

# Fur, Feathers & Transmission Lines



How rights of way  
affect wildlife

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# Foreword

## How rights of way affect wildlife

Manitoba Hydro is frequently asked questions about the effects of its facilities and operations on the environment and on people. In particular, many questions are asked about the effects of construction, operation and maintenance activities on wildlife and wildlife habitat.

This non-technical informational document provides a general overview of the positive and negative impacts associated with transmission lines in Manitoba.

While the primary focus for the publication is Northern Manitoba, much of the information also applies to transmission lines throughout the province. As such, this publication provides general responses to commonly asked questions, but does not provide details on any specific transmission line project.

This document has been written as the first in a series of publications, which respond to questions and concerns raised about the environmental effects of Manitoba Hydro's facilities and operations.

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# Table of Contents

INTRODUCTION .....	4
What are transmission lines? .....	5
What do transmission lines look like? .....	6
What does wildlife and habitat mean? .....	7
How does the location of the line affect wildlife and habitat? .....	7
What is mitigation? .....	8
CONSTRUCTION IMPACTS .....	9
How does ROW construction affect wildlife habitat? .....	9
What types of habitat are avoided during the routing of the transmission line? .....	10
What mitigative measures are possible to reduce or avoid negative effects on wildlife habitat? .....	11
What construction factors affect wildlife and habitat? .....	13
Clearing vegetation .....	13
Crossing water bodies .....	14
Disposal of cleared vegetation .....	15
Waste and chemicals .....	16
Borrow pits and roads .....	17
What type of disturbances do wildlife experience during the construction phase? .....	18
How are furbearing animals affected during construction? .....	19
LINE MAINTENANCE IMPACTS .....	20
What type of disturbances do wildlife experience during ROW maintenance? .....	20
What effects do vegetation management methods have on habitats? .....	21
PHYSICAL PRESENCE OF THE LINE IMPACTS .....	23
What are the long-term effects of the ROW on wildlife habitat? .....	23
Do the ROWs form a barrier to the movement of animals? .....	25
Do transmission lines cause bird mortality? .....	26
What can be done to reduce mortality from bird strikes? .....	28
Do birds use the structures? .....	28
What will be the effect of trapper access to wildlife populations? .....	30
Will the transmission line cause an increase in hunting and fishing access? .....	31
Do transmission lines make noise that disturbs wildlife? .....	32
What are the effects of electric and magnetic fields on wildlife? .....	33
SUMMARY .....	35

# Appendices

APPENDIX A – Potential Impacts on Wildlife Habitat Project Stages and Activities – Sample Matrix .....	40
APPENDIX B – Footnotes .....	41
APPENDIX C – General Environmental Protection Measures .....	44
– Manitoba Hydro Transmission Line Construction Practices .....	44
– Environmental Protection Measures for Construction in Urban Environments .....	49
– Environmental Protection Measures for Agricultural Lands .....	50
– Environmental Protection Measures for Boreal Wilderness Areas .....	53

# Introduction

Manitoba Hydro is a provincial Crown Corporation responsible for providing a reliable supply of electricity to Manitobans. The Hydro Act states that electricity must be supplied in a safe, reliable, and economical manner.

To meet the short and long-term electrical needs of its customers, Manitoba Hydro from time to time builds new transmission lines or makes changes to existing transmission line facilities. New construction and changes are often needed to meet regional population growth, shifts in industrial demand, to improve the reliability of existing systems, as part of ongoing operations and system maintenance activities.

As an integral part of the planning process, before commencing construction on all new transmission line projects, the required government and local approvals and licensing are acquired. One of the first steps in the project approval process is to review the proposed project through Site Selection and Environmental Assessment (SSEA) studies. The purposes of these SSEA studies are:

- 1) to select a transmission line route which will, within practical, technical, and economic parameters, minimize adverse environmental effects (Site Selection);
- 2) to predict the effect the project will have on the socio-economic and biophysical environment (Environmental Assessment);
- 3) to find practical ways of reducing environmental disturbance (Impact Management); and
- 4) to involve the public in the selection of a route and in the evaluation of impacts (Public Consultation).

This report focuses on information usually considered during the Environmental Assessment and Impact Management studies. In discussing possible impacts, it is important to recognize that proven methods (mitigation) exist to reduce or manage most negative effects; many of these are

identified in “Environmental Protection Practices” documents and Environmental Protection Plans for construction and maintenance of transmission lines. Manitoba Hydro Transmission Line Construction Measures are included in Appendix B. The impacts and mitigation measures discussed in this report are not site-specific, rather, the studies and experiences of the construction and operation of transmission lines and their rights-of-way (ROW) in Canada and the United States are reviewed and examples of situations that exist in Manitoba are presented.

Wildlife and their distinctive habitats may be impacted in several ways by transmission line facilities. The type and extent of habitat impacts depend on the characteristics of the wildlife species. Many wildlife species concentrate at various times of the year in specific, and often traditionally used areas. Waterfowl, for example, may use certain lakes for nesting or for staging prior to migration. Small animals such as mice and voles are limited in the extent of their range. Other species, such as caribou or white-tailed deer, use traditional routes for movement between winter and summer ranges. Many species of fish use localized areas of creeks or river-beds for spawning and overwintering.

This report discusses potential impacts in three broad categories:

- 1) construction impacts (access, ROW clearing, construction of towers, stringing of cables);
- 2) line maintenance impacts (inspection and repair); and
- 3) impacts related to the physical presence and operation of the transmission line.

The following introductory explanations and definitions provide a common background for the responses to questions about transmission lines and their effect on wildlife and wildlife habitat.

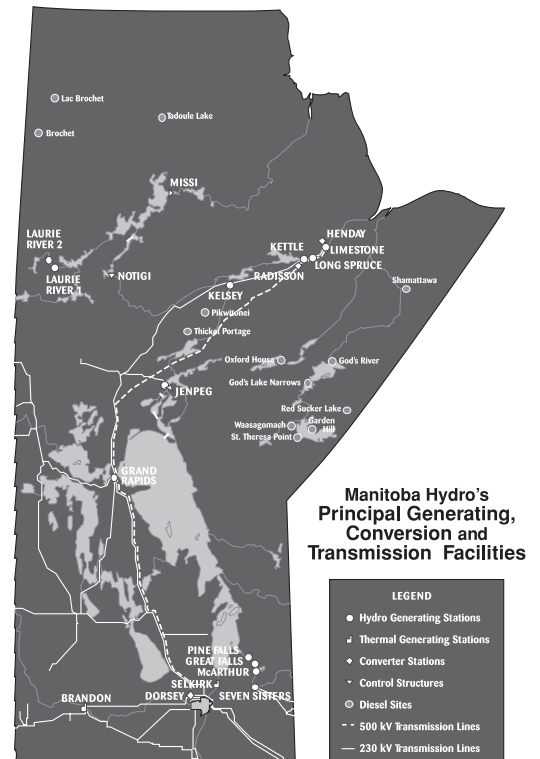
## What are transmission lines?

A network of high voltage transmission lines carries electricity from generating stations in northern and southern Manitoba, to meet the demand for power throughout the province. Manitoba Hydro transmission lines carry high voltages of up to 500 kV while lower voltage (66 kV and lower) transmission and distribution lines carry the power to homes, businesses and industries. The standard electrical wiring in Canadian houses carries 120 V, substantially

less voltage than a transmission line. Transmission lines end at transformer substations where the voltage is increased or decreased as required for further transmission.

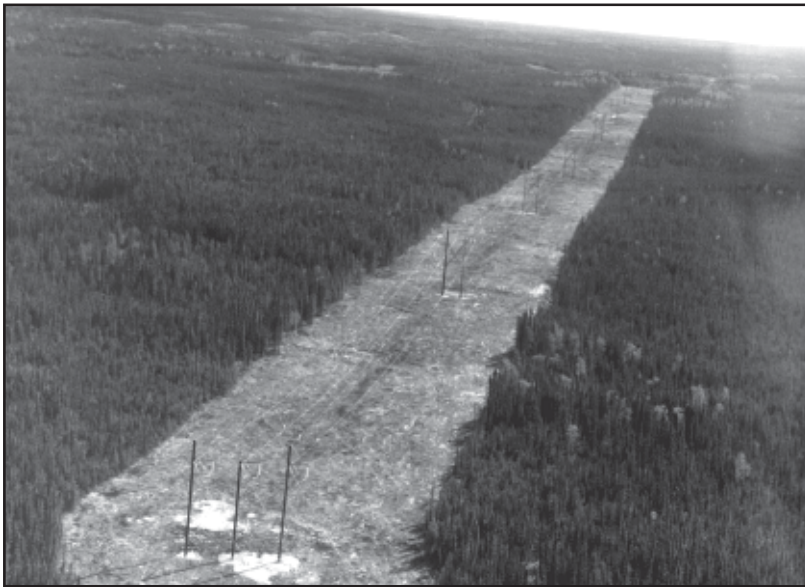


*Typical northern Manitoba community*



## What do transmission lines look like?

Transmission lines are made up of transmission line structures and metallic conductors (wires). Each transmission line is designed to carry specific electrical voltages, and the appearance of the line varies according to voltage or other engineering specifications. The structures that support the conductors are made from single or double wooden poles, or lattice or tubular steel. A single circuit transmission line consists of a set of three metallic conductors to create a complete electrical circuit. Double-circuit towers carry two sets of conductors, or six wires altogether. The two sets are not connected; in effect, each tower carries two separate transmission lines. The conductor must clear the ground at the low point between the towers by at least seven metres



*Transmission line in northern Manitoba*

as required by safety and industry standards. This height may vary in accordance with CSA standards and specific license requirements for individual transmission lines. To prevent unwanted outages caused by lightning, a lightning guard, commonly called a 'sky wire' is installed at the highest point on the transmission tower/structure above the conductors.

Transmission line structures, more commonly referred to as towers or poles, are secured into the ground. Some towers are mounted on concrete pilings or bases. Towers in some locations may have guy wires and anchors, which are used to support towers in situations where the ground cannot support the full weight of the tower and line without tipping. Towers range from 20 to 50 metres in height. The tallest transmission towers in the Manitoba Hydro system are more than 100 metres high to support the long crossing of the Nelson River.

Transmission lines are located within a cleared strip of land called a right-of-way (ROW). The width of the ROW generally ranges between 40 to 80 metres depending on the size of the towers. The ROW width is determined by several factors including the number of lines in the ROW, distance to tall trees which must be kept from touching the line, and requirements for landing helicopters which must bring in parts and work crews to carry out repairs. Where multiple transmission line facilities are required the ROW is expanded to accommodate these needs. ROW widths will vary depending upon voltage carried by the transmission line, and the kind of tower structures used. All Manitoba Hydro transmission line specifications meet national standards.



## What does wildlife and wildlife habitat mean?



Photo Credit: Department Natural Resources

Wildlife generally refers to all undomesticated and free-roaming organisms occurring in their natural environment, including: insects, amphibians, reptiles, fish, birds and mammals. Habitat is the natural environment or place where animals live. Each habitat has its own unique physical, chemical, and biological characteristics<sup>1</sup>. Some animals require different habitats at different times of the year or different times of their lives – such as calving grounds or nesting sites. Some habitats are less sensitive to disturbance than others. Many animals are unfamiliar with human activities or man-made structures, but some species have adapted to them, and use man-made structures as part of their habitat.

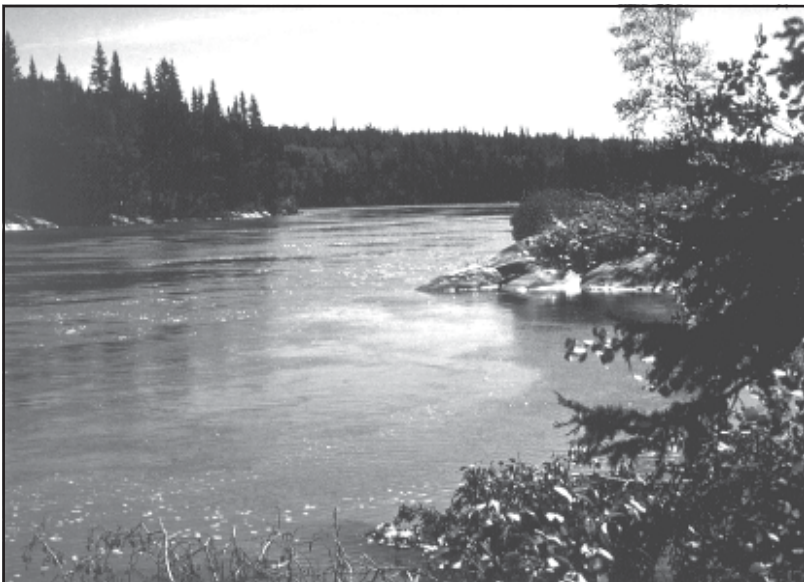
## How does the location of the line affect wildlife and habitat?

Location, sensitivity, and quantity of habitat need to be considered when discussing transmission lines and wildlife. Constructing a transmission line in a black spruce bog, for example, will have different impacts on different wildlife and habitat, than constructing a similar line in a jack pine forest. Constructing a transmission line in a black spruce bog in one part of northern

Manitoba may impact wildlife and habitat differently than constructing a similar line in another Manitoba bog. Impacts will differ depending on differences in soil, landform, plants, climate etc.

The sensitivity of the habitat to disturbance plays an important role in defining and measuring the impacts. A peat bog, for example, is more sensitive to disturbance than aspen forest. Each individual habitat feature, such as a tree or flower, also has different sensitivities to disturbance. Time is always needed to restore the balance of wildlife and habitat after any natural or human disturbance. In the case of human disturbance, the recovery period depends on the initial efforts to minimize the disturbance, as well as the nature of the disturbed site.

The use of areas that have been previously disturbed by man-made or natural events can lessen the magnitude of impacts to wildlife habitat. For example, some areas in northern Manitoba are frequently subjected to periodic natural disturbances such as fire. Constructing a transmission line



through wildlife habitat that has burned recently will have less impact on the existing environment than constructing a similar line through a virgin forest.

Northern Manitoba has large unbroken expanses of forest. If extensive areas of similar wildlife habitats are present, there is a low probability that any wildlife population would be seriously affected by a disturbance such as a transmission line in a limited part of that habitat. Transmission lines usually do not affect entire populations, but tend to affect only a few individuals.

As a general rule, species diversity (i.e., the number of different types of animals), and density (i.e., the total number per given area), decreases as you go from south to north, but total amount or availability of habitat within a region increases. This situation is also influenced by the quality of wildlife habitat present<sup>2</sup>.

Each habitat type (e.g., young versus mature black spruce bog) has a different variety of animals, and the impacts can vary from habitat type to habitat type. Wildlife and habitat are examined on an individual project and site-specific basis for transmission lines in the northern boreal forests and other areas of Manitoba.

## What is mitigation?

Mitigation is the process whereby a potential impact is avoided completely or minimized to the extent possible. For example, transmission towers are located far enough back from river banks to prevent project related erosion from occurring. In addition, vegetation is maintained or planted around the tower base to minimize or prevent soil erosion.

Reforestation programs and other remedial measures are incorporated into operations and maintenance programs when unanticipated disturbances resulting from construction practices occur. These actions are referred to as mitigation techniques. Proven guidelines and procedures or practices to mitigate impacts of its transmission line projects are followed. (Appendix C)



*Split Lake project workers installing bank stabilization works at the crossing of the Pukatawakan River, in keeping with the requirements of the Environmental Protection Plan for the project.*

# Construction Impacts

This section discusses several potential impacts that may occur and mitigation measures that may be used during the construction phase of a transmission line project. The two most important impacts associated with construction are physical changes to wildlife habitat, and temporary disturbance to wildlife from the use of machinery and the presence of humans.

