RIGHT-OF-WAY DEVELOPMENT AND MAINTENANCE[1]

by E.J. Medicky

Abstract: The development and management of a right-of-way is a complex process which must consider the ecological and social implications of the resulting severance on plants, animals and people, as well as the benefits which will accrue to the utility and society. Management policies must be based on sound ecological and economic practices that provide the required degree of line security as well as other benefits to society.

The province of Ontario is situated in an area which could best be described as being north of the Great Lakes. South to north it extends approximately 1,000 miles to Hudson Bay. On the east it is bordered by the province of Quebec, and roughly 1,000 miles to the west, by the province of Manitoba. The total area of this land mass is somewhat over 400,000 square miles. To put it another way, Ontario is approximately equal in size to the combined areas of the states of Ohio, Pennsylvania, Georgia and Texas.

The topography of the province is quite varied ranging from flat to rolling in the farm country of the south, to the Precambrian Shield in the north where rugged and rocky sites are found together with extensive clay flats.

According to J.S. Rowe (1972) three Forest Regions occur in the Province:

1. *Boreal Forest Region:* This Region is by far the most extensive, stretching from Hudson Bay to just north of the Great Lakes.
2. *Great Lakes-St. Lawrence Forest Region:* This Region is situated along the north shores of the St. Lawrence River and the Great Lakes, and extends west of Lake Superior to Manitoba.
3. *Deciduous Forest Region:* This Region covers a narrow band along the north shores of Lakes Ontario and Erie.

Growing on this vast area is a great variety of forest trees. Spruces, white and black (*Picea glauca* and *P. mariana*) intermixed with jack pine (*Pinus banksiana*), trembling aspen (*Populous tremuloides*) and white birch (*Betula papyrifera*) predominate in the north. Moving south the stand compositions change to red and white pine (*Pinus strobus* and *P. resinosa*), sugar and red maple (*Acer saccharum* and *A. rubrum*), red oak (*Quercus rubra*) and white elm (*Ulmus americana*). Along the northern shores of Lakes Ontario and Erie sugar maple, beech (*Fagus grandifolia*), basswood (*Tilia americana*), and white oak (*Q. alba*) are common together with scattered individuals of tulip tree (*Liriodendron tulipifera*) and cucumber tree (*Magnolia acuminata*).

The climate of Ontario is basically modified continental, the modification being due mainly to the presence of the Great Lakes.

Southern Ontario is bounded by the Lower Great Lakes—Ontario, Erie and Huron occupying an area of 100,000 square miles. The soils here are deep, fertile and suitable for agricultural purposes. In the extreme southwest of this area the growing season can extend to 220 days. Proceeding north to Hudson Bay soils become more acid while depth and fertility decrease, and wet organic soils become more prevalent. The growing season in the northern reaches of the province is less than 140 days. These factors have corresponding effects on growth patterns.

Southern Ontario is densely populated and highly industrialized, with extensive farm areas between the urban centers. The northern part of the province supports a small population, and is primarily forest cover.

Currently, the population of the province is over 8,000,000. What does this mean in terms of a utility such as Ontario Hydro which is charged with the task of supplying energy to these people?

[1]Presented to the International Shade Tree Conference in Detroit, Michigan in August 1975.

Statistically, at least, the following statements can be made about the Ontario Hydro Corporation (1973).

Operational area	250,000 sq. miles
Administrative Regions	7
Administrative Areas	61
Retail customers served	
-direct by Ontario Hydro	688,000
-through 353 municipal utilities	1,853,000
Primary energy supplied	78.5 billion kWh
Peak resources	17,500,000 kW
Generating stations	77
Transformer stations	194
Distribution stations	782
Transmission Lines	22,900 miles
Rural Distribution Lines	53,600 miles

The sheer vastness of the province of Ontario, the variety of terrain conditions encountered, and the number of people served make the routing, construction, and maintenance of a utility corridor a formidable task. Additionally, since the late sixty's, problems have been compounded because of pressures from environmentalists, citizens' groups or private individuals opposing new right-of-way construction for a variety of reasons some of which are legitimate, some of which are not.

