting from drift and/or volatilization, and measurable contamination of soil and water may occur during application of herbicides. Hazards related to occupational exposures and plant damage can be minimized by efficient and effective work practices (including drift-control measures) as indicated on the EPA- and State-approved herbicide labels. See worst-case analysis below for estimation of human risks due to drift of herbicides to nontarget areas.

The amount of herbicide in air away from a target area will be low due to dilution and to gradual particle deposition. The contribution that photo-decomposition may make to the reduction of air residues is not known. Even with an herbicide as widely used as 2,4-D, air concentrations are measured in amounts less than one microgram per cubic meter of air at sites away from treatment areas. The potential human intake resulting from such exposures is several orders of magnitude below acute inhalation toxic thresholds even using the most conservative estimates. It is reasonable to assume that exposures of humans to less-used herbicides would be correspondingly smaller and of even lower hazard.

Water -- Water can be contaminated by accidental direct herbicide application, surface runoff, and leaching from

treated soils. The possibilities of leaching or surface runoff are virtually eliminated by the use of buffer zones along all water bodies (see section on Mitigation Measures in Chapter 4). Accidental direct applications could result in local short-term concentrations which could be significant to sensitive aquatic organisms (see section of this chapter on Water Quality and Fisheries). Dilution, chemical and microbial degradation, and photodecomposition act to rapidly reduce concentrations of any herbicides that do reach water. See worst-case analysis below for estimation of human risks.

Field monitoring programs over the past 10 years have shown that surface contamination is highly localized, initial levels of contamination are very low (ppb), and initial levels are quickly reduced (Norris 1979). Therefore, potable community water supplies are unlikely to be contaminated by BPA's vegetation management program. A potential for contamination would require massive use of herbicides in an entire watershed before community water supplies would carry toxicologically significant levels of herbicide. The cumulative input of herbicides from forestry, agricultural, and rights-of-way uses to a small watershed over a short period of time might create such a situation.

Analysis of a stream crossed by a treated right-of-way did not detect herbicide residues, thereby indicating that the buffer zone effectively eliminated possible surface runoff and leaching. Other monitoring studies by Norris (1974) revealed that "barely detectable" (i.e. 0.004 ppm) drift of 2,4-D entered a test stream during aerial application when the buffer zone was observed. Although drift was detected, no significant hazard was presented to either aquatic organisms or downstream water users (Norris 1974).

Several monitoring studies have shown detectable levels of aerially-sprayed herbicides in domestic water supplies, although at levels several orders of magnitude below acute toxicity thresholds. For example, Norris (1975) found picloram residues in a domestic water supply at levels of 0.025 ppm or less. These levels are five orders of magnitude (i.e., 100,000 times) below the lowest acute oral toxicity reported for picloram (see Table 7-7). The occasional contamination of water supplies, even though at very low levels, underscores the necessity for thorough identification of water supply sources and locations on and near BPA rights-of-way.

Groundwater -- Contamination of groundwater by trace levels of herbicides has been observed in agricultural areas where

extensive use of herbicides has been made over large surface areas, especially with shallow water tables. Vegetation management on transmission line rights-of-way by BPA would be unlikely to result in groundwater contamination due to the small amounts of chemicals used and the limited areas treated.

The Spokane Valley-Rathdrum Prairie aquifer has been designated a "sole source" aquifer by EPA due to regional dependence on it as a water supply source. BPA's vegetation management activities are unlikely to cause significant contamination of the aquifer for several reasons. BPA uses small quantities of herbicides to control vegetation. Approximately 2,300 pounds of herbicide active ingredients are programmed for use in 1982 in the three counties either overlying the aquifer or in the drainage basin that recharges the aquifer (i.e., Spokane County, WA; Kootenai County, ID; and Shoshone County, ID). The aquifer is large (underlying about 350 square miles at depths of 40-400 feet) and it transmits large volumes of water rapidly (the recharge/discharge rate averages about 1,320 cubic feet per second and groundwater velocities are more than 60 feet per day in some areas) (Drost and Seitz 1978). The large dilution factor, and the small herbicide quantities used ensure that any incremental contamination of the aquifer as a result of BPA activities likely will be insignificant.

The possibility of groundwater contamination from vegetation management at substations has not been evaluated by BPA. These operations utilize high rates of herbicide application. The fate of herbicides under these conditions has not been studied to the same extent that the persistence and distribution of herbicides applied to rights-of-way has been investigated. Vegetation management at substations is not likely to impact general environmental quality and health because of its limited scope. However, knowledge of the long-term fate of herbicides used at substations would permit more certain determination of possible impacts on groundwater quality.

For example, the possible impacts on groundwater (i.e., Spokane Valley-Rathdrum Prairie Aquifer) of using 2,390 pounds of Pramitol 5PS on 17 acres of substations in Spokane County, Washington and Kootenai County, Idaho cannot be precisely predicted without such studies. By weight, 90 percent of Pramitol 5PS is sodium chlorate and sodium metaborate; both are persistent in soil and highly mobile in water.

Hydrological studies have shown that high recharge comes from directly over the aquifer during the rainy season.

Therefore contamination of groundwater from heavy applications at BPA substations would be avoided by applying only after the rainy season ends. Also, depths to groundwater tables below substations is a factor to be considered; if depths are less than 30 feet, heavy applications of highly-mobile and/or persistent herbicides should be avoided (D. Byram pers. comm.).

Groundwater monitoring of wells in the Spokane Valley-Rathdrum Prairie Aquifer has not indicated historical herbicide contamination of the aquifer from any source. The Spokane County Engineering Department (WA) and the Panhandle Health District (ID) conducted testing of well water extracted from the aquifer for six pesticides including 2,4-D and 2,4,5-T over a one-year period in 1976-1977. These herbicides were the only ones tested for because they were used to a much greater extent by agricultural operations than any other herbicides in the aquifer recharge area. No detectable levels of these two herbicides were found (i.e., less than 10 parts per trillion) (Tanner pers. comm.; Miller pers. comm.). Subsequently, monitoring of well water for herbicides has been discontinued.

Soil -- Knowledge of the behavior of herbicides in or on soils is critical to forecasting their rapid environmental degradation. Soil is recognized as the ultimate herbicide sink. Adsorption is the most important determinant of the behavior of herbicides in soil. This process will influence mobility, phytotoxicity, and susceptibility of herbicides to microbial and chemical degradation. Microscopic organic matter and clay particles favor soil adsorption. If not adsorbed or degraded herbicides may move from treated soils through leaching, volatilization, and surface runoff. The ultimate degradation of herbicides to natural substances such as carbon dioxide, water, and nitrogen occurs as a result of microbial and nonbiological processes. Photodecomposition may be important in areas receiving intense sunlight.

The processes enumerated in the preceding paragraph are primarily responsible for the persistence or nonpersistence of herbicides in soil. Studies of the phytotoxicity of soil residues are the basis of the persistence data in Table 7-11. They permit the herbicides used by BPA to be ranked into three classes: nonpersistent, moderately persistent, and persistent.

Since the data supporting the classification in Table 7-11 are based upon agricultural applications of the herbicides, the rankings are appropriate when used to compare herbicide

Table 7-11. Persistence of Phytotoxic Amounts of Herbicide
in Moist, Fertile Soil at Summer Temperatures
in the Northwest¹

Nonpersistent: Phytotoxic for 3 Months or Less	Moderately Persistent: Phytotoxic for 3 to 12 Months	Persistent: Phytotoxic for more than 12 months
Ammonium sulfamate 2,4-D 2,4-DP Glyphosate	Atrazine Dicamba Dichlobenil Diuron Monuron Prometone Simazine	Sodium chlorate Sodium metaborate Bromacil Picloram Tebuthiuron

FOOTNOTE:

¹Adapted from Helling et al. (1971).

materials rather than to predict the fate of specific herbicide treatments. Environmental conditions and rates of applications are of critical importance in forecasting soil persistence of particular herbicides used in vegetation management programs.

Some data concerning the fate of herbicides in soil and water have been collected in a long-term herbicide monitoring program conducted by BPA (Norris 1971-1976, 1979). Residues were measured following herbicide use for transmission line vegetation management. Areas treated with 2,4-D, picloram, and dicamba were studied. The herbicides remained in soil litter or upper soil levels (0-12 inches). The amounts present rapidly declined to minute or trace levels which were probably strongly adsorbed to soil particles. Long-term studies indicated that the herbicides migrated from treated soils to adjacent streams only under special conditions, e.g., when a wetland area was accidentally treated with herbicide or when a high water table was evident. In all cases, contamination occurred at levels less than 50 ppb (0.05 ppm).

The monitoring studies reviewed above support the contention that BPA vegetation management using herbicides is associated with minimal environmental contamination. The behavior of the herbicides used in transmission lines maintenance has been consistent with that observed in previous laboratory and field experiments.

Worst-Case Analysis of Potential Herbicide Effects on Human Health

The acute and chronic toxicity of herbicides and other chemicals can be measured readily using experimental animals and modern testing methods (see Herbicide Background Statements). In contrast, the process of risk estimation for human exposures to chemicals is highly complex and much less certain. Much uncertainty results from the lack of quantitative information on the environmental behavior and health effects of low level exposures on humans.

Risk collectively represents the inherent toxicity of a chemical, the magnitude of possible exposure, and the probability that such an exposure will occur. The biological consequences of single large exposures (acute toxicity) are more easily detected and described than the results (if any) of long-term low-level exposures. Long-term, low-level herbicide exposures are unlikely due to the patterns of herbicide use, environmental (biological and chemical) degradation, and the rapid removal or clearance of herbicides from exposed persons. Given these complexities,

hypothetical worst-case scenarios can be constructed to estimate potential risks from proposed patterns of herbicide use.

The risk estimations developed in this section will compare 1) known levels of chronic toxicity effects in test organisms with 2) the magnitudes of possible human exposures to herbicides in order to estimate safety factors for each worst-case scenario. The resulting safety factors can then be evaluated in terms of the probabilities that the worst-case exposures might occur.

Both occupational and environmental exposures of humans may result from BPA's proposed patterns of herbicide use. In addition, some human exposures may result from accidental and unintentional application of herbicides to nontarget areas.

In this worst-case analysis, potential human exposures to four herbicide active ingredients proposed for use by BPA will be evaluated. These four, 2,4-D, dicamba, picloram, and glyphosate, would be those used as foliage sprays to control right-of-way vegetation (see Table 3-3). Three of these, 2,4-D, dicamba, and picloram would be used in broadcast applications, either from the air or from ground-based equipment such as backpack sprayers and high-volume hose sprayers. All four herbicides would be used in spot foliage applications. As a result of broadcast uses and application to foliage, humans may be exposed to these herbicides through skin absorption, inhalation, or ingestion (water or food), although such exposures are unlikely to occur (see below).

Ammonium sulfamate is a fifth active ingredient proposed by BPA for use in right-of-way brush control. Ammonium sulfamate will not be evaluated in the worst-case analysis for several reasons. BPA would use this active ingredient to a very limited extent, primarily in stream buffer zones where use of other herbicides is restricted. BPA used less than 1000 lbs of ammonium sulfamate during the period 1978-1981 and did not propose any use in 1982.

Ammonium sulfamate has been tested in experimental animals and some studies have been performed in humans due to its potential fire-retardant properties. Acute toxicity is low, requiring the "Caution" signal word on the herbicide label. No chronic toxicity effects have been found (see Ammonium Sulfamate Background Statement: section on Chronic Effects). As a result, there is a high degree of certainty regarding its lack of potential impacts on human health.

Other herbicides proposed for use by BPA would be used only in substations or for wood power pole protection in range-land areas (Table 3-3). Possibilities of human exposure as a result of dispersal of the herbicides in the environment would be virtually nil. Therefore, these other herbicides will not be considered in this worst-case analysis.

Potential Occupational Exposures. Primary routes of occupational exposure possible in BPA's program are those associated with: 1) mixing and loading herbicides into application equipment, 2) applying herbicides to vegetation using ground equipment, and 3) monitoring aerial herbicide applications. Mixer-loaders experience the most severe herbicide exposures for workers involved in aerial applications. Dost (1983) reviewed the literature on exposure rates for herbicide workers and estimated that mixer-loaders weighing 50 kg (110 pounds) might experience a maximum daily dose of 0.1 mg per kg for a maximum 2,4-D application rate of 4 pounds per acre. Dost noted that use of protective garments and proper work procedures would substantially reduce the maximum exposure level.

BPA's proposed maximum aerial application rate for 2,4-D active ingredient is 6 lbs per acre (as formulated in Banvel 720 and Tordon 101 products; see Appendix B, Table B-2). Assuming a proportional exposure rate, a 50 kg mixer-loader on a BPA aerial spray project could experience up to 0.15 mg per kg daily dose of 2,4-D.

Among ground applicators, workers operating backpack sprayers (see Figure 3-9) are subject to the greatest herbicide exposures; the relatively high level of exposure results from carrying herbicide mixtures in tanks on their backs, spraying herbicide on foliage at close range, and walking through foliage that has been recently treated. Dost (1983) estimated maximum doses of herbicide for backpack applicators at 0.1 mg per kg per day, for a 2,4-D application rate of 4 pounds per acre.

BPA's proposed maximum herbicide application rate on foliage by backpack sprayer is 36 pounds per acre of 2,4-D active ingredient (i.e. 9 gallons per acre of Weedone 170 product; see Appendix B, Table B-2). Again assuming an exposure rate proportional to Dost's (1983) findings, a 50 kg BPA backpack applicator might experience a maximum dose of 0.9 mg per kg per day of 2,4-D herbicide. However, due to the intermittent (i.e. spot) nature of backpack spray applications, such a maximum dose is highly unlikely.

Another type of occupational exposure is that of an observer monitoring the performance of aerial spray application projects. At a maximum BPA proposed aerial application rate for 2,4-D of 6 pounds per acre, direct surface deposition of 2,4-D would be a maximum of 672 mg per m². An observer might have up to 0.2 m² (about 2 feet²) of exposed skin if shirtless but would absorb through the skin less than 10 percent of the deposited herbicide (Dost 1983). A maximum dose from one aerial spray pass therefore might be 13 mg for a 50 kg person or 0.27 mg per kg. This situation must be considered a one-time accidental type of exposure.

In studies of aerial spray crews, Lavy et al (1982) found a maximum exposure of an observer at 0.05 mg per kg per day (for more details on this study, see the 2,4-D Background Statement in Appendix A). This dose, therefore, would constitute a worst-case daily exposure rate for aerial application observers.

The dose levels discussed above are assumed to be absorbed through the skin due to direct occupational contact with herbicides. Various studies have also examined levels of herbicide exposure through respiration. In all cases, respiratory intake was found to be a very small fraction of dermal intake (Dost 1983).

Potential Environmental Exposure. Possible routes of environmental exposure to herbicides include skin absorption of off-target airborne drift and ingestion through food and water. Each of these routes will be considered individually. Dost (1983) evaluated potential off-target drift exposures of persons standing in the open adjacent to a right-of-way being aerally treated. In a five-mile-per-hour wind (the maximum wind in which BPA aerial herbicides are permitted), maximum off-target deposition at 100 feet from the target swath was estimated to be one percent of the intended application rate (Yates et al 1978, seen in Dost 1983).

At a maximum BPA aerial application rate of 6 pounds of 2,4-D per acre, the 100-foot off-target deposition (at one percent) would be 0.06 pounds per acre (i.e. 6.7 mg per m²). A 50 kg person standing at this distance with 0.2 m² of exposed skin and absorbing less than 10 percent of the deposited rate would experience a dose of 0.13 mg or 0.0026 mg per kg. Such an off-target exposure would occur only once for any particular person due to the temporary and periodic nature of BPA aerial spray operations (once every 4-5 years west of the Cascades).

In considering possible environmental exposures through drinking water, both operational and accidental occurrences need to be evaluated. As estimated above, drift deposition at a distance of 100 feet from a spray target area (i.e. the normal width of a stream buffer zone) may be as much as 6.7 mg per m² for BPA's highest proposed aerial application rate. If deposited on a stream 10 cm deep, the drift would cause an instantaneous theoretical concentration of 0.067 ppm (i.e. 67 ppb) in the stream. If it is assumed that a 50 kg person immediately consumed two liters of this stream water (and that no dilution, adsorption by sediments, or other normal reduction of concentration occurred), the person would ingest 0.13 mg of herbicide or 0.0026 mg per kg.

These calculated worst-case exposures through drinking water due to drift can be placed in the context of the results from various field studies reviewed earlier in this section. BPA's stream monitoring program has shown that 100-foot buffer zones are effective at minimizing herbicide contamination of streams. Either residues have not been detectable in streams or have been detectable at very low levels (0.004 ppm) (Norris 1974). Dost (1983) reported that herbicide concentrations in streams are usually found to be less than 1-2 ppb (0.001-0.002 ppm) if contemporary stream protection practices are followed.

Accidental direct aerial application of herbicides is usually considered the most likely route for herbicide contamination of streams to occur (Norris 1981). Failure of right-of-way inspectors to detect streams (e.g. intermittent watercourses) or failure of aerial spray equipment to shut-off as intended could result in such accidental direct applications. At BPA's proposed maximum aerial application rate, 672 mg per m² of 2,4-D herbicide could be deposited directly on an unobstructed stream surface. If the stream was 10 cm deep, the theoretical instantaneous stream concentration of herbicide would be 6.7 ppm. A 50 kg person immediately consuming 2 liters of this stream water, (assuming no dilution or other normally-occurring reduction in herbicide concentration) would ingest 13.4 mg of 2,4-D herbicide or 0.27 mg per kg.

Newton and Norris (1981) estimated the amount of 2,4-D that would enter a human diet as the result of an accidental direct application to a drinking water source. Their field measurements showed that when a slowly-moving stream was treated directly with 2,4-D, the peak concentration was 0.071 ppm in the water shortly after treatment but decreased to nondetectable levels after one week. A 50 kg human

consuming 2 liters per day of this water through the period of maximum concentration, would receive a total dose of 0.003 mg per kg the first day, and a cumulative dose of 0.005 mg per kg during the entire contamination period.

The peak concentration (0.071 ppm) observed in the field by Newton and Norris (1981) is 100 times smaller than the worst-case exposure calculated here for accidental direct deposition (6.7 ppm). Most of this difference is attributable to the normal processes acting in a stream to rapidly reduce herbicide concentrations after the initial deposition (i.e. dilution, biological and chemical degradation, adsorption by sediments and organic matter). More details on these processes are presented in the Herbicide Background Statements (see sections on Chemical Fate in Water).

Soil particles or organic matter to which herbicides are adsorbed may be carried into streams by sudden rainstorms and overland flow. When streams are heavily laden with sediment as after a rainstorm, use for drinking water is extremely unlikely. As the sediments settle out of the stream water, the herbicides are carried with them. Therefore, possibility of human exposure through this route is virtually nil.

Fish may temporarily concentrate herbicides contained in their stream habitats. Because herbicide concentrations decrease rapidly in streams and because fish must be exposed to herbicides for some period of time in order to concentrate herbicide in their tissues, significant concentration of herbicides by fish is highly unlikely. Fish rapidly clear all herbicides from their tissues by excretion because herbicides are highly water soluble and are rapidly metabolized to water soluble products (i.e. the herbicides under consideration here do not bioaccumulate -- see Herbicide Background Statements). Furthermore, small streams where herbicides might be detectable will contain few fish and those only of small size. Therefore, a concentration factor of 1 (i.e. fish concentration = water concentration) will be used.

As a worst-case scenario, consider fish caught in a stream containing 6.7 ppm of herbicide (the theoretical instantaneous concentration resulting from accidental direct application of 6 pounds per acre to a stream 10 cm deep). If a fish concentration factor of 1 occurred, 0.5 kg (1.1 pounds) of fish would contain 6.7 ppm or 3.4 mg of herbicide. A 50 kg person consuming 0.5 kg of this fish would ingest 3.4 mg of herbicide and experience a one-time dose of

0.067 mg per kg. The possibility of this dose being experienced by this route of exposure is virtually zero. The instantaneous initial concentration of herbicide in water is assumed to be immediately attained in fish flesh which is immediately consumed by a person. In reality, the time interval required for each of these steps would result in substantial herbicide dilution and degradation before human consumption.

Dost (1983) has analyzed potential human exposure to herbicides as a result of consumption of deer meat containing herbicide. Foliage available to browsing deer will contain up to 100 ppm of herbicide per pound of herbicide applied per acre at the time of application. Thus, at BPA's maximum application rate by backpack sprayer or high-volume hose sprayer of 36 pounds per acre, browse foliage may contain a maximum of 3,600 ppm of herbicide immediately after being sprayed. This concentration will decrease rapidly due to degradation of the herbicide in plant tissue.

Based on studies of feed intake and resulting herbicide concentrations in deer muscle (Dost 1983), a 3,600 ppm initial concentration in foliage could hypothetically result in 1.8 mg of herbicide per kg of deer muscle tissue. This calculation is based on the results of studies showing that tissue concentration is proportional to dose rate for water soluble chemicals. However, this calculation also assumes that the deer exclusively consumes sprayed foliage, an unreal assumption on linear transmission rights-of-way and where ground-based methods are used intermittently for herbicide application. A 50 kg human consuming 0.5 kg of this meat (from deer having fed on ground-sprayed right-of-way) would ingest 0.9 mg or 0.018 mg per kg. Meat from deer having fed on aerially-sprayed right-of-way (6 pounds per acre maximum application) would provide a 0.003 mg per kg dose to the 50 kg person.

Humans may also be exposed environmentally to herbicides through consumption of berries harvested on or near sprayed rights-of-way. Worst-case concentrations of herbicides in berries would result from backpack or high-volume hose spray applications on a right-of-way. Dost (1983) reported that previous studies found initial residues in berries of up to 33 ppm after a backpack application of 5.25 pounds per acre. BPA's maximum ground application rate of 36 pounds per acre would therefore result in a proportional initial residue in berries of 226 ppm on a treated right-of-way. A 50 kg person consuming 0.5 kg (about one pound) of such berries would ingest a dose of 113 mg or 2.26 mg per kg, (assuming no immobilization or degradation of herbicide on

the berries). A 50 kg person consuming 0.5 kg of berries from an aerially-sprayed right-of-way (6 pounds 2,4-D per acre maximum) would ingest 19 mg of herbicide or 0.38 mg per kg. Within two days, berry plants will show foliage damage due to the herbicide, thus warning any potential berry picker (Newton and Dost 1981). This route of exposure would at worst provide a single herbicide dose.

No drift to off-right-of-way areas will result from backpack spray applications. Some minor drift to berry patches off right-of-way may result from aerial applications. As mentioned above, Dost (1983) estimated that drift deposition at 100 feet from the target swath will be a maximum of one percent of the intended application rate. BPA's maximum aerial application rate of 6 pounds per acre might deposit up to 0.06 pounds per acre on a berry patch 100 feet off the right-of-way. The initial residue in berries would be a maximum of 0.38 ppm (proportional residue when 33 ppm results from 5.25 pounds per acre). A 50 kg person consuming 0.5 kg of these berries might ingest a dose of 0.19 mg or 0.0038 mg per kg per day.

The data calculated above on possible worst-case doses resulting from BPA's proposed uses of herbicides are based primarily on studies on the environmental behavior of 2,4-D (see 2,4-D Background Statement and Dost 1983). The other herbicides under consideration here (picloram, dicamba, and glyphosate) behave similarly in the environment and in biological organisms (e.g. all are rapidly excreted from animals after ingestion). Therefore worst-case doses for picloram, dicamba, and glyphosate can be estimated as proportions of the 2,4-D doses, given BPA's maximum proposed application rates (see Table 7-12).

Dicamba would be used by BPA at a maximum application rate of 3 pounds per acre for both aerial and ground-based applications (see Table B-2 in Appendix B); this rate is one-half of that proposed for 2,4-D aerial applications. Therefore maximum possible dicamba doses are about one-half those possible from 2,4-D aerial applications (Table 7-12).

Picloram will also be used at a much lower maximum application rate (1.5 pounds per acre for both aerial and ground spray applications). Several differences in environmental behavior of picloram are worthy of mention although not reflected in the proportional estimates shown in Table 7-12.

Picloram has greater mobility in soil than 2,4-D; even so, the rate of migration of picloram through soil does not produce levels of stream residues that will approach those already calculated for stream residues due to drift or

Table 7-12. Maximum Worst-Case Doses and Associated Safety Factors for Various Potential Routes of Occupational and Environmental Exposures to Herbicides Proposed for Use by BPA as Foliage Sprays on Rights-of-Way

POTENTIAL EXPOSURES ¹	2,4-D				DICAMBA		PICLORAM		GLYPHOSATE	
	MAXIMUM POSSIBLE dose for 50 kg person (mg/kg/day ²)		SAFETY FACTOR ⁴ based on 20 mg/kg/day reproductive no-effect level		MAXIMUM POSSIBLE dose for 50 kg person		MAXIMUM POSSIBLE dose for 50 kg person		MAXIMUM POSSIBLE dose for 50 kg person	
	AERIAL APPLICATION (maximum rate = 6 lb/ac)	BACKPACK APPLICATION (maximum rate = 36 lbs/ac)	AERIAL APPLICATION	BACKPACK APPLICATION	AERIAL or BACKPACK APPLICATION (maximum rate = 3 lbs/ac)	SAFETY FACTOR based on 3 mg/kg/day reproductive no-effect level	AERIAL or BACKPACK APPLICATION (maximum rate = 1.5 lbs/ac)	SAFETY FACTOR based on 80 mg/kg/day reproductive no-effect level	BACKPACK APPLICATION only (maximum rate = 1 lb/ac)	SAFETY FACTOR based on 30 mg/kg/day reproductive no-effect level
<u>OCCUPATIONAL</u>										
. Mixer-loader for aerial applications	0.15	NA	133	NA	0.075	40	0.0375	2,133	NA	NA
. Backpack applicators	NA ³	0.9	NA	22	0.075	40	0.0375	2,133	0.025	1,200
. Observer of aerial applications ⁵	0.27 SD ² 0.05	NA	74 SD 400	NA	0.14 SD 0.014	21 SD 210	0.068 SD 0.0068	1,180 SD 11,800	NA	NA
<u>ENVIRONMENTAL</u>										
. Drift exposure 100 feet off right-of-way	0.0027 SD	NA	7,400 SD	NA	0.0014 SD	2,140 SD	0.00068 SD	117,650 SD	NA	NA
. Drinking 2 liters of water from 10 cm deep stream with 100 foot buffer	0.0026 SD	NA	7,700 SD	NA	0.0013 SD	2,300 SD	0.00065 SD	123,080 SD	NA	NA
. Drinking 2 liters of water from 10 cm deep stream with no buffer	0.27 SD	NA	74 SD	NA	0.14 SD	21 SD	0.068 SD	1,180 SD	NA	NA
. Consuming 0.5 Kg of fish taken from 10 cm deep stream with no buffer	0.067 SD	NA	300 SD	NA	0.034 SD	88 SD	0.017 SD	4,706 SD	NA	NA

Table 7-12. Cont'd.

POTENTIAL EXPOSURES ¹	2,4-D				DICAMBA		PICLORAM		GLYPHOSATE	
	MAXIMUM POSSIBLE dose for 50 kg person (mg/kg/day ²)		SAFETY FACTOR ⁴ based on 20 mg/kg/day reproductive no-effect level		MAXIMUM POSSIBLE dose for 50 kg person	SAFETY FACTOR	MAXIMUM POSSIBLE dose for 50 kg person	SAFETY FACTOR	MAXIMUM POSSIBLE dose for 50 kg person	SAFETY FACTOR
	AERIAL APPLICATION (maximum rate = 6 lb/ac)	BACKPACK APPLICATION (maximum rate = 36 lbs/ac)	AERIAL APPLICATION	BACKPACK APPLICATION	AERIAL or BACKPACK APPLICATION (maximum rate = 3 lbs/ac)	based on 3 mg/kg/day reproductive no-effect level	AERIAL or BACKPACK APPLICATION (maximum rate = 1.5 lbs/ac)	based on 80 mg/kg/day reproductive no-effect level	BACKPACK APPLICATION only (maximum rate = 1 lb/ac)	based on 30 mg/kg/day reproductive no-effect level
. Consuming 0.5 Kg of meat from deer feeding on right-of-way	0.003	0.018	6,670	1,111	0.0015	2,000	0.00075	106,667	0.0005	60,000
. Consuming 0.5 Kg of berries grown on right-of-way	0.38 SD	2.26 SD	53 SD	9 SD	0.19 SD	16	0.095 SD	842 SD	0.063 SD	476 SD
. Consuming 0.5 Kg of berries grown 100 feet off right-of-way	0.0038 SD	NA	5,260 SD	NA	0.0019 SD	1,600 SD	0.00095 SD	84,210 SD	NA	NA

¹ See text for descriptions of exposure routes.² Daily doses are stated in mg/kg/day; doses indicated by SD are single doses stated in mg/kg.³ Not applicable.⁴ Safety factors indicate the number of exposures that must be experienced simultaneously to reach the given reproductive no-effect level.⁵ The top row of values is for a one-time exposure of an observer without a shirt accidentally sprayed at full application rate. The bottom row of values is for an observer's maximum daily exposures.

accidental direct application (Dost 1983). The picloram dose from drinking two liters of water from a stream without a buffer (0.068 mg per kg in Table 7-12) is based on 25 percent of the worst case 2,4-D concentration for this exposure (25 percent of 6.7 ppm = 1.7 ppm = 1.7 mg per liter). BPA's stream monitoring program has not detected picloram residues from leaching or surface runoff that exceed 0.05 ppm (see Picloram Background Statement: section on Chemical Fate in Water).

Picloram has accumulated in fish to a concentration much lower than the concentration in the water where tested. Therefore the fish concentration factor would be much less than 1 and any consumption of fish from a contaminated stream would present less of a dose than drinking the stream water (Dost 1983).

Glyphosate behaves environmentally in patterns similar to 2,4-D and other phenoxy herbicides. BPA proposes to use glyphosate in ground foliage applications but not aerially. Maximum application rates would be one pound per acre. Possible doses shown in Table 7-12 have been calculated proportionally to those for 2,4-D. In actuality, glyphosate concentrations in water, and in deer meat will be proportionally lower due to its rapid adsorption to stream sediments and its rapid excretion by animals (see Glyphosate Background Statement: sections on Chemical Fate and Chronic Effects).

Reproductive No-Effect Levels. A reproductive no-effect level is the maximum test dose at which a chemical has caused no adverse changes in the reproductive performance of a test organism. At higher test doses, reproduction has been affected adversely. Reproductive performance is tested using long-term (one-to-several generation) studies of low-level chemical exposures (i.e. chronic toxicity testing). Possible adverse reproductive effects include direct toxicity to the fetus and teratogenicity (i.e. malformation in development of the fetus) (Dost 1983). Teratogenicity may be caused by genetic damage to parents (i.e. mutagenicity).

Teratogenicity and mutagenicity as well as direct toxicity exhibit a dose-response relationship between chemical and organism-response. With lower and lower doses, a level is reached at which no adverse response is observed. This level, with a safety factor, is the dose at which no hazard exists to the organism or its reproductive performance from the chemical.

The following paragraphs discuss reproductive no-effect levels that have been estimated for 2,4-D, dicamba, picloram and glyphosate.

For 2,4-D, various studies have indicated that at doses of 25-35 mg per kg per day no adverse reproductive effects occur (see 2,4-D Background Statement: section on Chronic Effects). Dost (1983) recommends that a conservative figure of 20 mg per kg per day be used as the reproductive no-effect level for 2,4-D. In Table 7-12, the reproductive no-effect dose is divided by the various maximum possible doses to provide a conservatively-estimated safety factor. For example, the no-effect dose is 133 times the worst-case exposure expected for mixer-loader personnel.

Although dicamba has low acute toxicity (see Table 7-7 and Table 7-10), it has caused adverse reproductive changes in rabbits at relatively low doses. The reproductive no-effect level has been determined at 3 mg per kg per day (see Dicamba Background Statement: section on Chronic Effects). This value has been used to calculate safety factors for the different types of exposures in Table 7-12. Because of the low reproductive no-effect level estimated to date, Dost (1983) suggested restrictions on females working with dicamba.

The toxicological literature on picloram indicates a reproductive no-effect level of between 80 and 150 mg per kg per day (see Picloram Background Statement: section on Chronic Effects). The lower value has been used as a conservative estimate to calculate the worst-case safety factors shown in Table 7-12. Picloram exhibits the lowest acute toxicity level of the herbicides proposed for use by BPA (see Table 7-7).

The reproductive no-effect level for glyphosate was determined to be 30 mg per kg per day in an examination of proprietary testing data (Dost 1983) (see Glyphosate Background Statement: section on Chronic Effects).

The worst-case analysis based on reproductive no-effect levels that is presented in Table 7-12 does not apply to potential carcinogenicity of the four herbicides. No reliable scientific evidence has established that these herbicides are carcinogenic. The various herbicide background statements in Appendix A summarize research findings regarding potential carcinogenicity and other toxicological properties of the herbicides proposed for use by BPA. There are no existing data relating or correlating an incidence of cancer in test organisms with particular test doses of the chemicals.

Any quantitative hazard assessment, such as this worst-case analysis, must be based on relating potential levels of exposure to known levels at which toxicity symptoms have been found in test organisms. In other words, predictions (hazard assessments) can be made based upon established

cause-effect relationships or correlations. Meaningful predictions cannot be based on unsupported assumptions. Because no such cause-effect relationships or correlations are known for the four herbicides under consideration here, it is not possible to calculate or project a potential risk of cancer to persons exposed to these chemicals.

In Table 7-12, doses are stated either as daily (mg per kg per day) or as single doses (mg per kg). Daily doses may continue over some period of time (e.g. doses experienced by applicators in the course of normal work patterns). In contrast, single doses occur as one-time exposures within long time periods (e.g. doses experienced by persons only once during a right-of-way treatment cycle).

Reproductive no-effect levels apply to chronic exposures (i.e. small chemical doses over relatively long periods of time). Although teratogenicity is normally detected in chronic toxicity testing, it may be caused by a single dose. During fetal development, various organs have brief (1-2 day) vulnerability windows during which a sufficient dose may cause permanent malformation (Dost pers. comm.). Thus it is valid to calculate safety factors based on comparing reproductive no-effect levels with single chemical doses.

Safety factors may be interpreted as the number of times an individual would have to be exposed to the worst-case dose simultaneously in order to experience the given reproductive no-effect level. Where safety factors are low, attention should be focused on the probability of those worst-case exposures occurring. The potential worst-case environmental exposures estimated in Table 7-12 are unlikely to occur.

The consequences of herbicide use will be directly related to the chemical toxicity and the extent of occupational and environmental exposure. Since the chemicals will be used in accordance with the herbicide label under conditions prescribed in BPA's Transmission Line Maintenance Standard (e.g., buffer zones, drift control measures), unintentional and unavoidable exposures of humans and other living things will be minimized. Furthermore, the intrinsic toxicity of the herbicides used by BPA is low. Hence, the chemical vegetation management operations of BPA are likely to present little hazard to occupational and public health.

Occupational Hazards of Alternative Vegetation Control Methods

Hazards to vegetation management workers may be categorized as (1) site hazards, (2) tool and equipment materials, (3) herbicide toxicity hazards, and (4) hazards during transportation to and from treatment sites. Site hazards are

greatest for vegetation control methods requiring the most extensive and intimate contact with plants and areas being treated (i.e., manual methods and spot chemical methods such as cut-stump or injection treatments).

Tool and equipment hazards depend on whether the tool/equipment being used is power-operated, whether it is a cutting tool, and under what kinds of conditions it can be operated (e.g., from an access road or from within under-brush). The most common power-operated tools are driven by internal combustion engines. Internal combustion engines are a major source of carbon monoxide, lead, hydrocarbons, and nitrogen oxides, well-known air pollutants of community and occupational environments (U.S. Department of Health, Education, and Welfare 1970). These air pollutants are formed as a result of the mixture, compression, and ignition of air and gasoline to produce large volumes of carbon dioxide and water vapor.

The pollutant materials related to the use of internal combustion engines constitute health and environmental risks. Engine refueling and operation entail exposure to gasoline fumes and an ever-present but unlikely, possibility of explosion. Several of the combustion by-products are well-known toxic substances. These include the respiratory poison, carbon monoxide; the neurotoxin, lead; and the lung irritant, nitrogen dioxide. Risks associated with these substances are very low in open environments, but the substances should not be overlooked when gauging the relative risks of alternative vegetation control methods.

Herbicide toxicity hazards were discussed in the previous section. Transportation hazards are related to the number of trips required to a treatment site and to the conditions and lengths of roads which must be traversed. Methods having the lowest productivity rates (in terms of acres or stems treated) per worker will involve the greatest transportation hazards, particularly where access to distant sites over mountainous roads is required.

Accident rate data can be developed in several ways. Injury frequency rates indicate the number of injuries recorded per unit of hours worked. A second form of accident rate data is the casualty claim cost per unit area treated, thereby integrating accident severity and control method productivity into a single figure. Unfortunately, few accident data of either type are available.

BPA has recorded injury frequency resulting from "brush cutting activities" over the past five years of vegetation management. Data are reported as number of recordable

injuries per 200,000 man-hours worked (i.e., approximately 100 people working for one year). Injury frequency rates for "brush cutting" are as follows (Stanford pers. comm.):

1976	10.3
1977	2.5
1978	4.4
1979	4.6
1980	3.2

Brush cutting activities include all manual and groundbased chemical control treatments. Very few recordable injuries have been attributable to chemical treatments and no chemical toxicity injuries (e.g., skin or eye irritation) have been reported during the same five-year period. Also during this five-year period, no recordable injuries have occurred during all BPA helicopter operations, which include various maintenance tasks in addition to vegetation management activities (Stanford pers. comm.).

Dost (1981) surveyed accident records of the Oregon State Accident Insurance Fund (SAIF) to assess injury rates associated with forestry practices. For fiscal year 1978-1979, 627 accidents were reported for the category that includes reforestation workers (i.e., forestry workers other than loggers). Major types of accidents reported were knife wounds during Christmas tree shearing (11.3 percent), strains and bruises (46.6 percent), eye injuries (8.6 percent), chainsaw cuts (7.0 percent), poison oak (5.7 percent), fractures (4.8 percent) vehicle and equipment accidents (4.8 percent), and herbicide inhalation or skin contact (1.3 percent). The base numbers of workers exposed to the various types of accidents (e.g., chainsaw operators vs. herbicide applicators) are not known.

Newton and Dost (1981) estimated casualty claims per acre for manual methods in forestry at \$25 per acre for slashing (comparable to right-of-way brush control in high density brush) and \$11 per acre for spot release treatments (comparable to brush control in low density brush). These estimates were based on Oregon data for acreage cleared by manual methods in 1978-1979 (approximately 5,000 acres) and accident claims totaling \$107,826. By comparison, the claim cost for helicopter pilots was estimated at \$0.25 per acre (all claims were attributable to physical injuries).

Mechanical methods expose operators to two major types of accidents. Loss of control of machines on steep terrain may cause injury due to flying debris and brush, and machine roll-over. During normal operations, machines put extreme bending stress on tree trunks; when the energy is released, operators may suffer injuries from thrown trees, branches, or rocks. Injuries to which manual workers are exposed

include site hazards (e.g., unsure footing, falling trees and shrubs), tool hazards (from chainsaws in particular but also from axes and machetes; chainsaw exhaust fumes are also a hazard) and hazards of extensive trips on access road (Newton and Dost 1981).

Consequences of Alternative Methods. The relative occupational hazards of alternative methods for brush control on rights-of-way are rated in Table 7-13. Biological methods are not rated due to their experimental nature. Footnotes indicate mitigation measures available to minimize each type of hazard for the various control methods.

Visual Resources

Description of Potential Impacts

BPA vegetation management occurs on existing transmission rights-of-way and at existing substations. Substantial visual resource impacts may have occurred when such facilities were constructed, particularly where transmission lines traverse closed forests on hillsides or ridgelines (see Figure 7-5). The subject of this EIS, however, is limited to the impacts of alternative vegetation control methods at existing transmission facilities.

The visibility and potential contrast of managed right-of-way is different for each landscape setting type (Figure 7-5). Potential visual resource impacts of creating and maintaining a corridor in each of the landscape settings are indicated in Table 7-14. Potential impacts are related to the effects of a right-of-way on form, line, color, and texture of the vegetation in an area.

Establishment of a right-of-way corridor will depreciate visual quality primarily in open forest landscapes on all landforms (Figure 7-5 and Table 7-14). Where such landscapes are of high sensitivity (i.e. visible to concentrations of viewers with expectations of high scenic quality), impacts on visual resources will be potentially significant. Management of right-of-way vegetation may incrementally affect the already depreciated visual quality. In evaluating visual resource impacts of different vegetation control methods, discussion will be restricted to open forest and closed forest landscape setting types.

Temporary Vegetation Brown-Out. Vegetation brown-out occurs when herbicides are applied to target vegetation during the growing season. It is a temporary phenomenon lasting from the

Table 7-13. Relative Occupational Hazards Anticipated for Alternative Control Methods Used in Right-of-Way Vegetation Management

Type of Hazard ²	Alternative Control Methods ¹			
	Broadcast Chemical	Spot Chemical	Manual	Mechanical
Site Hazards	0	1 ^c	2 ^c	2 ^f
Tool/Equipment Hazards	0	1 ^d	2 ^d	2 ^d
Transportation Hazards	1 ^a	2 ^e	2 ^e	2 ^e
Herbicide Toxicity Hazards	1 ^b	1 ^b	-	-

NOTES: Key to Ratings: 0 = Virtually no occupational hazard
1 = Slight hazard
2 = Substantial hazard

Letter superscripts indicate mitigation measures to minimize hazard.

Key to Superscripts: a - (transportation hazard pertains primarily to herbicide mixer/loaders and treatment site monitors). Operate vehicles correctly.
b - Follow handling instructions on EPA-approved herbicide labels strictly.
c - Limit use of this method to low density stands of brush where individual target plants are accessible.
d - Follow operations instructions and safety precautions strictly.
e - Limit use of this method to sites with easy road access.
f - Limit use of this method to gentle terrain with less than 25 percent slopes.

FOOTNOTES:

¹Biological methods are not rated due to their experimental nature.

²See text for explanation.

Grassland

Open Forest

Closed Forest

Flat

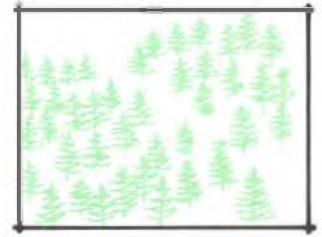


Visual Contrast: ° None
Form: ° None
Line: ° None
Color: ° None
Texture: ° None

° Low to Mod.
° Linear
° Edge to ROW
° Brown out
° Dense vs Cleared ROW

° High
° Linear
° Edge of ROW
° Brown out
° Dense vs. Cleared ROW

ValleyFloor

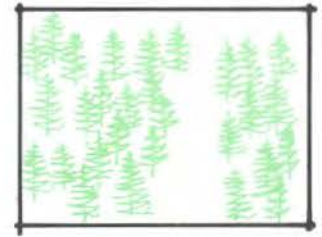
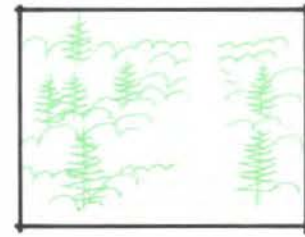


Visual Contrast: ° None
Form: ° None
Line: ° None
Color: ° None
Texture: ° None

° Low to Mod.
° Linear
° Edge to ROW
° Brown out
° Dense vs Cleared ROW

° High
° Linear
° Edge of ROW
° Brown out
° Dense vs. cleared ROW

Hillside

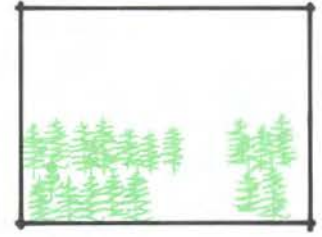
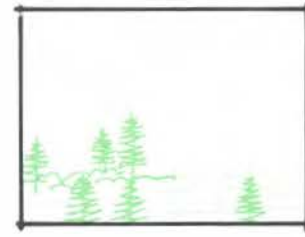
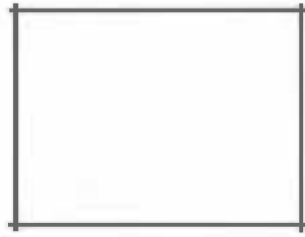


Visual Contrast: ° None
Form: ° None
Line: ° None
Color: ° None
Texture: ° None

° Low to Mod.
° Linear
° Edge to ROW
° Brown out
° Dense vs Cleared ROW

° High
° Linear
° Edge of ROW
° Brown out, veg. color
° Dense vs cleared ROW

Ridgeline



Visual Contrast: ° None
Form: ° None
Line: ° None
Color: ° None
Texture: ° None

° Low to Mod.
° Linear
° Notch, edge, ribbon
° Brown out
° Dense texture vs. Cleared ROW

° High
° Linear
° Notch, edge, ribbon
° Brown out
° Dense vs. Cleared ROW

Figure 7-5. Visibility and Potential Contrast of Managed Right-of-Way in each Landscape Setting Type

Table 7-14. Potential Visual Resource Impacts of R-O-W Vegetation Management in Each Landscape Setting Type

	Grassland/Shrubland	Vegetation Classes	
		Open Forest	Closed Forest
Flat	No substantial management	Limited management, small viewer angle	Extensive management, small viewer angle
	No impact	Limited impact	Extensive impact (provide screens in high sensitivity landscapes)
Valley floor	No substantial management	Limited management, small viewer angle	Extensive management, small viewer angle
	No impact	Limited impact	Extensive impact (provide screens in high sensitivity landscapes)
Hillside	No substantial management	Limited management, large viewer angle	Extensive management, large viewer angle
	No impact	Extensive impact if vegetation clusters are dense (feather edges in high sensitivity landscapes)	Extensive impact (feather edges in high sensitivity landscapes)
Ridgeline	No substantial management	Limited management, large viewer angle	Extensive management, large viewer angle
	No impact	Extensive impact if vegetation clusters are dense (feather edges in high sensitivity landscapes)	Extensive impact (feather edges in high sensitivity landscapes)

NOTE:

Mitigation measures are suggested where impacts are potentially extensive in high sensitivity landscapes. High sensitivity landscapes are visible to large concentrations of viewers having expectations of high scenic quality.

point when leaves turn brown soon after herbicide application until dead leaves fall to the ground.

Both broadcast and spot herbicide treatments may involve applications during the growing season. With spot applications brown-out is limited to scattered trees or shrubs. Broadcast herbicide applications may produce browned-out vegetation over large areas. Where the right-of-way is visible to viewers in a high sensitivity landscape, this brown-out may be considered an adverse although temporary impact on visual quality. Spot chemical methods include herbicides that can be applied during the dormant season to avoid foliage brown-out.

Exposure of Bare Soil. In areas of dense forest vegetation, right-of-way vegetation management using mechanical scarification techniques will expose large areas of bare soil. This exposure and imposition on the landscape will remain until sufficient vegetation has established and regrown to cover the bare soil. The impact on an area's visual quality will be particularly severe in high sensitivity landscapes.

Loss of Vegetation as Visual Screens. Where right-of-way corridors cross closed forest landscapes on flat or valley floor terrain, vegetation screens may be used as a way to conceal the right-of-way from near views (Table 7-14). Vegetation screens may be appropriate in high sensitivity landscapes where transmission lines cross highways, rivers, or trails. BPA typically maintains vegetation screens at such viewer concentration zones; these are often provided for in right-of-way management agreements with state and federal land management agencies.

Alternative vegetation control methods differ in ability to allow maintenance of vegetation screens. Selective methods (i.e., spot chemical and manual treatments) allow removal of individual trees that violate conductor clearance criteria without removing other screening vegetation. Nonselective methods (i.e., broadcast chemical, mechanical, and biological treatments), however, do not permit individual tree removal.

Maintenance of "Unnatural" Vegetation Edges. Where transmission corridors traverse open or closed forest landscapes on hillside or ridgeline terrain, the right-of-way edge imposes an "unnatural" feature on the landscape. Management of right-of-way vegetation may be conducted in a manner that maintains this "unnatural" edge. Alternatively, vegetation control treatments may be used to "feather" a right-of-way edge so that it appears irregular and less of a visual imposition on a landscape.

A feathered edge serves to blend right-of-way vegetation with adjacent forest by providing intermingled open areas and intermediate-height trees along the right-of-way edge. As with vegetation screens, selective control methods allow creation of feathered edges through individual tree removal. In contrast, nonselective methods (i.e. broadcast chemical, mechanical, and biological treatments) do not allow individual tree removal.

Consequences of Alternative Control Methods

Relationships between the alternative vegetation control methods and potential visual resource impacts are summarized in Table 7-15.

Historical and Cultural Resources

Description of Potential Impacts

Disturbance to Unknown Sites. Vegetation management using heavy equipment may disturb previously unidentified historical or cultural sites on rights-of-way. In particular, equipment that disrupts the soil surface (e.g., crawler tractors with brush rakes or blades) may cause damage to unknown sites. On existing rights-of-way, unknown sites will be limited to subsurface burial grounds or scatters of rock fragments of human origin (i.e. lithic scatters). Such sites are of value only for the archeological information they may contain. Presumably, no unknown sites occur at transmission facilities constructed since 1974 (see section of Chapter 6 on Historical and Cultural Resources).

Alteration of Visual Settings at Protected Sites. Visual settings at protected sites may be substantially altered by construction of a transmission line. In contrast, vegetation management on an existing rights-of-way may have only temporary and minor visual quality impacts at or near protected sites (see previous section of this chapter on Visual Resources). Temporary brown-out may occur when large areas of vegetation are treated with herbicides during the growing season (e.g., broadcast methods). Mechanical methods that scarify the soil surface may create large areas of bare soil, depreciating visual quality. The duration of this impact will depend on the length of time required for revegetation of the areas treated. Maintenance of distinct right-of-way edges in areas of closed forest may impact visual quality by imposing an unnatural form and line on the landscape and thereby highlighting the presence of the transmission line. However, this would amount to mere maintenance of the visual status quo resulting from initial construction of the facilities.

Table 7-15. Probable Environmental Consequences of Alternative Methods on Visual Resources
with Range of Potential Impacts Shown

Note: The lower number of the range indicated is the potential impact of a mitigated implementation of the respective control method; the upper number is the potential worst-case impact when mitigation measures are not observed or fail to operate as planned

Potential Visual Resource Impacts	Vegetation Control Methods				
	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Temporary vegetation brown-out	0 ^a -2	0 ^b -1	-	-	-
Exposure of bare soil	-	-	-	0 ^c -2	0 ^c -2
Loss of vegetation as visual screens	2	0 ^d -2	0 ^d -2	2	2
Maintenance of "unnatural" vegetation edges	2	0 ^e -2	0 ^e -2	1 ^e -2	1 ^e -2

NOTE:

Key to Ratings: 0 = virtually no impact
1 = potentially slight impact
2 = potentially significant impact

Letter superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating.

Key to Letter Superscripts: a = avoid use of this method in visually-sensitive areas
b = use dormant season herbicides in visually-sensitive areas
c = avoid soil scarification in visually-sensitive areas
d = apply control techniques to maintain vegetation screens
e = apply control techniques to feather right-of-way edges

Consequences of Alternative Methods

Environmental consequences of the alternative vegetation control methods are summarized in Table 7-16. Mechanical methods alone have potential to disturb previously unidentified sites. If sites are found, State Historic Preservation offices are notified immediately by BPA. Broadcast chemical and mechanical methods have the greatest potentials for visual quality impacts.

Land Uses

Description of Potential Impacts

The following sections describe potential impacts to land use on or adjacent to BPA rights-of-way that may ensue from vegetation management activities. Land use categories are commodity production (agriculture, timber management, range management), urban/residential, recreational/scenic, and municipal watersheds.

Noxious Weed Sources. Noxious weeds are plants of economic importance in commodity production because they occupy growing space in croplands, grazing lands, and forestlands, or because they poison livestock. The initial construction of BPA rights-of-way and subsequent maintenance activities may facilitate spread of noxious weeds and may provide refugia for reinfestation of adjacent lands.

Noxious weeds can spread along rights-of-way to new areas or BPA maintenance vehicles may carry weed seeds into previously uninfested locations. Structure sites and other uncultivated portions of transmission corridors may provide inoculant sites for reinvasion of weed species into surrounding fields where the species have been eradicated.

Weed Control Districts are formed by local farmers in conjunction with state departments of agriculture to combat economically important weed infestations. Where active control programs are being pursued, and where BPA's actions have contributed to or exacerbated noxious weed problems, BPA cooperates with the Districts to eradicate target weeds on rights-of-way. This portion of BPA's vegetation management program is undertaken as mitigation for the possible contribution of rights-of-way to noxious weed problems.

Herbicide Drift. Accidental drift of herbicide from broadcast applications to adjacent lands could affect commodity production adversely. Agricultural lands in high value row crops or orchards would be most susceptible to economic loss due to herbicide drift. Typically, however, these types of

Table 7-16. Probable Environmental Consequences of Alternative Methods on Historic and Cultural Resources with Range of Potential Impacts Shown

Note: The lower number of the range indicated is the potential impact of a mitigated implementation of the respective control method; the upper number is the potential worst-case impact when mitigation measures are not observed or fail to operate as planned.

Potential Impact on Historical and Cultural Resources	Vegetation Control Methods				
	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Disturbance to Unknown Sites	0	0	0	0 ^c -2	0
Reduction of Visual Quality at Protected Sites	0 ^a -1 ^d	0 ^b -1 ^d	0	0 ^a -2	0 ^b -1 ^d

NOTES:

Key to Ratings: 0 = Virtually no impact
1 = Potentially slight impact
2 = Potentially significant impact

Letter superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating.

Key to Letter Superscripts: a = Avoid use of this method in visually-sensitive areas.
b = Implement this method to enhance visual quality.
c = Avoid use of mechanical scarification on rights-of-way previously not surveyed for archeological resources.
d = Impacts are entirely temporary.

land uses extend throughout rights-of-way, making broadcast herbicide applications unnecessary. Herbicide drift could affect forest plantations adjacent to rights-of-way by suppressing or killing young trees immediately bordering the transmission lines.

Drift control measures practiced by BPA are discussed in Chapter 3. BPA also pays compensation for damages to crops attributable to BPA actions.

Herbicide Residues in Soil or Runoff Water. Residues of particular herbicides that persist in soils or runoff waters may affect commodity production in several ways. Where right-of-way lands have been treated previously with these herbicides, soil residues may prevent subsequent conversion of these lands to commodity production. For example, soil residues might cause failure of crop establishment (e.g., fruit tree plantings) or reduce crop yields on previously treated rights-of-way.

For herbicides that are persistent in surface waters, runoff to adjacent land also may decrease crop yields or cause crop failures. All commodity production uses such as forestry, agriculture, and grazing could be affected in this way.

The possibility of this type of impact from any of the herbicides proposed for use by BPA is discussed earlier in the section of this chapter on Public Health. Also, BPA will pay compensation for damages resulting from its actions.

Hazards to Public Health. Where urban/residential land uses occur adjacent to rights-of-way, control methods using herbicides may affect public health (see earlier section on Public Health). Where these land uses occupy rights-of-way under multiple-use agreements between BPA and landowners, management of vegetation is not required.

On watershed lands, a potential for public health impacts from herbicide use also may exist (see earlier section on Public Health). The persistence of herbicides in surface and groundwaters is the particular issue of concern for this land use. Potential for impact to municipal watersheds through erosion and sedimentation is discussed in the section of this chapter on Soils.

Visual Quality. Visual quality of rights-of-way may be a concern where transmission lines traverse areas of urban/residential land uses or recreational/scenic lands. Urban/residential land uses often occupy rights-of-way under multiple-use agreements, avoiding any temporary vegetation

management impacts to visual quality. Also, vegetation management occurs only on existing transmission lines. The incremental visual impact of vegetation management will be minimal in comparison to that of the existing transmission line.

Where transmission lines traverse the viewsheds of recreational or scenic lands, visual impact may be more substantial due to expectations of high visual quality by concentrated numbers of viewers in relatively natural settings. In such situations, vegetation management may help to conceal the transmission corridor in both near or far views, or conversely, it may highlight its presence on the landscape. For discussion of this type of impact, see the earlier section of this chapter on Visual Resources.

Noise. Urban/residential land uses may be affected temporarily by the transient noise of vegetation control activities. Noise levels produced will depend primarily on the type of equipment used.

Consequences of Alternative Methods

The following sections describe potential impacts of the various types of control methods on land uses. Both "worst-case" impacts, (i.e., assuming no mitigation measures) and mitigated impacts are identified. Potential impacts are summarized in Table 7-17.

Broadcast Chemical Methods. Broadcast chemical methods have varying potentials to affect land uses adjacent to rights-of-way. Herbicide drift from aerial or ground-based applications is a potential impact that can be minimized by using drift control measures with herbicide applications, by restricting applications to times of calm wind conditions, and by careful operation of equipment. For discussion of BPA's precautions to control herbicide drift, see the section of Chapter 4 on Mitigation Measures. Where such precautions are not observed, drift of herbicides may cause significant impacts to adjacent commodity production land uses. BPA minimizes this possibility, however, by not using broadcast methods in areas adjacent to susceptible crops, orchards, or tree plantations (see Chapter 4).

Land use impacts due to herbicide residues in soil or water and hazards to public health are discussed in an earlier section of this chapter on Public Health. Visual quality impacts to land uses are described in the section of this chapter on Visual Resources. Broadcast applications using helicopters or mechanical ground sprayers may produce high noise levels. These application methods typically are not

Table 7-17. Environmental Consequences of Alternative Methods on Land Uses
with Range of Potential Impacts Shown

Note: The lower number of the range indicated represents the potential impact of a mitigated implementation of the respective control method; the upper number represents the potential worst-case impact when mitigation measures are not observed or fail to operate as planned.

Potential Land Use Impacts	Vegetation Control Methods				
	Broadcast Chemical	Spot Chemical	Manual	Mechanical	Biological
Herbicide Drift	0 ^{ab} -2	0	0	0	0
Herbicide Residues in Soil or Water ¹	0 ^c -2	0 ^c -2	0	0	0
Hazards to Public Health ²	0 ^d -2	0 ^d -2	0	0	0
Visual Quality ³	0 ^e -2	0 ^g -1	0	0 ^e -2	0 ^g -1
Noise	0 ^f -1	0 ^f -1	0 ^f -2	0 ^f -2	0 ^f -1

NOTES:

Key to Ratings: 0 = Virtually no impact
1 = Potentially slight impact
2 = Potentially significant impact

Letter superscripts indicate mitigation measures whose implementation creates the lower mitigated impact rating.

Key to Letter Superscripts: a = Use drift control measures during broadcast applications.
(see text for explanation) b = Avoid broadcast applications near susceptible crops, orchards, or plantations.
c = Avoid use of herbicides that persist in phytotoxic concentrations (e.g., dicamba, picloram).
d = Avoid use of herbicides, application rates, or application sites that might pose health hazards.
e = Avoid use of this method in visually sensitive areas.
f = Avoid use of noise-producing methods in sensitive areas.
g = Implement this method to enhance visual quality.

FOOTNOTES:

¹Persistence of herbicides in water and soil is discussed in sections of this chapter on Water Quality and Public Health.

²Public health hazards from herbicide use are discussed in section of this chapter on Public Health.

³Visual quality impacts are discussed in section of this chapter on Visual Resources.

used in urban/residential areas, however, due to limited need for vegetation control where such land uses adjoin and occupy rights-of-way.

Spot Chemical Methods. Spot chemical methods have little or no potential for herbicide drift due to the application being restricted to individual problem plants. Mechanized ground sprayers may produce high noise levels but this activity is transitory with little nuisance to humans temporarily within hearing range. Herbicide persistence in the environment, public health hazards of herbicides, and impacts to visual quality are discussed elsewhere in this chapter.

Manual Methods. High noise levels produced by chain saw operations are temporary, although this control technique may be used often in urban/residential areas where broadcast chemical methods are inappropriate.