## How does ROW construction affect wildlife habitat?

Preliminary construction activities involve surveying the ROW, which requires manual clearing of narrow survey lines and small isolated helicopter landing areas. Major transmission line construction activities usually take place during winter. These activities include ROW clearing, establishing tower foundations, framing and erection



*Construction site in northern Boreal Forest*

of the structures, and stringing the conductors. Crews move down the transmission line route completing each phase of construction in sequence. Clearing is done by caterpillar mounted “V” blades, “K-G” blades, hand-clearing, or by other acceptable means. Slash from forested areas may be burned under permit. The preparation of tower foundations on bedrock may involve blasting, but excavation is the more likely alternative. In order to prepare foundations, borrow pits may be developed, or crews may use till or gravel, from naturally occurring depressions for back fill material. The structure erection crews and the conductor stringing crews use special heavy machinery for their activities. Work camps and temporary access trails are often required for northern transmission line projects; occasionally existing permanent roads also provide access.

Clearing of the ROW for a transmission line will remove relatively small amounts of wildlife habitat. The impact of this clearing varies from animal to animal. In some circumstances, clearing may encourage growth of plants that improve terrestrial habitat for certain animals such as moose, deer, hare, and upland birds. On the other hand, clearing critical habitat of rare and endangered species could have a negative impact, possibly severe, on those species. Effects are discussed in more detail in the “Physical Presence” of the Line Impacts Section (See page 23).

## What types of habitat are avoided during the routing of the transmission line?

The best way to avoid negative effects on wildlife habitat is to avoid sensitive sites. Before construction begins, detailed planning takes place to find a route which has the least possible negative impact, and the most potential benefits. Maintenance of species diversity is an important objective in project planning and design. Habitat inventory and analysis is done to map the locations of habitats that are unusual or unique to an area, and those that may be used for trapping, hunting, and domestic, sport or commercial fishing purposes. Consultation with local people is necessary to identify these areas and their importance. However, to minimize cost and design complexity, a transmission line should be as short and straight as possible. Deviations must have reasonable geographical, technical, or environmental justification.

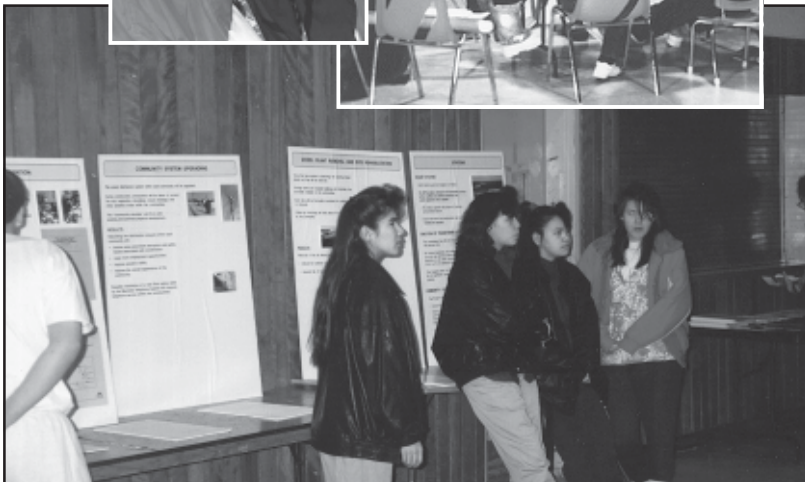
Route planning and construction practices vary greatly between northern and southern Manitoba due to physiographic differences.

Several types of habitat are generally avoided during the siting of transmission lines for both engineering and environmental reasons.

Wetlands are crucial to the survival of many species including waterfowl and furbearers. Shorelands and wetlands are also sensitive to disturbance and are often unstable; they are avoided as much as possible. Habitat critical to the survival of a species on a local or regional basis, habitat with endangered or threatened species, and habitat known to be particularly productive are also avoided wherever possible.

Plant communities that are naturally sparsely vegetated and require a long time for revegetation may also be classified as sensitive. Tundra communities and sand dune communities are slow-growing and vulnerable to disruption. Old-growth forests are less common than younger forests, and they tend to be more susceptible to development impacts.

Recent burns can provide an ideal routing opportunity for a ROW, but old burns (e.g., 20 years old) often provide superior moose habitat. Topographic features such as ridges and hills receive considerable long-term use by wildlife as travel corridors, and are avoided when routing transmission lines, where possible. Special stands of trees also provide important and sometimes unique habitat. For example, mature tamarack bogs provide valuable habitat for great gray owls and small mammals. Stands of mature black spruce greater than 50 hectares in size are old growth forest favoured by pine marten and woodpeckers. These areas are avoided where possible<sup>3</sup>.



*Northern community residents at public meeting*

## What mitigative measures are possible to reduce or avoid negative effects on wildlife habitat?

There are many mitigation measures that can be applied when constructing transmission lines in northern areas. For any proposed transmission line project, the Site Selection and Environmental Assessment studies consider all possible impacts on wildlife habitat, and evaluate these for local conditions. Recommendations for mitigation options are an important part of these studies. Once the route has been selected, further consultation with local people also identifies areas where special management practices may be needed. Selected mitigation measures are written into an “Environmental Protection Plan” (EnvPP) which is a detailed guide for the construction of the transmission line. All recommendations in the EnvPP are strictly adhered to and carried out by Manitoba Hydro and its contractors.

Various generic mitigation measures and habitat enhancement opportunities are possible, depending on the local circumstances. Mitigation measures useful to reduce negative impacts, and in some cases, enhance wildlife habitat include:

- leaving natural vegetation buffers between the line and sensitive wildlife habitats;
- employing construction methods and timing appropriate to the local site (e.g., suspend operations during a sensitive time period such as nest initiation, egg-laying, or calving);
- stabilizing disturbed soil to assist vegetation regrowth and to control erosion;
- planting shrubs or trees for cover (thermal, escape, hiding, etc.) for targeted wildlife species;
- protecting fruit and nut trees and shrubs to increase food production which benefits many wildlife species;
- promoting the regeneration of desirable vegetation;
- seeding former access roads with selected mixtures of forbs, grasses, and shrubs which provide food for many wildlife species;
- retaining dens and roost trees;
- using nesting platforms on transmission line towers to enhance raptor habitat;
- retaining snags and logs; and
- closing access roads when it is necessary to protect a wildlife species during all or part of a year, and when construction is completed.

The use of appropriate construction techniques and avoidance of sensitive areas are the most effective ways to minimize or avoid impacts to the aquatic environment. When temporary access roads are no longer required stream crossings should be removed, and all disturbed areas should be stabilized to prevent continued erosion. Construction material, vegetation, overburden or other material used at the crossing site should be disposed of in an



*Hand clearing vegetation*

approved manner or reused in restoration of stream banks. Stream crossings are constructed and removed in accordance with Recommended Fish Protection Procedures for Stream Crossings in Manitoba<sup>5</sup> and Recommended Buffer Zones for Protecting Fish Resources in Lakes and Streams in Forest Cutting Areas<sup>6</sup>. The publication “Stream Analysis and Fish Habitat Design” by Newbury and Gaboury is used by Manitoba Hydro as a technical reference<sup>7</sup>.

Techniques that are often used to avoid or minimize impacts include:

- scheduling the construction period so it has the least negative impact to the shoreline (clearing in winter months when the ground is frozen reduces rutting);
- maintaining an adequate undisturbed buffer zone of riparian vegetation along streams to provide shade and bank protection. The width of the buffer zone is increased or decreased depending on the size of the crossing, slope of the stream bank, and soil stability;
- hand-clearing vegetation at all sensitive stream crossings and within erosion control zones to minimize soil disturbance;



*Gulfport structure on a stable non-eroding terrain type.*

- eliminating the felling of trees into stream channels or dragging trees along or across channels and not piling slash and debris near a water course;
- burning slash away from water so ash will not enter streams or lakes;
- locating and aligning lines and roads to follow the contours of the land to minimize siltation of streams;
- eliminating or minimizing use of heavy equipment in streambeds to prevent silting of streams;
- using natural or constructed ice bridges for stream crossings;
- minimizing the number of stream crossings;
- keeping construction debris out of streams to reduce siltation of spawning areas and blockages;
- avoiding construction on banks with greater than 10% slope;
- fording streams where the substrate consists of bedrock, boulders or cobble, or some cases constructing rock fill ford crossings;
- not locating transmission line towers within the stream bed or, where possible, within the floodplain of any water body;
- taking immediate actions to control or minimize soil erosion should banks be inadvertently destabilized; and
- strictly adhering to all provincial guidelines, licence and work permit conditions and procedures for stream crossings.

Project specifications, guidelines, licences and permits are obtained prior to commencement of construction. All project participants are required to be familiar with these documents. During construction, senior field authorities of Manitoba Hydro and representatives of Manitoba Natural Resources and Manitoba Environment monitor activities and ensure that all environmental specifications are met.

## What construction factors affect wildlife and habitat?

### Clearing vegetation

Clearing the transmission line ROW changes the vegetation cover for the entire width of the ROW. Widths for ROW generally range between 40 m and 80 m depending on landscape characteristics, the size of the towers, line voltage and clearance requirements. Existing ROWs may also influence the overall width of the complete ROW. Vegetation changes include only the removal of tall trees and shrubs that affect the safety of the line and access to the line. With the exception of a relatively small area around each tower base, lower shrubs, grasses, moss or other herbaceous cover are left undisturbed along the ROW. Since construction usually occurs during winter, snow cover helps to minimize any negative impacts to the lower growing vegetation and the land surface.

No single method of ROW clearing is universally suitable or applicable to an entire ROW. During the planning process, areas along the ROWs may be identified which require specific types of clearing and slash disposal. The size of these areas will vary with topography and adjacent land use. Clearing methods may include total clearing (but only for the width of the ROW), selective clearing, and no clearing.



The way in which the vegetation is cleared can affect wildlife habitat. In peat bogs, wetlands or riparian (river) habitat, and other sensitive areas, trees are selectively hand-cut; this practice reduces or eliminates disturbance to the soil and ground vegetation.

The changes to habitat will also depend on the original vegetation before ROW construction. For example, cutting of black spruce in sphagnum bogs usually causes no change to the forest floor in the first year, but in subsequent years the ground cover changes to a sedge dominated community because of the increased exposure to sunlight. While trees may be slow to grow back, this change in ground cover can create good wildlife habitat. Growth and establishment of shrubby species followed by trees involves a long period of time in northern areas<sup>8</sup>.

Impacts may also occur to vegetation and habitat at the edge of the ROW. When trees are cut from the ROW, shade is removed from the forest, and sun-scald may damage trees on the ROW edge. This is especially true where ROWs follow an east-west course, exposing a north edge to the hot afternoon sun. As a result, sun tolerant trees will become established and persist at the ROW edge. Other plants grow and reproduce vigorously after exposure to full sunlight. Only the plants more sensitive to sunlight may show stress, poor growth and dieback.

Two other related impacts may occur along ROWs. Openings in an otherwise continuous forest canopy may allow winds to fell trees. Windthrow is most common in shallow, organic soils and may increase the area affected by a ROW. This situation is less severe in narrower ROWs and in those parallel to prevailing winds. The second impact, known as dieback, affects trees that had limbs damaged or cut at the edge of the ROW. Dieback, usually resulting from insect or fungal attack on the exposed limb, ranges from affecting only one or two limbs, to tree mortality<sup>9</sup>.

## Crossing water bodies

Impacts on aquatic and riparian habitat may occur when ROW construction crosses streams and rivers. Many fish species depend on shoreline wetlands for resting, spawning, feeding, and as nursery areas. Waterfowl and aquatic furbearers such as beaver also depend on such areas which may support higher population densities than other habitats.



*Natural buffer zone in the riparian zone of a river.*



*Buffer zone left on a right-of-way to protect a river valley.*

During the construction of a transmission line, crossing waterbodies can result in disturbance of the shoreline, which leads to erosion. Although construction practices are designed to prevent this, inadvertent damage to shoreline habitat could occur through excessive removal of vegetation, inadequate drainage control, and soil destabilization. Nearshore and shoreline habitats are the areas most likely to be affected during construction. The susceptibility of a shoreline to erosion varies with the type and amount of vegetation present, slope, soil texture, water flow regime, and weather conditions during construction.

Streamside or riparian vegetation helps regulate water temperature by shading the water from the sun. Those streams most sensitive to exposure to sunlight are generally shallow and wide with small tributaries, little groundwater inflow, and resident populations of cold water fishes. Clear, shallow, slow-moving streams with stable sand or silt bottoms are most likely to develop extensive plant beds if ROW stream crossings increase their exposure to sunlight. Unless it is extremely dense, this increased plant growth will usually benefit a stream's fish population<sup>10</sup> although it may not benefit all species.

If erosion is allowed to occur where a ROW crosses a stream, the soil particles will enter the waterbody. This process, known as sediment loading, creates murky water, decreases feeding efficiency for sight-feeding fish such as trout, and reduces the production of insects and micro-organisms. It may cover spawning beds, and indirectly reduces the oxygen content in spawning areas resulting in higher egg mortality and decreased spawning success. Foreign soil particles can also influence water chemistry (pH, temperature, and salinity), creating chemical imbalances which could have a negative impact on aquatic life<sup>11</sup>.



To the extent possible, buffer zones are maintained between construction areas and natural waterbodies. Any modifications to recommended buffer zones are made only with the consent of a Natural Resource Officer. Construction practices ensure that:

- machine clearing is not allowed within a minimum of 15 m of the high water mark,
- trees are not felled into streams,
- trees on the immediate bank, except those overhanging the stream, are hand cleared,
- slash is not left in buffer zone within 15 m of the high water mark, and
- all slash landing in the stream is removed by hand.

### Disposal of cleared vegetation

Disposal of brush and slash cleared from the transmission line ROW can affect wildlife habitat. There are four basic methods of dealing with the slash: burning, piling, chipping and leaving it where it falls. Chipping has minimal effect on wildlife habitat. Burning, leaving slash where it falls, and piling can have either a positive or negative influence on the plants that grow later and the wildlife that use them.

If the brush is burned during the wrong time of the year, there can be an increased risk of forest fire. However, as burning

occurs only under the conditions of a Natural Resources Permit, the potential for forest fire is eliminated. Generally the burning of slash piles along the ROW provides excellent growth conditions for many plant species. For example, deciduous shrubs favoured by moose may grow. Piles larger than 5 m long and 2 m high, or slash left scattered along the ROW can create a barrier to vehicle, moose and deer movement, but will also attract insects, songbirds, upland game birds, small mammals, rabbits, raccoons and foxes. Piling slash on the downslope of natural depressions and gullies also has the benefit of preventing soil erosion and sedimentation, while producing valuable forest humus<sup>12</sup>.

To summarize, during construction of the transmission line ROW, wildlife habitat can be affected in both positive and negative ways. The exact nature of the impact depends on many factors, but the change is generally beneficial for most species of terrestrial wildlife because clearing the ROW allows grasses and herbs to grow in the cut areas creating a beneficial habitat type which many different species use. Careful disposal of slash generally benefits terrestrial animals. Fording waterbodies with heavy equipment and clearing shoreline vegetation can result in erosion of the shoreline, although mitigation measures are used extensively to reduce these impacts. The magnitude of both positive and negative habitat impacts depends on how adaptable a species is to environmental change. Environmental information is incorporated into the construction specifications of all transmission line projects to minimize these impacts. Careful environmental protection planning and use of mitigation measures will reduce or eliminate most potential negative impacts<sup>13</sup>.



*Slash is piled and burned during construction to avoid future forest fire hazards.*

## Waste and chemicals

Garbage, if left on the construction site, could potentially hurt wildlife.

Confrontations between people and wildlife (though often not of a serious nature) may occur if wildlife such as foxes or wolves are attracted to construction camps as a result of improperly stored garbage. Mitigation techniques used to minimize such impacts can include daily burning, burial or complete removal of refuse to a designated disposal area. In general, open burning of refuse is prohibited unless permits have been granted by the appropriate regulatory agencies. Burning of some types of refuse, eg., plastics, can result in hazardous emissions.



