SEATTLE CITY LIGHT

VEGETATION MANAGEMENT

OVERVIEW STUDY

INTRODUCTION

The consultant was directed to briefly examine the Seattle City Light electrical transmission right-of-way from Ross Dam to Seattle and report on vegetation management implications, both now and in the future, in light of existing conditions.

Three separate actions have been taken in respect to providing recommendations for the utility as to immediate and future needs for adequate right-of-way management;

(i) a meeting was held in Vancouver, British Columbia with Mr. Stephen Ralph of the Office of Environmental Affairs and with Mr. Gerd Jerochim of the Dispatching, Operating and Underground Section of Distribution following their attendance at a Right-of-way Management Seminar given by the consultant at Simon Fraser University,

(ii) the right-of-way in question has been examined from the air in conjunction with Mr. Ralph and Mr. Peter Tenerelli of Dispatching, Operating and Underground System Construction and, finally,

(iii) this report has been prepared with a brief review of the present situation on the right-of-way coupled with recommendations on managing vegetation problems in the future.

THIS REPORT IS NECESSARILY BRIEF AND DOES NOT PURPORT TO BE AN IMPLEMENTATION PLAN FOR NEW APPROACHES TO MANAGING THE EXISTING TRANSMISSION RIGHT-OF-WAY. RATHER, IT IS PRESENTED AS A STRATEGIC OVERVIEW INTENDED TO PROVIDE A CONTEXT IN WHICH THE UTILITY MAY REVIEW ITS PRESENT CIRCUMSTANCE AND JUDGE ITS MOST APPROPRIATE NEEDS, GIVEN THE OTHER CONSTRAINTS THAT GOVERN OPERATING POLICY AND PROCEDURE. This report does, however, provide a spectrum of recommendations based on the findings of this study and partially drawn from the experience of other similar or larger utilities previously faced with comparable problems.

This report is organized into five short sections; (i) Executive Summary, (ii) Introduction, (iii) Review, (iv) Conclusions and (v) Recommendations. The Review Section is based on the discussions with Seattle City Light staff and the field trip previously noted. This section is also supported by 20 captioned photographs which document many of the conditions existing on the transmission right-of-way. A number of synoptic charts have been developed or are included to illustrate particular facets of this report in an abbreviated form.

It is recommended that the utility now undertake a detailed study of right-of-way conditions tower span by tower span. Such a study should be coupled with a workload analysis which will accurately predict the time and cost requirements to maintain the right-of-way at predetermined levels of protection using alternate methods of vegetation management appropriate to existing ecological and environmental conditions. Without such a detailed examination of existing conditions and an accurate recording method for vegetative, geomorphological, topographical and administrative opportunities and constraints along the linear corridor, it will not be possible to choose the most appropriate methods or program content for long term management, nor specifically identify areas where immediate vegetation management work should be targeted.

These problems are primarily associated with public concern or rejection of various vegetation management practices and the present indirect administrative division of responsibility within the utility for right-of-way maintenance. A number of underlying problems will predicate the likelihood of major improvements in the existing program. In particular, previous practice of broadcast foliar application of herbicides and the fact that no group specifically formed to undertake or supervise vegetation management exists within the utility are major limitations that will require careful study.

THESE TWO FACTORS, COUPLED WITH LITTLE UP-TO-DATE INFORMATION PREPARED WITH VEGETATION MANAGEMENT IN MIND, HAS MEANT THAT THIS REPORT PRIMARILY SUGGESTS DIRECTIONS IN WHICH THE UTILITY MAY WISH TO MOVE RATHER THAN SPECIFYING ACTUAL TASKS OR LOCATIONS WHERE WORK IS REQUIRED. IT MUST BE APPRECIATED, THEN, THAT THIS REPORT IS BASED ON A MINIMUM OF ACTUAL FIELD INFORMATION AND IS MAINLY CONCEPTUAL IN NATURE, BASED ON A LIMITED CONTACT WITH THE UTILITY.

REVIEW

Five broad issues are of importance in considering the Seattle City Light rights-of-way in the context of vegetation management. Each issue has a number of subsets to be reviewed. These issues and subsets are:

(i) What is the status of the right-of-way at present?

- (a) Immediate past history
- (b) Vegetation and urban areas
- (c) Vegetation and rural farm areas
- (d) Vegetation and forested areas

(ii) What are the problems and how severe are these problems at present?

(a) Outages

(b) Clearances, general

(c) Work hazard

(d) Public hazard

(e) Fire hazard

(f) Inaccessibility

(iii) What immediate remedies are required?

(a) Vegetation management

(b) Administrative needs

(c) Electrical requirements

(iv) What are the long term implications if nothing is changed?

(a) Service interruptions

(b) Safety

(c) Costs and workload

(v) What long term solutions are viable?

(a) Ecologically sound right-of-way management

(b) Administration of rights-of-way

(c) Right-of-way management program

(d) Adjust right-of-way management requirement

REVIEW OF THE ABOVE QUESTIONS (i) to (v)

(i) What is the status of the right-of-way at present?

(i) (a) Immediate past history

Administratively the transmission system can presently be broken into two main components; that portion south of the Sauk River and that to the north from the Sauk River to the Ross Dam. The portion to the south has a prior history of stem foliar spring and summer application of selective translocating herbicides applied with hydraulic ground equipment on a largely broadcast basis. Within the last three years no right-of-way vegetation management, using herbicides, has been practiced with the exception of a small contract control program for Tansy Ragwort (Senecio jacobaea).

In the north part of the system from mile fifty-seven to Ross Dam, some twenty-two right-of-way miles further, the largely forested character of the corridor and adjacent land has necessitated frequent vegetation management for both edge danger trees and within the right-of-way. The rugged topography and consequent high catenary in some locations, particularly at river crossings in the north system has reduced the need for vegetation management on every tower span.

An ongoing program exists for mechanical control of vegetation along right-of-way access roads using an articulated arm flail mower on a rental basis. Some minor danger tree removal has taken place between Bothell Substation and the Sauk River, however, this is apparently not part of an ongoing organized program.

(i) (b) Vegetation and urban/suburban areas

Where a clearly defined right-of-way is accessible and woody vegetation has been removed, grass mowing has been the predominant maintenance method. Problems relating to weed growth, complaints as to infrequency of maintenance, unauthorized access and uncontrolled disposal on the right-of-way are ongoing. In general, these problems do not constitute a major impediment in normal operations. No written policies on maintenance level, work standards or specifications were apparent for this work.

In suburban and urban areas there has been a consistent requirement to prune trees to maintain electrical clearances. This is true particularly south of the Bothell Substation, on lines where the right-of-way is largely easement and incorporated into or abutting individual residential properties.

Although not apparently part of the right-of-way function, maintenance is required and has been undertaken in or around substation facilities. Some soil sterilant use is apparent in substations but the circumstances, controls, consistency and responsibility for this work is not clear to the consultant given the limited nature of this study. Lawns have been cut under local contracts and the landscape emphasis is evidently on low maintenance shrubs. The issue of weed suppression in the approximately one hundred and twenty such sites requires further examination.

(i) (c) Vegetation and rural farm areas

Some areas of the right-of-way have been converted to agricultural purposes. In some cases large-scale adjacent agricultural land use has encompassed the right-of-way as in the Snohomish River Valley. Elsewhere agricultural activity has been restricted to single farmer or small groups of farms using land adjacent to the right-of-way with fields extending across the corridor. Few locations show express use of the right-of-way except for rough pasture. In some limited locations, horticultural use for garden crops is evident.

Whenever agricultural land use is predominant, few vegetation management problems could be seen with the exception of some danger tree potential in the vicinity of new agricultural land clearing.

(i) (d) Vegetation and forested areas

The preponderance of the right-of-way passes through presently forested lands. Logging activity adjacent to the right-of-way is limited. Few pure stands were seen. Typical Pacific Northwest coastal species of coniferous and deciduous trees predominate. A significant percentage of edge trees are mature Black Cottonwood (Populus trichocarpa) and Alder (Alnus rubra). These trees and tall drawn-up Lodgepole Pine and Hemlock present the major problem as danger trees.

The right-of-way corridor, particularly on the portion between Bothell Substation and the Sauk River supports extensive regrowth of both coniferous and deciduous vegetation. Readers are referred to the accompanying plates.

The two most apparent problems are encroachment from tall edge growth into the corridor posing a danger tree hazard and, in some locations, substantial areas of relatively tall fast-growing deciduous species, predominantly Alder, growing immediately below the circuits. For the most part, access to all but the difficult terrain in the vicinity north of the Skagit River allows future ground maintenance without difficulty.

1.

Existing right-of-way southwest of Bothell Switching Station. Right-of-way below aesthetic towers is mown.

2.

Bothell Switching Station showing tall growing vegetation below conductors in the foreground.

3.

Multiple use of the right-of-way for garden crops necessitates extreme care during adjacent vegetation management operations.

4.

Increasing urbanization beside the right-of-way may dictate change of practices from herbicide use to grooming, seeding, mowing or very selective tall tree removal.

5.

Extensive agricultural areas though substantially reducing the acreage supporting undesirable plants still require hedgerow and bushlot inspections.

6.

Some locations are supporting substantial regrowth that will require treatment in the foreseeable future.

7.

Encouraging property owners to convert right-of-way to haying areas or grazing pasture by direct aid can reduce vegetation management costs substantially.

8.

River crossings often have sufficient conductor clearance to permit retention of stream bank vegetation although individual tall trees may still require removal.

9.

The westerly edge of the right-of-way in this section provides ample danger tree clearance due to its clearance for an additional line. Woody plant regrowth in this area is spotty and largely coniferous. This area would be suitable for mechanical cutting as the conifers will not regrow.

10.

By comparison the easterly edge has significantly less clearance and supports both crown growth of stable trees and undesirable deciduous danger trees in close proximity to the outside conductor.

11.

In the immediate foreground there is some danger tree removal. In the middle of the right-of-way regrowth will eventually pose the same problem.

12.

The possibility that reclearing or danger tree removal and disposal operation can be a source of fire must be of constant concern.

13.

In some locations regrowth has almost completely obscured the original right-of-way edge.

14.

The extent of regrowth and the proximity of edge trees to the conductor is clearly seen in the plate.

15.

A tree top burning in the conductor is just evident at the foot of the plate, slightly right of centre.

16.

Despite good access to the right-of-way extensive regrowth has been tolerated in the last few years.

17.

A number of thick vegetation communities were noted along the length of the right-of-way. Although the maturity of these blocks is not known, they were seen to be free of tree regrowth.

18.

A number of property owners adjacent to the right-of-way have done limited grooming of their own volition.

19.

The poor eradication of large regrowth with broadcast summer stem foliage herbicide applications is well illustrated by the partial kill seen here.

20.

The problem of tall suburban tree growth of fast growing species requires intensive inspection and frequent tree trimming.

(ii) What are the current problems and how severe are these problems at present?

(ii) (a) Outages

No specific review was made of outage statistics or causal data. The general consensus of those asked was that, to date, loss of system due to interruptions caused by vegetation had a low frequency. It must be remembered, however, that outage information is not a reliable test of protection efficiency in that period between maintaining good clearances through an organized vegetation management program and the end of a normal return cycle for retreatment. It is only in the following period where rapid growth rates severely diminish clearance that the potential for catastrophic system loss occurs, usually during extremely inclement weather, with the system operating at full load.