Mechanical Methods. These methods potentially will affect adjacent urban/residential or recreational/scenic land uses through effects on visual quality (see section on Visual Resources in this chapter). Heavy equipment operation produces high noise levels, adversely affecting the environmental quality of humans within hearing range.

Biological Impacts. Noise levels potentially produced by application of biological methods (e.g., fertilization for wildlife habitat management, site preparation and planting of low-growing species) are difficult to predict due to their experimental nature.

Compatibility with Land Use Plans, Policies, and Controls

Federal Land Management

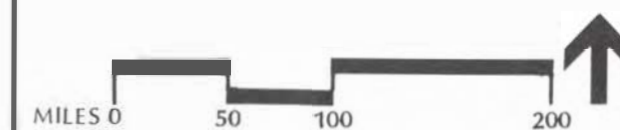
Federal agencies manage or administer large areas of public lands crossed by BPA transmission lines. The following sections discuss relationships between BPA and the various federal land management agencies regarding vegetation management activities on existing BPA rights-of-way. Selected public lands in the BPA service area are portrayed on Figure 7-6.

National Forests. The U.S. Forest Service (USFS) administers vast areas of forested and other wild lands in BPA's service area (see Figure 7-6). A Memorandum of Understanding (MOU) between USFS and BPA was signed on May 30, 1974 by the Chief of the Forest Service and the Administrator of BPA. On that same date a subsidiary MOU was entered into by USFS

Figure 7-6

Public Lands of the B.P.A. Service Area

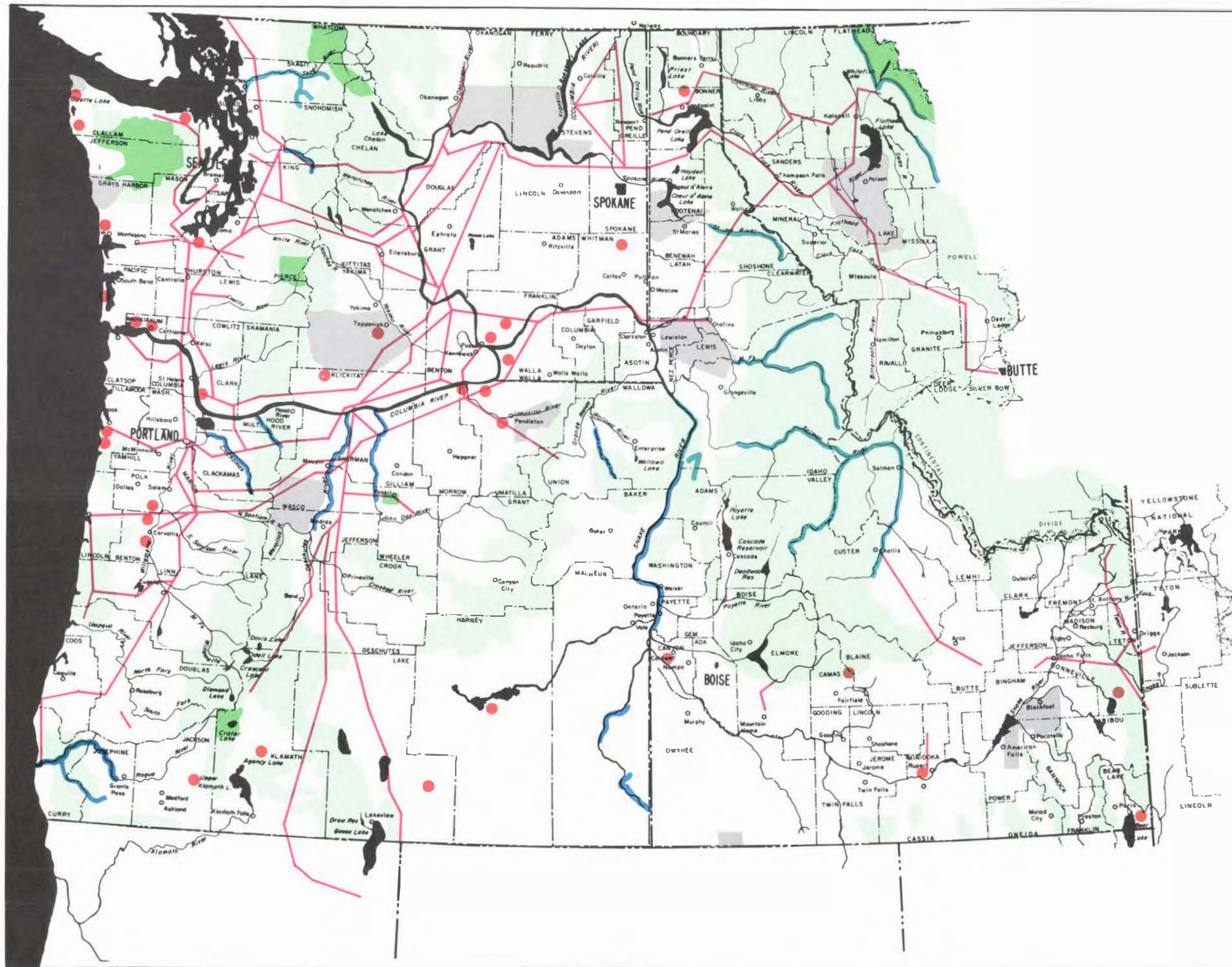
BONNEVILLE POWER ADMINISTRATION Vegetation Management EIS



LEGEND

- National Park / Recreation Area
- National Forest
- Indian Reservation
- Wildlife Refuge
- National Wild & Scenic River
- State Wild & Scenic River
- Power Transmission Line Route

Note: Power transmission line routes are intended to show general areas through which transmission lines are located. Routes may represent one or many transmission lines. The routes shown do not represent specific locations of specific lines.





Regional Foresters within the BPA service area and by the BPA Chief of Land.

The subsidiary MOU was designed to aid in the implementation of the more general MOU. Section 4 of the subsidiary MOU deals explicitly with right-of-way management plans. It describes responsibilities for ensuring maintenance of rights-of-way and delineates planning responsibilities. The focus of Section 4 is that the USFS has land management responsibility for rights-of-way. BPA, in turn, will carry out its vegetation management program in a manner that protects and enhances basic forest resource values.

Additional details on management of BPA rights-of-way across USFS lands are contained in Chapter 8 (section on Permit for Right-of-Way on Public Land). In general, the development of cooperative right-of-way management plans between USFS and BPA ensures compatibility between BPA's vegetation management program and USFS resource management objectives.

BLM Lands. BLM likewise administers large land areas in BPA's service area. Similarly to arrangements with USFS, BPA has established general and subsidiary MOUs with BLM specifying conditions for use of rights-of-way on BLM lands (see Chapter 8). The two agencies cooperatively prepare site-specific rights-of-way management plans to meet both agencies' objectives. Through this process, implementation of the proposed vegetation management program is ensured to be compatible with BLM land management responsibilities.

National Wildlife Refuges. BPA transmission lines cross several National Wildlife Refuges managed by the U.S. Fish and Wildlife Service (USFWS). Land areas occupied by these rights-of-way are small. Typically, vegetation types (e.g., wetlands) occupying refuge lands required little, if any, vegetation management. Cooperative agreements regarding vegetation management are established on a case-by-case basis for each wildlife refuge.

National Parks and Recreation Areas. There is no formalized agreement with the National Park Service (NPS) nor do any major BPA transmission facilities cross lands administered by NPS. Those electrical utility lines that do enter National Parks are primarily for service to concessionaires and are not major features of the system. Management of those particular lines is generally the responsibility of NPS and specifically the responsibility of individual park managers.

Other Federal Lands. Other federal lands include military reservations and research installations. Where BPA rights-of-way cross such lands, agreements for management of right-of-way vegetation are established with the officer or person in charge of the particular installation. BPA adjusts its management program as is necessary to be compatible with the objectives and concerns of each installation.

Indian Reservations. Formalized agreements exist between BPA and the Bureau of Indian Affairs (BIA), but they are concerned with other aspects of the BPA power system and do not deal with right-of-way management. BPA also has agreements with the Tribal Councils of several reservations within its service area. These agreements generally deal with matters other than right-of-way management, but in several instances vegetation management is dealt with. In the case of the Colville Confederated Tribes, the agreement specifies that the Tribal Council will be notified of all proposed BPA activities within rights-of-way. The agreement with the Warm Springs Tribe specifies that the timber value on rights-of-way lands will be reassessed every five years.

The Confederated Salish and Kootenai Tribes endorse "no pesticide applications" on the Flathead Indian Reservation in Montana; therefore only manual, mechanical, or biological methods are available for vegetation control on rights-of-way granted by these tribes. BPA cooperates with all Tribal Councils and BIA regarding vegetation management on Indian Reservations.

Coastal Zone Management

The Coastal Zone Management Act (16 USC 1451 et seq.) requires BPA to determine that its activities are consistent with the approved coastal management programs of Oregon and Washington. Activities requiring consistency determinations are those directly affecting the natural or social resources of the coastal zone. Although BPA's proposed program involves no acquisition of rights-of-way or no facility construction, some direct effects on coastal resources will occur. For details of the consistency-determination process, see the section of Chapter 8 on Coastal Management Program Consistency.

Oregon Coastal Management Program. Oregon's coastal zone extends from the Washington border to the California border, seaward to the extent of state jurisdiction, and inland to the crest of the coastal mountain range, excluding all lands under the exclusive jurisdiction of the Federal government. A number of BPA transmission lines are located in this coastal zone, from Curry County in the south to Clatsop County in the north.

In order to be consistent with Oregon's Coastal Management Program, an activity must conform to statewide planning Goals and Guidelines, local government comprehensive plans (where approved), and applicable state statutes. Statewide planning Goals 1-15 guide the management of land, water, and air resources throughout the state of Oregon. Goals 16-19 apply specifically to Oregon's coastal resources.

The following statewide Goals are relevant to BPA's proposed vegetation management program:

Goal No. 3	Preservation and protection of agricultural land
Goal No. 4	Conservation of forest land
Goal No. 5	Conservation of open space and protection of natural and scenic resources
Goal No. 6	Maintenance and improvement of the quality of air, water, and land resources
Goal No. 8	Satisfaction of recreation needs
Goal No. 11	Provision of public facilities and services
Goal No. 16	Protection of coastal estuaries and wetlands
Goal No. 17	Protection of coastal shorelands

Coastal zone consistency determinations specific to each of these planning Goals are described in Chapter 8. Those determinations are based on (1) detailed descriptions of proposed vegetation management activities (see Chapter 3), (2) descriptions of direct impacts of the activities on natural and social resources (see Chapter 7 - sections on Soils, Vegetation, Water Quality and Fisheries, Wildlife, Visual Resources, Historical and Cultural Resources, and Land Use), and (3) Descriptions of features of BPA's proposed program and mitigation measures that ensure consistency (see Chapter 4 - Alternative Management Programs). BPA's proposed program has been determined to be consistent with Oregon's Coastal Management Program (see Chapter 8).

Washington Coastal Zone Management Program. Washington's coastal zone incorporates the geographical area of the 15

counties which front on saltwater, excluding all lands under the exclusive jurisdiction of the federal government. BPA operates transmission facilities in 14 of the 15 coastal zone counties.

Consistency determinations for federal activities in Washington's coastal zone are required where an activity involves physical changes in air, water, vegetation, or land in the coastal zone (Washington Department of Ecology 1980). Where the proposed activity has coastalwide implications (e.g., BPA's proposed vegetation management program), consistency is to be determined based on Washington's Shoreline Management Act (SMA) of 1971 and the final guidelines for development of local shoreline master programs (WAC Chapter 173-16).

Detailed consistency determinations for each element and component of the SMA final guidelines are provided in Chapter 8 - Environmental Requirements. Insofar as BPA's proposed program has coastalwide implications, reference to local shoreline master programs is not required at this time. Based on the detailed analyses contained in Chapter 8, BPA's proposed vegetation management program has been determined to be compatible with Washington's Coastal Zone Management Program.

Other State Land Use Planning

Oregon. Oregon's 1973 Land Use Act (Senate Bill 100) requires all counties and incorporated cities to develop coordinated comprehensive plans, according to statewide planning goals and guidelines. Fifteen planning goals apply statewide; Goals No. 3, 4, 5, 6, 8, and 11 are relevant to BPA's proposed program in a general way (see previous section on Oregon Coastal Management Program). In particular, Goal No. 5 (conservation of open space and protection of natural and scenic resources) pertains to vegetation management activities in providing for protection of fish and wildlife habitats, significant natural areas, outstanding scenic views and sites, wilderness areas, Oregon recreation trails, federal wild and scenic waterways, and state scenic waterways.

Also, Goal No. 15 (protection and conservation of the Willamette River Greenway) requires lands within and near the Greenway to be managed to maintain the Greenway's qualities. Specifically, this goal mandates preservation of scenic qualities and viewpoints within the Greenway and enhancement and protection of the natural vegetational fringe along the Willamette River.

Local government units may regulate vegetation management activities in their local plans but none is known to have done so at this time.

No regulations at the state level deal specifically with right-of-way vegetation management. Two regulatory agencies, the State Department of Agriculture and the State Department of Environmental Quality, are concerned where vegetation management involves the use of herbicide applications. The State Department of Agriculture has adopted EPA's classification and application requirements for various herbicides.

The State Department of Agriculture also administers the Oregon Pesticide Use Clearinghouse, a group of state agencies that meets to express concerns and coordinate actions; it is voluntary and "open" to all levels of government. Recently BPA has used the clearinghouse as a mechanism for coordinating with state agencies on actions involving the use of herbicides. The Oregon Department of Environmental Quality investigates violations of the State's general air and water pollution regulations, regulates the disposal of pesticide containers, and inspects spill sites and spill cleanup procedures.

Washington. Washington State's enabling legislation for planning allows local governments to undertake planning, but does not require them to do so. Where a local community chooses to plan, there are few requirements for plan contents or coordination with other plans or planning entities. The only specific requirement is that the plan contain at least a land use and a transportation element. There are no specific requirements that directly affect vegetation management.

The Washington legislature has enacted two statutes to protect and preserve the natural character and scenic quality of river shorelines. The Washington State Scenic River Act (RCW 79.72) designated the Skykomish River in King and Snohomish Counties as a State Scenic River. Also the Green River Gorge has been designated a State Conservation Area (RCW 43.51).

The State Department of Ecology and the State Department of Agriculture are concerned with the use of herbicides. The Department of Ecology is involved primarily with hazardous waste disposal of all types, while the Department of Agriculture is involved with the application of pesticides. The Department of Agriculture's pesticide program is primarily one of ensuring compliance with the label instructions; it

also investigates complaints regarding herbicide application. Though the State does have its own Pesticide Control Act and a State Pesticide Application Act, the State's regulations regarding pesticides are basically an adoption of EPA's rules regarding the classification and application of pesticides.

Idaho. Idaho planning legislation requires planning by local governments. It is mandatory that each plan give consideration to the future location of "utility transmission corridors", though there is a great deal of uncertainty and controversy over the definition of such consideration. No specific provisions relate to vegetation management on transmission corridors. As in most states within BPA's service area, the State Department of Agriculture is primarily responsible for pesticides and pesticide application. Primary concern is with conformance with EPA restrictions regarding application procedures.

Montana. The State has legislation enabling local planning but planning is voluntary. For those communities choosing to plan, the state law prescribes a list of those things that a plan should address, none of which directly relates to vegetation management.

The Montana Department of Agriculture administers the Montana Pesticide Act (Title 80, Chapter 8, MCA) and enforces the use of pesticides in conformance with state and EPA standards and requirements.

The Montana Department of Health and Environmental Sciences monitors state water quality standards. For example, Montana state law provides that no pesticides may be used in "A - Closed Watersheds."

Wyoming. The State has a land use planning act but it is general. Primarily it enables incorporated areas to zone and counties to pass subdivision regulations. The State Land Use Plan provides some guidance for the siting of transmission line rights-of-way but does not deal with the maintenance of those facilities.

The State of Wyoming has its own Environmental Pesticide Control Act. It requires applicators to be licensed for the application of pesticides restricted by EPA. Aside from the licensing requirements, it is basically an adoption of federal regulations as delineated in the Federal Insecticide, Fungicide and Rodenticide Act. The State Water Quality Act does not deal specifically with pesticide application.

California. The State's Planning Act requires that local governments have plans and it delineates what those plans are to address. That act does not specifically require that either utility transmission corridors or vegetation management techniques be described.

California State's Pesticide Act is more stringent than EPA requirements for pesticides and pesticide handling. The list of restricted chemicals, those requiring special handling or special disposal, is longer than EPA's list. In the case of some of the restricted chemicals, state permits are required for their use. Those permits must be obtained from individual County Agricultural Commissioners.

California State law also differs from EPA, or federal law, in the registration requirements for certain chemicals. The registration process in California is more complicated than the process currently required by EPA. At times in the past, some chemicals have been banned from use in California before being banned by the EPA. Questions of jurisdiction over pesticide regulation can be expected to continue to arise.

Local or Regional Land Use Planning

Washington. No local regulations are known to specifically regulate or control rights-of-way vegetation management. Some individual counties, however, have expressed various levels of concern over the toxicity of certain herbicides and have taken measures to regulate their use, at least to the degree that they have control over various county activities such as highway, river dike, and park maintenance. King County, as an example, has a policy regulating its own use of pesticides. There are no known instances where counties regulate the pesticide applications of others. Insofar as no pertinent regulations exist, BPA's proposed program is compatible with local and regional land use planning.

Oregon. Some local communities have undertaken to regulate pesticide use, at least in the case of those actions over which they have control. Two local actions should be noted. Lane County, like some counties in the State of Washington, is modifying its use of herbicides in road and park maintenance procedures. In eastern Oregon, the East Umatilla Chemical Control District regulates pesticide use, particularly regarding the application of pesticides which evaporate easily at normal temperatures and pressures. No

known local or regional land use planning regulations are known to affect BPA's proposed program.

California. A few counties in the State of California have passed local regulations in an attempt to enforce restrictions against certain pesticides above and beyond the level of restriction imposed by state regulations; BPA has no rights-of-way in counties with such regulations.

Idaho, Wyoming, and Montana. There are no known instances where local jurisdictions have attempted to impose regulations on vegetation management more restrictive than state and federal land use and environmental regulations.

Conclusion

Review of federal, state, and local land use policies indicates that BPA's proposed vegetation management program involves no present or future conflicts with land use plans or controls. Lack of conflict derives from the fact that: (1) vegetation management occurs only on existing rights-of-way, (2) BPA's proposed program incorporates constraints and mitigation measures to assure protection of natural and social resources, and (3) Memoranda of Understanding are established with USFS and BLM to cooperatively develop rights-of-way management plans on federal lands.

Energy Requirements and Conservation Potential

Energy Use in Vegetation Management

In general, energy used in vegetation management can be categorized as direct fuel use or indirect energy use. Direct fuel use involves consumption of fuels in the transport of personnel, materials and equipment to a treatment area. In addition, fuel is consumed directly in the operation of equipment and vehicles during treatment. Primary fuels consumed are petroleum products (e.g., gasoline, diesel fuel, aviation fuel).

Indirect energy use includes energy consumed in the manufacture and distribution of materials, equipment, and vehicles used for vegetation management. Indirect energy includes not only the energy consumed to manufacture a product (i.e., materials, equipment and vehicles), but also some portion of the fuels consumed in the production of machinery and in the extraction of raw materials used to make a product. In

addition, indirect energy includes fuels used in the maintenance and repair of equipment. A variety of energy forms (e.g., electricity, natural gas, petroleum products) are consumed as indirect energy.

Estimating indirect energy use involves a series of complex procedures. In theory, an infinite web must be followed to account for all energy inputs to a process (i.e., manufacture of equipment, extraction of raw materials, distribution of machinery). The energy expenditure attributable to specific processes is difficult to quantify accurately. As a result, estimating indirect energy use in practice often is able to consider only one or two steps (Pimentel et al. 1974). For this analysis of vegetation control methods, indirect energy requirements are considered equivalent for all methods with the exception of energy used in the manufacture and distribution of herbicides used in chemical control of vegetation.

Energy Use Characteristics of Control Methods

Chemical Methods.

Direct Fuel Use. Vegetation control by chemical methods involves application of herbicides either by aerial equipment (i.e., helicopters with boom-type sprayers) or by ground-based equipment (for example, hydraulic hose sprayers). For both practices, fuel is consumed in transport and treatment activities. Fuel use for transport includes movement of personnel, equipment and materials by vehicle and aircraft from a daily headquarters (typically located about 20 miles from the treatment site) to the treatment area. Fuel use for treatment involves operation of equipment and vehicles at the site.

The type of fuel and fuel efficiency of transport and treatment equipment used in chemical control of vegetation are shown in Table 7-18. Estimates of fuel efficiency are average estimates and therefore will vary depending on local conditions (e.g., road conditions, terrain, vegetation density).

Indirect Energy Use. The indirect energy used in chemical methods includes all energy inputs in the manufacture and distribution of equipment, materials, fuels, and vehicles used in chemical control. Indirect energy use for some processes has been estimated; for example, Herendeen and Bullard (1974) estimated that energy expended for the production and distribution of aviation fuel and for the

Table 7-18. Fuel Type and Efficiency of Equipment Used in Vegetation Control

Method/Technique	Transport Vehicle	Fuel Type	Fuel Efficiency (miles/gal) ¹	Treatment Equipment	Fuel Type	Fuel Efficiency (gals/hr.) ¹
Chemical						
Groundbased Application	4-wheel drive vehicle	Gasoline	15	High-volume hydraulic hose sprayer (mounted on 4-wheel drive vehicle)	Gasoline	1
Aerial Application	Helicopter	Aviation fuel	N.A. ²	Helicopter with boom-type sprayer	Aviation fuel	20
	Tanker	Diesel	5			
	Truck	Gasoline	10			
Manual	Truck	Gasoline	10	Chain saw	Gasoline	one-fourth to one-half
Mechanical	Truck	Gasoline	10	Hydro-Ax®	Gasoline	5
	Truck w/trailer	Diesel	5	Tractor	Gasoline	8-10

FOOTNOTES:

¹Estimates of average fuel consumption. Actual fuel use will vary depending on conditions. Sources of fuel efficiency estimates are as follows:

- o 4-wheel drive vehicle, helicopter with boom-type sprayer, tanker, truck, truck with trailer (Parker pers. comm.).
- o High-volume hydraulic hose sprayer (based on 7 hp sprayer at half-throttle) (Orchard Supply pers. comm.).
- o Crawler tractor (based on 150 hp D-6 caterpillar tractor) (Tenco Industries pers. comm.).
- o Hydro-Ax® (based on 125 hp at 70 percent load factor), chain saw (Hartsell pers. comm.).

²N. A. no estimate available in miles per gallon.

production of application aircraft was 6,050 kcal/acre and 1,500 kcal/acre, respectively. Only indirect energy used in the production, formulation and distribution of herbicides is considered here. As previously stated, other indirect energy requirements (e.g., manufacture of equipment, extraction of raw materials) are assumed equivalent for all methods.

The energy required in the production of BPA-approved herbicides is shown in Table 7-19. Estimates of energy use in the production, formulation, packaging and transport of herbicides are summarized in Table 7-20. As shown, formulation of herbicides into oil-based solutions requires considerably more energy than other formulation types. It should be noted that estimates of energy used in the production and formulation of herbicides (Tables 7-19 and 7-20) are process requirements only. As such, to the extent that waste heat is recovered during production and formulation, these estimates will be overstated.

Manual Methods. Similarly to chemical methods, manual methods consume fuel in the transport of personnel, equipment and materials. Typically, a work crew is transported by truck from a daily headquarters to the treatment site. Treatment at the site can be accomplished by either mechanized (e.g., chain saws) or nonmechanized equipment. The type of fuel and fuel efficiency of transport and treatment equipment used in manual control of vegetation are shown in Table 7-18.

Mechanical Methods. Mechanical methods consume fuel in the transport of personnel, materials and equipment and in the operation of equipment and vehicles at the treatment site. Mechanical methods involve either heavy equipment such as bulldozers or heavy mowing or flailing equipment such as a Hydro-Ax. Transport of heavy equipment to a treatment area requires a truck and trailer vehicle.

The type of fuel and fuel efficiency of transport and treatment equipment used in mechanical control of vegetation are shown in Table 7-18.

Biological Methods. Because most biological control techniques are experimental at this time, energy requirements associated with their use are speculative. As with other control methods, biological methods would consume fuel in the transport of personnel, equipment and materials to a treatment area at least during an initial treatment. The

Table 7-19. Energy Input and Types of Formulation Used in the Production of BPA-Approved Herbicides¹

Common Name of Active Ingredient	Kcal/lb of Active Ingredient	Type of Formulation ²
Ammonium Sulfamate	N.A. ³	WSC
Atrazine	20,520	WP, WDG
Bromacil	N.A.	WP
Dicamba	31,860	OSL, WSL, P, G
Dichlobenil	N.A.	G
Diuron	29,160	WP
Glyphosate	49,030	WSL
Monuron	N.A.	WP
Picloram	24,830	P, WSL
Prometone	N.A.	EL, P
Simazine	N.A.	P
Sodium Chlorate	N.A.	P
Sodium Metaborate	N.A.	P
Tebuthiuron	N.A.	G, WP
2,4-D	10,970	WSA, LVE, OSL
		WSL
2,4-DP	14,510	LVE

FOOTNOTES:

¹Sources of Energy Inputs in Production of Herbicides are: Pimentel (1980) and California Department of Food and Agriculture (1978).

²Abbreviations stand for the following types of formulations:

- EC = Emulsifiable concentrate
- G = Granule
- LVE = Low volatile ester
- OSL = Oil soluble liquid
- P = Pellet
- WDG = Water dispersible granule
- WP = Wettable powder
- WSA = Water soluble amine
- WSC = Water soluble crystals
- WSL = Water soluble liquid

³N. A. = No estimates available

Table 7--20. Energy Inputs (Formulation, Packaging, Transport)
for Various Types of Herbicide Formulations ¹

Type of Herbicide Formulation	Kcal Input Per Pound of Active Herbicide Ingredient		
	Formulation	Packaging	Transport ²
- Miscible Oil	15,100 ³	3,860 ⁴	500
- Wettable Powder	1,130 ⁵	1,180 ⁶	300
- Granules	1,630 ⁷	9,070 ⁸	3,050

FOOTNOTES:

¹Source - adapted from Pimentel 1980.

²Assumed 0.24 kcal/lb/km for transport by truck and rail and at a mean distance of 640 km.

³Assumes a 30 percent formulation

⁴Packaging includes a metal 5-gallon container

⁵Assumes a 50 percent wettable powder

⁶Assumes herbicide formulation in 2.2 lb. paper packages

⁷Assumes 5 percent active ingredient in either granules or dust

⁸Assumes herbicide formulation in 44 lb. paper packages

treatment interval and the number of trips required to a site, however, is less certain than with other methods. Because use of biological control methods is likely to require monitoring of treatment effectiveness, periodic trips to the treatment area would be likely. As a result estimates of fuel requirements are highly variable.

One biological control method which is currently operational by BPA on a limited basis is control through the introduction of insects. At present, this method provides control of the noxious weed tansy ragwort. Data on the energy requirements of vegetation control by insect introduction are very limited. One study (California Department of Food and Agriculture 1978), indicates that rearing insects for biological control may consume considerable amounts of energy.

Comparison of Energy Requirements for Transmission Line Brush Control

Description of Conditions at a Hypothetical Site.

Typically, a treatment site is located about 20 miles from a BPA daily headquarters established at a local motel. A vegetation management crew and equipment are transported each morning from the headquarters to the treatment site and are returned in the evening. When aerial methods are employed, a heliport site is established, usually within five miles of the treatment area; additional heliport sites are used throughout the day as needed. Heavy equipment (e.g., crawler tractor or Hydro-Ax) is transported to the site by a truck and trailer. For aerial applications of herbicides, light trucks are used to position inspection and monitoring personnel at strategic points along the treatment corridor.

Vegetation density at treatment sites can vary from high extremes (e.g., 2,000 stems of tall-growing species such as Douglas-fir or red alder per acre) to low (e.g., 20 stems per acre with intervening spaces occupied by grasses, ferns, or low-growing shrubs). Broadcast and mechanical methods are technically inefficient for low density brush because they unnecessarily treat intervening spaces as well as target plants. In contrast, spot chemical and manual methods are technically inefficient for high density brush; access to stems for treatment becomes difficult and hazardous for workers when target stem densities are high. As a result, productivity rates are low.

For the purposes of comparing energy efficiencies, broadcast chemical and mechanical methods are considered appropriate

for high density brush (e.g., 2,000 stems per acre) but are not comparable to spot chemical and manual methods for control of low density brush (e.g., 20 stems per acre).

Relative Energy Requirements of Different Control Methods. A comparison of the relative energy requirements for right-of-way brush control by different control methods is presented in Table 7-21. Under the assumptions indicated, chemical methods, both aerial and ground-based, consume somewhat less energy per acre for control of high density brush than mechanical methods consume. For control of low density brush, spot chemical applications with water carriers and manual methods have similar energy requirements; spot chemical treatments with oil carriers are more than twice as high in energy requirements.

Energy Consequences of Alternative Methods

Although differences in the energy requirements of the control methods are evident in Table 7-21, these differences are affected to a considerable extent by the location of the site, vegetation conditions, and the duration of treatment effectiveness. If, for example, a more distant site is assumed, not only will the energy requirements for transport increase, but the productivity rate (i.e., acres treated daily) is likely to decrease. The net effect would be a decrease in the overall energy efficiency of each method.

Broadcast Chemical Methods. These methods are relatively energy efficient for high density brush. For low density brush, they are inefficient, for example, requiring more than twice the energy expenditure of manual or spot chemical methods for treatment of 20 stems per acre (Table 7-21).

Spot Chemical Methods. For low density brush, energy efficiency depends on whether an oil or water carrier is used for herbicide applications. With a water carrier, energy expenditures are similar to manual methods (Table 7-21). These methods, however, are highly inefficient for high density brush (e.g., 2,000 stems per acre) due to very low productivity rates per unit area, entailing many return trips of equipment and personnel to a small treatment area.

Manual Methods. Manual methods are relatively energy efficient for low density brush due to good productivity

Table 7-21. Estimated Energy Requirements for R-O-W Brush Control at Hypothetical High-Density and Low-Density Treatment Sites

Vegetation Density/ Control Method ¹	Direct Fuel Use kcal/day ²		Productivity Rate (ac Treated/day	Herbicide Indirect Energy Use (Kcal/ac)	Indirect Energy Use ³ (Kcal/day)	Total Direct Plus Indirect (Kcal/day)	Energy Efficiency (Kcal/ac)
	Transport	Treatment					
	Col (1)	Col (2)	Col (3)	Col (4)	(3) × (4) = 5	(1) + (2) + (5) = 6	(6) ÷ (3)
High-Density Brush (2,000 stems/ac)							
Chemical Broadcast (water carrier)							
- Aerial	752,400 ^a	2,103,000 ^b	50 ^c	81,760 ^d	4,088,000	6,943,400	138,868
- Groundbased	84,000 ^e	193,200 ^f	5 ^g	81,760 ^d	408,800	686,000	137,200
Mechanical	412,400 ^h	945,000 ⁱ	9 ^j	-	-	1,357,400	150,822
Low-Density Brush (20 stems/ac)							
Chemical Spot (oil carrier)	84,000 ^e	193,200 ^f	5 ^g	100,109 ^k	500,545	777,745	155,549
Chemical Spot (water carrier)	84,000 ^e	193,200 ^f	5 ^g	5,609 ^l	28,045	305,245	61,049
Manual	126,000 ^m	283,500 ⁿ	6 ^o	-	-	409,500	68,250

FOOTNOTES:

¹Different control methods are appropriate for either high density or low density brush; therefore, energy efficiencies of these different sets of methods are not comparable.

²Energy content of fuels: gasoline (31,500 kcal/gal), aviation fuel (34,000 kcal/gal), fuel oil (37,800 kcal/gal), diesel oil (35,800 kcal/gal); treatment site is located 20 miles from daily crew headquarters; for each method, transport and treatment is achieved with the use of vehicles identified in Table 7-16.

³Estimates include indirect energy input for herbicides only (see Table 7-17 and 7-18); indirect energy used in manufacture and processing of equipment, vehicles, and fuel is assumed equivalent for all methods.

Key to assumptions on which estimates are based:

- a - Assumes 0.5 hours helicopter flying time (340,000 kcal), 40 miles of travel for tanker (286,400 kcal), and 40 miles travel for crew truck (126,000 kcal) between daily headquarters and heliport.
- b - Assumes average daily flying time for helicopter during treatments is 3 hours (2,040,000 kcal) and daily truck travel along corridor during treatment is 20 miles (63,000 kcal).
- c - Typical seasonal average for acres treated per day; includes down-time due to weather or equipment failure (W. Acton pers. comm.).

Notes for Table 7-21. Cont'd.

- d - Assumes application rate of 2 gallons of Tordon 101 (which contains 1 pound picloram and 4 pounds of 2,4-D in 1:4 mixture) per acre; picloram production (24,830 kcal/lb) (Table 7-17); picloram formulation, packaging, and transport as a wettable powder (2,610 kcal/lb) (Table 7-18); 2,4-D production (10,970 kcal/lb) (Table 7-17); 2,4-D formulation, packaging, and transport as a wettable powder (2,610 kcal/lb) (Table 7-18); herbicide applied in aqueous mixture.
- e - Assumes 40 miles travel in 4-wheel-drive truck with hose sprayer mounted in back between daily headquarters and treatment site (84,000 kcal).
- f - Assumes treatment for 6 hours per day, including 2 miles of travel in 4-wheel-drive truck along transmission corridor (4,200 kcal) and 6 hours of operation high-volume hydraulic hose sprayer (189,000 kcal).
- g - Typical seasonal average for acres treated per day (W. Acton pers. comm.).
- h - Assumes 40 miles travel in crew truck (126,000 kcal) and 40 miles travel in truck towing heavy equipment trailer (286,400 kcal).
- i - Assumes treatment using Hydro-Ax mechanical flailer for 6 hours per day (945,000 kcal).
- j - (B. Hartsell pers. comm.)
- k - Assumes treatment of 20 stems or clumps per acre with 1 pint of Banvel 520 in-oil mixture applied per stem (i.e., 2.5 gallons of mixture applied per acre); this mixture contains typically 0.05 pound of dicamba and 0.1 pound of 2,4-D; dicamba production (31,860 kcal/lb) (Table 7-17); dicamba formulation, packaging, and transport as miscible oil (19,460 kcal/lb) (Table 7-17); 2,4-D production (10,970 kcal/lb) (Table 7-17); 2,4-D formulation, packaging and transport as miscible oil (19,460 kcal/lb) (Table 7-18); fuel oil carrier (2.5 gal; 37,800 kcal/gal).
- l - Same assumptions as above except water carrier instead of oil carrier.
- m - Assumes 40 miles travel in crew vehicle (126,000 kcal).
- n - Assumes six chain saws operating for 3 hours per day (9 gal. at 31,500 kcal per gal.).
- o - Typical seasonal average of 1 acre per crewman per day and six crewmen per crew vehicle working for 6 hours per day (W. Acton pers. comm.).

rates where stems are few and access to each stem is easy. For high density brush, these methods are highly inefficient with low productivity per unit area.

Mechanical Methods. These methods are relatively energy inefficient compared to chemical broadcast methods for high density brush (Table 7-21). They are inappropriate for low density brush due to high energy expenditures per unit area where only few stems require treatment.

Biological Methods. Energy efficiency is indeterminate at this time due to experimental nature of these methods for brush control. Energy costs to initiate and maintain biological control projects and longevity of treatments are unknown. Energy conservation potential may be substantial although untested at this time.

Energy Conservation Potential

Various conservation measures can reduce energy consumption without incurring any loss in productivity (i.e., acres treated). The potential for control methods to achieve energy savings is examined in the following sections.

Effectiveness of Treatment. Because of high energy costs in the transport of personnel and equipment, significant energy savings can be achieved by minimizing the need for subsequent trips to a site. The duration of treatment effectiveness west of the Cascades varies from 3-5 years (Table 3-4); consequently, the implementation of a management program which provides long-term treatment effectiveness can achieve significant energy savings. Therefore, complete control of plants by single treatments (e.g., cut-stump chemical treatments for sprouting species) is of high priority.

Of the different control methods evaluated, biological methods appear to have the greatest potential to achieve energy savings through long-term treatment effectiveness. In theory, the selection of the proper mix of biological control methods could provide effective control of target vegetation for an indeterminate time. At the present, however, the use of biological methods is experimental and therefore would likely require periodic trips to a treatment area to monitor effectiveness. As a result, the fuel requirements for transport of personnel and equipment in the use of biological methods is likely to be relatively high during initial phases of use.

Utilization of Appropriate Technology. The selection of vehicles, equipment and materials for use in vegetation control can achieve significant energy savings. For each method, the use of properly-sized and fuel-efficient vehicles and equipment will result in a more efficient use of fuel resources. Control methods dependent exclusively on vehicles and mechanical equipment to provide effective control (e.g., mechanical methods) have the greatest potential to achieve this type of energy savings.

Because of the relative energy intensiveness in the production and formulation of some herbicides, significant energy savings can be achieved in the selection of herbicides. In the production of herbicides, estimates of energy requirements range from approximately 11,000 kcal/lb. for 2,4-D to 50,000 kcal/lb. for glyphosate (Table 7-19). In the formulation, packaging and transport of herbicides, energy requirements vary according to the type of formulated product. Potentially more significant are the savings which can be achieved in the selection of herbicide carriers (i.e., oil vs. water). It should be noted that any potential energy savings in the production and formulation of certain herbicides must be weighed carefully against the quantity needed and treatment effectiveness.

Energy Recovery. Methods which recover energy resources that otherwise would be wasted can increase the overall energy efficiency of vegetation control methods. Of primary interest is the potential to achieve energy savings through biomass use. Waste wood material from vegetation management is a potential source of energy. The wood could be used either as a fuelwood or in the manufacture of alcohol fuels. Although some large material is generally present along a transmission line corridor, most material is relatively small in size. In addition, little of the material is directly accessible to existing roads. As a result, the energy used in the removal and transport of the material is likely to exceed the energy content of the material. At this time, recovery of wood waste under normal conditions is not considered an economical method to achieve energy savings.

Conclusion. A vegetation management program with the objective of efficient utilization of energy resources would incorporate the following conservation features:

- o Minimize need for subsequent trips and treatment by producing long-term vegetation control.

- o Utilize nonmechanical control methods, where feasible.
- o Use properly-sized and fuel-efficient vehicles and equipment.
- o For chemical control, apply herbicides which require less energy (in formulations and carriers) per equivalent unit of control.

Because energy conservation objectives must be weighed against other program objectives (e.g., minimize cost, minimize adverse environmental effects), selection of the most energy efficient control techniques will not always be feasible.

Unavoidable Adverse Environmental Effects Should The Proposed Program be Implemented

BPA's proposed vegetation management program involves control of target vegetation on existing rights-of-way and at existing transmission facilities. The program will use control treatments selected from among spot chemical, broadcast chemical, manual, and biological methods based on considerations of sociological, ecological, and economic consequences of treatment applications at specific sites. Treatment selection and implementation will be guided by the BPA Transmission Line Maintenance Standard and the mitigation measures described in Chapter 4. (Treatment selection guidelines also are discussed in Chapter 5.)

Given the above characteristics of BPA's proposed program, its implementation is not expected to cause significant and unavoidable adverse impacts on the Pacific Northwest environment. Use of spot and broadcast chemical control methods will result in unavoidable introductions of herbicides into environments of the Pacific Northwest. However, no significant adverse impacts are anticipated. (The fate, persistence, and consequences of these herbicide introductions are discussed in the section on Public Health in this chapter.)

Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Control of right-of-way and substation vegetation constitutes a short-term use of the environment to maintain BPA's system reliability. The resulting effects on the environment and productivity are also expected to be short-term. Vegetation would continue to regrow in all situations where

it is controlled. For example, in the highly-productive forested areas of western Oregon and Washington, tall-growing vegetation would require control every 3-5 years. The control methods used by BPA are not expected to cause long-term decrease in the productivity of treated rights-of-way. The proposed program therefore would maintain site productivity in the event that rights-of-way are subsequently converted to agriculture or other productive uses.

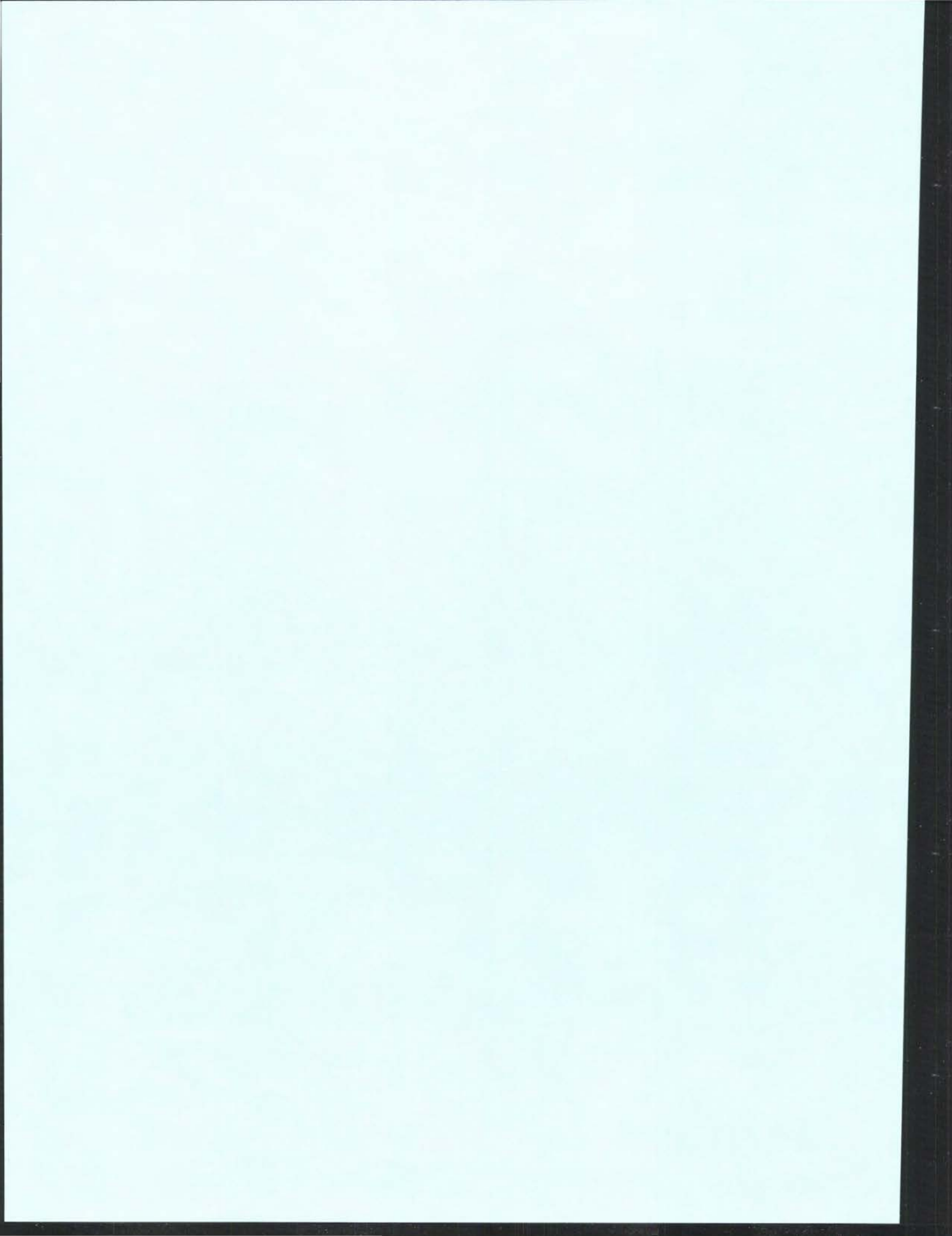
A short-term (i.e., several years) loss of site productivity may occur if soil persistent herbicides (e.g., picloram, dicamba) are applied to sites which may be later converted to crops or orchards. These relatively persistent herbicides are degraded to below phytotoxic levels in several years; therefore, no long-term decrease in site productivity is anticipated.

Irreversible or Irretrievable Commitments of Resources Should the Proposed Program be Implemented

The consumption of fossil fuels in the production of herbicides and other control equipment and in the operation of motor vehicles and application equipment constitutes an irreversible and irretrievable commitment of resources. This commitment of resources would be minimized, however, by selection of the most energy-efficient control method for each application site, given the absence of other constraints.

No other irreversible or irretrievable commitments of resources will result from the proposed program.

REVIEW, CONSULTATION, AND PERMIT REQUIREMENTS



Chapter 8

ENVIRONMENTAL REVIEW, CONSULTATION AND PERMIT REQUIREMENTS

Introduction

The federal government and the states have promulgated a number of environmental statutes and regulations that place various requirements for review, consultation, and permits on actions proposed by agencies such as Bonneville Power Administration (BPA). The statutes and regulations applicable to BPA's programs and activities can be grouped into 16 requirements based on the environmental components they are designed to protect (see BPA's "Checklist of 16", December 1, 1981). This chapter examines each of these 16 requirements to determine which are relevant to BPA's proposed vegetation management program.

In the following sections, the provisions of the 16 requirements are described, the relevance of each requirement to transmission facility vegetation management is analyzed, and the reasons why the requirement is relevant or not is indicated. Finally, for those requirements that are relevant, the means by which compliance is, or will be, assured is explained.

Environmental analyses of BPA's vegetation management program occur at several different levels of planning and implementation. This programmatic EIS generically analyzes environmental effects, constraints, and mitigation measures that apply to BPA's vegetation management program throughout its six-state service area. Project-level analyses occur as Right-of-Way Maintenance Specialists and others develop the site-specific vegetation management prescriptions for various transmission facilities within each of BPA's four administrative Areas (see Chapter 5).

Depending on the specific environmental requirement, it may be satisfactorily complied with at the program-level, project-level, or both levels of environmental analyses. For example, in some cases, an environmental requirement may be satisfied completely by incorporating a particular constraint or mitigation measure as a standard practice in the system-wide vegetation management program. In other cases, complete compliance is only partially provided by incorporation of a mitigation measure in the system-wide

program; subsequent selection and implementation of site-specific measures in carrying out individual vegetation management projects is needed to completely satisfy these requirements.

Information on the relevancy of the requirements and the levels at which compliance is assured (programmatically or project-specifically) is summarized in Table 8-1. The particular vegetation control methods to which the requirements apply are indicated also.

The second section of this chapter describes the relationships between the environmental requirements and the alternative programs under consideration in this EIS. The final section identifies permits, licenses, and entitlements necessary, if any, to implement BPA's proposed vegetation management program.

Requirements, Relevancy, and Compliance

1. Environmental Policy

Description of Requirements. The National Environmental Policy Act (NEPA) (42 USC 4321 et seq.) and regulations issued pursuant to the Act established policies and procedures for assuring that federal actions are consistent with the nation's environmental quality objectives. NEPA directs that, to the fullest extent possible, federal agencies are to carry out their programs in accordance with NEPA policies and procedures. NEPA's "action-forcing mechanism" requires that federal agencies use a "systematic, interdisciplinary approach" to assess the impacts of "major federal actions significantly affecting the quality of the human environment." Regulations of the Council on Environmental Quality (CEQ) provide detailed requirements for implementing NEPA (40 CFR Parts 1500-1508).

The Department of Energy (DOE) has adopted the CEQ regulations for implementing NEPA (10 CFR Part 1021), and has established its own final guidelines for implementing the procedural provisions of NEPA (45 FR 20694 as amended by 47 FR 7976 and 48 FR 685). DOE's final guidelines provide supplemental implementing procedures required by the CEQ regulations.

Relevancy to Vegetation Management. DOE's final guidelines indicate that BPA's proposed vegetation management program requires the preparation of this EIS, in accordance with NEPA procedures.

Table 8-1. Summary of Requirements, Relevancy, and Compliance

Environmental Requirement	Relevancy to Vegetation Management	Relevancy by Type of Vegetation Control Method					Levels for Compliance With Requirement		Means for Compliance
		Broadcast Herbicide	Spot Herbicide	Manual	Mechanical	Biological	Programmatic (This EIS)	Project-Level (Subsequent EA)	
1. Environmental Policy	Yes	x	x	x	x	x	Partial	Complete	Program EIS together with project-specific environmental analyses "tiered" to generic programmatic EIS.
2. Endangered/Threatened Species and Critical Habitat	Yes	x	x	x	x	x	Complete (as of May 15, 1983)		Project-specific environmental analyses verify no jeopardy to listed species or critical habitats or provide mitigation.
3. Fish and Wildlife Conservation	No Affirmative Requirements						-	-	Voluntary conservation of nongame fish and wildlife habitats.
4. Heritage Conservation	Yes	x	x	x	x	x	Partial	Complete	Determination that vegetation management at existing facilities do not have an effect upon known sites, protection of newly-discovered sites at BPA facilities, SHPO consultation with respect to BPA's determinations
5. State, Areawide, and local Plan and Program Consistency	No	-	-	-	-	-	-	-	(Nevertheless, there will be clearinghouse review).
6. Coastal Management Program Consistency	Yes	x	x	x	x	x	Complete	-	"General consistency determination" in this EIS
7. Floodplains	No	-	-	-	-	-	-	-	
8. Wetlands	Yes	x	x	-	-	-	Complete	-	Incorporation of measures for wetland protection from herbicide contamination in program assures no unusual circumstances in routine maintenance program.
9. Farmlands	Yes	x	-	-	-	-	Partial	Complete	Incorporation of measures to protect farmland productivity in program, implementation at project-level.

Table 8-1. Cont'd.

Environmental Requirement	Relevancy to Vegetation Management	Relevancy by Type of Vegetation Control Method					Levels for Compliance with Requirement		Means for Compliance
		Broadcast Herbicide	Spot Herbicide	Manual	Mechanical	Biological	Programmatic	Project-Level	
							(This EIS)	(Subsequent EA)	
10. Recreation Resources	Yes	x	x	x	x	-	Partial	Complete	Maintenance and enhancement of visual quality at or near recreational resources in cooperation with land management agencies.
12. Permit for Structures in Navigable Waters	No	-	-	-	-	-	-	-	
13. Permit for Discharges into Waters of the U.S.	No	-	-	-	-	-	-	-	
14. Permit for Right-of-Way on Public Land	No (directly) Yes (indirectly)	x	x	x	x	x	Partial	Complete	Cooperative development of R-O-W management plans pursuant to Memoranda of Understanding with USFS and BLM.
15. Pollution Control at Federal Facilities									
15a. Clean Air Act	No	-	-	-	-	-	-	-	
15b. Clean Water Act	Yes	x	x	-	x	-	Partial	Complete	Incorporation of measures to protect water quality in program, implementation of measures at project-level.
15c. Resource Conservation and Recovery Act	Yes	x	x	x	x	-	Partial	Complete	Incorporation of waste disposal procedures in program (R-O-W Maintenance Standards); implementation at project-level.

Table 8-1. Cont'd.

Environmental Requirement	Relevancy to Vegetation Management	Relevancy by Type of Vegetation Control Method					Levels for Compliance With Requirement		Means for Compliance
		Broadcast Herbicide	Spot Herbicide	Manual	Mechanical	Biological	Programmatic (This EIS)	Project-Level (Subsequent EA)	
15d. Safe Drinking Water Act	Yes	x	x	-	-	-	Partial	Complete	Incorporation of measures to protect water quality in program, implementation of measures at project-level.
15e. Noise Control Act	Yes	x	x	x	x	-	Partial	Complete	Compliance with state and local noise control standards where they exist.
15f. Federal Insecticide, Fungicide, and Rodenticide Act	Yes	x	x	-	-	-	Partial	Complete	Incorporation of herbicide-use constraints into program (R-O-W Maintenance Standard); implementation during field operations.
15g. Toxic Substances Control Act	No	-	-	-	-	-	-	-	
16. Energy Conservation at Federal Facilities	Yes	x	x	x	x	x	Complete	-	BPA's "General Operations Plan" for energy conservation covers vehicles and equipment used in vegetation management.

Means for Satisfying the Requirements. The present generic programmatic EIS has been prepared to satisfy NEPA, CEQ guidelines, and DOE requirements. The analysis in the EIS is generic because it evaluates "actions which have relevant similarities, such as common timing, impacts, alternatives, methods of implementation, media, or subject matter" [40 CFR 1502.4(c) (2)]. The EIS is programmatic because it looks at "proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action" [40 CFR 1502.4(a)]. This generic programmatic EIS evaluates and considers alternative vegetation control methods and alternative transmission facilities vegetation management programs. It has been prepared in order to provide BPA with the requisite environmental information so that it may make an environmentally well-informed decision with respect to selecting its future vegetation management program.

This EIS is conceived and written as a broad comprehensive background document to which subsequent environmental analyses can be tiered in accordance with CEQ regulations at 40 CFR 1502.20. Tiering is done in order to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review. This broad EIS covers the vegetation management program generically; subsequent environmental analyses will focus on more site-specific issues, while incorporating by reference the discussions of issues in the broad EIS.

2. Endangered and Threatened Species and Critical Habitat

Description of Requirements. Federal policies and procedures for protecting endangered and threatened species of fish, wildlife, and plants are established by the Endangered Species Act (16 USC 1536) and regulations issued pursuant to the Act. The purposes of the Act are to provide mechanisms for conservation of endangered and threatened species and the habitats upon which they depend, and to achieve the goals of international treaties and conventions related to endangered species. Under the Act, the Secretary of the Interior is required to determine which species are endangered or threatened and to issue regulations for protection of those species.

Section 7 of the Act requires federal agencies to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service in order to ensure that actions they authorize, fund, or carry out do not jeopardize the continued existence of a listed species or result in the

adverse modification or destruction of their critical habitat. Upon determination that an endangered or threatened species may be present in the area of a proposed action, the responsible agency must conduct a biological assessment to identify how the listed species might be affected. The biological assessment may be performed as part of an environmental assessment or EIS pursuant to NEPA.

Relevancy to Vegetation Management. Vegetation management activities in general have the potential to adversely affect endangered and threatened species of fish, wildlife, and plants if such species or their habitats are located on rights-of-way requiring treatment of vegetation. Therefore, potential impacts on these species or habitats must be addressed during the EIS process.

Means for Satisfying Requirements. Based on examination of current literature and consultation with Endangered Species Offices of the U.S. Fish and Wildlife Service (USFWS), no officially-listed species, species proposed for listing, or critical habitats will be affected adversely by BPA's vegetation management program. No proposed or listed endangered or threatened plant species occur in proximity to transmission facilities in BPA's six-state service area (see Chapter 7, section on Vegetation).

Two protected fish species (found in Oregon and Wyoming) do not occur in counties where BPA operates transmission facilities. A protected butterfly species inhabits two (and possibly a third) localized areas in Oregon; however, none is near BPA transmission facilities.

A number of large, mobile bird and mammal species that are officially-protected occur in states and counties of BPA's service area. Due to their mobility, the fact that a BPA right-of-way would constitute a very small proportion of any one animal's home range, and the fact that herbicides proposed for use by BPA have low toxicity levels and do not bioaccumulate, no adverse effects on these species will occur. In forested areas, right-of-way brush control will enhance the habitats of three protected large mammal species (i.e., gray wolf, grizzly bear, and Columbian white-tailed deer) by providing travel corridors and highly productive open habitats (see Chapter 7, Wildlife).

As provided in Section 7(c) of the Endangered Species Act, BPA's proposed vegetation management program will not

jeopardize the continued existence of any threatened or endangered species, or adversely modify their critical habitats.

3. Fish and Wildlife Conservation

Description of Requirements. The Fish and Wildlife Coordination Act (16 USC 661 et seq.) requires federal agencies undertaking projects affecting water resources to consult with the U.S. Fish and Wildlife Service in order to conserve or improve wildlife resources. As part of the consultation process, reports and recommendations of the U.S. Fish and Wildlife Service are required to be included in federal water project reports.

The Fish and Wildlife Conservation Act of 1980 (16 USC 2901 et seq.) encourages federal agencies to conserve and to promote conservation of nongame fish and wildlife and their habitats, to the maximum extent possible within each agency's statutory responsibilities. The Act places no affirmative requirements on federal agencies.

Relevancy to Vegetation Management. Vegetation management does not control or modify water resources within the meaning of the Fish and Wildlife Coordination Act; the Act therefore is not relevant to BPA's proposed action.

The Fish and Wildlife Conservation Act of 1980 does apply to BPA's vegetation management program in that management activities can be implemented in a manner that conserves nongame fish and wildlife and their habitats.

Means for Satisfying Requirements. A stated purpose of BPA's vegetation management program is the protection and enhancement of environmental quality, including nongame wildlife habitats. BPA's proposed program, which includes use of biological, manual, spot chemical, and broadcast chemical methods will generally benefit wildlife in forested areas. Maintenance of rights-of-way through forested areas increases the diversity and abundance of wildlife species (game species such as elk and deer in particular) by providing productive open habitats and edge effect.

In addition, some slight potential exists for adverse impacts on wildlife habitats (see Chapter 7, Wildlife). Potential adverse impacts will be avoided by limitation of broadcast chemical treatments to high density stands of target species (thus preventing elimination of nontarget

plants and enhancing habitat diversity) and by observance of stream buffer zones during broadcast herbicide applications. These mitigation measures when observed during project-level selection of control methods for individual management units will ensure protection and enhancement of nongame fish and wildlife habitats, in accordance with the Fish and Wildlife Conservation Act of 1980.

4. Heritage Conservation

Description of Requirements. A number of federal laws and regulations have been promulgated to protect the nation's historical, cultural, and prehistoric resources. These include the National Historic Preservation Act, the Archeological and Historic Preservation Act, the Archeological Resources Protection Act, the American Indian Religious Freedom Act, the National Natural Landmarks Program, and the World Heritage List.

Pursuant to the National Historic Preservation Act, the effects of any federal or federally-assisted undertaking on historical, cultural, or archeological resources must be evaluated. An "effect" is defined as any change in the quality of the characteristics that qualify the resource for protection under the law (36 CFR Part 800). For properties on or eligible for the National Register of Historic Places, the responsible federal agency must consult with the State Historic Preservation Officer (SHPO) regarding any potential adverse effects on resources of historic, architectural, archeological, or cultural significance.

The Archeological and Historic Preservation Act and the Archeological Resources Protection Act safeguard historical and archeological resources from damage or loss to federally-sponsored or permitted projects and from excavation or removal from federal and Indian lands. The American Indian Religious Freedom Act assures that federal activities do not impair access to religious sites and will not affect ceremonial rites of American Indians.

The Department of Interior administers the National Natural Landmarks Program and the World Heritage List to identify and encourage preservation of landmarks of national significance and of outstanding universal significance to mankind, respectively. Neither of these programs, however, places affirmative requirements on federal agencies to protect the landmarks listed.

Relevancy to Vegetation Management. Vegetation management, as practiced by BPA, occurs only on existing transmission line rights-of-way, along existing access roads, and within the boundaries of existing substations and microwave stations. Resources on or eligible for the National Register of Historic Places that exist on such sites presumably have been discovered during previous construction and operations activities.

In the unlikely event that a heretofore unidentified National Register site is discovered at existing BPA transmission facilities and would be affected by BPA's program, BPA will suspend vegetation management activities in the vicinity of the site and will follow recommendations of the Advisory Council on Historic Preservation (see 36 CFR 800.7). These recommendations pertain primarily to resources discovered during construction projects by federal agencies.

An effect upon a National Register site occurs when there is a change, beneficial or adverse, in the quality of the site that originally qualified it for inclusion in the National Register [36 CFR 800.3(a)]. Furthermore, the effect upon the site can be an adverse effect when there are alterations in the property's surrounding environment or an introduction of visual elements not compatible with the site [36 CFR 800.3(b)]. However, BPA's vegetation management activities occur only within the boundaries of existing transmission line rights-of-way, access roads, and substation and microwave yards.

Any change in the quality of the site, any alterations in the surrounding environment of a National Register site, or any introduction of incompatible visual elements with respect to the site, would have occurred at the time that the facilities were first constructed. Subsequent periodic vegetation management merely maintains the visual status quo resulting from this initial construction of the facilities. Accordingly, vegetation control at existing facilities does not constitute an "effect" as that term is defined in 36 CFR 800.3(a). The same is true with respect to the impacts of BPA's vegetation management activities upon Natural Landmarks, Historical Landmarks, and World Heritage Properties.

