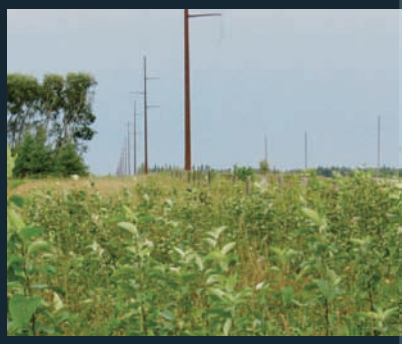
Fur, Feathers, Fins & Transmission Lines



How transmission lines and rights-of-way affect wildlife

Manitoba Hydro

Fur, Feathers, Fins & Transmission Lines

How transmission lines and rights-of-way affect wildlife

Copies of this report may be downloaded from: www.hydro.mb.ca

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Foreword

Manitoba Hydro is a provincial Crown Corporation responsible for providing a reliable supply of electricity to Manitobans. The Manitoba 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, or as part of ongoing operations and system maintenance activities.

Transmission lines bring power over long distances across the province, traversing forests, streams and other wildlife habitats. As a result, transmission lines have various effects on wildlife and wildlife habitats. This booklet has been created for trappers, hunters, fishers and others who work with, rely on, or study wildlife and wildlife habitats in Manitoba. It describes the various positive and negative effects transmission lines may have on wildlife and wildlife habitats and the mitigation strategies Manitoba Hydro employs to minimize any potential negative effects.

While the primary focus for the booklet is Northern Manitoba, much of the information also applies to transmission lines throughout the province. This booklet provides general responses to commonly asked questions about transmission lines.

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Introduction

Manitoba Hydro is a provincial Crown Corporation responsible for providing a reliable supply of electricity to Manitobans. The Manitoba 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, or as part of ongoing operations and system maintenance activities.

Manitoba Hydro is frequently asked questions about transmission lines. Many of these questions relate to the effect transmission lines may have on the environment and on people. In particular, we often hear from trappers, hunters and fishers who want to know more about the effects of construction, operation and maintenance of transmission lines related to animals, birds and fish.

Effects of Transmission Line Construction

There are several potential effects related to transmission line construction. The two most significant effects are physical changes to wildlife habitat and temporary disturbance to wildlife from the presence of construction workers and machinery.

What construction factors affect wildlife and wildlife habitat?

Several construction factors may have an effect on wildlife and wildlife habitat. These include clearing and disposal of vegetation, temporary access trails, crossing water bodies, waste and chemicals and borrow pits.

How does right-of-way and transmission line construction affect wildlife habitat?

Construction activities result in physical changes to wildlife habitat. Clearing of the right-of-way for a transmission line will remove relatively small amounts of wildlife habitat, however the effect on habitat varies from animal to animal. In some circumstances, clearing may encourage plants that improve habitat for

certain animals such as moose, deer, hare and birds. On the other hand, clearing critical habitat of rare or endangered species could have a negative or severe effect for those species.

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 effect, and the most potential benefits. Several types of habitat are generally avoided during the siting of transmission lines for both engineering and environmental reasons. 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 avoided wherever possible.

What mitigation measures can reduce or avoid negative effects on wildlife habitat?

Beyond avoiding sensitive sites, Manitoba Hydro uses a variety of mitigation measures to reduce or eliminate negative effects when constructing transmission lines in northern Manitoba. These include generally accepted mitigation measures and opportunities to enhance habitat, such as establishing buffer zones around sensitive habitat or scheduling construction activities when they will be least disruptive. Additional site-specific mitigation measures are written into detailed guides for construction known as Environmental Protection Plans. Manitoba Hydro strictly adheres to these measures.

What mitigation measures can reduce or avoid negative effects at water crossings?

When it comes to Manitoba's streams and rivers, Manitoba Hydro works to avoid or reduce negative effects at water crossings through appropriate planning and mitigation at every phase of the construction process. Before construction even begins, a detailed route planning process involves identifying and avoiding potential conflicts such as water crossings. Once a general route has been determined, negative effects at water crossings can be further avoided on a site-specific basis through avoidance of critical and

important habitat. Input from local residents can help identify important habitat in the area. Where water crossings are unavoidable, suitable mitigation measures are used and crossings are constructed and removed in accordance with government and industry guidelines.

What type of disturbances could wildlife experience during the construction phase?

Wildlife disturbance during construction is generally created by machinery used to construct transmission lines. Disturbances may include machinery noise, engine exhaust and dust emissions. Movement of people and vehicles may also disturb wildlife, and local wildlife may be temporarily displaced. Other small, localized effects could be expected from the presence of the construction work camps, including the presence of garbage and stored materials.

How are furbearing animals affected during construction?

Routing power lines through registered trapline areas may disrupt both furbearers and line holders. In general, species that are trapped for fur, food and income respond similarly to disturbance as any other species of wildlife. However, some furbearing animals are generally not affected by winter transmission line construction.

Effects of the Physical Presence of Transmission Lines

The physical presence of transmission lines can have an effect on wildlife. These potential effects include long-term changes to habitat, bird strikes, access issues, noise effects and associated avoidance behaviour, and electric and magnetic fields.

Do rights-of-way form a barrier to wildlife movement?

Whether a species is vulnerable to habitat change is directly related to its ability to adapt to changes in habitat. Relatively few animals find the right-of-way to be a barrier. Rights-of-way may displace or impede movements of some birds, marten and other small mammals that inhabit small territories or home ranges

in mature forest or that have difficulty crossing non-forested gaps.

Will right-of-way access have an affect on wildlife and wildlife habitat?

New rights-of-way have the potential to create additional local access. Snowmobile, ATV and other means of access may result in the introduction of non-native plant species and the increased potential for accidental fires. There are other positive and negative effects on wildlife and wildlife habitat, including new access for hunting, trapping, fishing and gathering activities. When the potential for effects from increased access is an issue, an Access Management Plan will be prepared to identify and minimize access issues and concerns.

What will be the effect on trapper access to wildlife populations?

Increased access along a transmission line may occur depending on the terrain and remoteness of the transmission lines, the number of traplines crossed by the transmission line, the total number of trappers concentrated in an area, and the availability of other travel corridors. In some areas the right-of-way will benefit trappers by providing them with the opportunity for easier winter access to a trapline. Remote access from a new right-of-way may even allow some trappers to gain access to previously inaccessible wildlife populations.

Will the transmission line right-of-way cause an increase in hunting and fishing access and harvest pressure?

During construction of the right-of-way, hunting and fishing access may increase while winter trails are usable. After construction, rights-of-way may create increased opportunities for access and resource harvesting. The increase in harvest 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 and fishers which take advantage of this new access.

Do transmission lines cause bird mortality?

There is a possibility of bird collisions with any man-made obstacle, including transmission lines. In general, proposed routes try to avoid crossing or paralleling water bodies or other habitat where large numbers of birds gather during the breeding or migratory seasons.

What can be done to reduce mortality from bird strikes?

Avoidance of critical areas of bird concentrations is the most effective mitigation measure to reduce bird strike mortality. During transmission line planning 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. Bird diverters and devices are increasingly being shown to reduce collisions.

Do birds use the structures?

Transmission line structures can enhance habitats for birds by providing additional breeding and roosting sites, and hunting and feeding perches. Many species of birds nest on utility distribution and transmission structures including hawks, eagles, and osprey.

Do transmission lines make noise that disturbs wildlife?

Not all wildlife species are sensitive to the low hum of some power lines that can be noticeable to people. Overall, it appears unlikely that line noise results in any significant effects to wildlife.