*Construction Camp*

An accidental spill of oils, chemicals, fuels and lubricants during construction along the ROW could result in potential damage to waterbodies and landforms. Different types of contaminants are capable of producing sub-lethal and lethal effects to aquatic wildlife. Spills can result in fish tainting and, in extreme cases, direct fish mortality.

Mitigation measures are applied (refer to Appendix C – Manitoba Hydro Transmission Line Construction Practices) to reduce the probability of an accidental spill or leak. All fuels, oils and lubricants are stored in dedicated areas at work camps and marshaling yards at a safe distance from sensitive features. Equipment such as double walled tanks, containment dyking, emergency response plans and trained personnel significantly reduce the probability of spills and facilitate prompt and effective responses to contain and clean-up spilled materials, thus reducing the severity of impacts when spills do occur. All waste oils and lubricants are stored in appropriate containers and removed from the project areas as required under applicable Manitoba environmental legislation. Avoidance of valued and sensitive areas, well trained and skilled operators, and good prevention and clean-up technology reduce any impacts from accidental spills of oils, chemicals, fuels and lubricants. Manitoba Hydro is currently investigating the safe management of fuel caches in many northern locations.

## **Borrow pits and roads**

To construct a transmission line, borrow pits and access trails are often needed. Borrow pits are extraction sites which provide gravel for use as fill for road construction or support for the tower bases. These pits are small in size compared to the



*Borrow pit for construction*

transmission line ROW, but they may cause minor localized habitat loss. This may be short term, however. When the pit is cleaned up, and the surface materials replaced, the slope is graded to allow for the re-establishment of vegetation, eventually returning the site to potential wildlife habitat. Shallow or deep water in the pit will promote the growth of vegetation in and near the water. Aquatic furbearers and waterfowl may find this to be desirable habitat<sup>14</sup>.

Access roads and trails to the construction area remove some wildlife habitat. These roads may lead to other problems such as increased access, which also may be more detrimental to wildlife populations. Increased access is discussed in the Physical Presence of the Line Impacts Section (See page 23).

## What type of disturbances do wildlife experience during the construction phase?

The most obvious source of wildlife disturbance is created by the machinery used to clear the ROW and to construct the power line. Disturbances may take the form of noise and exhaust fumes. Movement of people and vehicles also constitutes disturbance to wildlife, and local wildlife may be temporarily displaced. Other small, localized impacts could be expected from the presence of the construction and work camps, including the presence of garbage and stored materials. Each of these issues is discussed briefly below.



*Construction noise is short term.*

Engine noise of tracked and large-wheeled vehicles and from helicopters will disturb animals and birds and tend to keep them away from the construction area thus temporarily reducing the habitat space available. This could become critical if construction takes place during the reproduction season because habitat requirements at this time are often very specific. For example, noise may cause the abandonment of dens or nests. Such sites are generally identified during the environmental impact assessment study process.

The time of year and distance from the source of disturbance are also very important in determining the magnitude of impacts. Transmission line construction in northern Manitoba usually takes place during the winter months while the ground is frozen. Birds such as bald eagles, for example, would not be disturbed because they are not present during the winter season. Resident species, like some owls, initiate nests in early spring while snow is on the ground. Construction will not affect breeding and nesting owls if these activities occur more than two km away from the breeding/nesting area. While most mammals do not bear their young during winter months, special precautions may be necessary near denning/nesting sites when late spring construction takes place.

## How are furbearing animals affected during construction?

Routing power lines through registered trapline areas may disrupt both furbearers and trappers. Species that are trapped for fur, food and income, in general, respond similarly to disturbance as any other species of wildlife. However, some furbearing animals will not be affected at all by winter ROW and transmission line construction. Aquatic furbearers such as beaver and muskrat will not leave their preferred area unless bank dens, lodges or push-ups are accidentally damaged. This is unlikely to occur. Terrestrial furbearing animals may temporarily leave the area while construc-

tion activity occurs and this would result in temporarily decreased productivity on the traplines. These animals will normally return to the area after construction of the line has been completed.

Mitigation could take the form of compensation paid to affected trappers for loss of income during construction of the ROW. However, the loss of income for those trappers and traplines affected by construction activities are considered on a project by project basis through the SSEA process.



# Line Maintenance Impacts

Line maintenance activities include regular inspection, repair of the line, and the management of vegetation along the ROW. Access to the line is gained by ground (mainly bombardier) or air (primarily helicopter). Vegetation management is directed towards (i) removing trees which may threaten the security of the system by growing into or falling onto power lines and (ii) control of fast growing shrubs which impede access by ground or air. Control methods include machine cutting, selective hand-cutting, burning, mowing or selective herbicide application.

## What type of disturbances do wildlife experience during ROW maintenance?



*Aerial inspection of transmission lines*



Inspection and maintenance of the transmission line and ROW are conducted by either tracked vehicles or helicopter. Disturbances to wildlife as a result of noise produced by equipment or the presence of maintenance workers are infrequent, and generally neither significant nor long-term. Unfamiliar noise tends to keep animals (mainly birds and large mammals) away from the immediate area during the maintenance period. The effect of disturbances on wildlife depends on many factors, such as the species involved, the time of day, and time of year.

These effects may also be influenced by the nature and scope of the maintenance activities undertaken. Use of aircraft may frighten birds, causing them to leave nests and fly into transmission lines. In one incident in Manitoba, a light aircraft caused a flock of snow geese feeding on a field to take flight. Some of the geese were killed or injured when they struck transmission lines at the edge of a field<sup>15</sup>. This type of occurrence is very rare. In most northern situations, birds are not concentrated in large numbers adjacent to transmission lines.

## What effects do vegetation management methods have on habitats?

Manitoba Hydro manages vegetation along ROWs using mechanical methods or selective herbicides. Control methods are chosen depending on local circumstances, with the aim of minimizing impact on the surrounding environment. For example, herbicides are rarely used in northern boreal forests, and only on a special case basis, because slow-growing forms of vegetation in northern communities usually develop stable plant communities which need little maintenance. If vegetation management is needed, it is usually applied by a mechanical method. In some areas, tree species that grow quickly and reach a considerable height, such as poplar and aspen, may cause problems requiring mechanical or chemical

treatments. Hand cutting or selective herbicide applications may be made to individual trees, depending upon the circumstances.

During construction, ROW's are cleared mechanically and by hand-cutting. Subsequent maintenance will depend on the type of vegetation, its rate of growth, and the sensitivity of the site. Vegetation maintenance techniques include mowing, selective removal of plants by hand-cutting, selective trimming of limbs, or V-blading in winter. Herbicide spraying for problem tree species can be either selective spraying or broadcast foliar spraying, depending on tree densities. Selective spraying of herbicides is becoming more common. It is directed at taller tree species such as poplar. Shorter species such as willow are left to grow<sup>16</sup>.



*River valleys are crossed without disturbance. Structures are not located in critical riparian habitats.*



*Vegetation maintenance by hand-cutting*

To use herbicides, Manitoba Hydro must obtain a provincial permit, and must inform local people in advance. No herbicides are used on Reserve land unless the Band Council gives its permission. Herbicides are always applied by trained and licensed applicators.

Regardless of the method used, vegetation management affects wildlife habitat by changing the plant community. This impact, however, is less than that caused through the construction phase, and in fact may be beneficial. Studies concerning transmission line ROWs and wildlife have shown that following selective maintenance, habitat is improved and a greater diversity of wildlife species are present on the ROWs.

There are some examples where herbicide use has resulted in positive impacts to wildlife. Studies in New York showed that repeated broadcast spraying of herbicides allowed grasses, sedges, ferns and a few herbicide resistant herbs and woody plants to form the major community along the ROW. Selective spraying allowed a gradual increase in woody vegetation and allowed broad-leaved herbaceous plants to become established and persist. These low growing herbs, grasses and shrubs have a very high value to wildlife<sup>17</sup>. A long-term study of a ROW in Pennsylvania has shown that vegetation management has created a stable plant cover that is resistant to invasion by tall trees and provides high value plant food and cover to native animals<sup>18</sup>. The long-term effect of the ROW on habitat is discussed further in the section Physical Presence of the Line Impacts.

Access to structures is needed for inspection and maintenance purposes. On occasion, minor disturbances to terrain may result from tracked vehicles. Stream crossings are particularly sensitive to movement of equipment. By applying strict construction, maintenance and environmental protection practices, many potential impacts are reduced or eliminated.

To summarize, vegetation management techniques include both mechanical and chemical treatments. Mechanical treatments such as selective hand-cutting or “V” blading during winter are the most common types of vegetation maintenance in northern Manitoba. Herbicides may be used selectively in northern boreal forests, but only on a special case basis. All forms of vegetation management modifies wildlife habitat by producing stable, low-growing vegetation. These plants often benefit wildlife by providing food and cover.



# Physical Presence of the Line Impacts

Transmission lines and their physical presence on the landscape may also affect wildlife. These potential impacts include long-term habitat considerations, bird strikes, access issues, noise effects and associated avoidance behaviour, and electric and magnetic fields. Each of these topics is discussed below.

## What are the long-term effects of the ROW on wildlife habitat?

Vegetation change will affect wildlife in the area near the ROW. For some animals the impacts will be negative, through the loss of important habitat (those species which primarily use mature trees for cover and food), while for others, the changes in vegetation will be beneficial. The actual nature and extent of impacts on wildlife habitat depend on numerous factors, including construction methods, the type and amount of vegetation removed during construction, and the type of wildlife in the area. The following paragraphs review the possible effects that the strip of altered habitat may have in the long-term.

Individual ROWs are not associated with substantial habitat change. In 1992, a Manitoba plant community development study<sup>19</sup> revealed that the plant community in the transmission line ROW was more

abundant and richer (more plant species present) than the adjacent forested area. The plant community diversity of ROW vegetation was as diverse as that of the forest. This study also showed that upland game birds, some song birds, small mammals, rodents, deer and moose fed more often in the ROW than in the adjacent forest areas.

In Manitoba, ROWs provide many big game hunting opportunities in designated hunting areas throughout the province. This recreational use of ROWs is a useful spin-off benefit for many hunters.

Twenty-two ROW studies conducted in New York showed that ROWs were commonly used by numerous song birds, hawks, and eagles. Local game species commonly found along those ROWs included white-tailed deer, ruffed grouse, woodcock, wild turkey, cottontail rabbit, varying hare, woodchuck, gray squirrel, and raccoon. Deer used the ROWs in all but two of the 22 sites. Common shrubs on the ROWs were heavily utilized by deer as woody browse, an important winter food. More browse was available on the ROWs and their edges than in the adjacent forests.

The most significant factor related to ROWs is the potential and actual increase in wildlife habitat that is produced. Studies in the United States showed that several bird species became established because of the ROW opening. They would not have been present if the opening were not there to provide perching, feeding, and nesting sites, or the appropriate escape cover along the edge of the ROW<sup>20</sup>.



*Transmission line in Northern Boreal Forest*

Two key concepts are associated with the long-term presence of transmission line ROWs in wildlife habitat: the “edge effect” and “habitat fragmentation.” ROWs create what is called an “edge effect”. Edge refers to the border between different plant communities or habitat types, and it is regarded as an important component of wildlife habitat. ROWs, especially through unbroken boreal forested areas in northern Manitoba, create a mixture of habitats, allowing greater numbers and kinds of wildlife to be present. The new edge of the ROWs stimulates the growth of grasses and shrubs, which provides food for many animals<sup>21</sup>.

Habitat fragmentation is a concept which refers to plant communities that have become divided or isolated as a result of man’s or nature’s interventions. Larger areas of habitat usually contain more species, and more breeding pairs, and they persist longer. Small, isolated patches of habitat contain fewer species, fewer breeding pairs, and the animal population may die out<sup>22</sup>. Often, too much edge habitat is created by habitat fragmentation. Although



no current example of habitat fragmentation in boreal forests is documented, examples in other environments have been described. For instance, as tall grass prairie areas became fragmented by agriculture, roadways, towns etc., the animals which lived there gradually became restricted to small patches of land. Natural species dynamics quickly dictated the ‘winners’ and ‘losers’, resulting in some species disappearing from the local landscape. A dramatic example of this population shift is demonstrated by the mule deer, which is extirpated from the Manitoba agricultural landscape.

Individual transmission line projects may fragment the landscape by dividing wildlife habitats, by making each habitat unit slightly smaller, and by creating a negative edge effect. This concept especially applies to forested areas where habitat change (forest to grassland) may negatively impact some species (e.g., black-and-white warbler) which cannot tolerate edges. Other species invade these edges (e.g., brown-headed cowbirds) further reducing the remaining habitat available for edge intolerant species. If the original landscape has already been fragmented by other activities such as agriculture or forestry practices, an individual transmission line usually does not increase habitat fragmentation<sup>23</sup>.

To summarize, the physical presence of the transmission line ROW can create better wildlife habitat for some species in the long-term. The number and kinds of animals often remain the same or increase in response to the new mixture of habitats. Transmission lines may also contribute to habitat fragmentation and produce a negative edge effect for some species, reducing the total area available for them to live.

## Do the ROWs form a barrier to the movement of animals?

The vulnerability of each species to habitat change is also directly related to its ability to adapt to changes in habitat. Few animals find the ROW to be a barrier. ROWs may displace or impede movements of birds and mammals that inhabit small territories or home ranges in mature forest stands (e.g., Gapper's red-backed vole, northern bog lemming). Studies in northern Canada observed only one quarter as many red-backed voles on seismic cutlines as were taken from adjacent undisturbed forest cover. Snowshoe hares, pine marten and red squirrels also tended to avoid cutlines<sup>24</sup>



Narrow linear clearings do not act as barriers to movements of wide-ranging species such as moose, wolf, and black bear. Species that inhabit or use shrublands, forest regeneration areas or old burns will likely take advantage of ROWs. Herbivores (animals that eat plants) like willow ptarmigan, ruffed grouse and moose frequently feed and travel on ROWs, while carnivores such as wolf, lynx and red fox use ROWs for traveling and hunting herbivores using the ROW or the ROW edge.

During winter, a ROW may create a tunneling effect when it passes through dense forest. This results in an accumulation of drifting snow. Depending on the time of year, time needed to compact the snow, and the type of animal moving in the ROW, snow-drifting can have a small negative effect on the movement of animals. In a positive way, it may create better thermal cover for small mammals that tunnel and burrow under the snow.

Small animals avoid using the ROW itself, but instead concentrate along the edge. Birds, furbearing mammals, and ungulates (e.g., moose, deer) are commonly seen feeding and travelling along the ROWs.

## Do transmission lines cause bird mortality?

Bird mortality from collisions with lines or electrocution can be thought of in two different ways; biological significance and societal acceptability.

A biologically significant impact is one which results in a measurable change, for example in population size. In this respect, the impact of wire strike mortality on bird populations can be judged biologically significant only if it exceeds the capability of the population to compensate for losses, and results in measurable population decline.

The issue of bird strikes may be significant in another respect – societal perception.

A strongly negative public response can occur as the result of the deaths of only a few birds, and therefore, mitigation methods should be adopted to minimize this potentially harmful situation.

A partial list of factors which influence bird collisions with transmission lines are shown in Table 1. Data on bird mortality from transmission lines is difficult to obtain and often incomplete when available<sup>25</sup>.

Consequently, studies likely underestimate actual numbers. In 1981, one researcher estimated a total of 1 bird death per 100 kms of distribution lines in Canada<sup>26</sup>. Other studies in North America and Europe characterized bird mortality on power lines as an annual loss of 1 bird/km<sup>27</sup>. Bird losses due to collisions with overhead wires may total 800,000 to 1,250,000 birds annually in the United States<sup>28</sup>. In Manitoba, one study suggested that distribution utilities caused 100 to 115 bird deaths per year<sup>29</sup>.