(ii) (b) Clearances, general

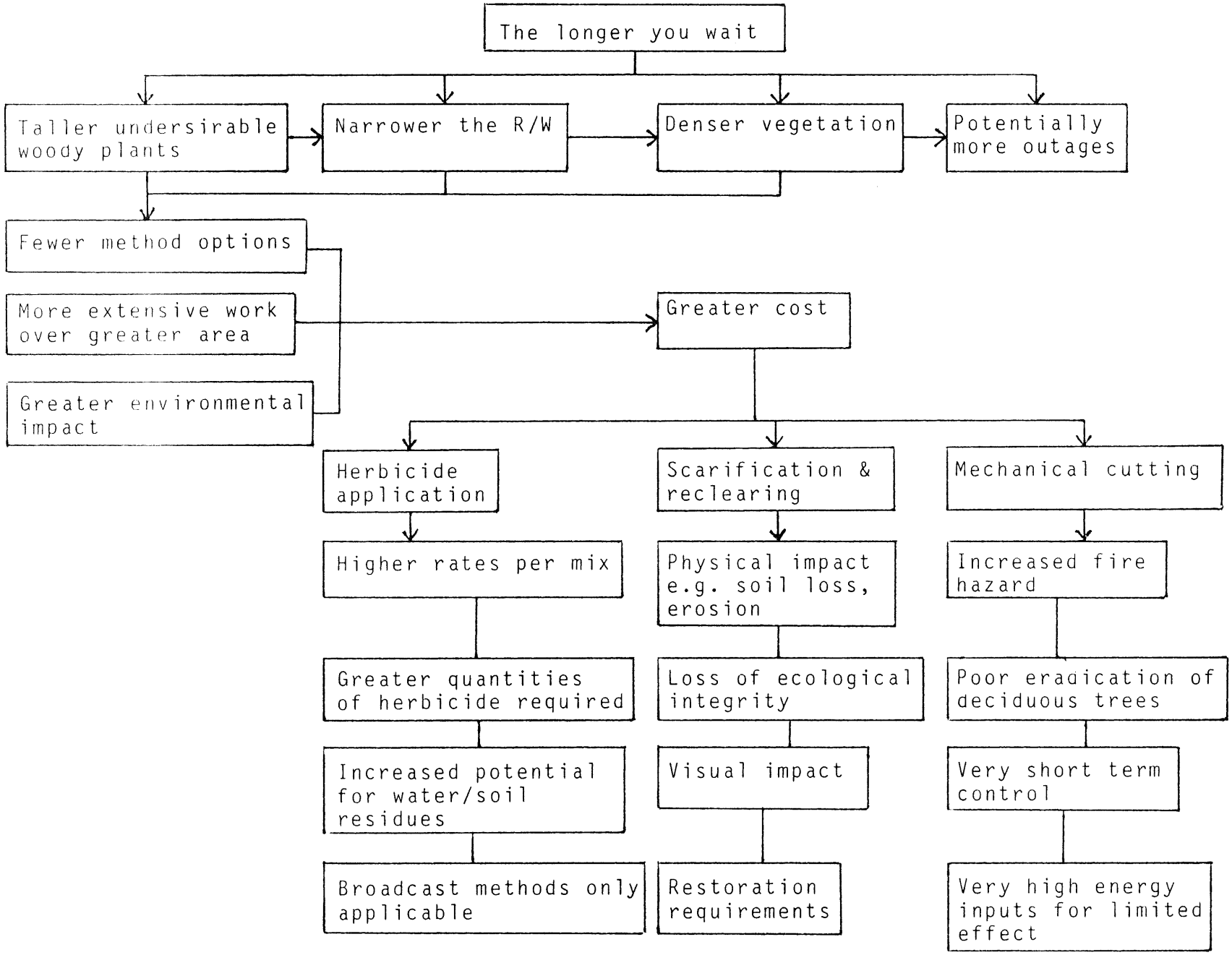
During the hiatus between past vegetation management practice, and the present realization that vegetation conditions are jeopardizing system security, woody plant growth has substantially diminished clearances. This has occurred both between trees and outside conductors and between the lowest catenary and undesirable immature but tall growing, woody vegetation within the right-of-way corridor.

Under appropriate wind, temperature and load conditions, it is clear that flashovers (and fires) are very possible. Throughout the system, danger tree problems are very evident. In some locations tip burning of vegetation was seen and the potential, with very few years added growth, is for the system to present major reliability problems unless a concerted vegetation management program is initiated, funded and implemented. The consequences of delay are shown on the adjacent schematic.

(ii) (c) Work hazard

Danger tree removal, in particular, requires considerable skill. This work can be undertaken in a live-line situation but this requires specialized equipment and tree removal in sections. This work is slow and costly. Even whole tree removal with the system under a hold-off tag requires directional felling to preclude conductor or tower strikes.

RIGHTS-OF-WAY VEGETATION MANGEMENT IMPLICATIONS IF DELAYED



Removal or treatment of dense underbrush on the right-of-way is also a higher safety risk with more inherent injury hazards than when vegetation is sparse and small. An additional concern in the context of work hazard relates to both general access and emergency access. If vegetation is allowed to predominate on the right-of-way or cause conductor breakage, repair must often take place during far less than optimum weather conditions, again exposing line crews to unnecessarily hazardous work conditions often outside normal working hours.

(ii) (d) Public hazard

A principal reason for vegetation management work, in addition to that concerning system reliability, is that of public protection from electrical hazards and fire risk. Some locations have been seen where flashovers of the 230 kv system to vegetation have occurred indicating that there is a clear need for a greater effort to maintain clearances. If the system is inadequately maintained by comparison with other similar utilities, the onus of liability will undoubtedly lie with the utility.

(ii) (e) Fire hazard

Fire hazard on the right-of-way increases in three forms when vegetation management is decreased for an extended period. There is the clear danger of flashover causing vegetation in the right-of-way to ignite. In addition, the amount of dense young woody vegetation can provide substantially more fuel for fire than would be the case on a well maintained right-of-way. Finally, there is the fire hazard associated with eventual vegetation treatment. The chemical or mechanical removal of growing vegetation almost always renders that vegetation more susceptible to fire. In fact, burning with the attendant fire escape potential may have to be used as a disposal method. The problem of fire originating on the right-of-way through this latter mechanism is evident in some locations on the existing right-of-way.

(ii) (f) Inaccessibility

The utility is fortunate to have a maintained right-of-way access throughout much of its transmission system. So far, this road system has apparently been kept in relatively good condition. A more evident problem is access and visibility within the right-of-way corridor. The extensive areas of woody vegetation will presently make line inspection or repair and insulator replacement more difficult and expensive than in a system practicing consistent vegetation management.

(iii) What immediate remedies are required?

(iii) (a) Vegetation management

It is apparent from the brief overflight on the system that danger trees and vegetation below the conductor but within the limits of approach are the two main elements of immediate concern.

Danger tree identification as distinguished by species, height, exposure, branching scaffold, health, vigour, rooting, soil type and proximity to the conductor is probably required throughout the transmission system. This is particularly warranted on the narrower easterly edge of the right-of-way where upper crowns of many deciduous trees have grown into the light space created by the right-of-way. A concerted effort is needed to identify both areas and trees of immediate concern and to initiate an intensive program for danger tree removal. While sophisticated computerized photogrammetry methods with a high level of reliability exist, logistical cost, lack of in-house staff training on these methods and time constraints probably preclude their use. A simple visual assessment along each right-of-way edge by foot, trail bike, or snowmobile will provide the required level of information to plan an initial danger tree removal program.

Swaths of vegetation growing below the conductor are apparently within the limit of approach in a few locations and these will require mapping and treatment before another full growing season. There is some indication that a few single stems may also constitute a hazard. Existing line patrols appear to have identified most trees in this condition. However, a complete field review of vegetation conditions as discussed in the Data Collection segment of the Recommendations in this report is required to fully identify areas of major concern. In the meantime the field patrol staff should document their knowledge of high risk locations. This information, coupled with their involvement in planning the 1982 program should serve to alleviate any immediate problem areas.

(iii) (b) Administrative needs

The present allocation of responsibilities has meant that on the south system at least, vegetation management is an adjunct responsibility demanding far greater supervision time to develop and implement an integrated vegetation management plan than the Distribution supervisor's existing workload can accommodate.

The time involved in (1) providing the liaison between groups/departments within the utility, (2) liaison with regulatory agencies and possibly the general public , and (3) implementation of a comprehensive vegetation management program, justifies the appointment of a vegetation management supervisor either within the existing framework or as a separate "Operations" entity. The extent to which this position would require additional support staff would be contingent on the eventual maintenance standards adopted and the extent to which field work would be contracted to the private sector. If it is decided to undertake most vegetation management operations in-house it will also be necessary to establish one or two permanent teams for field work involving vegetation management operations alone.

As important, and directly tied to the specific administrative requirements noted above, is a recognition by senior management of the utility that vegetation management is a segment of operations with high public visibility and potential for conflict with the general public, with landowners adjacent to rights-of-way and with regulatory agencies responsible for environmental protection. As such, it must be seen as an important and integral part of utility operations which requires specific planning, clear utility policy and ongoing fiscal support.

(iii) (c) Electrical concerns

Conductor blowout space and conductor sag are two important considerations that affect vegetation management practice. At present, side clearance in many locations is insufficient for adequate electrical protection. Flashover damage to conductor strings was not seen but no particular effort was made to identify this problem during the brief helicopter overflight. A considerable number of partially chipped insulators were noted. This latter situation may be reflected in the ease of access to some isolated locations along the right-of-way maintenance roads. It is apparent that considerable sag exists on some tower spans, however, it is not known if retensioning or restringing is possible or would improve ground to conductor clearances.

(iv) What are the long term implications if nothing is changed?

(iv) (a) Service effects

Without a concerted effort to regain vegetation mangement on the right-of-way, particularly on the south system, there will be both intermittent circuit interruptions and more major faults caused during storm conditions. The potential exists

for a prolonged system loss if load and weather conditions coincide making the line vulnerable to major tree damage. An example of the impact of vegetation caused outages is shown by the following incident. Generators 22 and 23 at Gorge Generating Station were damaged on Friday, August 7, 1981 during, or as a result of, a fault on the 5.7 mile 230 Kv transmission line between Diablo and Gorge. The transmission line apparently sagged because of loading and high ambient temperatures into a tree on the right-of-way located one-half mile from Diablo. The breakers at Diablo operated properly to clear the fault while those at Gorge did not. Costly and prolonged outages have resulted.

(iv) (b) Safety

It is obvious that as growth continues on the right-of-way and the acreage of vegetation within the limits of approach increases, then the potential for accidental electrocution or fire is increased.

(iv) (c) Work costs and workload

Within most utilities vegetation management is a sequential process that recurs on each part of the system with differing intensities and frequency depending on conditions that reflect

original clearing methods, previous vegetation management practice, adjacent land use and tree species, as well as the number of iterative retreatment cycles that have been undertaken. In this way maintenance costs are largely predictable and consistent year to year. Moreover, workload is appropriately adjusted to area and the workforce can be both stable and highly trained.

The implications that arise out of prolonged delay are given in the facing schematic for each of the three appropriate vegetation control methods.

(v) What long term solutions are viable?