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. Both electric and magnetic fields are present near transmission lines. Numerous research programs have studied the effects of EMF on wild and domesticated animals. Overall, this research has not found any relationship between EMF and the health, behaviour or productivity of animals. Additionally, studies of crops and other plants have reported no adverse effects on growth or viability.

Effects of Transmission Line and Right-of-Way Maintenance

Transmission line maintenance includes regular inspection and repairs to the lines and structures. Line maintenance activities are conducted by ground and by air. Whenever possible, Manitoba Hydro conducts maintenance when the risk of disturbance to wildlife and wildlife habitat is low and attempts to mitigate any environmental or ecological effects. Generally, disturbances from line maintenance are infrequent and don't have a lasting effect on wildlife or wildlife habitat.

What type of disturbances could wildlife experience during line maintenance?

Line maintenance work is infrequent and is only likely to temporarily disturb or displace wildlife, if at all. Disturbances can be related to noise from equipment or from maintenance worker activities. When it does occur, unfamiliar noise may keep animals (mainly birds and large mammals) away from the immediate area during maintenance activities. However, line maintenance workers often spot wildlife along rights-of-way.

How does Manitoba Hydro minimize the effects of line maintenance on wildlife?

To minimize the effects of maintenance activities on wildlife and wildlife habitats, Manitoba Hydro seeks input from transmission line maintenance staff, Manitoba Conservation, trappers, hunters, fishers and others to understand local habitat and wildlife sensitivities as well as any logistical constraints.

What is vegetation management?

To keep trees and shrubs from interfering with transmission lines, and to make sure workers can access the lines to maintain and repair them, Manitoba Hydro has to maintain the rights-of-way. This is called vegetation management. Machine-cutting, hand-cutting and herbicides are used to control danger trees but low growing plants are encouraged and can be beneficial to wildlife.

What effects does vegetation management have on wildlife and wildlife habitats?

Transmission line and right-of-way maintenance have less of an affect on wildlife and wildlife habitat than construction activities. However, all forms of vegetation management change wildlife habitat by producing stable, low-growing vegetation. These rich low growing plants often benefit wildlife by providing food and cover and may increase foraging and nesting opportunities.

Monitoring the Effects of Transmission Lines

Manitoba Hydro conducts monitoring to gain further insight into potential effects of transmission lines, to measure the effectiveness of the mitigation measures being used, and to identify any unanticipated effects in order to adapt practices. Monitoring practices for each transmission line project are conducted in accordance with the conditions of project licenses and are identified in an Environmental Protection Plan. Monitoring may involve site inspections and information gathering from environmental inspectors, community environmental monitors, local residents or even pilot programs or other studies. By following environmental protection practices, utilizing an Environmental Protection Plan and conducting follow-up inspections, Manitoba Hydro minimizes the possibility for long-term effects on the environment.

Introduction




Introduction

Manitoba Hydro is frequently asked questions about transmission lines. Many of these questions relate to the effect transmission lines may have on the environment and on people. In particular, we often hear from trappers, hunters and fishers who want to know more about the effects of construction, operation and maintenance of transmission lines related to animals, birds and fish.

A transmission line in northern Manitoba

The environmental effects of **transmission lines**, and how best to mitigate or minimize those effects, are the subject of ongoing study and consideration by Manitoba Hydro. The resulting practices that guide transmission line construction, operation, maintenance and monitoring are rooted in both scientific and **traditional knowledge**.

The positive and negative effects of transmission lines – and efforts to mitigate any negative effects – vary depending on several factors. In this booklet we discuss the effects of transmission lines on animals, birds and fish in three main sections. The sections are

- Transmission line construction
- Physical presence of transmission lines
- Transmission line maintenance

A fourth section addresses how Manitoba Hydro monitors transmission lines and their effects.

There are three main concepts, or definitions, that are central to the questions addressed in this booklet:

- Transmission lines and rights-of-way
- Wildlife habitat and sensitivity
- Mitigation

On the next few pages, you will find an introduction to each of these key concepts. Throughout this booklet you'll see several terms in **bold**. Definitions for these terms have been provided in the glossary on page 77.

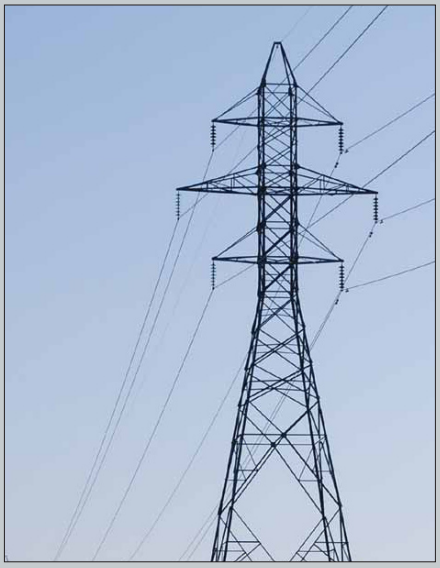
Key Concepts:
Transmission lines and rights-of-way

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 voltages up to 500 kV while lower voltage (66 kV and lower) 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 decreased as required for further distribution.

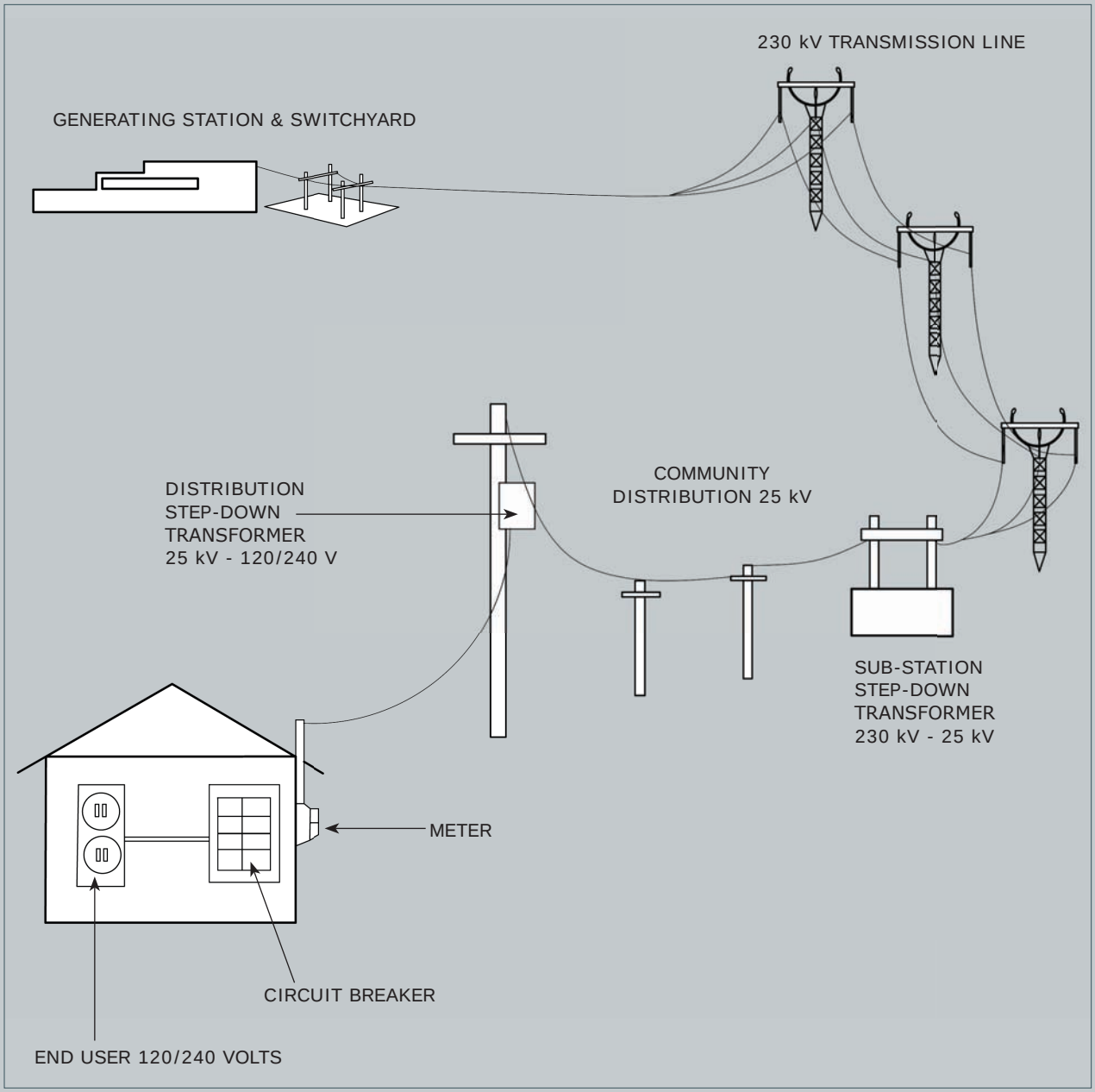
Transmission lines are made up of transmission line structures, more commonly referred to as **towers** or poles, and **conductors**, or wires. Each transmission line is designed to carry specific electrical voltages, and the appearance of the line may vary depending on voltage or other engineering considerations. The structures that support the conductors are made from single or double wooden poles, or steel.