The development of a right-of-way corridor will follow the decision to build a new line. Maintenance of that right-of-way will follow construction. Yet the two functions, development and maintenance, are inseparable. It is unfortunately one of the truisms of right-of-way development that the saving in the cost of capital construction can be wiped out over a short period of time during the ongoing maintenance of operating a line, if the line is not properly sited.

Because of its background in the natural sciences, the Forestry Department of Ontario Hydro has become deeply involved in maintaining the quality of our environment during the planning, construction, and maintenance phases of transmission line routings.

Following the decision by the System Planning Branch that a load center requires power, the first step in the planning of a specific transmission line is the selection of an appropriate study area to evaluate the "source to load" alternatives. The objectives of the study include minimizing the disruption to both the natural environment and man's uses of his environment, within the overall constraints of reasonable economic cost and system security.

In a number of routing studies, a map overlay system has been used to gather pertinent information, evaluate its relative importance, and combine many different factors into the best overall route. Initial inventory data describing natural features and human activities is collected either from existing sources or by techniques such as air photo interpretation.

In some cases, closely related types of data can be integrated to provide logical groupings for analysis. The result of this analysis provides a map of the relative impact on factors such as natural systems, agriculture, resource use, predicted land use, and visual perception. These factor maps are overlaid to produce a single composite impact map which is used to delineate corridors for further study.

The public is asked to comment on these maps at meetings, seminars, and information centers. Public input is essential to assess the relative importance of the environmental factors and to generate additional data.

The next phase identifies alternate rights-of-way within these corridors, using the lot line fabric as much as possible. At this stage such factors as individual stream crossings and woodlots become important and are examined in detail. Alternate routes are evaluated in terms of total impact on the environment, as well as cost, to arrive at a preferred routing.

The involvement of all interested parties, including government agencies, environmental groups, and members of the public is sought during this process. Information on areas of particular concern to nature-lovers can often be best provided by naturalists and sportsmen who are familiar with local conditions.

A final round of public meetings is held to ensure that all interested citizens have an opportunity to participate in the route selection. The final step in this process is the presentation of a report to the provincial Environmental Review Board. After the final alignment of the right-of-way is approved, areas of possible high impacts are identified and site specific studies are carried out to minimize the impact of construction activity.

At this stage, meetings are held with affected property owners to explain Hydro's property acquisition, construction, selective cutting, restoration and maintenance policies. The owners are then contacted in person. Additional questions are answered and permissions to survey obtained.

Now the real work begins. The Survey Department lays out the center line on the ground. Woodlots are evaluated by the Forest Resources Section for merchantable timber. The vacant land values are appraised by the Property Department. Also appraised at this time are injurious affection, disturbance to buildings, aggregate value, land severance.

Having done this, the Property Department presents the owner with a legal description of Hydro's requirements, and the compensation package of what Hydro is prepared to pay. This package will be based on a fair market value, and if the severance is such that hardships may result to the owner, the property may be bought outright. Two options are offered, easement or purchase, but no negotiations are undertaken at this stage of right-of-way acquisition.

Ontario Hydro then files for expropriation for its requirements along the entire length of the corridor. This procedure was adopted at the request of the National Farmers Union and other farm groups within the province to ensure that all land owners would be dealt with on the same basis, and to assure them avenues of appeal should they be unhappy with Hydro's offer. Appeals can be made to a Hearing of Necessity or to a Compensation Board Hearing. The decision of the Compensation Board Hearing is final and binding on both parties.

Hydro's policy is to expropriate only the minimum requirements, easements for rights-of-way or purchase for stations. Once an offer is made, very little room is left for negotiation. Some 90 days after expropriation, unless a notice of appeal has been filed, Hydro takes legal possession of the land.