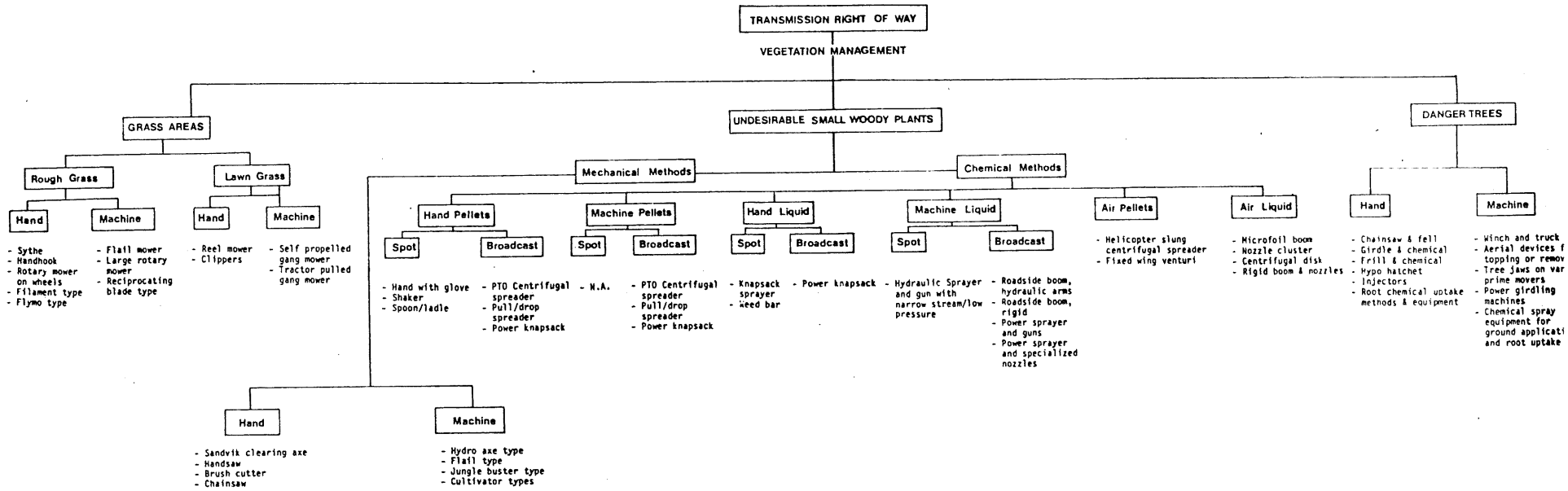
(v) (a) Ecologically sound right-of-way management

Simply put, the aim of an electrical utility right-of-way vegetation management program is to eradicate the tall growing woody plants that can endanger the system and to favour those that will help maintain vegetative cover and help suppress the establishment and growth of the undesirable woody plants. Two further aims that relate to vegetation management strategies are to maximize compatible land uses on the right-of-way and so diminish the area requiring on-going vegetation management and to ensure that aesthetic or environmental requirements are met

with compatible vegetation management practices. Protection of river banks in spawning areas and retention of taller vegetation at major road crossings are two examples. A further important responsibility in such a program is to ensure that rights-of-way are not corridors of propagation and movement for noxious weeds.

The spectrum of options to attain these aims is fairly limited, ranging from chemical usage through mechanical cutting to major ground disturbances and restoration. These options are shown in the schematic on the next page.

As with most biological systems, biological controls for right-of-way management are of limited value except to maintain rights-of-way that have attained a relatively stable ecological equilibrium. Biological controls must be distinguished from biological principles. The widespread practice of summer stem foliage applications of herbicide on a long but repeated cycle has been shown to be a self-sustaining requirement compared with more selective eradication of undesirable species as the right-of-way matures, leaving a sharply reduced vegetation treatment required over time. This period is most appropriately broken into two time periods. The first is conversion after initial clearing to a relatively stable forb/shrub community where the initial vegetation management


TRANSMISSION RIGHT OF WAY
VEGETATION MANAGEMENT
GRASS AREAS
Rough Grass
Hand
- Sythe
- Handhook
- Rotary mower on wheels
- Filament type
- Flymo type
Machine
- Flail mower
- Large rotary mower
- Reciprocating blade type
Lawn Grass
Hand
- Reel mower
- Clippers
Machine
- Self propelled gang mower
- Tractor pulled gang mower
UNDESIRABLE SMALL WOODY PLANTS
Mechanical Methods
Hand
- Sandvik clearing axe
- Handsaw
- Brush cutter
- Chainsaw
Machine
- Hydro axe type
- Flail type
- Jungle buster type
- Cultivator types
Chemical Methods
Hand Pellets
Spot
- Hand with glove
- Shaker
- Spoon/ladle
Broadcast
- PTO Centrifugal spreader
- Pull/drop spreader
- Power knapsack
Machine Pellets
Spot
- N.A.
Broadcast
- PTO Centrifugal spreader
- Pull/drop spreader
- Power knapsack
Hand Liquid
Spot
- Knapsack sprayer
- Weed bar
Broadcast
- Power knapsack
Machine Liquid
Spot
- Hydraulic Sprayer and gun with narrow stream/low pressure
Broadcast
- Roadside boom, hydraulic arms
- Roadside boom, rigid
- Power sprayer and guns
- Power sprayer and specialized nozzles
Air Pellets
- Helicopter slung centrifugal spreader
- Fixed wing venturi
Air Liquid
- Microfoil boom
- Nozzle cluster
- Centrifugal disk
- Rigid boom & nozzles
DANGER TREES
Hand
- Chainsaw & fell
- Girdle & chemical
- Frill & chemical
- Hypo hatchet
- Injectors
- Root chemical uptake methods & equipment
Machine
- Winch and truck
- Aerial devices f topping or remov
- Tree jaws on var prime movers
- Power girdling machines
- Chemical spray equipment for ground applicati and root uptake

emphasis is on eradication of existing tall growing woody plant propagules. The second period is that of maintaining the lower growing plant communities free of new growth from new propagules brought in by normal plant dispersal mechanisms or man.

In the case of the Seattle City Light rights-of-way supporting undesirable woody plants, selective herbicide management will be extremely expensive, environmentally sensitive and difficult because of the perceived but unsubstantiated human impacts attributed to many herbicides. It will also render incomplete kill in many locations because of the height and density of the vegetation now established. Consequently, it will be important to examine all treatment methods carefuly and adopt methods or combinations of methods that will ensure minimum impact with maximum return for the effort and funds expended.

On the Seattle City Light right-of-way the most important factor is to choose the most appropriate method that will provide the least cost/least impact result yet ensure the longest cycle before retreatment is required; consistent with the desire to manage floristic diversity by the principles set out previously in this report.

The right-of-way can be viewed in this context in the following categories. The first is that associated with urban areas where the right-of-way is largely rough grass. Here debris, rock, and terrain may limit equipment, however, flail-type mowers either tractor-mounted or self-propelled will provide the least expensive method of general maintenance. Frequency of mowing will be dictated by the required standard of appearance. Often this work is best contracted but requires consistant supervision. Periodic weed control with appropriate low pressure tractor-mounted boom equipment may be required but site/plant specific weed control is preferable if weed areas are small .

In both situations choice of herbicide and drift control are important. Two alternatives to consider are sowing with wildflower mixes, thus diminishing areas mown and, of course, encouraging other compatible users to occupy the right-of-way.

In suburban areas a major problem is the control of both height and side growth for ornamental or native trees growing in private properties. Here the most desirable approach is to effect species change. It is not, in this consultant's opinion, sufficient to strive only for incompatible tree removals since this can, in time, completely change the

treescape character of areas with subsequent and severe criticism of the utility. Rather, it is appropriate for a combination of arboriculturally sound pruning practice, for example, drop crotch pruning and use of fortified tree wound dressings, to be used in conjunction with an active, cooperative tree removal and compatible tree replacement program to be instituted with funding from the utility. Despite some capital costs, the long term savings in diminished outages and pruning costs have been demonstrated by other utilities. The improved public image and publicity alone can make the program worthwhile. Such a program should not be launched until the funding and infrastructure can handle the workload involved.

In rural areas along the right-of-way where a combination of semi-horticulture or small holding agriculture is an existing partial use of the right-of-way, either by design or providence, the vegetation manager will normally be faced with considerable resistance to herbicide use. This problem is exacerbated by those infill vegetation areas of the right-of-way that support tall, dense growth of undesirable species. While eradication of these species is necessary through the conversion stage prior to establishment of a more stable low growing plant community, broadcast use of herbicides is incompatible with adjacent uses. Here, then, the vegetation manager must integrate cultural, mechanical and chemical

techniques and endeavor to extend compatible uses. Grooming and pasture production, grooming and field creation, grooming and reseeding with groundcovers, forbs and desirable shrubs in non-productive areas are all possible. In addition, mechanical cutting, disposal, and subsequent treatment of roots with plant/site specific low rate applications of translocating herbicides to ensure complete root kill of deciduous species, or low cutting of coniferous species coupled with actual full plant herbicide coverage of individual very small tree growth, are all more desirable options than broadcast stem foliar treatment of all tall vegetation.

The next category is that of forested land where adjacent use is and will remain for productive or non-productive tree growth. Here Seattle City Light is faced with the forest harvest period where danger trees may be created, and the growing forest period where new danger trees appear over time. Morever, this development over time will influence the source and quantity of new propagules that can establish on the right-of-way beneath the conductors. In this latter case species, terrain, density, extent, environmental sensitivities, visibility, logistics, costs and program objectives will predicate methods chosen. This is more fully described in Appendix A. However, a few examples may illustrate the options. On flat, well-drained, accessible stretches of the

right-of-way with little protruding or surface rock, such as Lodgepole Pine (Pinus contorta) flats, mechanical cutting with such equipment as a HydroAx may be appropriate though more costly over the long term than careful floristic manipulation. On larger areas of alder below six feet in height an initial very thorough but contained stem foliar application may be appropriate, followed by slight scarification and seeding with native groundcover and shrubs on the resulting open patches.

In areas of taller undesirable deciduous species it may be environmentally, visually, technically and publically more appropriate to cut the undesirable component of the plant community and treat the remaining stumps or "stubble" with herbicides. In areas on the right-of-way where very large areas of undesirable species are now established and are at a height that has severely diminished clearances, and where the terrain is suitable, it may be most appropriate to reclear or "groom" the right-of-way with bulldozing and start from the beginning again to undertake the conversion and maintenance stages from a known benchmark of deliberately sown revegetation species.

uffice to say that each area must be examined on its own with its merits, constraints and existing conditions fully documented in order to judge the appropriatness of any particular method of vegetation management and to then test that choice against program criteria.

Two further areas of the right-of-way requiring particular attention because of the sensitive nature of their situation are those associated with water bodies (natural or drinking water) and those at major road crossings. In the former case great care is required to ensure that no diminished water quality results from right-of-way practices. While the methods of vegetation management may be similar to those described above, emphasis must on low impact methods, hand versus, mechanical work, and strict supervision in the immediate area. In the latter case the concern is one of visual impact. Many utilities have adopted the practice of leaving tall growing vegetation at road crossings on roads with higher traffic frequencies, particularly in scenic areas. With careful retention it is possible to almost completely reduce the view of towers and conductors when this is required. This does, however, face the vegetation manager with a problem of managing vegetation in close proximity to in-service conductors, often with a short cycle return period. This is costly and difficult but "live line" techniques applied to vegetation work conditions and careful manipulation of species and canopy can accomplish this retention of buffer zones to provide a fairly natural appearance.

(v) (b) Administration

The main difficulty encountered by most utilities where vegetation management has been a source of internal and/or external conflict has arisen from (i) an unwillingness or inability to recognize that vegetation mangement requires skills different from the mainly engineering requirements for most departments, (ii) lack of a consistent program that can balance workload with workforce and funding, and (iii) an organized, planned and predictive framework in which vegetation management and associated tasks are placed.

Without that recognition it is probable that those charged with undertaking right-of-way management within Seattle City Light will be overwhelmed by the extent of the task, system security will diminish rapidly and the utility will be faced with significant public and/or regulatory agency critism if widespread foliar broadcast spraying is adopted as a "quick" and the only solution to the extensive regrowth of undesirable woody plants that has developed on the right-of-way since the last overall program was suspended.

As a very minimum, it would seem important to recognize vegetation management as an integral yet self-contained facet of the utility's operations. Consequently, it will require a

minimum staff assigned to vegetation management as a primary mandate. This mandate should be supported with appropriate utility policy concerning vegetation management practices and compliance with regulatory agency requirements. In turn, the utility's public stance on vegetation management practices must be explicit and overt (See Appendix A).

(v) (c) Right-of-way vegetation management program

The program adopted for vegetation management must accurately reflect utility policy on vegetation management procedures and practices. It must also clearly respond to the system protection requirements in a cost effective manner, thus picking a set of maintenance objectives compatible with overall utility objectives and senior management expectations.

The program must also be able to accommodate or respond to the dictates, constraints or expectations of those on which it impinges. That is not to suggest that it must have no dedication and commitment to purpose but rather that it must be built around a sound core of program rationale for each facet of vegetation management operations.

In the long term there would be much merit in developing a Vegetation Management Plan that would embody the major components of the program so far discussed as well as documenting work strategies, workload assessment and long range budgeting.