A single circuit transmission line consists of a set of three 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, so each tower essentially carries two separate transmission lines

Transmission Line Distribution System



A simplified transmission and distribution system from generation to the consumer

High Voltage Direct Current (HVDC) transmission lines are different from most transmission lines in the province. Manitoba Hydro's system supplies electricity to its customers as **alternating current (AC)** power, so most transmission lines in the province carry AC power. HVDC transmission lines, sometimes known as bipole transmission lines (one positive pole and one negative pole), carry **direct current (DC)**. Using DC instead of AC transmission lines significantly reduces the amount of power lost during transmission. This makes HVDC lines more efficient at carrying power over long distances.

An HVDC line in Manitoba

There are many environmental statutes, policies, regulations and standards that Manitoba Hydro follows for its transmission lines. All Manitoba Hydro transmission line specifications meet national standards and Manitoba Hydro takes a proactive approach to environmental management, to anticipate and prevent environmental effects related to its operations. This approach is consistent with the Corporation's commitment to **sustainable development** and environmental stewardship.

Transmission Line Structure

To avoid unwanted outages caused by lightning, a lightning guard, or **sky wire** is installed at the highest point on the transmission tower

Insulators are used to connect the structure and the conductor while ensuring there is no path for the electricity to travel between the structure and the energized conductor

Conductors, or transmission line wires, carry electricity. The height of the conductors above the ground may vary, but conductors must clear the ground by at least seven metres as required by safety and industry standards

Transmission towers are secured into the ground using a variety of foundation types

Towers range from 20 to 50 metres (65 to 165 feet) in height. The tallest transmission towers in the Manitoba Hydro system are more than 100 metres (328 feet) high to support the long crossing of the Nelson River near the Limestone Generating Station

Towers in some locations may have **guy wires** and **anchors** which are used to support towers

Right-of-Way

Transmission lines are located within a cleared strip of land called a right-of-way. The width of the right-of-way, generally between 40 to 80 metres (130-260 feet), is determined by

- Whether multiple sets of transmission line towers are required
- The number of lines and kind of tower structures used
- The voltage carried by the transmission line
- The distance to tall trees, known as **danger trees**, which must be kept from touching or interfering with the line
- The requirements for landing helicopters for operations and maintenance work

Key Concepts: Wildlife, habitat and sensitivity

In this booklet, **wildlife** generally refers to birds, mammals and fish living in their natural environment. Wildlife **habitat** is used to describe the place where animals live. Each habitat has its own unique character. Some species need different habitats at different times of the year or at different times of their lives, such as during spawning, calving or nesting. Some habitats are less sensitive to change than others, and some species have adapted to human activities and use man-made structures as part of their habitat.

Hawks, ospreys and bald eagles will occasionally use transmission structures as nesting sites

Many wildlife species gather at certain times of the year in specific and often traditionally used areas:

- Waterfowl, or water birds, may use certain lakes for nesting or for staging before they migrate.
- Caribou, white-tailed deer and moose use traditional routes to move between winter and summer ranges.
- Small animals such as mice and voles have a limited range.
- Many kinds of fish spawn or spend the winter in specific areas of creeks or river-beds.

Manitoba Hydro examines these and other wildlife habitats on a site-specific basis in relation to transmission lines in northern boreal forests and other areas of Manitoba. Table 1 on the following page outlines some of the key factors Manitoba Hydro considers related to transmission lines, wildlife and wildlife habitat.

Table 1: Wildlife and wildlife habitat considerations

Transmission line location	Where a transmission line is located can result in very different effects.	• Clearing the right-of-way for a transmission line and encouraging low growing shrubs, grasses and herbs which thrive after exposure to full sunlight, provide good habitat for a variety of wildlife. However, **buffers** may be required when constructing a similar line in a wetland or shorelands.
Sensitivity of habitat to change	Some habitats are more sensitive to change and will take longer to recover from a **disturbance** than others.	• A peat bog, for example, is more sensitive to change than aspen forest.
Existing conditions	Locating transmission lines in areas that have recently experienced disturbances can minimize additional effects on wildlife habitat.	• For example, some areas in Northern Manitoba are frequently subjected to fires. Constructing a transmission line through wildlife habitat that has burned recently may have less of an effect than building a line through older burns which are often favoured by moose.
Size and availability of habitat	Considering the proximity of wildlife habitat when locating a transmission line can reduce effects on wildlife.	• Northern Manitoba's large unbroken expanses of forest are one example of a larger habitat where transmission lines may tend to affect only a few individuals within a larger wildlife population. Few exceptions may include woodland caribou.
Species diversity and density	Diversity and density refer to the number of different types of animals and the total number in a given area.	• Shorelines and wetlands are habitat for many fish, waterfowl and animals and may support higher population densities than other habitat areas[1].

Key Concepts: Mitigation

Transmission lines can have both positive and negative effects on wildlife and wildlife habitat. **Mitigation** refers to actions taken to avoid or minimize, to the extent possible, potential negative effects.

The mitigation measures referred to in this booklet are proven strategies, guidelines, procedures and practices from across Canada and the United States and reflect Manitoba Hydro's current practices. Manitoba Hydro documents these practices in **Environmental Protection Plans** and Environmental Protection Practices reports. These technical documents are prepared as part of mandatory environmental assessments conducted prior to the construction of transmission lines in Manitoba.

One example of mitigation is to make sure transmission towers are located far enough back from river banks to prevent erosion related to the towers from occurring. Manitoba Hydro establishes a buffer zone around sensitive areas such as streams and river banks

Effects of Transmission Line Construction




Effects of Transmission Line Construction

There are several potential effects related to **transmission line** construction. The two most significant effects are physical changes to **wildlife habitat** and temporary **disturbance** to wildlife from the presence of construction workers and machinery.

This section deals with the following topics related to transmission line construction:

- Effects on wildlife habitat
- Disturbances to wildlife
- Factors that affect wildlife and wildlife habitat

In northern Manitoba, major transmission line construction activities usually take place during winter when access is easier and the risk of negative environmental effects is lower. **Right-of-way** clearing and transmission line construction occurs in several phases. This includes a pre-construction phase which involves clearing narrow survey lines and small isolated helicopter landing areas to survey the right-of-way. Once construction begins, crews move down the transmission line route completing construction activities in sequence.