Construction can now begin.

Tower location and edge of cut having been surveyed, the first construction phase involves the building of access roads, and soil testing at selected tower locations. Roads are located to avoid high impact areas and long vistas down the right-of-way. Tower sites are cleared to the minimum requirements for assembly and erection. Where possible, trees and shrubs are left in the vicinity of the tower site.

The right-of-way is selectively cut using Hydro forces or approved contractors. Only those trees that will affect the construction or safe operation of the line are pruned or removed. Trees which will create future maintenance problems are also removed at this time. As the trees are cut the timber is marketed.

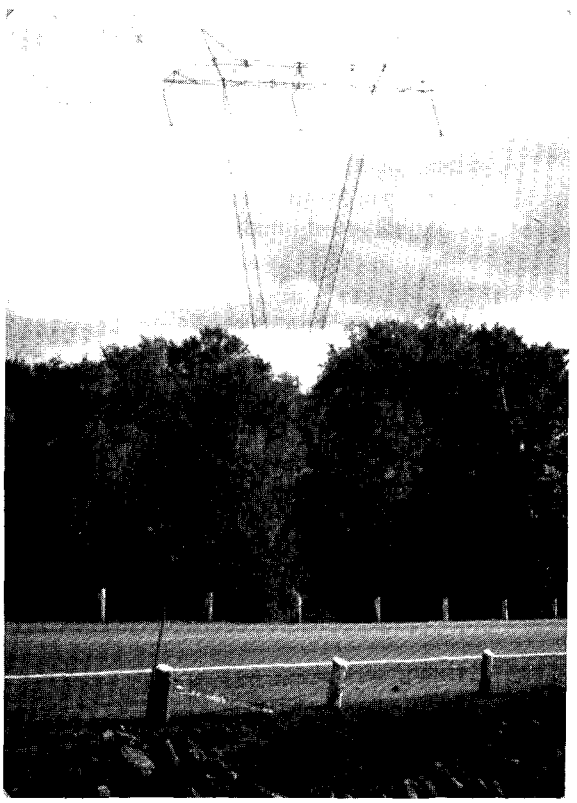

Figure 1. Selectively cut 500 kV right of way at a road crossing showing the screen.

After the facility is built, the restoration program begins, trees are planted in areas of high visual significance, to minimize the impact of the line. Grasses and legumes are seeded in potentially erodible areas to negate the possibility of erosion and to minimize regrowth of undesirable species. Currently experimental work is being undertaken to assess the possibility of seeding

rights-of-way with shrubs to provide competition for incompatible species and shelter and food for wildlife.

Once the towers have been installed, the conductors strung, right-of-way damage restored, and clearances checked against conductor sag diagrams, the lines are turned over to the Vegetation Management Section for management purposes.

The objectives of right-of-way management programs are as follows:

1. To ensure safety of public and staff.
2. To ensure a reliable supply of electrical service.
3. To ensure compliance with pertinent legislation.
4. To ensure compliance with the Corporation's current environmental standards.
5. To accomplish the foregoing at the most economical long-run cost.

Right-of-way vegetation can be broken down into two general categories, the compatible vegetation and the incompatible vegetation. In general, the compatible vegetation consists of the herbaceous species, and the low or slow growing woody species. This would include grasses, ferns, shrubs, and in some cases, trees such as white cedar. Conversely, the incompatible species consist primarily of the fast growing woody species, such as trembling aspen, which if left unchecked, would grow into the conductors. Also included in this group would be poisonous species which could pose health hazards.

Management programs involve a variety of techniques depending on the nature of the vegetation, topographic conditions, accessibility, legislative or local constraints, availability and type of resources, and economic considerations. Ontario Hydro bases Vegetation control operations on the concept of encouraging compatible growth while eradicating the incompatible. Basically, these programs involve five areas of activity: trees, brush, weeds, shrubs and grasses.