Collisions with wires have been recognized as a cause of waterfowl mortality, which is largely unnoticed and unreported. A study

**Table 1. Factors which may determine the number of bird collisions expected with a transmission line.**

<b>General Category</b>	<b>Factor</b>	<b>Suspected High Collision Risk Situation</b>
<b>Bird biology</b>	Species	Nocturnal fliers and those with awkward flight characteristics
	Age	Immature birds
	Health	Sick or injured birds
	Migration	Migrants as opposed to residents
	Sex	Birds involved in nuptial displays
<b>Flight</b>	Flight intensity	Large numbers crossing ROWs
	Altitude	Lower than uppermost wires
	Size of flocks	Large flock with small spacing between birds
	Time of flight	Nocturnal or diurnal flights during inclement weather
<b>Transmission line</b>	Tower type	Guyed structures, tall towers at river crossing
	Voltage	Lower voltage line
	Conductor	Small diameter single conductor
	Number of lines	Double circuit lines with wires at different heights
	Overhead ground	Multiple wires with small diameter
	Line length	Long line running through high use area
	Age of line	Newly constructed lines before birds can habituate to it
	Aircraft warning lights	Non-flashing lights on towers in established flyways
<b>Environment</b>	Weather	Fog, snow, rain, sleet, high winds
	Habitat	Attractive habitat on or surrounding ROW
	Human activity	Hunting, other activities which startle birds
	Location	Lines located perpendicular to narrow, low altitude flyways

in Manitoba estimated that up to 50 waterfowl per year were killed by impact with transmission lines, and up to 20 birds per year were electrocuted. This appeared to be related to preferred habitats of specific groups of birds. The time of year, time of day, and bird behaviour were thought to influence the incidence of collision, with the majority of strikes occurring during spring and fall migration. Hawks, owls, crows, partridges, sharp-tailed grouse, and herons were specified for bird-wire collisions. Hawks and eagles accounted for 22% of the mortality listings, most of which occurred on distribution lines<sup>30</sup>.

In Manitoba, data collected by the Manitoba Wildlife Rehabilitation Organization (MWRO) from 1989 – 1992 indicate that over this four year period, transmission line collisions accounted for 2.5% (49 cases) of all bird injuries brought to the organization. Distinctions were not made between transmission line, distribution line or telephone line collision injuries. Birds of prey accounted for 40% of the collisions. Volunteers with MWRO successfully rehabilitated and released about 15% of all these

cases. Manitoba Hydro supports the work of MWRO through the Environmental Partnership Fund.

Bird mortality from transmission and distribution lines can be compared to mortality from other sources. A waterfowl mortality study conducted over several years in the United States reported that of the total non-hunting related deaths, 89% were accounted for by diseases and poisoning. Botulism is a key source of poisoning in waterfowl, however, the loss of birds wounded by lead-shot can be significant. Weather accounted for 7.5%, predation, pollution and other miscellaneous factors accounted for an additional 3.6% of all deaths reported. Only 0.1% of waterfowl deaths were caused by collisions; of this figure 0.065% of the deaths were caused by wire strikes with telephone and power line wires, and the remaining 0.035% were attributed to collisions with automobiles, television and radio towers, aircraft, fences, buildings and other objects. The study concluded that while collisions may be significant locally, on a regional basis, they account for very little of the waterfowl deaths<sup>31</sup>.



Photo courtesy: Robert R. Taylor

*Great Gray owls on a distribution line during winter.*

In addition to collisions, bird mortality may occur through electrocution. Power failures often result from birds of prey, especially snowy owls, making contact with a live wire and ground wire at the same time, resulting in electrocution. Data from the MWRO shows that less than 1% of all cases brought to the organization resulted from electrical injuries. Six of these eight cases between 1989 and 1992 involved birds of prey. Although data is not available to distinguish between electrical injuries resulting from transmission or distribution lines, research has shown that electrocution of birds rarely occurs on high voltage transmission lines because conductors are far enough apart to prevent simultaneous contact of the bird's extremities with adjacent conductors or contact from a conductor to a ground. Manitoba Hydro is investigating a number of mitigation measures to alleviate this ongoing seasonal problem.

## What can be done to reduce mortality from bird strikes?

Avoidance of critical areas of bird concentrations is the most effective mitigation. During the planning stage it is important to identify ecologically sensitive areas such as staging areas for waterfowl, so they can be inventoried to establish the degree of sensitivity, and if necessary, avoided.

Possible methods as described in the literature, for reducing bird strikes include<sup>32</sup>:

- Following existing utility clearings and ROWs;
- Scheduling construction activities during periods of least impact to wildlife (e.g., avoid nesting season);
- Setting up buffer zones between the transmission line and areas of ecological importance to reduce disturbance, and divert birds over or away from the transmission line;
- Placing the power line, parallel rather than perpendicular to predominant lines of flight may be an option depending upon the circumstances involved;
- Following natural and existing barriers. Lines should be set as near as possible to backgrounds such as hills, cliffs, or buildings (within clearance specifications). This provides birds with a “massing” of objects, and additional reason to fly higher, thus avoiding the line;

- Creating areas of alternate habitat so birds will be drawn away from the line;
- Locating conductors parallel to prevailing winds;
- Limiting the use of guy wires which pose an additional hazard to birds;
- Tying 15 cm long black tape at 2 m intervals on the line, as shown by one study; and
- Adding coloured aviation balls to increase the visibility of the line.

Although little information is available on the effectiveness of incorporating buffer zones and other designs into a project to reduce bird-wire strikes, two U.S. studies did show that marking powerlines (fastening yellow aviation balls onto the static wires of alternating spans) significantly affects bird behaviour and reduces the number of collisions<sup>33</sup>. Use of coloured aviation balls in high bird traffic or movement corridors is a proven option to reduce mortality from bird-powerline strikes.

Recent information from ongoing bird vision studies indicates that birds see in a vastly different colour spectrum than human eyes. The practical application of these study results may lead to colourized transmission line structures as a new mitigation measure to help avoid bird strikes.

## Do birds use the structures?

The utilization of transmission lines by birds is probably biologically significant in that the lines create new habitats or enhance marginal habitats by providing additional breeding and roosting sites, and hunting and feeding perches<sup>34</sup>. In Canada, thousands of birds of dozens of species nest on utility distribution and transmission structures. Several studies have shown that transmission line towers in agricultural and grassland areas that lack nesting substrate, present the only nesting habitat for birds of prey<sup>35</sup>.

Some species make extensive use of transmission lines in boreal areas. Ospreys in eastern Canada frequently use hydro transmission line towers as perch sites. In Manitoba, ospreys, bald eagles, hawks and ravens are known to nest on transmission line towers. In some areas of the province, there have been reports of one osprey pair/300 kms of line. Eagles are more prominent nesters on northern transmission lines than ospreys. Hundreds of eagles and ospreys nest on Manitoba lines each year<sup>36</sup>. Other species such as pileated and other

woodpeckers, and secondary cavity nesters like American kestrel, wood duck, and in some instances, northern flying squirrels, frequently use wooden hydro poles as homes<sup>37</sup>.

Some nests on transmission lines may create a potential electrical hazard when nests are built on wires and insulators. These nests are usually removed. Eggs or young birds could be injured or killed if this were done in spring or summer. U.S. studies indicate that about only 3% of the nests were built directly above insulator strings on steel lattice towers. Mitigation techniques are available to minimize this



*Osprey nest at Grand Beach Distribution Station, near Grand Beach Provincial Park.*

problem, including the construction of artificial platforms and avian tower defenses below insulators, the removal of nests prior to egg-laying, or careful transplanting of the nest, eggs or young to nearby trees or platforms<sup>38</sup>.

A field survey of ospreys nesting on wood poles in the Waterhen and Mossey River areas of Manitoba showed that Manitoba Hydro Engineering and Construction staff have developed an interesting and effective approach to this problem. An osprey nest with three eggs had been built over an energized conductor on a 25 kilovolt line crossing the Waterhen River. The nest was in imminent danger of shorting out the line and injuring the birds. Manitoba Hydro staff responded by erecting an artificial nesting platform and cross arm well above the conductors, bolting it in place, and transferring the nest and eggs to the new platform. The ospreys accepted the new location and successfully reared the young. Within the same region, Manitoba Hydro staff have erected alternative wood pole nest sites, left decommissioned poles, and redesigned other “osprey-friendly” nesting structures for transmission and distribution lines<sup>39</sup>.

## What will be the effect of trapper access to wildlife populations?

Access along a transmission line depends on the “remoteness” of the transmission lines to a community, the number of traplines crossed by the line, the total number of trappers concentrated in an area, and the availability of other travel corridors. In such areas, direct road access to a transmission line ROW is generally difficult if not impossible. In some areas the ROW will benefit trappers by providing them with the opportunity for easier winter access to a trapline. Remote access from a new ROW may even allow some trappers to gain access to previously inaccessible wildlife populations.

The “edge effect” of shrubs and successional plants along the ROW will provide new habitat for hares and other small mammals, which in turn will attract predators (furbearers) and improve the potential for increased production of wildlife. The total production of animals and available harvest opportunities for different species however, depend on the quality and quantity of wildlife habitat crossed by the transmission line ROW and the total number of trappers using the ROW.



Photos courtesy: Manitoba Department Natural Resources

*Increased access assists trapping success.*



## Will the transmission line cause an increase in hunting and fishing access and harvest pressure?

Construction during the winter months can conflict with hunting seasons (e.g., moose). During construction of the ROW, hunting access may increase while winter roads are usable. The increase in hunting pressure from increased access, and its effect on wildlife, is directly dependent on the density of harvestable species in the area, and on the number of hunters which take advantage of this temporary new access. These effects will be short-term because winter roads are not passable in thaw conditions. Natural terrain conditions may also create access barriers.



*Buffer zone parallel to river preserves both river aesthetics and riverbank*

Over the long-term, the ROW will provide winter access and limited summer access depending on the type of terrain the ROW crosses. An increase in hunting may occur due to the presence of a transmission line. Long-term access could have a small, local negative effect on animal populations. For example, birds of prey such as eagles are more vulnerable to increased harassment and persecution along some accessible ROWs.

Many navigable waterways have access points, and a stream or river could be fished along its length regardless of a new access point created by the line. New transmission lines could increase access, however, in previously inaccessible fishing areas. Potential for increased access could increase the domestic, sport, or commercial harvest of fish. Special access concerns have been noted for some hydroelectric generating projects, but not for transmission line projects in northern Manitoba.

Mitigation can involve additional efforts by Natural Resource Officers to patrol access roads or ROWs during the hunting season to monitor hunting pressure. Other measures that might be applied include education of the work crew before the start of construction, imposing firearms restrictions within work camps, road closures, hunting season changes, and co-operative agreements to manage wildlife and hunting near ROWs.

## Do transmission lines make noise that disturbs wildlife?

Transmission line noise may be distinguished as three types:

1. 120 Hz AC hum;
2. Corona discharge;
3. Wind hum from wires and structures.

The level of noise emitted by transmission lines depends on the size of the conductor, voltage, conductor configuration, and on environmental conditions such as weather. For example, on a calm, dry sunny day, the average level of noise along the transmission line is about as loud as whispering. On a windy day, you might also hear the sound of wind blowing through the wires<sup>40</sup>. Under high humidity conditions the static noise is greater than in dry weather.

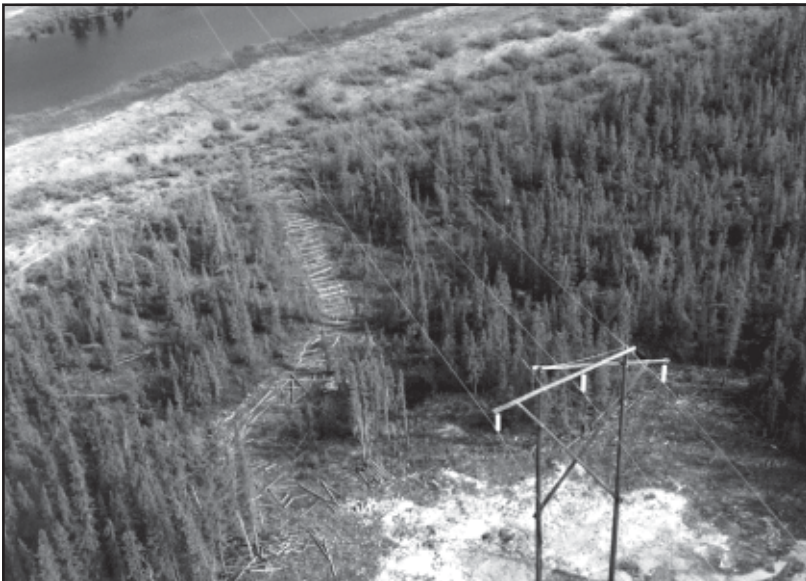
Only a limited amount of research has been published over the past twenty years reporting observations of the effects of noise from transmission lines on wildlife. Not all wildlife species are sensitive to the low hum of power lines that is most noticeable to humans. We know, for example, that hundreds of bird species appear to be

unaffected by transmission line noise because they actively perch, roost, and nest near or on the lines and towers. It is also known that different animals have different sensitivities to sound, many of which are not able to be heard by people.

Studies done in Norway showed that reindeer, most of which are domesticated and herded rather than being wild, were disturbed by newly constructed power lines. Herders reported that the reindeer were more difficult to herd and showed signs of stress, particularly in wet conditions when the lines emitted sudden (corona discharge) sounds. The animals appeared reluctant to cross under the lines, particularly during the first year or two after construction. It is not known whether this reluctance is due to noise, the foreign nature of the new ROW and lines in otherwise familiar surroundings, reduction in the growth of reindeer forage within the ROW, differences in snow conditions, or for other reasons<sup>41</sup>.

One United States researcher found that the highest noise levels measured did not deter elk, deer and several other species from crossing or foraging on cleared ROW in a manner consistent with their use of other forest clearings. In other studies, certain insects seem to be attracted to the noise of electrical equipment; this in turn, may increase the activity of insect eating birds and mammals along ROWs. In the United States, a number of studies showed no conclusive reactions to power line noise among bear, jackrabbits, deer, coyotes, and elk. Overall, it appears unlikely that line noise results in any significant effects to wild or domestic animals<sup>42</sup>.

From a Canadian perspective, various Canadian utility studies in progress using Global Positioning System (GPS) collars will provide much new data on this subject in the near future.



*Wildlife corridors and buffer zones are left to allow wildlife to cross rights of way; they help mitigate potential sensitivity to noise.*

## What are the effects of electric and magnetic fields on wildlife?

Electric and magnetic fields (EMF) are invisible fields of energy arising from the flow and use of electrical energy. EMF are a combination of both electric and magnetic fields. An example of an electric field is static cling on clothing. An example of a magnetic field is the pull of a magnet.

Both electric and magnetic fields are present near transmission lines. Electric field strength is highest immediately next to the conductors of high voltage transmission lines. The strength of the field drops off rapidly with increasing distance from the centre of the conductor. Magnetic fields also decrease rapidly in strength with increasing distance away from the conductor<sup>43</sup>.

There have been many laboratory and field studies on the effects of EMF on people. There have been some studies on the effects of EMF on plants and animals. It is also known that biological organisms are sensitive to certain kinds of electrical stimuli. In some of the studies, biological

changes have been noted that may be attributable to EMF but the results to date are inconclusive.