Salvageable timber is stacked in piles

Right-of-way clearing

Clearing the transmission line right-of-way involves clearing for transmission line construction and removal of tall **danger trees** that may affect the safety of the line or access to the line. In northern Manitoba, rights-of-way are typically cleared by machine using a method called winter shearing. The use of **"V" and "K-G" cutting blades** mounted on tractors is most effective in clearing **vegetation** with minimal ground disturbance. **Feller-bunchers**, hand clearing and other means are also used.

Slash from forested areas may be piled within the right-of-way and burned under permit, or timber may be **salvaged**.

Installing tower foundations

Where **tower** foundations are located on bedrock, blasting may be involved but excavation is the most common procedure. In order to prepare foundations, **borrow pits** may be developed, or crews may use till or gravel for backfill material.

Anchor installation

Anchors are secured into rock or soil to whatever depth is necessary for stability of the transmission line structures. **Guy wires** are attached to the anchors and then tensioned.

Work camps and temporary access trails are often required for northern transmission line projects. When possible, existing trails and roads are used for access.

Assembling and erecting transmission line structures

Structures will generally be assembled on-site and erected by crane. Helicopters may also be used to erect the structures. **Insulators** are typically attached to the structure when they are being erected.

Stringing conductors and ground wires

Once all towers in a section are erected, stringing can begin. **Conductor** stringing crews use heavy machinery such as dozers and tension pullers. Ground wires, also called **sky wires**, may consist of optical fibers which can be used for high-speed transmission of data.

What construction factors affect wildlife and wildlife habitat?

Several construction factors may have an effect on **wildlife** and wildlife **habitat**. These include clearing and disposal of **vegetation**, temporary access trails, crossing water bodies, waste and chemicals and **borrow pits**. Each of these topics is discussed below.

Clearing vegetation

Clearing activities usually change the vegetation cover for the entire width of the **transmission line right-of-way**, however lower shrubs, grasses, moss or other low cover are left undisturbed where possible. Construction is generally scheduled in the winter to minimize any negative effects on these plant communities and to the land itself. Clearing methods and changes at the edge of rights-of-way both influence wildlife habitat.

Clearing methods vary depending on local conditions and can have different effects on wildlife habitat. For example, in areas of very rugged terrain where conventional methods such as **K-G** or **V blading** are impractical, hand clearing methods may be necessary. In situations where **danger trees** located outside the right-of-way may affect the function of a transmission line, they will generally be removed using a **feller-buncher** to minimize the potential damage to adjacent vegetation and trees.

*Terrain may be a factor in determining clearing methods. In frozen conditions, feller-bunchers may be suitable for use in peat bogs, **riparian** areas and other sensitive habitats*

Changes may occur to vegetation and habitat at the edge of rights-of-way. When trees are cut, shade is removed from the forest and sun-scald may damage trees on the edge of the right-of-way. For example, some moss species may die back initially, but in subsequent years produce sun-tolerant leaves. In fact, with more exposure to sunlight, some trees that grow alongside transmission line rights-of-way are often taller than surrounding trees and the forest canopy may experience more growth.

Dieback may affect trees that had limbs damaged or cut at the edge of the right-of-way. Usually resulting from insect or fungal attacks on an exposed limb, dieback may affect only one or two limbs or in rare cases, may cause tree mortality[2].

Most of the trees in northern Manitoba grow less densely and as a result are suited to grow in these more open conditions

Disposal of cleared vegetation

Cleared slash is dealt with in a number of ways and some techniques can have a particularly beneficial effect on wildlife habitat. Piling and burning is the most common method of dealing with cleared vegetation. **Salvage** of timber and chipping are also practiced and occasionally, brush and slash is left where it is (for example, in a buffer zone). All disposal activities are completed in accordance with Manitoba Conservation permits.

Public and community fuel wood salvage may be possible when scheduling, safety, access and environmental concerns can be managed

Burning of slash only occurs during winter construction. Burning can contribute to excellent growth conditions for plants such as **deciduous** shrubs which are favoured by moose.

Wood salvage is one of Manitoba Hydro's first considerations when disposing of cleared vegetation. Salvaging **merchantable timber** may be possible where economically feasible, consistent with construction and environmental protection requirements and Manitoba Conservation work permits.

Chipping can be used to dispose of vegetation as well. It can have a minimal effect on wildlife habitat, however if too thick, it can smother vegetation and keep it from growing

Temporary access trails

Temporary access trails are often needed for transmission line construction. These trails physically remove some wildlife habitat and may result in other effects such as changes to soil, drainage patterns and permafrost, potential introduction of **invasive plants** or increased potential for accidental fires. **Mitigation** measures, including avoidance of sensitive sites and machinery maintenance, will minimize these effects. Other effects related to increased access to the area are discussed in the section *Effects of the Physical Presence of Transmission Lines*.

If new temporary access is required, sensitive features and habitat will be marked and avoided. Any new trails require work permits from Manitoba Conservation.

In addition, where areas have been temporarily cleared, re-growth of native vegetation is encouraged and in some cases, native and non-invasive grasses are seeded.

Where the potential for increased access is an issue in relation to managing potential effects on the environment, an Access Management Plan will be prepared prior to clearing and construction of the proposed transmission lines.

Mitigation procedures may include:

Minimizing traffic to the construction site.

Directing runoff away from disturbed areas vulnerable to erosion.

Minimizing **disturbance** to permafrost from rutting or scouring of topsoil.

Where possible, existing all-weather or winter roads and trails are used to access transmission line rights-of-way

Crossing water bodies

Transmission line construction may involve crossing water bodies. Shoreline wetlands can be sensitive habitat areas that support wildlife in higher population densities than other habitats. Crossing streams with heavy machinery and other construction activities may result in some shoreline erosion or disturbance to banks or stream bottoms, although mitigation measures are designed to prevent these effects. The loss of cover and shade due to vegetation removal can indirectly reduce the quality of instream habitats such as spawning or feeding areas.

The susceptibility of a shoreline to erosion varies with the type and amount of vegetation present, slope, soil texture, water flow and weather conditions during construction. If erosion occurs where transmission lines cross a stream, soil particles or **sediment** will enter the water. This process is called sedimentation and creates murky water. It may decrease feeding efficiency for sightfeeding fish such as trout, and may also reduce the production of insects and micro-organisms. Sediment may cover spawning beds, and indirectly reduce the oxygen content in those areas resulting in higher egg mortality and decreased spawning success[3].

Streamside vegetation helps regulate water temperature by shading the water from the sun

Removing bank vegetation may also increase the amount of sunlight reaching a stream which in turn may increase the temperature of the water and cause stress for some fish species. It also reduces leaf litter from adjacent trees and shrubs which is a source of food for some species[4].

One way to mitigate the effects of water crossings is to maintain buffer zones between construction areas and natural water bodies to the extent possible. This and other mitigation measures are outlined on pages 41 and 42.

Borrow pits

To construct a transmission line, borrow pits are often needed. Borrow pits are areas where fill materials such as gravel, sand, silt and clay are excavated for use in foundation installation. Effects of borrow pits on wildlife and habitat are generally related to the potential for noise, erosion, dust, soil and water contamination and minor, localized loss of habitat. Several mitigation measures are used to reduced or eliminate these effects.

New borrow pits are located as close to existing access routes as possible and the work face is oriented away from sensitive wildlife areas to minimize disturbance from noise. Where possible, excavations are deeper to minimize the area of surface disturbance.

Strict guidelines minimize the potential for erosion, dust, contamination and loss of habitat including minimum distances to stream banks or steep slopes.