(v) (d) Adjunct requirements

No vegetation management program can exist in isolation from the utility parent, nor should it. Since vegetation management is far from a prime objective of an electrical utility, it is important that the context within the utility structure is clear. However, that is not to suggest that the role be diminished to the point where vegetation management cannot respond adequately to the extremely high profile nature of the work in the public mind. It is suggested elsewhere in this report that vegetation management should have its own identity. It is also important that a vegetation management group have the flexibility to use other departments within the utility. Important amongst these are the legal and lands departments, the community relations department, the environmental department, the personnel and training department as well as the financial services, computing and purchasing groups. In this way the planning and management associated with a well organized vegetation management program can be implemented and sustained.

CONCLUSIONS

1. The present right-of-way system sustains a level of undesirable vegetation incompatible with good operating practice both from an electrical operations and from a vegetation management standpoint.

2. The rights-of-way have been subject to encroachment growth by edge danger trees and these trees present a potential to cause disruptive outages under adverse weather conditions.

3. Vegetation management within Seattle City Light has not been viewed as a discrete effort and consequently, responsibilities have devolved to a level where the required workload is now greater than staff time available to accommodate the increasing severity of the problem.

4. No organized vegetation management plan or policies apparently exist to provide the managerial framework in which to organize the breath of tasks that range from tree pruning to site specific environmental sensitivity analysis that now characterize publically acceptable transmission line vegetation management.

5. Although some baseline information is available and has been collected for other purposes, no complete, reliable and up-to-date base maps, photography or right-of-way condition information has been collected for vegetation management purposes.

6. While the north system has a small ongoing vegetation management program, the system south of the Sauk River has had no vegetation management for line protection within the last three growing seasons. Consequently, vegetation growth is substantial and will require a concerted effort to bring the right-of-way into an acceptable condition for ongoing maintenance.

7. The size and extent of undesirable vegetation in some locations may limit the environmentally acceptable options for vegetation eradication, particularly on the south system. In particular, herbicide applied in any broadcast foliar mode would require techniques, and/or application rates that have significant potential for drift, direct deposit into water, unacceptable soil residual, substantial visual impact and only partial eradication ofundesirable species yet extensive off-target effects on desirable vegetation.

8. The management of high profile suburban and urban rights-of-way is satisfactory but could be improved. In particular, the organization and responsibility for large tree trimming for line clearance requires careful study.

9. Any programs that reduce the area of right-of-way supporting undesirable vegetation that can interfere with conductors also reduces the overall dependence on vegetation management activities and, in the long term, can reduce operating costs. No programs of this type, such as conversion of lands to rough pasture or agriculture in rural areas or undesirable tree replacement in suburban areas, are presently in operation.

10. The opportunity still exists for the utility to establish a vegetation management identity and program within its operation in time to ensure that major system outages do not manifest themselves as a recurring pattern of revenue and service losses.

RECOMMENDATIONS

The recommendations made here reflect (i) the experience of the consultant with other utilities, (ii) the special needs of Seattle City Light both administratively and as a result of present conditions on the rights-of-way examined, (iii) the vegetation management needs as dictated by climatic conditions in the Pacific Northwest and, of course, (iv) by the size of system. None of the recommendations are burdensome over the longer term of five to ten year management cycles that are commonplace in vegetation management. However, the extent of growth on the right-of-way, particularly on the south system will require considerable expenditure of funds and effort to ensure a reasonable return to a right-of-way without a substantial amount of vegetation than now, or very soon, will reduce system security to an unacceptable level.

THE RECOMMENDATIONS PRESENTED HERE ARE GIVEN UNDER A NUMBER OF SEPARATE HEADINGS FOR CLARITY ALONE - NO INTENTION TO INDICATE A PRIORITY IN NEEDS IS IMPLICIT IN THE ORDER IN WHICH SUGGESTIONS ARE MADE. TO THE CONTRARY, THE CONSULTANT FEELS THAT, APART FROM THE OBVIOUS TEMPORAL SEPARATION BETWEEN DATA COLLECTION AND SUBSEQUENT INTERPRETATION, ALL CATEGORIES OF RECOMMENDATION SHOULD MOVE AHEAD CONCURRENTLY.

The following categories of Recommendations are provided:

(a) Administrative Recommendations

(b) Data and Information Collection Recommendations

(c) Data Interpretation Recommendations

(d) Recommendations Concerning Evaluation of Alternatives

(e) Recommendations Concerning Preparation of a 1982 Work Program

(f) Recommendations for the Preparation of a Vegetation Management Plan

(g) Recommendations Concerning Organization of Support Needs

Administrative Recommendations

1. Responsibility for vegetation management and associated tasks on a transmission system of the acreage administered by Seattle City Light and over the type of terrain encountered between Seattle and Ross should be vested in a small group charged with all aspects of vegetation management and should not be an adjunct to the management duties of staff with other diverse responsibilities. It is not appropriate for this consultant, with limited knowledge of the utility's infrastructure, to say where this group should fit and report. However, vegetation management is clearly an operations oriented responsibility and accountability for both program

management and execution must be assigned a line rather than a staff function.

This recommendation applies in both the case where vegetation management work will be contracted to outside services or undertaken in-house. In the latter situation, both full time maintenance field crews and a small nucleus of management staff will have to be considered.

2. The utility should examine closely the incidence and impact of major outages on its transmission system. While the constellation of severe weather conditions, plant growth rates and present maintenance practice has not occurred and caused a major number of prolonged outages, the potential, as already discussed, is clearly there. Consequently, the utility should undertake a study of its system protection needs as they relate to the potential for outages caused by vegetation and adopt a clearance and protection policy that reflects these needs.

3. Options exist for the vegetation management and related tasks for all aspects of the utility operations (transmission, distribution substations and administrative facilities) to be (a) contracted to the private sector, to be (b) undertaken wholly in-house by one or more groups directly responsible, (c) for a mix of in-house and contract work to be

relied upon or, of course (d) for no change to the existing pattern of work to be entertained. The latter option is not a viable alternative in the view of this consultant, however, it is recommended that the other possibilities require further examination with a view to establishing a utility policy for all aspects of environmental maintenance. While a mix of in-house and contract work may provide flexibility and comparisons of efficiency, this must be weighed against the benefits of sustaining a small, knowledgable utility-based operation for the system as a whole.

4. The disposition and geographical extent of management units, coupled with their similarity or disimilarity with regard to work content can play a large part in efficient management. It is recommended that the suitability of splitting right-of-way management simply between the "north system" and the "south system" be examined with the possibility of the system south of Bothell Switching Station becoming a separate management entity.

Data and Information Collection Recommendations

1. Since it is essential for any vegetation management program to be based on readily accessible, accurate and up-to-date legal information on the also on right-of-way and

right-of-way conditions it is recommended that four data collection and assembly programs be initiated.

(i) No appropriate nor recent aerial photography following the right-of-way was found to be available from Federal or State Government resource agencies. The complete transmission right-of-way system should be rephotographed in its entirety from the air. This aerial photography should be undertaken so as to provide a complete high quality black and white section mosaic very similar in concept to that originally prepared in 1977 from Bothell to Gorge Powerhouse. This photography should provide a scale of no less than 200 ft. to the inch or its metric equivalent.

(ii) The field patrol personnel have an invaluable store of information on actual social, legal, operation, geographical and seasonal conditions on the right-of-way. Since this information has not been documented, it is recommended that, with the sectional air mosaics forming a base map, as much of the detailed knowledge of the patrol personnel and their supervisors be recorded in an organized form, tower span by tower span.

(iii) It is recommended that, again with the low level aerial photography as a base, and using either an overlay or

ghosting technique, as much detailed "constraint" information be added or identified throughout the length of the right-of-way. This constraint information should be organized in four forms:

(a) Environmental (special wildlife areas, fisheries concerns, drinking water, etc.)

(b) Administrative jurisdictions or boundaries crossed by the right-of-way.

(c) Legal disposition of the right-of-way lands and special agreements (ownership, easements, verbal or written agreements, etc.).

(d) Electrical, as a sectional view of the design catenary to ground clearance for the lowest conductors on each span.

(iv) The right-of-way in its existing condition must also be well documented. Consequently, it is recommended that a detailed examination of the right-of-way be conducted on the ground for each tower span and that this inspection document the actual vegetation conditions both in the context of danger trees (to be identified by predetermined criteria congruent

with the needs and policy for protection) and for vegetation growing between or below the conductors. This survey of vegetation (and other pertinent environmental conditions) should record information of a largely objective nature - that is to say species, species heights by location and distribution, undesirable wood plant densities, identity of problem areas with a definitive explanation of the problem (criteria), etc. Preliminary photo interpretation may assist in identifying conditions and locations on the right-of-way but should not be substituted for field work.

2. A vegetation manager very quickly finds that the nature of linear corridors and the potential, actual or perceived impacts of his or her work combine to necessitate an extensive "knowledge : people : personalities : responsibilities : regulatory requirements" network both within and external to his or her utility. The ability with which a vegetation manager can build his or her network will predicate the success with which he/she can implement his/her programs. It is, therefore, recommended that every effort be made to identify <u>all</u> of the individuals, institutions, local state or federal agencies, special interest groups, etc. with which the vegetation management program must or should interact and for the "vegetation management group" supervisor to establish a working rapport with those so identified.

Data Interpretation Recommendations

1. Prior to the collection of field data it is recommended that thought be given to the eventual format in which this information will fit. General recommendations concerning a vegetation management plan outline are contained in a following section. It is recommended that no data collection or documentation of field experience begin until the general guidelines for the development of the vegetation management program are completed. This is to ensure that the organizational and conceptual framework for vegetation management is established before detailed work begins.

2. It will be important to establish at an early stage which group(s) and which individuals will be responsible for data collection and particularly, data interpretation as it is translated into workload forecasts. It is recommended that the vegetation management staffing recommended in this report ideally precede data synthesis on field conditions and establishment of any vegetation management program so that the appropriate staff can be directly involved in plan, program and project development.

3. It is probable that vegetation management may be organized as a revised function within the utility using

existing staff if appropriate educational, background skills and experience are available. If a vegetation management specialist is not available, it is strongly recommended that the utility rely on additional local expertise from the private sector to undertake field data collection, program formulation and plan preparation.

4. During the information and data synthesis stage it is recommended that a comprehensive list of probable "environmental maintenance tasks" including vegetation management, wildlife or fish habitat protection, cattle gates and guard maintenance, access control, culvert and bridge maintenance, noxious weed determination or control, erosion prevention and similar work be developed. In turn this listing will provide a useful review of the spectrum of tasks involved in right-of-way maintenance and a checklist of possible activities for workload analysis.

Recommendations Concerning Evaluation of Alternatives

1. The question of alternatives has three major components. Two, those concerning assignment of responsibilities and the question of contract vs in-house staff to carry out major vegetation management field work within the utility have been addressed previously. The third major

concern is that of examining right-of-way vegetation management techniques that are appropriate for the Seattle City Light system. Choice of technique will become more apparent as the detailed field information on vegetation conditions is collected. Some external constraints may limit the options for herbicide use and these should be identified. They will include fish, wildlife and water quality concerns, adjacent land use considerations, undesirable vegetation densities, heights and extent, public interest and regulatory agency expectations. The extensive growth of potentially tall growing vegetation within the right-of-way particularly on the south system will necessitate careful consideration of re-clearing, grooming, and some mechanical cutting.

2. Throughout the length of the existing system there is agricultural activity including cultivation within the right-of-way corridor. It is recommended that Seattle City Light examine the opportunities for extending multiple use of the right-of-way including an active program for right-of-way conversion to grazing or a agronomic crop land. Few other enterprises are as efficient in reducing areas supporting undesirable vegetation on the right-of-way, however, all possibilities, including recreational users, should be closely examined.

3. A substantial and recurring cost in urban and suburban areas is incurred to prune privately owned trees. Often the species involved require short cycle returns because of rapid growth rates.

This, coupled with tree size and lack of arboriculturally trained personnel would suggest that a tree removal, relocation and replacement program sponsored by the utility should be considered. While capital investment may be of concern, savings can be shown over very few retreatment cycles where accurate unit cost records are maintained.