The following are examples of how EMF may affect wildlife<sup>44</sup>:

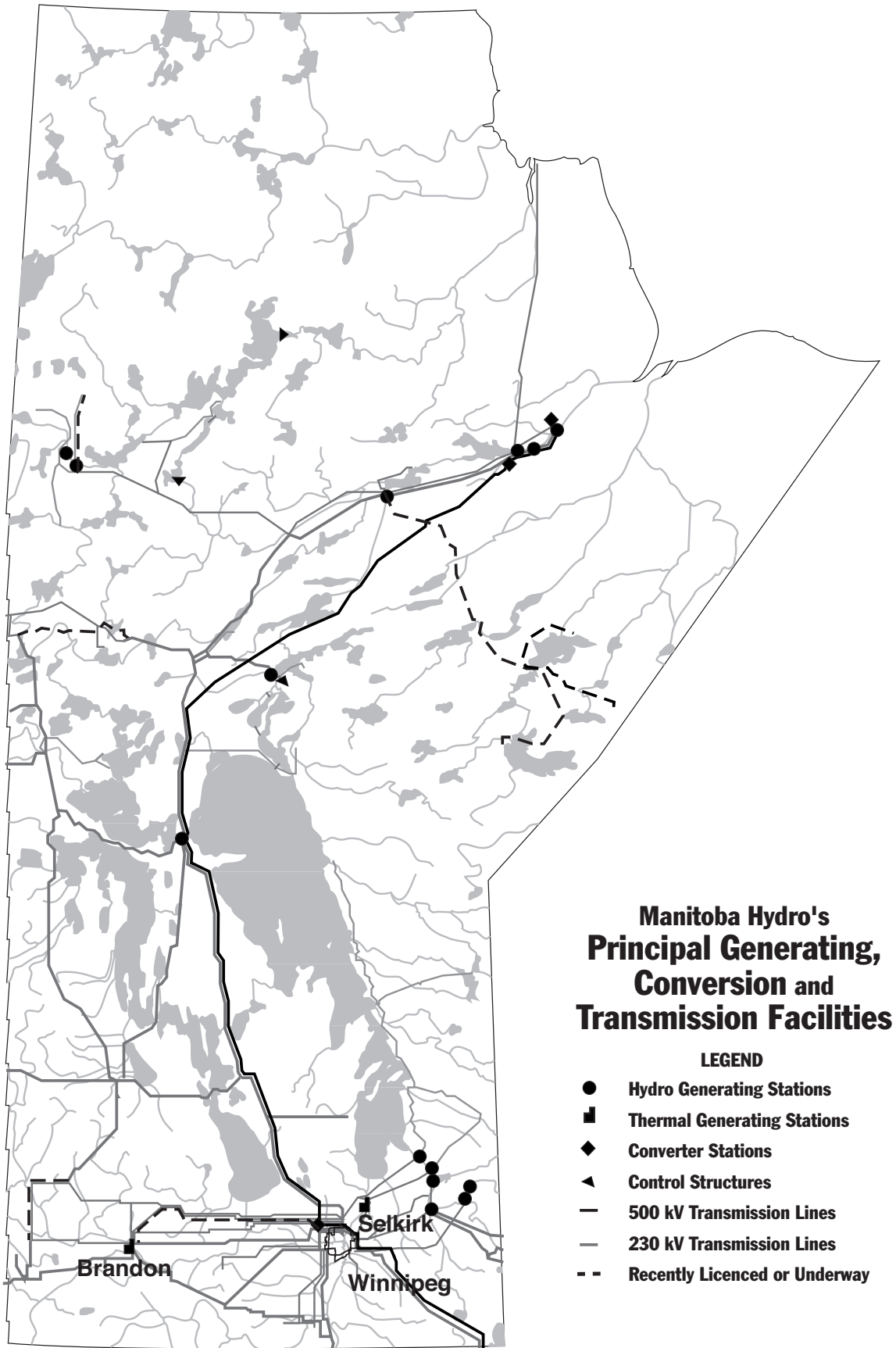
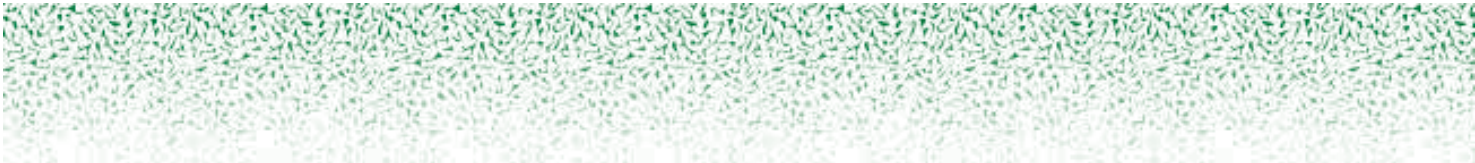
- Studies have shown that strong EMFs can cause subtle biological effects, such as blunting of leaf tips; this effect is similar to that which results from plants getting too much sunlight.
- Electric and magnetic fields from transmission lines are not strong enough to be perceived by fish, thus it is unlikely that EMF will affect their behaviour.
- Studies on bees suggest that the bees had lower productivity under electric fields.
- Studies on birds of prey nesting on transmission line towers did not indicate that EMF effects had depressed raptor and raven productivity, but more studies were recommended to determine if long-term effects exist.
- Other studies on birds showed that various electrical fields may cause minor effects in orientation for pigeons and migrating birds. Their flight orientation changed slightly when they were close to the energized source.

The majority of laboratory and field studies show that EMF along transmission lines does not affect plants or animals to any significant degree, although some scientists suggest that more field studies are needed.

While sensitive to public concerns regarding possible health effects from EMF, Manitoba Hydro believes there is at present no scientific evidence to justify modification of existing practices or facilities for the generation, transmission, and distribution of electricity.



*Global research continues on the potential EMF effects on humans and wildlife.*



# Summary

In recent years, wildlife habitat in Manitoba has been decreasing because of industrial development, urban and rural expansion, and very intensive agricultural methods. Transmission line rights-of-way (ROW) however, are a land use that has potential for benefiting wildlife and habitat. By incorporating sound management strategies into existing construction and maintenance practices, Manitoba Hydro can sustain or enhance wildlife habitat and continue to meet electric transmission reliability requirements.

This document examined both the positive and negative potential effects which transmission lines can have on wildlife or its habitat. It reviewed studies of the construction and operation of transmission lines and their ROWs primarily in the northern forests of Canada and the United States, and gives examples of situations that exist for northern Manitoba transmission lines.

Wildlife habitat is considered in the initial stages of planning a transmission line route. A comprehensive Site Selection and Environmental Assessment (SSEA) study is undertaken prior to acquiring environmental approval, construction and operation of a proposed transmission line. One important component of the study is to select a trans-

mission line route that will have the greatest positive benefit, and the least negative impact on the environment. Avoidance of sensitive wildlife habitat is one of the primary goals.

During the construction of a transmission line, many mitigative measures are used to minimize negative impacts on wildlife and habitat. For example, natural vegetation buffers are left between the line and sensitive habitats of endangered or rare wildlife, construction activities are timed to avoid sensitive periods for wildlife (e.g., nesting, migration, calving), and the growth of desirable vegetation is promoted. For water crossings, construction techniques used to protect water quality and aquatic habitat include maintaining an adequate buffer zone of shoreline vegetation to prevent soil erosion, hand-clearing trees, and locating towers outside the high water mark. Detailed Environmental Protection Plans and strict construction practices are used to mitigate negative effects and enhance positive benefits of ROW construction.

Noise and the presence of people during construction may cause animals to temporarily avoid the construction area. This could result in a temporary decrease in the number of animals, possibly affecting the uses of wildlife such as trapping in an area near the transmission line.

Transmission line ROW maintenance may include hand-clearing, "V" blading, or the selective use of herbicides. Maintenance practices such as the application of herbicides can be beneficial to the creation and maintenance of wildlife habitat by targeting undesirable species. Similar effects are produced from the usual line maintenance techniques such as brush-mowing and selective hand-cutting of tree limbs.



*Common access corridor for linear developments in northern Manitoba.*

The construction, operation and maintenance of a transmission line and ROW may affect wildlife through possible changes in habitat. Although clearing the ROW for the transmission line removes a relatively small amount of a particular type of wildlife habitat, the impact of this clearing varies from species to species. The increase in edge habitat may increase the abundance and diversity of species by providing them with additional food and cover. Habitat fragmentation however, may lead to a decrease in space available for interior forest-dwelling species. Predators or

parasites may use the ROW as a travel corridor to prey on endangered or rare species and further decrease their numbers.

The presence of transmission lines and towers affect wildlife in other ways. Transmission line towers creates additional nesting or perching structures for birds, but the presence of the lines leads to small levels of bird-wire collisions or, although very rare, electrocutions. A few studies suggest that transmission line noise may temporarily affect some animals.

Electric and magnetic fields along transmission lines may cause subtle biological effects on plants and animals, although many laboratory and field studies indicate that they do not affect health. In general, transmission line ROWs do not create a barrier to most animal movements. In fact, many animals use the plants in the ROW for food and cover, and use the ROW as a travel corridor. Increased access to wildlife populations by hunters and fishermen using the transmission line ROW is a concern for previously inaccessible areas.

Manitoba Hydro already uses many different mitigative measures to reduce the negative impacts and maximize the benefits to wildlife and habitat. It will continue to study ROW impacts in detail, and adapt these findings to maintain and enhance wildlife and habitat throughout Manitoba whenever possible.



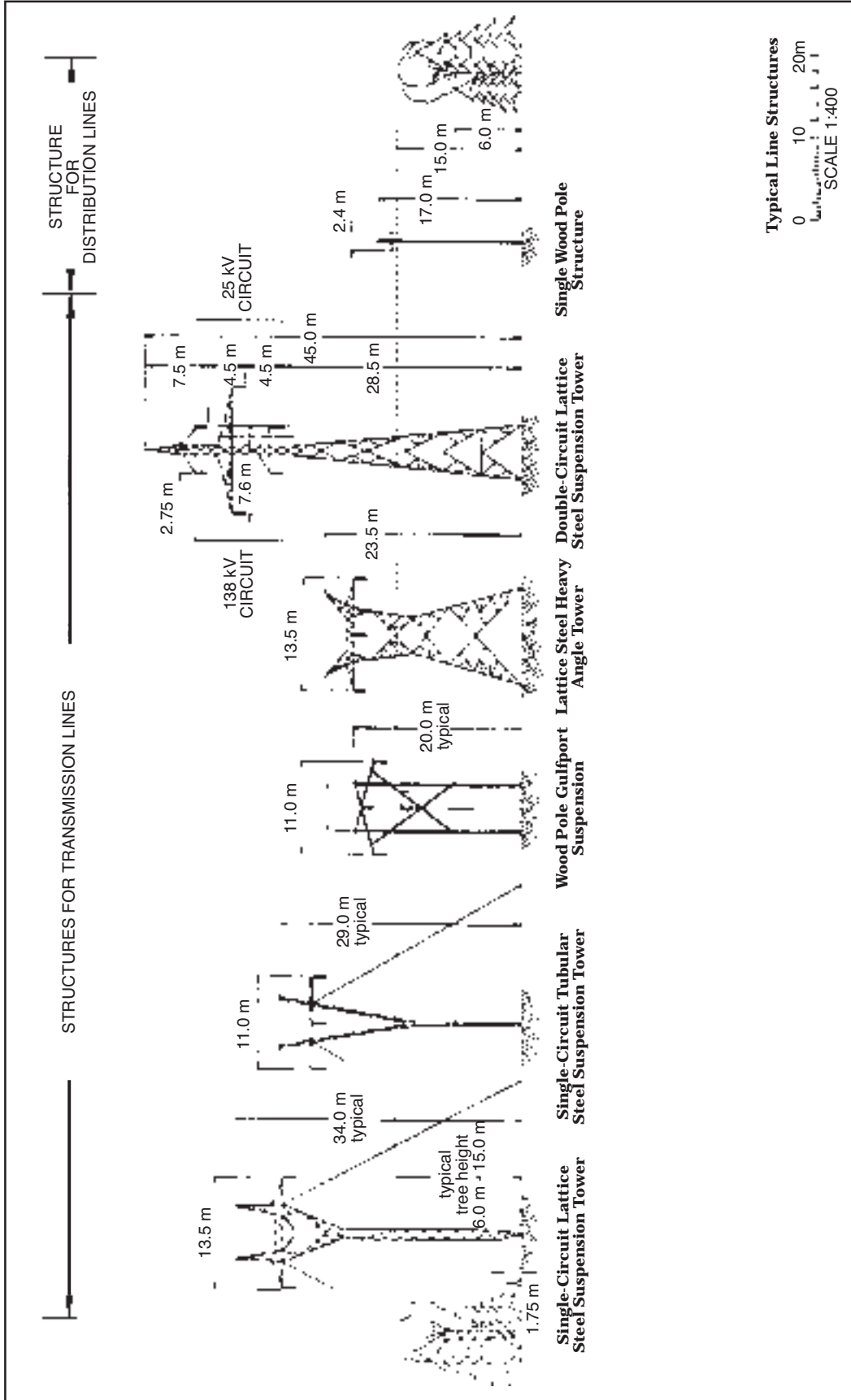
*Site inspection by Manitoba Hydro employee*

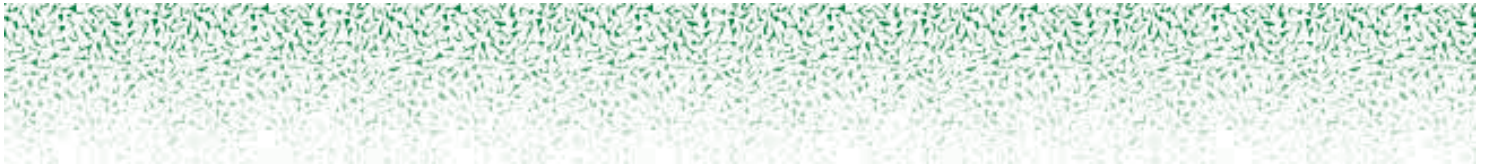


*From big to small – illustrations showing the many different types of Transmission line and Crossing structures now in use throughout Manitoba.*

*See following pages.*

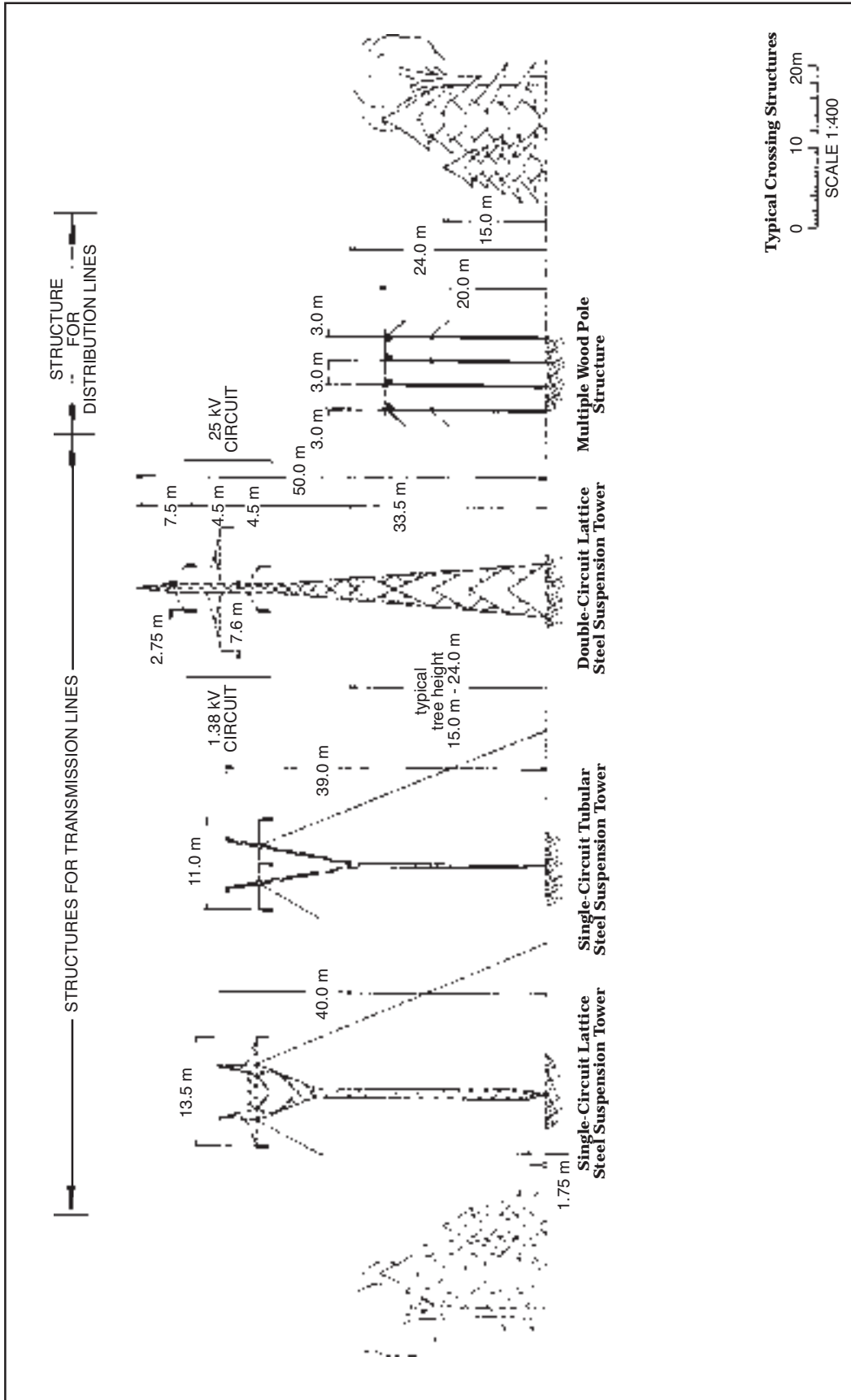
# Typical Line Structures







# Typical Crossing Structures



# APPENDICES

# APPENDIX B

## Footnotes

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# APPENDIX C

## General Environmental Protection Measures/Construction

The following sections describe general environmental protection measures that would be employed, as relevant, in Manitoba Hydro transmission line projects.