When pits are cleaned up, a variety of procedures may be used to eventually return the site to potential wildlife habitat. For example, organic material is replaced on pit slopes and bottoms. The slopes are graded to allow for re-establishment of vegetation and in some cases, seeded with native or non-invasive grasses to assist in rehabilitation of the site.

Borrow pits are areas where fill materials such as gravel, sand, silt and clay are excavated for use in foundation construction

Waste and chemicals

Garbage and accidental oil, chemical or fuel spills can result in negative effects on wildlife and wildlife habitat. Before construction begins, containment, transport, disposal and emergency procedures are developed and approved by local and provincial authorities.

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 is attracted to construction camps as a result of improperly stored garbage. To reduce the likelihood of these confrontations, garbage and debris is collected and removed to a landfill site approved for use by appropriate regulatory authorities.

Environmental protection guidelines ensure storage facilities are located away from sensitive sites such as stream banks

Hazardous material spills, habitat disruption and contamination could result in potential damage to water bodies and landforms. To reduce the potential for an accidental spill or leak during transmission line construction, fuels, oils and chemicals are kept away from water bodies and are often stored in **marshalling yards**. All chemicals are stored in appropriate containers and removed from the project areas as required under applicable Manitoba environmental legislation.

Natural openings are generally good locations for storage, where soil disruption from additional clearing can be avoided. Sites where soil has a high weight-bearing capacity and low permeability are also preferred to minimize the potential effects of accidental spills.

If they do occur, all hazardous material incidents or spills are carefully documented, reported and mitigated through Manitoba Hydro's Spill Response procedures. For example, when a site becomes contaminated by a chemical leak such as gasoline, the impacted area is marked-off, a series of soil samples are collected and analyzed, the affected matter (snow, soil or plant material) is transported off-site, and clean replacement material is then used to backfill the area.

How does right-of-way and transmission line construction affect wildlife habitat?

Construction activities result in physical changes to **wildlife habitat**. Clearing of the **right-of-way** for a transmission line will remove relatively small amounts of wildlife habitat, however the effect on habitat varies from animal to animal. In some circumstances, clearing may encourage plants that improve habitat for certain animals such as moose, deer, hare and birds. On the other hand, clearing critical habitat of rare or endangered species could have a negative or severe effect for those species.

Moose habitat can be improved through right-of-way clearing

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

Route planning and construction practices vary greatly between northern and southern Manitoba due largely to differences in terrain.

For example, requirements for traversing rugged northern boreal forests are different than for cleared agricultural land in southern Manitoba.

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 effect, and the most potential benefits. Several types of habitat are generally avoided during the siting of **transmission lines** for both engineering and environmental reasons. 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 avoided wherever possible.

Several 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. Plant communities that are naturally sparsely vegetated and require a long time for revegetation such as tundra and sand dune communities may also be classified as sensitive. 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 **right-of-way**, but old burns (for example, 20 years old) often provide superior moose habitat. Topographic features such as ridges and hills receive considerable longterm use by wildlife as travel corridors, and are avoided when routing transmission lines, where possible.

Maintaining diverse species is an important objective in transmission line planning and design. Manitoba Hydro inventories, analyzes and maps the locations of unique or unusual habitats or areas used for trapping, hunting, and fishing purposes. Consultation with local people is necessary to identify these areas and their importance. However, to minimize cost and design complexity, transmission lines are generally as short and straight as possible unless reasonable geographical, technical, or environmental considerations call for alternate routing.

In northern Manitoba, sensitive or critical habitats for species included in the federal Species at Risk Act and the Manitoba Endangered Species Act are avoided where possible through the Site Selection and Environmental Assessment process. These may include core winter caribou habitat or wetlands where caribou calving habitat or colonial nesting sites are found.

Caribou calving habitat is sometimes called caribou calving islands due to their island-like appearance within wetland areas

A caribou cow, young adult and calf

What mitigation measures can reduce or avoid negative effects on wildlife habitat?

Beyond avoiding sensitive sites, Manitoba Hydro uses a variety of **mitigation** measures to reduce or eliminate negative effects when constructing **transmission lines** in northern Manitoba. These include generally accepted mitigation measures and opportunities to enhance **habitat**, such as establishing **buffer** zones around sensitive habitat or scheduling construction activities when they will be least disruptive. Additional site-specific mitigation measures are written into detailed guides for construction known as **Environmental Protection Plans**. Manitoba Hydro strictly adheres to these measures.

A Manitoba Hydro worker identifies a buffer zone around a sensitive habitat

Some of the mitigation measures that are useful to reduce negative effects, and in some cases, enhance **wildlife** habitat include

- Leaving natural **vegetation** buffers between the transmission line and sensitive wildlife habitats such as nesting sites of eagles, ospreys and other birds of prey
- Identifying and retaining active dens or burrows and roosting trees on or adjacent to the right-of-way
- Employing construction methods and timing appropriate to the local site (for example, suspending operations during a sensitive time period such as nest initiation, egg laying, or calving)
- Stabilizing disturbed soil to assist vegetation re-growth and to control erosion
- Planting shrubs or trees as cover 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
- Retaining snags and logs
- Using nesting platforms on transmission line **towers** to enhance raptor habitat
- Avoiding calving and nesting areas

Buffer around a nesting site

*A pine marten in a **right-of-way***

A blue heron rookery

Recommendations on mitigation measures such as these are an important part of Site Selection and Environmental Assessment studies which are conducted for any transmission line construction project. These studies consider all possible effects on wildlife habitat and evaluate the effects that are specific to local conditions.

Once the transmission line route has been selected, further consultation with local people also identifies areas where special management practices may be needed. Selected mitigation measures are then written into an Environmental Protection Plan for that project.

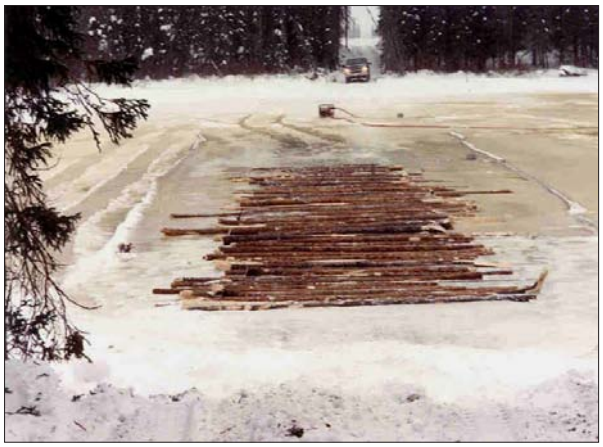
Special management practices are identified for every transmission line project

What mitigation measures can reduce or avoid negative effects at water crossings?

When it comes to Manitoba's streams and rivers, Manitoba Hydro works to avoid or reduce negative effects at water crossings through appropriate planning and **mitigation** at every phase of the construction process. Before construction even begins, a detailed route planning process involves identifying and avoiding potential conflicts such as water crossings. Once a general route has been determined, negative effects at water crossings can be further avoided on a site-specific basis through avoidance of critical and important **habitat**. Input from local residents can help identify important habitat in the area. Where water crossings are unavoidable, suitable mitigation measures are used and crossings are constructed and removed in accordance with government and industry guidelines.