BPA vegetation management activities will have no effect on access to Native American religious sites or on their ceremonial rites.

Means for Satisfying Requirements. Compliance with federal requirements concerning heritage conservation is largely provided for at the programmatic level of the EIS because vegetation management activities, in general, do not have an effect upon National Register sites. With respect to heretofore unidentified National Register sites at existing BPA facilities, compliance would be provided for during project-level planning. More specifically, should such a site be discovered at an existing BPA facility, and it is determined that it would be affected by BPA's program, vegetation management activities would be suspended in the vicinity of the site, and the Advisory Council's prescriptions for protection of newly discovered properties (36 CFR 800.7) would be adhered to. BPA will consult with each of the State Historic Preservation Officers (SHPOs) in its service area regarding the above determination with respect to the effect of BPA's proposed vegetation management program.

5. State, Areawide, and Local Plan and Program Consistency

Description of Requirements. The Intergovernmental Cooperation Act (ICA) of 1968 (42 USC 4233) and Office of Management and Budget (OMB) Circular No. A-95 (41 FR 4052, January 13, 1976) require coordination of federal aid programs with state, areawide, and local comprehensive planning. The ICA established a national policy for intergovernmental coordination and cooperation, and requires consistency to the maximum extent practicable between federal aid for development purposes and state, regional, and local planning.

OMB Circular A-95 established a system for notification and review of state and local applications for federal assistance and for consultation regarding direct federal development projects. This A-95 review system also provides a mechanism for dissemination of EISs, environmental assessments, and other analyses prepared by federal agencies to interested state and local government agencies for comments as required by NEPA. Various state and areawide clearinghouses facilitate the notification, review, and dissemination of project plans and EISs, as specified by OMB Circular A-95.

Relevancy to Vegetation Management. The requirements of ICA and OMB Circular A-95 are not relevant to BPA's proposed vegetation management program. Maintenance of transmission facilities vegetation is neither a direct federal development nor a federally-assisted project within the meaning of

the Act or the OMB Circular; it is rather a form of routine maintenance. Therefore, BPA's proposed action does not require clearinghouse review. BPA will, nevertheless, use the clearinghouses to circulate this EIS to state, regional, and local agencies, and thereby provide them an opportunity to comment.

6. Coastal Management Program Consistency

Description of Requirements. The Coastal Zone Management Act (16 USC 1451 et seq.) offers grants to coastal states for the development of comprehensive, long-range coastal management plans meeting broad statutory criteria, and for state implementation of these plans following federal approval. The Act is administered by the National Oceanic and Atmospheric Administration (NOAA). Each coastal management plan must: identify coastal zone boundaries; define permissible land and water uses within the coastal zone; inventory and designate areas of particular concern within the coastal zone; identify means by which the state proposes to exert control over land and water uses; establish guidelines for priorities of uses within particular areas; and describe the organizational structure proposed to implement the management program.

Within the BPA service area, state coastal zone management plans have been completed by the states of Washington and Oregon.

Of particular importance to BPA is the Act's federal consistency requirements: "Each federal agency conducting or supporting activities directly affecting the coastal zone shall conduct or support those activities in a manner which is, to the maximum extent practicable, consistent with approved state management programs" (Section 307[c] [1]). Federal agencies undertaking development projects directly have a similar consistency requirement (Section 307[c] [2]).

NOAA has promulgated regulations implementing the Act's federal consistency requirement (15 CFR Part 930). The regulations broadly define "federal activity" as any functions performed by or on behalf of a federal agency in the exercise of its statutory responsibilities, with the exceptions of licenses, permits, or federal assistance to an applicant agency. The regulations require federal agencies to make findings as to whether their activities directly affect the coastal zone, and to provide state agencies with consistency determinations for activities which are found to directly affect the coastal zone. Federal agencies are

encouraged to use existing notification procedures, such as for review of NEPA documents, to provide consistency determinations to state agencies. State agencies are required to respond within 45 days as to their agreement or disagreement with the consistency determination.

For repeated activities (such as ongoing maintenance) which have direct effects on the coastal zone, the NOAA regulations allow the federal agency to "develop a general consistency determination, thereby avoiding the necessity of issuing separate consistency determinations for each incremental action controlled by the major activity" (15 CFR 930.39). The general consistency determination may be used only when the federal agency finds that the incremental actions are (1) repetitive or periodic, (2) substantially similar in nature, and (3) individually have insignificant impacts on the coastal zone when performed separately.

The NOAA regulations also define the required contents of a consistency determination. The consistency determination must (1) indicate whether the activity will be undertaken in a manner which is consistent to the maximum extent practicable with the coastal zone management program; and (2) include a detailed description of the activity, the direct coastal zone impacts of the activity, and information sufficient to support the consistency determination.

Relevancy to Vegetation Management. Although BPA's proposed vegetation management program involves no acquisition of right-of-way or no facility construction, some direct effects on natural and social coastal resources will occur. Therefore BPA is required to make a determination that its activities are consistent with approved coastal management programs of Oregon and Washington. Because BPA vegetation management is repetitive with similar impacts on the coastal zone, a general consistency determination is appropriate.

Means for Satisfying Requirements.

Oregon Coastal Management Program. In order to be consistent with Oregon's Coastal Management Program, an activity must conform to statewide planning Goals and Guidelines, local government comprehensive plans (where approved), and applicable state statutes. The compatibility of BPA's proposed program with various statewide Goals and Guidelines is documented in Table 8-2. For details of impact analyses, see Chapter 7 sections on Soils, Vegetation, Water Quality and Fisheries, Wildlife, Visual Resources, and Land Use.

Table 8-2. Compatibility of BPA's Proposed Vegetation Management Program with Oregon Statewide Planning Goals and Guidelines

Goal/Guideline Number	Description	Basis of Compatibility ¹
3	Preservation and maintenance of agricultural land.	Proposed program involves no conversion of agricultural land to other uses.
4	Conservation of forest lands.	No conversion to non-forest uses is involved; forest vegetation is allowed to grow on rights-of-way wherever it is compatible with conductor clearance and access criteria (e.g., canyons).
5	Conservation of open space and protection of natural and scenic resources.	Proposed program involves no conversion of open spaces to other uses; fish and wildlife habitats are protected (see Chapter 7 - Wildlife); visual settings of scenic areas, historic sites, and recreation areas are maintained in consultation with management agencies (see requirement no. 4 of this Chapter).
6	Maintenance and improvement of air, water, and land resources quality.	Proposed program will not violate state and federal environmental quality statutes with respect to air, water, and land resources (see various sections of this chapter).
8	Satisfaction of recreational needs.	Proposed program will not limit the availability of transmission rights-of-way for recreational purposes under multiple-use agreements with land management agencies or other landowners; multiple-use of rights-of-way is an auxiliary purpose of BPA's vegetation management program (see Chapter 2).
11	Provision of public facilities and services.	Proposed program involves no new transmission lines; multiple-use of existing rights-of-way is promoted.
16	Protection of coastal estuaries and associated wetlands.	Possible adverse impacts to coastal estuaries or wetlands are highly unlikely (see Chapter 7 - Water Quality); buffer zones along all streams and water bodies minimize herbicide contamination below significant levels.
17	Protection of coastal shorelands.	Proposed program will maintain riparian vegetation and wildlife habitat (see Chapter 7 - Wildlife and Water Quality); soil erosion and sedimentation will not be increased; proposed program is compatible with permitted shoreline uses.

FOOTNOTE:

¹Compatibility is ensured through observance of mitigation measures described in Chapter 4.

Mitigation measures that ensure compatibility are described in Chapter 4. Vegetation control methods comprising the proposed program (i.e., biological, manual, spot chemical, and broadcast chemical) are described in Chapter 3.

Local government comprehensive plans developed pursuant to the Oregon Coastal Management Program have not addressed vegetation management specifically. Insofar as BPA's proposed program is consistent with statewide Goals and Guidelines, it is consistent with approved local plans. In addition, BPA's proposed program will be implemented to fully comply with applicable state statutes. Therefore, based on these factors, BPA's proposed vegetation management program is determined to be consistent with Oregon's Coastal Management Program.

Washington Coastal Zone Management Program. Consistency determinations for federal activities in Washington's coastal zone are required where an activity involves physical changes in air, water, vegetation, or land in the coastal zone (Washington Department of Ecology 1980). Where the proposed activity has coastalwide implications (e.g., BPA's proposed vegetation management program), consistency is to be determined based on Washington's Shoreline Management Act (SMA) of 1971 and the final guidelines for development of local shoreline master programs (WAC Chapter 173-16).

Local shoreline master programs are initiated at the local level, must be approved by the State Department of Ecology, and, once approved, become state regulations. Where proposed federal activities are site-specific in nature (e.g., vegetation control projects implemented under BPA's proposed program), consistency determinations must be based on local shoreline master programs in force at treatment sites. For ongoing, routine, minor activities, a federal agency may establish a Memorandum of Agreement to exempt such activities from required consistency determinations.

The SMA guidelines include three major components that are relevant to BPA vegetation management:

1. Environments: A classification system for shoreline areas (natural, conservancy, rural, or urban), designed to function as a framework for implementing shoreline policies and regulations,
2. Shorelines of statewide significance: A set of principles to be incorporated in local master programs, and

3. Use Activities: Criteria for local regulation of land use activities proposed for the coastal zone (of 21 use activities for which criteria are provided, agricultural practices, forest management practices, and utilities are relevant to BPA vegetation management).

BPA's proposed program is found to be compatible with the relevant components of the SMA final guidelines (see Table 8-3) and therefore is consistent with Washington's Coastal Zone Management Program.

Potential adverse impacts of BPA's vegetation management are insignificant when performed separately. Vegetation treatments are applied at 3-5 year intervals in western Oregon and Washington (see Chapter 3). Treatments cover very small proportions of any watershed or local area. Because of this low level of potential impact and the repetitive and similar nature of treatment activities, a general consistency determination is made for both Oregon and Washington Coastal Zone Management Programs.

7. Floodplains

Description of Requirements. Executive Order 11988 requires federal agencies, in carrying out their responsibilities, to take action to reduce the risk of flood loss; to minimize flood impacts on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. The Department of Energy (DOE) has issued regulations pursuant to Executive Order 11988 and Executive Order 11990 (discussed in the next section) (10 CFR Part 1022). The DOE regulations describe activities to which the Executive Orders apply and procedures for preparing a "floodplains/wetlands assessment" as part of an EIS or Environmental Assessment.

The DOE regulations at 10 CFR 1022.5(g) specify that since routine maintenance activities at existing DOE facilities normally will have minimal or no adverse impacts on floodplains and wetlands, the regulations ordinarily shall not apply. Where unusual circumstances indicate the possibility of impact from maintenance activities, however, the need for a floodplain/wetlands assessment should be considered.

Relevancy to Vegetation Management. Procedures for floodplain review are not relevant to BPA's vegetation management program because the program may be considered

Table 8-3. Compatibility of BPA's Proposed Vegetation Management Program with Washington Shoreline Management Act Final Guidelines

Guideline Component	Pertinent Elements	Basis of Compatibility ¹
Environments	. Natural . Conservancy . Rural . Urban	. BPA's proposed program occurs only on existing transmission rights-of-way; therefore, no changes in land use or alterations of the characteristics of these environmental types are involved. . Also, the program will be implemented in a way that minimizes any adverse effects on adjacent land uses, water quality, wildlife habitats (see Chapter 7 and Chapter 4).
Shorelines of statewide significance	. Preservation of natural shoreline character . Long-term over short-term benefit . Protection of shoreline biological resources . Increase of public access . Increase of recreational opportunities	. Because vegetation management occurs on existing transmission rights-of-way, no loss of shoreline natural character is involved. . Long-term productivity of rights-of-way and adjacent lands is maintained. . The resources and ecology of shorelines are protected through stream and waterbody buffer zones and other mitigation measures described in Chapter 4. . Public access is not affected. . Proposed program has no impacts on recreational opportunities.
Use activities	. Agricultural practices . Forest management practices . Utilities	. Proposed program will not cause significant herbicide contamination of streams, water bodies, or adjacent lands (see Chapter 7 section on <u>Water Quality</u>). . Buffer zones will be maintained adjacent to all water bodies (only individual tall-growing plants will be removed). . Soil erosion will not increase (see Chapter 7 section on <u>Soils</u>). . Cutting debris will not be allowed to remain in streams. . Visual quality will be maintained through retention of visual screens at road and stream crossings. . Water quality will be maintained. . Riparian buffer zones will prevent stream temperature increases (see Chapter 4 <u>Mitigation Measures</u>). . Proposed program entails only maintenance of vegetation at existing transmission facilities.

FOOTNOTE:

¹Compatibility is ensured through observance of mitigation measures described in Chapter 4.

routine maintenance of DOE facilities and because no unusual circumstances indicate possibility of adverse impacts. Furthermore, BPA's vegetation control activities are not related to flood losses or flood impacts on human safety, health, and welfare. A floodplains assessment is not required.

8. Wetlands

Description of Requirements. Executive Order 11990 requires federal agencies, in carrying out their responsibilities, to take action to minimize the loss or degradation of wetlands. Each agency is required to avoid undertaking or providing assistance for construction in wetlands unless the agency finds there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands. The DOE has issued regulations pursuant to Executive Order 11990; these regulations were reviewed in the previous section.

Relevancy to Vegetation Management. DOE regulations specify that wetland assessments are not required for routine maintenance activities at DOE facilities (10 CFR 1022.5[g]). Where unusual circumstances indicate a possibility of adverse impacts to beneficial or natural wetlands values, however, an assessment is required. The use of herbicides to control vegetation on transmission line rights-of-way through wetlands might be considered an unusual circumstance with potential for adverse impact. However, mitigation measures incorporated in the proposed program (e.g., stream buffer zones, drift control measures) and the low orders of toxicity of the herbicides proposed for use indicate that adverse impacts on wetland ecosystems are highly unlikely (see Chapter 7, Water Quality). Therefore, no unusual circumstances exist and a wetlands assessment is not required for BPA's routine vegetation management activities.

9. Farmlands

Description of Requirements. The Council on Environmental Quality issued a memorandum in 1980 emphasizing the need for determining the effects of proposed federal agency actions on prime or unique agricultural lands (45 FR 59189, September 8, 1980). Prime farmlands are to be considered a "depletable resource" and impacts to them must be evaluated in the environmental assessment process. Impacts to be evaluated include reduction in farmland productivity and conversion of farmlands to other uses.

Relevancy to Vegetation Management. The proposed vegetation management program entails control of vegetation on existing transmission line rights-of-way and at existing substation and microwave facilities. Therefore no conversion of farmland to other uses will occur.

Typically, vegetation control is not needed in areas under cultivation due to agricultural use of the right-of-way itself. Landowners may enter into Tree and Brush Control Agreements with BPA whereby they assume responsibility for controlling right-of-way vegetation. Often in cultivated areas, the regional climate will not support trees and tall shrubs that might impinge on transmission lines and therefore require control.

Where cultivated fields adjoin rights-of-way requiring control of vegetation, drift of herbicides applied by broadcast methods might cause a temporary reduction (during the present crop rotation) in farmland productivity. Drift control measures (i.e., thickening agents, permissible weather conditions), however, minimize the possibility of such an occurrence.

As part of its vegetation management program, BPA often aids in control of noxious weeds on rights-of-way through cultivated areas. This activity is considered a mitigation for the spread of noxious weeds along the rights-of-way and is undertaken in cooperation with landowners, county weed control agents and local Weed Control Districts.

Means for Satisfying Requirements. Prime farmland protection requirements are relevant to BPA's proposed program due to potential impacts on agricultural productivity. However, these impacts are avoided because typically, vegetation control is not needed in areas under cultivation. Use of drift control measures during broadcast application of herbicides and adherence to other mitigation measures, and continued practice of noxious weed control on rights-of-way in agricultural areas also minimizes any adverse impacts on farmland productivity. Therefore, the requirements are fully satisfied by incorporation of these measures into the vegetation management program and by implementation of the measures during vegetation management projects.

10. Recreation Resources

Description of Requirements. A number of federal programs have been created to protect important national recreation resources. These include the National Wild and Scenic

Rivers System, established by the Wild and Scenic Rivers Act (16 USC 1271 et seq.); the National Trails System, established by the National Trails System Act (16 USC 1241 et seq.); wilderness areas administered by the U.S. Forest Service, Bureau of Land Management (BLM) and National Park Service; Areas of Critical Environmental Concern administered by BLM; and estuarine sanctuaries designated under the Coastal Zone Management Programs.

In general, these programs include provisions to discourage federal agencies from taking actions which would impair the recognized values of the recreational resources in question. The Wild and Scenic Rivers Act restricts federal agency participation in water projects which would affect designated "wild" or "scenic" rivers. Pursuant to the Act the Nationwide Inventory listed rivers potentially qualified for inclusion in the Wild and Scenic Rivers System; federal agencies are required to consult with the Department of Interior or Department of Agriculture before taking actions which might foreclose wild, scenic, or recreational river status for the inventoried rivers (45 FR 59190, September 8, 1980).

Primary emphasis in administration of wild and scenic rivers is to be given to protection of aesthetic and scenic features as well as other values (PL 90-542 Sec. 10). Similar regulations protect the scenic and recreational qualities of wilderness areas and lands under wilderness review (see 44 FR 72014, December 12, 1979).

The National Trails System Act discourages activities by federal agencies that limit access opportunities to designated trails or that are incompatible with recreational uses. Where designated trails on National Forest or National Park lands cross utility rights-of-way, those rights-of-way shall be maintained to fulfill the purposes of the National Trails System Act (PL 90-543).

The Urban Park and Recreation Recovery Act of 1978 has no requirements pertinent to vegetation management along BPA's transmission system.

The Office of Coastal Zone Management (of the National Oceanic and Atmospheric Administration) administers the National Estuarine Sanctuary Program. Under this program, grants are provided to coastal states to acquire, develop, and operate estuarine sanctuaries as natural areas for research and educational purposes (15 CFR Part 921). Each designated sanctuary may include all or part of an estuary, adjoining transitional areas, and adjacent uplands in order to constitute a viable ecological unit. Within estuarine

sanctuaries, noncompatible uses which might detract from or restrict the use of sanctuaries as natural field laboratories are prohibited.

Within the BPA service area, two such sanctuaries have been established, one in Washington (Skagit County) and one in Oregon (Coos County). Neither sanctuary is crossed by BPA's transmission lines. These and other estuaries within the coastal zones of both states are protected by provisions of each state's coastal zone management program.

A BLM Area of Critical Environmental Concern (ACEC) is an area within public lands where special management attention is required to protect and prevent irreparable damage to important resources or to protect human life and safety from natural hazards (45 FR 57320, August 27, 1980). An ACEC designation may allow multiple-use activities including development and commodity production if compatible with the recognized resource values and not detrimental to human property or lives. The management requirements for each ACEC are determined specifically to fit the resources or hazards at the particular site involved. BLM District Managers designate ACECs and approve ACEC management plans.

By definition, transmission lines and wilderness areas cannot coexist; therefore protection of wilderness areas will not be discussed further.

Relevancy to Vegetation Management. BPA's vegetation management activities occur on existing rights-of-way and at existing transmission system facilities. Vegetation management may incrementally benefit or diminish visual quality where transmission lines cross or parallel wild and scenic rivers and natural trails. Therefore, requirements to protect the visual quality of these recreational resources are relevant to BPAs proposed program.

The Urban Park and Recreation Recovery Act does not apply to BPA's vegetation management program. Similarly, provisions of the National Estuarine Sanctuary Program do not apply to vegetation management. Management of transmission line vegetation in BLM ACECs is subject to management plans negotiated between BLM districts and BPA, subsidiary to the Memorandum of Understanding between the two agencies (see Section 14 of this Chapter).

Means for Satisfying Requirements. Where BPA transmission lines cross or parallel components of the National Trails System or the Wild and Scenic River System, BPA typically

develops a cooperative management plan with the agency administering the component. Such plans specify vegetation management treatments (e.g., maintenance of vegetation screens, greater reliance upon more selective methods of control) to protect the visual setting of the recreational resource. Provisions of the plans are identified in the ROWDATA comment record for each right-of-way management unit covered by the plans (see Chapter 5). Implementation of vegetation control in conformance with the cooperative management plans assures compliance with requirements for protection of national trails and wild and scenic rivers.

11. Urban Policy

Description of Requirements. The executive order requiring urban and community impact analysis (EO 12074) has been revoked. No pertinent requirements remain.

12. Permit for Structures in Navigable Waters

Description of Requirements. Pursuant to the Rivers and Harbors Appropriation Act, the U.S. Army Corps of Engineers issues permits for various types of activities that occur in the waters of the United States or in the ocean. Permit program regulations (33 CFR Part 320 and Parts 322-329) have been issued by the Corps for activities such as construction of dams, dikes, or other structures in navigable waters; discharges of dredged or fill material into navigable waters; and transportation of dredged material for ocean disposal. The Corps regulations describe permit application requirements and permit approval criteria for each type of regulated activity.

Relevancy to Vegetation Management. Because vegetation management does not entail activities which would require a Corps permit (i.e., construction of structure in, over, or affecting navigable waters), the requirements of the Corps permit regulations are not relevant to BPA's vegetation management program.

13. Permit for Discharges into Waters of the United States

Description of Requirements. The Clean Water Act, as amended, requires the U.S. Army Corps of Engineers to issue "Section 404" permits for discharges of dredged or fill materials into waters of the United States. The Corps has

established 404 permit program regulations (40 CFR Part 323), which include use of Environmental Protection Agency (EPA) guidelines for review of permit applications and coordination with EPA in issuing the permits.

Relevancy to Vegetation Management. Because vegetation management does not entail activities which would require a Corps 404 permit (i.e., discharge of fill material into any waters of the United States), the requirements of the Corps 404 permit program are not relevant to BPA's vegetation management program.

14. Permit for Right-of-Way on Public Land

Description of Requirements. The Federal Land Policy and Management Act of 1976 (FLPMA) authorizes the Secretaries of Interior and Agriculture to grant utility and other rights-of-way on federal lands under their jurisdictions (43 USC 1761). Each right-of-way grant must contain provisions to protect environmental concerns such as scenic values, fish and wildlife habitat, and air and water quality as well as provisions to comply with state standards for public health and safety and environmental protection during operations and maintenance activities. In general, such grants must protect the public interest in the federal lands traversed by the rights-of-way.

On National Forest lands, utility rights-of-way are special use authorizations granted by the Chief of the Forest Service (USFS), subject to the provisions of FLPMA (36 CFR Part 251). Pursuant to federal laws predating FLPMA, the Chief of the Forest Service and the Administrator of BPA signed, in 1974, a Memorandum of Understanding (MOU) setting forth requirements and procedures for BPA rights-of-way on National Forest lands. Construction, operation, and maintenance of BPA transmission lines must be consistent with objectives of the National Forest system.

In accordance with the above MOU, a subsidiary MOU was signed in 1974 between USFS Regional Foresters of the Pacific Northwest (Regions 1, 4, and 6) and BPA. This MOU specified plans for cooperative management of existing rights-of-way in order to meet both BPA and National Forest objectives. USFS retained land management responsibility on rights-of-way while BPA secured the right to operate and maintain transmission facilities and agreed to conduct its activities in a manner which protects or enhances basic forest resource values.

National Forest Supervisors and BPA Area Operation and Maintenance Managers are responsible for the preparation of detailed management plans for each specific piece of right-of-way on National Forest land. The plans must identify and describe planned management and resource protection practices by location on each National Forest ranger district. Such management plans are currently in force for all BPA rights-of-way on National Forest lands.

FLPMA also governs management of BPA rights-of-way on lands under jurisdiction of the Bureau of Land Management (BLM) (43 CFR Part 2800). In 1967, the Director of BLM and the BPA Administrator signed an MOU specifying conditions for BPA use of rights-of-way on BLM lands. Similarly to the MOU with USFS, this MOU announces the mutual consent of both agencies to cooperatively meet both agencies' objectives. A subsidiary MOU (effective in 1982) further details the format and content of site-specific right-of-way management plans to be drawn up by the two agencies.

In a few instances, BPA transmission lines cross lands administered by the National Park Service on the U.S. Fish and Wildlife Service. In these cases, cooperative management plans are established between BPA and the administrators of the individual park or refuge.

Relevancy to Vegetation Management. FLPMA is not directly relevant to BPA's proposed program because the program does not involve acquisition of new rights-of-way across public lands. However, at the time permission was obtained from a federal land management agency to establish a now-existing transmission right-of-way, that permission may have been predicated upon eventual development of a mutually-acceptable rights-of-way management plan. Such a cooperative plan would be pursuant to interagency agreements set forth in the MOUs and subsidiary MOUs described above. Therefore, requirements of the original rights-of-way grants and the MOUs are relevant to BPA's proposed program.

Means for Satisfying Requirements. Federal right-of-way permit requirements are satisfied by the various MOUs and ultimately by development of and adherence to the right-of-way management plans. These cooperative plans ensure consistency between the objectives and actions of BPA and those of the federal land management agencies. The management plans specify vegetation control methods to be used on

each portion of BPA right-of-way on BLM or USFS lands. Methods for control of vegetation are subject to all applicable federal and state laws.

15a. Pollution Control at Federal Facilities - Clean Air Act

Description of Requirements. The Clean Air Act, as amended (42 USC 1857 et seq.), sets the basic framework for federal, state, and local air quality management programs. The major implementation provision of the Clean Air Act requires each state to establish and implement a plan to achieve the federal ambient air quality standards within specified time frames. The resulting "state implementation plans" provide the basic regulatory programs for controlling pollutant emissions from existing and future emission sources. The scope of state control programs depends partially on current air quality conditions in various subareas of a state.

Basic control requirements are set on a pollutant-by-pollutant basis. National ambient air quality standards are promulgated as primary standards (for the protection of human health) and secondary standards (for the protection of other values such as crops and materials). Areas which exceed any federal primary air quality standards (nonattainment areas) are required to control both existing and new emission sources so as to achieve annual incremental reductions in pollutant emissions until the federal standards are met.

Relevancy to Vegetation Management. Federal requirements pertaining to exhaust emissions from motor vehicles and aircraft are satisfied at the time of sale by original manufacturers. Exhaust emissions will be minimized further by properly maintaining and operating all vehicles and equipment. Mobile source emission requirements apply to vehicle manufacturers but do not apply to vehicle operators during vegetation management activities.

Requirements pertaining to burning (e.g., smoke particulates) do not apply to BPA's proposed program; BPA does not use either slash burning or broadcast burning in its vegetation management program. Slash resulting from manual cutting is either lopped and scattered or placed in piles without burning.

No federal or state regulations exist that pertain to potential pollutants evolving from volatile components or herbicides or herbicide carriers.

15b. Pollution Control at Federal Facilities - Clean Water Act

Description of Requirements. The Clean Water Act, as amended (33 USC 1251 et seq.), sets forth the national strategy for controlling water pollution. The law prescribes national goals and policies, establishes uniform effluent discharge limitations, requires states to establish and enforce water quality standards, establishes various levels of water quality planning, and establishes a National Pollutant Discharge Elimination System (NPDES) permit program for municipal and industrial point source discharges.

Section 208 of the Clean Water Act specifies programs for states to control nonpoint source pollution. States are required to prepare water quality management plans to achieve the Act's goal of fishable and swimmable waters by 1983. In these plans, states must establish regulatory programs to control runoff and other pollution associated with agriculture, forestry, construction, and other nonpoint sources of pollution. Water quality management plans are prepared for specific watersheds and regions of each state and pertain to the conditions and activities present in those watersheds or regions.

Section 303 of the Clean Water Act specifies requirements for state water quality standards. Under Section 303 and additional EPA regulations pertaining to water quality standards (40 CFR Part 120), states are required to establish and enforce water quality standards which protect public health and welfare and protect downstream water quality. Existing water quality standards are to be upgraded to achieve the Clean Water Act's 1983 goals of fishable and swimmable waters.

Relevancy to Vegetation Management. Vegetation management on transmission line corridors and at substations does not involve point source discharges of pollutants. Provisions of the Clean Water Act, as amended, pertaining to point source pollutant discharges do not apply, therefore, to BPA's proposed program.

Vegetation management using mechanical or chemical methods could conceivably cause nonpoint source pollution and therefore falls under the jurisdiction of state water quality management plans. As a federal agency, BPA is required to observe state and local water quality regulations (Clean Water Act Section 313[a]).

Means for Satisfying Requirements. BPA designs and implements its vegetation management program in a manner that minimizes any direct or indirect impacts to water quality and thereby upholds state water quality standards (see Chapter 7 - Water Quality and Public Health). Water quality standards will be upheld by the design of the vegetation management program at the program-planning level and by the implementation of use restrictions and mitigation measures at the specific project level.

BPA's proposed program does not include mechanical methods of vegetation control, thereby avoiding soil disturbance leading to erosion, a type of nonpoint source pollution.

BPA has incorporated many constraints on the use of herbicides into its proposed vegetation management program (see Chapter 4 - Mitigation Measures). These include the recognition of buffer zones adjacent to all bodies of water (e.g., 100-foot buffers for aerial herbicide application; 50-foot buffers for ground-based foliage spray applications; 10-foot buffers for other spot chemical applications, except for those herbicides determined by EPA to be safe for use near water); restrictions on herbicide applications when weather conditions might cause drift or leaching, and use of drift control measures when applying herbicides with broadcast techniques. Detailed right-of-way inventories and low-altitude aerial photography permit exact determination of the location of streams and other bodies of water (see Chapter 5).

BPA's herbicide-residue monitoring program has verified that these and other herbicide-use restrictions effectively protect water quality (Norris 1979) (see Chapter 7 - Public Health). Full compliance with state water quality standards is ensured, therefore, by proper observance of herbicide use restrictions set forth in BPA's Transmission Line Vegetation Standard at the project-implementation level of vegetation management.

15c. Pollution Control at Federal Facilities - Resource Conservation and Recovery Act

Description of Requirements. The Resource Conservation and Recovery Act (RCRA) (42 USC 3251 et seq.) establishes national policies and programs for solid waste management, in general, and for hazardous waste management, in particular. With respect to solid waste management, the Act prohibits new open dumping sites, calls for EPA criteria for sanitary landfills (established by 40 CFR Part 257), and requires that all open dumping sites be converted to sanitary landfills or closed by 1983. The Act further provides

financial assistance for the development and implementation of comprehensive state solid-waste-management plans, which are to include environmentally-sound disposal methods and resource recovery programs.

Subtitle C of RCRA establishes a program for comprehensive "cradle-to-grave" regulation of hazardous wastes. Under this program, EPA has identified hazardous wastes subject to Subtitle C; established standards for generators and transporters of hazardous wastes; established standards for owners and operators of treatment, storage, and disposal facilities; issues permits for treatment, storage, and disposal facilities; and issues guidelines for states seeking to implement Subtitle C programs.

A generator is any person or firm whose act or process produces hazardous waste identified or listed by EPA (40 CFR Part 261). A generator may accumulate hazardous waste on-site without a permit for 90 days or less, provided that certain standards are met (e.g. packaging, labelling). Generators accumulating hazardous wastes for more than 90 days must acquire permits and meet requirements for owners and operators of treatment, storage, and disposal facilities. A transporter of hazardous wastes must acquire an EPA identification number and meet requirements of the RCRA manifest system (40 CFR Part 263).

Relevancy to Vegetation Management. Vegetation management may generate three types of wastes classifiable as (1) clearing waste (e.g., slash from felled trees and shrubs), (2) domestic solid waste (i.e., garbage, refuse, etc.), and (3) hazardous or problem waste. The requirements of RCRA are not relevant to clearing wastes resulting from the felling, topping, or pruning of trees and shrubs.

Domestic solid waste and hazardous waste are regulated by EPA and the states pursuant to RCRA. Domestic solid waste generated by BPA during vegetation management activities (e.g., triple-rinsed herbicide containers, broken cutting tools) must be disposed of in state-approved sanitary landfills.

Vegetation management using certain herbicides identified by EPA (40 CFR Part 261) potentially may generate hazardous wastes. Hazardous wastes may include unrinsed herbicide containers, soil or other materials contaminated by spills of concentrated herbicides, and unused herbicide products. These hazardous materials require special handling and disposal according to EPA regulations and state laws. Each

state in the BPA service area has its own agency designated for monitoring and regulation of hazardous waste spills and disposal.

Means for Satisfying Requirements. Requirements pertaining to domestic solid waste are satisfied by BPA partially at the programmatic level by the establishment of routine procedures for disposal of these wastes in state-approved sanitary landfills (as described in BPA's Transmission Line Maintenance Standard). Likewise, requirements pertaining to hazardous wastes are satisfied partially at the programmatic level by incorporating specific instructions on procedures for handling and disposal of herbicide containers and other contaminated materials in the BPA Maintenance Standard. The Maintenance Standard also specifies procedures for cleanup and notification of responsible state agencies in the event of herbicide spills.

Full compliance with solid and hazardous waste requirements is provided by proper implementation of the specified procedures during actual vegetation management activities. For example, full compliance with RCRA is assured when all requirements for handling, storage, transporting and disposal of hazardous wastes are met and the responsible state agencies have been notified when and where necessary.

15d. Pollution Control at Federal Facilities - Safe Drinking Water Act

Description of Requirements. The Safe Drinking Water Act (42 USC 300f et seq.) establishes the national program for protecting drinking water supplied by municipal and industrial water suppliers. Pursuant to the Act, EPA has issued national primary drinking water standards to protect human health (40 CFR Part 141) and national secondary standards for qualities such as taste and odor (40 CFR Part 143). These standards are minimums to be adopted by the states and applied to municipal and industrial water suppliers. Under the Act, states with approved programs have the primary implementation and enforcement authority.

Section 1424(e) of the Act authorizes EPA to determine that an underground aquifer is the "sole source" of drinking water for an area or community and that, if contaminated, the aquifer would constitute a significant hazard to public health. Once an aquifer is so designated, no federal financial assistance is available for projects which may contaminate the aquifer.

Relevancy to Vegetation Management. Requirements of the Safe Drinking Water Act pertaining to drinking water standards do not apply to BPA's vegetation management program since BPA is not a municipal or industrial drinking water supplier.

EPA has designated the Spokane Valley-Rathdrum Prairie aquifer as a "sole source" aquifer (43 FR 5566; February 9, 1978). BPA operates transmission facilities in the recharge area for the aquifer. BPA's vegetation management program does not involve federal financial assistance and therefore is not regulated by the sole source aquifer provisions of the Safe Drinking Water Act. Nevertheless, it is unlikely that BPA's proposed program will contaminate the Spokane-Rathdrum aquifer. The aquifer is large and transmits large volumes of water rapidly. The large dilution factor and the small quantities of herbicides used by BPA in the recharge area ensure that incremental contamination of the aquifer as a result of BPA activities will be insignificant (see Chapter 7 - Public Health).

15e. Pollution Control at Federal Facilities - Noise Control Act

Description of Requirements. The Noise Control Act of 1972 (42 USC 4901 et seq.) established a federal policy as well as various programs for control of noise detrimental to public health and welfare. For example, the Act established a national program to control interstate transportation noise sources.

The Act also requires EPA to set noise emission standards for other major noise sources and empowers EPA to require product labeling for products emitting noise levels capable of adversely affecting health and welfare. Finally, Section 4(b) of the Act requires each federal agency engaged in noise-emitting activities to comply with federal, state, and local requirements for control and abatement of environmental noise.

Relevancy to Vegetation Management. Most BPA rights-of-way and those requiring vegetation control are in remote areas away from noise-sensitive properties. Some vegetation control equipment (e.g., chainsaws, chippers, helicopters) may generate considerable noise. However, noise is minimized by use of mufflers on internal combustion engines and by the fact that vegetation control activities are temporary, occurring every 3-5 years in western Oregon and Washington.

Where state or local noise control standards are in force, the Noise Control Act requires BPA to comply with them. Typically, however, permanent noise sources are regulated more strictly than temporary ones, and industrial sources are regulated more strictly than silvicultural or agricultural activities (comparable to vegetation management).

Means for Satisfying Requirements. Compliance with noise control standards must occur at the project-design and implementation level of BPA's vegetation management program. During rights-of-way inventory procedures, areas where noise levels are restricted must be identified and alternative methods of vegetation control must be substituted if necessary.

15f. Pollution Control at Federal Facilities - Federal Insecticide, Fungicide, and Rodenticide Act

Description of Requirements. The Federal Insecticide, Fungicide, and Rodenticide Act, as amended (FIFRA) (7 USC 136 et seq.) established procedures for the registration, classification, and regulation of herbicides and other pesticides. EPA is responsible for setting standards for the enforcement of FIFRA.

Section 3(a) of FIFRA prohibits the distribution or sale of any pesticide not registered by EPA. As part of the registration process, EPA must classify each pesticide for general or restricted use. Pesticides are classified for restricted use if they present health hazards to applicators or other persons, or if they may cause unreasonable adverse impacts to the environment. Pesticides classified for restricted use must be applied only by or under the direct supervision of a certified applicator (40 CFR Part 162).

Under FIFRA, EPA established regulations for the storage and disposal of pesticide containers and excess amounts of pesticides (40 CFR Part 165). EPA also has set health and safety standards for the protection of workers at the sites of pesticide applications (40 CFR Part 170). Under the Act, the states have primary responsibility for enforcing the various provisions of FIFRA regarding pesticide use and certification of applicators, subject to approval by EPA.

Relevancy to Vegetation Management. The requirements of FIFRA apply directly to the use of herbicides in transmission line vegetation management.

Means for Satisfying Requirements. FIFRA requirements must be complied with both during the development of BPA's vegetation management program and during the design and implementation of individual herbicide treatments. At the programmatic level, BPA has incorporated in its Transmission Line Maintenance Standard and proposed program explicit directions and constraints regarding herbicide use practices (see Chapter 4 - Mitigation Measures). These use specifications are followed in the field to ensure compliance with all applicable federal and state regulations under FIFRA.

BPA proposes to use only herbicides registered by EPA in its vegetation management activities. All herbicides will be used in strict accordance with EPA-approved label instructions. All herbicide applications will be performed by or under the supervision of applicators licensed according to applicable state regulations. Full compliance with FIFRA is assured, therefore, by proper observance of all BPA's herbicide use constraints during actual field applications.

15g. Pollution Control at Federal Facilities - Toxic Substances control Act

Description of Requirements. The Toxic Substances Control Act (15 USC 2601 et seq.) empowers EPA to control production and use of toxic substances. The Act requires manufacturers to give EPA 90 days notice of plans to produce a new chemical or to market a significant new use for an old chemical. EPA may require producers to test selected chemicals, and is empowered to require producers to keep records on new chemicals.

Under the Act, EPA is empowered to regulate any aspect of a chemical use likely to result in an unreasonable risk of serious or widespread injury to public health or the environment. The Act requires specific actions related to polychlorinated biphenyls (PCBs), under which EPA has issued regulations regarding manufacturing, processing, distribution and use (40 CFR Part 761); and disposal (44 FR 66989; November 21, 1979).

Relevancy to Vegetation Management. Vegetation management does not involve the manufacture, sale, or use of new chemicals or of PCBs. All herbicides used by BPA for vegetation control have been previously tested and registered for use by EPA. Therefore, requirements of the Toxic Substances Control Act do not apply to BPA's vegetation management program.

16. Energy Conservation at Federal Facilities

Description of Requirements. NEPA, as amended, and CEQ regulations for implementing NEPA require analyses of the energy requirements and conservation potential of alternative federal projects and actions. In addition to these stipulations, two other federal laws govern energy conservation efforts of federal facilities and operations. The Energy Policy and Conservation Act, as amended (42 USC 6201 et seq.), directs the President to develop mandatory standards for energy conservation and efficiency for federal facilities and actions.

The National Energy Conservation Policy Act (42 USC 8241 et seq.) directs the Secretary of Energy to develop programs to encourage the use of solar energy technology in federal buildings.

Pursuant to these laws, DOE has developed guidelines for federal agencies in developing general operations plans to conserve energy (10 CFR Part 436, Subpart F). "General operations" are defined as agency operations other than building operations; they include operation of motor vehicles and aircraft. (DOE has issued another set of guidelines for energy conservation in federal buildings, 10 CFR Part 436, Subpart C).

Relevancy to Vegetation Management. Vegetation management activities of BPA are considered "general operations" with respect to federal energy conservation requirements. Therefore, BPA is required to develop a general operations plan for energy conservation.

Means for Satisfying Requirements. Motor vehicle and equipment operations during BPA's vegetation management activities are covered by BPA's agency-wide "general operations plan" administered by the BPA "Motor Vehicle Pool". This requirement is therefore satisfied fully.

Summary

Information on environmental requirements, applicability, and means for compliance is summarized in Table 8-1. Levels for compliance are indicated as either programmatic (in this EIS) or as project-level (in subsequent site-specific environmental analyses).

Relationship of Environmental Requirements to Alternative Vegetation Management Programs

Alternative vegetation management programs being evaluated by BPA are comprised of various combinations of available control methods (see Chapter 4 for description of alternative programs). Analyses in the present chapter indicate that the preferred alternative (BPA's proposed program) is able to fully comply with environmental requirements. Full compliance is provided either by overall program design or by a combination of program design and project implementation (see Table 8-1).

Among the various alternative programs evaluated in Chapter 4, all except one would be able to comply with the environmental requirements considered in this chapter. Ability to comply is based on the fact that, at sites where broadcast chemical or mechanical methods might be restricted by environmental laws or regulations, other methods (i.e., manual or spot chemical) would be available to control target vegetation. Compliance is possible in that all instructions, constraints, and mitigation measures described in the BPA Transmission Line Maintenance Standard (see Chapter 4) can be observed by substitution of control methods where necessary.

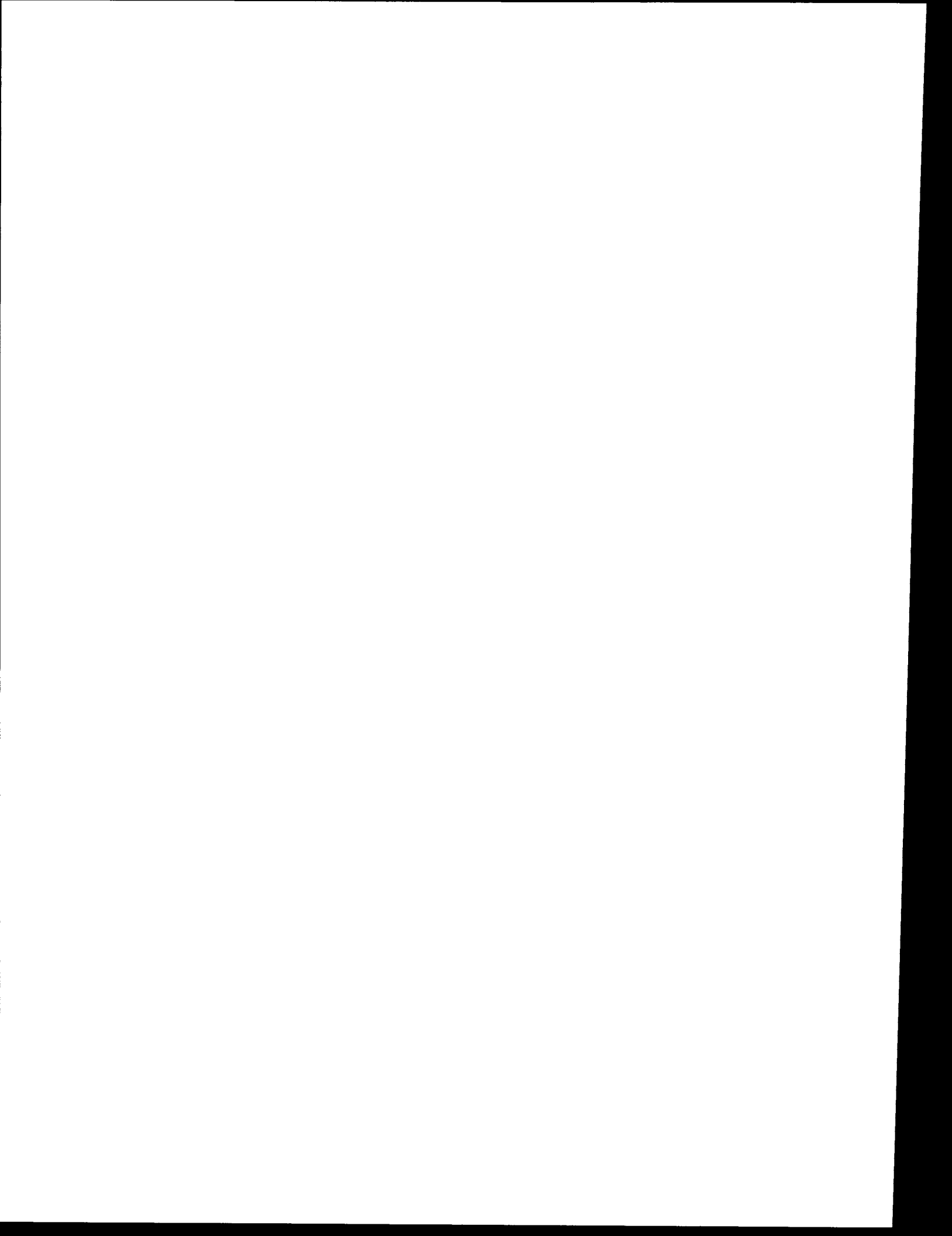
In contrast, the alternative program relying exclusively on broadcast chemical methods would be unable to fully comply with environmental requirements. This is due to the fact that other selective control methods would not be available to substitute in sensitive sites (e.g., stream buffer zones, high sensitivity landscapes, cropland buffer zones).

Permits, Licenses, and Entitlements Necessary to Implement the Proposed Program

BPA's preferred vegetation management program includes the availability of spot chemical, broadcast chemical, manual, and biological control methods, with treatment methods for individual control projects selected based on consideration of social, ecological, and economic consequences. Because the vegetation management program is an ongoing maintenance activity, and because the proposed control methods are those which are currently in use, no new permits, licenses, or entitlements will be necessary specifically to implement the proposed program. A number of permits, licenses, or entitlements required to conduct a vegetation management program are currently in place. These will continue to be renewed periodically as they expire or in response to

changing requirements and/or circumstances. The most important of the existing permits, licenses, or entitlements are:

1. Cooperative vegetation plans for rights-of-way crossing BLM, Forest Service, National Park Service, and U.S. Fish and Wildlife Service lands.
2. For chemical control methods, state manifests for hazardous waste transportation, state certificates for hazardous waste disposal, state licenses for herbicide applicators, and Forest Service permits to use pesticides on National Forest lands.



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Chapter 9

REFERENCES AND BIBLIOGRAPHY

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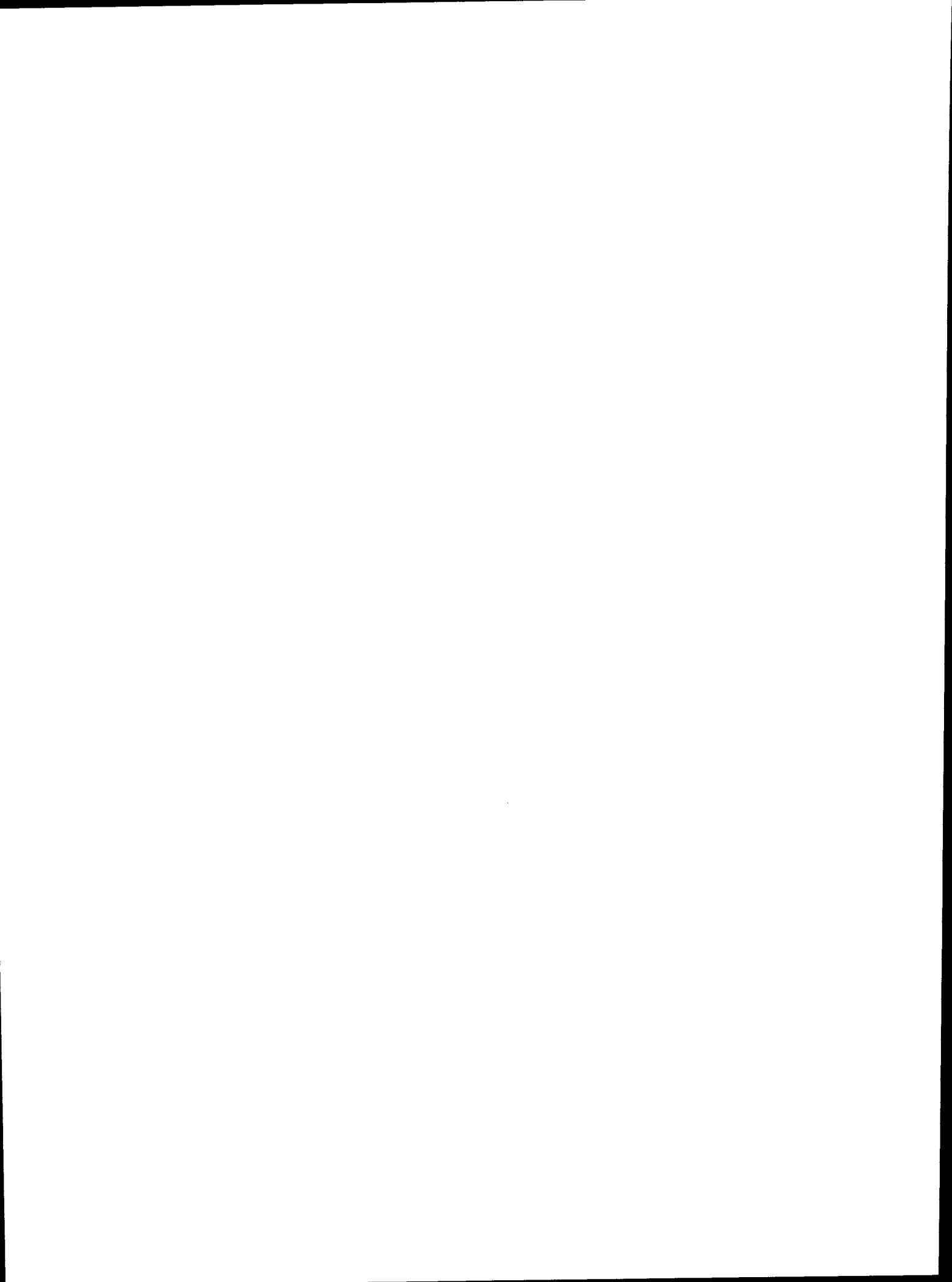
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COMMENTS RECEIVED ON THE DRAFT EIS



Chapter 12

COMMENTS RECEIVED ON THE DRAFT EIS AND RESPONSES TO COMMENTS

Introduction

BPA published the Draft EIS on its Transmission Facilities Vegetation Management Program in September 1982. Approximately 1400 copies of the Draft EIS were distributed to interested citizens and to public agencies. BPA solicited written comments on the Draft EIS and these were accepted during October and November 1982. A total of 68 comment letters were received during the 60-day comment period.

Many of the comment letters addressed similar issues and concerns. Analysis of the content of comment letters indicated nine major areas of controversy concerning BPA's proposed vegetation management program. Each of these major areas of controversy was mentioned in five or more comment letters.

The following section contains nine general responses that address the most frequent comments within the nine major areas of controversy. The general responses are arranged in order of the number of comment letters to which they pertain. For example, the first general response addresses comments raised by 17 comment letters while the last general response addresses comments raised by five letters.

In the section after the general responses, all comment letters received by BPA are printed along with specific responses addressing specific comments in each. Each specific comment is numbered to enable matching with the like-numbered specific response. Where appropriate, commentors are referred to the general responses that follow.

General Responses

General Response A: Preference for Greater Use of Biological Methods of Vegetation Control

Seventeen comment letters (25 percent) expressed preferences for greater use of biological methods by BPA's vegetation management program. These commentors were primarily private individuals but also included federal and local agencies.

In general, these commentators felt that biological control methods should be used wherever feasible due to less potential for adverse environmental impacts as well as more potential for long-term control of target vegetation.

The 17 comment letters contained 23 specific comments about biological methods:

- o 8 letters - more use of low-growing, stable vegetation;
- o 4 letters - more use of livestock grazing (e.g. goats);
- o 4 letters - support for use of wildlife management (see Chapter 3 section on Biological Methods);
- o 2 letters - more use of introduced insects to control noxious weeds; and
- o 5 letters - more BPA research into biological methods.

BPA employs the principles of Integrated Pest Management (IPM) in planning and implementing its vegetation management program (see Chapter 2). A guiding principle of IPM is that naturally-occurring biological control methods should be used wherever feasible. In accordance with this principle, BPA is participating in a cooperative program using an introduced insect to control the noxious weed, tansy ragwort (see Chapter 3 section on Biological Methods). Also, BPA is funding a multi-year research study of a biological strategy to control right-of-way brush (see below). A recent study funded by BPA evaluated the feasibility of using sheep grazing to control right-of-way vegetation (see Chapter 3).

BPA's policy is to allow vegetation to grow on rights-of-way with the least amount of control sufficient to maintain service reliability. Treatments are selected and designed to control target plants without damaging nontarget vegetation (e.g. low-growing shrubs). Typically, this promotes low-growing plant cover on rights-of-way as tall-growing target species are controlled or removed.

The Chapter 7 section on Vegetation describes the dynamics of right-of-way vegetation as affected by alternative vegetation control methods. Manual and spot chemical methods are implemented selectively to remove only those tall-growing plants that may threaten conductor clearance

criteria. Broadcast chemical methods can also be implemented selectively by using herbicide formulations to which only target tall-growing species are susceptible.

Table 7-3 shows the relative susceptibilities of common plant species to the broadcast vegetation formulations proposed for use by BPA. All tall-growing conifer species and several tall-growing hardwood species (e.g. red alder) are highly susceptible to these vegetation formulations. In contrast, common low-growing shrub species such as salal, salmonberry, and huckleberry are resistant or only slightly susceptible to these herbicides.

The result of BPA's vegetation management activities, whether manual, spot chemical, or broadcast chemical, is the creation and maintenance of low-growing vegetation on rights-of-way. The stability of this low-growing plant cover depends on how well it prevents the establishment and growth of tall-growing target species. BC Hydro has reported that dense cover of salal, salmonberry, and huckleberry may prevent tree invasion indefinitely on some of its right-of-way sites (see Chapter 3 section on Biological Methods).

Certain management activities (e.g. right-of-way clearing prescriptions, fertilizing, mulching, planting) may enhance the vigor and density of low-growing shrubs and herbaceous plants, and thereby prevent tree invasion. The long-term costs, benefits, and feasibility of these vegetation activities are not known at this time. A BPA research project studying some of these activities (e.g. mulching and fertilization to stimulate dense grass cover and promote wildlife grazing) is promising but will not be completed until late 1983 (see Chapter 3 section on Biological Methods).

BC Hydro has estimated that such activities would be useful on only a small proportion of its right-of-way area (Miller pers. comm.) BC Hydro is conducting experiments on promotion of low-growing stable vegetation on some coastal sites.

A number of commentators have encouraged BPA to use goat or sheep browsing to control right-of-way brush. Previous studies of the feasibility of livestock grazing for this purpose are described in the Chapter 3 section on Biological Methods. In general, the success of this method depends on the relative palatability of tall-growing target species versus other nontarget species. To effectively control fuelbreak brush in Southern California, it was found that goats should be used at sufficient stocking levels to eat all leaves from all brush species two or three times per year (see Chapter 3).

The economic feasibility of goat browsing to control right-of-way brush has not been studied. However, the recommended Southern California goat browsing frequency of 2-3 times per year appears relatively labor intensive and expensive compared to BPA's present treatment interval of 3-5 years west of the Cascades. In addition, the linear, narrow configuration of transmission rights-of-way imposes practical limitations. Grazing animals would require fencing on right-of-way edges or careful herding. Also, 98 percent of BPA right-of-way requiring vegetation control is owned or managed by others; the vegetation objective of these other entities may conflict with use of livestock grazing on BPA right-of-way (see General Response D below).

BPA participates in noxious weed control campaigns in cooperation with others when its rights-of-way or activities have contributed to a noxious weed infestation. Consideration is given to the use of biological control methods to combat such infestations. For example, BPA is currently active in the biological control effort aimed at tansy ragwort (see Chapter 3 section on Biological Methods). Some have argued that rights-of-way may provide routes for tansy ragwort invasion of areas east of the Cascades. Although biological control agents are in use for other noxious weeds in BPA's service area, BPA is not currently participating in these efforts.

Commentors have encouraged BPA to continue research into biological control methods. BPA's research efforts are described in the Chapter 5 section on Testing and Approval of New Control Methods. A major function of BPA's Branch of Transmission Line Maintenance (BTLM) is to evaluate new control methods. A major research study of wildlife management as a method to control right-of-way brush is nearing completion (see Chapter 3). When a new method has proved effective on target vegetation, cost-efficient, and environmentally-safe, it may be approved by the Chief of BTLM for addition to BPA's vegetation management program.

Further research by BPA may be appropriate for certain aspects of biological methods for control of right-of-way brush. Right-of-way clearing prescriptions for use during transmission line construction may be useful in protecting low-growing species from disturbance; such species may form stable plant cover that can resist subsequent tree invasion on some sites.

Further evaluation of techniques for mulch or sludge applications to promote dense sod formation and thereby prevent tree invasion may be appropriate. A cost feasibility study of goat browsing for right-of-way management in the Pacific

Northwest may also be instructive; such a study could rely on published cost and palatability data to indicate feasibility.

As recommended by one comment letter, applied research effort should be provided to develop seed sources and planting materials for low-growing species that can resist tree invasion on rights-of-way.

BPA intends to stay informed, through its Branch of Transmission Line Maintenance, as to the effectiveness, cost, and environmental consequences of various biological methods of control, as well as of other approaches.

General Response B: Preference for Greater Use of Manual Methods of Vegetation Control

A preference for greater use of manual vegetation control methods was expressed in 16 (24 percent) of the comment letters received on the Draft EIS. The basis for this preference was virtually unanimous among the commentors: nearly all wanted BPA to avoid or minimize the use of herbicides and to provide additional employment opportunities. For example, one commentor suggested that delinquent youths or convicts be used for manual control of vegetation.

Manual vegetation control methods are described in Chapter 3 and the environmental consequences of their use are discussed in Chapter 7. Highlights of their advantages and disadvantages are as follows: The primary operational advantage of using manual methods is the great selectivity that is possible in treating individual plants; for this reason, manual methods are often used by BPA where vegetation screens are to be maintained and where riparian vegetation is to be left to shade streams (spot chemical methods have the same operational advantage). Manual methods are highly effective and relatively efficient in treating low-density stands of target trees and shrubs. Manual methods are also advantageous for use in various types of sensitive sites (e.g. stream buffer zones, areas adjacent to crops) due to their lack of potential adverse impacts on public health, water quality, and adjacent land uses. Use of manual methods also provides more employment opportunities than use of less labor-intensive methods.

Manual methods exhibit a number of operational disadvantages in certain situations. For treatment of high density stands of target brush, manual methods are inefficient and therefore costly. Dense shrub or tree growth blocks access to

stems to be cut and requires a large amount of time to treat. Steep topography is difficult and sometimes hazardous for manual workers to negotiate. Inaccessible sites require long road and foot travel times before work can begin.

The sprouting behavior of several important target species (i.e. red alder, bigleaf maple) can be a problem if manual cutting is used without a cut-stump herbicide treatment to prevent resprouting; otherwise frequent retreatment to control these rapidly-growing species is needed. It is important to recognize that cut-stump treatments involve virtually no risk of herbicide exposure to either the public or the environment; herbicide is applied directly to the cut surface of the stem and to the bark of the stump below the cut surface.

Researchers at the Washington State Department of Natural Resources have reported preliminary findings that the sprouting response of red alder or bigleaf maple may be reduced by cutting during certain times of the day, year, or phases of the moon (see Chapter 3 section on Manual Methods). However, these findings have not been documented in rigorous experimental studies. Further field testing, with provisions for statistical reliability of results, is needed before this strategy for control of sprouting can be used operationally.