### Manitoba Hydro Transmission Line Construction Practices

The following items summarize key general environmental protection measures associated with Manitoba Hydro transmission line construction practices.

#### General Management

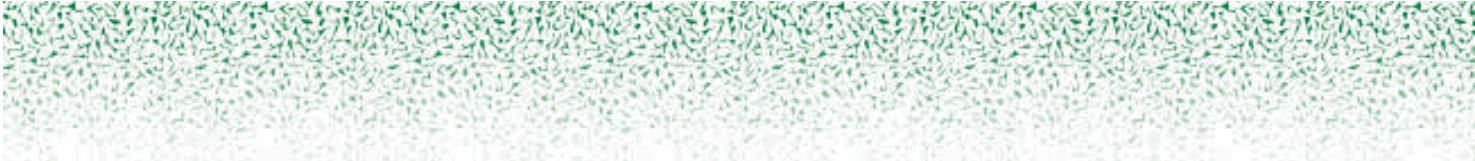
- G1. Project specifications, guidelines, licences and permits must be obtained prior to commencement of construction. All project participants are to be familiar with these documents.

#### Clearing

- G2. Timber removal on Crown Lands will be conducted in accordance with Department of Natural Resources “Forest Damage Appraisal and Valuation” Policy. Special clearing and timber disposal conditions may be issued for a specific project. On private land clearing conditions will be negotiated with the landowner.
- G3. Vegetation will be removed by mechanical means except where hand clearing is stipulated. Chemical vegetation control will not be carried out during construction clearing.
- G4. Machine clearing shall remove trees and bush with minimal disturbance to existing organic cover using “V” blades, “K-G” blades and other acceptable means.
- G5. Buffer zones shall be maintained between construction areas and natural waterbodies. Any modifications to recommended buffer zones will only be made with the consent of the Natural Resources Officer (NRO) i.e.:
- Skidders or clearing equipment are not allowed within a minimum of 15 m of high water mark except to allow temporary access across a stream or other waterbody.
  - Trees are not to be felled into streams.
  - Trees on the immediate bank, except those overhanging the stream, are not to be cut.
  - Slash is not to be left in buffer zone within 15 m of high water mark.
  - All slash landing in stream is to be removed by hand.
- G6. If any site, artifact or material is found which has heritage value, work activities shall be halted, and the senior field authority advised.
- G7. ROW clearing should be limited to areas required for construction, operation and maintenance of the line.
- G8. Areas requiring hand clearing i.e. buffer zones, sensitive sites - shall be marked during the centreline survey.
- G9. Local residents should be notified of the availability of timber from the ROW on Crown Lands prior to construction.
- G10. Slash will be cut, piled and burned, unless otherwise specified in work permits.
- G11. Danger trees (tall enough, that if they fall towards the right-of-way, may strike the conductor, guy wires or towers) outside of ROW will be identified by the senior field authority; and appropriate action taken.

#### Borrow Pits

- G12. Borrow pits shall be located as close to existing access as possible. A buffer of natural vegetation will be left between access roads and borrow pits.
- G13. Borrow pits shall not be located within 100 m of stream banks or steep slopes unless a specific exemption is provided by the local Natural Resources Officer.

- 
- G14. During development, borrow pits shall be monitored for the presence of historic or heritage material. The Senior Field Authority shall be informed of any such finds immediately.
- G15. Worked out pits shall be left with maximum 4:1 (horizontal:vertical) wall slopes. Slash and soil cover are to be replaced on pit slopes and bottoms after borrow material has been removed to encourage re-vegetation.

### **Access**

- G16. Access permission will be procured from the landowner or administrative authority prior to the commencement of construction.
- G17. Where possible, vehicle and machinery traffic is to be limited to right-of-way.
- G18. Existing all weather or winter roads/trails are to be utilized whenever possible.
- G19. If new access roads are developed outside the ROW, care shall be taken to avoid locally sensitive/significant features. Prior approval of NRO will be required.
- G20. In areas of steep slopes, susceptible to erosion, special consideration shall be given to directing run-off away from disturbed areas. Some vegetation, slash or snow covering should be maintained to protect the soil and overburden.
- G21. Access road grades should not exceed 12%. Grades near waterbodies should not exceed 5%. This gradient may be achieved through the use of snow/log ramps.
- G22. Ice and snow bridges developed for stream crossings are to be removed prior to spring break-up.

### **Marshalling Yards**

Temporary marshalling yards are used mainly for the storage of materials. However, they are also used for packaging and repackaging materials for delivery to work sites; equipment assembly, storage and servicing of transport and work machinery and for miscellaneous work operations such as carpentry and welding.

Remote temporary storage sites away from main marshalling yards and camps will require similar types of environmental protection measures and should also be located to minimize potential environmental impacts:

- G23. The site shall be located at least 30 m from any watercourse unless otherwise authorized by Manitoba Hydro.
- G24. The site should be of low value with respect to its potential for other uses when compared to other lands in the area.
- G25. Minimizing the area cleared for storage will reduce costs, minimize wildlife habitat loss and decrease the potential for erosion, especially on slopes and stream approaches. The best location for storage sites are natural openings that will not require additional clearing. Minimize surface disruption and where possible low shrub and ground vegetation should be kept intact. Salvage timber should be limbed, bucked and stacked near the site.
- G26. Topsoil and organic materials should be removed during site preparation and stockpiled to be respread over the disturbed area following its use.
- G27. During summer construction periods in Agro-Manitoba, storage areas should be located on soil types resistant to severe compaction, where possible. In the northern part of the province, permafrost soils are highly susceptible to degradation after disturbance.
- Poles should be stored in an elevated pile (on cross beams or pole ramps) to avoid direct contact with the ground, thereby minimizing the area of treated materials in direct contact with the soil.
  - Low permeability soils are preferred as storage sites for fuels, lubricants and chemicals.



G28. Revegetation should be considered in disturbed areas to:

- a) stabilize erodible soils
- b) create or restore wildlife habitat
- c) prevent or delay the invasion of unwanted plant species; or
- d) to enhance or restore the aesthetic appeal of an area.

These sites will be specifically identified as requiring special treatment, otherwise natural revegetation will be allowed to occur.

G29. Marshalling yards and temporary storage sites are to be identified to local Natural Resources officials prior to use. Site preparation, operating and remediation procedures as well as emergency action plans are to be provided. Regular visual inspections to ensure compliance with work permits should be conducted during the construction (storage) period. A final inspection should be conducted with the appropriate regulatory authority or private landowner and at the appropriate time of year to ensure reclamation methods have been successful.

### **Material Handling and Storage**

Site specific clean-up requirements often cannot be identified in advance of construction. The extent of clean-up activity required will be decided by the environmental inspector in accordance with applicable permits, regulations and internal standards.

G30. Fuel, lubricants and other potentially hazardous materials shall be stored and handled within dedicated areas at work camps and marshalling yards in full compliance with regulatory requirements.

G31. Dedicated areas shall provide natural containment and facilitate clean up through measures such as:

- maximum separation from sensitive features;
- clear identification of the materials present;
- access restricted to authorized vehicles only;
- bermed storage areas;
- double walled tanks; and
- dedicated spill response equipment as per regulatory requirements.

G32. The location and volumes of products transferred from storage areas to specific work sites shall be monitored daily, 100 gallon fuel tanks mounted in truck boxes are exempted.

G33. All containers are to be inspected daily. As per regulation, product inventory is to be taken regularly and retained for inspection upon request, 100 gallon fuel tanks mounted in truck boxes included.

G34. The senior field authority or his designate is to be assigned responsibility of Emergency Response Coordinator in event of a spill.

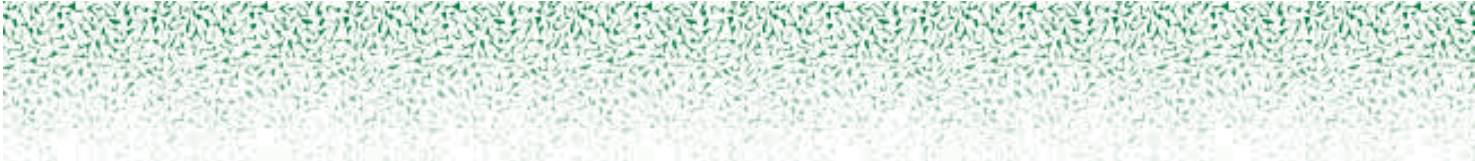
G35. Materials required for spill containment and clean up shall be available at all temporary work sites during construction and maintenance of facilities.

G36. In the event of a spill:

- the on-site Emergency Response Coordinator shall be notified immediately and action taken to contain the spill.
- if the spill exceeds 10 litres, or if stipulated quantities of other controlled substances are spilled the local Natural Resources Officer and the Manitoba Hydro Safety and Occupational Health Division are to be notified.
- Manitoba Environment (945-4888) and Environment Canada (981-7111) or (403) 468-8020 after working hours) are to be notified if more than 68 litres of hydro carbon product is spilled.

G37. A permit is required from Manitoba Environment for handling and storage of fuel products, 100 gallon fuel tanks mounted in truck boxes are exempted.



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- G38. All contractors must be aware of, and adhere to, Manitoba Hydro's spill response procedure.
  - G39. Site clean-up and disposal of contaminated material shall be as directed by the Emergency Response Coordinator.
  - G40. General clean up in storage areas and sites where incidental spillage occurs will be in accordance with regulatory standards. All soil is to be remediated or disposed in a manner approved by regulatory authorities and Manitoba Hydro.

#### **Waste Management**

- G41. The work site is to be kept tidy at all times with construction and personal waste collected for proper disposal. Garbage is to be cleaned up so that wildlife is not attracted to work sites.
- G42. Indiscriminate burning, dumping, littering or abandonment is not to take place.
- G43. Before commencement of the work, protocols for containment, transport and disposal of wastes are to be developed and approved by local and provincial authorities including Manitoba Environment, Manitoba Department of Natural Resources and the local LGD or Municipality.
- G44. Manitoba Hydro's system for recycling waste oils and other materials shall be accessible to contractors.
- G45. Waste materials shall not be used as starter fuel for burning slash.
- G46. Opportunities for waste reduction, material reuse or recycling should be identified and a program developed for same if economically possible.

#### **Wildlife**

- G47. Riparian habitats represent the most crucial ecosystems. Specific environmental protection practices are recommended in site specific Environmental Protection Plans. A riparian area or zone is a landscape feature that consists of a natural ecosystem occurring along watercourses or waterbodies. It occupies the transitional area between terrestrial and aquatic ecosystems. It is a "green zone" associated with lakes, reservoirs, estuaries, potholes, springs, bogs, fens, wet meadows and ephemeral, intermittent or perennial streams.
- G48. Wildlife and domestic livestock are not to be fed or harassed.
- G49. Nuisance wildlife are to be reported to the Natural Resources Officer.
- G50. Trees containing large nests of sticks and active dens or burrows are to be identified. Mitigation may be required to preserve important species of birds and animals. Adjustments to the ROW should have been made during the planning phase based on information in environmental assessments.

#### **Safety**

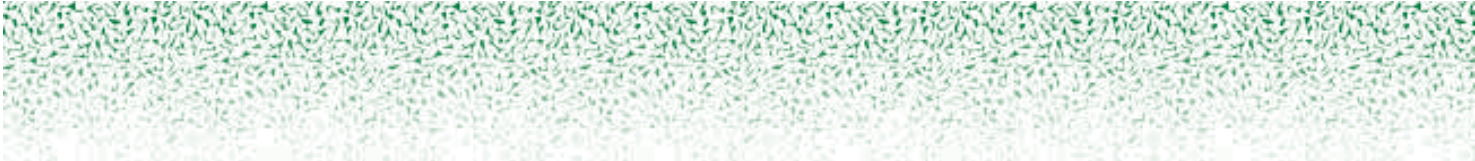
- G51. Employees and contractors employed by Manitoba Hydro must adhere to Corporate Safety Procedures at all times.

#### **Regulatory Requirements**

- G52. Manitoba Hydro requires that staff and contractors comply with all regulatory requirements relating to the construction and operation of its projects and facilities. Specific regulatory requirements for this project will be contained in the Natural Resources Work Permit(s) and Environmental Protection Plans.

#### **Rehabilitation and Revegetation**

Where construction practices unavoidably disturb natural vegetation on potentially sensitive sites mitigation plans will be prepared and implemented during construction, to control/prevent erosion, re-establish habitat or create buffer zones rehabilitation and re-vegetation programs will be initiated. Rehabilitation measures and species selection will be undertaken



as required by site conditions and rehabilitation objectives. In each instance the purpose and nature of the rehabilitation program will be developed in consultation with regulatory authorities, local resource users, landowners and technical experts. Factors to be considered will include feasibility, practicality, effectiveness and management requirements. Site rehabilitation/re-vegetation programs are intended to re-establish “natural” conditions; not to enhance or replace the existing circumstances.

### **Transportation and Handling of Dangerous Goods**

All dangerous/hazardous goods will be transported and handled according to the procedures prescribed in the applicable legislation, regulations and Manitoba Hydro policies. Project staff will be trained and certified in the handling of and emergency response procedures for the specific dangerous / hazardous goods used on the project. Contractors shall comply with all laws, regulations and bylaws relating to the work, duly executed by federal, provincial and municipal authorities.

### **Workplace Hazardous Materials Information System (WHMIS) Inventory**

An inventory of materials covered by WHMIS will be maintained on site. WHMIS documentation will be displayed and available as required. Staff will receive WHMIS training in compliance with regulatory and Corporate requirements.

### **Spill and Emergency Response**

Specific spill prevention, spill and emergency response measures will be included in project instructions. Trained staff will be assigned responsibility for inspection and response team leadership. Basic and special emergency equipment as required will be available on site and from standby sources. Project management can obtain support, if necessary, from the services of other Manitoba Hydro projects and facilities and external agencies such as the Department of Natural Resources, RCMP and Canada Coast Guard. Refer to the following Manitoba Hydro documents:

- PCB Spill Response Handbook
- Corporate Safety and Occupational Health Rules
- Hazardous Waste Management Handbook

For further assistance contact:

Safety & Occupational Health Division  
Manitoba Hydro  
474-4225 (business hours)  
941-9409 (after business hours)

### **Worksite Safety and Health Measures**

All activities will be undertaken in compliance with Safety and Health requirements; in many instances Manitoba Hydro standards are more stringent than government standards. Safety Committees will be established as required and safety meetings will be held. Manitoba Hydro employees will be instructed in all necessary special conditions associated with a project. Contractors shall comply with all laws, regulations and bylaws relating to the work, duly enacted by federal, provincial and municipal authorities.