*A **buffer** zone is established at a stream crossing*

In addition to the general mitigation measures listed on page 38, Manitoba Hydro often uses the following techniques to avoid or minimize construction effects at stream and water crossings:



Ice bridge

***Riparian** vegetation*

Helicopter utilizing a small bridge for landing

- Scheduling the construction period so it has the least negative effect to the shoreline (clearing in winter months when the ground is frozen reduces rutting from machinery)
- Using existing trails wherever possible to limit the clearing of **vegetation** or soil compaction
- Using ice bridges and snow fills for stream crossings
- Constructing approaches and crossings perpendicular to the stream or river to minimize loss or **disturbance** to vegetation
- Eliminating or minimizing use of heavy equipment in streambeds to prevent silting of streams
- Avoiding crossings on inherently unstable areas such as meander bends or braided streams that may result in erosion or scouring of the stream bed
- Installing effective **sediment** and erosion control measures prior to construction to prevent entry of sediment into the water body
- Minimizing the removal of riparian vegetation and maintaining adequate undisturbed buffer zones along streams to provide shade and bank protection
- Hand-clearing vegetation to minimize disturbance to stream banks

- Locating temporary or permanent structures above the **ordinary high water mark**
- Washing, refueling and servicing machinery away from the water
- Keeping construction debris out of streams to reduce siltation of spawning areas and blockages
- Inspecting sediment and erosion control measures regularly and taking immediate action to repair any inadvertent damage
- Removing materials used in temporary crossing construction
- Stabilizing and revegetating banks after crossing is complete

Stream crossings and access through riparian ecosystems are constructed and removed in accordance with *Fisheries and Oceans Canada Manitoba Operational Statements*[5].

Manitoba Hydro obtains project specifications, guidelines, licences and permits before beginning construction. During construction, senior field authorities monitor activities and ensure that all environmental requirements are met. After construction, monitoring activities continue to ensure environmental protection guidelines are followed and commitments have been met. This may involve revegetation of riparian areas or other remediation of a site. More information on monitoring activities can be found in the section *Monitoring the Effects of Transmission Lines.*

*Inherently unstable or sensitive sites are avoided where possible through **transmission line** route planning*

Vegetation buffer in a right-of-way

What type of disturbances could wildlife experience during the construction phase?

Wildlife disturbance during construction is generally created by machinery used to construct **transmission lines**. Disturbances may include machinery noise, engine exhaust and dust emissions. Movement of people and vehicles may also disturb wildlife, and local wildlife may be temporarily displaced. Other small, localized effects could be expected from the presence of the construction work camps, including the presence of garbage and stored materials.

The time of year and distance from the source of disturbance are two important factors when determining the potential magnitude of the effects of construction. Engine noise of construction vehicles and helicopters will disturb animals and birds and tend to keep them away from the construction area. This may temporarily reduce their available area of **habitat**. For example, construction noise may cause the abandonment of dens or nests. A temporary reduction of habitat may be critical if construction coincides with the reproductive season of certain species because habitat requirements at this time are often very specific. These types of sites are generally identified as part of a transmission line Site Selection and Environmental Assessment study process.

Owl breeding and nesting sites are avoided during construction[6]

Transmission line construction in northern Manitoba usually takes place during the winter months while the ground is frozen. Birds such as bald eagles, would not be disturbed because they are not present during the winter season. However, resident species like some owls initiate nests in early spring while snow is still on the ground. While most mammals do not bear their young during winter months, special precautions may be necessary near denning or nesting sites when late spring construction takes place.

How are furbearing animals affected during construction?

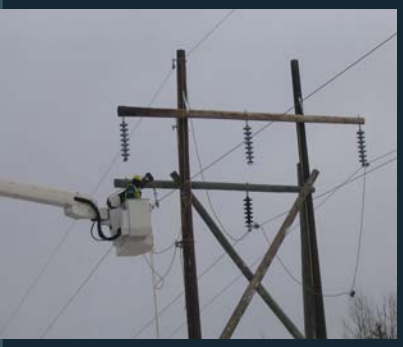
Routing power lines through **registered trapline** areas may disrupt both **furbearers** and line holders. In general, species that are trapped for fur, food and income respond similarly to **disturbance** as any other species of **wildlife**. However, some furbearing animals are generally not affected by winter **transmission line** construction.

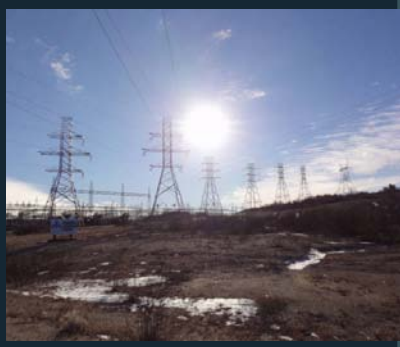
Within each registered trapline, clearing and construction activities likely extend over a short period and trappers will be notified of the schedule for construction activities in advance. Given the short-term duration of these activities in any one area, effects on furbearing animals and other wildlife are expected to be minor. **Mitigation** of these effects may take the form of a disturbance allowance paid to affected line holders for loss of income during the period of clearing and construction. However, disturbance allowances are considered on a project by project basis.

Aquatic furbearers such as beaver and muskrat will not leave their preferred area unless bank dens, push-ups, or lodges are accidentally damaged which is unlikely to occur

Terrestrial furbearing animals, such as this family of lynx, may temporarily leave the area while construction activity occurs and this may result in temporarily decreased productivity on the traplines. These animals will normally return to the area after construction of the line has been completed

Effects of the Physical Presence of Transmission Lines



Effects of the Physical Presence of Transmission Lines

The physical presence of **transmission lines** can have an effect on **wildlife**. These potential effects include long-term changes to **habitat**, bird strikes, access issues, noise effects and associated avoidance behaviour, and **electric and magnetic fields**.

*An artificial nesting platform alongside a **right-of-way***

Two key concepts are associated with the long-term presence of transmission line rights-of-way in wildlife habitat: **edge effect** and **habitat fragmentation**. While the mixture of habitats created by rights-of-way can allow greater density and diversity of wildlife to be present, transmission lines may also produce a negative edge effect for some species which require large, undisturbed habitat.

Rights-of-way can create an edge effect, which refers to the border between different types of habitat and it is regarded as an important component of wildlife habitat. **Vegetation** composition changes in the newly created edge because plant species that do well in high light conditions become more widespread and abundant while interior species not accustomed to higher light intensity are eliminated.

Changes to habitat composition will also change habitat quality for plants and animals which can have a positive, negative or neutral effect depending on the species[7].

Habitat fragmentation refers to plant communities that have become divided or isolated. Individual transmission line projects may fragment the landscape by dividing large blocks of forested habitat into smaller blocks which can result in a decline in species within the remaining forests. The northern spotted owl is one example of a raptor dependant on old growth forest that is negatively affected by fragmentation[8]. Woodland caribou, which require large tracts of relatively undisturbed habitat may also be negatively affected by any habitat fragmentation effects caused by transmission line rights-of-way[9].

Manitoba Hydro continues to be involved in ongoing caribou-related studies including conducting aerial surveys and radio collaring of woodland caribou.

Edge effect refers to the border between different types of habitat

Do rights-of-way form a barrier to wildlife movement?

Whether a species is vulnerable to **habitat** change is directly related to its ability to adapt to changes in habitat. Relatively few animals find the **right-of-way** to be a barrier. Rights-of-way may displace or impede movements of some birds, marten and other small mammals that inhabit small territories or home ranges in mature forest or that have difficulty crossing non-forested gaps[10].

Small animals will avoid using a right-of-way itself, but instead concentrate along the edge. Birds, furbearing mammals, and ungulates (moose and deer, for example) are commonly seen feeding and travelling along rights-of-way.

Rights-of-way are not barriers for wide-ranging species such as moose and bear

Narrow linear clearings do not act as barriers to movements of wide-ranging species such as moose and black bear and may even create travel corridors for predators such as wolves, enhancing their movement and hunting opportunities within their range[11].