4. The existing right-of-way north of Bothell Switching Station accommodates a number of other utility users. No evidence was found that any reciprocal or joint program exists for vegetation management in these locations. While the acreage involved is small, it would seem appropriate to approach other utility users of the corridor to participate in the Seattle City Light vegetation management program.

Recommendations Concerning Preparation of a 1982 Work Program

1. To the extent that the field data collection progresses and identifies the locations where significant problems exist, particularly in the case of danger trees, it is

recommended that the 1982 field program be targeted to these areas. Should there be extremely adverse winter weather that includes heavy ice or wet snow accumulation, particularly on edge trees, there is the strong possibility that outages will occur. Therefore, trees susceptible to limb breakage or stem bend, in particular, cottonwood and drawn-up understory hemlock respectively should be identified and removed as soon as possible.

2. As soon as field inspection begins to quantify the extent of immediate problem areas, a preliminary workload analysis based on current productivity and methods should be undertaken to establish realistic man-hour needs for priority work. A 1982 work program and budget should follow to reflect these initial findings and priority areas.

3. The 1982 work program should be based on the existing administrative structure, and rely on some additional assistance from contract labour and equipment from firms directly conversant with utility operations. It is recommended that the 1982 program be prepared with the rights-of-way south of Bothell Switching Station broken into rural, suburban and urban components and with tree trimming work areas separately identified and calculated.

4. It is recommended that the present road access work be continued in 1982 and a specific road inspection and maintenance schedule developed.

5. Tansy Ragwort and other noxious weeds are of particular concern to the agricultural community. Some control spraying of herbicide has been undertaken for Tansy Ragwort on Seattle City Light properties or easements as recently as this year. The problem of invasive or noxious weeds requires constant vigilance and it is recommended that the proposed vegetation management program clearly reflect this need in the 1982 growing season.

Recommendations for Preparation of the Vegetation Management Plan

1. It is recommended that the main framework for the vegetation management program would be a Seattle City Light Transmission Line Vegetation Management Plan.

2. The Vegetation Management Plan will provide the focus for data collection, interpretation, work programming and implementation. However, the Plan's usefulness will be enhanced if prior thought is given to the compatibility of such a Plan with the eventual preparation of environmental impact

statements to be filed for major vegetation control projects. It is further recommended, however, that the purpose of the two documents be clearly seen as different and the internal Plan document seen as an organizational and informational assembly of constantly updated factual information about right-of-way and vegetation management considerations, objectives and conditions in addition to basic environmental information.

3. It is recommended that the essential contents of the Plan would include:

(a) A description section, including data base mapping and photography on the right-of-way. This section would include all factual information gathered on right-of-way conditions and adjacent land uses as well as indicating environmental hazard areas.

(b) A discussion section that reviewed the alternatives and implications of vegetation management on the right-of-way now and over succeeding retreatment cycles. Actual treatment options would be included and discussed here.

(c) A decision section that indicates the utility's vegetation management objectives, legal obligations, landowner commitments and maintenance standards. This section would also provide the policy framework in which the vegetation management program is undertaken and the regulatory agency requirements that circumscribe opportunities.

(d) A review section that specifies the actual vegetation management procedures adopted by the utility for undesirable right-of-way vegetation during the reclearing, conversion and maintenance phases. This section would also document the explicit rationale for each procedure adopted.

(e) A review section that would examine annual program planning, logistical requirements, individual project planning, project supervision, environmental safety considerations and records control.

(f) A review section that initially examines the needs for post operational assessment, in particular project monitoring, effectiveness appraisal, records review, efficiency assessment and complaint problems. Later this section would serve as the actual review process format for program review each year.

Recommendations Concerning Organization of Support Needs

1. The review section of this report identifies a number of groups within the utility with which a vegetation manager or group will interact. Four of these groups can provide invaluable assistance to a vegetation management unit and it is recommended that the legal and lands groups, the group responsible for staff training and the community relations group be apprised of the possibility that their services will be called upon for input into a vegetation management planning process.

2. Any innovative vegetation management program has, as a segment of its program, an applied research approach to new methods or materials that can be incorporated into accepted procedures. It is recommended that vegetation control techniques, in particular, be given careful study on the Seattle City Light right-of-way to establish the most appropriate long term methods for adoption into the vegetation management program.

3. Community relations information concerning the rationale, policy, approved methods, approved materials, internal controls and program organization for vegetation management will assist in focussing the utility's management to

address the overall questions of appropriate vegetation control practices that can be approved for an external document. While the onus for preparing such a document must rest with a number of groups within the utility, including the line department executing the work, the community relations and property departments, as well as the environmental and legal groups, it is important that it be vetted by senior utility management to substantiate the organization's public posture with regard to vegetation management. It is imperative that this step be undertaken as a benchmark to support the line department responsible for field work prior to any possibility of major public criticism of program strategies and methods. A few suggestions concerning document contents are given in Appendix A.

4. There are many other utilities faced with the same situation as Seattle City Light in that public opinion and regulatory uncertainty about some herbicides, coupled with a desire for biologically and environmentally sound methods, has prompted a hold (or major modification) on field priorities and a review of vegeation management planning. It is recommended that the utility keep abreast of new developments through IEEE, CEA, such publications as Weeds, Trees and Turf, other utility programs (see Appendix B - a very recent call by Bonneville Power for a generic EIS on vegetation management) and appropriate conferences (see Appendix C - Agenda for 2nd International Right-of-way Conference).

APPENDIX A

APPENDIX A

ELECTRICAL UTILITY VEGETATION MANAGEMENT

INTRODUCTION

Electricity can, given the right conditions, arc from one point to another. There is, therefore, a minimum safe clearance around an electrical circuit which must be maintained to preclude this. To provide for this, and for construction and maintenance access, as well as for protection of the line from falling trees, a right-of-way must normally be cut through wooded areas. Since the tendency for such areas is to regenerate naturally, there is a constant regrowth of vetetation often in the form of trees. Utility vegetation management, then, is only an adjunct to the main purpose of supplying safe, continuous power; it is occasioned by the characteristics of electricity and our present technology of transmitting power overland for long distances through exposed conductors hung from metal or wooden structures.

It is often suggested that undergrounding of the normal above-ground electrical circuits would relieve entirely the problems of vegetation management. This is not, unfortunately, true. Long distance high voltage transmission by underground cable is not technically feasible at present because of heating

problems, current losses and because of unacceptably high installation cost. It is also now known that those short sections of lower voltage underground cable already in service require intensive vegetation control programs to stop vegetation growing in the special heat dissipating material around the cable. Undergrounding is, therefore, not the panacea that it might first appear. Seattle City Light, using present technology, and considering the terrain and vegetation predominant in the State, is thus faced with a continuing task of managing vegetation underneath electrical circuits and at the edge of the right-of-way. Where the right-of-way traverses rough, inaccessable terrain, the job is more difficult and conversely, where it crosses developed land the job is much simpler.

Seattle City Light does not maintain a large staff responsible for vegetation management and, therefore, has no direct vested interest in vegetation management. Rather, a small group of professionals with appropriate experience supervise either a number of trained in-house field personnel or qualified contractors to carry out the tasks involved in vegetation control. Similarly, Seattle City Light is not committed to any one method of vegetation management. Herbicides have, and will continue to play a part in manipulating vegetation in order to accomplish the goals and objectives laid out in the next sections of this "document". It is hoped that this review will also explain satisfactorily the rationale and precautions for

use associated with herbicides while placing that use in the broader context of rights-of-way vegetation management in general, and on the Seattle City Light transmission right-of-way, in particular.

VEGETATION MANAGEMENT GOALS

For utility vegetation management, a broad social goal can be simply stated as maintaining the health and integrity of the air, soil, water, fauna (including man), desirable flora, appearance, and use of the land within the constraints of operating an electrical supply system. In a narrower sense, the technical goal is to ensure that tall growing vegetation does not become in any way a safety hazard or interrupt the continuous operation of the line, while all other vegetation is retained in perpetuity on the right-of-way.

In order to attain this corporate goal, a vegetation manager must set, and have approved, a number of objectives which will delineate his program. It is then possible to assess both social and technical alternative methods for carrying out the program by comparing them with explicit criteria. It is possible to see at this point, when social, economic and environmental criteria are chosen, what emphasis has been placed on particular concerns and to see if they meet an individual's standards, values and sense of safeguards appropriate for the environment.

Once this step has been accomplished and every opportunity given for people's concerns to be recorded and incorporated into the planning process, then policies can be set, and the variety of social, economic, environmental, theoretical, technical and available resource factors considered and a clear strategy approved for managing the problem.

The final major step, program implementation, is again one requiring careful forethought both for the vegetation manager responsible for the program and for any party who feels that they might be affected by any proposed actions. Intervention is important if it can be demonstrated that there are sound grounds for concern. Seattle City Light is firmly committed to open discussion and welcomes the viewpoint of any party with a direct concern for all vegetation management practices.

VEGETATION MANAGEMENT OBJECTIVES

The social objective of the vegetation management process is to ensure that there is a clear public understanding of the rationale for, as well as the alternatives and consequences of, any particular decision in the vegetation management program. It has already been noted that some form of vegetation management is a necessary part of the operation of overhead electrical transmission systems.

A further social objective of the vegetation management process then, is to ensure that the general public are given ample formal opportunity to review Seattle City Light's vegetation management proposals, both at the formative stage (with meetings, these "reports", and by personal comment) and also prior to any particular project. It is a final social objective to ensure general public and regulatory agency acceptance of the planning and execution of specific projects.

The environmental objectives of all vegetation management is to ensure that the least adverse environmental impact results from any control method, particularly in the long-term. This is important in vegetation management, since short-term simple solutions may, over a period of years, have far greater detrimental effects than more sophisticated but outwardly contentious management. It is, therefore, a specific objective of vegetation management in wooded areas to use ecologically sound methods which will completely remove undesirable tall growing hazardous plants from the right-of-way while retaining all other species. These will tend to reduce regrowth of new undesirable species and maximize wildlife and aesthetic benefits. It must be noted that this process involves only those areas where the tall vegetation would be truly hazardous and not in deep valley bottoms or similar topography or where multiple use precludes woody plant growth. If this objeactive is carefully met, it is possible to eventually minimize most

vegetation practices on all of the right-of-way except when specific efforts have been made to deliberately retain tall vegetation, for example, at road crossings.

Economic objectives of a utility vegetation management program evolve from the general premise of operating the total electrical system in the most long-term cost-effective manner. An obvious direct concern is to ensure continuity of service with a high level of line security and thus yield the maximum revenue from the operation of the power line. Of course, concommitant to this requirement, and of paramount importance, is that operation of the facility does not in any way endanger the safety of the general public or the natural environment and does not directly or indirectly pose an employee hazard.

The specific economic objective of a vegetation management program is to ensure that whatever method is chosen yields the least long-term cost per hectare per annum over a given period, let us say for example, 20 years. It should be clearly understood that the least long-term cost is not viewed as including only direct program costs but also includes those external "costs" which are so difficult to identify but relate to public perceptions and quantifiable impacts on the quality of the natural environment.

ALTERNATIVES

If it is accepted that vegetation management in one form or another will be necessary at least on major sections of the right-of-way after construction of a new facility and throughout its subsequent life, then there are a number of social and technical options available. These options can be further separated between pre-construction and post-construction periods. Since Seattle City Light is primarily concerned, at present, with post-construction vegetation management, this facet of operations is more specifically addressed.

Alternatives which are of obvious importance in actually undertaking the maintenance program are detailed subsets of the original clearing alternatives adopted, as well as an array of site-specific methods which can now be employed to remove the undesirable portion of potentially hazardous tall growing vegetation from the edge and centre of the right-of-way within the objectives and criteria set for maintenance.

A purpose, then, of the following section on vegetation management is to clearly state or predict the actual alternatives Seattle City Light has, or will choose, for its transmission system and to examine the criteria used for determining the recommended vegetation management policies and

strategy. These policies and strategy will eventually form part of a final Prescription Maintenance Plan prepared and adopted by the utility.