Trees

The Corporation policy is to provide a certain minimum clearance between trees and conductors. This is accomplished by pruning or removal using skilled Hydro tradesmen, employing approved arboricultural practices.

The amount of minimum clearance required varies with the voltage of the line. On all circuits except 500 kV and double circuit 230 kV, tall structurally sound trees located off the right-of-way are given "standing clearance" only. These trees, if they were to fall towards the line, could strike the conductors, but in order to preserve them, and to keep right-of-way widths to an acceptable minimum, the Corporation is willing to accept the risk posed by them. On 500 kV and double circuit 230 kV both standing and falling clearance is provided, so that no tree in falling will come within a certain distance of the conductor as outlined below.

Voltage	Minimum Permissible Clearance	Clearing Cycle
500 kV	15 feet	2 years
345 kV	15 feet	2 years
230 kV	10 feet	2 years
115 kV	10 feet	2 years
27.6 kV to 69 kV	5 feet	4 years
0 to 15 kV	1 foot	4 to 6 years

The clearances listed above are the *MINIMUM PERMISSIBLE CLEARANCES.* Additionally, an allowance must be made for the amount of growth that will take place during the clearance cycle.

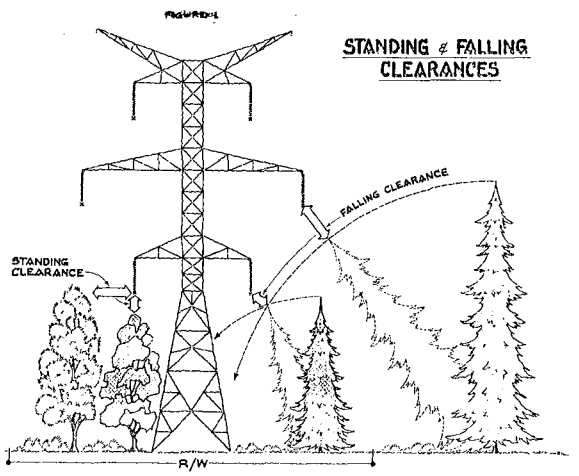

Figure 2. Standing and falling clearances.

Brush

Brush is defined as immature trees, whose diameter is less than four inches at breast height. If incompatible, it is controlled by either manual or mechanical cutting or by the use of selective herbicides. When properly carried out the latter amounts to biological control in that the incompatible species are wiped out. The compatible species are encouraged, thereby providing competition for the incompatible species and limiting their germination and growth.

Spraying is governed by both Corporation specifications and government legislation. The work is done by licensed Hydro tradesmen and approved licensed contractors.

Figure 3. Compatible vegetation (sumac) on a distribution right-of-way.

Weeds

Where Hydro is responsible for weed control in order to comply with the Weed Control Act, approved techniques are used. This may be a case of mechanical mowing, or applications of selective herbicides. As with brush control programs, the work is governed by applicable specifications and legislation, and carried out by qualified resources.

Shrubs and Grasses

The vast majority of shrubs and grasses are compatible with overhead power lines, and hence their establishment and development are encouraged. Not only do they contribute to the appearance of the right-of-way, but they provide competition to seedlings of incompatible species, and reduce the possibility of erosion at the same time.

Multi-Use

The primary purpose of any electrical utility right-of-way is the transmission of energy. Yet other uses can be compatible with the transmission of power provided they act in harmony with it. The multiple use aspects include such undertakings as linear parks, garden plots, fish and wildlife areas, snowmobile trails, parking lots and agriculture.

The greatest impact of multi-use of right-of-way management manifests itself in the urban centers. Parks, for example, can provide energy outlets for children in high density population areas, while garden plots provide recreation and enjoyment for apartment dwellers.

These areas, if developed on a cost sharing basis jointly with municipal authorities, can benefit the community while at the same time reducing management costs.