To enhance **wildlife** movement across the right-of-way, **mitigation** measures may include establishing wildlife corridors, or uncleared strips across the right-of-way. Slash piles may also add to habitat for small animals.

Wolves may use rights-of-way to enhance their movement and hunting opportunities

During winter, a right-of-way may create a tunnelling effect when passing through dense forest which may result 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 right-of-way, 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.

Will right-of-way access have an affect on wildlife and wildlife habitat?

New **rights-of-way** have the potential to create additional local access. Snowmobile, ATV and other means of access may result in the introduction of non-native plant species and the increased potential for accidental fires. There are other positive and negative effects on **wildlife** and wildlife **habitat**, including new access for hunting, trapping, fishing and gathering activities. When the potential for effects from increased access is an issue, an Access Management Plan will be prepared to identify and minimize access issues and concerns.

Access created by transmission line rights-of-way may affect a variety of activities from fishing, hunting and trapping to gathering plants, berries and fuel wood, wild rice harvesting, outfitting, mining claims, forestry and tourism.

Transmission line rights-of-way are not public roads and are not intended or designed for public travel. Fens, bogs, streams, rivers, rock outcrops and other terrain can make rights-of-way very difficult to negotiate with most motorized vehicles, particularly during spring, summer and early fall. Winter use is more common[12] and is directly related to factors such as

- The presence of intersecting roads or nearby communities
- The remoteness of the area
- The type of terrain
- The presence of alternate travel routes

Increased access to resources such as big game or fish can be viewed both positively and negatively. Manitoba Hydro does not encourage travel along rights-of-way but it can be expected that some travel for varying purposes will occur. Signage is strategically placed to deliver information for safety or education purposes.

Signage is often part of an Access Management Plan

What will be the effect on trapper access to wildlife populations?

Increased access along a **transmission line** may occur depending on the terrain and remoteness of the transmission lines, the number of traplines crossed by the transmission line, the total number of trappers concentrated in an area, and the availability of other travel corridors. In some areas the **right-of-way** will benefit trappers by providing them with the opportunity for easier winter access to a trapline. Remote access from a new right-of-way may even allow some trappers to gain access to previously inaccessible **wildlife** populations.

Annual fur sale in Thompson, MB

The **edge effect** of rights-of-way on plant communities will provide new **habitat** for hares and other small mammals, which in turn will attract furbearing predators and improve the potential for increased production of wildlife. The total production of animals and available harvest opportunities for different species depend on the quality and quantity of wildlife habitat crossed by the transmission line right-of-way and the total number of trappers accessing the right-of-way. For example, increased human access to rights-of-way and related hunting and trapping-related mortality could result in an abandonment of these areas by some furbearers[13].

Manitoba Hydro is very interested in better understanding furbearer behaviour and trapper success along newly constructed and existing transmission lines. To help achieve this, a pilot study has been initiated to work with local trappers in northern Manitoba. Various aspects that could have influence on furbearers are being observed including small mammal populations, furbearer behaviour, weather statistics and trappers harvest. Results of this study could help future Site Selection and Environmental Assessments for transmission lines whereby helping to minimize negative impacts and increase positive ones.

Will the transmission line right-of-way cause an increase in hunting and fishing access and harvest pressure?

During construction of the **right-of-way**, hunting and fishing access may increase while winter trails are usable. After construction, rights-of-way may create increased opportunities for access and resource harvesting. The increase in harvest 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 and fishers which take advantage of this new access.

Over the long-term, the right-of-way will provide winter access and limited summer access depending on the type of terrain the right-of-way 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 along some accessible rights-of-way.

A trapper's cabin in northern Manitoba

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. However, new transmission lines could increase access in previously inaccessible fishing areas and potential for increased access could increase the harvest of fish.

If the potential for increased access is an issue, an Access Management Plan may be developed towards minimizing the potential adverse effects of access. It will identify the location of access corridors, how they will be developed and managed to minimize effects to wildlife habitat, and when and how they will be decommissioned. It may also identify if and when right-of-way clearing and maintenance methods will be managed to limit future access.

Mitigation can involve additional efforts by Natural Resource Officers to patrol access trails or rights-of-way 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 rights-of-way.

Do transmission lines cause bird mortality?

There is a possibility of bird collisions with any man-made obstacle, including **transmission lines**. In general, proposed routes try to avoid crossing or paralleling water bodies or other **habitat** where large numbers of birds gather during the breeding or migratory seasons.

Proposed transmission line routes generally avoid areas where birds gather in large numbers

Bird mortality from collisions with lines or electrocution is biologically significant when it results in a measurable change, for example in population size. The effect of **bird strike mortality** can be judged biologically significant only if it results in population decline. Manitoba Hydro does not have any indication that this scale or type of effect is occurring, but is actively studying the issue. **Mitigation** measures minimize the potential for biological effects.

Data on bird mortality from transmission lines is difficult to obtain. Methods generally include visually monitoring bird movements and dead bird searches. A partial list of factors which influence bird collisions with transmission lines are shown in Table 2.

Estimates of bird deaths in the USA from electrocution are in the range of thousands per year while collisions are in the range of hundreds of thousands to 175 million per year[14]. However, estimates of bird deaths vary considerably. Bird-wire collisions are rarely reported for many thousands of kilometres of transmission lines in North America, or are limited to a particular location or season. There are documented cases of problem sites. For example, one study near prairie wetlands and lakes in North Dakota estimated 124 bird deaths per kilometre per year[15].

Table 2: Factors which may determine the number of bird collisions expected with a transmission line

General Category	Factor	Suspected High Collision Risk Situation
Bird Biology	Species	Nocturnal fliers and those with awkward flight characteristics
	Wing loading	Heavier body and smaller wings restricts manoeuvrability
	Age	Immature birds
	Health	Sick or injured birds
	Migration	Migrants as opposed to residents
	Sex	Birds involved in nuptial displays, gender related size/movement patterns
Flight	Flight intensity	Large numbers crossing **rights-of-way**
	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
Transmission Line	Tower type	Guyed structures, tall towers at river crossings
	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
Environment	Weather	Fog, snow, rain, sleet, high winds
	Habitat	Attractive habitat on or surrounding right-of-way
	Human activity	Hunting, other activities which startle birds
	Location	Lines located perpendicular to narrow, low altitude flyways

Manitoba Hydro takes into consideration areas of high bird traffic during the routing of transmission lines and to the extent possible, avoids wetlands, lakes or other high bird traffic areas. When unavoidable, potential problem sites are identified and mitigation measures such as bird diverters are used to prevent bird-wire collision.

Past studies have shown that, in general, bird deaths due to collisions with power lines are considered an unimportant source of mortality at the population level[16]. However, under certain circumstances collision losses can be biologically significant, for example, if the species is threatened or endangered[17]. No such examples are known of in Manitoba.

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. However, distinctions were not made between transmission line, distribution line or telephone line collision injuries. Birds of prey accounted for 40% of those collisions. Volunteers with MWRO successfully rehabilitated and released about 15% of all these cases.

A family of mallard ducks

Bird mortality from transmission and distribution lines can be compared to mortality from other sources. The first attempt to estimate bird mortality from human causes in the U.S. suggested 1.9 percent of the then bird population were killed by human causes and the majority were hunting-related. More recent estimates suggest that vehicle strikes and building and window collisions each account for tens to hundreds of millions of bird deaths annually. Communication towers and wind turbines are two types of structures increasingly studied regarding bird mortality. Current estimates suggest bird mortality in the range of tens of millions for communications towers and in the thousands for wind turbines. Other sources include oil spills or other contaminants, cat predation, aircraft and train strikes[18].