CRITERIA

As with other sections of this brief review, criteria can be broken down into three classes: social, environmental and economic. These criteria are detailed expansions of the objectives set for the program and provide a specific insight into how a utility expects to perform in carrying out its reponsibilities which flow from the goal of socially acceptable and technically prudent management. These criteria are shown in list form and include all criteria applied to vegetation management after initial clearing.

Social Criteria

General public acceptance of program
Government Agency acceptance of program
Corporate acceptance of program
Conforms to all legal requirements
Conforms to all legal agreements

Environmental Criteria

Minimum hazardous vegetation left after clearing

Maximum re-establishment of desirable vegetation after clearing

No contamination of surface or ground water

Maximum use of "undersirable vegetation specific", eradication methods and materials

Maximum retention of desirable vegetation

Minimum impact on non-target organisms

Maximum generation of multiple use benefits

Minimum disturbance on the right-of-way in repetitious cycles

Minimum use of herbicides consistent with other criteria

Economic Criteria

Least cost per hectare per annum when considered over the long-term (e.g. 20 years)

Cost to include a value for social, environmental, ecological and technical considerations

FACTORS THAT INFLUENCE VEGETATION MANAGEMENT DECISIONS

It is important to understand that vegetation management is a complex science requiring appraisal of a wide variety of factors to arrive at any particular course of action.

Unfamiliarity with this situation might cause one to feel that the choice of a particular method over another and in the face of opposition, was a deliberate attempt to overide the wishes and democratic rights of people in a particular area. This is not the case. The critical questions are ones that relate to preceptions and facts, beliefs, falacies, interpretations of complex science, values, equity, consistency and potentials for adverse effects. It is not surprising, then, that some conflicts do appear.

In this section an attempt is made to separate the important factors pertaining to vegetation management decisions that apply to the post-clearing period of ongoing maintenance into six topics. In this way, as with criteria, the reader can examine the concerns and judgements made by a vegetation manager in arriving at particular decisions.

Post Clearing Individual Project Considerations

The factors which influence maintenance decisions for vegetation management are detailed and complex, involve various tradeoffs, and can be the subject of debate. Seattle City Light employs professionally qualified staff to administer the vegetation management program. These staff are available for consultation and maintain a high level of professional and

personal ethics. This, coupled with years of experience is a safeguard that the most prudent planning and decision making process if followed.

In recent years public concern about environmental quality in general, and the use of herbicides for vegetation control in the context of rights-of-way document in particular, has been the subject of controversy. The staff at Seattle City Light responsible for vegetation management must use their professional judgement to assess the mass of conflicting information generation on an emotional topic and distil the information down to a form relevant to, and accurate for, the circumstances in Washington State. In addition, this judgement process must be linked to that of other professionals in other disciplines who advise on or regulate the methods or materials in question.

It is a corporate, professional, ethical and personal responsibility for staff to ensure that no practices are adopted which conflict with health, safety or social and environmental objectives and criteria discussed here.

In order for the general public to better understand the actual process involved in arriving at project decisions (that either use or do not include using herbicides) this section endeavors to outline the factors involved.

The following are the major factors of concern for deciding when, why and how to carry out a project. However, it must be understood that the vegetation manager does not use these factors as a mere check list. These factors must be integrated together and tailored to the specific right-of-way in question. Some are considerations which fit the broader program planning stage while some are more applicable to the individual project stage. All are important and require careful study. Program and project factors include:

Social

Stated program objectives

Stated program criteria

Stated project rationale

Stated Federal and State Government policies

Utility program policies

Land use

Legal boundaries

Legal commitments

Legal requirements

Federal and State Government agency requirements

Local or Regional Government expectations

Public concerns expressed

Aesthetic expectations

Environmental

Sensitive areas, type and locations, water, soil, etc.

Wildlife utilization objectives

Topography

Ground conditions

Economic

Comparative method costs and effectiveness

Timing

Complexity of logistics

Dollars available

Theoretical

Projected ecological effectiveness

Clear separation of conversion phase from maintenance phase

Probable intensities of potential environmental impacts

Technical

Problem species and composition

Species height, density, rate of growth

Original clearing and maintenance policy

Source of problem species

Extent of area now covered by problem species

Existing clearances

Line clearance policy

Line protection policy

Access

Experience

Season

Potential for continuing regeneration of undesirable species on right-of-way

Available Resources

Safety requirement

Staff training

Equipment, material or contractor availability

Priorities for the transmission administrative sections

Supervision requirements

POLICY

The overall program must be set in a framework of clear explicit policies and commitments which will dictate exactly how all vegetation management programs will be carried out. [A review of the policy of the utility would appear here]

STRATEGY

The final step in a vegetation management program for a specific site such as the Ross to Seattle transmission sections of the Seattle City Light System is to prepare a report which embodies all of the topics discussed in this section and applies them appropriately to the particular alignment. This report then becomes the Prescription Maintenance Plan for the right-of-way and will provide the necessary operating guide and historical documentation required for an efficient, safe and effective vegetation management program.

Seattle City Light will be preparing such a detailed report for all sections of the right-of-way from Ross to Seattle. This report will address not only the objectives, criteria and factors examined in this brief review, but will prepare an actual planned program for maintenance in the future.

APPENDIX B

APPENDIX B

BONNEVILLE'S TRANSMISSION FACILITIES VEGETATION MANAGEMENT PROGRAM ENVIRONMENTAL IMPACT STATEMENT

Draft EIS Outline

I. Cover Sheet

II. Summary

- A. Major Conclusions
- B. Areas of Controversy
- C. Issues to be Resolved

III. Table of Contents

IV. Purpose of and Need for Action

- A. Need
  - 1. Transmission line rights-of-way
    - a. Hazardous vegetation
    - b. Noxious weeds
  - 2. Substation yards
  - 3. Microwave facililties
  - 4. Access roads
  - 5. Other
- B. Purpose
  - 1. Public and worker safety
  - 2. Technical and economic efficiency
  - 3. Preservation and enhancement of environmental quality
  - 4. Integrated pest management principles

V. Alternatives Including the Proposed Action

A. Alternative Vegetation Control Methods

1. Chemical

a. Compounds

b. Selective application

c. Broadcast application

2. Manual

3. Mechanical

4. Biological

a. Vegetative competition

b. Suppression by animals

B. Program Alternatives: Various Combinations of Vegetation Control Methods

1. Not to meet the identified need ("no action")

2. BPA's prefered alternative, which is to continue to use all available vegetation control methods (chemical, manual, mechanical, bilogical) according to the criteria in Bonneville's Transmission Line Maintenance Standard No. 63040-50, and consistent with integrated pest management principles as applied to BPA's vegetation management program.

3. Eliminate broadcast application of herbicides completely; the program relies exclusively on selective ground application of herbicides, manual cutting, mechanical control, and biological control.

4. Eliminate all applications of herbicides completely; the program relies exclusively on manual cutting, mechanical control, and biological control.

5. A program that relies exclusively on broadcast application of herbicides.

6. A program that relies exclusively on manual cutting and mechanical control.

7. A program that relies exclusively on biological control.

C. Mitigation Measures Included in and Not Already Included in the Proposed Action or Alternatives

1. Multiple use

2. Vegetation management agreements with landowners

3. Management for wildlife habitat

4. Restriction of herbicide application near various types of sensitive areas

5. Elimination of the use of phenoxy heribicdes

6. Elimination of the use of picloram

* 7. Advance spray notification

8. Herbicide applicator training

* 9. Surface and ground water monitoring

What about Limiting # of application methods?

NOT mitigation

VI. Affected Environment

A. Water Quality (surface and ground)

B. Public Health

C. Vegetation (including endangered species)

D. Animals (including endangered species)

E. Soils

F. Land Uses

1. Agriculture

2. Grazing

3. Recreation

4. Residential

5. Other

G. Visual Resources

VII. Environmental Consequences

A. Direct and Indirect Environmental Impacts of the Alternative Vegetation Control Methods

1. Water Quality (surface and ground)

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

2. Public Health

a. Chemical

(1) Selective application

(2) Broadcast application

c. Manual

c. Mechanical

d. Biological

3. Vegetation (including endangered species)

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

4. Animals (including endangered species)

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

5. Soils

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

6. Land uses

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

7. Visual resources

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

8. Urban, historic, and cultural resources

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

B. Compatibility with Land Use Plans, Policies, and Controls

1. National forests (U.S. Forest Service)

2. Public lands (Bureau of Land Management)

3. National wildlife refuges (U.S. Fish and Wildlife Service)

4. National parks and recreation areas (National Park Service)

5. Other Federal lands

6. Indian reservations

7. State plans (including coastal zone management plans)

8. Regional plans

9. Local plans

C. Resource Requirements and Conservation Potential

1. Energy

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

2. Natural or depletable resources

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

3. The built environment [see CEQ Regs. 1502.16(g)]

a. Chemical

(1) Selective application

(2) Broadcast application

b. Manual

c. Mechanical

d. Biological

D. Adverse Environmental Effects Which Cannot be Avoided Should the Proposal be Implemented

E. Irreversible or Irretrievable Commitments of Resources if the Proposal is Implemented

F. Relationship Between Short-Term uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

VIII. Other Environmental Review, Consultation, and Permit Requirements ("Checklist of 16")

A. Not to meet the identified need ("no action")

B. BPA's prefered alternative, which is to continue to use all available vegetation control methods (chemical, manual, mechanical, bilogical) according to the criteria in Bonneville's Transmission Line Maintenance Standard No. 63040-50, and consistent with integrated pest management principles as applied to BPA's vegetation management program.

C. Eliminate broadcast application of herbicides completely; the program relies exclusively on selective ground application of herbicides, manual cutting, mechanical control, and biological control.

D. Eliminate all applications of herbicides completely; the program relies exclusively on manual cutting, mechanical control, and biological control.

E. A program that relies exclusively on broadcast application of herbicides.

F. A program that relies exclusively on manual cutting of herbicides.

G. A program that relies exclusively on biological control.

H. Permits, Licenses, and Other Entitlements Necessary to Implement the Proposed Program

IX. List of Preparers

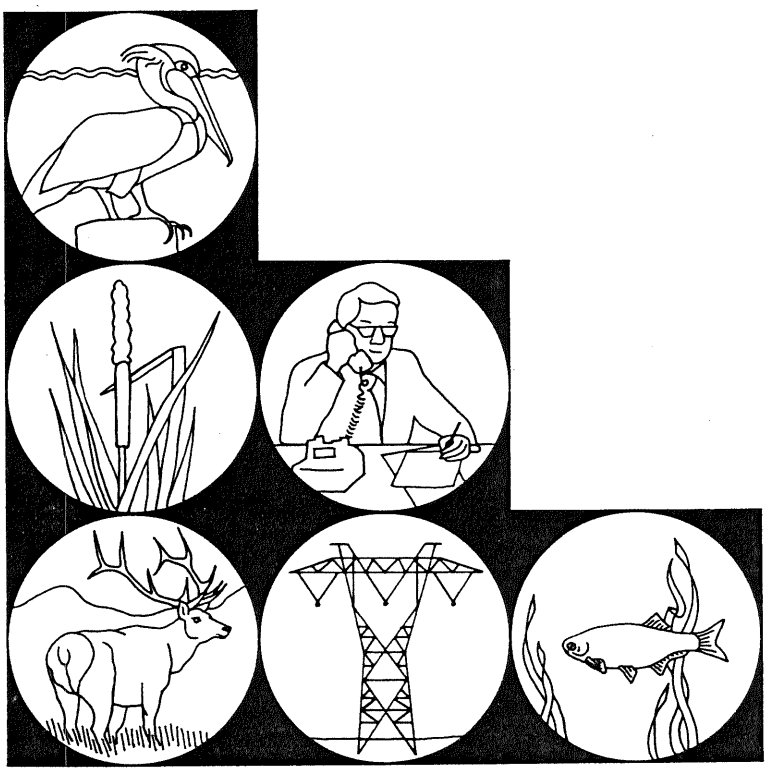
X. List of Agencies, Organizations, and Persons to Whom Copies of the Statement are Sent

XI. Index

O-0489A

APPENDIX C

Third Symposium on Environmental Concerns in Rights-of-Way Management



February 15–18, 1982

Hyatt Islandia Hotel . . San Diego, California

Steering Committee

Edward Colson, Symposium Chairman
Pacific Gas and Electric Company

Allen Crabtree, Program Chairman
Michigan Department of Natural Resources

Dr. Dale Arner
Mississippi State University

Dr. Donald Gartman
Columbia Gas System

Dr. John Huckabee
Electric Power Research Institute

Al Rodney
Public Service Company of New Mexico

James Roseberry
Bureau of Land Management

Dr. R. Kent Schreiber
Eastern Energy and Land Use Team,
U.S. Fish and Wildlife Service

Douglas Smith
Federal Highway Administration

Dr. Gus Tillman
The Cary Arboretum of the New York Botanical Gardens

Coordinators

Bess Bragg
Mississippi State University

Julie Grubb
Pacific Gas and Electric Company

Francine Scherger
Communitec, Inc., Ann Arbor, Michigan

Special thanks to Patti Brown, formerly of Pacific Gas and Electric Company, for making the preliminary arrangements.