A primary disadvantage of manual methods is the greater likelihood of worker safety hazards (see Table 7-13). Manual workers are exposed to site hazards, tool hazards, and transportation hazards. These hazards increase with density of target vegetation, steepness of topography, and remoteness of the treatment site.

Manual methods (e.g. hoeing, hand pulling, chopping) are not practical for three of BPA's vegetation control needs: noxious weed control, substation weed control, or wooden pole protection. BPA does not propose to use manual methods in these situations.

BPA does not retain a large labor force of its own for vegetation control. Roughly 80 percent of BPA's vegetation management effort is contracted. These contracts must follow federal contracting regulations (e.g. federal agencies are prohibited from contracting for convict labor). Contracts must be performed in accordance with contract specifications. For example, with the shift to more selective vegetation control methods (i.e. manual and spot chemical), workers must be capable of distinguishing those tall-growing plants that need treatment (i.e., target

species) from other nontarget species. With lower technical qualifications of workers, BPA's costs for inspection of contract performance increase. For more details on contract costs, see the Chapter 3 section on Typical Costs and Longevity of Treatments.

In its proposed program, BPA would use manual methods in the following situations (see Treatment Selection Guidelines in Table 5-1):

- o within stream and water body buffer zones.
- o in accessible locations of low-density brush.
- o adjacent to susceptible crops or plantings.
- o where vegetation screens are maintained.

Spot chemical methods would be used in these same situations where sprouting species are to be treated. Manual methods alone (i.e. without cut-stump treatments) would only be used where only non-sprouting species (e.g. conifers) were present.

Over the 10-year period 1973-1982, BPA's use of manual methods has averaged six percent of the treated acres in the Puget Sound Area, six percent of treated acres in the Lower Columbia Area, 20 percent of treated acres in the Upper Columbia Area, and 17 percent in the Snake River Area (see Appendix C). Overall, BPA has used manual methods on nine percent of the right-of-way acres treated during the 10-year period.

Most commentators who preferred the use of manual methods desired that BPA reduce or avoid use of chemical methods. It must be emphasized that potential impacts of spot chemical methods differ from those of broadcast (e.g. aerial) chemical methods. Reviewers should also refer to General Responses C, F, H, and I for discussions of comments specifically referring to use of herbicides.

General Response C: Concern About Potential Water Quality Impacts of Herbicide Use

Thirteen commentators (19 percent of all comment letters), expressed concern about potential water quality impacts of BPA's proposed uses of herbicides. The concern pertained both to waters used for human consumption and to waters providing habitat for anadromous fish and other aquatic

organisms. Several commentators drew their domestic water supplies from watersheds crossed by BPA transmission lines and were personally fearful of being exposed to herbicides used on rights-of-way. Five commentators specifically requested BPA to observe larger stream buffer zones than those proposed in the Draft EIS.

BPA's proposed vegetation management program incorporates a number of mitigation measures that will prevent or minimize impacts on water quality from herbicide use (see Table 4-5, Nos. 22-28, 32, 34, 35, 40, and 46). Measure No. 24 requires strict observation of buffer zones at all bodies of water (e.g. streams, ponds, wetlands, seeps). Buffer zones observed for aerial broadcast applications are 100 feet, for ground-based broadcast applications - 50 feet, for spot foliage spray - 50 feet, and for other spot applications - 10 feet. Weather conditions (e.g. wind, humidity, precipitation) are monitored by BPA inspectors on-site at the time of broadcast applications to minimize drift, volatilization, or surface runoff of applied herbicides (Measure No. 25). Aerial spray contractors are required to fulfill BPA's spray delivery specifications (see Chapter 3 section on Techniques for Herbicide Application) before conducting aerial herbicide applications (Measure No. 35).

As indicated in Mitigation Measure No. 26, BPA monitors herbicide residues in streams near treated rights-of-way, when requested appropriately by landowners, land management agencies (e.g. USDA Forest Service), or the Areas. BPA has conducted stream monitoring for more than 10 years. The results of the monitoring program are described in the Chapter 7 section on Public Health. In cases where herbicides were detected in streams, contamination was highly localized, occurred at very low levels, and quickly decreased. Contamination has not been detected at concentrations greater than 50 ppb (0.05 ppm) in stream waters. These monitoring results indicate that stream buffer zones observed by BPA are effective at minimizing water contamination by herbicides.

A worst-case analysis of possible environmental exposures to BPA's proposed herbicide application has been included in the Chapter 7 section on Public Health. Deposition of drift from aerial application or by accidental direct application to a stream are two possible routes for water contamination.

Other routes of stream contamination are less likely (Norris 1981). For example, drift from ground-based spray operations is minimal. Accidental applications to streams from ground-based equipment are highly unlikely; with ground-based equipment, operators are adjacent to the point of

spray deposition and would notice any nearby streams or water bodies.

Detectable contamination of streams may result from erosion of soil particles to which herbicides are adsorbed or from migration through soil. Concentrations observed in water due to contamination by these routes, however, will not reach the levels possible due to drift or accidental direct application (Dost 1983).

BPA proposes to use three herbicide active ingredients in aerial applications: 2,4-D, dicamba, and picloram. Worst-case concentrations of these herbicides in a 10 cm deep stream due to drift are as follows: 2,4-D - 0.067 ppm, dicamba - 0.034 ppm, picloram - 0.017 ppm. A 50 kg (110 pound) person immediately drinking two liters of such water would ingest 0.0026 mg/kg of 2,4-D, 0.0013 mg/kg of dicamba, or 0.0006 mg/kg of picloram. This worst-case scenario assumes that none of the normal rapid reduction in stream concentration (due to dilution, elution, and adsorption on sediments) occurs before the water is consumed. When these one-time doses due to drift are compared to the reproductive no-effect levels known for the three herbicides, safety factors of 7,700, 2,300, and 123,000 respectively, result (see worst-case analysis in Chapter 7).

If accidental direct aerial application to a stream occurs (e.g. if the aerial operator fails to observe the 100-foot stream buffer zone), initial worst-case concentrations would be as follows: 2,4-D - 6.72 ppm, dicamba - 3.36 ppm, and picloram - 1.68 ppm. Resulting safety factors for a 50 kg person would be 74 for 2,4-D exposures, 21 for dicamba, and 1,180 for picloram (see worst-case analysis in Chapter 7). A safety factor of 74 signifies that the 50 kg person would have to simultaneously ingest 74 worst-case doses before exposure would equal the maximum testing dose at which no effects on reproduction occurred in test animals.

The herbicides proposed for use by BPA do not accumulate in biological organisms. Any dose experienced by an animal or human will be rapidly cleared from the body (see Herbicide Background Statements).

Several commentors specifically cited the potential hazard of 2,4-D esters to aquatic organisms as a reason to more rigorously protect stream habitats from accidental or unintentional deposition of these formulations. Please see General Response I for discussion of this issue.

Cumulative impacts of herbicides applied by BPA in addition to other uses were of concern to some commentors. The

proportion of any particular watershed occupied by BPA right-of-way is generally very small. Only a small portion of this would be treated with herbicides in any particular year, if at all. Thus, BPA's proposed use of herbicides would contribute little to the cumulative herbicide input to that watershed from all uses (e.g. agriculture, forestry, lawns, and gardens plus right-of-way uses).

Concern was expressed for the possibility of drinking water chlorination interacting adversely with herbicides. If herbicides or their breakdown products find their way into surface or groundwaters, they become associated with substances generally classed as organic matter. Humic substances which result from the decay of organic matter contribute the greatest amount of organic material to drinking water (Condie et al. 1983). Some humic substances are chlorinated during water disinfection and toxic derivatives, such as chloroacetones, chloroacetonitriles, chloroacetic acids, chlorobutanones, chloropropenes, and chloropropenonitriles are formed (Ringhand et al. 1983). The contribution that herbicide residues might make to the organic load in water would be extremely low (usually negligible) relative to the total load. Whether the chlorinated organics are of health significance is uncertain and the subject of current toxicological studies.

Adverse synergistic interactions among herbicides or between herbicides and other chemicals are alleged by one commentator. As a result of the interaction, a biological response (e.g. toxicity) might be greater than would be expected from either substance alone. When herbicides are applied, the highest levels of exposure of vegetation and nontarget organisms occur at the time of application. As a consequence of physical, chemical, and biological processes, the materials used as herbicides are broken down to less toxicologically-significant products. This breakdown process which occurs with natural as well as synthetic chemicals minimizes the possibility that there will be synergistic interactions among herbicides or their degradation products. No synergistic reactions are known among herbicides proposed for use by BPA.

BPA endeavors to undertake vegetation management in a manner that is compatible with landowner objectives along its right-of-way. BPA may enter into agreements with landowners to promote such compatibility (see Mitigation Measure No. 6 in Table 4-5). For example, where appropriate, agreements may specify exclusion of all herbicides, application techniques, timing of treatments, or notification before treatments. Such agreements may be formal or informal. BPA

currently has agreements with several municipal water supply ownerships regarding limitations on herbicide use.

This EIS has identified a number of mitigation measures that would further reduce the likelihood of adverse effects on water quality from BPA's proposed program. These measures are not presently incorporated in the proposed program or alternatives. One measure (No. 33 in Table 4-5) entails monitoring of groundwater and surface water at substations to better understand the potential for water supply contamination. Measure No. 41 would entail flagging of stream buffer zones to ensure their observance by aerial applicators. Under Measure No. 42, aerial spray delivery systems would be shut off 150 feet from streams to ensure no herbicide deposition within the stream buffer zone. In order to further reduce the potential for adverse impacts on aquatic organisms, Measure No. 44 would eliminate use of 2,4-D esters where danger of contaminating water bodies exists. For discussion of the process for BPA's adoption or rejection of these additional mitigation measures, see General Response E.

General Response D: Preference for Greater Use of Multiple-Use Agreements

Ten comment letters (15 percent) encouraged greater use of multiple-use agreements to effect control of right-of-way vegetation. In general, these commentators saw such agreements as a way to lessen BPA's use of herbicides as well as to provide landowners the option of selecting the vegetation control method to be used on their lands.

Multiple-use agreements are described in detail in the Chapter 3 section on Multiple Use Arrangements with Landowners. It is BPA policy to promote the development of compatible land uses on BPA rights-of-way. System-wide, BPA rights-of-way occupy roughly 200,000 acres; of this, 116,000 acres are presently in compatible land uses (e.g., agriculture, rangeland) such that no brush control is required.

On approximately 84,000 right-of-way acres, BPA must actively control tall-growing vegetation. Approximately 70 percent (58,800 acres) is owned by private individuals or corporations. On these private lands, owners may enter into "Tree and Brush Control Agreements" with BPA, whereby the owners assume responsibility for managing right-of-way vegetation on their properties (see details in Chapter 3). BPA provides no cost reimbursement to landowners for maintenance work under the agreements.

Several commentators encouraged BPA to lease or make available at no charge right-of-way lands for grazing, in order to control brush. BPA is prohibited by federal law from participating in such auxiliary activities on its own lands (about 1,700 acres of those needing brush control). On private lands (58,800 acres), BPA does not have the prerogative to promote such activities; that right is retained by the landowners. On lands administered by public agencies (22,700 acres requiring brush control), right-of-way management plans are cooperatively developed by BPA and the responsible agencies.

Six commentators urged BPA to more actively promote multiple-use agreements with landowners. Such a promotional effort would apply to the 58,800 acres privately held and needing brush control. Past BPA experience with these agreements is highly variable (see Chapter 3); many landowners default on agreements requiring BPA to incur the brush control cost in addition to the initial cost of administering the agreements.

Other utilities have attempted cost-sharing programs with landowners to stimulate more landowner interest and less defaulting on brush control agreements (see Chapter 3). In preparing the Final EIS, two of these utilities were contacted to determine how successful the programs have been (see Chapter 3). In both cases, landowner interest in establishing agreements has been low and the rate at which established agreements are defaulted has been high. These utilities thus have incurred both agreement-administration costs as well as vegetation treatment costs.

A mitigation measure identified in this EIS but not included in the preferred program or alternatives is that BPA investigate the feasibility of establishing a cost-sharing program with landowners (see No. 18 in Table 4-5). A decision on this mitigation measure will be explained in the Record of Decision on the Final EIS (see General Response E).

General Response E: Support for Mitigation Measures Not Included in the Proposed Action or Alternatives

Nine comment letters (13 percent of those received on the Draft EIS) expressed support for those mitigation measures not included in the proposed action or alternatives, but which could further reduce the likelihood of adverse impacts. All mitigation measures are listed in Table 4-5.

The greatest support (seven letters) was expressed for mitigation measure No. 33 - "monitor the fate of herbicides in groundwater and surface water at substations where

herbicides are used at high application rates." Several of these commentors were concerned about the potential for water supply contamination due to substation herbicide applications and likewise were concerned that the possibility of such contamination had not been studied by BPA.

The second greatest support (six letters) was given to mitigation measure No. 44 - "eliminate use of 2,4-D ester formulations where any danger of contaminating water bodies exists, due to toxic effects on aquatic organisms." Five letters supported mitigations measure No. 41 - "flag edges of stream buffer zones to ensure that helicopter operators recognize their presence; monitor a sample of stream buffer zone edges using spray deposit cards to evaluate observance of edges by aerial applicators."

The following mitigation measures each received support in four comment letters:

- o No. 16 - "develop management guidelines for selection of treatment methods; document guidelines in instructional memoranda to Area staffs."
- o No. 17 - "document rationale for selection of treatment method for each management unit."
- o No. 42 - "to ensure no aerial application within 100-foot stream buffer zone, require shutoff of spray delivery system 150 feet from stream."
- o No. 48 and
No. 54 "in riparian areas, retain adequate shading of streams to prevent elevated stream temperatures."

Three comment letters expressed support for all 16 mitigation measures not currently included in the proposed action or alternatives. In general, the pattern of support for the mitigation measures indicates that water quality (both surface and groundwater) and documentation of BPA's vegetation management performance (through measures Nos. 16, 17, 33, and 41) are of greatest concern to these commentors.

BPA will make a decision with respect to its future Transmission Facilities Vegetation Management Program no sooner than 30 days after the notice of availability of this Final EIS is published in the Federal Register. During this 30-day period, BPA will conduct a careful review of the Final EIS, including the various mitigation measures and

public and agency comments received. The decision, once it is made, will be documented in a Record of Decision (ROD) which will be made available to the public.

In the ROD, BPA will identify which alternative is environmentally preferable. BPA will also state which alternative vegetation management program it has selected. The ROD will also identify the mitigation measures which BPA has committed itself to adopt and incorporate in its selected program.

In addition, the ROD will state whether all feasible mitigation measures have been adopted. Mitigation measures identified in this EIS that are not presently incorporated in the proposed action or alternatives will either be (1) adopted, or (2) an explanation will be provided stating why they were not adopted.

General Response F: Opposition to Broadcast Chemical Methods of Vegetation Control

Eight commentors (12 percent of all commentors) expressed opposition to use of broadcast chemical methods in BPA's vegetation management program. Three of these commentors sought elimination of broadcast treatments from BPA's program, while the other five desired that use of broadcast treatments be minimized to the extent possible.

Several of these commentors based their opposition on past examples (not BPA's) of aerial herbicide spraying mistakes, on the potential for hazard due to future possible errors by BPA's aerial applicators (e.g. overlooking of stream buffer zones), and on general doubts that BPA's aerial applications would be implemented as described in the EIS.

Selection of specific treatments for specific right-of-way management units requires consideration of a number of factors such as condition of target vegetation, site accessibility and topography, and proximity of sensitive resources. Treatment selection requires careful judgement on the part of Area Right-of-Way Maintenance Specialists. Such judgement is made in the context of general guidelines that indicate the types of situations where particular treatment methods would be used (see Chapter 5 and Table 5-1).

The guidelines for use of broadcast chemical methods are as follows: BPA proposes to use broadcast chemical methods in situations where potential for damage to sensitive resources is minimal and where other vegetation control methods are

inefficient. More specifically, ground-based broadcast treatments (i.e. foliage sprays applied with high-volume hose sprayers) are constrained by the following general guidelines: (1) they would take place at least 50 feet away from the nearest body of water; (2) they would be used for controlling low or high density brush at accessible locations; and (3) they would be used for controlling noxious weeds at accessible locations. Aerial broadcast treatments are constrained by the following general guidelines: (1) they would take place at least 100 feet away from the nearest body of water; (2) they would be used in inaccessible locations (also accessible locations in some cases) of uniform and high density brush stands; (3) they would be used in controlling inaccessible locations of dense and extensive noxious weed populations; (4) they would not be used adjacent to susceptible crops or plantings or where extensive brownout is unacceptable.

The treatment selections made in accordance with these general guidelines manifest themselves in two ways: (1) Working Instructions, or (2) Work Statements. For work to be performed by BPA's own Force Account Personnel, treatment selections for various sections of right-of-way are described in detailed Working Instructions. The BPA Foreman overseeing the Force Account work is responsible for seeing to it that the Working Instructions are adhered to and signs them off upon their successful completion. For work performed by contract (all aerial broadcast treatments are contracted out), treatment selections for the various sections of right-of-way are described in detail in the Work Statement, which is incorporated into the contract itself. An inspector is assigned to the contract by the appropriate BPA Area Office. The contract inspector is responsible for overseeing the performance of the contract and seeing to it that the treatment selections spelled out in the Work Statement are adhered to. Daily reports are filled out by the inspectors bearing witness to contract compliance.

In some instances, BPA enters into agreements with landowners to facilitate compatibility of vegetation management activities with landowner objectives (see no. 6, Table 4-5). For example, where appropriate, agreements may specify types of treatments to be used, type or application technique of herbicide treatments, type of other control methods, timing of treatments, and notification before treatments. Such agreements may be formal or informal. Where such agreements have been entered into, documentation is available on an individual-ownership basis as part of the landowner agreement with BPA.

Where BPA rights-of-way cross public lands administered by the U.S. Forest Service or the Bureau of Land Management, treatment selections for the various sections of rights-of-way are documented in detailed management plans (see Chapter 8 section on Permit for Right-of-Way on Public Land). These plans are jointly prepared by BPA and the land managing agency pursuant to Memoranda of Understanding with both USFS and BLM. BPA also works closely with other land managing agencies, Indian tribes, and the States in seeking mutually acceptable management prescriptions. All of the above policies and practices (trained specialists exercising careful judgement in making treatment selection; adherence to Treatment Selection Guidelines, Working Instructions, and Work Statements; contract inspection; landowner agreements; and Right-of-Way Management Plans entered into with land managing agencies) give evidence of BPA's commitment to implement its vegetation management program in an environmentally-sound manner, as described in the EIS. These practices also adequately document that the program is implemented in this manner.

Although BPA has used aerial treatments in the past and proposes to use them in its future program, BPA does not use such methods exclusively. For the 10-year period, 1973-1982, the average numbers of BPA right-of-way acres treated by each vegetation control method are tabulated in Appendix C for each BPA Area. During this period, aerial broadcast treatments were used on 24 percent of the treated acres in the Puget Sound Area, 20 percent of the treated acres in the Lower Columbia Area, 10 percent in the Upper Columbia Area, and zero percent in the Snake River Area. Over the entire BPA Service Area, the aerial broadcast method was used on 19 percent of the acres treated during the 10-year period.

Broadcast chemical methods (both ground-based and aerial) have technical advantages for certain kinds of situations. Large areas can be treated using relatively few people in short periods of time. Where the treated area is densely occupied with target vegetation (e.g. 2,000 stems per acre), treatment efficiency is high; this derives from the fact that high costs of equipment, fuel, and chemicals are spread across many treated plants. However, where the treated area is sparsely occupied by few target plants (e.g. 20 stems per acre), treatment efficiency is low; high costs can be apportioned to few target stems.

Broadcast aerial treatments are not hampered by dense vegetation, steep topography, or lack of good access roads as ground-based manual and spot chemical methods are. Therefore, aerial treatments reduce the safety hazards to workers if ground-based methods were required for treatment

of such sites (see Chapter 7 section on Occupational Safety). Minor occupational hazards are associated with broadcast aerial treatments.

Broadcast treatments can be implemented selectively to control certain types of vegetation while not damaging other types. Herbicide selectivity depends on the type of vegetation formulation used, its rate of application, the type of vegetation treated, and the season of application. Three herbicide mixtures are proposed for use by BPA in broadcast applications. Tall-growing conifer species and some tall-growing hardwood species are highly susceptible to these mixtures (see Table 7-3). In contrast, most shrub species, grasses, and ferns are resistant or only slightly susceptible. Therefore, BPA's proposed aerial vegetation treatments would be relatively selective for control of tall-growing target vegetation.

Broadcast aerial treatments can potentially damage adjacent land uses, stream water quality, and visual quality if not restricted from treatment of sensitive sites and not carefully implemented. For these reasons, BPA's proposed program incorporates a number of mitigation measures to minimize the potential for adverse impacts (see Table 4-5, Nos. 24-26, 29-31, and 34-40). In addition, a number of mitigation measures not included in the proposed action of alternatives are identified in Table 4-5 (see Nos. 41-44); these could further reduce the likelihood of adverse impacts from broadcast treatments.

Mitigation measure No. 35 requires that aerial spray contractors satisfactorily fulfill BPA's aerial spray delivery specifications (see Chapter 3 section on Techniques for Herbicide Application). These specifications require aerial spray contractors to pass rigorous pattern and drift control tests. BPA inspectors test contractor performance of the specifications on a right-of-way after award of aerial spray contracts.

Other presently-incorporated mitigation measures include 100-foot buffer zones along streams and water bodies, monitoring of weather conditions to minimize drift, inspecting rights-of-way immediately prior to broadcast applications, 10-foot buffer zones at right-of-way edges, and restriction of broadcast treatments to remote areas with limited access.

Mitigation measures not presently incorporated in the proposed action that could further reduce the likelihood of adverse impacts from broadcast applications are:

- o No. 41 - Flag the edges of stream buffer zones to ensure their observance by helicopter operators;
- o No. 42 - Require aerial spray system shut-off 150 feet from streams to prevent spray deposition within the 100-foot stream buffer zone;
- o No. 43 - Use broadcast methods primarily on high density stands of target species; and
- o No. 44 - Eliminate use of 2,4-D ester formulations where any danger of contaminating water bodies exists.

For details of these mitigation measures, see the Chapter 4 section on Mitigation Measures. Also see General Response E.

For more than 10 years, BPA has monitored stream water quality near rights-of-way treated by aerial broadcast applications (see Chapter 7 section on Public Health and mitigation measure No. 26 in Table 4-5). The results of this monitoring have shown that detectable herbicide residues have in some cases entered streams; however, in all cases where detection occurred, contamination was less than 0.05 ppm (parts per million).

Among the three herbicide active ingredients proposed for use by BPA in broadcast applications, dicamba has the lowest reproductive no-effect level (3 mg per kg per day) as shown by toxicity testing. A 50 kg (110 lb) person drinking 2 liters of water containing 0.05 ppm of dicamba would ingest 0.05 mg per liter per day = 0.1 mg per day = 0.002 mg per kg per day. With a non-effect level of 3 mg per kg per day, a safety factor of 1,500 would exist (see Worst-Case Analysis in the Chapter 7 section on Public Health).

The data presented in this EIS indicate that broadcast herbicide applications as proposed by BPA pose little hazard to public health. Other mitigation measures not included in the proposed action or alternatives could further reduce the likelihood of adverse impacts. Additional details of BPA's monitoring results and analysis of potential public health effects are provided in the Chapter 7 section on Public Health.

General Response G: Preference for Documentation of Treatment Selection and Notification of Treatment Implementation

Six comment letters (nine percent of commentors) expressed desire for additional documentation of BPA's selection of individual vegetation control treatments, or desire for additional notification of landowners when treatments are to be implemented. These commentors represented viewpoints both supportive of and opposed to herbicide use by BPA.

Five commentors specifically requested that BPA document the rationale by which a treatment is selected for each right-of-way management unit. The basis for this request is to enable interested members of the public to track the reasoning behind any particular treatment used on a specific site. Two of the six commentors wanted BPA to notify all landowners, as a general practice, whenever herbicides were to be used on rights-of-way.

BPA currently has policies on documentation of vegetation management activities and treatment implementation and on notification of landowners. BPA's ROWDATA computerized data storage system is described in the Chapter 5 section on Development of Vegetation Management Prescriptions. A ROWDATA record is maintained for each right-of-way management unit; the record contains detailed information on date and method of last treatment, the type and application rate of herbicide (if used in the last treatment), and the unit's land classification (see Chapter 5). Critical or sensitive areas (e.g. stream buffers) are also identified in the ROWDATA records.

As each treatment is implemented, a Daily Brush and Weed Control Report (see mitigation measure No. 10 in Table 4-5) is completed by BPA vegetation management personnel. This report documents how and under what conditions (e.g. weather) a treatment was implemented. Some of this information is subsequently entered into the ROWDATA record for the management unit. Also see General Response F.

BPA's present notification policy is described in Table 4-5 (see mitigation measures No. 6 and No. 30). Two herbicides proposed for use by BPA (i.e. dicamba and picloram) have EPA-approved label restrictions pertaining to grazing. When these herbicides are planned for use on lands showing evidence of grazing, BPA notifies the respective landowners to remove livestock from the right-of-way for a specified period of time during and after herbicide application (mitigation measure No. 30).

It is also BPA policy to establish agreements with landowners to facilitate compatibility of vegetation management activities with landowner objectives (mitigation measure no. 6). Under such formal or informal agreements, BPA may agree to notify landowners before rights-of-way on their lands are treated. Such agreements may also specify types or timing of treatments to be used. Thus, BPA's present notification policy extends to those landowners who request appropriately to be notified.

This EIS has identified a mitigation measure not included in the preferred program or alternatives calling for additional documentation for BPA's vegetation management program (see No. 17 in Table 4-5). Under this measure, BPA would document the rationale upon which a treatment method is selected for each management unit. The purpose of this documentation would be to provide evidence in the treatment record of what factors led BPA to select a particular control method for a specific treatment site. Therefore, the documentation would show for the record that BPA had considered on a site-specific basis the social, environmental, and economic consequences of the various available treatment methods (i.e. used an IPM decision process).

Adoption of such a policy would have both costs and benefits. On the benefit side, BPA would be able to show on the record that it had considered relevant factors in choosing a given treatment method in each particular situation. BPA's reasoning behind each individual decision at each treatment site could be reviewed (by outside parties if necessary) if an issue arose at a particular site. BPA monitoring of treatment effectiveness would have the advantage of having access to the reasoning behind previously using a particular treatment method.

On the cost side, BPA staff feel that such a policy could become a burdensome exercise in record keeping. For example, approximately 84,000 acres of BPA right-of-way, subdivided into 42,000 management units, require vegetation management. Several thousand management units require decisions on selection of control treatments in each Area in each year (see Chapter 5).

BPA's treatment selection decisions are not arbitrary. Decisions on vegetation management prescriptions are made in accordance with the BPA Transmission Line Maintenance Standard (No. 63040-50). Management prescriptions are developed through a five-step process: (1) field inspections; (2) use of low-level photography, ROWDATA, and plan and profile drawings; (3) contract development and

implementation; (4) landowner notification; and (5) monitoring (see Chapter 5 section on Development of Vegetation Management Prescriptions). Decisions on vegetation management prescriptions are influenced by many factors. General guidelines used in selecting treatments for individual management units are identified in Table 5-1. Treatment implementation is documented in Working Instructions and Work Statement. See General Response F.

This EIS does not recommend a broadening of BPA's notification policy. BPA rights-of-way may cross many separate ownerships within short distances. Landowners are often absentee for backcountry ownerships. Ownerships often are bought or sold within BPA's typical treatment intervals (e.g. every 10 years east of the Cascades). Therefore, a policy of notifying all landowners would be a costly task, involving many person-hours to track down current owners and their addresses.

This EIS has concluded that the present on-request notification policy is sufficient; landowners who are concerned about BPA vegetation management practices should contact the Area Right-of-Way Maintenance Specialist responsible for right-of-way on their lands.

General Response H: Opposition to Use of Picloram Herbicide

Five comment letters (representing 7 percent of all commenters) expressed opposition to the use of picloram in BPA's vegetation management program. These commentors cited a number of reasons for their opposition; the most frequently mentioned concern was regarding the invalidation of previous testing results by EPA and a new study asserting carcinogenic effects of picloram. Other comments contained in the five comment letters pertained to picloram's known soil persistence, mobility in water, and "restricted use" classification.

A new section has been added to the Picloram Herbicide Background Statement (see Appendices) entitled Recent Developments in Toxicity Testing. The new section discusses several recent allegations regarding carcinogenicity of picloram and EPA's handling of these allegations. The current status of findings on picloram is as follows:

- o Short-term toxicity testing results continue to support the current registration and uses of picloram.

- Several negative long-term toxicity studies were found invalid and are being repeated.
- The publication by Reuber (1981) has not been supported by the institutions with which he was associated.
- A long-term study that found benign tumors has not been considered positive evidence for increased human cancer risk due to the high doses producing the benign tumors, and due to the low potential for human exposure from current use practices for picloram.
- EPA has concluded that no evidence currently exists that picloram poses risks of unreasonable adverse effects to human health, although more long-term testing data are needed.

Evaluation of health and environmental effects is a dynamic, continuing process. BPA's proposed uses of picloram are consistent with registered label prescriptions and, given the current state of scientific knowledge, these proposed uses pose a minimal risk of adverse health effects.

Much confusion exists with regard to picloram's "restricted use" classification. The classification requires that only certified applicators may apply picloram. The classification was assigned due to picloram's high potency to vegetation in combination with its high mobility in soil. Picloram may travel through the soil from sites where applied to damage nearby nontarget plants. Certified applicators are trained to apply herbicides in such a manner that nearby nontarget vegetation is not killed or damaged due to surface runoff or leaching of the applied herbicide. The restricted-use classification was not assigned because of known or suspected human health risks.

Several commentors cited a study by Woodward (1976, see Picloram Background Statement for full reference) in which the growth and survival of lake trout fry were altered at picloram concentrations of 0.035 ppm held constant for 60 days. In a subsequent study, Woodward (1979) used concentrations that decreased over a 60-day period to simulate actual field behavior of picloram. At an initial test concentration of 0.29 ppm decreasing to 0.048 ppm, no effect on cutthroat trout fry survival or growth was detected. Woodward (1979) concluded that picloram should be used in a manner that ensures stream residues do not exceed 0.29 ppm during the first rainfall after application (see Picloram Background Statement).

BPA's proposed maximum rate of picloram application is 1.5 pounds per acre. Stream residue monitoring by BPA over the last 10 years has not detected picloram at concentrations greater than 0.05 ppm. The Picloram Background Statement describes other studies of stream residue monitoring (e.g. during the first rainfall after application). These studies indicate that at BPA's proposed application rate, picloram residues will not reach biologically-significant levels, although they may be detectable.

It must be emphasized that detection does not represent hazard in itself. Hazard is a function of level of exposure relative to known levels at which toxicity symptoms have occurred in test organisms.

Commentors have expressed concern about the known persistence of picloram in soils where applied. Results of many studies of soil persistence are reported in the Picloram Background Statement. Picloram residues have been detected for up to three years in soils. Such residues have not been found at levels that pose a toxicity hazard to humans or wildlife. Although the persistence and mobility of picloram in soil may result in its detection in nearby streams, levels detected in streams or other water sources have not reached concentrations that are toxicologically-significant (see Picloram Background Statement).

A worst-case analysis of potential human exposures to herbicides proposed for use by BPA in right-of-way foliage applications has been included in the Chapter 7 section on Public Health. In all of the worst-case scenarios (which assumed no degradation, adsorption, dilution, or other normal decrease in herbicide concentrations), substantial safety factors exist with respect to potential human exposures to picloram. This finding derives from the pattern of use proposed by BPA in conjunction with the low order of toxicity known for picloram.

General Response I: Opposition to Use of 2,4-D Herbicide

Five commentors expressed opposition to BPA's proposed use of 2,4-D for vegetation management. Four of these commentors also expressed opposition to BPA's proposed use of picloram (see General Response H). Opposition to the use of 2,4-D was based primarily on recent assertions of its carcinogenic potential.

Several commentors cited a manuscript attributed to Reuber which alledged that cancerous tumors had been caused in rats by test exposures to 2,4-D. Although originally circulated

in 1979, this manuscript has not been subjected to peer (scientific) review and remains unpublished in the scientific literature.

The International Agency for Research on Cancer (IARC) evaluated previous studies on 2,4-D carcinogenicity and concluded that existing data were inadequate (IARC 1977, see full reference in 2,4-D Background Statement). These previous studies used methodologies that are outdated by present EPA testing standards. Due to previous testing inadequacies, an industrial task force of 2,4-D manufacturers is conducting additional chronic toxicity testing. A lack of reliable data (i.e., data gaps) rather than evidence of adverse health effects led to this additional testing (see Addendum to 2,4-D Background Statement).

A review by Shearer (1980) concluded that the previous inadequate carcinogenicity studies suggested 2,4-D may have had some unknown role in stimulating the rate of cancer cell development in test animals. By itself, this suggestion cannot be considered evidence of carcinogenic potential of 2,4-D. The additional studies, using adequate, modern testing methodologies must be awaited to provide either positive or negative evidence of such potential.

Various allegations of teratogenic and mutagenic activity of 2,4-D have been made. Teratogenic effects have occurred in testing studies at high doses approaching levels that produce acute toxicity. Weak mutagenic effects of 2,4-D have been found but are not known to pose an environmental hazard to humans (see 2,4-D Background Statement). The available scientific evidence indicates that levels of exposure possible from uses in vegetation management are well below toxic thresholds.

As was pointed out in the 2,4-D Background Statement, much of the controversy surrounding the use of herbicides is related to chlorodibenzodioxin impurities found in 2,4,5-T. The herbicide 2,4,5-T can contain part per million amounts of the extremely toxic contaminant, 2,3,6,7- tetrachloro-dibenzo-p-dioxin (TCDD). BPA does not use 2,4,5-T. 2,4-D, which is used by BPA, does not contain TCDD.

Commentors have expressed concern for public health hazards alleged to be posed by two contaminants present at low levels in 2,4-D. DCDD (2,7-dichloro dibenzo-p-dioxin) has been found in a small number of 2,4-D samples produced in the United States. Another contaminant, 2,4-dichlorophenol (2,4-DCP) occurs commonly in manufactured 2,4-D and also is the immediate microbial breakdown product of 2,4-D in the environment.

Dost (1983) analyzed the potential for public health hazard from DCDD and 2,4-DCP. DCDD is about one million times less toxic than the well-known dioxin TCDD. The toxicity of 2,4-DCP is also very low. Dost (1983) concluded that the potential environmental exposure to 2,4-DCP is so low that it cannot be quantified. Potential exposures to DCDD are similarly low. Thus, at maximum occupational or environmental exposures to 2,4-D, neither 2,4-DCP or DCDD represent a public health hazard.

Concern for 2,4-D effects on aquatic organisms has been expressed by commentators. Acute and chronic toxicity testing on trout has provided no-effect levels of approximately 0.030 ppm for some 2,4-D ester formulations (see 2,4-D Background Statement). A worst-case analysis of accidental aerial applications directly on small streams (see Chapter 7 section on Water Quality and Fisheries and Table 7-5) shows that instantaneous initial concentrations in 10 cm deep water could reach 4.5 ppm for 2,4-D esters as proposed for use by BPA. Drift from BPA aerial applications where a 100-foot buffer zone is observed could result in an initial concentration in 10 cm deep water of 0.045 ppm of 2,4-D ester (see worst-case analysis in Chapter 7 section on Public Health).

This evidence indicates that BPA's proposed use of 2,4-D esters could adversely affect fish and other aquatic organisms at the initial point of herbicide deposition on a stream. Two factors, however, will limit this effect: 2,4-D esters are rapidly hydrolyzed to less toxic amine forms in water; the rate of this hydrolysis is pH and temperature dependent. Secondly, the initial worst-case concentrations in a stream will be rapidly reduced by dilution, elution, adsorption, and degradation in the stream environment. Due to these factors, adverse aquatic effects will be limited to local stream reaches where deposition occurred and will be short lived.

Due to this limited potential for hazard to aquatic organisms, this EIS has identified several mitigation measures not presently included in BPA's proposed vegetation management program (see Nos. 41, 42, and 44 in Table 4-5). These measures, if adopted by BPA, could further reduce the likelihood of adverse effects on aquatic organisms resulting from BPA vegetation management.

A worst-case analysis of potential human exposures to herbicides proposed for use by BPA in right-of-way foliage applications is included in the Chapter 7 section on Public Health. The worst-case scenarios assume none of the normal decreases in herbicide concentration due to degradation,

adsorption, or dilution before potential human exposures. The patterns of use proposed by BPA are compared to reported no-effect levels for adverse reproductive effects in order to provide minimum safety factors. Substantial safety factors are evident for most potential routes of human exposure (see General Response C).

Low safety factors were calculated for exposures through ingestion of stream water contaminated when no buffer zone is observed and through consumption of berries sprayed on a right-of-way immediately beforehand. Although the likelihood of these two worst-case scenarios is very small, the necessity of rigorously observing stream buffer zones, inspecting rights-of-way immediately prior to broadcast applications, and inspecting aerial applicators to ensure compliance with BPA's spray delivery specifications remains (see Nos. 34, 35, 36, and 40 in Table 4-5).

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320	Dorothy Beason, Hermiston OR	10/05/82
321	Thomas Menten, Boise ID	No date
322	Bradley Barber, Moscow ID	10/06/82
324	Joan Chantler, Portland OR	No date
326	Office of Archaeology & Historic Preservation Olympia WA	10/05/82
327	B. Rowe, LaGrande OR	No date
328	Dan Sprague, Clatskanie OR	No date
329	Roger Gregory, Priest River ID	10/08/82
330	Cooperative Extension Service, Sanders County MT	10/07/82
331	U.S. Dept. of Housing & Urban Development Denver CO	10/07/82
332	Eileen Gruhn, Richland WA	10/05/82
333	Oregon Parks & Recreation Division, Salem OR	10/11/82
335	Montana Historical Society, Helena MT	10/07/82
336	Robert Johnson, Orondo WA	10/16/82
337	Tacoma-Pierce County Health Dept., Tacoma WA	10/14/82
338	Glenn Mattson, Columbus OH	No date
339	U.S. Dept of Health & Human Services	10/22/82
340	Breitenbush Community, Detroit OR	10/21/82
341	Linda Thomas, Walla Walla WA	10/22/82
342	City of Salem, Salem OR	10/26/82
343	Jack Riehl, Walla Walla WA	10/25/82

344	Washington State University, Pullman WA	10/26/82
345	Bill Proctor, Boise ID	10/28/82
346	Oregon Dept. of Land Conservation & Development Salem OR	10/22/82
347	Oregon State Clearinghouse, Salem OR	11/02/82
350	Pamela Septech, Seattle WA	11/04/82
351	Dave Fellows, Eugene OR	No date
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353	U.S. Forest Service, Washington DC	11/10/82
355	Eugene Galloway, Tacoma WA	No date
356	Monsanto, St. Louis MO	11/09/82
357	Larry & Ruthane Dolezal, Troy MT	11/19/82
359	Bruce Mulvey, Woodinville WA	11/25/82
360	Ruth Roundy, Marysville WA	No date
361	Jane Newton, Philomath OR	11/29/82
362	U.S. Dept. of Health & Human Services Center for Disease Control, Atlanta GA	11/30/82
363	Jan Volz	11/22/82
365	Garvin Crabtree, Philomath OR	12/01/82
366	U.S. Soil Conservation Service, Portland OR	12/03/82
370	Marilyn Boysen, Philomath OR	12/01/82
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376	U.S. Forest Service, Troutdale OR	12/03/82
378	U.S. Forest Service, Washington DC	12/03/82
380	U.S. Army Corps of Engineers, Portland OR	12/02/82
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389	Environmental Protection Agency, Region X Seattle WA	11/30/82
390	Noxious Weed Control Board, Goldendale WA	12/06/82
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394	Barbara Rhodes, Libby MT	12/06/82
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399	Washington State Dept. of Ecology, Olympia WA	12/06/82
400	Washington State Dept. of Natural Resources Olympia WA	11/23/82
402	U.S. Forest Service, Rocky Mountain Region Lakewood CO	12/06/82
404	Estelle & Robert Hunt, Redmond OR	12/01/82
407	Mt. Baker Watershed Protection Assn., Deming WA	12/04/82
414	Seattle City Light, Seattle WA	12/06/82
416	Squaxin Island Tribe, Shelton WA	12/08/82
418	Citizens for Environmental Quality, Asotin WA	12/04/82
422	Metropolitan Service District, Portland OR	12/13/82
424	Whatcom County, Dept. of Public Works Bellingham WA	12/16/82
426	Various Individuals, Baker OR	12/16/82
428	U.S. Dept. of the Interior, Washington DC	12/20/82

L-1-SJ

Oct 3, 1982

Dear BPA

I would like a copy of the Vegetation Management Environmental Impact Statement and the overview. I support the use of some herbicides in vegetation control if they are used properly and without harm to soil or adjacent land uses. Hand treatment should be used adjacent to homes, farms, private timber and other areas sensitive to the herbicides being used. Perhaps a combination herbicide/hand treatment could be used over the same area.

Also I would like any information on hand treatment contracts in this area (Bigt Sound, southeast Wash.). Information like a bidders list, sample contract, technical specifications etc. would be appreciated.

Thank you

Dennis Esham

Forester

Dennis Esham

9011 Old Hwy 99 SE #105

Olympia, Wash

98501

Response to Dennis Esham Letter of October 3, 1982 (No. 1)

1. In the types of sensitive areas mentioned, BPA proposes to use manual and spot chemical methods of vegetation control, as suggested. See Table 5-1.

Response to Robert Hurrell Letter of October 4, 1982 (No. 2)

1. Slash from right-of-way vegetation management is of small sizes. Trees removed are generally less than three inches diameter and ten feet tall; removed brush is smaller in size. Thus the amount of woody debris is limited as well as widely scattered, often in inaccessible locations. Recovery of wood waste from BPA's vegetation management would probably not provide a net energy gain. See Chapter 7 section on Energy Conservation Potential.

L-2-SJ

Cons Boy De
Oct 4, 1982

Dear Sir:

I think it would be great if we had a wood chip mulch burning plant, a mulch grate feed in. So as you could put any thing into it. Stumps, logs, chips, tree thinnings etc. all lumber, even garbage.

Something big enough to burn maybe 5 or 6 thousands tons a yr in period.

There lots of fuel in wood and we should let it burn in our own back. One way of getting some of the money back and cost of clearing out ways. Just a thought - (am)

When you probably already thought of it the long ago.

Robert Hurrell
7006 Wilshire Blvd
Cons Boy
Oct. 97460



L-2-SJ

1. See General Response B.

L-3-SJ

P.O. Box 2558
Hermiston, OR 97838
Oct 5

B.P.A.

To Whom This May Concern,

Question:

Who pays for all these b19 ads?

Who pays for all these b19 motor inn's facilities? ^{especially} (Hermiston + Tamarack)

Who pays for all the Information statements?

You already know, but then you about the little guy - are you?

do what you have to do on that infernal vegetation and crap on my opinion, I live on five (5) acres of sand, sagebrush, tumbleweeds and numerous other weeds, known in your language as "unwanted vegetation"

do I come running to you for opinions about how to deal with misadventures?

-2-

L-3-SJ

I am a new property owner but I already know what I'm gonna do about my problem. You've been at this apparently long enough to already have lots of facts & figures and know-hows. Why do you want laymen opinions? Save all these big bucks and lower my electric bill. Really that, all any of us poor working folks know for a fact. May to May survival is the name of the game.

With the economy in the state it is, my one comment would be - stick to the manual removal, County line to County line and each contractor be a bonafide resident of that County. Keep those big bucks in that particular County, and a precious few at least will be out of the unemployment line.

Most Sincerely
Dorothy Beason

2-4-55

Response to Thomas G. Menten Letter (no date) (No. 4)

1. See Chapter 5 section on Testing and Approval of New Control Methods.
2. See General Response A.

Dear Sir:

With regards to your "vegetation management program":

- 1) I suggest that specific provision be made for experimentation with several techniques, with evaluation of cost, effectiveness, and environmental impact. These should be designed experiments with involvement of a statistician (presumably a biostatistician)
- 2) I propose that in many cases, the tall growth that thickens transmission lines can be replaced with lower growth. This should extend the time between necessary vegetation thinning.
- 3) Consider maintenance problems (both cost and long term environmental impact) when routing the lines: the least expensive route may not be a straight line.

Thank you for considering my comments.

Sincerely,
Tom

Menden (T.G.)

THOMAS G. MENTEN

OCCUPATION: consulting statistician 3425 SPICELAND

BOISE, ID 83704

Oct. 6, 1982
325 1/2 N. Polk
Moscow, ID 83843

Dear Biff,

I have a suggestion concerning your vegetation management problem. I think you could develop a program to employ delinquent youths and unemployed inner-city youths to control brush manually.

I worked for an agency called Self-Help Manpower which hired high school aged youths for trail maintenance on national forests. Most of the participants were on probation for one reason or another and for most, it was the first time they ever had to really work. It was very good work experience for the participants, and a lot of work was accomplished. One youth who was on probation remarked "If I had been forced to work this hard instead of sitting around the reform school, I never would have committed a second offense."

You may even be able to work out a deal with correctional institutions to get free labor. In California, some convicts have the option of working in jail and working on fire fighting crews for no pay. Many opt for the work just to be outside.

I am certain that this would work, at least on a limited scale.

4-6-55

Please let me know what you think about this, and if I can be of further (or any) assistance.

Sincerely,
Buddy S. Budy

P.S. The strong points of my suggestion are:

- (1) Free or very cheap labor
- (2) Community service (rehabilitation) resulting in an improved public image
- (3) No adverse environmental effects such as the use of herbicides

Response to Bradley S. Barber Letter (no date) (No. 6)

1. See General Response B.
2. See General Response B.

1-7-55

Joan Chantler

3705 32nd Bl
Portland OR 97202

2-7-55

P.S. Instead of spending \$60,000 on a feasibility study, why not spend it trying the idea out on a small scale?

Pat adds in some rental papers - figure what it costs you are able to poison the land.

"Goat-owners. B.P.A. will pay -- an acre to have your goats clear our brush."

Of course, I don't know if it would work, but it's worth thinking about.

Another idea

~~One thing~~ I think is that if you used for consultants people who are used to scrambling hard for a living, rather than folks who have been reclining on \$30,000 a year incomes all these years, you might get cheaper, perhaps less glamorous, solutions to problems.

Sincerely,

Joan Chantler

3 P.A.

P.O. Box 3621-55
Portland OR 97208

To Whom it May Concern:

Re your ad in the Willamette Week soliciting comments on vegetation management

?

I know you are ~~may~~ laugh, but - what about goats?

Seriously, consider these advantages

1. Goats are browsers, not grazers. They prefer to eat vine maple, aspen, blackberry - just the sort of things you need to get rid of.

2. You don't have to pay a goat minimum wage. Instead of hiring a crew, you could hire one goat herder, or perhaps you could use portable fencing.

3. There are lots of low-income folks who keep goats. Perhaps you could somehow involve them in a "free forage" plus a minimal amount pay scheme.

Sort of goats, I'd rather pay folks to eat, even if it costs more than use poison. People need work, we need a poison-free environment. Thanks.

Sincerely,

Joan Chantler

Response to Joan Chantler Letter (no date) (No. 7)

1. See General Response A.
2. See General Response D.
3. See General Response B.

JOHN SPELLMAN
Governor



L-8-55

JACOB THOMAS
Director

STATE OF WASHINGTON

OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION

111 West Twenty-First Avenue, KL-11 • Olympia, Washington 98504 • (206) 753-4011

October 5, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Log Reference: 250-F-BPA-14

Re: Transmission Facilities Vegetation
Management Program DEIS

Dear Mr. Morrell:

A staff review has been completed of your draft environmental impact statement. The document adequately considers known and anticipated cultural resources and the potential for impact to these. We concur with the proposed mitigative actions. | 1

The above comments are based on the information available at the time of this review. Should additional information become available, our assessment may be revised. In the event that cultural materials are inadvertently discovered during construction, work in the immediate vicinity should be discontinued and this office notified. Please indicate the log reference number noted above in further communications concerning this project. A copy of these comments should be included in subsequent environmental documents. | 2

Thank you for this opportunity to comment.

Sincerely,

Robert G. Whitlam, Ph.D.
Archaeologist

dj

Response to Washington State Office of Archeology and
Historic Preservation Letter of October 5, 1982 (No. 8)

1. Your concurrence is acknowledged.
2. It is BPA policy to suspend work and notify state historic preservation offices in the event that cultural materials are found.

B. P. A., P.O. Box 3621-SJ
 Portland, Ore. 97206

Dear Sirs: I would like to submit a suggestion for the elimination of vegetation under your B. Power lines. Why not use goats? This would provide a few jobs for people (herders), and eliminate the use of herbicides that might pollute the environment.

I am not being facetious when I add: use goats, instead of herbicides, as you can eat their meat and use their hides.

Signed: A Concerned Citizen

B. Rowe,

96 Cedar,

La Grange, Oregon 97850

1. See General Response D.

How do you control unwanted
vegetation over 84,000 acres
of land? L-10-S-5

Where brush will grow, grass will
grow, where grass will grow, Sheep range
grow. I think that in mind I would divide
it into suitable tracts, grow long
term leases to suitable tenant
homesteaders.

I would assist them in the initial
fencing, grass & flock establishment
& let them fly off!
The home steads have shown our
his ability to keep the brush down
& access open for Burnsville
Fire enterprise is probably the
cheapest & brush spray Burnsville
Ode day

Van Sprague
RT 3 Box 3157
Chickamauga Oregon 97016

"Largest Coast to Coast Store in Idaho"
Roger Gregory, Owner
Mike Schaff, Manager
Box 699
PRIEST RIVER, IDAHO 83856
Phone: 448-1621

L-11-55

TOTAL HARDWARE **Coast to Coast**

10/8/82

Response to Roger Gregory Letter of October 8, 1982 (No. 11)

No comments.

Dear Sirs

In reference to the attached.

I would like to make a ~~statement~~
on the fisheries.

I would urge that you put
in the Fish Hatchery in north Idaho
which all these dams & no dollars are
fishing has gone to pots - NO FISH.
- something has to be done to bring back
the fisheries - our economy is partly
based on tourism

Roger Gregory



COOPERATIVE EXTENSION SERVICE

Montana State University, U. S. Department of Agriculture, and Montana Counties Cooperating

SANDERS COUNTY

Box 189
Thompson Falls, Montana 59873
Ph. 827-3532

October 7, 1982

Bonneville Power Administration
PO Box 3621-SJ
Portland, OR 97208

Sirs,

I am writing both personally and professionally to comment on the Draft Environmental Impact Statement - Vegetation Management Program.

On Page 33 of the publication, you mentioned a multi-year experimental study of biological weed control. I would like to get some information outlining what type of study is being done, and what part if any is being conducted in Montana.

On page 34 of the same, you stated that biological controls for weed species not listed were unavailable. There has been biological weed research and insect releases in western Montana beginning, I believe, in 1948 on St Johnswort, Hypericum perforatum, from 1973 to present on Spotted Knapweed Centaurea maculosa, and from 1974-present on Musk Thistle Carduus nutans. Insect populations have become established on each of the mentioned weeds, with measurable results on the St Johnswort and Musk Thistle. Releases of the seed head fly on spotted knapweed have shown a dramatic increase in the insect populations though measureable results are not yet available.

I suggest that you contact the Montana State University Research Center for biological organisms now available for weeds that are perhaps less than "exotic", and may well aid you in your comprehensive weed program.

Sincerely,

Don Nicholson
County Extension Agent
Sanders County, Montana

DN/lb

"The Programs of the Montana Cooperative Extension Service are available to all people regardless of race, creed, color, sex or national origin."

Response to Sanders County Cooperative Extension Service Letter of October 7, 1982 (No. 12)

1. The section of Chapter 3 on Biological Control Methods: Control of Weeds by Introduced Insects has been revised to include discussion of these biological weed control methods. Also see General Response A.



U.S. Department of Housing and Urban Development
Denver Regional/Area Office, Region VIII
Executive Tower Building
1405 Curtis Street
Denver, Colorado 80202
October 7, 1982

4-13-SJ

Response to U.S. Department of Housing and Urban Development
Letter of October 7, 1982 (No. 13).

No comments.

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621 - SJ
Portland, Oregon 97208

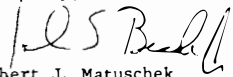
Dear Mr. Morrell:

Thank you for the opportunity to review and comment on the draft Environmental Impact Statement, Transmission Facilities Vegetation Management Program in States of Oregon, Washington, and Idaho, and in parts of Montana, Wyoming, and California.

Your draft has been reviewed with specific consideration for the areas of responsibility assigned to the Department of Housing and Urban Development (HUD). Within these parameters this statement is adequate for our purposes. Since your proposal discusses transmission facilities within three HUD geographic regions, Denver, Seattle, and San Francisco, it has been agreed by each to comment separately on the sites in their respective regions.

If you have any questions regarding these comments, please contact Mr. Carroll F. Goodwin, Area Environmental Officer at (303) 837-3102 or FTS: 327-3102.

Sincerely,


Robert J. Matuschek
Director
Office of Regional Community
Planning and Development, 8C

331

2-14-55

2420 Harris Avenue
Richland, WA 99352
October 5, 1982

BONNEVILLE POWER ADMINISTRATION
P. O. BOX 3621
PORTLAND, OR 97208

Gentlemen:

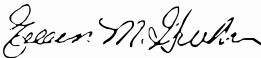
The timing and geography of THE BPA's VEGETATION MANAGEMENT PROGRAM PUBLIC INFORMATION CENTERS must have an internal logic which is not immediately apparent, as the relative populations of Snohomish and the Tri-Cities would dictate the latter as the more likely place to conduct such an activity if its aim were truly to inform the public....Not to quibble, however.

I have completed the "Information Request" coupon which ran with your ad in Sunday's Tri-City Herald. Please mail the information in time for its use in preparation of additional comments before the end of the comment period.

It is my sincere hope that the BPA Vegetation Management philosophy acknowledges as its overriding goal the preservation and protection of these managed lands for their owners - the citizens of the United States. Such a goal would dictate that no technique to control vegetation would pose a threat to present or future citizens.

As more and more of the previously silent take to our pens and typewriters, I believe that administrative officials will become increasingly aware and grateful that we share the burden of this decision process.

Sincerely,,


(Mrs.) Eileen M. Gruhn

P.S. Would you please mail an additional copy of the complete Impact Statement and Overview to

Miss Christine Gruhn
215 Clarke Drive
Athens, GA 30605
(She is a candidate for the Masters degree in Plant Sciences there, and can contribute to my education on this matter)

Response to Eileen M. Gruhn Letter of October 5, 1982
(No. 14)

1. Please see the Chapter 2 section on Purposes of BPA's Vegetation Management Program. One of these purposes is protection of environmental quality as required by the National Environmental Policy Act. Our analysis in this EIS has concluded that BPA's proposed program does not threaten the environments of present or future citizens.



VICTOR ATIYEH
GOVERNOR

Department of Transportation

PARKS AND RECREATION DIVISION

525 TRADE STREET SE., SALEM, OREGON 97310

October 11, 1982

ANTHONY R. MORRELL
ENVIRONMENTAL MANAGER
BONNEVILLE POWER ADMIN
PO BOX 3621-SJ
PORTLAND OR 97208

Dear Mr. Morrell:

RE: Transmission Facilities Vegetation Management EIS

Thank you for the opportunity to review the draft EIS on BPA's Transmission Line Vegetation Management Program. We have a few concerns that we would like to discuss with you. For the most part, they deal with chapter 7, pages 196 through 200.

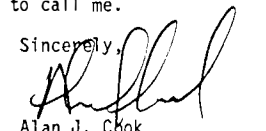
Our first concern is map #7-6 (Public Lands of the BPA Service Area). There appears to be an inadvertent cross of the map color codes between the National Wild and Scenic Rivers and the State Scenic Waterways. All of the State Scenic Waterways have not been identified on this map. I am enclosing for your information an up-to-date map indicating where the existing State Scenic Waterways are. Furthermore, neither the Snake nor the Rogue Rivers are designated as "Wild and Scenic" for their entirety. This should help bring map #7-6 up to date.

On page 200, in the discussion "Other State Land Use Planning," in reference to the statewide planning goals and guidelines in Oregon and the statement that "none of the planning goals address vegetation management specifically," we would like to point out that both Goals 5 and 15 do address vegetation management and/or visual affects on land use. Under Goal 5, vegetation management is appropriate to sub-elements (d), (e), (f), (h), (k), and (i). Under Goal 15, the Willamette River Greenway, management use criteria address visual and scenic requirements and vegetative management. We feel that a discussion of these or clarification of the role that these goals play in vegetation management would enhance the EIS. A complete copy of the goals is also included for your reference. The State Parks Division is charged with managing the Willamette River Greenway Program, State Scenic Waterways Program, and the State Recreation Trails Programs as well as its own lands.

Anthony R. Morrell
October 11, 1982
Page 2

Overall, the Division feels that the environmentally preferred alternative, as we understand it (alternative 10), would be the most acceptable to the Division and its programs. If we can be of any further help in providing information and background as to our concerns, please do not hesitate to call me.

Sincerely,


Alan J. Cook
State Recreation Planner

AJC:kc

333

2

Response to Oregon Parks and Recreation Division Letter of
October 11, 1982 (No. 15)

1. Figure 7-6 has been corrected as indicated. Thank you for pointing out the errors.
2. The section on Oregon State Land Use Planning has been revised with discussions of Planning Goals Nos. 5 and 15 as they relate to vegetation management.



MONTANA HISTORICAL SOCIETY

HISTORIC PRESERVATION OFFICE

225 NORTH ROBERTS STREET • (406) 449-4584 • HELENA, MONTANA 59601

October 7, 1982

Peter Johnson
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Mr. Johnson:

Re: Draft E.I.S. on Transmission
Facilities Vegetation Management Program.

Thank you for the opportunity to review the above-named document. Our primary concern in reviewing the document rests with the statements made on page 123. Although we have reviewed BPA compliance with Federal historic preservation regulations at the time of line construction, we do not believe that BPA has ever taken action to insure the marking and protection of cultural resource sites after the time of construction. Since BPA is responsible for line maintenance and vegetation management, we would strongly urge the development of actual policies to insure consideration of cultural resource beyond the period of construction. That does not, however, now exist and should not be "presumed" as in place.

Sincerely,

Marcella Sherfy
Marcella Sherfy
Deputy SHPO

TAF/det

cc: Agnes Zipperian
Clearinghouse

2-16-55
OCT 12 1982
Response to Montana Historical Society Letter of October 7, 1982 (No. 16)

1. The cited statement in the Chapter 6 section on Historical and Cultural Resources (page 123 in DEIS) was an overstatement; marking of cultural resource sites after the time of construction has not been consistently done. In order to correct this situation a mitigation measure has been identified to ensure that the presence of cultural resource sites is recognized during future vegetation management activities (see No. 20 in Table 4-5). This measure is not presently incorporated in the proposed program or alternatives. It would require encoding of locations of cultural resource sites on the ROWDATA right-of-way inventory system used in planning of BPA's vegetation management program (see Chapter 5 section on Development of Vegetation Management Prescriptions).

Response to Robert W. Johnson Letter of October 16, 1982
(No. 17)

1. See Chapter 7 section on Vegetation for description of the potential impacts of BPA's proposed program on low-growing plants used by wildlife (see especially Tables 7-2 and 7-3). See Chapter 7 section on Wildlife for discussion of the possibility of herbicide toxicity effects on wildlife. See General Response C regarding water quality.

2. See General Response B.

BPA
FORWARD

1-17-85

OCT 16, 1982
Robert W Johnson
Alpine Lakes Protection Soc.
Wenatchee Chapter
PO Box 4
Orondo WA 98843

Dear Sir:

Our problems are many, serious -
mentally. In the outland alone
we have to deal with 240 and
to relatives, BPAW (consequence
during seismic breakdown), Enclim
which is presently in legislative
controversy etc etc. It all
leads me to believe that we
are undoubtedly leading one
adverse - perhaps increasingly -
into a trap, through our techno-
logical pursuit of seeking speed
and efficiency to rid the un-
wanted. I do not believe that
the cost of gaining the perfect
apple should include poisoned
wildlife, carcinogenically polluted
air, and sterile soil. Neither
do I believe the cost of Thana-

1-17-85

will be electrical power should
be jeopardized to low growth
wild vegetation, airborn and
contaminants wildlife... if not
dead, and the risk: whatever
risk - ~~to~~ high country water
contamination. While on that
subject, for my money the little
and/or County W Department
should leave all road compounds
out of the water sampling
program.