## Environmental Protection Measures for Construction in Urban Environments

Construction in an urban area has high potential for disturbance to private property and public activities. Project scheduling and logistics planning can minimize the effects of construction.

- U1. Municipal and local protocols and bylaws will be observed. Appropriate methods will be applied to comply with regulatory standards during construction and operation of facilities.
- U2. In built-up areas and other areas where noise and vibration may create undue stress, work will be limited to daylight hours in accordance with local noise by-laws.
- U3. Mud and dust will be managed in a manner which will ensure safe, continuous public activities near construction sites.
- U4. Construction methods and timing will be designed to minimize traffic disruption. Equipment and materials will be operated and stored in secure designated areas when possible to ensure public safety.
- U5. Every effort will be made to ensure that construction activities and equipment do not impact upon neighbouring properties, structures and operation. Appearance and general aesthetics of construction areas will be considered during the construction planning process. In the short term, security measures may be required at specific sites for public safety reasons.
- U6. Site lines will be broken by buffer strips where ROW's cross public access to avoid linear views along the length of the ROW.
- U7. Vegetation screens and buffers using natural or planted vegetation will be incorporated into the designs for facilities. Topsoil will be replaced on access roads and construction sites upon abandonment of the sites.
- U8. Disturbance to heritage resource sites and green spaces will be avoided where possible. When facilities are located adjacent to such sites, measures will be designed to make facilities less obtrusive and enhance the general aesthetics of the area.

## Environmental Protection Measures for Agricultural Lands

The General Environmental Protection Measures apply to construction, operation and decommissioning of every project and existing facility on agricultural lands in Manitoba.

Agricultural practices have altered the natural characteristics of the landscape and have become the prevalent environmental feature. As a result the effects on natural ecological phenomena can be even more significant. The construction, operation and decommissioning of Manitoba Hydro facilities should be carried out in a manner which will minimize disruption to agricultural practices. Particular care should be taken to avoid further perturbation to identified isolated natural ecosites and patches of connecting habitats created by the construction of rights-of-way.

Above all, communication with landowners on private lands and Provincial Crown Lands is essential. They will have been involved in the site selection process.

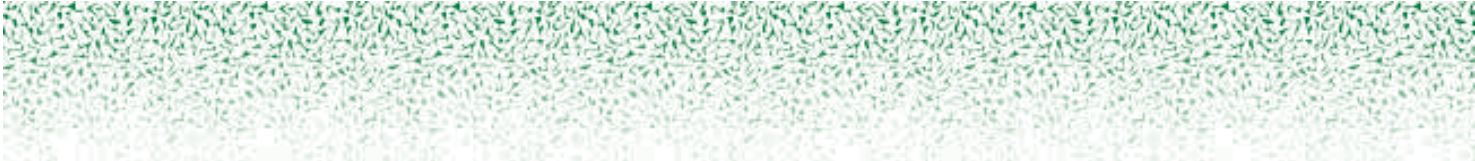
The following general guidelines for agricultural lands are consistent with current land use policies set out by regulatory agencies and Manitoba Hydro Transmission Line Construction Practices.

### Access Roads

- A1. Routes will be developed to minimize disruption to:
    - streams
    - drainage ditches
    - soils with low weight bearing capacity
    - sensitive biological areas
    - cultural and historic resources
    - farming practices and crops
  - A2. Route design will be reviewed with the landowner.
  - A3. Existing access to the right-of-way will be utilized where possible. Access routes will be mapped on a right-of-way development plan. Vehicles will be restricted to those routes.
  - A4. Roads constructed across all cultivated agricultural land will be temporary as negotiated in advance between the property owner and Manitoba Hydro. Site traffic will be minimized. Access roads will be located along existing traffic routes where possible. Construction equipment with soft tracks and low ground bearing capacity will be used where and when appropriate.
  - A5. Where possible, construction access should be completed along sections of a right-of-way during frozen or dry conditions. The construction of rock or gravel access roads will be avoided. Snow should be plowed or compacted to facilitate deeper frost penetration.
  - A6. Construction activities may be scheduled to recognize in order of priority:
    - areas designated for winter construction only
    - seasonal agricultural practice
    - areas susceptible to rutting
    - steep slopes (>10%)
    - all other areas including wet woodlots and wetlands
- Appropriate measures will be taken to minimize negative impacts to agricultural lands during frost free and wet periods.
- Access agreements and releases upon completion of the project require the landowner's signature.

### Stream Crossings

In addition to the guidelines provided by provincial regulatory authorities in "Recommended Fish Protection Procedures for Stream Crossings in Manitoba" the following measures will



be implemented. The senior field authority will be familiar with the specific legislation regarding natural and man-made waterways and their management in agro Manitoba.

- A7. Access routes to construction sites will avoid stream crossings where possible.
- A8. Where crossing is necessary the crossing type and design will be specified in the Right-of-Way Development Plan. Consultation with the local Natural Resource Officer should ensue and appropriate approvals regarding crossing sensitive streams obtained. The type of stream crossing design will be determined by site inspection.
- A9. Necessary crossings of streams will be designed to protect the stream bed and banks, to minimize clearing of riparian vegetation, to prevent disruption to normal drainage patterns and to minimize interference to fish passage.
- A10. Cover crops will be established (seeded/planted and then monitored to ensure success) on disturbed areas as soon as possible after a permanent stream crossing is installed.

### **Wetlands**

Wetland habitat conservation in agricultural areas throughout Canada is of increasing importance. All wetlands are critical to ensuring the long term well being of waterfowl populations.

Five major classes of wetlands in natural basins are recognized on the basis of ecological differentiation according to *Classification of Natural Ponds and Lakes in the Glaciated Prairie Region*. The classes are designated as follows:

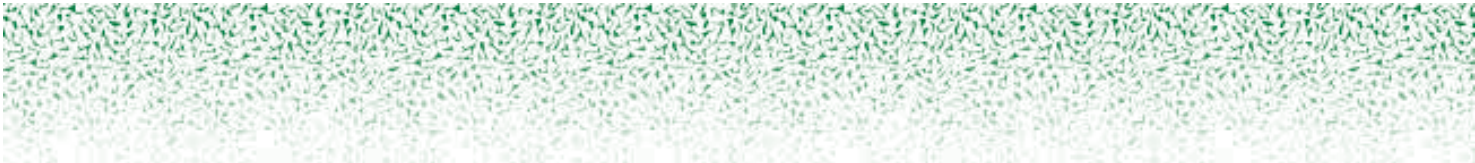
Class I	Ephemeral Ponds
Class II	Temporary Ponds
Class III	Seasonal Ponds and Lakes
Class IV	Semipermanent Ponds and Lakes
Class V	Permanent Ponds and Lakes

- A11. Where possible tower construction in wetlands should be avoided.
- A12. At the planning stage, tower placement, conductor height and line marking will be considered to minimize bird strikes on conductors particularly in areas that experience unusual or prolonged inclement weather conditions.
- A13. Alternatives to overhead conductors adjacent to wetlands should be considered for distribution lines; ie. buried cable may be used where economically and technically feasible.
- A14. Construction and access through wetlands should be planned for periods when critical life functions of waterfowl are not affected; ie. late fall and winter.
- A15. Equalizing culverts, approved by water resource managers, will be provided on a temporary/permanent basis where natural and man-made drainage is disrupted.
- A16. Where wooden structures must be placed in a wetlands only Chromated Copper Arsenate, Type C (CCA) treated poles will be used.

### **Erosion and Sedimentation Control**

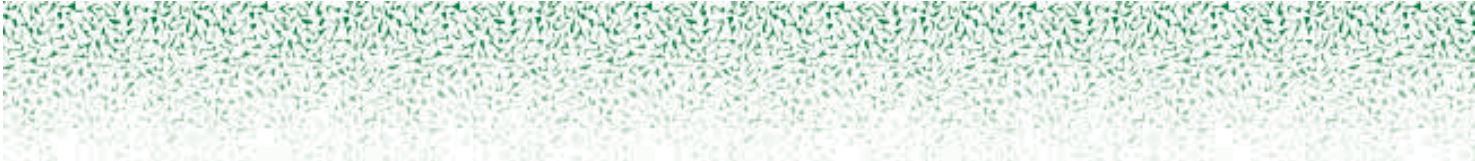
Several other sections make reference to erosion and sedimentation control specific to construction activities. In addition to these sections the following practices will be adhered to:

- A17. All dewatering of excavations and depression will be directed away from watercourses.
- A18. Contaminated dewatered materials will be filtered through rock containment or silt fences; or removed in a dewatering truck. The Environmental Protection Department of Manitoba Hydro should be contacted for instruction as to site specific actions. Bentonite and any other filtered materials will be removed to an approved disposal site.

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- A19. Where topsoil is stripped from a worksite, it will be stockpiled in a location where natural drainage will not be impeded. If appropriate to the particular facility design it will be replaced upon completion of construction activities. When its not appropriate to replace topsoil, disposal arrangements will be made with the landowner as a first option.
- A20. Top-soil and sub-soil will be segregated for re-use in construction site reclamation. Fertilizers may be added to the soil.
- A21. Where construction sites are located in flood plains, near wetlands or adjacent to streams, excess excavated soils will be removed to high ground on the right-of-way. The disposal area will be graded and seeded. If a suitable location cannot be found or if the spoil is contaminated it will be removed to an approved disposal site.
- A22. Water used to clean concrete trucks, chutes and mixers will not be allowed to enter any surface waters directly. Such wash waters should be percolated through the soil after hardened concrete has been removed to reduce lime concentrations.  
Where there is potential for heavy run-off, berm construction and diversion channels may be necessary to retain such waters to allow time for percolation.
- A23. Where tower sites are located on slopes and/or in proximity to water courses some method of sedimentation control will be provided. Included in the options are:
- straw mulchings and seeding
  - erosion control blanket and seeding
  - straw bale containment dam
  - silt fence
- Where such measures are employed; sites should be monitored and the effectiveness of the measures documented.
- A24. Where an existing natural or man made windbreak is cleared entirely or a gap is created in a windbreak, it will be re-established in a location compatible with local farming practices. Selection of species will be made in cooperation with the landowner. PFRA provides guidelines for shelterbelt design and species.

### **Drainage Protection**

- A25. Drainage ditch and tile locations will be plotted on Right-of-Way Development Plans. Crossing locations will be reviewed in the field and verified with the property owner or in the case of Crown Lands with the appropriate regulatory authority.
- A26. Drainage ditches, field tiles and other in-ground water control structures will be avoided or protected. Protection options include the following:
- crossing under frozen conditions only
  - construction of access roads
  - ramping drains with filter fabric and granular material
  - timber mats, corduroy or steel plates over the structure of concern.
- A27. If damaged, drainage structures will be repaired immediately or well in advance of spring run-off in the case of winter construction schedules.  
Where drainage damage is indicated (ie. water ponding, rutting) damage locations will be documented. Temporary restoration if possible; will be undertaken during construction. Otherwise final repair will be scheduled following completion of construction.
- A28. The senior field authority will stop work:
- when ground conditions are such that no effective construction practice will prevent irreparable damage caused by severe rutting resulting in:
    - increase in erosion and sedimentation potential.

- 
- destroying soil structure and channelizing runoff.
  - soil mixing resulting in reduced fertility.
  - when a property owner has expressed concern about construction practices during wet conditions.

### **Vegetation Management**

A29. All vegetation removal, planting and maintenance will be carried out with the approval of the landowner. In most instances, vegetation management will be undertaken by the landowner under agreement with Manitoba Hydro. Manitoba Hydro may provide relevant information and technical advice when requested.

### **Security and Safety**

- A30. Landowners will be advised (in advance of construction entry) of the timing, duration and nature of activities to be conducted on their property.
- A31. At all times during construction and maintenance of transmission lines, care will be taken to ensure the safety of livestock and rural residents. Excavation, material stockpiles and equipment will be clearly marked, maintained and isolated to avoid injury to livestock or interference with normal farming activities. Pasture gates will be closed and fences maintained.
- A32. Fences will be grounded in accordance with Manitoba Hydro Standards as described on Manitoba Hydro Drawing 1-34000-DC56800-001.

## Environmental Protection Measures for Boreal Wilderness Areas

The Boreal Wilderness Area contains natural attributes of the landscape which warrant special consideration. Individual areas (ecosites) with differing topography, soils, drainage and vegetation will vary in extent along a transmission line corridor and at a specific site. Their regional and local significance and the potential impact of the proposed construction and operation will be reflected in the detail of the Environmental Protection Plan (Env.PP). The appropriate mitigation for each site will be consistent with sustainable development goals related to providing continued recreational, educational, scientific, aesthetic and traditional use benefits to future generations.

Further to the importance of attributes and their regional or local significance, criteria for delineating natural areas in the Env.PP and final judgements at the field level will be made in consideration of:

- level of significance of the feature
- access to the feature
- fragility or sensitivity of the feature
- expected volume of use of the area
- management requirements

In most cases Boreal Wilderness Areas are Crown Lands and any development occurring thereon require approvals from government regulatory agencies.

- B1. Prior to any construction activity on Crown Lands, local regulatory authorities must be advised and their approval procured. Work permits from NRO's are required.
- B2. Special land use designations such as First Nations' Resource Areas, Wildlife Management Areas, Parks, etc. will be recognized and construction activities carried out in a manner compatible with such designations.
- B3. Resource management and monitoring programs will be conducted in full cooperation with local authorities such as Natural Resource Officers and Environmental Officers. The rights and interests of local resource users - trappers, fishermen, loggers and timber operators, lodge operators, etc. will be respected. Signed releases will be provided by the local authority upon completion of the project subject to an on-site inspection.



# Environmental Protection Measures for Operation and Maintenance

## Stations

Stations are inspected regularly to ensure proper functioning of equipment. These inspections include regular equipment checks, vegetation control and general site maintenance. Emergency repairs may involve repair or replacement resulting from a major equipment failure. A worst case scenario is a major leak of insulating oil to the ground. Insulating oil may contain PCB material. The Manitoba Hydro “PCB Colour Dot Identification System” should be consulted to determine the possible presence of PCBs in transformer oil.

- OMS1. Stations fences will be locked at all times.
- OMS2. Chemical vegetation control will be performed by a qualified applicator in accordance with the pesticide use permit.
- OMS3. Any noticeable leaks from equipment must be reported and repaired as soon as possible.
- OMS4. Any existing emergency collection sumps and oil water separators should be maintained according to the protocols for each station. Transport and disposal of all hazardous product should be as outlined in Manitoba Hydro’s Hazardous Waste Management Handbook.
- OMS5. Any oil spill greater than 68 L or less than 68 L and containing greater than 45 ppm PCB must be reported to Manitoba Environment at (204) 945-4888. If greater than 1 g of PCBs are discharged to the environment, they must be reported to Environment Canada, Environmental Protection Services, at (204) 987-7788.
- OMS6. Soil contaminated with oils may be removed or remediated on site. Oils containing PCBs will be removed and transported to an appropriate storage or disposal site. All PCB materials should be handled according to “Manitoba Hydro’s PCB Spill Response Handbook” and “The Code of Practice for the Storage of PCBs at Manitoba Hydro Facilities”.

## Towers

Transmission lines are regularly patrolled using aircraft or ground vehicles. Typical maintenance ground checks include tower footing and anchor testing programs.

Emergency line repairs may involve erection of tower bypass columns and the stringing of temporary conductor wire.