Sponsors

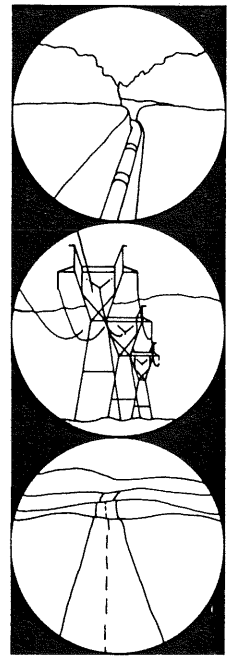
Electric Power Research Institute
U.S. Fish and Wildlife Service
U.S. Forest Service
Western Ecological Services Co.
Wildlife Management Institute
Woodward-Clyde Consultants

Goal

The goal of the Third Symposium on Environmental Concerns in Rights-of-Way Management is to provide a forum for the exchange of information on current scientific research and state-of-the-art engineering techniques and regulations in rights-of-way management.

The scope of the Symposium has expanded to include pipeline as well as transmission line and transportation rights-of-way. Concurrent sessions discussing planning and routing, wildlife management, vegetative management, aquatic impacts, endangered species, and EHV corridors promise to make the Third Symposium the broadest and most stimulating conference held to-date.

Rights-of-Way Management



Pipeline

Transmission Line

Transportation

Program Highlights

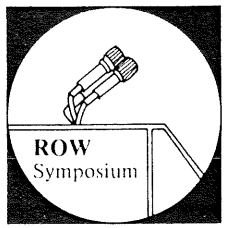
General sessions will open and close the Symposium. Assistant Secretary of the Interior Ray Arnett will deliver the Keynote Address at the opening session. A breakfast session with seating by right-of-way specialty will close the Symposium. Participants will wrap up the week's discussions and make plans for the Fourth Symposium.

This year's program has been expanded to include six interest areas:

- Planning and Routing
- Wildlife Management
- Vegetative Management
- Aquatic Impacts
- Endangered Species
- Extra High Voltage Transmission Health and Safety (EHV)

These topics will be discussed throughout the Symposium at concurrent technical sessions. They will be featured in the informal poster sessions presented throughout the day on Tuesday, February 16th.

Monday and Wednesday evenings are open. Meeting rooms are available for informal sessions. If you wish to chair such a session, express your interest on the registration form in the back of this booklet. We'll reserve a room for you and mention the session in the final program.



Preliminary Schedule

SUNDAY, FEBRUARY 14, 1982

4:00 p.m.	REGISTRATION BEGINS
7:00–10:00 p.m.	ICE-BREAKER

MONDAY, FEBRUARY 15

7:30 a.m.	REGISTRATION BEGINS
Morning	GENERAL SESSION Keynote Address: Ray Arnett, Assistant Secretary of the Interior
Afternoon	CONCURRENT SESSIONS I. Planning and Routing II. Vegetative Management III. Aquatic Impacts

TUESDAY, FEBRUARY 16

All Day	POSTER SESSION
Morning	CONCURRENT SESSIONS I. Planning and Routing II. Vegetative Management III. Aquatic Impacts
Afternoon	CONCURRENT SESSIONS I. Planning and Routing II. Wildlife Management III. Vegetative Management
Evening	WESTERN BUFFET

WEDNESDAY, FEBRUARY 17

Morning	CONCURRENT SESSIONS I. Planning and Routing II. Wildlife Management III. EHV
Afternoon	CONCURRENT SESSIONS I. Wildlife Management/ Planning and Routing II. Vegetative Management III. Endangered Species (Panel Discussion)

THURSDAY, FEBRUARY 18

9:00 a.m.	CLOSING SESSION Wrap-up and Planning Breakfast, by Right-of-Way Specialty
12:00 noon	ADJOURN

Planning and Routing

Al Rodney, Session Chairman

A New Approach—Environmental Feasibility Studies
M. Filion, MacLaren Engineers
R. Stedwill, Saskatchewan Power Corp.

Environmental Planning for ROW in a Rapidly Developing Multiple Resource Setting—the Alberta Deep Basin
D. Wooley and *G. Passey*
Alberta Energy and Natural Resources

The Minnesota DC Transmission Line: What Went Wrong and Why?
D. McConnon, United Power Assoc.

ROW Sharing
B. Howlett, NUS Corp.

Communicating Impacts
B. Howlett, NUS Corp.

The MANDAN Project: an International Perspective on EHV Transmission Line Siting
V. Schafer, Nebraska Public Power Dept.
W. Everett, Manitoba Hydroelectric Board
J. Jacobson, Midwest Environmental Services

Computer-assisted Data Analysis of Route Selection
S. Kangisser and *G. Shanholzer*
Envirosphere Co.
L. Jordon
Earth Resources Data Analysis Systems

An Efficient Algorithm for the Generation of Prioritized Sequences of Paths
W. Lemmon and *R. Abrams*
Middle South Services, Inc.

The Complexities of Routing an HV Transmission Line through Federal Land: a Case Study
J. Bridges and *B. McFarlane*
Commonwealth Associates
J. Thomas
South Carolina Public Service Authority

Protection of the Environment during Planning and Construction of Transmission Line Projects
W. Scott, Ontario Hydro

Quantitative Comparison of the Aesthetic Impact of Alternative Transmission Line Corridors: a Case Study
A. Sicherman, T. Baily, W. Odening
Woodward-Clyde Consultants

Clarity, Consultation, and Commitment—Ingredients for Successful Corridor Routing
B. Stern, United Engineers

Minimizing Transmission Line Visibility—a Process Involving Engineer, Planner, and Citizen Decisionmaker
W. Bakowski, D. Perry, J. Nickerson
Chas. T. Main Co.

Viewshed Determination and Aesthetic Simulation
S. Kangisser, Envirosphere Co.

Evaluating ROW Impacts on Recreation
S. Allen
Montana Dept. of Resources and Conservation

NY Natural Gas Pipelines: a One-Stop Shopping Process
R. Powell, New York Public Service Commission

Siting Considerations: Multiple-Use Versus Single-Use Rights-of-Way
J. Steinmaus, Stanley Consultants

Public Issues and Efficiency in ROW Use: a Minnesotan Approach
L. Hartman
Minnesota Environmental Quality Board

Impact Analysis Methods—a Comparative Review
D. Bisenius, J. Marcotte, T. Murray
Bonneville Power Administration

Changing Perspectives to Undergrounding Transmission Lines: a Case Study
J. Clapp
Connecticut Dept. of Environmental Protection

Highway Noise and Residential Property Values
G. Cramer and *M. Derbes*
Louisiana Dept. of Transportation Development

Historical/Architectural Evaluation for Transmission Line Routing
G. Wroniewicz, Virginia Electric Power Corp.
Kern, Commonwealth Associates

ROW Management and Social Impact Assessment
R. McManus, University of Calgary

Socio-Economic Impacts and Electrical Transmission Route Selection in Central Alberta, Canada
R. McManus, University of Calgary

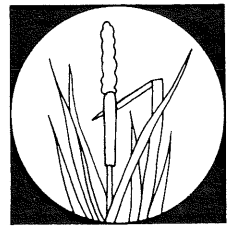
Utility Approaches to Public Participation: the Need for Evaluation
B. Bujnowski, Pennsylvania Power and Light Co.

Endangered Species—a Panel Discussion

Dale Arner, Moderator

Participants:
T. Shoemaker and *G. Reyes-French*, Environmental Research and Technology, Inc.
The Endangered Species Act and ROW Management
J. Rieger, CALTRANS, San Diego, CA
Highway Alignments and an Endangered Species
A. Clark, Woodward-Clyde Consultants
Threatened and Endangered Aquatic Species and ROW

Vegetative Management



Doug Smith, Session Chairman

Computer Vegetation Management
F. Chan, Pacific Gas and Electric Co.

Revegetation Guidelines Development for Pipeline ROW
S. Long and *S. Ellis*
Environmental Research and Technology, Inc.

A ROW Management Research Program
K. McLoughlin, Empire State Electric Energy Research Corp.
P. Johnston, Asplundh Environmental Services

Use of Jellied Gasoline in Powerline Maintenance: A Preliminary Study
D. Arner, W. Elam, D. Hartley
Mississippi State University

Use of Prescribed Burning for Managing ROW in Southern New England—Preliminary Results
D. Olson, L. Alexander, S. Macrigeanis
University of New Hampshire

Evaluation of Woody Vegetation on New Transmission Line ROW
D. Allsbrooks, D. Fowler, L. Turner
Tennessee Valley Authority

Vegetation Recovery of a Pipeline ROW on a Texas Coastal Barrier Island
G. Odegard, J. George, J. Sproul, T. Sawyer
El Paso Natural Gas Company

Straw Mulch for Erosion Control and Plant Establishment on Highway ROW in San Diego, California
B. Kay, W. Graves, R. Koenigs
University of California-Davis

Management of Forest Stands on Highway ROW
H. Young, Complete Tree Institute, University of Maine

Selecting Woody Vegetation for New Rights-of-Way: Complex Prescription that Simplifies Long-term Management
S. Amster, Ecoplans, Ltd.

Plant Materials and Techniques for Revegetation of California Roadsides
R. Clary, U.S. Dept. of Agric.-Soil Conservation Service, Lockeford, California

Biological Controls for ROW Management in Western Forests
R. Taber, S. West, K. Raedeke
University of Washington

Potential Role of Allelopathy in ROW Vegetation Management
G. Tillman, Cary Arboretum

The Role of Chemicals in Management of Roadside Vegetation
L. Voorhees, Oak Ridge National Laboratory

New York State PSC Policy on the Use of Herbicides in Managing Electric Transmission ROW Vegetation
J. Malefyt, NY Dept. of Public Service

ROW Vegetation Produced by Aerial, Selective Basal and Ground Foliar Herbicide Application
W. Bramble and *W. Byrnes*,
Purdue University
P. Johnston, Asplundh Environmental Services

Plant Growth Regulator Influences on Chaparral, Native Grasses, and Forbs
H. Hicht and *S. Hemstreet*
University of California-Riverside
T. Plumb, Pacific Southwest Forest and Range Experiment Station, U.S. Forest Service

Grass Growth Regulation Properties of S-Ethyl Dipropylthiocarbamate (EPTC): a 3-Year Study
W. Chappell and *P. Hopkins*
Virginia Polytechnic Institute

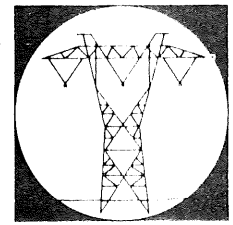
ROW Maintenance to Reduce Costs and to Increase Vegetative Diversity and Wildlife Habitat—A Demonstration
J. Huntley, U.S. Forest Service
D. Arner and *D. Hartley*
Mississippi State University

The Use of D-Limonene as a Substitute for Fuel Oil Spraying Dormant Brush
W. Chappell, Virginia Polytechnic Institute

Implication of Landowner Maintenance of Power Line Rights-of-Way
G. Tillman, Cary Arboretum
B. Hahn, Asplundh Environmental Services
R. Kimmel, West Virginia University

Spike 80W as an Alternative
R. Myers, Carolina Power and Light

Extra High Voltage Transmission Health and Safety



Gus Tillman, Session Chairman

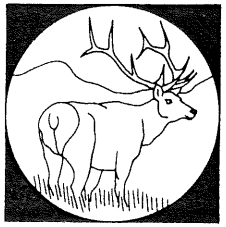
The Issue of Health and Safety of EHV Electric Transmission and the Siting of New Energy Facilities
F. Burggraf, The I A Partnership

Economic and Ecological Effects of 60Hz High Intensity Electric Fields on Vegetation Growing on Transmission Line ROW
G. McKee, Pennsylvania State University
M. Perkins, M. Baird, T. Reed, J. Barnick
Westinghouse Electric Corp.