Do we know all this and
me? I do not have your state
on cost comparisons. Nevertheless

I agree stick with some more
manual methods... in your case
manual brush cutting over if
the cost is higher; otherwise
for one billion the cost will
be much much higher. Signed
Robert W Johnson - a citizen for
a clean, healthy, pacific environment.

2-18-85



health

R. M. NICOLA M.D., M.H.S.A. • DIRECTOR OF HEALTH

Response to Tacoma-Pierce County Health Department Letter of
October 14, 1982 (No. 18)

No comments.

October 14, 1982

Mr. Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

337 This department has reviewed the Draft Environmental Impact Statement for the
Transmission Facilities Vegetation Management Program developed by the Depart-
ment of Energy.

This agency reviewed primarily those sections addressing Public Health and
Occupational Safety. We have no additional comments at this time regarding
those sections.

Sincerely,

DONALD L. OLIVER, Director
Environmental Health Division

DLO/jyl

cc: Dan Cagle, Pierce County Planning

TACOMA-PIERCE COUNTY HEALTH DEPARTMENT

3629 SOUTH D ST. TACOMA, WASHINGTON 98408

Gentlemen:

L-19-SJ

I Have An Excellent Suggestion To
Keep The Right Of Way For The Power Lines
Clear Of Bush & Trees.

Response to Glenn Mattson Letter (no date) (No. 19)

1. See General Response D.

- ① ~~Initially~~ Initially Clear All Of The Land Of
Bush & Trees.
- ② Install A Good Livestock Fence On
Both Sides Of The Right Of Way
- ③ Let Some Farmer Use The Right Of
Way For Pasturing Animals That Are
Noted For Keeping The Brush Down
Like Sheep & Goats. Let The Farmer
Use The Land For Free — It's Worth It.

Yours Truly

Glenn Mattson Apt #2
305 North Kellner Court
Columbus, Ohio, 43209



DEPARTMENT OF HEALTH & HUMAN SERVICES

Office of the
Principal Regional Official

Region VIII
Federal Office Building
1961 Stout Street
Denver CO 80294
ROFEC

Response to U.S. Department of Health and Human Services
Letter of October 22, 1982 (No. 20)

No comments.

October 22, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
Post Office Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

We have reviewed the DEIS on the Bonneville Power Administration
Transmission Facilities Vegetation Management Program and have
no comments.

Thank you for the opportunity to review this DEIS.

Sincerely yours,

E. W. McIntire
Director, ROFEC



Breitenbush Community
Healing — Retreat — Conference Center

at Breitenbush Hot Springs
P.O. Box 578
Detroit, OR 97342
Ph. 503-854-3501

L-21-55

October 21, 1982

Anthony R. Morrell
Environmental Manager - B.P.A.
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Friends:

Thank you for the opportunity to comment on B.P.A.'s draft EIS regarding Vegetation Management. We are a group of 25 individuals who live at and operate a hot springs resort about 1/2 mile from your lines. These lines were sprayed last year and the Community is very committed to understand how we can influence such activities.

We have the following concerns which we wish to have addressed:

1. Why does BPA pay no cost-sharing when lines are maintained under a Multiple Use Arrangement with Landowners (page 37-38 describes other utilities which do cost share but simply states the BPA doesn't)? | 1
2. What are the costs considered in arriving at the relative costs of treatment methods listed on page 43? Simply stating totals without showing their justification is not helpful. | 2
3. Why were the mitigation measures described on pages 79-81 not included in the preferred alternative? All of them seem crucial if we are to be subject to chemicals in our watershed, and the extent to which they were included in your program would greatly influence the extent to which we would contest any such operation. | 3

Thank you for hearing our concerns and we look forward to hearing your reply.

Sincerely,

David Rath

David Rath
Breitenbush Community

DR:PM

Response to Breitenbush Community Letter of October 21, 1982
(No. 21)

1. See General Response D.

2. A more detailed description of the component costs included in the typical treatment cost estimates (Table 3-4) has been added to the Chapter 3 section on Typical Costs and Longevity of Treatments.

3. Your support of the recommended mitigation measures is acknowledged. See General Responses C and E.

L-22-SJ

23 October '82

Dear BPA,

Concerning the Vegetation Management Impact Statement, my feelings are as follows:

In this time of high unemployment, depleted and finite oil resources, and massive environmental assault, I strongly encourage you to choose a labor-intensive, non-herbicide approach in your land management.

There is a group that is managing some forest land this way in Washington state. And I believe a group called Hoedads in Eugene, a workers' cooperative, also uses this or could refer you to those who do.

You asked for public opinion, this is mine: No herbicides, not even 2,4-D, but hand and machine labor to control the vegetation instead.

Sincerely,

Linda Thomas

800 C Palmside Walla Walla
WA 99077

Response to Linda Thomas Letter of October 23, 1982 (No. 22)

1. See General Response B.

2. Your preference is acknowledged. The impact analyses contained in this EIS indicate that the herbicides proposed for use by BPA, if used at the proposed application rates and patterns of use and with the mitigation measures incorporated in the proposed program, will not adversely affect public health or the environment. See General Responses C, F, H, and I.

4-23-85



Public Works Department

October 26, 1982

Response to City of Salem, Oregon Public Works Department
Letter of October 26, 1982 (No. 23)

1. Your support for the preferred alternative and your satisfaction with recent vegetation management implementation is acknowledged.

Bonneville Power Administration
ATTN: Anthony R. Morrell, Environmental Manager
P.O. Box 3621 - SJ
Portland, Oregon 97208

RE: Draft EIS - TRANSMISSION FACILITIES VEGETATION
MANAGEMENT PROGRAM, September 1982

Gentlemen:

The purpose of this letter is to inform you that the above referenced draft environmental impact statement (EIS) has been reviewed by City of Salem, Public Works Department staff to determine what, if any, the potential impact of the program would have upon the quality of the water resource produced by the North Santiam River drainage basin.

The City of Salem takes its domestic water supply from the North Santiam River at a point one mile east of Stayton, Oregon. Because the City relies primarily upon a surface source for its water supply, it takes considerable time to monitor the potential effects of land management agency policy and program implementation on its water supply.

On the basis of the information provided in the draft EIS it appears there is little likelihood of significant impact upon the water resource within the North Santiam River drainage basin if the BPA's preferred management alternative is selected and implemented with the mitigation measures described in the BPA Maintenance Standards and included in the preferred alternative.

During the past summer, BPA carried out an aerial application of herbicide along a transmission line right-of-way within the North Santiam River basin. We were very satisfied with the notice given the City by BPA staff regarding the project and the apparent concern shown by them for the protection of the water resource, and anticipate that this behavior will continue in the future.

If any changes are made in the preferred alternative of this program, or the mitigation measures, we would like to have an opportunity to review the changes if they could adversely affect the quality of the water resource produced by the North Santiam River drainage basin.

Very truly yours,

Ronald J. Mery
RONALD J. MERRY
Director of Public Works

RJM:DW:bg
cc: B. T. Van Wormer

Keith Farrow
David Wiley

342

143 W. Maple
Walla Walla WA 99362
October 25, 1982

L-24-55

Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208
Friends:

I would think it extremely difficult - in fact, unconscionable - for you to address your vegetation management program with anything but a manual program.

It should be clear to all of us by now that the unsophisticated, ham-handed idea of spraying unwanted vegetation with powerful poisons is an exceedingly dangerous practice. Only mindless minions of chemical concerns can continue to favor this kind of atrocity.

Certainly, the same far-reaching foresight which built the BPA can be applied to ingenious new solutions based on human labor which will 1) protect the power lines, 2) put people to work and 3) not kill us all.

Thank you.

Jack Riehl
JACK RIEHL

Response to Jack Riehl Letter of October 25, 1982 (No. 24)

1. See General Response B.

2. The impact analyses contained in this EIS indicate that the herbicides proposed for use by BPA, if used at the proposed application rates and patterns of use and with the mitigation measures incorporated in the proposed program, will not adversely affect public health or the environment. See General Responses C, F, H, and I.

WASHINGTON STATE UNIVERSITY
PULLMAN, WASHINGTON 99164

L-25-55

WILDLIFE BIOLOGY
Department of Zoology
26 October 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

I have had an opportunity to review BPA's "Vegetation Management Program." Basically I was favorably impressed with the document but have some specific comments to make.

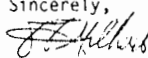
1) The multiple-use agreement with land owners is an excellent concept. This provides the land owner with the option of vegetation control of his/her choosing. In conjunction with this, BPA might consider a communications process which would inform land owners of the timing and type of treatment to be utilized when land owner agreements are not in place.

2) The 100' buffer is precariously small and, despite the best intentions of BPA, offers the potential for abuse; a 250' buffer would be more realistic for protection of critical habitat areas.

3) In Chapter 6--Wildlife, no mention is made of the potential for re-creating travel corridors between critical habitats which may have been severed by the ROW. This would require historical analysis of migration routes, critical summer and winter habitat, etc., for particular wildlife species and eventual rehabilitation in the form of tree cover within conductor limits. Pruning of trees in these narrow habitat links would be the prescribed vegetation management technique. Although this may not be an important consideration for some wildlife species, there is evidence that ROW can be an ecological barrier for certain deer species, for example, under winter conditions particularly.

These are relatively minor criticisms, and I looked specifically for errors of omission in the herbicide technical data. In general, the technical data were complete and outlined what we all know, that with proper handling and application, only unexpected climatic events, e.g. heavy rain, are likely to cause problems. Broadcast spraying does have the potential to affect nesting and nesting birds, and timing of application should consider this possibility. Otherwise, there is little criticism which can be addressed against so general a document as this. Some mechanism should be developed which would allow public surveillance of treatment schedules and methods by unit of ROW.

Thank you for the chance to comment on your draft EIS.

Sincerely,

F. F. Gilbert

Response to F. F. Gilbert Letter of October 26, 1982 (No. 25)

1. Your support for multiple-use agreements is acknowledged. See General Response D.

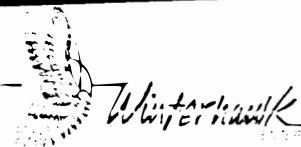
2. See General Response G for discussion of BPA notification policy.

3. See General Response C.

4. The concept of habitat diversity is discussed in the Chapter 7 section on Wildlife. Selective vegetation control methods (e.g. spot chemical, manual) can be used to create and maintain habitat corridors across managed rights-of-way, in the manner that you have suggested. For example, BPA uses selective methods to maintain vegetation screens along highways and riparian buffer zones along streams. If a BPA right-of-way is shown to subdivide an important habitat of a protected wildlife species, BPA will cooperate and conduct its vegetation management program to mitigate that impact. Please contact the Area Right-of-Way Maintenance Specialist in regards to specific sites or habitats of concern.

5. Analyses contained in the Chapter 7 section on Wildlife indicate that broadcast herbicide treatments will not adversely affect nesting birds or their reproductive success. The three active ingredients (i.e. dicamba, picloram, and 2,4-D) proposed for broadcast applications by BPA have not shown toxicological effects on nesting birds. Although diesel oil is known to affect egg hatchability and bird survival, BPA does not use diesel oil as a carrier for broadcast herbicide applications. Therefore, broadcast chemical treatments as proposed by BPA have little potential to affect nesting birds.

6. See General Response G.



1. Your preference is acknowledged.

Oct 25 82

Dear Sir;

I want that \$84,000 ⁵acres left
untouched and my statements are much
like most Idaho people if you ask

For _____

Do you want us to have a future

Then — please consider the Earth!!!

You can ~~see~~ only rape and rape

so much before you feel the
results of your negligence and disrespect.

Thank You'

Bill Procter
President —
Winterhawk Enterprises.



Department of Land Conservation and Development

1175 COURT STREET N.E., SALEM, OREGON 97310 PHONE (503) 378-4926

October 22, 1982

Michael W. Berg
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Mr. Berg:

The Department of Land Conservation and Development has reviewed the September 1982 Draft EIS for BPA's Fiscal Year 1983 Transmission Facilities Vegetation Management Program.

The EIS (p. 198) correctly notes that, in order to be consistent with Oregon's Coastal Management Program, activities within Oregon's coastal zone must conform to statewide land use planning goals, applicable state statutes and acknowledged comprehensive plans. After reviewing the draft EIS, we concur that the Transmission Facilities Vegetation Management Program is consistent with statewide land use planning goals. Consistency with existing state statutes for maintenance of water quality will be assured through BPA's participation in Oregon's Pesticide Use Clearinghouse.

The Transmission Facilities Vegetation Management Program will be consistent with local comprehensive plan requirements if BPA obtains necessary local approvals.

Thank you for the opportunity to review the Draft EIS. If you have any questions, please call Gail McEwen at 378-5052.

Sincerely,

James F. Ross
Director

JFR:GAM:kg
1655B/10B

cc: DLCD Field Office, Newport
Kay Wilcox, IRD (OR 821001-001-4)

Response to Oregon Department of Land Conservation and Development Letter of October 22, 1982 (No. 27a)

1. Your concurrence with the EIS's finding of consistency is acknowledged.
2. BPA participates in Oregon's Pesticide Use Clearinghouse.
3. BPA will obtain local approvals as necessary.



Executive Department

155 COTTAGE STREET N.E., SALEM, OREGON 97310

November 2, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Subject: Transmission Facility Vegetation Management Pgm.
PNRS #OR821001-001-4

Thank you for submitting the subject draft Environmental Impact Statement for State of Oregon review and comment.

The draft was referred to the appropriate state agencies. The Departments of Fish and Wildlife and Land Conservation and Development, the Division of State Lands, Parks Division, and State Historic Preservation Office offered the enclosed comments which should be addressed in preparation of the final Environmental Impact Statement.

We will expect to receive copies of the final statement as required by Council of Environmental Quality Guidelines.

Sincerely,

INTERGOVERNMENTAL RELATIONS DIVISION

Kay F. Wilcox
Kay F. Wilcox
A-95 Coordinator

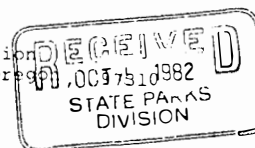
KW:mh
Enclosures



OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
155 Cottage St NE, Salem, Oregon 97310
Phone Number: 378-3732



PNRS STATE REVIEW

Project #: OR 821001-001-4 Return Date: OCT 23 1982

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the review date.

ENVIRONMENTAL IMPACT REVIEW DRAFT STATEMENT

- () This project has no significant environmental impact.
- () The environmental impact is adequately described.
- (x) We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.
- () No comment.

Remarks

Some professional input as to location of treatment procedures for known sites within the BPA system
by cultural resources

2

Agency SHPO By _____
PNRS #8 FOR FURTHER INFORMATION
PHONE CONTACT LELAND
GUSELL AT 378-6923



OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
155 Cottage St NE, Salem, Oregon, 97310
Phone Number: 378-3732

PNRS STATE REVIEW

Project #: OR 821001-001-4 Return Date: 06/19/82

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the review date.

ENVIRONMENTAL IMPACT REVIEW DRAFT STATEMENT

- () This project has no significant environmental impact.
- () The environmental impact is adequately described.
- (X) We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.
- () No comment.

Remarks

Cleared powerline right-of-ways are usually highly productive of forage which is beneficial to big game wildlife species. Vegetation management techniques maintain habitat diversity contributing to the "edge effect" that benefits a wide variety of wildlife species.

However, herbicide applications can have an adverse affect if the entire right-of-way is treated at one time. Wildlife dependent upon a particular stage of vegetative succession would be adversely affected if the entire right-of-way were treated at the same time.

We recommend that only one-third to one-half of the right-of-way be treated in alternating blocks one-half mile long during any one year.

Agency Fish & Wildlife By Larry Faust 209-5679

PNRS #8



OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
155 Cottage St NE, Salem, Oregon
Phone Number: 378-3732

PNRS STATE REVIEW

Project #: OR 821001-001-4 Return Date: 06/19/82

ENVIRONMENTAL IMPACT REVIEW PROCEDURES

If you cannot respond by the above return date, please call to arrange an extension at least one week prior to the review date.

ENVIRONMENTAL IMPACT REVIEW DRAFT STATEMENT

- () This project has no significant environmental impact.
- () The environmental impact is adequately described.
- (X) We suggest that the following points be considered in the preparation of a Final Environmental Impact Statement.
- () No comment.

Remarks

To reduce the possibility of herbicide contamination of class I and II streams we recommend the buffer corridor be extended to 500 ft. for spot chemical appl. and 200 ft. for aerial application. Manual removal of target species is recommended within the buffer corridor of class I and II streams; this should lower potential "worst-case" impacts of chemical vegetative control methods.

Agency Land By Wm. J. ...

PNRS #8

RECEIVED
00101982
DIVISION OF STATE LANDS

348

3

4

Response to Oregon Intergovernmental Relations Division
Letter of November 2, 1982 (27b)

1. Responses to letters from Parks and Recreation Division and Department of Land Conservation and Development are presented separately.

2. BPA's proposed vegetation management program would use manual, biological, and chemical methods of vegetation control. The program maintains the visual status quo resulting from initial construction of transmission facilities. Use of chemical methods may cause minor incremental and temporary reductions in visual quality at protected sites. No other adverse impacts are anticipated (see Table 7-15).

3. Management units on BPA rights-of-way average about two acres in size (see Chapter 5 section on Development of Vegetation Management Prescriptions). Adjacent management units are often treated using different control methods due to differing conditions of vegetation or environmental sensitivity (e.g. stream buffer zones). Long stretches of right-of-way are rarely treated in the same way. Habitat "edge" both between management units as well as along right-of-way margins is normally plentiful.

4. BPA monitoring of herbicide residues in streams following herbicide applications has shown very low, although sometimes detectable, levels of herbicide contamination. A worst-case analysis of potential routes of human exposure to herbicides as proposed for use by BPA has been added to the Chapter 7 section on Public Health. In order to further reduce the likelihood of stream contamination from aerial applications, this EIS has identified an additional mitigation measure not presently included in the preferred program alternative; this measure would require shutoff of aerial spray equipment 150 feet from a stream in order to ensure no spray deposition within the 100-foot stream buffer zone (see measure No. 42 in Table 4-5).

1. See General Response B.
2. None of the herbicides proposed for use by BPA accumulate in biological organisms. Therefore, they will not be concentrated in humans or other organisms as a result of BPA's proposed program. See section of Chapter 7 on Public Health for a detailed discussion of the potential impacts of herbicide use.
3. Typically, BPA's vegetation control activities do not remove whole trees of merchantable size. Therefore, the type of contract suggested is not feasible.

11.4.82

2-28-83

Gerritelle Tauer determination

This is not a "substantive statement,"
only an expression of deep concern
over the use of powerful herbicides
to control vegetation growth.

Like many others, I understand the
seriousness of the problem posed by
fast-growing vegetation to the problem

of maintaining an open landscape
(though not some of the more recent
examples of the same, like the
people of the long-term
study of the vegetation
and the other vegetation
people. Our response seems
reasonable in all directions
and it seems wise to pay the

1

2

Price of sensitive handling.
What about contracts with
the business of logging
to eliminate and then use, the
trees? Such, of course, is an alternative
I appreciate the opportunity to
express my views.

Pamela Leptich

3043 61st S.W.
Seattle 98116

3

7-28-83

⁴⁻²⁹⁻⁵⁵
Bonneville Power Administration;

I wish it to go on record
that I strongly oppose the use
of herbicide sprays to control
vegetation under any circumstances.

This is a perfect situation to put
people to work. I believe also +
there are studies to support this,
that manual brush clearing is
cost-effective if not in the short
run but surely in the long run.

Sincerely,

Dave Fellows

48 W 26th
Eugene OR 97405

Response to Dave Fellows Letter (no date) (No. 29)

1. Preference is acknowledged. See General Response F.
2. See General Response B.



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
District Office
P. O. Box 550
Prineville, OR 97754

4-20-55
IN REPLY REFER TO

1790

Response to Bureau of Land Management (Prineville District)
Letter of November 8, 1982 (No. 30)

1. Map 7-6 has been corrected as indicated.

November 8, 1982

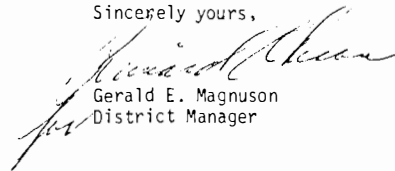
Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Thank you for the opportunity to review DOE/EIS 0097, Transmission
Facilities Vegetation Management Program.

Map 7-6 indicates that the Deschutes and John Day Rivers are
components of the Natural Wild and Scenic Rivers system. They
should be shown as components of the State Wild and Scenic River
System.

Sincerely yours,


Gerald E. Magnuson
District Manager

352



United States
Department of
Agriculture

Forest
Service

Washington
Office

12th & Independence SW
P.O. Box 2417
Washington, DC 20013

Reply to 2150

Date NOV 10 1982

Mr. Peter Johnson
Administrator
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Johnson:

As requested, we have reviewed the draft environmental impact statement (DEIS) on the Bonneville Power Administration's (BPA) Transmission Facilities Vegetation Management Program.

As a cooperating agency, we appreciate the opportunity to review and comment on this document which is intended to comprehensively and objectively evaluate the impacts of transmission facilities vegetation management.

Overall, we find the DEIS well prepared and actually have few comments to provide since we had already commented on a preliminary draft. We are returning a copy of the DEIS with marginal comments. In addition, we would like to mention the following specifics for your consideration:

Page 35, paragraph 4. Suggest adding that fencing is a viable but expensive alternative to herding.

Tables on pages 30 and 32. Why is December 15, 1981, used as a reference date when this DEIS was prepared in September 1982 and on page 90, paragraph 3, July 1, 1982, is used as a reference point?

Pages 103 and 138, paragraph 1. "Worst case" in this instance may be a poor choice of words in light of recent court decisions in Oregon (e.g., Judge Frye's opinion disallowing the use of herbicides by BLM) requiring toxicological worst case analyses to be presented in National Environmental Policy Act (NEPA) documentation.

Page 250, paragraph 3. We believe it should be indicated that "Forest Service permits to use pesticides on National Forest System lands" should be added to the list for item number 2. Forest Service Manual direction (FSM 2158.2 and 3) calls for pesticide-use proposals and use reports, and while we believe BPA is complying with this direction in the Pacific Northwest, it would seem appropriate to specify this.

In regard to the Appendix - Background Statements, we have the following comments:

Mr. Peter Johnson

For each herbicide, a large amount of data is presented, but it is not brought together to give the reader a good analysis of the facts. A "worst case" analysis for each herbicide similar to the one for fish on page 149 of the DEIS would be helpful to the reader.

The presumed LO50 for humans is figured for each herbicide in oz/lb. This is good as these are terms the average reader can relate to. At the same time, the LO50 should also be expressed in the metric system so that the LO50 can be related to the other information presented.

For our own information, can you please provide additional information on the automatic equipment used to monitor the persistence and movement of herbicide residues in soil and water as indicated on page 88 and in Figures 5-1 and 5-2.

Thank you again for the opportunity to review and comment on your DEIS. Good luck in finalizing this important document.

Sincerely,

James L. Peterson
for R. MAX PETERSON
Chief

Enclosure

Response to USDA Forest Service (Washington Office) Letter
of November 10, 1982 (No. 31)

1. Suggested addition has been made.
2. The different dates appeared in the DEIS due to different timing in preparing the indicated sections. Dates in the FEIS are consistent; all information is current as of May 1, 1983.
3. Your suggestion is appropriate; the words "worst-case" have been deleted on both pages indicated.
4. Suggested addition has been made.
5. A "worst-case analysis" of herbicides with respect to public health has been added to the Chapter 7 section on Public Health.
6. The presumed LD50 for humans (in oz/lb) is calculated directly from the LD50 (in mg/kg) for rat populations. Both LD50s are given in the last paragraph of the section on Acute Toxicity in each Herbicide Background Statement.
7. Please contact BPA's Branch of Transmission Line Maintenance at the Ross Complex in Vancouver, WA.

Response to Eugene Galloway Letter (no date) (No. 32)

1. The purposes of BPA's Vegetation Management Program are described in Chapter 2 of this EIS. Two of the identified purposes, Protection of Environmental Quality and Adherence to Principles of Integrated Pest Management, require management attention to the long-term health of environments along BPA rights-of-way.

gentle men.

A review of the Vegetation Management Program material would most certainly indicate a wealth of information covering the various methods of vegetation control. It is a massive summa of a complex subject.

However, what really seems to be at question is the will to use this information for the ever all long term benefit of all the ecological systems involved. You often hear the short term financial gain only adds to the detriment of the long term needs except, perhaps, to the marketing organization.

The Bonneville Power Administration should be well aware of the problems flowing from the marketing of a program that should be

L-32-50

Consider carefully enough opinions contrary to their own views. I think it may be fairly stated that most things that occur are not the results of what we do or do not know, but what we do or do not do.

Thank you
Eugene Galloway
7724 NW 32nd St
Became WA 98107

4-33-85

Monsanto

MONSANTO AGRICULTURAL PRODUCTS CO.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63167
Phone: (314) 694-1000

November 9, 1982

Response to Monsanto Agricultural Products Co. Letter of
November 9, 1982 (No. 33)

1. The Roundup Herbicide Bulletin has been added to the bibliography of the Herbicide Background Statement on Glyphosate.

Mr. Anthony R. Morrell
Environmental Manager
Booneville Power Administration
P. O. Box 3621, Routing Code SJ
Portland, Oregon 97208

Dear Mr. Morrell:

I have received a copy of your Draft Environmental Impact Statement on Transmission Facilities Vegetation Management Program dated September, 1982. I was very impressed by the quality and detail of this document.

I noted in reading the section on glyphosate in the Appendix (A 79-88) that you had not received our most recent informational pieces on that material. I have enclosed a copy of the most recent bulletin on Roundup® Herbicide and the Material Safety Data Sheets on Roundup and glyphosate.

If I can provide you with any additional information or respond to any inquiries on our product, I would be very happy to do so.

Sincerely yours,



Robert V. Peterson
Environmental Affairs Manager

RVP:rk
Enclosure

cc: A. G. Barnett
cc: D. A. Brown
cc: R. C. Herrington

Roundup® is a registered trademark of Monsanto Company.

BONNEVILLE POWER ADMINISTRATION

ANTHONY R. MORRELL,

WE WERE INTERESTED TO SEE YOUR DRAFT ENVIRONMENTAL IMPACT STATEMENT AND THE APPENDICES. IT REMINDS US AGAIN OF THE PRIVILEGE THAT WE HAVE TO BE PART OF YOUR DECISION-MAKING PROCESS. THANK YOU FOR THIS OPPORTUNITY TO SUBMIT OUR COMMENTS ON YOUR VEGETATION MANAGEMENT PROGRAM.

AFTER REVIEWING THE TEN ALTERNATIVES ON PAGE 47 WE ARE ENCOURAGED TO SEE THAT IN CHOOSING #10 YOU INCORPORATE TWO OF OUR FAVORITE APPROACHES TO VEGETATION MANAGEMENT, BIOLOGICAL AND MANUAL METHODS. OUR CONCERN LIES IN THE OTHER TWO METHODS INCLUDED IN ALTERNATIVE 10: SPOT CHEMICAL AND BROADCAST CHEMICAL. OUR MAJOR CONCERN BEING OVER BROADCAST CHEMICAL USE. WE SINCERELY HOPE THAT B.P.A. WILL BE WILLING TO LEAVE THIS METHOD AS A LAST RESORT. IF THE FACTORS INVOLVED IN ANY CASE ARE INTELLIGENTLY ANALYSED AND CONSIDERED, CERTAINLY SOME OTHER FORM OF CONTROL CAN BE IMPLEMENTED, IN MOST EVERY CASE.

IN OUR OPINION ALTERNATIVE 7 IS THE ONLY ACCEPTABLE ONE; OUR CONCERN BEING IN THE AREA OF CHEMICAL USAGE. AFTER MUCH PREVIOUS RESEARCH WE ARE CONVINCED THAT WHEN CHEMICALS ARE USED, SAFETY IS VIRTUALLY NON-EXISTENT. BECAUSE THERE IS SO MUCH UNCERTAINTY SURROUNDING THE DATA OF PREVIOUS CHEMICAL RESEARCH, WOULDN'T IT BE MUCH WISER TO IMPLEMENT ONLY THOSE METHODS THAT WERE PROVEN SAFE?

LINCOLN COUNTY IS IN THE UPPER COLUMBIAN COUNTRIES, AND IN PREVIOUS CONVERSATIONS WITH THE B.P.A. PERSONNEL NEAR US, THE CHIEF CONCERN HERE SEEMS TO BE THE CONTROL OF THIN-LEAFED ALDER AND OTHER HARDWOODS, ALONG RIGHT-OF-WAY ROADS. THE APPARENT NEED FOR CLEARING THESE ROADS IS FOR MAINTENANCE ACCESS. SINCE MOST ALL THE HARDWOODS ARE NOT TALL ENOUGH GROWING TO INTERFERE WITH THE POWER LINES, AND THE MAIN PROBLEM THEY POSE IS TO THE ACCESS ROADS; WOULD IT BE FEASIBLE TO PERFORM MAINTENANCE OPERATIONS FROM THE AIR, RATHER THAN FROM THE ACCESS ROADS? VIA HELICOPTER OR OTHER SIMILAR VEHICLES. THESE ROADS COULD THEN BE ABANDONED AND THE PROBLEM OF THESE RE-SPROUTING SPECIES WOULD BE ELIMINATED.

WE ARE VERY MUCH IN FAVOR OF B.P.A. WORKING TOWARD MAINTENANCE FREE POWERLINE CORRIDORS BY ESTABLISHING STABLE, LOW GROWING PLANT SPECIES. THIS LONG-TERM GOAL IN OUR OPINION VERY WORTHWHILE TO PURSUE. ALSO, THIS PRACTICE WOULD VIRTUALLY ELIMINATE WEED-CONTROL PROBLEMS BECAUSE OF THE GROUND COVER AND COMPETITIVE VEGETATIVE COMMUNITY IT WOULD PROVIDE. WE HOPE THAT IN CASES WHERE THE SOIL IS DISTURBED DUE TO CONSTRUCTION OR OTHER ACTIVITY, THAT YOU WILL SEED THE AREA WITH GRASSES OR OTHER STURDY VEGETATION AS A PREVENTATIVE MEASURE, TO INSURE THAT WEEDS DO NOT MOVE INTO THE DISTURBED AREA.

WE WOULD ENCOURAGE MORE PRESCRIBED GRAZING AND MULTIPLE USE ARRANGEMENTS WITH LANDOWNERS, AND ADJACENT LAND OWNERS. ALSO IN IMPLEMENTING MANUAL METHODS WE WOULD ENCOURAGE YOU TO CONTRACT OUT TO LOCAL WORKERS WHO KNOW THE TERRAIN AND ARE EXPERIENCED IN THE LOCAL VEGETATION. COMPARING THE MANUAL METHODS TO CHEMICAL METHODS, PLEASE CONSIDER THE JOBS FOR PEOPLE THAT THE MANUAL METHODS PROVIDE, RESULTING IN A NEGLIGIBLE IMPACT ON THE ENVIRONMENT - AS COMPARED WITH THE HIGH COST OF CHEMICALS AND EQUIPMENT, PLUS THE ENVIRONMENTAL RISKS. DOES IT SEEM MOST REASONABLE TO IMPLEMENT THE FORMER WHENEVER POSSIBLE?

IF AS A LAST RESORT IN SOME ISOLATED SITUATIONS, SOME CHEMICAL USE SEEMS NECESSARY TO YOU, COULD YOU MAKE IT A PRACTICE TO NOTIFY THE ADJACENT LANDOWNERS OF YOUR PLANS PRIOR TO ANY CHEMICAL USE? WE LIVE RIGHT NEXT TO A POWER-LINE AND WOULD RUN THE RISK OF WATER CONTAMINATION AND CROP DAMAGE, BESIDES OUR OWN EXPOSURE, IF ANY CHEMICALS WERE EVER USED HERE. OUR CHIEF CONCERN IS THE USE OF PICLORAM. THE DRAFT EIS APPENDICES STATES ON PAGE A-103 THAT YOU INTEND TO USE 3,549 LBS. OF PICLORAM IN 1982. WE SINCERELY HOPE YOU DO NOT USE THIS POTENT CHEMICAL AS A MERE CONVENIENCE, WHEN OTHER ALTERNATIVES MAY EXIST. WE FIND IN YOUR ACCOUNTS PG. A-113 THAT THERE IS A HIGH DEGREE OF PICLORAM PERSISTENCE IN SOILS, AND THAT IT IS DESTRUCTIVE TO THE SURVIVAL AND GROWTH OF TROUT FRY, EVEN IN LOW CONCENTRATIONS, PAGE A-111. WE ARE VERY OPPOSED TO B.P.A. USING THIS CHEMICAL, DUE TO ITS PERSISTENCE IN THE ENVIRONMENT, ITS DESTRUCTIVE EFFECTS ON TROUT FRY, THE POISONING OF NON-TARGET VEGETATION, AND THE PROGRESSIVE PROBLEMS THAT ALLOW FOR NOXIOUS WEED INTRUSIONS.

PLEASE BE COMMITTED TO TAKING THE LONG VIEW IN REGARD TO YOUR VEGETATION MANAGEMENT PRACTICES. WE ARE CONFIDENT THAT YOU WILL RECEIVE A GREAT DEAL OF SUPPORT FROM THE PUBLIC, BY PURSUING THOSE PRACTICES THAT ENSURE THE BEST CONDITIONS FOR THE LAND AND ALL FORMS OF LIFE INVOLVED.

THANK YOU FOR CONSIDERING OUR COMMENTS. WE WILL BE ANXIOUS TO KNOW YOUR FINAL DECISIONS FOR THIS PROGRAM.

SINCERELY,

Ferry and Reithma-Delval

P.S. WE WOULD LIKE YOU TO BE AWARE OF OUR INDIVIDUAL SITUATION HERE. OUR WATER SYSTEM LIES UNDER THE B.P.A. POWER-LINE BEHIND OUR HOUSE. THE SPRING WE USE IS JUST ABOVE THE POWER-LINE AND COULD BE CONTAMINATED IF ANY CHEMICALS WERE EVER USED HERE. WE ARE AWARE OF THE RESTRICTIONS ON CHEMICAL USE NEAR A WATER SOURCE, AND TO AVOID ANY LEGAL CONFRONTATION WOULD URGE YOU TO CONTACT US IF YOU EVER PLAN TO USE A CHEMICAL NEAR OUR ACREAGE. OUR LAND DESCRIPTION IS: THE $5\frac{1}{2}$ $5\frac{1}{2}$ SE $\frac{1}{4}$ N $\frac{1}{4}$ of SECTION 36 T14P 32

Response to Larry and Ruthanne Dolezal Letter of
November 19, 1982 (No. 34)

1. See General Response F.

2. It is true that some uncertainty exists as to the effects on humans of small doses of some herbicides proposed for use by BPA. In order to more fully evaluate potential adverse effects on human health, a worst-case analysis of the herbicides proposed for use has been added to the Chapter 7 section on Public Health and Occupational Safety.

3. Transmission line maintenance incorporates three types of activities: periodic inspections, routine and preventive maintenance, and emergency maintenance. BPA performs much of its inspection work from the air. Routine and emergency maintenance activities, however, often require use of heavy equipment and heavy repair materials (e.g. insulators, conductors, steel tower components). To perform these maintenance activities entirely from the air would be extremely expensive and inefficient.

Please note, in Table C-3 of Appendix C, that an average of 68 acres of right-of-way have been treated to control vegetation over the last 10 years in Lincoln County, Montana; approximately half of this was treated by manual methods and half by spot chemical methods. Aerial chemical methods have not been used during this period in Lincoln County.

4. See General Response A.

5. This EIS applies only to management of existing BPA transmission rights-of-way and facilities and not to construction activities. It is a BPA requirement, however, that lands disturbed by construction be restored and seeded within 30 days after construction is complete (see BPA 1977).

6. See General Responses A and D.

7. See General Response B.

8. See General Response G.

9. See General Response H.

10. Please contact BPA's Upper Columbia Area Transmission Maintenance Superintendent in Spokane, WA regarding specific parcels crossed by BPA right-of-way. Also see General Response C.

Bruce L. Mulvey
1307 PLAZA 600 • SEATTLE, WASHINGTON 98101

25 Nov-82

Mr Anthony Morrell, Environmental Mgr.
Sounnville Power Admin.
P.O. Box 3621-SV
Portland, Ore. 97208

Dear Mr. Morrell,

I have reviewed the BPA Transmission
Facilities Vegetation Management Prog. EIS.
My overall feeling is that
as many power lines as
possible should be buried
underground whenever possible.

Thanks

Bruce L. Mulvey
17716 184 AVE NE
WOODINVILLE, WA
98072

Response to Bruce Mulvey Letter of November 25, 1982 (No. 35)

1. This EIS does not evaluate alternatives for construction and location of transmission lines. The subject of underground transmission lines is discussed in other BPA environmental documents (see BPA 1977).

1. See General Response B.

L-36-SJ

I have reviewed the Environmental Impact Statement (overview) and offer these few comments.

1. Statement indicates indepth study.

2. My philosophy rests on the use of technical methods for much of the control. People need electricity but overall each individual needs oxygen food & shelter to survive. And that basic need is the bottom line for people and other life survival. Public power could use a fair base for control and to maintain environmental values as CCC's did in 30.

Ruth Roundy, Mayville.
1203 Cedar St. W. 98270

149 Peterson Rd
Philomath, OR 97370
November 29, 1982

Bonneville Power Administration
P.O. Box 3621 - SJ
Portland, OR 97208

RE: Vegetation Management Altern.

Sirs:

Where local conditions vary, freedom to choose among management options is needed for management success with the least hazard, expense, or inconvenience. For this reason, BPA's preferred Alternative 10 appears the one to go with. Please go with it!

Your unusually even-handed EIS approach helps a public badly needing education about technology. Yet even your EIS could give more insight about the non-herbicidal options for handling brush on rights-of-way.

There is a tendency in vegetation management EIS's to treat herbicides as if they were the only chemicals among the alternatives. This is far from true.

All vegetation management involves chemicals. The combustion products, hydrocarbons, and fuel additives associated with chainsaws, tractors, or the cars of hand-slashers deserve and need, but do not get, risk treatment equal to herbicides. Gasoline (or diesel) is listed in drug manuals as having equivalent toxic hazard to undiluted herbicide, and gas or diesel exhausts are demonstrably far more hazardous than herbicide sprays. Moreover, consumption or evolution of these fuel-related chemicals is greater in non-herbicide alternatives than with herbicides.

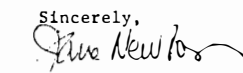
These points are fundamental. The data are available, and relevant, especially considering the startling ratio of risk over herbicides. Yet where are they in (any) EIS?

It is true that equivalency of toxicology information might be hard to achieve. The body of information about herbicides is enormous. The lesser amount about alternatives does not make them "safer"...it makes them less "known". If relative knowledge is the sole criterion, herbicides are far more trustworthy; reams of data establish their level of safety.

Society acknowledges fuel and exhaust hazards yet accepts the use of machinery in the woods as chemically "safe" despite the absence of proof. The public, and federal judges, need to know that by their own criteria, either of chemical safety or of chemical uncertainty, herbicides are more acceptable than any alternatives the require more fuel. An EIS owes clarification that this is the case.

The risks and impacts of various vegetation management tools have been dealt with by Newton and Dost in "Environmental Effects of Veg. Mg't Practices on DNR Forest Lands", (Washington DNR, Sept '81, 252 pp). It deals specifically with the chemical and non-chemical hazards of the non-herbicide techniques at the level of detail currently available.

Sincerely,


Jane Newton.

Response to Jane Newton Letter of November 29, 1982 (No. 37)

1. Your support for Alternative 10 is acknowledged.
2. The discussion of Occupational Hazards in Chapter 7 has been augmented to further acknowledge the fuel and exhaust hazards involved in some vegetation control methods.
3. Newton and Dost (1981) has been used extensively in preparing this EIS.



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333
(404) 452-4095
November 30, 1982

Response to Public Health Service Letter of November 30,
1982 (No. 38)

1. Comment is acknowledged.

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

We have reviewed the Draft Environmental Impact Statement (EIS) for Bonneville Power Administration Transmission Facilities Vegetation Management Program. We are responding on behalf of the Public Health Service.

We have reviewed this document for possible health effects and have no comments to offer since we believe the proposed alternatives have been properly addressed. It appears that all herbicides proposed for use by the Bonneville Power Administration (BPA) are registered by the Environmental Protection Agency (EPA) for the uses shown in the Draft EIS. Application will be made by properly trained personnel at the application rates approved by EPA and safeguards will be taken to minimize hazards to workers and the general public.

Thank you for the opportunity of reviewing this Draft EIS. Please send us a copy of the final document when it becomes available.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health

Nov. 22, 1982

Page 2

William Vaughan
Assistant Sec. for Environmental Protection, Safety & Emergency
U.S. Department of Energy
Washington D.C. 20545

Dear Mr. Vaughan,

After exploring the Draft Environmental Impact Statement for the Bonneville Power Administration's Vegetation Management Program I would like to make the following comments:

- 1) I believe Social Criteria #3, 7, & 8 should be considered of "High" importance. Considering today's overcrowding and diminishing open land 84,000 acres must be considered of high importance. Multiple land use is of considerable value to the public, housing and paving are taking a large toll on American's open lands. | 1
- 2) The proposed control of vegetation thru creation and production of wildlife habitat would seem to have great potential and I would really like to see this control method followed up on and considered strongly. The reduction of habitat is the most threatening problem our wildlife faces today and this control measure seems to offer new and improved areas for wildlife. | 2
- 3) I believe Economic Criteria #10 (employment opportunities) should be rated of high importance. Many people are presently in need of employment. President Reagan's directives encourage large companies to put their profits back into the economy. What is BPA's profit margin? This could provide the opportunity for BPA to support and follow this directive. | 3

- 4) What about an alternative #11? This alternative would combine Manual and Spot Chemical management methods. It would be a costly alternative but would offer the least environmental, plant, animal and soil damage plus the most desirable opportunities for the labor market. | 4
- 5) I note that the preferences of alternative #10 are based on compliance with all instructions and constraints, and mitigation measures. The track record of large companies and/or the possibility of individual error has not been taken into account. What kind of record does BPA have? I believe that this is an overly optimistic view of the potential hazards. Further, no provisions have been made to financially compensate for errors in spray application, i.e. reparations to farmers whose crops have been damaged, etc. | 5
- 6) I would like to encourage documentation of individual treatment selection. In general all additional mitigation measures proposed by the EIS seem reasonable and should be strongly considered and adopted. | 6
- 7) Since the target seems to be high trees, would there be any possibility of opening the area to wood cutters? A treatment rotation of 10 - 20 years was mentioned that would seem to allow trees to grow to sufficient size to cut for wood. | 7

Page 3

- 8) In reference to Tabel 7-4: No explanation or reasoning is given as to why "Manual Vegetation Management" rates 0 - 2 on elevated stream temperatures. I see no reason why manual control would produce this result. It's similar to "Spot Chemical Methods" in potential, but if the premise is accepted that all guidelines for spraying will be followed why not accept the premise that all guidelines for trampling and selection of species to be removed will be followed by manual crews? Page 152 says that poor procedures in regards to work around streams would not be followed, so why the poor rating?

8

I would like to thank you for the opportunity to review the EIS and to comment on it. I hope you will give some consideration to my views. Thanks again!

Sincerely,

Jan Volz
Jan Volz

Response to Jan Volz Letter of November 22, 1982 (No. 39)

1. Evaluation criteria and their relative ratings of importance were developed after careful consideration of the concerns of the public, agencies, and BPA vegetation management personnel (see Chapter 4 section on Evaluation Process). All of the 14 evaluation criteria are important; the relative ratings of importance used in evaluating the alternatives appear to best represent the breadth and intensity of concerns regarding BPA's vegetation management program.

It is BPA's policy to promote compatible and mutually-beneficial uses of rights-of-way by landowners. Compatible uses may include agriculture, rangeland, recreation facilities, and Christmas tree plantations. See Chapter 3 section on Multiple Use Arrangements with Landowners and General Response D.

2. See General Response A.

3. See General Response B.

4. In response to this and other comments, a new alternative combining Manual, Spot Chemical, and Biological control methods has been evaluated in the Final EIS; see Chapter 4 section on Evaluation and Comparison of Alternative Programs.

5. BPA compensates others for damages that its activities have caused. These are tort claim matters that are routinely handled through BPA's General Counsel Office.

6. Your support for this recommended mitigation measure is acknowledged. See General Responses E and G.

7. Landowners of BPA rights-of-way retain title for all uses except construction, operation, and maintenance of transmission lines. More than 97 percent of BPA right-of-way requiring brush control is owned by private individuals or corporations or administered by various state and federal agencies. Landowners desiring to manage right-of-way on their lands for production of firewood can establish formal "Tree and Brush Control Agreements" with BPA (see Chapter 3 section on Multiple Use Arrangements with Landowners).

8. The rating shown for manual methods relative to stream temperatures in Table 7-4 was a typographical error; the rating has been corrected.

L-90-5J

Star Rt. 2, Box 23
Philomath, Or 97370
December 1, 1982

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Or 97208

Dear Mr. Morrell,

This letter is to convey comments on the distributed draft of your Environmental Impact Statement concerning Transmission Facilities Vegetation Management Program.

Generally it appears that there was adequate study of appropriate factors in the preparation of this EIS and that careful consideration has been given to essentially all components of vegetative and related biotic systems impacted by the presence of transmission line rights-of-way. My comments will apply primarily to the section "Issues to be Resolved" as listed on page vi in the summary of the EIS and are as follows:

(1) It would seem appropriate to develop an economic model to assist in the decision making process of selecting the appropriate combination of vegetation management systems for specific sites or types of sites. In order to do this it would then be necessary to assign relative numerical "values" to the various components of the system and thereby give reviewers, or others concerned with your practices, a better understanding of the relative values you place on environmental, social, or other factors in your decision making process. This should also result in the best economic choice of management practices within the constraints of acceptable environmental and social impact.

(2) I would encourage pursuit of item 5 (promotion of multiple use) in your consideration of "Issues to be Resolved". This should be included in any economic model, as suggested above.

(3) In item 13, page iv of the Summary, concerning research in vegetation control measures, I would suggest that your research program could include a modest component for the evaluation, and integration into your management programs, of plants with allelopathic characteristics. Suppression of undesirable species with introduced plants that are both highly competitive and allelopathic, and at the same time not potentially capable of violating your standards, can be very desirable economically in the moderate to long-term setting.

Thank you for this opportunity to respond to your efforts in developing suggested vegetation management programs for your facilities.

Sincerely,

Garvin Crabtree

Response to Garvin Crabtree Letter of December 1, 1982
(No. 40)

1. It is not possible to mechanically select treatment methods for specific sites as suggested. Also, economic efficiency is only one of several guiding purposes of BPA's vegetation management program (see Chapter 2). Selection of treatments for specific sites requires consideration of many factors and requires judgement on the part of Area Maintenance personnel as to how to balance the factors (see Chapter 5 section on Treatment Selection Guidelines).

A number of mitigation measures have been identified by this study but are not presently included in the proposed action or other alternatives (see Chapter 4 section on Mitigation Measures). Among these, Measure 17 (see Table 4-5) recommends documentation of the rationale for site-specific treatment selection using BPA's ROWDATA system. Such documentation would demonstrate that an IPM decision process is being used on a site-specific basis in BPA's vegetation management program (see General Response E).

2. See General Response D.

3. See General Response A.



United States
Department of
Agriculture

Soil
Conservation
Service

West National Technical Center
511 N. W. Broadway, Rm 510
Portland, Oregon 97209

2-41-85

Anthony R. Morrell
12/3/82

2

December 3, 1982

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

The Soil Conservation Service has reviewed the BPA draft environmental impact statement (EIS) concerning Transmission Facilities Vegetation Management Program. Overall, the two documents are quite well prepared.

When the final EIS is completed, we would appreciate 20 copies so that we can distribute the document to all SCS state offices in our work area, as well as to our National Headquarters. The herbicide appendix would be very useful to our staffs.

We have the following general comments, as well as suggestions for improvement:

General Comments

The basic premise of the draft EIS is that vegetation will be controlled/eliminated by herbicides. There is another alternative method that could be explored. That alternative is the use of "desirable" low growing plant materials to replace the "undesirable" vegetation. This alternative would stabilize the soil and retard invasion of undesirable vegetation.

For example, covar sheep fescue excludes chaparral invasion in southwestern Oregon. This plant species may be able to control woody invasion elsewhere in the Northwest, and should be tested for this use.

In addition, we agree that research on vegetative controls of invasion by tall species is needed, but the greatest need is to develop seed supplies for those low growing species which offer the greatest potential. Seed could then be used for large scale tests, and for subsequent applications if results are good. The Soil Conservation Service Plant Materials Center in Corvallis, Oregon could play a role in helping to meet this need. If more basic research is emphasized at the expense of "cultivar" development, it may be 25 years before a vegetal solution is realized.

Suggestions for Improvement

1. Page 53. We question the conclusion drawn under Item 4 that "visual impacts of vegetation management activities would be incrementally small" because of existing transmission facilities in place dominance of landscapes. In many open and closed forest situations, it is the ROW clearing contrast which is dominant, not the structures. By managing the clearing for visual considerations, secondary benefits for reducing some facility contrast could also be gained.

2. Pages 54 and 64. Soil productivity received a moderate importance rating under issues and concerns. The reason given was that implementation of an alternative by BPA that would alter long-term maintenance of soil productivity would be important if there was eventual removal of transmission lines or changes in land use beneath existing lines. Soil productivity could be influenced by BPA alternatives that: (1) increase soil erosion, or (2) increase soil persistence for particular herbicides. Alternative 5, which would have potential for soil erosion and, therefore, adverse effects on soil productivity, has been eliminated from the environmentally preferable alternative (alternative 10). On the other hand, spot or broadcast herbicide treatments are included in alternatives 3, 4, 6, 8, 9, and 10). Site specific soil evaluation is needed to determine latent effects of herbicides. However, it should be recognized that prior herbicide or soil sterilant applications could have at least a short term influence on soil productivity for changed land uses resulting from transmission line removal. Soil properties such as pH, percent organic matter, cation exchange capacity and percent clay, indicate the potential for herbicide carryover that could reduce productivity of subsequent plantings, such as crops, in right-of-ways.

In addition, since soils are the primary sink for herbicides and soil sterilants, it seems appropriate to mention on page 64 the potential residual impact. This could be handled by a text and/or table reference to the rate of herbicide or soil sterilant degradation by microbial or non biological processes. We have attached an example table from the EPA publication, Water Pollution from Cropland, Volume I, November 1975. This type of table showing herbicide and soil sterilant, soil persistence and predominant transport mode, would be useful in the document for projecting the herbicide effects on soils in the environmental consequences of various alternatives such as on page 145. The type of table proposed is a somewhat different presentation on residual effects than BPA Table 7-11, which deals only with persistence of phytotoxic amounts of herbicide.

3. Page 58, Table 4-2. This table indicates that the BPA preferred program would have a potential impact rating of "C" for VISUAL, HISTORICAL, AND CULTURAL. This is extremely difficult to track through Table 4-3 which uses criteria based on low/high sensitivity landscapes. The reader should be clearly advised of the relative difference in impact (C-negligible, D-adverse, E-major adverse) between vegetation management techniques in particular landscape settings (low/high sensitivity).

Also, are all landscapes either low or high sensitivity? High sensitivity is generally described on p. 122-23, but little information is provided on low. It would be helpful to tie the diagrams (Figs. 6-2 and 7-5) to a summary chart indicating how sensitivity levels are intertwined with contrast rating, landscape types, etc.

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The Soil Conservation Service
is an agency of the
Department of Agriculture

SCS-AS-1
10-79

Anthony R. Morrell
12/3/82

3

4. Page 61. It seems contradictory to state that manual methods (Alt. 2) or broadcast chemicals (Alt. 4) could adapt to or preclude feathering, respectively, when an unequivocal rejection of feathering was stated on p. 188.

5. Page 88. The ability of BPA to monitor effects of control treatments on soil, surface water, and ground water appears to be minimal. Although BPA can be assumed to be conducting grab samples, they are not mentioned. BPA has only three automatic samplers and, from the text, the reader can only infer they are not used regularly or systematically.

6. Page 106, Table 6-1. The average total annual precipitation is shown to range from 2-15 or 2-20 inches in the Columbia Basin, High Lava Plains, and Basin and Range. We question the representativeness of the 2-inch value for the low end of the average and think that the value should be about 6 or 7 inches.

7. Page 106, Table 6-1. We question the inclusion of only granitic and meta-igneous rocks in the northern Rockies. We suggest that, at least, meta-sedimentary rocks be included. An example would be the Belt Formation that occurs along the Idaho-Montana border.

8. Page 107, paragraph 3. We question the discussion that, "productivity and growth rates are primarily a function of moisture and temperature relationships." Moisture could be interpreted as meaning precipitation, whereas, soil moisture might be what is controlling productivity. For example, deep soils with high available water capacities are more productive and support vegetation with higher growth rates than shallow soils with low available water capacities, though both soils may receive the same precipitation and occur at elevations with comparable temperatures. Also, soils developed from serpentine parent materials are less productive than soils developed from most other parent rocks, under the same climatic environment. We recommend the discussion be revised to state that productivity and growth rates...are primarily a function of soil moisture, precipitation, and temperature relationships.

9. Page 128, para. 2. It is stated that when non mechanical treatments are utilized, the chances of increased soil erosion will be minimal. Use of soil sterilants or long residue herbicides could result in complete vegetative kills. When methods are used that kill or destroy all vegetation for long durations, there is a potential for soil erosion. The document does recognize that mechanical methods have the greatest potential for increasing soil erosion.

We recommend that BPA include in the selected alternatives a requirement that a soil erosion control plan, containing adequate measures to control soil erosion, be developed for all mechanically disturbed areas and those areas treated with soil sterilants or long term residue type chemicals.

10. Pages 188 and 190. An overriding concern is the inclusion of two categories: (1) ability to maintain vegetation screens and (2) ability to feather right-of-way edges as environmental consequences. To maintain consistence and logic, environmental consequences are more accurately described as (1) loss of visual screens, and (2) unnatural vegetative edges. The techniques of feathering and selective retention of material in visually sensitive areas are mitigation measures and should be addressed in Chapter 4.

Anthony R. Morrell
12/3/82

4

The content of the "feathering" paragraph should be reconsidered in its entirety. Several assertions appear illogical.

a. The statement, "...the 'unnatural' aspect of the edge is an impact of initial line construction," appears to be an illogical and unnecessary disclaimer. Certainly, initial construction occurred at a point in time and was initially responsible for the impact, but it is the maintenance of this impact in the form of vegetation management that should be the issue. Without continuing human intervention to maintain these "unnatural edges," many would simply cease to exist along with their adverse impacts.

b. It likewise appears inconsistent to state that feathering as a mitigation measure has been "eliminated" from the consideration in toto due to economics and policy. Economics could justifiably preclude blanket use of a measure; however, selective use of this technique could likely be accomplished with no or negligible economic impact. In any case, the economics should be dealt with in Table 4-3 under Treatment Cost.

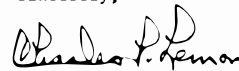
The statement that BPA "does not practice feathering" appears to be inappropriate in the context of an objective discussion of environmental consequences. Feathering is simply one technique to mitigate the impact of unnatural vegetative edges as is the practice of placing large piles of vegetation debris at critical viewpoints to disrupt lines and provide wildlife cover. Therefore, feathering should not be dismissed at this point in the manuscript.

11. Page A-6. Fate and Distribution in the Environment. We suggest that the discussion be expanded to include the following additional factors that change the effect of herbicides by changing the carbohydrate levels or distribution in plants that are affected: (1) temperature and time of application; (2) time of day when herbicide is applied; (3) age of the plant; and (4) stage of plant growth at the time of application. In addition, there is a need for additional discussion of soil moisture and its importance on successful herbicide results.

12. Page A-6. Chemical Fate and Distribution in the Environment. We suggest you add a table that shows for the herbicides discussed such parameters as water solubility, degree of adsorptivity to soil colloids, soil persistence at common use rates, and appropriate time of placement. Various amounts of this type of information are included in the appendix narratives, however, it is very difficult to make comparisons of the chemical properties of herbicides and their interactions with the soil as well as the plant community, in the way the data is presented. Furthermore, an additional table would be useful that shows the stage of growth for various plants when herbicide application is most effective, even though this could be handled by stating that herbicides should be applied according to the manufacturer's instructions.

We appreciated the opportunity to review the subject document.

Sincerely,


CHARLES F. LEMON
Director

Attachments

cc: (w/att.)

G. Margheim, Environmental Coordinator, Ecological Sciences Staff, SCS, Washington, D. C.
E. Andreuccetti, State Conservationist, SCS, Davis, CA
V. Haderlie, State Conservationist, SCS, Bozeman, MT
A. Garrison, State Conservationist, SCS, Boise, ID
J. Kanalz, State Conservationist, SCS, Portland, OR
L. Brown, State Conservationist, Spokane, WA
S. H. Fuchs, Head, Ecol.Sci.Staff, WNTC, Portland, OR

Table 8a. Agricultural herbicides: types, transport modes, toxicities, and persistence in soil

Common Names of Herbicides	Chemical Class ¹	Predominant Transport Mode ²	Toxicity ³		Approximate Persistence in Soil, days
			Rat. Acute Oral LD ₅₀ , mg/kg	Fish ⁴ LC ₅₀ , mg/liter	
Alachlor	AM	SW	1200	2.3	40-70
Ametrityne ⁵	TZ	SW	1110	Low toxicity	30-90
Amitrole	TZ	W	2500	>50	15-30
Asulam	CB	W	>8000	⁶ 5000	25-40
Atrazine	TZ	SW	3080	⁷ 12.6	300-500
Barban	CB	S	1350	⁸ 1.3	20
Benelol	NA	S	800	⁹ 0.03	120-150
Bensulide	AM	S	770	0.72	500-700
Bentazon	DZ	W	1100	190	40-60
Bifenox	AR	S	4600	1.8	700
Bromacil	DZ	W	5200	70	40-60
Bromoxynil	NT	SW	250	0.05	40-80
Butylate	CB	S	4500	4.2	>40
Cacodylic Acid	AS	S		¹⁰ >40	20-40
CDAA	AM	W	700	2.0	20-40
CDEEC	CB	SW	850	4.9	20-40
Chloramben	AR	W	3500	⁶ 7.0	40-60
Chlorbromuron	UR	SW	2150	0.56	300-400
Chloroxuron	UR	S	3700	¹¹ >15	120-260
Chlorpropham	CB	SW	1500	¹² 10	10-30
Cyanazine	TZ	SW	334	4.9	10-30
Cycloate ⁵	CB	SW	2000	4.5	10-30
2, 4-D Acid	PO	W	370	¹³ >50	10-30
2, 4-D Amine	PO	W	370	¹⁴ >15	10-30
2, 4-D Ester	PO	S	500-875	4.5	10-30
Dalapon	AL	W	6590	>100	15-30
2, 4-DB	PO	S	300	4.0	400
DCPA	AR	S	3000	>500	120
Diallate	CB	S	395	5.9	60-180
Dicamba	AR	W	1028	35	90-120
Dichlobenil	NT	S	3160	10.20	15-30
Diminazone	NA	S	3000	6.7	90-180
Dimoseb	PH	SW	5	¹⁵ 0.4	>500
Diphenamid	AM	W	970	25.0	200-500
Diquat	CT	S	400	12.3	
Diuron	UR	S	3400	>60	
DSMA	AS	S	600	>15	
Endosulf	PH	W	38	1.15	
EPTC	CB	SW	1360	19.0	
Ethac ⁵	AR	SW	1780	7.5	
Ethion	UR	W	6400	53	
Fluometuron	UR	SW	7900	¹⁶ >60	
Fluroxypyr	AR	S	15000	0.18	
Glyphosate	AL	S	4320	Low toxicity	
Isopropalin	NA	S	5000	Toxic	
Linuron	UR	S	1500	16.0	
MIBR 8251	AM	SW	633	312	
MCPA	PO	SW	650	10.0	
Metribuzin	TZ	W	1930	>100	
Molinate	CB	W	501	0.29	
Munuron	UR	SW	3500	1.8	
MSMA	AS	S	700	>15	
Naphtalam	AR	W	1770	>180	

Table 8a. Agricultural herbicides: types, transport modes, toxicities, and persistence in soil—(continued)

Common Names of Herbicides	Chemical Class ¹	Predominant Transport Mode ²	Toxicity ³		Approximate Persistence in Soil, days
			Rat. Acute Oral LD ₅₀ , mg/kg	Fish ⁴ LC ₅₀ , mg/liter	
Nitralin	NA	S	2000	Low toxicity	
Nitrofen	PO	S	2630	Toxic	
Oryzalin	AM	S	>10000	Low toxicity	
Paraquat	CT	S	150	¹⁷ 400	>500
Pebulate ⁵	CB	S	921	¹⁸ 6.3	50-60
Phenmedipham	CB	S	2000	¹⁹ 20	100
Picloram	AR	W	8200	2.5	550
Profluralin	NA	S	2200	Toxic	320-640
Prometon ⁵	TZ	S	1750	²⁰ >1.0	>400
Prometryne ⁵	TZ	S	3750	²¹ >1.0	30-40
Pronamide ⁵	AM	S	5620		60-270
Propachlor ⁵	AM	W	710	1.3	30-50
Propanil ⁵	AM	S	1384	>10.0	1-3
Propazine ⁵	TZ	S	5000	>100	200-400
Propham	CB	W	5000	²² 32	20-40
Pyrazon	DZ	W	2500	²³ 40	30-60
Silvex	PO	SW	375	²⁴ 0.36	
Simazine	TZ	S	5000	5.0	200-400
2, 4, 5-T	PO	W	300	0.5-16.7	
TCA	AL	W	3370	²⁵ >2000	20-70
Terbacil	DZ	W	5000	²⁶ 86	700
Terbutryne ⁵	TZ	SW	2400	Low toxicity	20-70
Triallate ⁵	CB	S	1675	4.9	30-40
Trifluralin	NA	S	3700	²⁷ 0.1	120-180
Vernolate ⁵	CB	SW	1625	9.6	50

¹ Chemical type designations: **AL**, aliphatic acids; **AM**, amides and anilides; **AR**, aromatic acids and esters; **AS**, arsenicals; **CB**, carbamates and thiocarbamates; **CT**, cationics; **DZ**, diazines; **NA**, nitroanilines; **NT**, nitriles; **PH**, phenols and dicarboxylic acids; **PO**, phenoxy compounds; **TZ**, triazines and triazoles; **UR**, ureas.