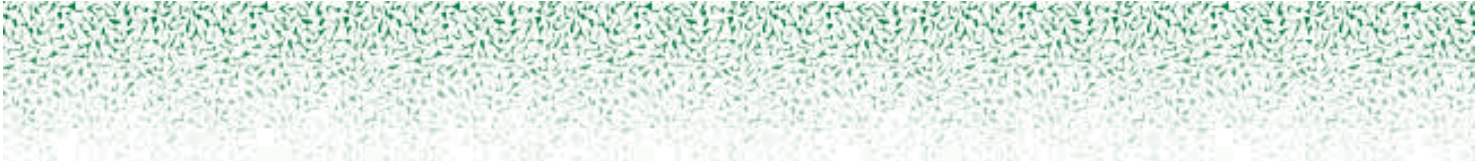
Environmental concerns from tower maintenance and emergency repairs may include the following:

- OMT1. Disturbance to wildlife from ground and air patrols.
  - OMT2. Disturbance to vegetation from ground patrols and emergency repairs.
  - OMT3. Crop loss or damage incurred while accessing facilities during emergency repairs.
- Operation and maintenance activities of transmission towers generally do not fall under specific regulations. Any specific mitigation requirements for activities associated with tower maintenance may be incorporated into the facility’s Environmental Protection Plan for Operation and Maintenance.

## Rights-of-Way

Right-of-way travel involves the movement of personnel and equipment along transmission line rights-of-way subsequent to their clearing. Right-of-way travel is extensively conducted during construction of the line and is routinely conducted during operation and maintenance activities.

Right-of-way management includes those activities associated with vegetation control, erosion control, pest control and drainage management. The majority of right-of-way vegetation management is conducted using a brush mower, Hydro Ax, or caterpillar



equipped with shear blades. Hand-clearing is used in environmentally sensitive locations. Herbicidal vegetation treatment is applied to stations, ground anchors, tower bases and distribution lines.

- OMR1. Report all sightings of significant wildlife features, such as eagle nests, owl nests, colonial nesters, wolf packs, moose, caribou, bear, etc., to the Environmental Protection & Codes Department.
- OMR2. Landowners must be notified before ground patrols begin.
- OMR3. Use existing access roads and bridges to the extent possible.
- OMR4. Disturbance to the right-of-way will be kept to a minimum. Use wheeled vehicles where possible during the summer months.
- OMR5. During helicopter inspections in the spring, avoid nesting sites of eagles, osprey and other birds of prey. Disturbance may cause adults to leave their nests. Stay a minimum of 200 m from nests. Where possible, avoid helicopter patrols in known nesting areas in spring.
- OMR6. If raptor nests must be removed, to protect the integrity of the line, time the work for the fall or winter when nests are inactive (Figure 2.4.3.4-1).
- OMR7. Consult the NRO and obtain the necessary permit before taking action to remove beaver dams.
- OMR8. Where unplanned power outages require immediate response, environmental damage can be minimized by referring to the measures recommended in this document.
  - Site remediation will occur immediately after the completion of construction or maintenance activities.
  - If site remediation cannot be undertaken upon completion of construction or maintenance activities, it will be undertaken as soon as possible under more favourable conditions.
  - Compensation payments may be required where impacts cannot be avoided or minimized to a level acceptable to landowners or regulators.

# Environmental Protection Measures for Decommissioning

## Decommissioning Stations

Decommissioning of a station involves dismantling of the superstructure and equipment and disposal of all unusable components. The site must then be remediated to accommodate future land use.

Possible environmental concerns resulting from decommissioning stations include the following:

- Disposal of conventional solid waste material.
- Disposal of hazardous materials.
- Remediation of contaminated soils.
- Determining alternative uses of the site.

Upon decision to decommission a station, alternative uses of the site will be assessed, and a preferred use determined.

- DS1. If agriculture is the probable use, all above ground and underground obstacles that could impede agricultural use of the site will be removed.
- DS2. Electrical equipment and associated structures will be dismantled and salvaged. All unsalvageable material will be transported to an approved landfill site.
- DS3. Footings and foundations will be removed to a depth of 2 m. Waste concrete will be removed to an approved landfill site.
- DS4. Random samples of soil will be taken to determine levels of contamination for possible contaminants.
- soils with contaminants above 0.05 micrograms of PCB per microgram of soil will be removed to an approved storage and/or disposal facility.
  - removed soil will be replaced with uncontaminated material.
- DS5. If the site reverts to agricultural use, all surface granular materials will be removed from the site and replaced with clean uncontaminated topsoil. The site will be deep-ploughed to relieve compaction.
- DS6. Other soil materials will be selected depending on the nature of the proposed use.
- DS7. Depending on the extent of petroleum contamination in soils, remediation may involve in situ treatment, disposal of the local landfill, disposal at a licensed hazardous materials facility, or on-site landfarming. A careful investigation of contaminant parameters, future land use, site risks, and remedial technologies must be conducted prior to implementing a remediation plan.

## Decommissioning Transmission Towers

Decommissioning towers involves dismantling tower structures and the salvage or disposal of all steel and wood pole tower components. Tower decommissioning also involves the collection and salvage or disposal of conductor and counterpoise (ground wire).

Decommissioning rights-of-way involves the clean-up and/or remediation of transmission line rights-of-way to accommodate future land use requirements.

Decommissioning temporary pole yards involves the removal of all new and used poles, dismantling any ancillary equipment or structures, and the remediation of the yard property.

Possible environmental concerns resulting from the decommissioning of towers, rights-of-way and marshalling yards involve the following:

- Disposal of waste material.
- Disposal of hazardous material.
- Remediation of contaminated soils.
- Proliferation of noxious weeds in rights-of-way.

- Maintenance of public safety.
- Alteration of habitat.

- DT1. All conductors, insulators, counterpoise and other material employed in transmission lines will be collected and removed from the right-of-way. Salvageable materials will be salvaged. Other materials will be collected and transported to a landfill site.
- DT2. After materials have been removed, the right-of-way will be patrolled to ensure that all materials have been retrieved and that the right-of-way will be left clean.
- DT3. All tower foundation structures will be excavated and removed.
- DT4. All holes or ruts created by foundation removal or right-of-way travel will be filled or graded. In agricultural land, at least 300 mm of topsoil should be spread on any excavation site.

### **Decommissioning Transmission Rights-of-Way**

In the event of decommissioning, an alternative use will be identified for the property. That use will determine many of the environmental measures that may have to be undertaken to convert a right-of-way to another use. The following measures will, nevertheless, be undertaken.

- DR1. If required, the right-of-way will be graded, disced or ploughed to remove ruts caused by rubber-tired and tracked vehicles.
- DR2. Where any grading, discing or ploughing is required on Crown Land, the disturbed area will be reseeded if the disturbed area is extensive and root zones have been disturbed.
- DR3. Noxious weeds along a right-of-way in agricultural land must be ploughed or sprayed with an approved herbicide.
- DR4. In forest or wooded areas, if the abandoned transmission line is not to be replaced by a new transmission line on the same right-of-way, the unused right-of-way will be allowed to revegetate naturally. Specific areas subject to erosion may be reseeded manually.

### **Decommissioning Marshalling Yards**

In the event of decommissioning, an alternative use will be identified for the property. That use will determine many of the environmental measures that may have to be undertaken to convert a storage and pole yard to another use. The following measures will, nevertheless be undertaken.

- DM1. All structures will be dismantled and salvaged. All equipment, supplies, and other goods stored on-site will be removed to a new location.
- DM2. All chemicals will be transported to another storage and pole yard, or will otherwise be disposed of in accordance with all applicable laws and regulations.
- DM3. All garbage and debris will be removed from the site and disposed of in a landfill site.
- DM4. Fences will be removed.
- DM5. Wood poles will either be removed to another pole yard or will be disposed of as salvage.
- DM6. Where treated poles have been stored on-site, surrounding soils will be tested to determine the degree of contamination, if any.
- DM7. Non-reusable wood poles may be sold.
- DM8. Depending on the extent of soil or groundwater contamination at the pole yard, soil remediation may involve in situ treatment, disposal at the local landfill or disposal at a licensed hazardous waste disposal facility. Transport, storage and disposal will occur in accordance with all applicable laws and regulations.



## **Decommissioning Access Roads**

When an access road is no longer required, decommissioning is needed. Some roads can be simply left to naturally rehabilitate; however, most require some physical action prior to abandonment. Physical abandonment involves the removal of any drainage structures, road material and any associated steps to minimize and control erosion. The following environmental practices should be considered:

- DA1. The road should be inspected prior to decommissioning to document areas of staining, stressed vegetation, debris, etc. Soil and ground water samples should be taken at suspect areas to delineate the extent of any contaminated areas.
- DA2. Access roads ownership and management may be transferred to the adjacent landowner, municipality, or the Crown. Often, these stakeholders will request that access roads remain intact for public use. Manitoba Hydro will leave access roads in a serviceable condition for future maintenance requirements. This may require partial obstruction of access to ROWs.
- DA3. Natural regeneration of abandoned roads should be considered wherever possible.
- DA4. The road and ditch should be graded to allow coverage of suitable material for vegetation regeneration.
- DA5. Where possible, banks and approaches should be graded to match existing topography.
- DA6. Removing culverts and crossings and cutting the access road, allows natural drainage paths to be restored.
- DA7. In areas of high erosion risk, permanent erosion control structures may be required along access road rights-of-way.
- DA8. The entrance to the abandoned access road must be suitably barricaded to prevent vehicle access.
- DA9. Ongoing visual inspection is required to ensure adequate restoration and minimal environmental degradation.

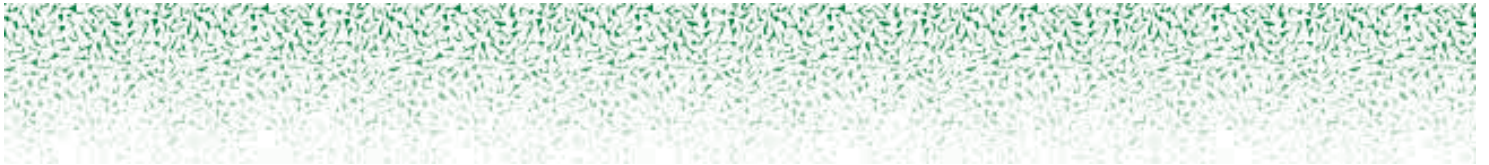
## **Decommissioning Stream Crossings**

Streams are crossed by roads, distribution lines, or underground conduits. Watercourses can be crossed using one of three techniques: fording, culverts, bridges. The type of crossing required is determined by evaluating hydraulic implications, environmental sensitivities, cost and time.

Stream crossings, whether for a distribution line or access road, can have significant environmental impacts if environmental sensitivities are not addressed adequately.

Environmental concerns pertaining to boreal, agricultural and urban settings can be summarized as follows:

- Contamination of soils and ground water
- Elimination of or disturbance to wildlife habitat
- Erosion of soils
- Aesthetics
- River and stream crossings
- Proliferation of noxious weeds
- Impacts to surface drainage
- Impacts to grazing animals
- Impacts to farm residences
- Erosion
- Noise



- DSC1. Stream crossing sites require a return to original conditions after use.
- DSC2. The crossing site should be visited prior to decommissioning to document any staining, stressed vegetation, or signs of any spills of hazardous products. Soil and ground water sampling may be required to define the extent of soil contamination. Any contaminated soil must be remediated on-site or removed to an approved landfill or other soil treatment facility.
- DSC3. Prior to decommissioning a stream crossing, consult with local, provincial and federal government officials (such as the local NRO, Department of Fisheries and Oceans, Provincial Water Resources Branch, etc.) to confirm the crossing is not required by these agencies or the local landowner.
- DSC4. When a ford is no longer required, the stream channel, banks and approach should be restored to its original contours by removing any material placed to construct the ford.
- DSC5. After removal of fording works, measures should be taken to ensure the site is not accessible to illegal fording. Measures should include cross-ditching the access road and placement of large boulders across the road.
- DSC6. For culvert crossings, all roadway material and culvert pipe must be removed and the stream banks returned to their original configuration.
- DSC7. For bridge crossings, all decking material must be removed, as well as any supporting structures located in the stream bed. Bridge abutments may remain as long as they are graded to prevent erosion and suitably prepared to accept natural revegetation.
- DSC8. Any temporary bank protection, approach road protection, or instream obstructions should be removed and the areas should be stabilized by revegetation and/or more permanent erosion control methods where necessary.
- DSC9. Instream work should not be undertaken during flood seasons or fish spawning/migration periods.
- DSC10. All materials (construction, waste, empty containers, etc.) must be removed from the site.

## Use of Salvaged Wood Poles or Crossarms

This information sheet has been prepared to inform the user of preservative treated wood products of the precautions that should be followed when using these materials.

All wood poles and crossarms used by Manitoba Hydro have been treated with a Federally registered preservative to protect them from decay. The preservatives commonly used include but are not limited to creosote, pentachlorophenol and chromated copper arsenate. While their concentration does diminish with age, they do remain in the wood for a long time and exposure to them may cause adverse health effects.

### **Application for Use:**

For the North Central Project written application must be made to the Senior Construction Supervisor for Manitoba Hydro before salvaged poles or crossarms will be released to the public. The proposed use must be stated in the application. If the application is approved, the applicant will be required to sign a disclaimer absolving Manitoba Hydro of any liability for health related problems claimed to be as a result of the approved use or any other use of salvaged poles and crossarms.

All wood poles, braces and crossarms used by Manitoba Hydro are full length treated with a Federally registered wood preservative to protect them from decay and extend their service life. At present, there are two preservatives that are acceptable by Manitoba Hydro specifications. These are Pentachlorophenol (Penta) and Chromated Copper Arsenate, type C (CCA). Both preservatives are considered to be equal in performance and no preference is made at time of purchase.

Penta is an oil borne preservative that does have a tendency to migrate out of the pole to a minor extent. An in-house study completed in 1990 found that five years after installation, penta was detectable in the soil immediately adjacent to the pole. This adds to the effectiveness of the preservative as it provides a barrier against the naturally occurring wood rotting fungi in the soil. This study also found that the levels of penta were at or near the background concentrations, one meter out from the pole after five years.

The CCA preservative is a water borne product, and once properly fixed in the wood cells will not come back into solution. We have yet to see any evidence of a migration of the preservative out of the wood into the surrounding soils. However, poles treated with CCA do have a tendency to be more susceptible to brush or forest fires. Unlike the oil borne preservative, which tend to flash up quickly when a fire passes by them and then go out, CCA treated material tends to smoulder a long time causing more damage to the pole, and may often require replacement.

CCA treated poles will be selectively set in wetland areas to preclude any migration of chemicals into surface water or ground water.

### **Use Precautions:**

- Treated wood should never be burnt as firewood for heating or cooking. During burning the preservative may give off contaminants in the smoke or ash that can be toxic to humans or the environment.
- Treated wood should not be used in residential interiors.
- Treated wood should not be used where it will be in frequent or prolonged contact with bare skin.
- Treated wood should not be used in locations where it may be in direct contact with fish, wildlife, domestic animals or livestock.
- Treated wood should not be used where it may come in contact with foodstuffs or animal feed.
- Treated wood should not be used where it may come into direct or indirect contact with water particularly drinking water for public, animal or livestock consumption.



**Handling Precautions:**

- Avoid frequent or prolonged skin contact with treated wood. Wear long sleeve shirts, long pants and gloves that are impervious to chemicals when handling material.
- When sawing or machining treated material, wear eye protection and dust mask to avoid inhalation of sawdust.
- After working with treated materials, before eating, drinking, using tobacco products or using the restroom, wash exposed skin areas thoroughly.
- Contaminated work clothes should be laundered before re-use. Wash work clothes separately from other household clothing.

Surplus or unwanted treated wood products may be disposed of as domestic waste products in small quantities at an approved landfill site.

**WARNING:**

**If an adverse health effect occurs that may be related to the use of treated products, consult a physician.**





Copies of this report may be obtained from:  
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