Every right-of-way has a starting point and a terminal point, these being generating stations, transformer stations, distribution stations, switch yards, etc. These too have a significant impact on the environment. Yet the judicious use of plant material adjacent to them can soften the stark appearance of hardware to make it blend in with the surrounding community.

All of us in the electrical utility field realize the recent problems that have developed with the routing, construction, and maintenance of transmission lines. Over the last few years acquisition of land for new rights-of-way has become exceedingly difficult. Management practices, notably in the area of herbicide applications, have come under close scrutiny by government departments and under fire from various environmentally oriented groups. Sometimes legitimate, sometimes not, these groups have in many cases failed to comprehend the needs and problems of electrical utilities. The net result has been that, at times, the necessary expansion of networks has been seriously impeded, and at times, stopped.

Like it or not, these times are here to stay. Speculation is that with a shorter work week and greater incomes people have more time to become involved in community affairs, however broad that community may be. Yet the utilities are not entirely blameless in the problems they are now facing.

To overstate the case to some extent, a few short years ago right-of-way selection consisted of choosing the shortest distance between two points which would offer the least resistance to construction. Management meant removing or pruning trees and blanket spraying. Very little consideration was given to the effect of these undertakings on the environment or their social implications.

Things have a way of changing, and the changes which have come about during the late sixties are not necessarily all bad. Community involvement in the siting of a station or a 140 foot tower is good since the facility will be as much a part of the community as a necessary link in the Hydro network. The impact studies and environmental considerations are also good in that they determine the best possible corridor which has the least impact on the plant or human community.

Finally, I would like to ask five questions and attempt to answer them within my scope of experience as a utility forester in Ontario.

1. Does your utility have a right-of-way development and management policy?
2. Do your practices meet current legislative requirements?
3. Are you sincerely concerned about the impact of rights-of-way, existing and planned, on the environment and the community?
4. Do your practices reflect a concern for current environmental thinking within reasonable economic constraints?
5. Are you prepared to initiate right-of-way development and management plans before someone does the job for you?

I would like to suggest that if the answer to any one of those questions is "No", you've got a potential problem on your hands. Past practices and policies were good inasmuch as they affected the past. Many are still viable, but they must be tempered with the current viewpoints as they relate to the problem. I'm not suggesting that by changing your ideas and jumping on the ecological bandwagon your problems will be over. I am, however, suggesting that they can be minimized to the point where you will be able to live with them.

An honest and sincere conviction that you're doing the right thing is a start. Selling your ideas to your management is the next logical step. Where your ideas differ substantially from those reflected in the community, they have to be sold to the public. Lastly deal with the public honestly and live up to the commitments you make to them.

References

Anonymous, 1975. Maintenance Line Clearing Operations. Ontario Hydro.

Anonymous, 1974. Ontario Hydro at a Glance. Ontario Hydro.

Hosie, R.C., 1973. Native Trees of Canada. Canadian Forestry Service, Department of the Environment.

McPhail, R.A. 1975. Right-of-Way Vegetation Management. Ontario Hydro.

McPhail, R.A., 1975. Right-of-Way Management. Ontario Hydro.

McPhail, R.A., 1971. Current Research in the Vegetation Management Program of a Large Canadian Electrical Utility. Paper presented to the 1971 Weed Science Society Meeting.

Rowe, J.S., 1972. Forest Regions of Canada. Canadian Forestry Service, Ministry of the Environment.

Webber, L.R. and D.W. Hoffman, 1967. Origin, Classification and Use of Ontario Soils. Ontario Department of Agriculture and Food.

White, J.H. and R.C. Hosie, 1968. The Forest Trees of Ontario. Timber Branch, Ontario Department of Lands and Forests.

Winter, J.E.F., 1974. Forestry Patrols of HV Lines (50 kV and up). Ontario Hydro.

Winter, J.E.F., 1970. Selective Vegetation Control. Ontario Hydro.

Wong, Y.S., 1975. The Climate of Ontario. Ontario Hydro.

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