² Where movement of herbicides in runoff from treated fields occurs, **S** denotes those chemicals that will most likely move primarily with the sediment, **W** denotes those that will most likely move primarily with the water, and **SW** denotes those that will most likely move in appreciable proportion with both sediment and water.

³ Expressed as the lethal dose, or lethal concentration, to 50% of the test animals (LD₅₀ or LC₅₀, respectively).

⁴ 48- or 96-hour LC₅₀ for bluegills or rainbow trout, unless otherwise specified.

⁵ Trade name; no corresponding common name exists.

⁶ 24-hour LC₅₀.

⁷ For goldfish.

⁸ For killifish.

⁹ For spot.

¹⁰ LC₁₀₀.

¹¹ For mullet.

¹² For harlequin fish.

¹³ For catfish.

¹⁴ For sunfish.

Response to Soil Conservation Service Letter of December 3, 1982 (No. 41)

1. It is not true that "the basic premise of the draft EIS is that vegetation will be controlled/eliminated by herbicides". The preferred program alternative includes the availability of manual, biological and chemical methods for use in specific management situations. Treatments are selected for specific sites based on consideration of environmental, economic, and management factors. Guidelines used by BPA in selecting individual treatments are described in the Chapter 5 section on Treatment Selection Guidelines.

2. See General Response A.

3. Initial right-of-way clearing can dominate a local landscape in some forest situations. Subsequent vegetation management activities, as a general rule, are relatively minor compared to the initial intrusion caused by line construction.

4. The possibility of persistent herbicide effects on changed land uses is recognized in the Chapter 7 section on Land Uses. Applications of granular and pelletized herbicides are avoided in areas that may be subsequently planted to crops; this is a mitigation measure presently incorporated in the preferred alternative (see Mitigation Measure No. 45 in Table 4-5).

5. Discussion of potential residual impacts of herbicides on soil productivity has been added to Table 4-3.

6. Persistence of phytotoxic amounts of herbicide is the issue of concern. Table 7-11 adequately provides information on this issue.

7. Rationale for potential impact ratings in Table 4-3 has been augmented to better explain the relative differences in potential impacts among vegetation management methods.

8. Discussions in Chapter 6 and 7 sections on Visual Resources have been augmented to show the connections among high sensitivity landscapes and landscape setting types.

9. The referenced "rejection of feathering" in Chapter 7 has been deleted.

10. BPA's monitoring is more extensive than the referenced discussion indicated. The discussion (Chapter 5 section on Development of Vegetation Management Prescriptions) has been augmented to better characterize BPA's herbicide monitoring ability. At the present time, BPA does not monitor groundwater, although such monitoring at substations has been

Response to Soil Conservation Service Letter of December 3, 1982 (No. 41) (cont'd)

identified as a mitigation measure. Also see General Response C.

11. Precipitation values in Table 6-1 have been corrected.

12. Indicated correction has been made.

13. Forms of moisture that interact with the operational environment of a plant include both soil and atmospheric moisture. As you have pointed out, both influence productivity. The wording of the text has been amended as suggested.

14. BPA proposes to use soil sterilants and long-residue herbicides to achieve complete vegetation control only in two situations: 1) in substation switchyards and 2) around the bases of wooden power poles. Substation switchyards are constructed on ground that is levelled and gravelled (see Figure 3-2); drainage systems including catch basins and drain pipes are installed to control surface runoff. Erosion from substation switchyards is negligible. Around wooden power poles, vegetation is controlled in an area extending outward approximately three feet from the base of a pole. Erosion hazards from such small scattered areas are minimal. BPA does not propose to use mechanical equipment in its vegetation management program. Based on these characteristics of the preferred alternative, soil erosion due to BPA vegetation management will be minimal and a soil erosion control plan is not necessary.

15. The discussion of potential impacts on Visual Resources in Chapter 7 has been rewritten to accommodate the suggestions of this comment.

16. The cited paragraph has been rewritten to acknowledge maintenance of "unnatural" edge as a potential impact of continuing vegetation management. Rights-of-way will remain highly visible if tall-growing vegetation is to be prevented from exceeding clearance criteria.

17. Discussion of economic and policy aspects of "feathering" has been shifted to the Chapter 4 section on Mitigation Measures.

18. The suggestions of additional factors to be discussed in the Herbicide Background Statements are appreciated. The suggestions, however, appear to pertain primarily to the activity of herbicides in plants. In contrast, the focus of the Background Statements is the level of toxicological hazard for humans and the environment associated with each herbicide. The requested additional information is more appropriately available from other sources.

1-4-82

310 VINCENT ST.
PHILMATH OR 97370
DECEMBER 1, 1982

COMMENTS ON BPA DRAFT EIS ON TRANSMISSION FACILITIES VEGETATION
MANAGEMENT PROGRAM.

IN THE WHOLE THE STATEMENT IS VERY GOOD AND THOROUGH.
ALTHOUGH I HAVE RESERVATIONS ON THE ALTERNATIVES CONSIDERED (AND
THOSE NOT CONSIDERED) AND ON THE CLASSIFICATION SYSTEM OF TABLE
2, I BELIEVE ALTERNATIVE 10 IS THE ALTERNATIVE WHICH WILL
7 BPA'S NEEDS BEST. AND, IF CERTAIN MITIGATION MEASURES
ARE ADOPTED AND INCLUDED IN THE PREFERRED ALTERNATIVE,
THEN I THINK THE ADVERSE IMPACT ON THE ENVIRONMENT WILL BE
MINIMAL.

IN MAKING MY COMMENTS, I WILL REFER TO THE RELEVANT PAGE NO.
PAGE 34: "PLANT AND ENCOURAGE LOW-GROWING SPECIES..." THIS SHOULD
BE ENCOURAGED AND IF SUCCESSFUL COULD ELIMINATE THE NEED TO
RETREAT AN AREA. NATIVE PLANTS SHOULD BE USED TO REPLACE
INVASIVE SPECIES.

PAGE 36: VOLE AND BLACK-TAILED DEER MANAGEMENT SHOULD BE
IMPLEMENTED WHEN STUDIES ARE COMPLETE.

PAGE 40: PERHAPS LEGISLATION SHOULD BE CREATED TO PERMIT THE
LEASING OF BPA LANDS FOR ANCILLARY PURPOSES.

PAGE 73: PARAGRAPH ONE: THE WORDING IS VAGUE; WILL, BROAD-
CAST CHEMICAL METHODS BE RESTRICTED TO DENSE, UNIFORM
THATCHES OF TARGET SPECIES AND TO INACCESSIBLE AREAS? I THINK
THIS SHOULD BE.

TABLE 4-5 MITIGATION MEASURES

I UNDERSTAND THIS TABLE THOSE MEASURES NOT ASTERISKED
WILL NOT BE IMPLEMENTED UNDER THE PREFERRED ALTERNATIVE.

I BELIEVE THAT ALL OF THE MITIGATION MEASURES LISTED...
ASTERISKED OR NOT, ARE VALUABLE AND PERTINENT AND SHOULD
BE IMPLEMENTED. IN PARTICULAR, MEASURES 3 & 13 MUST BE
CARRIED OUT TO PROVIDE A SOUND BASIS FOR DECISION MAKING,
AND EFFICIENT CONTROL OF VEGETATION. IN CARRYING OUT
MEASURE 3, MEASURE 16 WOULD PROVIDE NEEDED DIRECTION
OR MANAGEMENT UNITS. MEASURE 17 IS NECESSARY FOR PUBLIC

1-4-82

ACCEPTABILITY AND REVIEW. MEASURES 15 & 20 ARE IMPORTANT
TO ENERGY CONSERVATION AND THE PROTECTION OF RARE PLANTS
AND ANIMALS. FOR THESE REASONS, MEASURES 3, 13, 15, 16, 17 &
20 SHOULD BE INCLUDED IN THE SELECTED ALTERNATIVE.

TABLE 4-5 CHEMICAL METHODS
AGAIN, ALL THE MEASURES HAVE MERIT AND ARE CRITICAL TO
THE PROPER USE OF CHEMICAL HERBICIDES. MEASURE 13
SHOULD BE IMPLEMENTED WHEREVER THE SUBSTATION IS CLOSE
TO SURFACE OR GROUND WATER, OR WHEN THERE IS A POSSIBILITY
OF CONTAMINATION DUE TO SPILLAGE OF OTHER OVERUSE.

BROADCAST CHEMICAL METHODS:
ALL MEASURES ARE IMPORTANT; MEASURES 8, 9 & 11 SHOULD BE
IMPLEMENTED IN ORDER TO PROVIDE PROTECTION OF STREAMS
AND AQUATIC SPECIES. MEASURE 10 IS ESSENTIAL TO THE
EFFICIENT TREATMENT OF VEGETATION WITH MINIMUM IMPACT
ON THE ENVIRONMENT.

SPOT CHEMICAL AND MANUAL METHODS:
ALL MEASURES HAVE MERIT AND SHOULD BE IMPLEMENTED.
PAGE 171 DUE TO THE POTENTIAL CHRONIC TOXICITIES OF DIURON
AND 2,4-D IN PARTICULAR, THESE HERBICIDES MUST BE USED
WITH CAUTION. ESTER FORMULATIONS OF 2,4-D (PAGE 150)
SHOULD PROBABLY NOT BE USED NEAR WATER.

APPENDICES:
ATRAZINE: PARTICULAR CARE SHOULD BE TAKEN TO PREVENT
ACCIDENTS AND SPILLAGE AROUND STREAMS; BUFFER ZONES SHOULD
BE USED.

DICAMBA: DUE TO HIGH MOBILITY AND RUNOFF DURING FIRST
RAIN, DICAMBA SHOULD NOT BE USED IN AREAS OF HIGH
WATER TABLE. AND BUFFER ZONES SHOULD BE MAINTAINED ALONG
STREAMS

DIURON: ONE OF THE METABOLIC DERIVATIVES, 3,4-DICHLOROBENZYLME,
MAY BE CARCINOGENIC, AND THIS MAY ACCOUNT FOR THE RUBENCHNIK DATA.
PERHAPS DIURON SHOULD BE PHASED OUT OF BPA'S MANAGEMENT PROGRAM,
OR USE SUSPENDED UNTIL THE CARCINOGENICITY ISSUE IS RESOLVED,
PARTICULARLY SINCE IT IS MORE RARELY PERSISTENT.
MONURON: DUE TO ITS CARCINOGENICITY, SPECIAL CARE MUST BE
TAKEN IN USING UP THE STOCK.

6-11-85

371
PICLORAM SINCE IT IS PERSISTENT BUFFER ZONES MUST BE MAINTAINED AROUND STREAMS. | 14

2, 4-D: ESTER FORMULATIONS SHOULD NOT BE USED NEAR STREAMS | 15

PAGE 10: MITIGATION MEASURES NOT INCLUDED IN THE PREFERRED ALTERNATIVE: #1 WOULD DOCUMENT HOW THE "GENERIC EIS" IS APPLIED TO INDIVIDUAL CASES. THE PUBLIC HAS THE RIGHT TO KNOW THIS, AND I BELIEVE IT WOULD AID IN PUBLIC ACCEPTABILITY. #3 MONITORING THE FATE OF HERBICIDES IN WATER IS INCLUDED IN THE PREFERRED ALTERNATIVE. MITIGATION MEASURE #9. AS PREVIOUSLY STATED IN THESE COMMENTS, THERE ARE CERTAIN TIMES AT WHICH MONITORING SHOULD OCCUR: WHERE THE SUBSTATION IS CLOSE TO SURFACE OF GROUND WATER OR WHEN SPILLAGE OR OVERUSE HAS OCCURRED.

#4 BECAUSE "ESTER FORMULATIONS OF 2,4-D...ARE POTENTIALLY THE MOST TOXIC OF THE PROPOSED HERBICIDES TO FISH" (P.150) IT SHOULD NOT BE USED "WHERE POSSIBILITY OF CONTAMINATING AQUATIC ECOSYSTEMS EXIST."

VI ISSUES TO BE RESOLVED:

1. DIURON SHOULD BE ELIMINATED.
2. AUTOMATIC SHUT-OFF SYSTEMS WOULD INSURE THE INTEGRITY OF THE BUFFER ZONES.
3. MONITORING MAY BE NECESSARY IN SOME CASES.
4. THE RATIONALE FOR CONTROL TREATMENTS SHOULD BE DOCUMENTED.
5. MULTIPLE USE AGREEMENTS SEEM BENEFICIAL BUT IF THE ABANDONED CHRISTMAS TREE FARMS ARE AN INDICATION OF OWNER COOPERATION, THEN THIS DOES NOT SEEM FRUITFUL.
6. 2,4-D 20% FORMULATIONS SHOULD NOT BE USED NEAR WATER.

Marilyn P. Boyesen

MARILYN P. BOYSEN

Response to Marilyn P. Boyesen Letter of December 1, 1982 (No. 42)

1. See General Response A.

2. See General Response A.

3. Of the approximately 84,000 acres of BPA right-of-way requiring brush control, only two percent or approximately 1680 acres are owned in fee by BPA. Suggestions for changes in BPA's enabling legislation should be addressed to the U.S. Congress. See General Response D.

4. As a general rule, broadcast chemical applications are restricted to dense, uniform stands of target vegetation (see Chapter 5 section on Treatment Selection Guidelines and Table 5-1).

5. Mitigation Measures 3 and 13 (Table 4-5) are presently incorporated in the BPA's preferred alternative. Measures 15, 16, 17, and 20 have been identified by this study as measures to further reduce the likelihood of adverse impacts. See General Response E and G.

6. Mitigation Measure 13 (Chemical Methods -- now numbered 33) has been identified by this study; see General Response E.

7. Mitigation Measures 8, 9, 10, and 11 (Broadcast Chemical Methods -- now numbered 41, 42, 43, and 44) have been identified by this study; they are not presently incorporated in the proposed alternative. See General Responses C and E.

8. See Comment Response 4 above.

9. Regarding diuron, see Response No. 12 below. Regarding 2,4-D, see General Response I.

10. Atrazine is proposed for use by BPA only in enclosed substation switchyards for weed control. Therefore possibilities of stream contamination are virtually nonexistent.

11. Buffer zones are observed along all bodies of water (including streams, ponds, springs, seeps, and areas of high water table) during use of dicamba herbicides. See Mitigation Measure 24 (Table 4-5) and Table 5-1. For example, dicamba is not used within 10 feet of a water body. Between 10 and 50 feet, dicamba can only be used in spot treatments such as cut stump or basal stem spray applications. Between 50 and 100 feet, dicamba can be applied only as a spot treatment or ground-based broadcast treatment. For aerial applications, 100 foot buffer zones must be observed.

Response to Marilyn P. Boysen Letter of December 1, 1982
(No. 42) (cont'd)

12. Diuron is proposed for use by BPA on a very limited scale for control of herbaceous weeds at substations. Possibilities of environmental human exposure are minimal. The Rubenchik et al (1973) data are anomalous and will remain so until additional experimental work is done. EPA has not classified diuron as a carcinogen.

13. Monuron is used only within substations for weed control; possibilities of environmental human exposure are minimal.

14. Buffer zones are observed during applications of picloram (see Table 5-1).

15. Buffer zones are observed during applications of 2,4-D ester formulations (see Table 5-1). This study has further identified an additional mitigation measure to prevent contamination of water bodies by 2,4-D ester (see Measure 44, Table 4-5).

16. See General Response E.

State of Montana
Office of the Governor
Helena, Montana 59620

TED SCHWINDEN
GOVERNOR

December 3, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621, Routing Code SJ
Portland, Oregon 97208

Dear Mr. Morrell:

I would like to thank you for the opportunity to review and comment on the Draft Environmental Impact Statement/BPA Transmission Facilities Vegetation Management Program.

Although the document is thorough and well-written in covering a wide range of issues, the State of Montana would like to offer the enclosed comments.

I look forward to receiving your final document.

Sincerely,



TED SCHWINDEN
Governor

Attachment

AREAS OF MAJOR CONCERN

- A. The state must be assured that BPA intends to comply with state water quality standards, especially in A-Closed watersheds. State law provides that no pesticides may be used in A-Closed watersheds. If a written agreement is necessary to insure that no pesticides are used, the Department of Health and Environmental Sciences will draft the agreement.
- B. On page 201, the statement "...there is no state pesticide act, ..." is incorrect. The Montana Pesticide Act (Title 80, Chapter 8, MCA) is administered by the Montana Department of Agriculture.
- C. The DEIS is informative for scope and background data, but is very general with regard to vegetation removal throughout the six-state region in the Pacific Northwest. Montana's vegetation varies widely and is obviously different from the Pacific coast area. Specific data is needed about Montana's vegetation problems as they relate to BPA's right-of-ways and selected methods of vegetational removal.

There are existing BPA right-of-ways in Montana. Vegetation removal data from existing Montana programs is collected, as stated in the DEIS, in a computer system, ROWDATA. Data for Montana should be made available and used to evaluate the proposed removal program. Points to consider are: location of right-of-way, type of vegetation to be removed (and comparison to proposed sites), method of removal (chemical or mechanical), specific chemical used (if any) at each location, type of application, chemical concentration, proximity of location to population areas, average wind/weather data; and frequency and duration of chemical application, success rate, as well as any malfunctions and their scope.

- D. The DEIS appears to favor chemical usage, but lacks definitive statements that chemicals will actually be used. That point should be addressed clearly and directly. If mechanical cutting is used, the method of disposing of cut material should be identified. If the refuse is to be burned, the BPA must observe the conditions in Montana's Open Burning Regulation (16.8.1300 A.R.M. et. seq.) and work in cooperation with the Air Quality Bureau and the Smoke Management Program.
- E. The management program as presented in the DEIS appears limited to a consideration of in place rights-of-way and contains no specific discussion of initial site preparation, clearing, etc. The FEIS would be strengthened by addressing this matter because initial site preparation is important in determining the future management options of the rights-of-way vegetation.
- F. In the description of target vegetation (pages 11-15), the discussion of management for tall growing or otherwise hazardous trees is limited to those within the rights-of-way's. Where BPA rights-of-way pass through forested state-owned lands, trees outside the rights-of-way may pose similar problems as they mature and increase in height. This subject should be addressed in the FEIS.

The DEIS does not appear to address BPA's policy of right-of-way width as it applies to dangerous trees adjacent to the right-of-way. The state could support a BPA policy specifying a periodic selective removal of danger trees as part of an overall management program.

G. The preferred alternative does not indicate the mechanical methods of management. The state feels that mechanical methods, as included in other alternatives, would strengthen the preferred alternative with a viable and proven management tool. The addition of spot chemical treatment to the preferred alternative is also commendable.

H. The management policy discussion does not address landowner notification by BPA prior to the initiation of management related activities. As a part of any successful vegetation management program, BPA should contact landowners and adjacent landowners before any management activities affecting or potentially affecting vegetation within or adjacent to the rights-of-way are undertaken. This is especially important when chemical treatment is a component of the management activity. In past instances where BPA has contacted the Department of Health and Environmental Sciences prior to the use of chemicals, acceptable alternatives have been developed for use in the management program.

7

8

9

Response to Montana Office of the Governor Letter of
December 3, 1982 (No. 43)

1. BPA intends to fully comply with Montana state water quality standards. The Montana Department of Health and Environmental Sciences should contact BPA's Upper Columbia Area Right-of-Way Maintenance Specialist in Spokane, WA to ensure that he is cognizant of any overlap between "A-Closed Watersheds" and BPA rights-of-way. If such overlap does exist, written agreements concerning BPA's vegetation management practices may be appropriate.

2. The statement regarding Montana pesticide legislation has been corrected.

3. The types of data and analysis requested in this comment are considered at the site-specific level of treatment selection and implementation (see Chapter 4 sections on Development of Vegetation Management Prescriptions and Treatment Selection Guidelines). This programmatic EIS evaluates the vegetation control methods that would be available for BPA to use in general types of situations.

This EIS has identified a mitigation measure that would make available the types of data requested in this comment and considered in selection of individual site-specific treatments (see No. 17 in Table 4-5). This mitigation measure is not presently incorporated in BPA's preferred program alternative. See General Responses E and G.

4. BPA's preferred alternative as evaluated in this EIS would include chemical methods for use to control vegetation. The chemicals that would be included in the program are evaluated individually in Herbicide Background Statements in Appendix A (also see Chapter 7 section on Public Health). At this programmatic level of analysis, however, no definitive statement can be made that chemicals would be used at any particular site. Individual site-specific treatment selection is discussed in Chapter 5.

5. BPA does not propose to burn slash; slash would be either chipped or lopped and scattered.

6. The comment is correct that initial clearing influences subsequent management options for right-of-way vegetation. This EIS, however, pertains only to vegetation management on existing rights-of-way. This concern is appropriate for environmental analyses of new transmission line proposals.

Response to Montana Office of the Governor Letter of
December 3, 1982 (No. 43) (cont'd)

7. Trees growing off rights-of-way may indeed pose hazards for transmission system reliability. BPA policy is to determine compensation and obtain permission to cut from owners of danger trees before removing them. BPA will contact Montana forest administrators before cutting danger trees on state forest lands. BPA's periodic transmission line inspections identify danger trees to be selectively removed.

8. Your preference for use of mechanical and spot chemical methods is acknowledged.

9. Your preference for landowner notification is acknowledged. See General Response G.



United States
Department of
Agriculture

Forest
Service

Columbia Gorge RD

31520 SE Woodard Rd.
Troutdale, OR 97060

Reply to 2720

Date December 3, 1982

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

Thank you for the opportunity to comment on the first draft of the Vegetation Management Environmental Impact Statement. After review of the document, several comments, concerns and requests have surfaced. For ease in referral, page numbers from the document are included where applicable.

- (Page IV) Why were alternatives 3 and 4 in mitigation measures not included in the preferred alternative? These refer to monitoring the fate of herbicides (in ground and surface water) used at high application rates for substation weed control and restrictions on use of 2, 4-D esters where possibility of contaminating aquatic ecosystems exists. | 1
- (Page V) We are interested in having a summary of BPA's water monitoring program and results and a contact name with which to discuss studies if we desire them to monitor as provided on page 88. | 2
- (Page 112) A concern with the document is that it gives no mention to the Bull Run Watershed which is managed under special legislation by the Forest Service with activities coordinated with the City of Portland. The Bull Run Watershed is perhaps the largest exclusive surface water source used in the Pacific Northwest, furnishing water for the City of Portland and surrounding metropolitan area. Does the scope of this document include this area? The Hanford-Ostrander Transmission Line passes through this watershed, yet it is not shown on any included map as a power transmission line route. | 3

An issue not addressed in the EIS is the risk of fire in a sprayed powerline right-of-way area. In conjunction with this is the possible hazards of toxic smoke to fire fighters should a fire occur in that area. | 4

With regards to Bull Run Watershed, slash treatment addressed in the draft EIS is not complete and seems to be mentioned almost as an afterthought. | 5

Please note that with alternatives involving power tools or equipment on Forest Service lands, use must meet the Mt. Hood National Forest fire precaution schedule.

Please take these comments into consideration when evaluating and rewriting the final environmental impact statement.

Sincerely,


GENE ZIMMERMAN
District Ranger

cc: Harold Lange, S.O.

376



Response to USDA Forest Service, Columbia Gorge Ranger
District Letter of December 3, 1982 (No. 44)

1. See General Response E.

2. Please contact BPA's Branch of Transmission Line Maintenance in Vancouver, WA for information on the water monitoring program.

3. Figure 2-1 and other BPA Service Area maps contained in the EIS are to provide a conceptual understanding of the general locations and extent of the BPA transmission system. The maps do not attempt to show all BPA transmission lines but rather simplified conceptual route locations. Some corrections have been made on the maps to better portray these route locations.

In a generic sense, the scope of this EIS does cover the Bull Run Watershed and the Hanford-Ostrander Transmission Line. See Chapter 7 sections on Water Quality and Public Health; also see General Response C.

4. Dost (1982) analyzed the hazard to firefighters from inhaling smoke produced from herbicide-treated vegetation. He considered four representative herbicides, 2,4-D, dicamba, picloram, and glyphosate; these four active ingredients are those proposed for use by BPA in right-of-way foliage treatments. By the time treated vegetation would be combustible, herbicide would have degraded to about 25-50 percent of the original application.

Dost (1982) concluded that each of the four herbicides would degrade in burning plant material to products representing no hazard to person inhaling the smoke. The absence of hazard is due to the extremely low or nonexistent concentrations of toxic degradation products in smoke.

5. Treatment of slash on National Forest lands is specified in Right-of-Way Management Plans developed cooperatively by BPA and Forest Service personnel (see Chapter 8 section on Permit for Right-of-Way on Public Land).



United States
Department of
Agriculture

Forest
Service

Washington
Office

12th & Independence SW
P.O. Box 2417
Washington, DC 20013

Reply to: 1950

Date DEC 3 1982

Mr. Anthony R. Morrell
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Morrell:

We have reviewed the DEIS for BPA Transmission Facilities Vegetation Management Program (DOE/EIS-0097). The statement is well prepared and covers the subject in a very thorough and professional way. Our general comments are as follows:

In general, our consensus is that of agreement with the preferred alternative which allows several methods (including chemical) for vegetation management. However, we do suggest that only those herbicides which have the least harmful total impact and are least persistent in the environment be considered for use. Biological control should be emphasized where possible. Where danger of open water contamination exists, the use of 2,4-D ester formulations should be completely eliminated. Also, the width of buffer zones adjacent to open water should be increased or at least open to increase in specific cases. Heavy precipitation areas with steep drainages need wider buffer zones.

The issuance of this EIS would be a good step forward toward better long-term right-of-way management and would probably eliminate the need for review and comments on an annual EIS for this same activity. The right-of-way management plans, as referred to on page 239 of the statement, are excellent tools for anticipating many of the coordination problems we might otherwise face. They have not, however, been written to anticipate all the details in a given year's program of changes that might occur from year to year. Further, the plans are incomplete or obsolete on some of our National Forests. Therefore, the vegetation management work program for any given year must be subject to review on a case-by-case basis by appropriate Forest Supervisors of our National Forests where work is planned in order to have management of National Forests proceed in a fully cooperative and coordinated manner.

Mr. Anthony R. Morrell

Specific Comments

The proposed use of Tordon 101 between Towers 93/1 and 87/1 could completely eliminate the ground cover and leave unsightly brush stems which might require clipping and disposal. This would bare the soil and subject these erosive soils to the possibility of slumping and erosion. We suggest that mechanical control would leave the brush roots intact and protect the soil. Though mechanical control would not last as long as chemical, the environment gains would be worthwhile.

Page 54 - Item 7 - Biophysical Criteria. The statement is made that "Most rights-of-way will remain dedicated to transmission-line uses for the foreseeable future." We believe this should be changed to reflect multiple use of the ROW's. Specifically, we refer to Christmas-tree planting and cutting, vegetation for wildlife use, and continued vegetative control to maintain an edge effect.

Page 54 - Item 8. The statement is made that "No currently listed or proposed, threatened or endangered plant or animal species will be adversely affected by BPA's vegetation management program." We suggest this statement be changed to reflect the chance of threatened or endangered species being present such as bald eagle, peregrine falcon, or grizzly bear. These conflicts could occur on the Targhee National Forest within existing BPA rights-of-way.

Page 112 - Noxious Weeds. Musk thistle in Teton and Bonneville Counties, Idaho, needs to be added. Other species might also be identified in the annual pesticide-use plan. Where appropriate, the Counties of Broadwater and Jefferson, Montana, should be added to county lists.

Page 188 states that BPA does not practice "feathering" of rights-of-way edges. In areas of significant viewing quality, it may be necessary to use all available techniques to mitigate visual impacts.

There is generally a good recognition and discussion of wildlife and fish and their habitats and the potential effects of the various alternatives on wildlife and fish. Evaluation criteria are identified and alternatives are compared in a fairly concise, easy-to-read format.

We appreciate the opportunity to review and comment on this draft environmental impact statement.

Sincerely,

J. Lamar Beasley
J. LAMAR BEASLEY
Deputy Chief

Response to USDA Forest Service (Washington Office) Letter
of December 3, 1982 (No. 45)

1. The EIS has concluded that the herbicides proposed for use by BPA do not pose significant public health or environmental hazards, given the patterns and rates of application proposed by BPA (see Chapter 7 section on Public Health). Site-specific treatment selection would be based on consideration of social, ecological, and economic consequences of using the available control methods.
2. See General Response A.
3. Elimination of use of 2,4-D ester formulations near water bodies has been identified as a mitigation measure by this EIS; however, this measure is not presently incorporated in the preferred alternative. See General Response E.
4. See General Response C. BPA's program of monitoring surface waters during and after aerial herbicide applications has shown that the buffer zones presently used are adequate to prevent hazards to human or environmental health. (See Chapter 7 section on Public Health.)
5. National Forest Supervisors and BPA Area Operation and Maintenance Managers are together responsible for the preparation of detailed site-specific management plans for BPA right-of-way on National Forest land. These cooperative management plans are developed to meet both BPA and National Forest objectives (see Chapter 8 section on Permit for Right-of-Way on Public Land).
6. The statement about soil productivity has been changed to reflect the compatible multiple uses of right-of-way lands.
7. The potential for adverse impacts on these species is discussed in the Chapter 7 section on Endangered and Threatened Wildlife. Our analyses concluded that no adverse impacts would occur due to BPA's proposed vegetation management program. Vegetation management on rights-of-way in forested areas will enhance habitat for grizzly bears by increasing mast-producing plants and by opening travel corridors.
8. Musk thistle has been added to the referenced list of common noxious weeds.
9. The referenced statement has been deleted; BPA may practice "feathering" in certain exceptional cases to mitigate visual resource impacts.



DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208

2-46-53

NPDPL-ER

2 December 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

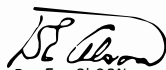
This is in response to Mr. Peter Johnson's letter requesting our review of your Draft Environmental Impact Statement for the Transmission Facilities Vegetation Management Program.

Since the impact of vegetation management on BPA transmission corridors crossing Corps of Engineers administered lands is not specifically addressed, we request that any vegetation manipulation or control activities occurring on these lands be prearranged between the BPA and the appropriate Corps of Engineers District Office.

We note on your list of agencies receiving the EIS that the Portland and Seattle Districts were included, but the Walla Walla District was missing. In order to ensure appropriate coordination it is suggested that they be included with the other District Offices in all future correspondence.

We appreciate the opportunity to review and comment on the EIS.

Sincerely,


D. E. OLSON
Chief, Planning Division

Response to Department of Army Corps of Engineers Letter of December 2, 1982 (No. 46)

1. Please contact the BPA Area Right-of-Way Maintenance Specialists responsible for BPA facilities on such lands to establish agreements regarding notification.
2. The Walla Walla District will be included in future correspondence.

380

Response to G. C. Flynt-Deason Letter of December 5, 1982
(No. 47)

1. Your preference is acknowledged. See General Response B.

"82-12-5"

Regarding the Knoxville Power
Administration future vegetation
management program;

Please use non-chemical
methods, such, to counter
people's health problems
that are caused by
sedentary habits, know most
of the work done with
hand tools.

Thank you.

G. C. Flynt-Deason



PUGET
POWER

December 1, 1982

Response to Puget Sound Power and Light Company Letter of
December 1, 1982 (No. 48)

No comments.

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621, Routing Code SJ
Portland, OR 97208

Dear Mr. Morrell:

Draft Environmental Impact Statement
B.P.A. Transmission Facilities Vegetation Management Program

We have reviewed the subject document and, based on our own experience, find the discussion of management alternatives to be complete and accurate.

Thank you for the opportunity to comment.

Very truly yours,

M.V. Stimac

M. V. Stimac, Manager
Licensing & Regulation

382



Panhandle Environmental League

Chapter of the
Idaho Conservation League

P.O. Box 963, Sandpoint, Idaho 83864

December 2, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

On behalf of the Pesticides Task Force of the Panhandle Environmental League Chapter of the Idaho Conservation League, I would like to respond to the Bonneville Power Administration's Draft Environmental Impact Statement entitled, "Transmission Facilities Vegetation Management Program" released in September, 1982.

After reviewing the control methods outlined in Chapters 3 and 4 of the EIS, I believe that we can only endorse the choice of Alternative 2, the use of manual control methods. We object to the consideration of your Preferred Alternative 10 because of the intention of herbicide use by both spot and broadcast spraying.

Our concerns are based on the potential health and environmental hazards involved with the use of herbicides sprays that the EPA intends to use in their management program, specifically Tordon 10K, Tordon 101, Formula 40 (2,4-D amine), Esteron 99 (2,4-D ester) and Weedone 170. We are also concerned about the potential of contaminating drinking water supplies, municipal watersheds, streams and lakes as well. In addition to these concerns, we are questioning the potential of herbicide spray drift, despite your mitigation measures, which would cause potential damage to adjacent lands. I would like to now present our criticisms of the EIS.

First, in reviewing picloram, the ingredient in Tordon, in Appendix A, your conclusions have been that the herbicide presents a low hazard to the public and the environment. The Environmental Protection Agency (EPA) recently included picloram as one of 37 of "restricted use" pesticides because of its toxicity, which in our view does not classify it as "relatively benign" as your scientific references show. The determination that picloram is non-carcinogenic makes us wonder why you did not research the subject more adequately. We strongly recommend that you consider Dr. Melvin D. Reuter's research findings on the "Carcinogenicity of Picloram" that was published in the Journal of Toxicology and Environmental Health. Dr. Reuter was a leading pathologist for the National Cancer Institute's Frederick (Maryland) Cancer Research Center, and his findings should be included in your research overview of picloram. We are alarmed at the recent findings of chronic effects of the use of picloram in areas like Cherokee County, North Carolina where Tordon has been heavily used in the past, mainly by the U.S. Forest Service. Cancer rates in this area have soared in the last six years to where the number of deaths from cancer is 60% above the national average, and rising. The high cancer rates may be related to the heavy use of Tordon in that area and this relationship should

Page 2

not be overlooked when looking at potential health effects when using Tordon. We are also concerned about the persistence of picloram in the soil, especially if it is used on mountainous areas in the Northwest that are also subject to rainy weather. Because picloram can easily leach from the soils for months, if not years, the potential of water contamination is very real if used on right-of-ways that may be near streams or landowners' springs or wells. There are currently suits across the country with utility companies such as the Georgia Power Company and the Alabama Power Company from adjacent landowners whose drinking water became contaminated with picloram after it was used on utility rights-of-way. We strongly recommend that picloram not be used because of the potential risk to the environment and public health.

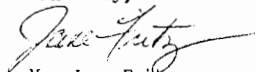
In reviewing your overview of 2,4-D and its various compounds, we are extremely surprised that you made the comment that 2,4-D is "among the most thoroughly tested chemicals used in pest controls" and again that its appropriate use results in a "low degree of hazard" to the public and the environment. This is surprising because you neglected to include in your overview of 2,4-D research studies done that show 2,4-D is not a benign herbicide in any form but instead a potentially dangerous pesticide when considering the risk to public health. Contrary to your findings, 2,4-D is considered carcinogenic, mutagenic, and teratogenic by researchers Dr. Melvin D. Reuter and Dr. Ruth W. Shearer. We suggest you review Dr. Reuter's manuscript entitled "Carcinogenicity of 2,4-Dichlorophenoxyacetic acid" and Dr. Shearer's Literature Reviews of Four Selected Herbicides: 2,4-D, Dichlobenil, Dinquat & Endosulfan, Municipality of Metropolitan Seattle, for additional research information. We are concerned that although the acute toxicity affects have been adequately tested on 2,4-D, the EPA has asked that the herbicide be re-registered to include the chronic and long term health affects related to its use. This research is just being started and until it is completed, we do not feel that 2,4-D should be used. We also feel that the various dioxin contaminants in 2,4-D, although not as toxic as TCDD, should be more adequately tested, especially since dioxins are bioaccumulative in fatty tissues.

With regard to aquatic contamination, 2,4-D has been proven to be acutely toxic to fish, but no chronic, low-level toxicity studies have been done. We object to the use of 2,4-D near water sources and believe the 100-foot buffer zone is inadequate, and should be extended to 1000 feet. The potential danger to fish populations and spawning activities, make the use of 2,4-D in the Northwest a risky business. Potential water contamination and adjacent land defoliation is possible when one considers the possibility of droplet drift when 2,4-D is applied aerially or volatilization of the herbicide that is possible even after the spray is on the vegetation. We absolutely object to the proposed use of 2,4-D by the EPA for these reasons.

In conclusion, we feel that the only viable alternative for vegetation management practices is manual methods as outlined in Alternative 2. The time and labor (economic) constraints that result are easily balanced by the potential public health and environmental detrimental effects. We feel that jobs are better than poisons and hope that you will consider our comments in earnest. We applaud your research into the various biological methods that are experimental and hope you continue this work and implement these methods when feasible and urge you to continue establishing low growing, stable competitive plant species. And we hope that multiple use agreements with adjacent landowners continue to be encouraged.

Thank you for your consideration of our remarks. We hope this testimony will be included in the public review of the Draft EIS and that somehow it will be reflected in the Final EIS. We would appreciate being included on any mailings concerning this program in the future.

Sincerely,



Ms. Jane Fritz
Chairperson
Pesticide Task Force

Response to Panhandle Environmental League Letter of
December 2, 1982 (No. 49)

1. Your preference for Alternative 2 is acknowledged; see General Responses B and F.
2. See General Response H.
3. See General Response I.
4. See General Responses C and I. Also note that very little aerial herbicide application is conducted in BPA's Upper Columbia Area (see Appendix C, Table C-3).
5. Possibilities of water contamination by aerially-applied 2,4-D are minimal (see General Response C). Damage to adjacent nontarget vegetation is also minimally possible. Likelihood of both these occurrences is reduced by the mitigation measures incorporated in the proposed program. Additional measures have been identified to further reduce the likelihood of stream contamination (see Nos. 41, 42, and 44 in Table 4-5). BPA monitors weather conditions during aerial spray operations to minimize drift and volatilization (see No. 34 in Table 4-5); for example ambient temperature must be below 70° F and humidity above 50 percent for aerial applications to proceed (low temperatures and high humidity reduce volatilization).
6. See General Response B.
7. See General Response A.
8. See General Response D.

December 4, 1982

Anthony Morrell
Environmental Manager
P.O. Box 3621-SJ
Portland, Oregon 97208

Comments Regarding BPA Transmission Facilities Vegetation
Management Program Draft Environmental Impact Statement

This document was apparently produced to justify a pre-existing set of management methods. This is unfortunate, since the process of compliance with NEPA is an opportunity for an agency to critically assess potential management options as well as those already in use.

1. Alternatives to Current Practices

The use of low-growing stable vegetation communities for right-of-way maintenance is inadequately considered in the Draft EIS (pp34,35). This method, while requiring a substantial initial investment, offers the potential of much lower maintenance costs in the long term. A major advantage of the method is that it would allow for a reduction in the use of chemical herbicides on transmission line rights-of-way. The safety of herbicide use, especially in broadcast applications, is in many cases subject to question on scientific grounds (I will provide important examples shortly.) and the source of much public concern.

Transmission line right of way maintenance through establishment of stable low-growing vegetation is not included in any of the management options proposed in the Draft EIS. This is understandable since the lack of data on this method makes the assessment of the environmental impacts and cost-effectiveness impossible. "Further research is needed." (p 35) But Table 3-5 (p 44) indicates that this biological management technique is not even included on an experimental basis in BPA's program. I think that a government agency that spends as much on vegetation control as the BPA does can and should devote a portion of those funds to investigation of a potentially useful management method. If BPA won't do it, who will?

2. Assessment of Herbicide Use Impact

The application method can greatly influence the environmental impact of chemical herbicide use. Back-and-squirt application affords a much lower probability of surface

water contamination than aerial application, for instance. The amount of each herbicide proposed for use by BPA is not broken down by application route. (Table 3-2, Table 3-3 and Appendix A) Therefore, I fail to understand how the environmental impact of herbicide use can be totally defined unless it has been pre-determined that none of the application methods listed for each compound pose any environmental hazard. As I indicated above, this is subject to question, particularly in the case of broadcast application of phenoxy herbicides.

3. Public Health Concerns

A serious deficiency of the Draft EIS concerns important gaps in the data base for 2,4-D and picloram. Regarding 2,4-D, IARC concluded that existing data were inadequate to evaluate the carcinogenicity of 2,4-D in animals and man." (p A-159) Negative carcinogenicity tests of picloram have been found invalid by the EPA, so there is no reliable data for that compound.

The premature termination of the 2-year carcinogenicity test of dicamba (p A-52) should cast serious doubt on the negative results of that study. Dicamba is second only to 2,4-D among the organochlorine herbicides in terms of the amount proposed for use.

Thus, some of the herbicides used most by BPA have ill-defined carcinogenic potential. This is especially serious since they are all used in broadcast (including aerial) applications, providing the best possibilities of human exposure. The Draft EIS is inadequate because it lacks important data regarding a significant aspect of impact.

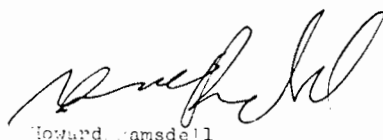
4. Important Mitigation Measures Not Included in Proposed Action

In Table 4-5, #13 under "Chemical Methods" (Monitoring of groundwater near substations with high herbicide application rates) is a safeguard that should be included in a responsible management plan. Some of the herbicides involved have considerable water mobility and the contamination of groundwater in such cases is poorly understood. The Draft EIS has simply dismissed these concerns without adequate study of potential problems.

Stream buffer zones should be rigorously observed. This is important if water contamination problems are to be avoided. For instance, the contention that stream water contamination by 2,4-D is insignificant assumes that buffer zones are observed. (p A-154) It is therefore important that buffer zones be flagged and monitored (Table 4-5 #8, "Broadcast

2-50-03

Chemical Methods). This practice should be included in management plans using broadcast applications of herbicides.



Howard Ramsdell

2960 NW Western Blvd.
Corvallis, Oregon 97333

Response to Howard Ramsdell Letter of December 4, 1982
(No. 50)

1. See General Response A. Table 3-5 has been corrected to show that establishment of stable, low-growing, plant communities is being studied by University of Washington researchers under contract to BPA.
2. Application methods for herbicides proposed for use by BPA are determined at the time of site-specific treatment selection (see Chapter 5 sections on Development of Vegetation Management Prescriptions and Treatment Selection Guidelines). Both non-chemical and chemical methods are considered as well as various routes of herbicide application (see Table 5-1), depending on many site-specific factors (e.g. type and density of vegetation, proximity to sensitive areas, etc.). Therefore a detailed breakdown of proposed uses by application route cannot be provided at this programmatic level of analysis.

Among the several application routes, broadcast applications present the greatest although low possibility of human exposure to herbicides. Therefore a worst-case analysis of the public health hazard of broadcast herbicide applications has been added to the Chapter 7 section on Public Health (also see General Response C).
3. See General Response I.
4. See General Response H.
5. BPA proposes to use dicamba in accordance with label prescriptions approved by EPA. A "worst-case" analysis of potential human exposures to dicamba from proposed BPA uses has been added to the Chapter 7 section on Public Health.
6. See General Responses C and E. Your support for the recommended mitigation measure is acknowledged.
7. See General Responses C and E. Your support for the recommended mitigation measure is acknowledged.

2-51-53

Response to Stephen R. Frazier Letter of December, 1982
(No. 51)

1. Your preference for Alternative 7 is acknowledged.

Steve Frazier
Rt. 3 Box 2792
Moses Lake, Washington
98857

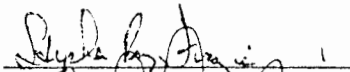
December 1, 1982

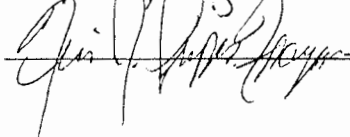
Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SU
Portland, Oregon
97208

Re: Vegetation Management Program

Mr. Morrell;

Upon review of the Draft E.I.S. for the B.P.A.'s Vegetation Management Program, the accompanying appendices and the E.I.S. overview sheet, we are in favor of Alternative number 7 and urge B.P.A. to select this method in dealing with its vegetation management program.

 Stephen R. Frazier

 Teri J. Pieger Frazier



Bees & Bglines

JOAN MANES OLSTROM 3164 MAPLE COURT REEDSPORT, OREGON 97467

December 1, 1982

Anthony R. Morrell,
Environmental Manager, BPA
P.O. Box 3621-SJ
Portland, Or. 97208

Dear Mr. Morrell:

Thank you for sending the environmental impact information on your vegetation management program.

First of all, I must comment that I am amazed at the work that has been done to compile all this information and put it into printed form for citizen input.

I am concerned about the safety of many chemicals that we use in herbicides, pesticides, and even in our food. I think many probably will have negative effects in humans, animals, the water table, etc. that we do not now comprehend. I am also concerned about effects on honey (and other) bees and the resulting loss of bee pasture by herbicides, slash and burn, etc.

Therefore I am most in favor of the hand and machine cutting, mechanical choppers, etc. where feasible, especially near roadways, streams-lakes, and human habitation. Biological and grazing controls (wild or domestic) are also on my favored lists.

However, I do realize that much of our land is not suitable to these controls and that it is sometimes necessary to use herbicides--in very steep areas, for safety around your stations, etc. I would hope herbicide uses would be minimal--spot use favored over "wholesale" aerial broadcasting.

On pages 113-4 you mentioned that a certain butterfly was endangered. As a beekeeper I am concerned about possible negative effects of herbicides over large areas on honey bees themselves and the resulting loss of bee pastures (killing of nectar-pollen yielding plants).

Honey, alkali, and leafcutter bees are very important in our food chain; honey bees are necessary in the production of 1/3 of our food supply through pollination of fruit, vegetable, seed (for cabbage, carrots, etc.), and nuts for humans and also for legume-clover-alfalfa for livestock consumption. Besides pollinating food-forage crops, beekeepers may take bees to forested areas for honey production and also to "build-up" or strengthen the hive. We need both pollination and honey production to keep the commercial and part-time beekeeper in business.

In addition, bee pollination (including solitary and bumblebees) helps control wind and water erosion by causing plants to set seeds, thus continuing reproduction of plants necessary to hold soil. Run-off and blow-off are slowed. Dying plants enrich the soil for the next generation of growth. Many wild plants furnish seeds, nuts, and fruits for wild animals. "Wild" honey bees living in our forests do much pollinating. (Dr. Burgett, Bee Specialist, Entomology at OSU) estimates there is one bee tree for every square mile of our forested areas.)

Seeding areas you need to re-vegetate with mixed species of low shrubs, vines, and also clovers, buckwheat, etc. might encourage grazers (deer, etc.) to come and help keep down the taller trees that you do not want.

Thank you for allowing me some comments.

Cordially yours,

Joan Olstrom

JOANN'S HONEY,
APIARIES & SUPPLIES

HOME ECONOMIST

FREE-LANCE
WRITER

member Oregon State Beekeepers Assoc. and American Beekeeping Fed.

Response to Joan Olstrom Letter of December 1, 1982 (No. 52)

1. See General Responses A and B.

2. Your preference is acknowledged. See General Response F.

3. In response to this comment, the Chapter 7 section on Wildlife: Description of Potential Herbicide Toxicity Impacts has been augmented with a discussion of the possibility of adverse effects on bees. The conclusion of that discussion is that any direct toxic effects of herbicide use will be insignificant; the more significant consequence of vegetation management will be changes in foraging activity due to alterations in the availability of pollen-producing plants (both increases and decreases are possible).

4. See General Response A.



U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

4-53-15

REPLY TO
ATTN OF:

M/S 443

Response to U.S. Environmental Protection Agency Region X
Letter of November 30, 1982 (No. 53)

1. The reference has been added as suggested.

NOV 30 1982

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97212

RE: Draft Environmental Impact Statement (DEIS) for Bonneville Power
Administration's Transmission Facilities Vegetation Management Program

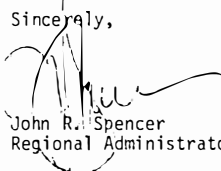
Dear Mr. Morrell:

My staff has completed a review of this Draft Environmental Impact Statement, concentrating on the technical accuracy of the herbicide toxicology discussions. From the Environmental Protection Agency's perspective, the information is thorough, accurate and well presented. Our only suggestion is to include an additional text to which the reader would be directed in the introductory section of Appendix A (page A-1):

Hayes, Jr., W. J., 1982, Pesticides Studied in Man, Williams and Wilkins, Baltimore and London. ISBN 0-683-03896-6

The Draft Environmental Impact Statement is also responsive to our previous comments, as a cooperating agency, on the content and organization of the Environmental Impact Statement. The Environmental Protection Agency has rated this Draft Environmental Impact Statement LO-1 (LO - lack of objections; 1 - adequate information).

Sincerely,


John R. Spencer
Regional Administrator

389



Noxious Weed Control Board

228 W. Main Street, Room 210
Goldendale, Washington 98620

December 6, 1982

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P. O. Box 3621-SJ
Portland, OR 97208

Dear Mr. Morrell:

The draft E.I.S. for the B.P.A. Transmission Facilities Vegetation Management Program has been reviewed at the request of the Klickitat County Noxious Weed Control Board and the Board of County Commissioners. This document was primarily examined with regards to this county's noxious weed program but other secondary interests were also considered. Generally the draft E.I.S. is a reasonable and complete examination of the problems involved in vegetation management on B.P.A. transmission facilities. The stated preferred alternative for control appears to be the best alternative.

Noxious weed control is mentioned throughout the draft E.I.S. in terms of B.P.A.'s recognition of the need to mitigate noxious weed control (p. 8 and 11) to assist private landowners noxious weed control efforts (p. 37 and 75), to cooperate with noxious weed control programs (p. 88, 110-112), and to eliminate noxious weed sources on B.P.A. transmission right-of-ways (p. 192). The draft E.I.S. correctly acknowledges that the B.P.A. Transmission Facilities influences the vegetation growing along the right-of-ways and may aide in the dissemination of noxious weeds. B.P.A. has cooperated with this county's noxious weed control efforts. One significant concern is that the transmission facilities present unique problems in noxious weed control.

This county, like many counties east of the Cascades, has serious range weed infestations. Control efforts largely employ aerial broadcast application of species selective herbicides in remote areas. Ground application is impractical. Aerial application of herbicides flown above the transmission facilities is environmentally safe when thickening agents are added to the spray mix. The control results are often less than satisfactory. B.P.A. could mitigate this problem by making available either a Microfoil boom to local helicopter applicators or by scheduling a microfoil boom equipped helicopter in the late Fall and early Spring in this area. The availability of this specialized and costly equipment would be more desirable than B.P.A. cost sharing monies or other mitigation efforts.

Another item related to noxious weed control that should be clarified is biological control (p. 45, 49, 93). While biological control has its limitations, it has been very effective in reducing the spread of a number

Area (509)
773-5810

Anthony R. Morrell

Page 2

December 6, 1982

of noxious weeds. Noxious weeds that currently have viable biological control organisms include St. Johnswort (*Hypericum perforatum*), Rush Skeltonweed (*Chondrilla juncea*), Spotted Knapweed (*Centaurea maculosa*), Diffuse Knapweed (*Centaurea diffusa*), Musk Thistle (*Carduus thioermeri*) and Dalmatian Toadflax (*Linaria dalmatica*). Biological control is a useful, viable control technique which is well received by the general public. B.P.A. could further mitigate noxious weed problems by assisting in maintaining biological control release sites and providing grants to researchers working in this area. Dr. Gary Piper, Dept. of Entomology, Washington State University, Pullman and Dr. Joe McCaffrey, Dept. of Entomology, University of Idaho, Moscow could provide more information on biological control programs.

Several other issues raised by the draft E.I.S. should also be addressed. The use criteria and hazards of herbicides were presented openly and fairly accurately. Herbicides are tools in vegetation management and like all tools they must be used properly. The use of granular or pelletized herbicides within 10 feet of water bodies even for spot treatment is questionable, both legally and judgementally. Dry formulations of herbicides should not be used near water bodies, if only for public relations concerns. Instead spot treatment of Glyphosate is reasonable and legal up to the waters edge. It is one of only two herbicides listed for use up to the edge of potable water by the State of Washington.

Likewise the broadcast aerial application section does not list Picloram as a noxious weed control herbicide (p. 93). Dow Chemical Corp. and Velsicol Corp. both have indicated to me that Picloram is less mobile but more persistent than Dicamba in the soil. Persistence and soil movement are two concerns in rangeland herbicides. Consideration should be given to using Picloram as a broadcast herbicide for noxious weed control. There is also an error on page 88 concerning grazing on Picloram treated pastures and range. The Tordon 22K label only excludes dairy cows from grazing treated areas for two weeks following application. Picloram is not metabolized by grazing animals and so is readily expelled in urine and milk by animals grazing treated forage. It is a useful and safe herbicide when used according to the label.

Finally, the future testing of additional herbicides and growth hormones is not clearly described. Several new and possibly useful herbicides have recently been developed and may benefit B.P.A.'s vegetation management. These herbicides include Triclopyr, Glean and oust. Also the use of growth retardants may be useful in forested areas to maintain low growing vegetation under transmission lines without using herbicides.

Again the draft E.I.S. is reasonably accurate with the notes recommended changes.

Sincerely,

Bob Gorman, Weed Supervisor
Vice-President Eastern Washington Assoc.
of Weed Supervisors

cc: Fred Holly, Chmn., Klickitat Co. Board of Commissioners
Bruce Cameron, Chmn., Klickitat Co. Noxious Weed Control Board

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Response to Klickitat Noxious Weed Control Board Letter of
December 6, 1982 (No. 54)

1. Your preference for Alternative 10 is acknowledged.
2. BPA contracts with private operators for all aerial applications of herbicides. BPA does not own microfoil booms or helicopters so equipped. Therefore such equipment is not available for loan to counties or local weed control boards.
3. The section of Chapter 3 on Control of Weeds by Introduced Insects has been corrected to indicate that these other viable biological control organisms do exist. Also see General Response A.
4. BPA appreciates the suggestion of sources for technical assistance in biological weed control. BPA's policy with regard to noxious weed control is described in the Chapter 2 section on Underlying Need for Action. BPA cooperates with active weed control programs where BPA's actions may have caused or contributed to the weed problem. BPA does not initiate weed control programs. Mr. August Trz, BPA's Right-of-Way Maintenance Specialist for the Snake River Area should be contacted for details of BPA's weed control activities in Klickitat County.
5. As indicated in Table 5-1 (Treatment Selection Guidelines), BPA uses only ammonium sulfamate (without corrosion inhibitor) within 10 feet of a stream or water body. No dry formulations of herbicides are used within this buffer zone.
6. Picloram has label restrictions against livestock grazing for two weeks after application. Also, it is BPA policy to notify landowners concerning the grazing restrictions before any use of picloram on rights-of-way. Due to these factors, BPA does not use picloram for noxious weed control.
7. BPA's testing of additional herbicides is described in the section of Chapter 3 on Additional Chemical Methods. Among the herbicides to be tested during the period 1982-1986 is Triclopyr. If new vegetation control methods prove to be environmentally safe as well as effective, they may be approved by BPA for addition to its vegetation management program (see Chapter 5 section on Testing and Approval of New Control Methods).

2415-11 xl SL

Willamette, Oregon 97141

December 5, 1982 1-55-55

Bonneville Power Administration

1003 N.E. Stollady

Portland, Oregon 97232

Dear Sirs:

This letter is my response to your

Draft Environmental Impact Statement
Transmission Facilities Vegetation Management

Oregon:

I agree after transmission lines are in place alternative #1, no action is not a reasonable choice. The decision for maintenance of rights-of-way was made before transmission lines construction.

After reading the EIS, I see that alternative #10 is probably the best alternative. It allows for a choice of methods for each site. I believe each choice must be site specific. I would like to see used management methods that are the least damaging to the total environment. I have difficulty believing

-2-

1-55-55

chemicals are the best alternative. I in the last several years the public has learned more and more about the hazards of chemicals in the environment. Therefore, I encourage the BPA to use chemicals only when needed.

I also encourage the BPA to maintain an interest in chemical research in regard to long term problems.

The draft EIS said biological methods are in an experimental stage. I feel the BPA should encourage more research into biological methods of vegetation management methods.

A thought occurred to me while reading the draft EIS. Does the existence of power in the transmission lines affect the vegetation in the right of way? If it does how?

I did find a problem with the draft EIS. There was much needed information. But, by the time I got to Chapter 8 I was getting bogged down. I found Chapter 7 to be wordy and repetitive in sections. There also was information I do not believe was necessary to the EIS. An example was section 13

of Chapter 8, Permit for Structures on Navigable Waters. After setting up the requirements for the permit then it stated no permit was needed for vegetation management.

I hope my comments will help you in preparation of the final EIS.

Sincerely,
H. M. La Matry

Response to H. M. La Matry Letter of December 5, 1982
(No. 55)

1. Your preference for Alternative 10 is acknowledged.
2. BPA uses an Integrated Pest Management (IPM) process to select site-specific treatments. IPM entails consideration of social, environmental, and economic consequences of using available control methods. Naturally-occurring controls are most preferred where feasible but other methods (e.g. manual or chemical) may be used where appropriate. BPA conducts continuing research to identify additional control methods (e.g. biological, chemical) that are suitable for use.
3. BPA is conducting research into biological methods (see Chapter 3 section on Biological Methods). Your preference is acknowledged. See General Response A.
4. BPA and other electric utilities have studied the "field effects" of electrical current on biological organisms for a number of years. These effects are not pertinent to vegetation management and are not discussed in this EIS. Please see reference to BPA (1982) in Chapter 9.