Environmental Impact Considerations for Future Transmission Lines of 1000kV and above
J. Lee, A. Gabriel, K. Barnhardt, J. Hooson
Bonneville Power Administration

Irrigation Systems and their Impact upon Existing and Proposed Transmission Lines
J. Varner, Georgia Power Co.

Wildlife Management



Kent Schreiber, Session Chairman

Wildlife Use of Irrigation Canal ROW in the Prairie Pothole Region of North Dakota
T. Gatz
Bureau of Reclamation, Bismark, ND

A Comparison of ROW Maintenance Treatments and Use by Wildlife
D. Hartley and *D. Arner*
Mississippi State University

Impacts of the Granite Reef Aquaduct on Desert Ungulates
P. Krausman and *J. Hervert*
University of Arizona

Activity of White-tailed Deer along an Interstate Highway
K. Dixon, G. Feldhamer, J. Gates, D. Harman
University of Maryland, Frostburg

Spotlight Surveys as Indicators of Deer Activity Along an Interstate Highway in Pennsylvania
J. Gates, G. Feldhamer, D. Harman, K. Dixon
University of Maryland, Frostburg

Comparative Use of Transmission Line Corridors and Parallel Study Corridors by Mule Deer in the Sierra Nevada Mountains of Central California
J. Mordhardt, S. Moock, W. Tippets
Ecological Analysts, Inc.

Special Considerations for Implanting Two 735kV Lines in the Hill Head Deer Yard near Montreal
P. Lamothe, Hydro-Quebec
P. Dupuy, A. Marsan & Associates

Changes in Animal Activity Immediately Following the Experimental Clearing of a Forested ROW
G. Doucet and *J. R. Bider*, McGill University

Raptor Utilization of Power Line ROW in New Hampshire
J. Denoncour, U.S. Forest Service, MN
D. Olson, University of New Hampshire

Mitigating the Incidence of Bird Collisions with Transmission Lines
D. Beaulaurier, Western Interstate Commission for Higher Education
B. James and *P. Jackson*
Environmental Consultants
J. Meyer and *J. Lee*
Bonneville Power Administration

Effects of Powerline Corridors on the Density and Diversity of Bird Communities in Forested Areas
R. Kroodsma, Oak Ridge National Laboratory

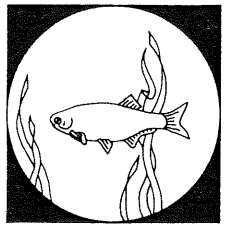
Effects of Roads on Breeding Birds
L. Adams, Urban Wildlife Resource Center
A. Geis, Patuxent Wildlife Resource Center

Effects of Vegetation Management on Bird Populations along Electric Transmission ROW
J. Malefyt, New York Dept. of Public Service

Evaluation of Effectiveness of Deer Protection Systems on Hamilton Branch Canal
M. Fry and *V. Wyman*
Pacific Gas and Electric Co.

An Analysis of Long-term Deer Loss Records from Two Canals Serving Hydroelectric Power Systems in Northern California
M. Fry and *V. Wyman*
Pacific Gas and Electric Co.

Aquatic Impacts



Don Gartman, Session Chairman

Water Quality Concerns Associated with Pipeline Stream Crossings
P. Ritter, Woodward-Clyde Consultants

Potential Impacts of ROW on Fishes—Analyses for Planners
M. Busdosh, Woodward-Clyde Consultants

The Impact of a Pipeline Crossing on the Benthos of a Pennsylvania Trout Stream
D. Gartman
Columbia Gas Systems Service Corp.

ROW Construction Impacts to Aquatic Biota
E. Mancini and *B. Dehoney*
Woodward-Clyde Consultants

Submerged Pipeline River Crossings
K. Berry, Westcoast Transmission Co., Ltd., Vancouver, BC

Effects of Pyritic Road Fill on a Natural Lake Ecosystem
R. Tiedemann, Idaho Transportation Dept.

Mitigating the Impacts of Highway Construction on Trout Streams
V. Pierce
Michigan Dept. of Natural Resources

Off-road Vehicle Abuses of Pipeline Stream Crossings: their Prevention and Correction
A. Crabtree
Michigan Dept. of Natural Resources
G. Kaliman, Consumers Power Corp.

Environmental Evaluation of Topsoil Correction and Water Techniques for Pipeline Construction in Canada
D. Mutrie and *I. Scott*, Dome Petroleum, Ltd.

Valuation of Wetlands
D. Smith, Dept. of Transportation

Poster Session

Allen Crabtree, Session Chairman

Environmental Protection Planning for a Canadian Segment of the Alaska Highway Gas Pipeline
D. Morris, Westcoast Trans Co., Ltd. BC

Unique Single Regulatory Process for Electric Transmission Lines
D. Beamer, Alberta Energy Resource Conservation Board

Effective Management and Disposal of Electric Utility Company Recreation Land
W. Reid, Consumers Power Co.

Applications of Aerial Photography in Transmission Line "Natural Features" Studies
N. Van Dyke and *A. Cassady*
Pennsylvania Power and Light Co.

Changing Perspective in Regulatory Oversight of Electric Transmission ROW Management in Pennsylvania
L. Knight and *A. Turner*
Pennsylvania Public Utility Commission

Control of Woodpecker Attacks on Wooden Utility Poles
R. Vaughn, Vaughn, Inc.

Stabilizing Highway ROW with Rose Clover in Southern California
W. Graves, B. Kay, R. Keonigs
University of California-Davis

Environmental Monitoring for Transmission Lines
R. Crouse, Photo Science, Inc.

ROW Vegetation Monitoring Using Oblique Aerial Photography
R. Stedwill and *R. Cooper*, Saskatchewan Power Corp.

Use of Low Level Photography to Manage Transmission Line ROW
J. Johnson, Bonneville Power Administration

Computer-aided ROW Management
W. Acton, Bonneville Power Administration

Evaluation of Garlon Herbicide as a Tool for Gas Pipeline ROW Managment at a Southern West Virginia Watershed
R. Hendler and *W. Betsch*, Dow Chemical
P. Reynolds, W. Ollice, J. Williamson
Columbia Gas Systems Service Corp.

Activities

On Sunday evening, February 14th, we'll kick off the Third Symposium with an Ice-breaker Party at the Convention Center. You can register, see old friends, and meet new ones while enjoying wine and cheese poolside.

A Western Buffet of chicken and ribs will be barbequed poolside at our annual banquet on Tuesday, February 16th. Join us for a fun-filled California casual evening!

Meals

With the exception of the Western Buffet on Tuesday evening, you're on your own for meals. San Diego abounds with good food, particularly seafood. Located within the Hyatt complex itself are a coffeeshop and elegant restaurant. Or you can walk to five international restaurants in the new Marina Village shopping area or several other coffeeshops. You can even pick up a bag of peanuts at nearby Sea World!

Location

San Diego, California is the site of the Third Symposium. All activities will take place at the Hyatt Islandia Hotel on Mission Bay, 1441 Quivira Road.

Known for its consistently mild climate, San Diego has average high temperatures in February of 66°. The average low for this time of year is 48°. Occasional rainfall is probable.

San Diego, itself, offers an exciting array of attractions: the San Diego Zoo, Sea World, Old Town, and surrounding natural vistas, to name but a few. Mexico is 25 minutes away; Disneyland a distance of 90 miles. Deep-sea sport fishing and sailboat rentals are available year-round. Tennis courts and golf courses abound. All but the most exclusive restaurants in the area encourage casual dress. A wide variety of discount options for many local attractions will be available to registrants and their guests at the registration table.

Accommodations

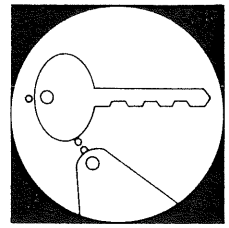
The Hyatt Islandia is located on Mission Bay, 7 minutes from San Diego International Airport. The hotel provides free, 24-hour shuttle-bus service from and to the airport. Use the courtesy phone in the airport baggage area.

Two hundred and fifty guest rooms have been reserved for Symposium participants. All rooms in the Tower have an exclusive view of Mission Bay. Suites are available upon request. Room rates for your stay at the Symposium are as follows:

	Single	Double
Garden rooms	$47	$62
Lower Tower	56	71
Upper Tower	63	78

The Reservation Form at the back of this booklet should be completed and returned *directly to the hotel.* All reservations must be accompanied by a deposit for the first night.

Reservations must be received by the Hyatt's Reservation Supervisor **by January 25, 1982.** Reservations requested after that date are subject to availability.



Registration

On-site registration begins at 4:00 p.m. on Sunday, February 14. The registration/information desk will be set up in the hall outside the Hyatt Conference Center. Registration will continue on Monday, February 15, beginning at 7:30 a.m.

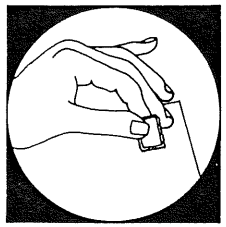
Fees

The registration fee, received BEFORE January 1, 1982, is $70 and includes registration, a copy of the Symposium Proceedings, the Sunday night Ice-breaker, and the Western Buffet on Tuesday night.

AFTER January 1, 1982, the fee will be $80, including a copy of the Proceedings.

Extra banquet tickets are available at $25 each.

To register, complete the form on the next page and mail it, along with a check for the appropriate fee, to:



Bess Bragg
Right-of-Way Symposium
P.O. Drawer LW
Mississippi State, MS 39762

Symposium Registration Form

☐ I have enclosed $70 (BEFORE January 1, 1982).

☐ I have enclosed $80 (AFTER January 1, 1982).

__ Number of extra banquet tickets @ $25 each.

☐ I plan to attend the closing breakfast.

☐ I wish to chair an informal session. Please reserve a meeting room for me. My session will be on:

_____

_____

NAME _____

POSITION _____

COMPANY/AGENCY _____

ADDRESS _____

CITY _____ STATE _____

ZIP CODE _____ PHONE _____

NAME FOR IDENTIFICATION BADGE _____

Mail To: Bess Bragg, Rights-of-Way Symposium
P.O. Drawer LW, Mississippi State,
MS 39762

Symposium Registration Form

Hotel Reservation Form

Accommodations desired for

ROW Symposium, February 15–18, 1982:

Single: ☐ $47 Garden ☐ $56 Lower Tower ☐ 63 Upper Tower

Double: ☐ $62 Garden ☐ $71 Lower Tower ☐ $78 Upper Tower

(2 persons—King or Queen/Queen)

Please note: Reservations must be received 21 days prior to arrival accompanied by a first night's deposit to hold your reservations. Check-in prior to 4 p.m. is subject to availability.

NAME _____

HOME ADDRESS _____

CITY _____ STATE _____ ZIP _____

ARRIVAL DATE: _____ DEPARTURE DATE: _____

Mail To: Hyatt Islandia, 1441 Quivira Road, San Diego, CA 92109

Hotel Reservation Form