Barbara L. Rhodes
Rt. 1, Box 1945 Libby, Montana 59901
December 6, 1988

Comments-Bonneville Power Administration-Transmission Facilities-

Vegetation Management Program

Bonneville is an agency supported by the public, enabled by Congress and mandated to provide the least cost, most efficient, and environmentally benign power for the region. In this pursuit the management of rights of way and transmission facilities should serve the public interest.

You identify-public health and environmental hazard in the use of pesticides, especially the use of Picloram and 2,4-D. Your discussion does not cover the scientific literature. In studies D. E. Woodward states that Picloram is highly persistent in the soil, is mobile in soil water, could contaminate ground or run-off water, and could contaminate aquatic habitats for many weeks after application. The persistence of Picloram increases the possibility of continuous aquatic habitat contamination. Woodward says "I was unable to determine an exact no-effect concentration of Picloram because growth was affected at the lowest levels tested." Chronic toxicity of Picloram on early life stages of lake trout is more significant than might be anticipated on the basis of only acute tests with fingerlings. The lowest Picloram concentrations significantly affected Alevin survival, yolk sac absorption time, fry survival, and growth rates. Your E. I. G. says the use of Picloram resulted in detectable soil residues for up to three years, and that runoff waters in treated watersheds have frequently been shown to contain detectable residues. M. D. Reuber has reviewed tissue slides done for registration testing of Picloram and found that these histological sections prove that Picloram is highly carcinogenic in rats and mice, and show other toxic changes including chronic kidney disease, heart disease and atrophy of the testes. M. D. Reuber says "Sufficient documentation is available on qualitative extrapolation of animal data that one must conclude that a finding of carcinogenicity in one mammalian species should be deemed to have relevance for other mammalian species-including man. Due to the long latent

Comments-Vegetation Management-continued

period of many human carcinogens this threat may not be manifested for thirty or forty years. Given the state of carcinogenicity testing and knowledge, there can be only one safe tolerance for a carcinogen- an absolute zero tolerance and the only way a substance shown to be carcinogenic in test animals will not be a threat to human health (or wildlife) is simply to prevent that substance from entering the environment.

2,4-D induces excessive and aberrant production of nucleic acid which acts in the plant as a tissue proliferant, overtaxing the growth mechanism in the plant whose systems fail under the stress. Emergency action has been taken in Canada to outlaw 2,4-D because various dioxins have been identified in 2,4-D samples. Dioxins appear to be unavoidable contaminants in the manufacture of 2,4-D, and are some of the deadliest poisons known to man. There is evidence to indicate that combustion or photodecomposition, as with sunlight, spontaneously forms dioxin from 2,4-D. Male and female rats ingesting 2,4-D developed increased incidences of malignant neoplasms or cancers (Reuber, 1980).

M. J. Flewa and J.M. Gentile suggest that the present monitoring system used to detect genetic damage by pesticides is inadequate, and L. A. Norris who is generally supportive of the use of herbicides says that he is concerned the danger in the use of these chemicals comes from the changes in habitat for wildlife.

In light of these concerns reported in the literature Bonneville should chose to use manual and mechanical methods of controlling unwanted vegetation, because it is the most environmentally benign and because this investment of management funds would yield the most employment. Bonneville must now act in accordance with the wildlife enhancing provisions of the Northwest Power Planning Act and should therefore not contemplate action to diminish existing habitat by the use of toxics.

Barbara L. Rhodes

Response to Barbara Rhodes Letter of December 6, 1982
(No. 56)

1. See General Response H.
2. See General Response H.
3. See General Response I.

4. Your support for Alternative 5 is acknowledged. Alternative 5 would be less favorable than the proposed alternative on five environmental evaluation criteria: worker safety; water quality and fisheries; soil productivity; plants and animals; and visual, historical, and cultural resources (see Tables 4-2 and 4-3). Mechanical methods are responsible for adverse environmental impacts (e.g. soil disturbance) relative to most of these criteria. Also, Alternative 5 would be very expensive for several reasons: Mechanical methods cannot be used on much of the steep, rugged terrain typical of the Pacific Northwest. Also mechanical methods are not available for weed control on rights-of-way or for vegetation control at substations. Manual methods (e.g. hoeing or hand-pulling) would be required in these situations.

5. As described in the Chapter 7 section on Wildlife, the herbicides proposed for use by BPA will not pose toxic hazards to wildlife. The effects of chemical methods on wildlife habitat depend on the manner in which they are used. This EIS has identified several mitigation measures not presently included in the proposed program (see Nos. 43 and 49 in Table 4-5) which would enhance wildlife habitat diversity on managed rights-of-way.



King County Executive
Randy Revelle

Department of Planning and Community Development
Holly Miller, Director

December 2, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
Post Office Box 3621, Routing Code SJ
Portland, OR 97208

RE: Transmission Facilities Vegetation Management Program
Draft Environmental Impact Statement (DEIS)

Dear Mr. Morrell:

King County has reviewed the subject DEIS and attached appendices. Generally, the DEIS and technical appendices provide an informative discussion of the proposed vegetation management program and the environmental issues related to its implementation. The following comments are provided for your consideration in preparing the final EIS and in selecting a preferred management alternative and associated mitigation measures.

1. We agree that site specific vegetation control projects implemented under BPA's proposed program should be consistent with local shoreline management master programs. King County's Shoreline Master Program includes policies and guidelines pertaining to utilities and transmission facilities that are relevant to the proposed vegetation management practices. The Natural and Conservancy shoreline Environment categories of the Master Program also provide policy guidance that is pertinent to BPA's vegetation control programs. For example, a substantial part of the Green River Gorge in eastern King County has been designated a Natural Environment which provides for maximum restrictions on all shoreline use activities. County practice has been to restrict clearing and development activities within the entire 200 foot shoreline management zone in the Gorge. The Building and Land Development Division of this department should be contacted on all King County shoreline management matters (344-5286).
2. Wetlands are not consistently identified in the DEIS as areas where buffer zones are required in the application of vegetation management practices. We believe the final EIS should make clear that wetlands are within the definition of water bodies that are afforded buffer zone protections in the application of these measures.

Mr. Anthony Morrell
December 2, 1982
Page 2

King County has enacted legislation which recognizes the value of wetlands and provides strict regulation of development actions in and adjacent to designated wetland areas (King County Sensitive Areas Ordinance - King County Code 21.54). The County has also conducted a county-wide wetland inventory which refined data on County wetlands compiled by the U.S. Fish and Wildlife Service under its national wetland inventory program.

Over 800 wetlands, some of which are within the BPA transmission line rights-of-way, have been catalogued and information collected relative to their biologic, hydrologic and cultural values. From this information, a wetland rating system has been developed which identifies the relative significance of each wetland in comparison to others throughout the County. Management and regulatory guidelines are now being prepared which are based on the rating system.

In general, the proposed management guidelines recommend that development actions respect a minimum undisturbed buffer of 100 feet for wetlands identified as Unique and Outstanding, 50 feet for wetlands identified as Significant and 15 feet for wetlands of Low Concern. Physical alteration of these buffers is generally not permitted, except for extraordinary circumstances or as part of an enhancement plan. Buffer zones established from detailed natural and habitat resource information peculiar to the individual wetland site provide a much more defensible and realistic measure of the need for a zone of insulation around the wetland than standardized buffer widths that do not consider site specific conditions and values.

We recommend that the final EIS discuss the potential for expanding the criteria for determining the width of buffer zones adjacent to wetlands to recognize cases where locally adopted resource management programs can provide more detailed and site specific information on the value of these areas. This discussion should also address the practicability of using detailed wetland information such as is available in King County to define when an "unusual circumstance" exists which would trigger the preparation of a wetland assessment prior to a decision to conduct vegetation management activities (pg. 234 of DEIS). Information on King County's Wetlands Program can be obtained from the Planning Division, Resource Section, of this department (344-7990).

3. King County has also prepared proposed stream corridor policies and guidelines which recommend variable width conservancy areas adjacent to streams to protect the natural hydraulic and habitat functions of the stream. The proposed guidelines are related to a "stream type" classification system developed under the auspices of Washington State Forest Practices Act Regulations (RCW 76.09). The proposed guidelines provide for undisturbed stream corridors not less than 30 feet from the normal waters edge or 20 feet from the top of bank for stream Types 1 through 4. The proposed minimum corridor width for Type 5 streams is 20 feet from the normal water's edge or 15 feet from the top of bank, whichever is greater.

4 57-53

Minimum corridor widths may also be expanded to acknowledge the presence of site specific conditions such as steep slopes, highly erosive soils and adjacent wetlands. As in the case of our recommendations on wetland buffer zones, this information is provided for your consideration in evaluating the issue posed in the DEIS summary section related to the need for increasing the width of buffer zones adjacent to streams and other water bodies.

4. The discussion in Chapter 5 of the DEIS pertaining to the program's compatibility with land use plans and policies should include reference to the following: 1) Washington State Scenic River Act (RCW 79.72) which designated the Skykomish River in King and parts of Snohomish County as a State Scenic River, and 2) the legislative designation of the Green River Gorge as a State Conservation Area (RCW 43.51). Both statutes were enacted for the purpose of assuring that these scenic and unique shorelines are managed in a manner which protects and preserves the natural character of the river and associated shoreline resources.
5. King County has an active vegetation management program which includes brush control along County road shoulders, noxious weed control and general vegetation control as part of the operation and maintenance of County-owned properties such as parks and field offices. Some of these County lands and road rights-of-way abut BPA transmission line rights-of-way. Close coordination of BPA's vegetation management program with King County's will help assure our efforts are compatible and mutually beneficial to landowners and the general public. We are particularly interested in reviewing and providing comment on the environmental assessments prepared subsequent to this DEIS, which will establish management prescriptions for specific management units in King County; and respectfully request they be transmitted to King County. Information on King County's vegetation control program along road rights-of-way and parks properties can be obtained by contracting the King County Road Maintenance Division (255-2531) or King County Parks Division (344-4232), respectively.
6. King County has a local Weed Control Board that has worked with private land owners to control noxious weeds such as tansy ragwort. The BPA has assisted the Board's activities in the past and has provided chemicals to landowners for treatment of weed infestations in and around transmission line rights-of-ways. King County and the Weed Control Board support the continuation of these cooperative efforts with our respective vegetation management programs. The King County Weed Control Board is associated with the King County Cooperative Extension Service and can be contacted at 344-7680.

4 57-55

Thank you for the opportunity to provide comments on the DEIS. If you have specific questions concerning our comments, please feel free to contact Dave Clark of the Planning Division at 344-7990.

Sincerely,

Holly Miller

Holly Miller
Director

HM:DC:mlm

cc: Donald LaBelle, Director, Department of Public Works
ATTN: John Litras, Superintendent, Road Maintenance Division
Vance Hitchcock, Foreman, Spray Section
Ron McConnell, Acting Manager, Division of Building & Land Development
ATTN: Andy Routsala, Shoreline Planner, Plan Implementation Section
Joe Nagel, Manager, Parks and Recreation Division
ATTN: Randy Schroers, Administrative Assistant, Parks Operation Section, Parks Div.
Harold Robertson, Manager, Planning Division
ATTN: Donovan Tracy, Chief, Resource Planning Section
John W. Bernard, Area Extension Agent, King County Cooperative Extension Service
Roy Brooks, President, King County Weed Control Board

Response to King County (WA) Department of Planning and
Community Development Letter of December 2, 1982 (No. 57)

1. BPA recognizes that wetlands are water bodies requiring the observance of appropriate buffer zones when chemical methods of vegetation control are used. We have attempted to identify them consistently as such in the EIS.

2. BPA will work with landowners, land management agencies, and local governmental authorities to ensure compatibility of its vegetation management program with landowner objectives and local land use planning. This EIS has identified a mitigation measure not presently included in the preferred alternative (No. 19 in Table 4-5) which would further facilitate land use compatibility of BPA's proposed program. Establishment of memoranda of agreement with local land use planning entities could address the types of resource management programs suggested in this comment.

3. BPA will observe buffer zones along all streams and water bodies for broadcast chemical applications (see No. 24 in Table 4-5). For aerial applications, a 100-foot buffer zone would be observed; for ground-based broadcast applications, a 50-foot buffer zone would be observed. Within these buffer zones, only individual tall-growing trees would be removed as needed to maintain conductor clearance criteria. No general clearing of vegetation would occur. In addition, at many stream crossings, BPA manages stream-side vegetation to provide visual screens (see No. 8 in Table 4-5). BPA's stream buffer zones appear to provide adequate protection for the "natural hydraulic and habitat functions" of streams crossed by rights-of-way.

4. The Chapter 7 section on Compatibility with Land Use Plans, Policies, and Controls has been amended as suggested.

JOHN SPEELMAN
Governor



DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6000

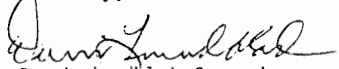
December 6, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

We have coordinated the review of the draft environmental impact statement for the transmission facilities vegetation management program with the other state agencies. In addition to Ecology, the only agency responding is the Department of Natural Resources. The comments are attached for your information.

Sincerely,


Dennis Lundblad, Supervisor
Operations Management Division

cc: Greg Sorlie, Ecology
Harry Anderson, Natural Resources

Comments by Washington State
Department of Ecology

on the

Transmission Facilities Vegetation Management Program
Draft Environmental Impact Statement (EIS)

We are primarily concerned about the potential of chemical contamination of water supplies. The use of stream buffer zones and drift control methods should reduce the possibility of contamination. We urge BPA to contact our regional offices before they work in an area in order that downstream domestic water rights can be located and precautions taken as appropriate.



Department of Natural Resources
Forest Land Management Division
OLYMPIA, WASHINGTON
98504

BRIAN J. BOYLE
Commissioner of Public Lands

Department of Ecology
Page 2
November 23, 1982

November 23, 1982

Department of Ecology
Environmental Review Section
Mail Stop PV-11
Olympia, WA 98504

RE: Bonneville Power Administration Draft Environmental Impact Statement

The Department of Natural Resources has reviewed the DEIS on "Transmission Facilities Vegetation Management Program" prepared by the Bonneville Power Administration and find this to be a well written, positive approach for an EIS.

There are a number of specific comments we would like to make which would improve the document. These are:

- * Page 13, paragraph four, last sentence - All bigleaf maple resprout vigorously, red alder does not resprout as vigorously, especially large diameter trees. Small diameter red alder (less than 4") resprout prolifically. 2
- * Page 23, paragraph two, last sentence - These treatments can be accomplished in any season provided moisture is not flowing down the tree trunk or the temperature is not below 40° F which could result in freezing of the trees' moisture conductive system. 3
- * Page 31, paragraph three, cutting - We have found that some species can be cut at precise intervals which will result in little or no resprouting. Bigleaf maple cut in May and June when flowering and leaf development occur, and red alder cut during July and August, which corresponds to summer drought show limited ability to resprout. 4
- * Page 32, paragraph one, girdling - Same comments regarding resprouting as above. 5
- * Page 170, Table 7-9 - We believe the toxicity for Roundup should be category III rather than category II. 6

- * Page 175, paragraph three, under Public Health Hazards - Should provide the safety margin based in no effect level in rat studies for 2,4-D, which is 30mg/kg. 7
- * Appendices, page A-142, paragraph five - Weedone 170 is manufactured by Union Carbide. 8

The Department appreciates the opportunity to review this DEIS, and hope our comments are helpful.

Sincerely,

Harry W. Anderson
Harry W. Anderson
Division Manager

HA:te

cc: Marsha Hixon

Response to Washington Department of Ecology Letter of
December 6, 1982 (No. 58)

1. Please contact BPA's Area Right-of-Way Maintenance Specialists to establish agreements regarding notification.
2. The Chapter 3 section on Manual Methods has been revised to reflect this information.
3. Our review of the sentence in question indicates that it is correct as written in the Draft EIS.
4. See Response No. 2 above.
5. No published data are known to support this comment.
6. The toxicity category for Roundup Herbicide is II, requiring the Human Hazard Signal Word "Warning" on the product label (Monsanto Material Safety Data; March, 1982). The toxicity category for Technical Glyphosate is III (Human Hazard Signal Word "Caution").
7. A "worst-case analysis" of various routes of human exposure to the herbicides proposed for use by BPA has been added to the Chapter 7 section on Public Health. In that analysis, no-effect levels are used as the standards of comparison in estimating safety margins, as you have suggested.
8. Statement has been corrected.



United States
Department of
Agriculture

Forest
Service

Rocky Mountain
Region

11177 West 8th Avenue
P.O. Box 25127
Lakewood, CO 80225

2-29-80

Reply to 1950

Date DEC 6 1982

SEARCHED	INDEXED
SERIALIZED	FILED
DEC 6 1982	
FBI - DENVER	
EXHIBIT	FILED
DATE	FILED

Peter Johnson, Administrator
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Mr. Johnson:

Thank you for the opportunity to review and comment on your Facilities
Vegetation Management Program Draft Environmental Impact Statement. Our
comments are enclosed.

Sincerely,

402

for *Craig W. Rupp*

CRAIG W. RUPP
Regional Forester

Enclosure

Comments on the Draft EIS
"Transmission Facilities Vegetation Management Program"
Bonneville Power Administration

General Comments

The visual, historical and cultural resources are grouped together for rating and input to the DEIS. We believe that the visual resource should be separated from the cultural resource. Cultural resources shown in the DEIS may not have a big effect on existing rights-of-way. However, the visual impact may be significant on the landscape if the right-of-way is kept clear of any trees and other vegetation. The clear cut or treated swath through the forest environment will have an impact on the landscape. This does not show by combining the cultural with the visual resource. The Rocky Mountain Region of the Forest Service is attempting to improve visual quality by applying visual management principles which will reduce impacts of large openings such as powerline rights-of-way.

Many of the issues seem only to deal with herbicide use, with little emphasis on vegetation management without the use of herbicides. We realize in the Pacific Northwest (Washington and Oregon) the use of herbicides is probably a necessary requirement. However, in the other States, Idaho, Montana, Wyoming, etc., herbicide use is often not required.

In the DEIS there was a discussion on the control of weeds. The term "weed" needs to be better defined in the final EIS. Many "weeds" provide excellent ground cover and forage for livestock and big game animals. Such "weeds" should not be removed.

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Response to USDA Forest Service Rocky Mountain Region Letter
of December 6, 1982 (No. 59)

1. It is true that visual impacts may be significant if rights-of-way are kept clear of vegetation. Little concern has been expressed by the public regarding visual resources or cultural and historical resources, relative to other concerns such as public health, worker safety, water quality, plants and animals, and use of Integrated Pest Management. Therefore we decided in setting up the evaluation criteria that issues of high concern should be evaluated separately while issues of low concern could be grouped.

A review of Tables 4-2 and 4-5 will show that the grouping of visual, cultural, and historical resources has had no significant effect on the evaluation and comparison of alternatives. Mechanical and broadcast chemical methods have the greatest potentials for adverse impacts (for different reasons); therefore alternatives including these methods produce unfavorable ratings on the criterion for visual, cultural, and historical resources.

2. As used in the EIS, the term "weed" is defined in the Chapter 3 section on Target Vegetation. Weeds are herbaceous plants growing where they are not wanted. By this definition, herbaceous plants providing ground cover and forage for livestock and wildlife on rights-of-way are not considered weeds. However, in substations such plants may be considered weeds because of fire and safety hazards.

I.
1/3/1/82
4315 N. Central Blvd.
Redmond, Ore.
97756
To: William Vaughan
From: Robert and Etoile Hunt
Re: Draft Environmental Impact Statement for B. P.A.
Vegetation Management Program

initially would like to state that we enjoyed making your report - as so much needs obviously went into preparing it.

The points that we would like to comment on are that @ 84,000 acres constitutes an area large enough to be of a distinct concern to us. Suppose the loss of wildlife habitat in order to central vegetation seems an extremely creative idea.

③ This set of points appear to be a necessary and helpful analysis, factor in this report it could be (should be) argued that manual control, or partial manual control at least, would create jobs which is also an important factor. The quality of the land that you are going to do is precious - we've been very little about what these chemicals and

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II. Acquisition of wildlife habitat will be in the long run. We also see where there are chemicals, generally when used in the past have caused irreparable harm.

Alternatives to some very serious - in that the damage of this is given to us without choice for mistakes, but will eventually find ways for the environment in the midst of this effort? (Hence) some would in aid to clearing situation. The extent of level necessary, with a minimum of damage.

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Regarding Table 7.4 I don't understand why the manual table stands when the point elevated stream temperatures of a person is standing at the stream he (she) (in more judiciously determine what tree to cut & what to leave standing for temperature regulation.

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In all probability when you have generally had out with a very (usually spraying) all the regulations were jointly addressed to. Rod 5-10, 82 L-60-51

III. However, in my experience (and my husband's) we have been in contact with -

(a) Aerial spraying by the Forest Service in Lincoln County, recently ignored suffer zones near townships of the Alsea River.

(b) The wind blew the sprays into populated areas and the helicopter kept spraying.

(c) A tank on the bed of a truck collapsed and spilled hundreds of 24.5-T into a stream in the Waldport area.

(d) In Alfalfa (Washington county) last year, a helicopter sprayed school children and teachers at the elementary school (a professional operator).

Please understand, we are not trying to be unrealistic or overly emotional - just with the fact that manual techniques will not harm the

IV.

land and eco-systems contained therein, coupled with the fact that we can not keep destroying God's precious gift we don't think best factors are important ~~and~~ we will matter if the wrong decisions are made.

The sea and now profit and love attitudes have been prevalent in the decades past - We now have criminally spread all the way to the Arctic Circle* that will not disintegrate.

In order to accommodate large business interests our government has been all too willing to capitulate and forgo prudence.

We can live with less electricity but we can not live with less land.

Thank you for listening,

Gayle Hunt
Robert Hunt

* DDE, DDD, DDA, DDT

* Adventures with Arctic Wildlife, 1970, Gayton Printers; Authors: Gilbert and Vivian Staender

Response to Robert and Estelle Hunt Letter of December 1,
1982 (No. 60)

1. See General Response A.
2. See General Response B.
3. Individual site-specific treatments are selected by BPA's Right-of-Way Maintenance Specialists (see Chapter 5 sections on Development of Vegetation Management Prescriptions and Treatment Selection Guidelines). Treatments are selected based on the condition of the vegetation on each management unit (averaging two acres in size) as well as on other social, environmental, and economic factors. It is BPA policy to allow vegetation to grow on rights-of-way with the least amount of control sufficient to maintain electrical service reliability.
4. The rating shown for manual methods relative to stream temperatures in Table 7-4 was a typographical error; the rating has been corrected.
5. See General Response F.



L-61-55

L-61-55

December 4, 1982

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621, Routing Code SJ
Portland, OR 97208

Re: Please find our written testimony concerning the Transmission Facilities Vegetation Management Program EIS.

Thank you,

Leonora King
Leonora King

The Mt. Baker Watershed Protection Association is a citizen's group formed in response to a community need to protect its watersheds from herbicide exposure. We are commenting on the Draft Environmental Impact Statement on Bonneville Power Administration Transmission Facilities Vegetation Management Program because we feel it does not adequately address the aerial application of picloram in watersheds and because certain statements in the EIS need clarification and revision. We also want to make known our appreciation for mitigation measures which offer, however minutely, additional protection to the environment and to ourselves.

Most of our comments are made in regard to Lake Whatcom, its settling pond, Mirror Lake, and watersheds supplying private domestic water. These are different situations - one a body of water with considerable drainage crossed by BPA rights-of-way; the other a general entity composed of numerous streams transverseing BPA rights-of-way as they flow out of the hills to supply private wells, springs, and surface water systems.

The uses of various herbicides on watersheds is alarming. We are concerned with unknown synergistic relationships, the use of toxicologically significant 2,4-D Esters near watersheds, the use of persistent chemicals such as picloram, their impact on drinking water (especially water that is later treated with chlorine as is the case for Lake Whatcom and the city of Bellingham), and the seemingly endless story of EPA inadequacies in regard to safety testing and registration of chemicals.

GENERAL COMMENTS

Our general comments are listed below.

1. Need for further documentation of procedures and rationale by which control treatments are selected. We urge BPA to adopt this suggestion but would include other documentation as well. Complete spray information with weather conditions, report of whether personnel actually checked the area prior to spray, water monitoring, etc.
2. Flag edges of stream buffer zones to ensure that helicopter operators

recognize their presence during aerial application; monitor a sample of stream buffer zone edges using spray cards. Both are relatively inexpensive and require limited personnel. We highly recommend both to provide management with data valuable in future decision making.

3. Require shut-off of spray delivery system 150 feet from stream. We feel this is only reasonable. We further suggest spraying parallel to streams when possible.

4. Resprouting. The EIS goes into some detail on this issue and we feel it does not give a balanced picture. The Washington Department of Natural Resources has conducted promising studies in forest lands with hand clearing of alders by varying the times of year and the phases of the moon the alders are cut. The results have been very encouraging. Reliance on herbicides may not be inherent in vegetation management as the EIS implies.

One must also remember that after vegetation has been treated once, the situation is not the same. The brush is usually not as dense as before initial treatment. Therefore, subsequent treatment of the same area may fall into different categories requiring a different management decision.

The chart on page 2 of the EIS shows herbicide treatment necessary after only one year later than manual treatments. We feel this is minimal time difference, pointing to the efficiency of manual.

The U.S. General Accounting Office issued a study entitled "Better Data Needed To Determine The Extent To Which Herbicides Should Be Used On Forest Lands," which concluded that costs of manual and herbicide control are narrowing. Therefore, we conclude that the alternative is not an unrealistic choice for vegetation management in many cases.

5. Use of herbicides at substations. The lack of testing and monitoring of chemical use at substations warrants serious reconsideration of the doses as well as specific chemicals proposed for that purpose. The EIS did not suggest either

the alternative of low growing ground cover or that of less drastic chemical treatments.

6. Flying altitude and drift. Aerial application should be avoided whenever possible due to drift and the potential for human error. We are particularly concerned about the height from which BPA applies herbicides. Page 23 of the EIS explains rigorous drift control test that spray delivery systems must pass. This amazing feat needs documentation.

7. All chemicals used by BPA metabolize to non-toxic properties. First comment to that is that in most cases no one knows. Very little testing has been done along these lines. However, studies do suggest 2,4-Dichlorophenol, 2,4-D's primary breakdown product, in combination with the residual 2,4-D, is more dangerous than the 2,4-D as applied.

8. BPA is to be commended for right-of-way inspection prior to spray activities and for their agreements with landowners and other individuals.

A CAUTION ABOUT EPA REGISTRATION

1. A synopsis of EPA registration.

The Insecticide Act of 1910 and later the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA) which replaced it, protected users from deceptive labeling and ineffective products. At about the same time, chemical manufacturers were finding themselves at the end of WW II with large government research grants and a great economic incentive to find civilian markets for the chemicals developed during the war. The increase of pesticide production, from 100 million pounds in 1947 to 1.4 billion by 1975 forced Congress to recognize the need for further legislation to protect the environment. In 1972 FIFRA was amended by the Federal Environmental Pesticides Control Act (FEPCA) which provided that EPA process all new pesticide registration applications and tolerance residue petitions and review and reregister approximately 50,000 pesticides previously registered over the past 30 years. This is especially interesting in light of the

fact that most of the older data did not include a consideration of long-term effects, such as potential mutagenicity, teratogenicity, and carcinogenicity. EPA was to determine if the pesticide would perform its function without unreasonable adverse effects on human health and the environment. Congress then set an unreachable deadline of 1976.

Although there is ample evidence of EPA's failure to implement the 1972 amendments, perhaps the most significant is the collapse in 1976 of the registration program. EPA, struggling with severe manpower shortages, began to think about shortcuts. Products with similar chemical structures were grouped into "batches." Findings concerning toxicity of one was then generalized to the whole "batch." This approach unfortunately ignored the unknown synergistic relationships as well as the possibly toxic properties of the so called inert ingredients.

The members of the reregistration task force validated not the adequacy of the safety testing data submitted by the chemical manufacturers, but often simply the existence of it. They did not read the raw data. Thus decisions on the safety of the chemical were based solely on the research conclusions of the manufacturer, which often did not reflect the raw data.

In 1978 FIFRA was amended to accomplish reregistration in the most "expeditious manner possible." Essentially this means that years later few chemicals have been found to meet the criteria of the law. Often EPA cannot realistically tell you if a pesticide is safe because EPA simply doesn't know.

Thus the statement on page 168 of the EIS is unsatisfactory, "To be federally registered, a pesticide must not give evidence of unreasonable hazard to health or the environment when used according to the label. Thus the EPA and state-approved label represents the best available guidance for the safe and efficacious use of pesticides. The importance of the label is emphasized in BPA's Transmission Line Maintenance Standard."

One might also note that picloram (except Tordon 101K used in forestry) is on EPA's restricted use list.

We would also like to briefly mention the unreliability of commercial laboratories. By now the Industrial Biotech "scandal" is common knowledge but other labs have also been found deficient, including Gulf South who conducted studies on picloram.

Although the EIS did mention several studies to validate the use of picloram, we would like to point out that it did not address testing for chronic toxicity of Tordon 101. There are no reports of animals exposed to Tordon for more than 30 days, nor of any animals so exposed being observed for longer than a month. There does not seem to be any testing for absorption, metabolism, neurotoxicity, chronic toxicity, mutagenicity, fetal toxicity, or induction of cancer, birth defects, or sterility. All acute testing has been done by Dow, the manufacturer.

Most of the testing for picloram has been for acute toxicity. Of its limited long-term feeding studies one was done by Industrial Biotech and found to be invalid. Another was done by Gulf South Research under contract to the National Cancer Institute. This study has also been audited and questioned by the EPA. The results reported in the EIS of an earlier three generation study (stillbirths in the first generation and reduced fertility in the second) is hardly reassuring. The long-term carcinogenicity study reported in the EIS found picloram could induce benign tumors in female rats. This is good news?

The EIS also fails to mention Melvin Reuber's review of the NCI tests done in 1961. It concluded there was a positive correlation between picloram and tumors of the liver and endocrine glands in rats, and tumors of the spleen in mice. Animals fed picloram developed kidney and liver damage, hair loss, vaginal bleeding, tremors, thyroid and parathyroid hyperplasia, skin irritation, dark urine and atrophy of the testes. In a long-term study one often finds chronic problems not associated with the problem on which they are working.

It is interesting to note that picloram was selected by NCI for study because of its persistence and mobility in soil and water suggesting a possible long-term low level exposure.

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Page 162 of the EIS which explains how rapidly picloram is excreted ignores the long-term low level exposure possibility as well as damage the chemical might induce as it travels through the body, no matter how quickly.

Standard animal tests do not adequately compare with human exposure as numerous humans exposed to picloram suffer from chronic headaches, weakness, vision problems, deterioration of memory and concentration, and tingling hands and feet- all difficult to detect in laboratory animals.

The EIS states on p. 171 "their use at the application rates proposed pose no significant hazards of chronic toxicity to animals or humans. This is also ignoring that individuals are exposed to countless other toxins, pollutants, and environmental and hereditary make-ups.

On p. A-11 it states, low concentrations of picloram can reduce survival and growth of lake trout fry... and that the toxic threshold for early life stages is considerably less than acute toxicity thresholds for adult fish. By the same token impact to children is not adequately measured or assessed.

Comments found in the Washington Department of Natural Resources EIS for Forest Land Management Program say the greatest danger for Tordon appears to occur with repeated sustained intake thru several generations at which time teratogenicity occurs.

The BPA EIS says on p. A-11, continual exposure to concentrations as low as .035 ppm unlikely due to limited movement (emphasis added) of picloram from soil to water. This is very contradictory to your own statements:

p. A-113, "surface run-off and leaching are both means by which picloram can move from treated soil to water."

"Rainfall shortly after application can remove up to 50% of the herbicide from a watershed."

p. 104, "Picloram can be easily leached from soil by heavy rain and is very persis-

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ent..."

p. 50, "picloram mobile in soil water."

Another contradiction occurs on p. v, "rapid degradation in soil and water." This is simply not the case for picloram and it is specifically why we are urging EPA to cancel its use on watersheds. You also state that none of the chemicals proposed for use accumulate in the environment. However, a study cited in the aforementioned Department of Natural Resources EIS showed herbicide levels in deer stomachs. Another study released by the National Center for Health Statistics reported 7% of the population surveyed had residues of Garlon (a pyridene base like picloram) in them. Garlon has only been in use a few years.

In the case of using picloram near a standing body of water, the chance of serious contamination increases, especially when this lake is affected by fall flooding of the numerous streams crossing the treated areas of right-of-way. p. 140, "...standing water is most likely to show highest levels of contamination initially or over a period of time." p. A 106, "water collected in ponds adjacent to treated area... stabilized at approximately 5 ppb." How long did this level persist?

On page 320 of their EIS the DNR also states, "greater ^{opportunity} for concentration occurs when a stream carrying chemicals empties into a marsh, pond, or lake." And on page 316, "Herbicide concentrate in ponds and lakes. They can be further concentrated biologically by plankton and other aquatic organisms and can cause fish mortality."

In one study they found "bottom sediment in a slow moving stream accumulated Tordon."

The persistence of picloram contamination in a relatively deep body of water at fairly cool temperatures and the subsequent, routine disturbance of that water with flooding is important considerations in this case. Potential for exposure for a significant portion of watershed is also possible. The spill of Tordon 101 mentioned in the EIS and numerous other reports of Tordon and picloram exposure leads one to question the use of this chemical so near the drinking water of so

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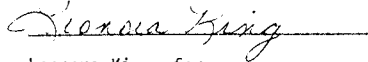
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people.

To quote the EIS, " These observations illustrate the need to carefully control the release of picloram in the environment. We feel the aerial application of picloram near watersheds is unjustified by the EIS, unnecessary when other chemicals and alternative control methods are available, and its use is irresponsible action for BPA. We urge integration of this special circumstance not covered by the EIS into the vegetation management plan. The suggestion on page 77, "restrict use of broadcast chemicals to remote areas with limited access where no possibility of water supply contamination exists," is excellent. And in areas where individuals feel their personal water supplies are threatened by BPA use of chemicals, we suggest BPA conduct water monitoring samples.

In summary, given the inadequate chronic testing for picloram and the potential for impact to large numbers of people, we urge BPA to discontinue use of picloram in or around watersheds, especially Lake Whatcom.

Thank you,



Leonora King, for

Mt. Baker Watershed Protection Association

Response to Mount Baker Watershed Protection Association
Letter of December 4, 1982 (No. 61)

1. Synergism refers to biological response (e.g. toxicity) resulting from interaction between two substances. As a result of the interaction, the response is greater than would be predicted from either substance alone. Synergism requires that the affected organism must be exposed simultaneously to both substances.

No synergistic interactions are known among the herbicides proposed for use by BPA. The highest levels of exposure of both vegetation and nontarget organisms occur at the time herbicides are applied. Subsequent physical, chemical, and biological processes break down the herbicides to less toxicologically significant materials. This breakdown process minimizes the possibility of synergistic interaction among herbicides, or their breakdown products and also minimizes the possibility of a toxic biological response.

2. See General Response C.

3. Your support for this mitigation measure is acknowledged. See General Responses E and G.

4. Documentation of conditions during spray operations is presently provided by "Daily Brush and Weed Control Reports" (BPA Form No. 307) (see Mitigation Measure No. 10 in Table 4-5).

5. Your support for these identified mitigation measures is also acknowledged. See General Response E.

6. See Response 3 above.

7. The Chapter 3 section on Manual Methods has been augmented with a discussion of reported new findings on sprouting responses after cutting. Unfortunately, the DNR results alluded to have not been documented in an authentic experimental design. Further study is needed.

8. BPA's Area Right-of-Way Maintenance Specialists identify management units needing vegetation control and select appropriate control treatments on a site-specific basis (see Chapter 5 section on Treatment Selection Guidelines). Treatments are selected based on consideration of many factors (e.g. vegetation condition) and in order to maintain system reliability with the least amount of control effort. A separate management decision is made for each management unit at each time that it needs treatment (usually at 5-10 year intervals).

Response to Mount Baker Watershed Protection Association
Letter of December 4, 1982 (No. 61) (cont'd)

9. You are correct that, in many cases, manual treatments are appropriate for vegetation management on BPA rights-of-way. See General Response B. Over the last 10 years, manual control methods have been used on nine percent of the right-of-way acres treated by BPA (see Appendix C).

10. BPA has tested and monitored herbicides and rates of application used for substation weed control for many years. BPA is constantly seeking herbicides to use in this situation that have less potential for environmental damage while effectively removing vegetation that poses fire and safety hazards. Because of environmental problems in the past, BPA has recently discontinued use of several herbicides at substations.

This EIS documented that BPA has not monitored the fates of herbicides used at substations in groundwater and surface waters. As a result, the EIS identified the adoption of a mitigation measure to undertake such water monitoring at substations (see Measure No. 33 in Table 4-5). This measure, however, is not presently incorporated in the preferred program alternative. Your support for this mitigation measure is acknowledged. See General Response E.

11. The discussion of "Aerial Techniques" of herbicide application in Chapter 3 has been augmented to more thoroughly explain BPA monitoring of spray delivery performance and drift control measures. Also see General Response F.

12. Documentation does not exist in the scientific literature for the alleged toxic hazards of 2,4-D breakdown products. Physical, chemical, and biological processes transform toxic chemicals into materials called "breakdown products." Such products are generally more water soluble than the parent chemical and, as a result, they are generally less toxic. In addition, breakdown products, which normally include several primary products plus a larger number of secondary products, occur in quantities that are less than the original quantity of parent chemical. The small amounts of possible breakdown products therefore minimize the possibility that they will cause a harmful biological response (i.e. toxicity). This consideration of possible dose-response relationships indicates that little hazard is associated with 2,4-D breakdown products. Also see General Response I.

Response to Mount Baker Watershed Protection Association
Letter of December 4, 1982 (No. 61) (cont'd)

13. Scientific uncertainty does exist concerning the public health and environmental effects of some herbicides and herbicide breakdown products. Likewise BPA recognizes that it must make its own judgments about the effects of its proposed use of herbicides on humans and the environment, in accordance with the National Environmental Policy Act. Therefore a "worst-case analysis" of the herbicides proposed for use by BPA has been added to the Chapter 7 section on Public Health. Also, the cited language on (former) page 168 has been amended to reflect the above considerations.

14. See General Response H.

15. See General Response H.

16. There is no scientific evidence for human health hazard due to long-term low-level exposure to picloram.

17. See General Response H.

18. The fact that picloram is persistent in soil and mobile in soil water means that picloram can be detected in streams draining treated areas (see Picloram Background Statement). However, the amount of picloram that does move in this manner is limited, and stream concentrations as high as 0.035 ppm are unlikely. (The statement on page A-113 is as follows: "Rainfall shortly after application can remove up to five percent of the herbicide from a watershed.")

19. Although picloram is persistent at levels toxic to plants for longer periods than the other herbicides proposed for use by BPA, picloram is also the least toxic (see Table 7-7). Hazard assessment must consider levels of potential exposure relative to known levels at which toxicity symptoms have been found. Such a consideration for picloram results in the conclusion that BPA's proposed use of picloram would not be toxicologically significant.

20. An observation of detectable herbicide levels in deer stomachs is not evidence that the herbicide is accumulating in the environment. One would also need to know the amounts of herbicide being ingested and being excreted over time in order to postulate bioaccumulation.

21. A lake with normal inflow and outflow is not considered "standing water." The Picloram Background Statement describes results of studies of picloram residues in streams

Response to Mount Baker Watershed Protection Association
Letter of December 4, 1982 (No. 61) (cont'd)

during the first rainfall after application. Detected residues have not occurred at levels posing hazards to humans or aquatic organisms. For example, 5 ppb = 0.005 ppm = 0.005 mg/l. A 50 kg (110 lb) person drinking four liters of such water per day would ingest 0.02 mg/day or 0.004 mg/kg/day; a safety factor of 200,000 would exist.

22. The references cited from the EIS by Washington Department of Natural Resources do not indicate what chemicals are being described, how or at what rates they were applied, or where scientific documentation is available. Intuitively, stream concentrations of a substance are decreased by dilution when deposited in a larger body of water.

23. The levels of picloram detected in water supplies during post monitoring studies have not represented human health hazards (see Picloram Background Statement). The fact that picloram is persistent in soil and mobile in water does necessitate careful control of its use as provided by the mitigation measures incorporated in BPA's proposed program. If used as proposed by BPA, picloram would pose minimal potential for human or environmental hazard.

24. The cited "suggestion" is a mitigation measure (Table 4-5, No. 40) identified by this EIS but not presently incorporated in the preferred alternative program. Your support for this recommended mitigation measure is acknowledged. See General Response E.

25. Water monitoring is currently practiced by BPA (see Mitigation Measure No. 26 in Table 4-5). To request water supply monitoring for a specific site, please contact the Area Right-of-Way Maintenance Specialist for the BPA Area where the site is located (e.g. Lake Whatcom is located in the Puget Sound Area).

Four
Seattle
City Light

Joseph P. Recchi, Superintendent
Charles Royer, Mayor

December 6, 1982



Mr. Anthony R. Morrell
December 6, 1982
Page 2

Mr. Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-5J
Portland, Oregon 97208

Dear Mr. Morrell:

Thank you for opportunity to review the Draft Environmental Impact Statement (DEIS) entitled Transmission Facilities Vegetation Management Program. Seattle City Light is grappling with many of the same issues, and we recognize the complexity and difficulty of the matter.

Overall, the DEIS is one of the most comprehensive documents we have seen on the general subject of vegetation management. We do, however, have some comments and criticisms (below) which we hope will be addressed in the Final EIS.

1. The description of "biological methods" as an alternative vegetation management option is inadequate. Much more literature and experience exists on establishment of stable, low-growing plant species (pp. 34 - 35) than the one page description in the DEIS would imply. The importance and potential of ecological vegetation control cannot be dismissed as "experimental", since the scientific principles are well known. We are aware of well established programs using such methods at British Columbia Hydro and Power Authority and at Ontario Hydro.

Until an adequate description of ecological vegetation control methods is presented, the EIS is incomplete. Once a good description of ecological methods is made, another combination of alternatives should be evaluated and ranked. This alternative would consist of an integrated program made up of manual, spot chemical, and ecological methods. Since BPA does not intend to use mechanical methods, its inclusion would only bias the rankings.

2. In the summary, a list of fourteen mitigation measures is provided in support of the selection of the preferred alternative. At least nine of these measures are not mitigation

as the term is commonly used and understood. Mitigation is something done beyond the requirements of law, regulation and standard practices. Yet the DEIS lists many measures as mitigation despite the fact that the measures are requirements of state and federal laws on the use of herbicides.

3. Although the credentials of the "list of preparers" of the herbicide background statements are impressive, we note that the team lacks a specialist in human toxicology. Since health concerns of herbicide use is quite high, the team would be enhanced by the addition of a qualified human toxicologist or geneticist.

Seattle City Light and other utilities look to BPA for leadership in development of more environmentally acceptable vegetation management practices. We hope that the Final EIS will address our concerns.

Sincerely,

Joseph P. Recchi
Superintendent

PM:rps

Response to Seattle City Light Department Letter of
December 6, 1982 (No. 62)

1. See General Response A.

2. As suggested, we have evaluated an additional program alternative (manual, spot chemical, and biological methods) in Chapter 4 (see section on Evaluation and Comparison of Alternative Programs).

3. BPA agrees that, technically, legal requirements do not constitute mitigation measures for the proposed action. In this EIS, however, we have chosen to identify three general types of measures that serve to avoid or minimize potential impacts of vegetation management: 1) mandatory (legally-required) measures, 2) discretionary measures that are incorporated in the proposed program alternative, and 3) discretionary measures that are not presently incorporated in the proposed program. In the general sense, all three types can be considered measures that "mitigate" potential impacts.

4. Dr. Robert I. Krieger, Professor of Toxicology at the University of Idaho, is a qualified toxicologist serving on the EIS study team. Dr. Krieger prepared the Herbicide Background Statements contained in the EIS Appendix A.



SQUAXIN ISLAND TRIBE

WEST 51 HWY 108
Route Box 257 Shelton, Wash. 98584
SHELTON, WA 98584

December 8, 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208

Dear Mr. Morrell:

The Squaxin Island Tribe welcomes the opportunity to comment on the draft EIS for the proposed Transmission Facilities Vegetation Management Program. We submit the following comments for your consideration.

The EIS presents extensive information on the need for a program and methods currently available to achieve BPA's objectives. However, specific information is not presented on the minimum distance required between the tops of trees and transmission conductors. This information is necessary to evaluate what the maximum time between treatments could be and whether additional biological methods of control are feasible.

The EIS does not address the following alternatives:

1. Manual and biological
2. Manual and spot chemical
3. Manual and broadcast chemical
4. Mechanical and spot chemical
5. Mechanical and broadcast chemical
6. Biological and spot chemical
7. Biological and broadcast chemical
8. Manual, mechanical and spot chemical
9. Manual, mechanical and broadcast chemical

These alternatives should be evaluated in the EIS.

The Tribe suggests that all alternatives be evaluated, including biological only and mechanical only alternatives. This will allow a better understanding of the range of possible impacts by the public. The fact that an alternative doesn't meet BPA's capability expectations can be indicated during the evaluation process. The public might prefer to select a minimally impacting treatment and modify facilities to be more compatible with the desired maintenance method.

The EIS does not identify what the measurement standards for each criterion are. The criteria are so general that each criterion conceivably contains several standards. Although examples are given it is uncertain whether they are actually standards, and they are not measurable. For example water quality and fisheries might have the following standards:

1. Turbidity (NTU's)
2. Sedimentation (mm/unit area)
3. Contamination (PPM)
4. Increased Temperature (°C or °F)

The EIS does not quantify potential impact ratings for each criterion. The public needs to be aware what BPA considers a rating to mean in terms of quantified levels of impacts.

Environmental consequences of proposed actions must be quantified. The subjective rating system utilized is inadequate to allow analysis of the expected impacts. Impacts should be expressed in terms of the standards mentioned above.

Increased fire hazard resulting from proposed treatments is not addressed. As the material treated is not removed and becomes more flammable after treatment the risk of ignition becomes greater.

Treatment selection guidelines are inadequate to insure protection of water quality and fish. We recommend no chemical treatment within 50 feet of a stream, and only cut stump or single stem chemical treatments with amononium sulfamate (w/o corrosion inhibitor) within 50 to 100 feet of a stream. For noxious weeds we recommend biological controls only within 100 feet of a stream.

In addition, we oppose aerial spraying of herbicides. Recently the Washington Department of Natural Resources made the decision to stop aerial spraying of herbicides on their land. We suggest that BPA seriously consider making a similar move.

We hope that you will implement the above comments in the final EIS.

Sincerely,

Brian Wood
Brian Wood
Forester/Hydrologist

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Response to Squaxin Island Tribe Letter of December 8, 1982
(No. 63)

1. In general, BPA attempts to control tall-growing tree species when they are most easily removed with the least disturbance to the environment and with the least safety hazard to workers. Typically, this means treatment of tall-growing species when they are seedlings and saplings (i.e. up to about 10 feet tall and three inches in diameter). While trees are within this size range, they can be safely and efficiently treated by manual, spot chemical, or broadcast chemical methods without creating fire hazards or other substantial environmental damage.

In special situations such as vegetation screens along highways and recreational rivers, BPA allows trees to grow to larger sizes and may rely on manual topping or pruning to prevent violation of conductor clearance criteria. However, these special situations require close monitoring of tree height growth by BPA personnel.

Finally, biological methods are not feasible for removing problem trees on rights-of-way. Biological methods are available for preventing the establishment of tall-growing trees. See footnote 1 in Table 3-5.

2. An EIS is not required to evaluate all possible alternatives. An EIS is required to analyze and compare a reasonable range of alternatives covering the full spectrum of possible alternatives (46 FR 18026). We feel that the range of program alternatives evaluated in the draft EIS provided a relatively complete analysis of the range of possible impacts from any of the available control methods. In response to several comment letters, an additional program alternative (No. 11) has been evaluated in this Final EIS (see Chapter 4).

3. It is not possible at the programmatic level of analysis of this EIS to quantify potential impacts in relation to standards as you suggest. Admittedly the rating system used involves a degree of subjectivity. We feel, however, that a reasonable assessment of potential impacts and the usefulness of mitigation measures in avoiding those impacts has been provided in this EIS. If there are specific instances where the commentor feels incorrect impact ratings were concluded, the comment letter should so indicate.

Response to Squaxin Island Tribe Letter of December 8, 1982
(No. 63) (cont'd)

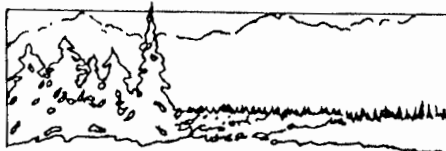
4. It is BPA practice to lop-and-scatter large tree debris after cutting. West of the Cascades, dense tree stands are treated with broadcast chemicals at 4-5 year intervals, partially to prevent the buildup of large fuel volumes. On Forest Service and Bureau of Land Management lands, Right-of-Way Management Plans are cooperatively developed by BPA and the agency specifying methods for treatment of brush and slash.

5. See General Response C.

6. Your preference is acknowledged. See General Response F.

Citizens for Environmental Quality

Route 4, Box 2A
Asotin, Washington 99402
(509) 243-4704
a non-profit educational corporation



December 4, 1982

Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell,

Thank you for the opportunity to comment upon your draft environmental statement (DES), "Transmission Facilities Vegetation Management Program," September, 1982.

There is an extremely important concern not addressed in your section on occupational hazards which should be addressed in the final environmental statement (FES). A safety plan needs to be established and implemented by your agency to help protect the health of veterans who were exposed to agent orange (2,4,5-T & 2,4-D) and other chemicals in Vietnam. This is an important consideration for your employees since reexposure to pesticides has been shown to be one of the problems experienced by many Vietnam veterans. The Seattle Veterans' Action Center, (2024 E. Union, Seattle, WA 98122, phone: (206) 625-4656), can provide you with documentation of this problem. Please take the time to contact them for further information.

As you may be aware, Bonneville employees have suffered health effects in the past because of a lack of awareness on the part of your agency concerning reexposure problems. As an example, last year three employees, all Vietnam veterans, became ill after entering substations in the Lewiston, Idaho area which had been sprayed with an insecticide. Symptoms experienced were headaches, nausea, muscle twitches and numbness.

To minimize exposure to these individuals, your pesticide project work plans and/or safety plans should include the following:

- (1) An acknowledgement that the problem of reexposure does exist.
- (2) Vietnam veterans who fear health problems from reexposure should not be required to handle, mix or apply pesticides.
- (3) In areas where pesticides have been applied, a cooling off period should be established before veterans are required to enter the areas.

By setting up safety measures now, it is quite possible that your agency will save thousands of dollars over the long-term in sick leave, health care benefits and personal injury lawsuits.

CEQ Comments to Anthony Morrell, December 4, 1982-page 2.

I have enclosed a February 16, 1980 affidavit of Dr. Granville F. Knight, allergy and nutrition specialist, which examines some of the health problems associated with pesticides.

Thank you for considering the above stated comments. I look forward to receiving your final EIS.

Respectfully submitted,

Georgia E. Hoglund
Georgia E. Hoglund
Authorized Representative

enc: (1)

1 AFFIDAVIT OF GRANVILLE P. KNIGHT, M.D.

2 STATE OF CALIFORNIA ss.
3 COUNTY OF SAN DIEGO

4 I, GRANVILLE P. KNIGHT, M.D. being first duly sworn,
5 say:

6 1. My name is Granville P. Knight. I am a physician
7 in private practice in the City of Poway, specializing in allergy
8 and nutrition. I am not only a member of the AMA and a Fellow
9 of the American College of Allergists, but a member, or Fellow,
10 of 10 or 12 other medical societies. I was a member of the Los
11 Angeles County Milk Commission for 12 years and I am now an
12 honorary member of the National Association of Medical Milk
13 Commissions.

14 2. I have been interested in the subject of pesticide
15 toxicity for more than 26 years and have clinically investigated
16 many cases of pesticide poisoning over that period of time.

17 3. In 1952, I testified before the DeLaney Committee
18 to Investigate the Use of Chemicals in Foods and Cosmetics. I
19 have presented testimony on the subject of pesticides before the
20 Los Angeles County committee appointed to look into the subject;
21 the Los Angeles City Council and the California State Committee
22 on Environmental Quality.

23 4. I am thoroughly convinced that toxic reactions to
24 pesticides are much more common than has been suspected in the
25 past. Unfortunately, except for the reports of a few individuals
26 such as Morton S. Biskind, M.D., of Westport, Connecticut; the
27 late Francis M. Pottenger, Jr., M.D., of Monrovia, California;
28 Malcolm Hargraves, Member Emeritus of the Mayo Clinic and a few
29 others, the syndrome of pesticide intoxication has received
30 little publicity and most scientists are unaware of the toxic
31
32

1 potentialities of contact with these chemicals.

2 5. Twenty-eight years ago, I began studying cases of
3 suspected pesticide poisoning - most of which exhibited symptoms
4 which have become more and more common since that time. These
5 symptoms include headaches, severe pains in the chest, back or
6 extremities, nausea, vomiting and diarrhea, often preceded or
7 followed by upper respiratory infections. These strange syndromes
8 have been characterized by a tendency to chronicity and to
9 recurrence in waves. This is typical of the symptomatology
10 produced by the organic phosphates, the chlorinated hydrocarbon
11 pesticides, and the phenoxy herbicides, as documented by Morton
12 S. Biskind, M.D., many years ago. In this category are not only
13 2,4-D, 2,4-DP, 2,4,5-T, and Silves (2,4,5-DP), but DDT, Endrin,
14 Aldrin, Chlordane, Lindane, Methoxychlor, and other pesticides
15 of different chemical structure such as the Triazines, Zedran
16 and others.

17 6. Many of these pesticides, particularly DDT, have
18 been used in increasing amounts since 1949 and some of them are
19 now distributed worldwide, reaching both the Arctic and the
20 Antarctic. Wind currents carry these pesticides as a result of
21 sprays and evaporation, or residues picked up from plants or the
22 soil. We know that pesticides, when applied by air, are subject
23 to widespread drift which may reach fifteen or more miles in the
24 case of small particles. It has been estimated that in forest
25 application no more than twenty percent reaches the target; the
26 remainder contaminates the environment.

27 7. Interestingly enough, the symptoms produced in
28 susceptible individuals by contact with the organic phosphates,
29 the chlorinated hydrocarbons and the phenoxy herbicides as well
30 as other weed killers are similar to, and perhaps identical with,
31 the symptoms of many virus infections which have now become
32 common in the past twenty years. It is almost impossible to

1 distinguish between them. A high index of suspicion is essential
2 and a careful history may at times elicit the fact that symptoms
3 followed exposure and re-exposure to pesticide sprays, whereas
4 before that time, they had been attributed only to a virus
5 infection. Chemical solvents may also produce illness.

6 8. Incidentally, these symptoms are completely
7 different than the usual allergic manifestations of hay fever or
8 allergic rhinitis and asthma, which may be caused by pollens or
9 housedust. Recently there have been complaints of extremely
10 severe headaches unrelieved by aspirin, pressure in the chest
11 (simulating a heart attack), severe pains in various parts of the
12 body, including the chest, back and extremities, malaise,
13 emotional depression and extreme fatigue of long duration. (These
14 complaints are typical of symptoms produced by pesticides and
15 tend to recur in cycles of one, two or three weeks.)

16 9. The phenoxy herbicides, which include 2,4-D, 2,4-DP,
17 2,4,5-T, Silvex, and others, are used primarily as postemergence
18 herbicides. They have been in widespread use since 1952, and
19 have been applied to our national forests up and down the coast
20 of California and as far north as Canada. They are useful in
21 preserving firebreaks and also for what is called "brush conver-
22 sion", which consists of destroying brush with the hope that
23 young trees may be freed and that stands of grass may eventually
24 take the place of the brush. 2,4,5-T and Silvex contain an
25 obligatory contaminate namely Tetrachlorodibenzo-p-dioxin, one of
26 the most toxic chemicals known to man. This is one hundred
27 thousand to one million times more potent than Thalidomide in
28 producing birth deformities in animals. Any amount of this
29 Dioxin in air, food or water is too much.

30 10. Unfortunately, according to the "Report of the
31 Secretary's Commission on Pesticides and Their Relationship to
32 Environmental Health", Parts I and II, U.S. Department of H.E.W.,

1 December 1969, they found in the literature about forty-two
2 scientific studies referring to mutagenic testing of some
3 compounds. Thirty-one of the thirty-two compounds tested showed
4 mutagenic activity in at least one system. In other words, in
5 experimental animals, these chemicals produce changes in the
6 chromosome pattern of living creatures, leading to mutations of
7 various types - none of them desirable.

8 11. The phenoxy herbicides, 2,4-D, 2,4-DP, 2,4,5-T and
9 Silvex, are not only mutagenic but teratogenic, and probably
10 carcinogenic, or cancer-inducing, as well.

11 12. Analysis of over one hundred blood or urine samples
12 from patients of mine showed, in more than half of them, evidence
13 of 2,4-D, 2,4-DP, 2,4,5-T or Silvex, indicating contamination
14 which must have come from the air, since the latter two have
15 reportedly not been used by the state or the Los Angeles County
16 for the past nine years.

17 It is important to note that "Agent Orange", consisting
18 of equal parts of 2,4-D and 2,4,5-T, was used in tremendous
19 quantities in South Vietnam as a defoliant and was finally banned
20 when it was suspected of causing severe damage to human beings
21 and the environment. How curious that citizens of the United
22 States, and particularly California, should be exposed to these
23 two compounds, as well as 2,4-DP and Silvex, by drift from
24 spraying in our national forests up and down the coast over a
25 period of 26 years.

26 13. From my observations and studies, I am convinced
27 that contact with these phenoxy herbicides, in susceptible
28 individuals, may produce symptoms ranging from mild to extremely
29 severe, with the possibility of irreversible damage. Such
30 exposure is particularly dangerous for pregnant women and for
31 young children.

32 14. I strongly suspect that our recurrent waves of

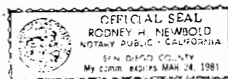
1 upper respiratory and abdominal symptoms which have been
 2 attributed to viruses may be due in part to contact with the
 3 phenoxy herbicides. I believe they lower resistance to viruses
 4 and recent animal experiments have substantiated this concept.
 5 Of significance in this respect is the finding of the Bionetics
 6 Studies that all these compounds when tested in mice would
 7 produce birth deformities and cancer. Of great interest was the
 8 fact that many of these animals developed virus pneumonia under
 9 test conditions.

10 15. It is my considered opinion that the use of phenoxy
 11 herbicides and other herbicides, such as Simazine, Paraquat,
 12 Sevin, Atrazine, Zectran and others, constitute a serious hazard
 13 to unsuspecting citizens. I believe that application of these
 14 compounds by airplane or helicopter should be banned. Ground
 15 spraying can still produce drift and should be carefully
 16 monitored if any exceptions are made in this area.

17 16. The enclosed reprint "What Are Pesticides Doing to
 18 Human Beings?" which has been recently revised and updated,
 19 contains some interesting information and references.

20
 21 Further, I declare that if sworn in as a witness, I can
 22 competently testify that the foregoing statements are true and
 23 correct.

24 Executed this 16th day of February, 1980, at Rancho
 25 Bernardo, California.



26
 27
 28
 29 *Franklin F. Knight, M.D.*
 30 Franklin F. Knight, M.D.
 31 Pomerado Medical-Dental Center
 32 15525 Pomerado Road, Ste. 03
 Pomerado, California 92064
 (714) 487-7480

Response to Citizens for Environmental Quality Letter of
December 4, 1982 (No. 64)

1. No BPA employee is required to work with the herbicides used in BPA's vegetation management program. Any employee who is concerned about contact with herbicides proposed for use by BPA should request job assignments not entailing contact with herbicides.

2. This EIS describes environmental impacts of vegetation control methods available for use in right-of-way and substation vegetation management. Use of insecticides is not part of BPA's vegetation management program and is therefore not evaluated in this EIS.

3. BPA conducts worker safety instruction for all employees involved in vegetation management (see Mitigation Measure No. 11 in Table 4-5). This instruction includes specific measures to prevent physical contact, ingestion, or inhalation of herbicides. BPA acknowledges that potential problems may result from exposure to herbicides and therefore endeavors to minimize such exposure for all employees.

4. See Response No. 1 above.

5. There is no known requirement or recommendation for "cooling-off periods" following application of the herbicides proposed for use by BPA in its vegetation management program. In addition, the herbicides proposed for use are rapidly immobilized and degraded in vegetation and soil after application, thereby being unavailable for subsequent human exposure through inhalation or dermal contact. See "worst-case" analysis in the Chapter 7 section on Public Health.

6. BPA proposes to use 2,4-D and 2,4-DP in its vegetation management program. See General Response I.

7. No documentation for these assertions is available in the scientific literature.



METROPOLITAN SERVICE DISTRICT
527 SW HALL ST. PORTLAND, OR. 97201, 503/221-1646

Rick Gustafson
EXECUTIVE OFFICER

Metro Council
Cindy Banzer
PRESIDENT/OFFICER
DISTRICT 9

Bob Olson
DEPUTY PRESIDENT
OFFICER
DISTRICT 1

Charlie Williamson
DISTRICT 2

Craig Berkman
DISTRICT 3

Corky Kirkpatrick
DISTRICT 4

Jack Deines
DISTRICT 5

Jane Rhodes
DISTRICT 6

Betty Schedeen
DISTRICT 7

Ernie Bonner
DISTRICT 8

Bruce Efinger
DISTRICT 10

Marge Kaloury
DISTRICT 11

Mike Burton
DISTRICT 12

December 13, 1982

Mr. ^{Bill} Freeland
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208

Dear Mr. Freeland:

Re: Areawide Clearinghouse Review
BPA Transmission Facilities Vegetation Mgt. Program
Metro File #8210-1

Circular A-95 Revised of the Federal Office of Management and Budget requires Areawide Clearinghouse review of numerous federally assisted projects. Metro serves as the designated Areawide Clearinghouse for the Portland metropolitan area. The primary purpose of this review is to assure coordination of proposed projects with state, area-wide and local plans and policies. This assists the federal agencies to allocate our federal tax dollars in a way that is as consistent as possible with local views.

The proposed project has been reviewed by interested jurisdictions and agencies within the region. It has been determined that the project does not violate any adopted regional plans or policies and appears to be consistent with existing local plans and policies. Therefore, Metro recommends favorable A-95 action on this project pending review of enclosed local comments. Attached are specific comments from Metro and Washington County..

If we can be of further assistance in processing this matter, feel free to call our A-95 Review Coordinator, Mel Huie.

Sincerely,

Dan LaGrande
Public Affairs Director

DL:MCH:gl/7359B/D2
Enclosures

NOTE: Your organization is responsible for forwarding a copy of this letter to the federal agency that it is dealing with.

A-95 REVIEW RESPONSE FORM

TO: *Ethan Seltzer, Metropolitan Service District*
FROM: MEL HUIE, A-95 Review Coordinator
PROJECT TITLE: BPA Transmission Facilities
DATE SENT: 10/27/82 RETURN TO METRO BY: 11/10/82 FILE NUMBER: 8210-1

The attached proposal is provided for your review in accordance with procedures established for regional coordination in the U.S. Office of Management and Budget's Circular A-95. We need your response so that Metro, as the Areawide Clearinghouse for federal grants, can include your comments in our recommendation to the applicant and funding agency.

Please contact me if you need additional information, cannot respond by the date indicated above or have any questions.

TYPE OF REVIEW

- ☒ Project Review
☒ Environmental Impact Assessment/Statement
☐ Other _____

- ☒ We support the proposal. It is consistent with local/regional plans and policies.
☐ We support the proposal with conditions. Explain specific conditions.
☐ We do not support the proposal. Explain and document your objections.
☐ We require more information before we can complete our review.
☐ Additional comments for project information and improvement are included.
☐ No comment.

EXPLANATION AND COMMENTS (For additional space, please use the back of the page.)

EXPLANATION:
① BPA COMMITMENT TO PURSUE IPM RESEARCH AND APPLICATIONS
ASSESSMENT.
② MINIMIZATION OF BROADCAST SITES. 12

Reviewed by: *Ethan Seltzer* Ethan Seltzer, Metro
Date: 11/12/82
Department: *DMC*



METROPOLITAN SERVICE DISTRICT • 527 SW Hall St. Portland, OR 97201 • 503/221-1646

A-95 REVIEW RESPONSE FORM

TO: WASHINGTON COUNTY
 FROM: MEL HUIE, A-95 Review Coordinator
 PROJECT TITLE: BPA Transmission Facilities
 DATE SENT: 10/27/82 RETURN TO METRO BY: 11-10-82 FILE NUMBER: 8210-1

WASHINGTON COUNTY
 ADMINISTRATIVE OFFICE

The attached proposal is provided for your review in accordance with procedures established for regional coordination in the U.S. Office of Management and Budget's Circular A-95. We need your response so that Metro, as the Areawide Clearinghouse for federal grants, can include your comments in our recommendation to the applicant and funding agency.

Please contact me if you need additional information, cannot respond by the date indicated above or have any questions.

TYPE OF REVIEW

☒ Project Review
☒ Environmental Impact Assessment/Statement
☐ Other _____

- ☒ We support the proposal. It is consistent with local/regional plans and policies.
☐ We support the proposal with conditions. Explain specific conditions.
☐ We do not support the proposal. Explain and document your objections.
☐ We require more information before we can complete our review.
☐ Additional comments for project information and improvement are included.
☐ No comment.

EXPLANATION AND COMMENTS (For additional space, please use the back of the page.)

We support the program in principle and believe it is consistent with the public interest; however, we lack the staff resources to adequately examine and comment upon the toxicological ramifications of the program's herbicide application component.

Reviewer: Donald W. Mason Phone: 648-8676 Date: 10-29-82
 Department: Acting County Administrator

Response to Metropolitan Service District (Portland, OR)
 Letter of December 13, 1982 (No. 65)

1. Adherence to the principles of IPM is a stated purpose of BPA's vegetation management program (see Chapter 2). The Chapter 5 section on Testing and Approval of New Control Methods describes BPA's vegetation management research activities. BPA is currently funding research on wildlife management as a biological method to control right-of-way vegetation (see Chapter 3 section on Biological Methods).
2. Your preference is acknowledged. See General Response F.



METROPOLITAN SERVICE DISTRICT • 527 S.W. Mall St., Portland, OR 97201 • 503/221-1646

Whatcom County

DEPARTMENT OF PUBLIC WORKS

Paul F. Rushing, Director
Edwin R. Henken, Assistant Director

WU



BUREAU of BUILDINGS and CODE ADMINISTRATION

Donovan F. Kehr, Deputy Administrator
401 Grand Avenue, Bellingham, Washington 98225
City: 676-6907 County: 398-1310

December 16, 1982

Anthony R. Morrell, Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ,
Portland, Oregon 97208

Re: Draft EIS: Transmission Facilities Vegetation Management Program,
September, 1982.

Dear Mr. Morrell,

On December 3, 1982, we concluded that we would not have completed our review of the DEIS by your closing date of December 6. Nat Dickinson of our office called your office and we were granted an extension for comments by Bill Freeland until December 21, 1982. We appreciate this courtesy.

We have learned from your publication of August, 1982, Environmental Assessment, Fiscal Year 1983, Transmission Facilities Vegetation Management Program, that Whatcom County is scheduled to have weed control at your facilities by the use of "Spike 1G" (Tebuthiuron) and "Roundup" (Glyphosate).

We realize that BPA maintains approximately 35-40 miles of transmission right-of-way and several sub-stations in Whatcom County and given the brief information in the publication cited above it is not possible to know exactly where the herbicides are intended for use, but we would like to bring the following concern to your attention.

The Lake Whatcom watershed lies generally within Townships 37 & 38 North, and Ranges 3 & 4 East (see enclosed map). Lake Whatcom serves as the sole potable water source for approximately 50,000 people in the City of Bellingham and adjacent areas. Your transmission right-of-way traverses this watershed just east of the lake between the Skagit County line and Mount Baker Highway (State 542). Whatcom County has received a Referendum 39 Grant from the Water Quality Management Division of the Department of Ecology of the State of Washington to have a water quality study done for the Lake Whatcom watershed area. The study period is from June, 1982, to January 1, 1984. One of the basic objectives of the study is, "To evaluate an array of lake restoration and protection methods, and to recommend an appropriate combination which will protect and restore lake water quality over the long term."

The Lake Whatcom watershed contains considerable forest lands that are subjected to periodic herbicide and insecticide treatments. The impact on the quality of lake water of these chemicals, combined with the pollutants from urban and suburban development are not quantitatively known at this time. But, following the study, we hope to have the basic information that will allow a reasonable

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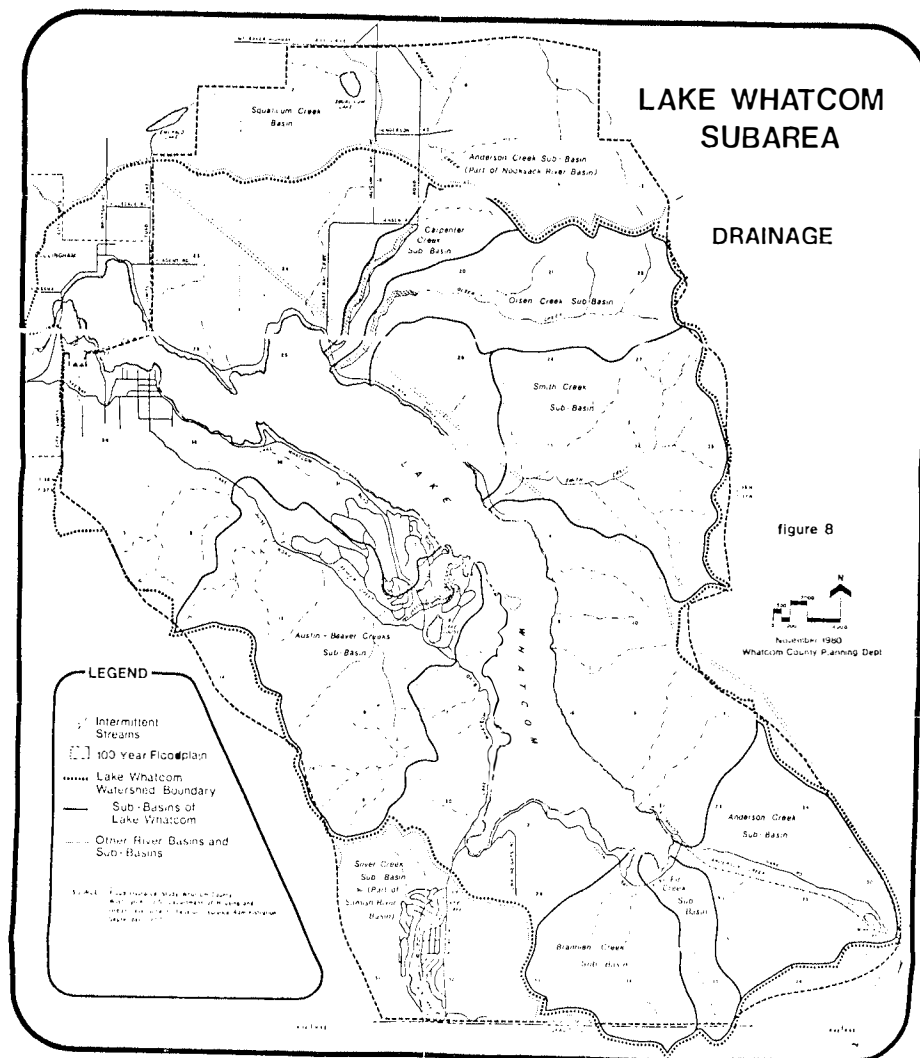
assessment of the continued use of chemicals within the watershed. We have found no mention in the BPA draft EIS of cumulative impacts of your chemical use with other sources of pollutants. Since the present state of water quality of the lake and watershed is not known, it would appear that your conclusion is not justified that implementation of the program "...is not expected to cause significant and unavoidable adverse impacts..." for our area (p. 215). Also, your discussion of Public Health Hazards (p. 175) does not consider impacts on lakes that serve as potable water supply sources. While we are, of course, concerned about fish and wildlife, we are much more concerned about the impacts of water contamination on the health of humans of all ages and physical conditions that are daily served by Lake Whatcom water.

Since the long-term effects (carcinogenicity, mutagenicity) of the two chemicals (glyphosate, tebuthiuron) proposed to be used in Whatcom County are unknown because studies are either unavailable or still being evaluated (Table 7-10), it would seem unwise to use them in a particularly sensitive area such as the potable water source watershed.

Lake Whatcom is unique among recreational and suburban lakes in the state of Washington because it also functions as a public water supply. The ability of this lake to continue as a potable water source is critical to the welfare of approximately half the population of the county, and we are anxious to determine the factors that affect water quality in order to develop programs for the future maintenance of water quality. Whatcom County has ceased using "Roundup" as a roadside weed control in the Lake Whatcom area. We hope that BPA is also interested in preserving the quality of this unique lake and will cooperate with us during the lake study period by reconsidering the use of "Spike 1G" and/or "Roundup" in the watershed.

Sincerely,

Jerry Mixon
Deputy Environmental Review
Officer for Whatcom County



Response to Whatcom County Department of Public Works Letter of December 16, 1982 (No. 66)

1. Cumulative impacts from use of herbicides by forestry and agriculture in addition to right-of-way management are discussed in the Chapter 7 section on Public Health. BPA's proportional contribution to the cumulative total of herbicide use would be very small; rights-of-way represent small proportions of any particular watershed and BPA's use of herbicides occurs at relatively infrequent intervals. Regulation of cumulative herbicide loadings in a watershed is more properly the responsibility of a local or regional governmental entity.

2. The discussion on page 175 of the DEIS does apply to potable community water supplies (Chapter 7 section on Public Health). The analyses in this EIS indicate that BPA's proposed uses of herbicides, at specified maximum application rates and with specified mitigation measures (see Table 4-5), will not adversely affect drinking water quality. The herbicides proposed for use do not accumulate in biological organisms and are degraded rapidly by biological and chemical processes. See General Response C.

3. Tebuthiuron and glyphosate are labeled for use as herbicides in vegetation management. Data supplied by the manufacturers in support of their registration do not indicate that either substance poses a significant threat to human health or environmental quality. In Whatcom County, tebuthiuron would be used only for weed control in substation switchyards where possibilities of environmental contamination and resulting water quality impacts are minimal. On rights-of-way, glyphosate would only be used in spot foliage treatments for brush control; it would also be used in substations. The EIS analysis indicates little possibility of adversely affecting drinking water supplies from the proposed uses of these herbicides.

December 16, 1982

855 Valley Avenue
Baker, Oregon 97814

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Re: Transmission Facilities - Vegetation Management Program
September '82 - Draft

Dear Mr. Morrell:

We have received and reviewed the above draft of the environmental impact statement. We have read all of the alternative vegetation management programs, including the proposed program and it is our belief that even after taking into account the negative aspects of Alternative "2" (for example; worker safety, treatment costs, treatment effectiveness, and operational flexibility), we still believe that Alternative "2" has the most benefits and is by far the most logical and safest program alternative. We feel that Alternative "2" is a safer choice than the proposed Alternative "10".

Concerning "Issues to be resolved": It is our belief that the use of 2-4-D Ester Formulations should be greatly curtailed if not completely eliminated. Particularly where any danger of water contamination exists. In fact, we suggest extremely limited use of herbicides and very tight monitoring of said applications. We believe that increased use of manual methods and decreased use of chemical methods is the best approach.

Thank you for your attention on this matter.

Sincerely,

JOHN E. LARSEN A.I.A., BAKER, OREGON

Sandra J. Harrison, Office Mgr., Baker, Ore

FATTI HUDSON, DESIGNER, BAKER OREGON

One Sines, Realtor, BAKER, ORE

Blenda Luvinski, Secy., Baker, Oregon

Mary Therese Randles, Hayward, CA

Jim Collins, Baker, Oregon

Dixie Hanley, teacher, Baker, Oregon

W. S. DAVIS, M.D. Baker, Ore.

Page 2 - Letter to BPA - IMPACT STATEMENT

Shirley Delors, Rancher Baker, Or.

Deane E. Stone, Planner, Baker, Oreg.

Paul Tomkins, Licensed Surveyor in Training Baker, Ore.

Response to John E. Larson et al Letter of December 16, 1982
(No. 67)

1. Your preference is acknowledged. See General Response B.
2. See General Responses E and I.



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 82/1621

DEC 20 1982

Mr. Anthony R. Morrell
Environmental Manager
Bonneville Power Administration
P.O. Box 3621-SJ
Portland, Oregon 97208

Dear Mr. Morrell:

We have reviewed the draft environmental impact statement for Transmission Facilities Vegetation Management Program as proposed by the Bonneville Power Administration (BPA) and have the following comments.

General

Every possible effort should be made to manage vegetation so as to encourage endemic plants that will provide wildlife forage. This can be very effective in areas inhabited by large mammals (e.g., deer and elk) and would enhance wildlife diversity.

Surface and Ground Water

Every effort should be made to avoid stream contamination through herbicide use, especially in the vicinity of anadromous fish streams. This could be accomplished most effectively by increasing the size of buffer zones adjacent to streams. Also, clearing of stream-side vegetation by chemical or manual methods could result in elevated stream temperatures. To the extent practicable, we recommend that stream-side clearing, which would expose additional water surface to solar radiation, be minimized. Monitoring of surface water should be implemented to evaluate the migration and fate of herbicide applications.

The statement recognizes the greater potential for impacts on water resources in the substation areas as noted on page vii, 81. It is stated that one issue to be resolved is whether to monitor the fate of herbicides applied for vegetation control in these areas. We suggest that ground-water monitoring should be included in mitigation plans for substation areas underlain by materials having high intergranular or fracture permeability or by significant unconfined or semiconfined aquifers. The monitoring should continue at least long enough to allow sufficient time for downward migration of pollutants and for a variety of climatic conditions, including maximum post-application precipitation, to be experienced.

Endangered Species

In accordance with Section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531, et. seq.), BPA is required to assure that full consideration has been given to the impacts of

Mr. Anthony R. Morrell

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its actions with regard to federally listed or proposed threatened or endangered species for all federally funded, constructed, permitted, or licensed projects under its jurisdiction. We have reviewed the sections of this document regarding Endangered Species, and, based upon our review, we see no immediate need for BPA to initiate formal consultation with the Fish and Wildlife Service. Nevertheless, Table 4 should indicate that the Borax Lake Chub has been officially listed as an Endangered Species. The final rulemaking appeared in the Federal Register on October 5, 1982, having an effective date of November 4, 1982. Also, this Table should recognize that Oregon supports a large wintering population of bald eagles as well as a resident population. Curry and Jackson Counties contain one and two known nesting territories, respectively. Umatilla County has one pair of eagles which appear to be establishing an active territory.

Columbian white-tailed deer (CWTD) do use grass and forbs, but they also require various kinds of browse at different times of the year. If any right-of-way management activity is going to occur in CWTD habitat, BPA should request formal consultation on those activities.

Without knowledge of the exact route of all transmission lines, it is difficult to assess potential impacts of right-of-way management on Rocky Mountain wolves, grizzly bears and bald eagle nesting territories. If BPA determines that any right-of-way management activities may affect these species, formal consultation with the Fish and Wildlife Service should be initiated. Further, we are uncertain about the degree of access provided by maintenance roads in rights-of-way. Roads into remote areas, not normally traveled by motorized vehicles, should be closed to public vehicular use to minimize human disturbances in areas important to elk, grizzly bears, wolves, and bald eagles. These restrictions should be developed in coordination with the appropriate State game departments.

Compatibility With Land Use Plans

This section should recognize the specific position of the Confederated Salish and Kootenai Tribes with respect to environmental health and quality. The Tribes endorse "no pesticide applications." Therefore, manual, mechanical or biological control methods are the only alternatives for consideration for vegetation management on any rights-of-way granted by the Confederated Salish and Kootenai Tribes. BPA's vegetation management activities on the Flathead Indian Reservation may require additional liaison for this reason. These concerns should be presented in the final statement.

We hope these comments will be helpful to you in the preparation of a final statement.

Sincerely,

Bruce Blanchard
Bruce Blanchard, Director
Environmental Project Review

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Response to US Department of Interior Letter of December 20, 1982 (No. 68)

1. It is overall BPA policy to allow vegetation to grow on rights-of-way with the least amount of control sufficient to maintain service reliability. In practice, this means that only tall-growing plant species that may violate conductor clearance criteria are intentionally controlled. Please see Chapter 7 section on Wildlife for a detailed description of potential impacts on wildlife habitat.

2. BPA's proposed program incorporates a number of measures to prevent herbicide contamination of streams (see Table 4-5), including observance of buffer zones and monitoring of weather conditions at the time of spray projects. Monitoring of surface streams by BPA near aerial spray projects indicates that 100-foot buffer zones are adequate to protect stream water quality (see Chapter 7 section on Public Health). However, due to the toxicity of 2,4-D esters to aquatic organisms (see Table 7-5), this EIS has identified that these formulations should not be aerially-applied where any danger of contaminating water bodies exists. See General Response E.

3. This EIS has also identified a mitigation measure that stream shading be retained to prevent elevated stream temperatures (see Mitigation Measures Nos. 48 and 54 in Table 4-5). This measure is not presently incorporated in BPA's proposed program. Your support for this measure is acknowledged. See General Response E.

4. BPA currently monitors herbicide residues in surface waters following right-of-way applications, in response to appropriate requests from land management agencies, landowners, or the BPA Area staffs (see Measure No. 26 in Table 4-5).

5. Your support for this identified mitigation measure (No. 33 in Table 4-5) is acknowledged. See General Response E.

6. Table 6-4 has been revised to reflect this information.

7. Forage requirement information in the text has been revised as suggested. All counties of Columbian white-tailed deer occurrence (see Table 6-4) are in BPA's Lower Columbia Area. Prior to undertaking vegetation management activities in the range of this deer, BPA will consult with US Fish and Wildlife Service.

8. BPA will consult with US Fish and Wildlife Service concerning vegetation management activities that might affect these species.

Response to US Department of Interior Letter of December 20, 1982 (No. 68) (cont'd)

9. Virtually all BPA rights-of-way are on lands owned or administered by others. It is the landowner's prerogative to permit or restrict access on right-of-way maintenance roads. BPA cooperates with landowners in preventing unauthorized access.

10. Text in Chapter 7 section on Compatibility with Land Use Plans, Policies, and Controls has been revised to reflect this information.

LIST OF PERSONS RECEIVING THE EIS



Chapter 13

LIST OF PERSONS RECEIVING THE EIS

*Comment received.

FEDERAL AGENCIES

U.S. Department of Agriculture

U.S. Department of Agriculture, Washington, D.C.

*Forest Service, Washington, D.C.

Region 1, Missoula, MT

*Region 2, Lakewood, CO

Region 4, Ogden, UT

Region 5, San Francisco, CA

Region 6, Portland, OR

National Forests - Region 1

Beaverhead National Forest, Dillon, MT

Clearwater National Forest, Orofino, ID

Deerlodge National Forest, Butte, MT

Flathead National Forest, Kalispell, MT

Gallatin National Forest, Bozeman, MT

Kootenai National Forest, Libby, MT

Lewis & Clark National Forest, Great Falls, MT

Lolo National Forest, Missoula, MT

Panhandle National Forest, Coeur d'Alene, ID

National Forests - Region 4

Bridges-Teton NF, Jackson, WY

Forest Service, Planning & Budget, Director, Ogden, UT

Targhee National Forest, St. Anthony, ID

National Forests - Region 5

Modoc NF, Alturas, CA

National Forests - Region 6

Colville National Forest, Colville, WA

Deschutes National Forest, Bend, OR

Forest Service, Lands & Minerals, Portland, OR

Fremont National Forest, Lakeview, OR

Gifford Pinchot National Forest, Vancouver, WA

Malheur National Forest, John Day, OR

Mt. Baker-Snoqualmie National Forest, Seattle, WA

Mt. Hood National Forest, Gresham, OR

Ochoco National Forest, Prineville, OR

Okanogan National Forest, Okanogan, WA

Olympic National Forest, Olympia, WA

Rogue River National Forest, Medford, OR

Siskiyou National Forest, Grants Pass, OR

Siuslaw National Forest, Corvallis, OR

Umatilla National Forest, Pendleton, OR

Umpqua National Forest, Roseburg, OR

Wallowa-Whitman National Forest, Baker, OR

Wenatchee National Forest, Wenatchee, WA
Willamette National Forest, Eugene, OR
Winema National Forest, Klamath Falls, OR
Pacific Northwest Forest & Range Experiment Station
LaGrande, OR
Portland, OR
Corvallis, OR

Ranger Districts - Region 6

Bear Springs Ranger Station, Maupin, OR
Cle Elum Ranger District, Cle Elum, WA
*Columbia Gorge Ranger District, Troutdale, OR
Estacada Ranger District, Estacada, OR
North Bend Ranger District, North Bend, WA
Skykomish Ranger District, Skykomish, WA
Wind River Ranger District, Carson, WA
Zig Zag Ranger District, Zig Zag, OR

Rural Electrification Administration, Washington, D.C.
Soil Conservation Service, Washington, D.C.
State Conservationist, Portland, OR
State Conservationist, Bozeman, MT
State Conservationist, Davis, CA
State Conservationist, Spokane, WA
State Conservationist, Boise, ID
*WTSC, Portland, OR
Headwaters RC&D, Butte, MT

U.S. Department of Commerce

U.S. Department of Commerce, Washington, D.C.
National Oceanic & Atmospheric Administration, Rockville, MD
Ecology & Conservation Division, Washington, DC
Western Region, Salt Lake City, UT
National Marine Fisheries Service, Seattle, WA

U.S. Department of Defense

U.S. Department of the Army

Office of the Chief Engineer, Washington, D.C.
Seattle District Corps of Engineers, Seattle, WA
*North Pacific Division, Corps of Engineers, Portland, OR
Portland District, Portland, OR
Dept. of Military Affairs, Helena, MT

U.S. Department of the Air Force

Fairchild AFB, WA

U.S. Department of the Navy

Submarine Base Bangor, Bremerton, WA

U.S. Department of Energy

U.S. Department of Energy, Washington, D.C.

Western Area Power Administration, Headquarters, Golden, CO
Billings Area Office, Billings, MT
Fort Collins Office, Fort Collins, CO
Denver Federal Center, Denver, CO
Central Valley Project, Sacramento, CA

Alaska Power Administration, Juneau, AK
Hanford Operations Office, Richland, WA
Economic Regulatory Administration, Washington, D.C.
Federal Energy Regulatory Commission, Washington, D.C.
Argonne National Laboratory, Argonne, IL
Oak Ridge National Laboratory, Oak Ridge, TN

U.S. Department of Health and Human Services

Office of the Secretary, Washington, D.C.
*Regional Office, Denver, CO
Regional Office, Seattle, WA
*Public Health Service, Atlanta, GA

U.S. Department of Housing and Urban Development

Office of the Secretary, Washington, D.C.
Service Office, Helena, MT
*Region VIII, Denver, CO
Region X, Seattle, WA

U.S. Environmental Protection Agency

Administrator, Washington, D.C.
Region VIII, Denver, CO
*Region X, Seattle, WA
Area Office, Helena, MT
Area Office, Boise, ID
Area Office, Portland, OR

U.S. Department of the Interior

*Office of the Secretary, Washington, D.C.
Office of the Secretary, Portland, OR
Interagency Archeological Services, San Francisco, CA

Office of Environmental Project Review, Washington, D.C. (18 copies)

Bureaus:

Director, U.S. Fish & Wildlife Service, Washington, D.C.

Regional Director, Denver, CO

Endangered Species Coordinator, Billings, MT

Regional Director, Portland, OR

Field Office Manager, Boise, ID

Field Office Manager, Billings, MT

Field Office Manager, Olympia, WA

Field Office Manager, Sacramento, CA

Endangered Species Coordinator, Boise, ID

Endangered Species Coordinator, Olympia, WA

Director, National Park Service, Washington, D.C.

Regional Director, Seattle, WA

Regional Director, Denver, CO

Director, Bureau of Mines, Washington, D.C.

Western Field Operations Center, Spokane, WA

Albany Research Center, Albany, OR

U.S. Geological Survey

National Center, Reston, VA

Central Region, Denver, CO

Western Region, Menlo Park, CA

Water Resources Division, Boise, ID

Water Resources Division, Billings, MT

Water Resources Division, Helena, MT

USGS Survey Library, Denver, CO

Director, Office of Surface Mining, Washington, D.C.

Bureau of Indian Affairs

Assistant Secretary, Washington, D.C.

Area Director, Billings, MT

Portland Area Office, Portland, OR

Western Washington Agency, Everett, WA (Puget Sound Agency)

Northern Idaho Agency, Lapwai, ID

Flathead Agency, Pablo, MT

Spokane Agency, Wellpinit, WA

Fort Hall Agency, Fort Hall, ID

Colville Agency, Nespelem, WA

Olympic Peninsula Agency, Hoquiam, WA

Siletz Agency, Siletz, OR

Umatilla Agency, Pendleton, OR

Warm Springs Agency, Warm Springs, OR

Yakima Agency, Toppenish, WA

Bureau of Land Management

Director, Washington, D.C.

Public Affairs Office, Washington, D.C.

State Offices:

Denver Service Center, CO

Oregon/Washington State Office, Portland, OR

Planning & Environmental Coord. Staff, Portland, OR

Public Affairs Office, Billings, MT

State Director, Billings, MT

State Director, Boise, ID

District Offices:

Butte District, Butte, MT

Spokane District, Spokane, WA

Lakeview District, Lakeview, OR

Burns District, Burns, OR

Vale District, Vale, OR

*Prineville District, Prineville, OR

Baker District, Baker, OR

Salem District, Salem, OR

Eugene District, Eugene, OR

Roseburg District, Roseburg, OR

Medford District, Medford, OR

Coos Bay District, Coos Bay, OR

Idaho District, Boise, ID

Resource Areas:

Garnet Resource Area, Missoula, MT

Area Manager, Coeur d'Alene, ID

Area Manager, Missoula, MT

Commissioner, Bureau of Reclamation, Washington, D.C.

Pacific Northwest Region, Boise, ID

Regional Environmental Affairs Office, Billings, MT

Upper Missouri Region, Billings, MT

Lower Missouri Region, Denver, CO

Ephrata, WA

Grand Coulee Project, Coulee City, WA

Mid-Pacific Region, Sacramento, CA

U.S. Department of Transportation

U.S. Department of Transportation, Washington, D.C.

Federal Aviation Administration

Assistant Secretary for Environment, Washington, D.C.

Director, Rocky Mountain Region, Aurora, CO

Northwest Region, Seattle, WA

Federal Highway Administration, Washington, D.C.

Regional Headquarters, Portland, OR

Regional Headquarters, Denver, CO

Federal Railroad Administration
Regional Headquarters, San Francisco, CA
Division Administration, Helena, MT

Coast Guard
Seattle District, Seattle, WA

Boards, Committees, Commissions

Advisory Council on Historic Preservation, Washington, D.C.
Western Region, Golden, CO
Federal Regional Council
Region X, Seattle, WA
Migratory Bird Conservation Commission, Washington, D.C.
Tennessee Valley Authority, Norris, TN
Water Resources Council, Washington, D.C.

STATE GOVERNORS

*Honorable Ted Schwinden, Helena, MT
Honorable John V. Evans, Boise, ID
Honorable John D. Spellman, Olympia, WA
Honorable Victor Atiyeh, Salem, OR
Honorable Ed Herschler, Cheyenne, WY
Honorable Scott M. Matheson, Salt Lake City, UT
Honorable George Deukmejian, Sacramento, CA

STATE OF ALASKA

State Clearinghouse, Juneau, AK
A-95 Coordinator, Anchorage, AK

STATE OF IDAHO

CONGRESSIONAL DELEGATION

Senator James A. McClure
Senator Steven D. Symms
Representative Larry E. Craig
Representative George Hansen

IDAHO AGENCIES

Office of the Governor, Boise, ID
Division of Highways, Boise, ID
Department of Highways, Coeur d'Alene, ID
Department of Agriculture, Boise, ID
Division of Economic & Comm. Affairs, Boise, ID
Department of Fish and Game, Boise, ID
Regional Manager, Coeur d'Alene, ID

Department of Lands, Boise, ID
Regional Manager, Sandpoint, ID
Department of Water Resources, Boise, ID
Department of Transportation, Boise, ID
Department of Health and Welfare, Coeur d'Alene, ID
Division of Environment, Boise, ID
Division of Budget, Policy Planning & Coordination (A-95), Boise, ID
Division of Aeronautics & Public Transportation, Boise, ID
Department of Parks & Recreation, Boise, ID
Historical Society, Boise, ID
Idaho State Energy Office, Boise, ID
Department of Employment, Boise, ID
State Extension Services, Moscow, ID
State Soil Conservation Commission, Boise, ID

IDAHO PLANNING BOARDS/COMMISSIONERS/DEPARTMENTS/MISCELLANEOUS

Panhandle Area Council, Coeur d'Alene, ID
Panhandle Planning & Development Council, Coeur d'Alene, ID
Shoshone County Planning Commission, Wallace, ID
Board of Commissioners, Kootenai County Courthouse, Coeur d'Alene, ID
Board of Commissioners, Shoshone County Courthouse, Wallace, ID
Board of Commissioners, Bonner County Courthouse, Sandpoint, ID
County Planning Commission, Bonner County Courthouse, Sandpoint, ID
Idaho Public Utilities Commission, Boise, ID
Idaho-Washington Resource Conservation & Development Project, Coeur d'Alene, ID
Planning Dept. City of Coeur d'Alene, ID
Boundary County Board of Commissioners, Bonners Ferry, ID
Board of Commissioners, Cassia County Courthouse, Burley, ID
Minidoka County Planning Commission, Rupert, ID
Chairman, Board of Commissioners, Bonneville County, Idaho Falls, ID
IDA-ORE Planning & Dev. Assn., Weiser, ID
Ada County Comm., Boise, ID
Ada Planning Assn, Boise, ID
S.E. IDA COG, Pocatello, ID
Clearwater Econ. Dev. Assn., Moscow, ID
E. Cent. Idaho Planning & Dev. Assn., Rexburg, ID
IDA Assn. of Counties, Boise, ID
Adams County Comm., Council, ID
Bannock County Comm., Pocatello, ID
Bear Lake County Comm., Paris, ID
Bingham County Comm., Blackfoot, ID
Blaine County Commissioners, Hailey, ID
Blaine County Planning Office, Hailey, ID
Energy Education Project, Hailey, ID
Boise County Commissioners, Idaho City, ID
Bonneville County Commissioners, Idaho Falls, ID
Butte County Commissioners, Anco, ID
Camas County Commissioners, Fairfield, ID
Canyon County Commissioners, Caldwell, ID

Caribou County Commissioners, Soda Springs, ID
Cassia County Commissioners, Burley, ID
Clark County Commissioners, DuBois, ID
Custer County Commissioners, Challis, ID
Elmore County Commissioners, Mt. Home, ID
Franklin County Commissioners, Preston, ID
Fremont County Commissioners, St. Anthony, ID
Gem County Commissioners, Emmett, ID
Gooding County Commissioners, Gooding, ID
Jefferson County Commissioners, Rigby, ID
Jerome County Commissioners, Jerome, ID
Lemhi County Commissioners, Salmon, ID
Lincoln County Commissioners, Shoshone, ID
Madison County Commissioners, Rexburg, ID
Madison County Energy Commission, Rexburg, ID
Minidoka County Commissioners, Rupert, ID
Minidoka County Energy Coord., Rupert, ID
Oneida County Commissioners, Malad City, ID
Owyhee County Commissioners, Murphy, ID
Payette County Commissioners, Payette, ID
Power County Commissioners, American Falls, ID
Teton County Commissioners, Driggs, ID
Twin Falls County Commissioners, Twin Falls, ID
Valley County Commissioners, Cascade, ID
Washington County Commissioners, Weiser, ID

STATE OF MONTANA

CONGRESSIONAL DELEGATION

Senator Max Baucus
Senator John Melcher
Representative Pat Williams
Representative Ron Marlenee

MONTANA AGENCIES

Office of the Governor, Helena, MT
Office of Budget and Program Planning, Helena, MT
Office of Lieutenant Governor, Helena, MT
Office of the Secretary of State, Helena, MT
Department of Natural Resources & Conservation
Director, Helena, MT
Area Office, Missoula, MT
Energy Planning Division, Helena, MT
Facility Siting Division, Helena, MT
Department of Education, Helena, MT
Environmental Quality Council, Helena, MT
Department of Health & Environmental Sciences, Helena, MT
Department of Community Affairs, Helena, MT

Department of Highways, Helena, MT
 Environmental Health Director, Missoula, MT
 *Montana Historical Society, Helena, MT
 State Historic Preservation Officer, Helena, MT
 Department of Fish, Wildlife and Parks
 Fisheries Division, Helena, MT
 Parks Division, Helena, MT
 Wildlife Division, Helena, MT
 Design and Contruction Bureau, Parks Division, Helena, MT
 Department of State Lands, Helena, MT
 Department of Agriculture, Helena, MT
 Montana Division of Forestry, Missoula, MT
 Bureau of Mines & Geology, Billings & Butte, MT

MONTANA PLANNING BOARDS/COMMISSIONERS/DEPARTMENTS/MISC.

Anaconda-Deer Lodge County, Planning Board, Anaconda, MT
 Board of Commissioners, Kalispell, MT
 *Sanders County, Board of Commissioners, Thompson Falls, MT
 Missoula County, Board of Commissioners, Missoula, MT
 Broadwater County Planning Board, Townsend, MT
 Butte-Silver Bow Planning Board, Butte, MT
 Broadwater County Commission, Townsend, MT
 Deerlodge County Commission, Anaconda, MT
 School District #3, Superior, MT
 Mineral County Attorney, Superior, MT
 Mineral County Planning Board, St. Regis, MT
 Butte/Silver Bow Government, Butte, MT
 Sanders County, County Planning Board, Thompson Falls, MT
 Deer Lodge City-County Planning Board, Deer Lodge, MT
 County Planner, Deer Lodge, MT
 Granite County Planning Board, Philipsburg, MT
 Granite County Commissioners, Philipsburg, MT
 Jefferson County Commissioners, Boulder, MT
 Jefferson County Planning Board, Boulder, MT
 Lake Board of County Commissioners, Polson, MT
 Lake County Planning Board, Polson, MT
 Lewis & Clark County Planning Board, Helena, MT
 Lincoln County Planning Board, Libby, MT
 Mineral County Board of County Commissioners, Superior, MT
 Missoula County Planning Board, Missoula, MT
 Missoula County Commissioners, Missoula, MT
 Powell County Commissioners, Deer Lodge, MT
 Powell County Planning Board, Deer Lodge, MT
 Alberton School, Alberton, MT
 Mineral County Assessor, Superior, MT
 Mineral County Planning Board, Superior, MT
 Thompson Falls City Planning Board, Thompson Falls, MT
 Missoula Planning Office, Missoula, MT
 Mineral County Planner, Superior, MT

Missoula County Attorney's Office, Missoula, MT
Montana Association of Counties, Helena, MT
Helena City Planning Board, Helena, MT
Flathead County Areawide Planning Organization, Kalispell, MT

STATE OF OREGON

CONGRESSIONAL DELEGATION

Senator Mark Hatfield
Senator Robert W. Packwood
Representative Les AuCoin
Representative Ron Wyden
Representative Denny Smith
Representative Robert Smith
Representative James Weaver

OREGON AGENCIES

Oregon Department of Energy, Salem, OR
*Intergovernmental Relations Division, Salem, OR
Department of Environmental Quality, Portland, OR
*Department of Fish & Wildlife, Portland, OR
*Department of Transportation, Salem, OR
Department of Agriculture, Salem, OR
State Extension Services, Corvallis, OR
State Marine Board, Salem, OR
Water Resources Department, Salem, OR
State Historic Preservation Office, Salem, OR
Public Utilities Commission, Salem, OR
Oregon Dept. of Land Conservation and Development, Salem, OR

OREGON PLANNING BOARDS/COMMISSIONERS/DEPARTMENTS

Board of Commissioners, Coos County Courthouse, Coquille, OR
Board of Commissioners, Curry County Courthouse, Gold Beach, OR
Board of Commissioners, Douglas County Courthouse, Roseburg, OR
Board of Commissioners, Jefferson County Courthouse, Madras, OR
City Forester, City of Portland OR
Columbia Region Assoc. of Governments, Portland, OR
Mid-Willamette Valley Council of Governments, Salem, OR
Multnomah County Planning, Portland, OR
District 4 Council of Governments, Corvallis, OR
Board of Commissioners, Union County Courthouse, La Grande, OR
Board of Commissioners, Gilliam County Courthouse, Condon, OR
Board of Commissioners, Sherman County Courthouse, Moro, OR
Board of Commissioners, Wasco County Courthouse, The Dalles, OR
Hood River County Board of Commissioners, Hood River, OR

Lane Council of Governments, (A-95 Coord.), Eugene, OR
Board of Commissioners, Lane County Courthouse, Eugene, OR
Board of Commissioners, Marion County Courthouse, Salem, OR
Board of Commissioners, Polk County Courthouse, Dallas, OR
Board of Commissioners, Yamhill County Courthouse, McMinnville, OR
Board of Commissioners, Benton County Courthouse, Corvallis, OR
Lincoln County Board of Commissioners, Newport, OR
Linn County Board of Commissioners, Albany, OR
Board of Commissioners, Clackamas County Courthouse, Oregon City, OR
Board of Commissioners, Columbia County Courthouse, St. Helens, OR
Board of Commissioners, Multnomah County Courthouse, Portland, OR
Board of Commissioners, Washington County Courthouse, Hillsboro, OR
Clatsop-Tillamook Intergovernmental Council, Cannon Beach, OR
Board of Commissioners, Clatsop County Courthouse, Astoria, OR
Tillamook County Board of Commissioners, Tillamook, OR
Coos-Curry Council of Governments, North Bend, OR
Columbia County Planning Dept., St. Helens, OR
Columbia County Board of Commissioners, St. Helens, OR
Tillamook County, Tillamook, OR
Washington County Administrative Office, Hillsboro, OR
*Director of Public Works, City of Salem, OR
*Metro. S.D., Portland, OR
Rogue Valley Council of Governments, Central Pt., OR
Mid-Columbia Council of Governments, The Dalles, OR
Central OR Intergovernmental Council, Redmond, OR
Klamath-Lake Planning Council, Lakeview, OR
Blue Mountain Intergovernmental Council, Enterprise, OR
Umpqua Regional Council of Governments, Roseburg, OR

STATE OF WASHINGTON

CONGRESSIONAL DELEGATION

Senator Slade Gorton
Senator Henry M. Jackson
Representative Don Bonker
Representative Norman D. Dicks
Representative Thomas S. Foley
Representative Mike Lowry
Representative Sid Morrison
Representative Jack Pritchard
Representative Al Swift

WASHINGTON AGENCIES

*Department of Natural Resources, Olympia, WA
District 6, Spokane, WA
*Department of Ecology, Olympia-Lacey, WA
Regional Manager, Spokane, WA

Department of Fisheries, Olympia, WA
Department of Game, Olympia, WA
 Region 1, Spokane, WA
Department of Transportation, Spokane, WA
State Energy Office, Olympia, WA
Office of Community Development, Olympia, WA
*Office of Archaeology & Historic Preservation, Olympia, WA
Office of Planning & Fiscal Management, Olympia, WA
State Historic Preservation Officer, Olympia, WA
Department of Agriculture, Olympia, WA
Sea Grant Program, Seattle, WA
State Extension Services, Pullman, WA

Commissioners, Councils, Committees, Society, Miscellaneous:
 State Parks & Recreation Commission, Olympia, WA
 Energy Facility Site Evaluation Council, Olympia, WA
 Washington Archeological Research Center, Pullman, WA
 Columbia River Gorge Commissions, Stevenson, WA
 Vera Irrigation District #15, Veradale, WA

WASHINGTON PLANNING BOARDS/DEPARTMENTS

Benton County Commissioners, Prosser, WA
Benton-Franklin Governmental Conference, Richland, WA
Chelan County Board of Commissioners, Wenatchee, WA
Chelan County Regional Planning Council, Wenatchee, WA
Clallam County Board of Commissioners, Port Angeles, WA
Clallam County Governmental Conference, Port Angeles, WA
Clark County Commissioners, Vancouver, WA
Clark County Reg. Planning Council, Vancouver, WA
Columbia County Board of Commissioners, Dayton, WA
Columbia County Planning Dept., Dayton, WA
Cowlitz County Board of Commissioners, Kelso, WA
Cowlitz County Dept. of Community Development, Kelso, WA
Cowlitz County PUD, Longview, WA
Cowlitz-Wahkiakum Governmental Conference, Kelso, WA
Douglas County Reg. Planning Comm., East Wenatchee, WA
Franklin County Commissioner, Pasco, WA
Franklin County Planner, Pasco, WA
Grant County Board of Commissioners, Ephrata, WA
Grant County Planning Dept., Ephrata, WA
Grays Harbor County Planning Department, Montesano, WA
Grays Harbor Regional Planning Commission, Aberdeen, WA
Island County Planning Dept., Coupeville, WA
Jefferson County Board of Commissioners, Port Townsend, WA
Jefferson-Port Townsend Regional Council, Port Townsend, WA
King County Admin, Public Works, Seattle, WA
*King County Planning Division, Seattle, WA
King County Weed Control Board, Seattle, WA
Kitsap County Dept. of Community Development and Planning, Port Orchard, WA

Kittitas County Conference of Governments, Ellensburg, WA
Klickitat County Planning Dept., Goldendale, WA
Klickitat Regional Council, Goldendale, WA
Lewis County Board of Commissioners, Chehalis, WA
Lewis Regional Planning Commission, Chehalis, WA
Lincoln County Board of Commissioners, Davenport, WA
Mason County Board of Commissioners, Shelton, WA
Mason Regional Planning Council, Shelton, WA
*Noxious Weed Control Board, Goldendale, WA
Okanogan Reg. Planning Council, Okanogan, WA
Pacific County Board of Commissioners, South Bend, WA
Pacific County Regional Planning Council, South Bend, WA
*Pierce County Planning Department, Tacoma, WA
Puget Sound Council of Governments, Seattle, WA
San Juan County Planning Dept., Friday Harbor, WA
Skagit County Board of Commissioners, Mount Vernon, WA
Skagit County Planning Dept., Mount Vernon, WA
Skagit Regional Planning Council, Burlington, WA
Skamania County Board of Commissioners, Stevenson, WA
Skamania Regional Planning Council, Stevenson, WA
Snohomish County Planning Department, Everett, WA
Spokane County Board of Commissioners, Spokane, WA
Spokane Regional Planning Conference, Spokane, WA
Spokane Area Development Council, Spokane, WA
Spokane County Commissioners, Spokane, WA
Spokane County Planning Department, Spokane, WA
Spokane County Engineering Department, Spokane, WA
Thurston County, Olympia, WA
Thurston Regional Planning Council, Olympia, WA
Wahkiakum County Commissioners, Cathlamet, WA
Walla Walla Reg. Planning Comm., Walla Walla, WA
Whatcom County Board of Commissioners, Bellingham, WA
Whatcom County Council of Governments, Bellingham, WA
*Whatcom County Grant Office, Bellingham, WA
Whatcom County Water District 10, Bellingham, WA
Whitman County Reg. Planning Council, Colfax, WA
Yakima County Conference of Governments, Yakima, WA
Yakima County Commissioners, Yakima, WA

STATE OF CALIFORNIA

CONGRESSIONAL DELEGATION

Senator Alan Cranston
Senator Peter Wilson
Representative Gene Chappie

CALIFORNIA AGENCIES

Susanville Board of Supervisors, Susanville, CA
Modoc County Board of Supervisors, Alturas, CA

STATE OF WYOMING

CONGRESSIONAL DELEGATION

Senator Malcolm Wallop
Senator Alan Simpson
Representative Richard Cheney

WYOMING AGENCIES

Office of the Governor, Planning Coordinator
Lincoln County Commissioners, Kemmerer, WY
Teton County Commissioners, Jackson, WY

STATE OF NEVADA

CONGRESSIONAL DELEGATION

Senator Paul Laxalt
Senator Chic Hecht
Representative Harry Reid
Representative Barbara Vucanovich

NEVADA AGENCIES

Elko County Commissioners, Elko, NV
Humbolt County Commissioners, Winnemucca, NV

STATE OF UTAH

CONGRESSIONAL DELEGATION

Senator Orrin Hatch
Senator Edwin Garn
Representative David Marriott
Representative James Hanson
Representative Howard Nielson

UTAH AGENCIES

Box Elder County Commissioners, Brigham City, UT

CITIES/MISCELLANEOUS

City of Glendale, Glendale, CA
City of Spokane, Mayor, Spokane, WA
Billings Area Chamber of Commerce, Billings, MT
Thompson Falls-Trout Creek-Noxon Chamber of Commerce, Thompson Falls, MT
Mayor of Alberton, Alberton, MT

COLLEGES/UNIVERSITIES/SCHOOLS

Ball State University, Muncie, IN
Eastern Washington State University, Cheney, WA
Laboratory of Anthropology, University of Idaho, Moscow, ID
Northwestern University, Evanston, IL
Pennsylvania State University, University Park, PA
*Washington State University, Pullman, WA

LIBRARIES

Argonne National Library, Argonne, IL
Aubrey R. Watzek Library, Lewis & Clark College, Portland, OR
Billings Public Library, Billings, MT
Boise Public Library, Boise, ID
Boise State University Library, Boise, ID
Boulder City Library, Boulder, MT
Butte Free Public Library, Butte, MT
Carroll College Library, Helena, MT
College of Idaho Terteling Library, Caldwell, ID
College of Southern Idaho Documents Library, Twin Falls, ID
Colorado State University Library, Fort Collins, CO
Daniel J. Evans Library, Evergreen State College, Olympia, WA
Eastern Montana College Library, Billings, MT
Eastern Oregon State College Library, La Grande, OR
Environmental Library, University of MT, Missoula, MT
Environmental Resource Library, Huxley College of Environmental Studies,
Bellingham, WA
Eric V. Hauser Memorial Library, Reed College, Portland, OR
Everett Community College Library, Everett, WA
Everett Public Library, Everett, WA
Flathead County Free Library, Kalispell, MT
Fort Vancouver Regional Library, Vancouver, WA
Governmental Research Assistance Library, Seattle Public Library, Seattle, WA
Great Falls Public Library, Great Falls, MT
Harvey W. Scott Memorial Library, Pacific University, Forest Grove, OR
Hearst Free Library, Anaconda, MT
Henry Suzzallo Memorial Library, University of Washington, Seattle, WA
Idaho State Library, Boise, ID
Idaho State University Library, Boise, ID
Idaho State University Library, Documents Division, Pocatello, ID
John F. Kennedy Memorial Library, Eastern Washington State College, Cheney, WA
Lake County Library, Polson, MT

Lewis & Clark Library, Helena, MT
 Library Association of Portland, Portland, OR
 Mabel Zoe Wilson Library, Western Washington State College, Bellingham, WA
 Missoula City-County Library, Missoula, MT
 Missoula Public & Missoula County Free Library, Missoula, MT
 Montana College of Mineral Sciences & Technology Library, Butte, MT
 Montana Historical Society Library, Helena, MT
 Montana State Library, Helena, MT
 Montana State University Library, Bozeman, MT
 North Olympic Library System, Port Angeles, WA
 Northern Montana College Library, Havre, MT
 Northrup Library, Linfield College, McMinnville, OR
 Oregon State Library, Salem, OR
 Oregon Supreme Court Library, Salem, OR
 Penrose Memorial Library, Whitman College, Walla Walla, WA
 Plains Public Library, Plains, MT
 Polson City Library, Polson, MT
 Port Angeles Public Library, Port Angeles, WA
 Portland State University Library, Portland, OR
 Ricks College, David O. McKay Library, Rexburg, ID
 Ronan City Library, Ronan, MT
 Seattle Public Library, Seattle, WA
 Spokane Public Library, Spokane, WA
 Southern Oregon State College Library, Ashland, OR
 Thompson Falls Public Library, Thompson Falls, MT
 University of Idaho Library, Moscow, ID
 University of Montana Environmental Library, Missoula, MT
 University of Montana Library, Missoula, MT
 University of Oregon Library, Eugene, OR
 University of Puget Sound, Everill S. Collins Memorial Library, Tacoma, WA
 University of Washington School of Law Library, Seattle, WA
 Victor J. Bouillon Library, Central Washington State College, Ellensburg, WA
 Washington State Library, Olympia, WA
 Washington State University Library, Pullman, WA
 Western Oregon State College Library, Monmouth, OR
 Willamette University Library, Salem, OR
 William Jasper Kerr Library, Corvallis, OR
 William K. Kohrs Memorial Library, Deer Lodge, MT

INDIAN TRIBES

Colville Confederated Tribes, Nespelem, WA
 Confederated Salish & Kootenai Tribes of the Flathead Reservation, Pablo, MT
 Ft McDermitt Paiute Tribe, McDermitt, NV
 Lummi Business Council, Bellingham, WA
 Makah Tribal Council, Neah Bay, WA
 *Squaxin Island Tribe, Shelton, WA
 Swinomish Indian Senate, LaConner, WA

UTILITIES

Arizona Public Service Co, Phoenix, AZ
Basin Electric Power Corp., Bismarck, ND
Columbia Gas System, Wilmington, DE
Los Angeles Department of Power & Light, Los Angeles, CA
Public Service Company of Oklahoma, Tulsa, OK

CUSTOMERS

Benton County PUD # 1
Central Lincoln PUD
Chelan County PUD #1
City of Idaho Falls
Eugene Water & Electric Board
Northern Lights, Inc.
Pierce Co Utilities
Prairie Power Coop
*Seattle City Light
Snohomish County PUD
Tillmook PUD

PRIVATE UTILITIES

B C Hydro & Power Authority, Vancouver, BC, Canada
CP National
Idaho Power Co.
Montana Power Co.
 Missoula
 Butte
 Colstrip
*Puget Sound Power & Light Co.
Washington Water Power Co.
West Kootenay Power & Light Co.

DIRECT SERVICE INDUSTRIES

BUSINESSES

Adams & Kay, Laguna Hills, CA
Apple Valley Appraisals, Oroville, WA
ATL Corp, San Pedro, CA
Bader Real Estate, Fall River Mills, CA
Battelle, Applied Ecology Section, Richland, WA
Battelle Research Center, Seattle, WA
Bechtel Power Corp, Gaithersburg, MD
Cedar & Goble
Colfax Meat Packing Co, Colfax, WA
Dames & Moore, Golden, CO
Dames & Moore, Seattle, WA

Ecology & Environment, Inc., Buffalo, NY
 EI Dupont, Wilmington, DE
 Energy Resources Company, La Jolla, CA
 Engineering Science, Denver, CO
 Environmental Impact Services, Tucson, AZ
 Environmental Management Services Co., Ft. Collins, CO
 Envirosphere Company, Bellevue, WA
 Fetscher Logging Co., Missoula, MT
 Fieldmaster Construction, Tacoma, WA
 Forest Consulting Serv, Eugene, OR
 Forest King Consulting, Estacada, OR
 Forest Land, BN Timberlands Inc, Kalispell, MT
 George Aubert Orchards Inc, Parkdale, OR
 *G Cooper & Assoc, Seattle, WA
 G O Klock & Assoc, Wenatchee, WA
 G Seed Company, Tonasket, WA
 Hewlett Packard, Boise Div, Boise, ID
 Hudson & Assoc, Baker, OR
 Idaho Forge & Fab, Moscow, ID
 Jones & Stokes Assoc Inc, Bellevue, WA
 Lawyer Nursery, Plains, MT
 Lone Pine Forestry, Seattle, WA
 Monsanto, Boise, ID
 *Monsanto Agricultural Products Co, St Louis, MO
 Morrison-Knudsen Co Inc, Boise, ID
 Nero & Assoc Inc, Portland, OR
 Niemi Forestry, Castle Rock, WA
 R A Edwards Inc, Goldendale, WA
 Rockwell Hanford Operations, Richland, WA
 RPF Ecological Associates, Evanston, IL
 Rutherford & Assoc, Cookeville, TN
 Santiam Spray Service, Sweet Home, OR
 Shapiro & Assoc Inc, Seattle, WA
 Strata Industries Inc, Thruston, OR
 T. Baker Smith & Son, Inc. Environmental Research Div., Houma, LA
 The Gage Company, Tacoma, WA
 The Mitre Corp, McLean, VA
 Tompkin & Assoc, Salem, OR
 Total Tree Logging Inc, Newport, OR
 Tri-State Generation & Trans Assoc Inc, Denver, CO
 Utility Data Institute, Inc., Washington, DC
 Warner Consulting, Benton City, WA
 Willamette Industries Inc, Albany, OR
 *Winterhawk Enterprises
 Zephyr Computing, Eugene, OR

INTEREST GROUPS

AAVW Boise Branch, Boise, ID
ACT, Port Orchard, WA
*Alpine Lakes Protection Soc, Wenatchee Chapter, Orondo, WA
Audubon Society, Helena, MT
Audubon Society, Seattle, WA
Black Hills Audubon Society, Olympia, WA
*Breitenbush Hot Springs Community, Detroit, OR
CAST, Colville, WA
COIC, Bend, OR
Committee to Save the Earth, Mercer Island, WA
Concerned Mothers, Bothell, WA
Continental Divide Trail Society, Bethesda, MD
Council of Energy Resource Tribes, Washington, D.C.
Earth & Life Sciences, Idaho Falls, ID
Earth-World Organization, Eugene, OR
Ecology & Environment, Buffalo, NY
Eddyville Concerned Citizens, Eddyville, OR
Edison Chiloquin Foundation, Chiloquin, OR
ERSAL, Corvallis, OR
Everett Wash Chapter Trout Unlimited, Snohomish, WA
Forelaws on Board, Boring, OR
Forestry Assoc Intl, Seattle, WA
Friends of the Columbia River Gorge, Portland, OR
Hood Canal Environmental Council, Seabeck, WA
Humboldt Herbicide Task Force, Arcata, CA
Idaho Conservation League, Boise, ID
Idaho State University Outdoor Program, Pocatello, ID
Inland Forest Resource Council, Missoula, MT
Inst for Environmental Studies, Seattle, WA
League of Women Voters, Olympia, WA
Mainsview, Poulsbo, WA
Mason County Energy Ed Grp, Shelton, WA
Montana Association of Conservation Districts, Helena, MT
*Mt Baker Watershed Protection Assn, Deming, WA
Mt Jefferson Group Sierra Club, Salem, OR
National Wildlife Federation, Olympia, WA
NOBPA, Boulder, MT
North Cascades Conservation Council, Seattle, WA
Northwest Coalition for Alternatives to Pesticides, Eugene, OR
Northwest Environmental Defense Center, Portland, OR
O.C.E.A.N., Astoria, OR
Oregon Environmental Council, Portland, OR
Oregon Farm Bureau, Salem, OR
OR-State Beekeepers, Reedsport, OR
*Panhandle Environmental League, Sandpoint, ID
Pilchuck Audubon Soc, Stanwood, WA
Portland Audubon, Portland, OR
Puget Sound Assoc of Cooperating Tribes, Suquamish, WA

Quest Northwest, Edmonds, WA
Sierra Club, Ketchum, ID
Sierra Club, Olympia, WA
Sierra Club Toxics Comm, Bainbridge Isl, WA
Siuslaw Task Force, Corvallis, OR
SONCAP, Grants Pass, OR
Southern Oregon Citizens Against Toxic Sprays, Grants Pass, OR
Survival Center, University of Oregon, Eugene, OR
TASC, Bellevue, WA
The Wilderness Society, Seattle, WA
Washington State Bowhunters, Everett, WA
Western Environmental Trade Association, Helena, MT
Western Forestry and Conservation Association, Portland, OR

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