Waterfowl such as ducks, geese, herons, and cranes are among the most common bird strike casualties[19]. This is because their large, heavy bodies are less manoeuvrable, and because they tend to make high speed feeding runs in the morning and at dusk when low lighting conditions are most common. Grouse, and in particular ptarmigan, may also be particularly vulnerable to collision mortality. Alternately, raptors and ravens may be less likely to become victims of power line collisions because they fly at slower speeds and are more manoeuvrable[20].

A sandhill crane is spotted in a right-of-way

An osprey nest on a transmission line structure

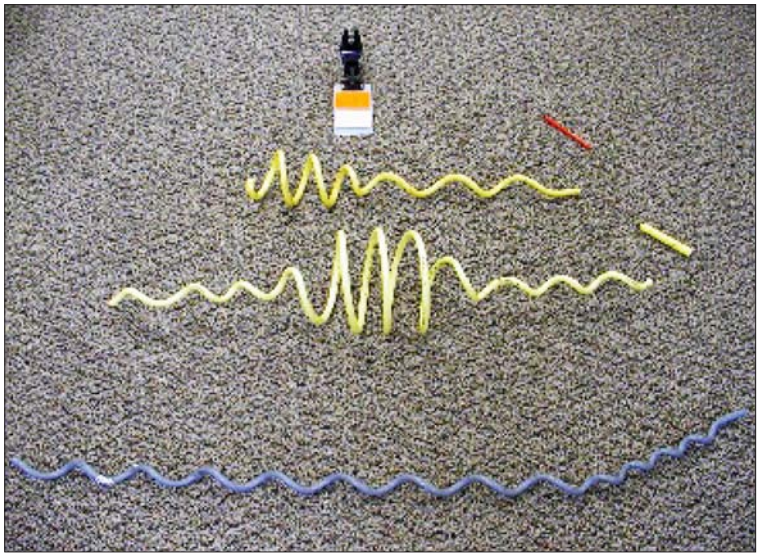
In addition to collisions, bird mortality may occur through electrocution. Research has shown that electrocution of birds rarely occurs on high voltage transmission lines because conductors are far enough apart to prevent simultaneous contact of the bird's extremities with adjacent conductors or contact from a conductor to a ground.

In an attempt to better understand and address both bird collision and electrocution problems, research is being conducted by the Electric Power Research Institute and others at the Audubon National Wildlife Refuge, North Dakota and it is anticipated the research will be published in 2011. Preliminary findings show a stronger leaning towards vehicle collisions than transmission or distribution line collisions[21]. Manitoba Hydro practices are regularly updated to reflect the most current research and best practices.

What can be done to reduce mortality from bird strikes?

Avoidance of critical areas of bird concentrations is the most effective **mitigation** measure to reduce **bird strike mortality**. During transmission line planning 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. Bird diverters and devices are increasingly being shown to reduce collisions.

Up to 90% of collisions may occur on the **sky wire**. Compared to **conductors**, its narrow diameter makes it difficult to see in low light, fog and other reduced visibility conditions[22]. However, sky wires serve an essential function in reducing the likelihood of damage to transmission lines from lightning strikes. Marking the transmission lines or sky wires can make the lines more visible to birds in flight[23]. Results from 18 studies demonstrated a 45% reduction in collisions when conductors or sky wires were marked[24]. In another study, collisions decreased by 60% after sky wires were marked[25].



Common collision mitigation devices (from top to bottom): Firefly flight diverter, bird flight diverter, swan flight diverter, and spiral damper

The effectiveness of the device can depend on factors related to environmental conditions, species and transmission voltage[26]. Manitoba Hydro uses a variety of diverters and markers to reduce bird strikes.

Other possible mitigation methods for reducing bird strikes include

- Routing lines parallel to lines of flight and prevailing winds
- Setting lines against such background as hills or cliffs to give birds a clear view of the lines
- Modifying **habitat** near transmission lines to change the attractiveness to birds, such as trees growing near or above the height of power lines, causing birds to gain altitude and clear the transmission lines
- Modifying habitat to reduce **disturbance** to birds; for example, creating feeding and resting habitat on the same side of the transmission line to minimize reasons for birds to cross

Do birds use the structures?

Transmission line structures can enhance **habitats** for birds by providing additional breeding and roosting sites, and hunting and feeding perches. Many species of birds nest on utility distribution and transmission structures including hawks, eagles, and osprey.

Some species make extensive use of transmission lines in boreal areas. In Manitoba, ospreys, bald eagles, hawks and ravens are known to nest on transmission line **towers**[27]. Eagles are more prominent nesters on northern transmission lines than ospreys. Other species such as pileated and other woodpeckers, American kestrel, wood duck, and in some instances, northern flying squirrels, frequently use wooden hydro poles as homes. Transmission line workers have observed successful hatching and fledging in nests located on transmission line structures. The return of nesting birds each year anecdotally suggests transmission lines do not negatively effect these bird activities.

Some nests on transmission lines may create a potential electrical hazard when nests are built on wires and **insulators**. **Mitigation** techniques are available to minimize this problem, including

- Construction of artificial platforms
- Use of bird perch deterrents such as porcupine wire below insulators
- Removal of nests prior to egg-laying, or careful transplanting of the nest, eggs or young to nearby trees or platforms

Artificial platforms reduce electrical hazards and enhance habitat for breeding and roosting

A bird's nest being removed prior to egg-laying

Do transmission lines make noise that disturbs wildlife?

Not all **wildlife** species are sensitive to the low hum of some power lines that can be noticeable to people. Overall, it appears unlikely that line noise results in any significant effects to wildlife.

Transmission line noise may be distinguished as three types:

- 120 Hz AC hum
- **Corona** discharge
- Wind hum from wires and structures

Under high humidity, static noise from transmission lines is greater than in dry weather.

The level of noise emitted by transmission lines is related to **conductor** size and configuration, voltage and weather conditions. 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, wind can be heard blowing through the wires.

There is limited research on the effects of transmission line noise on wildlife. However, we know 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**. Owls, for example, often use transmission line towers as perch sites and to search for mice and voles. Although owls depend on sound to locate prey under the snow, transmission line noise does not appear to hinder hunting at these locations[28].

One study in Norway demonstrates that while reindeer may hear corona noise from power lines, the noise may not necessarily disturb the animals. It is likely that sudden, loud noises have stronger effects on reindeer than the low-intensity corona noise[29].

Anecdotal information from transmission line maintenance and construction workers suggests transmission line noise has not deterred caribou, moose and other animals from feeding along transmission line **rights-of-way**. Current Global Positioning System collar studies on woodland caribou in Manitoba may provide new information about the effects of noise and other potential **disturbances** on caribou populations.

Noise from transmission lines does not appear to disturb wildlife

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. Both electric and magnetic fields are present near **transmission lines**. Numerous research programs have studied the effects of EMF on wild and domesticated animals. Overall, this research has not found any relationship between EMF and the health, behaviour or productivity of animals. Additionally, studies of crops and other plants have reported no adverse effects on growth or viability.

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. The EMF levels measured near any source depend on a number of factors, but largely on the distance at which the measurement is taken. Both electric and magnetic field levels decrease with increasing distance from the source, just as the heat from a candle or stove decreases as you move further away.

Research has not shown a relationship between EMF and the health or behaviour of animals

A large body of research has been conducted in Canada and other countries for almost forty years on a wide variety of topics related to the potential for AC electric and magnetic fields to affect health. This research includes

- Observational studies of people, which evaluate the relationship between estimated magnetic field exposures and diseases
- Studies of laboratory animals exposed to high EMF levels for long periods of time and studies of cells and tissues exposed to EMF in the laboratory

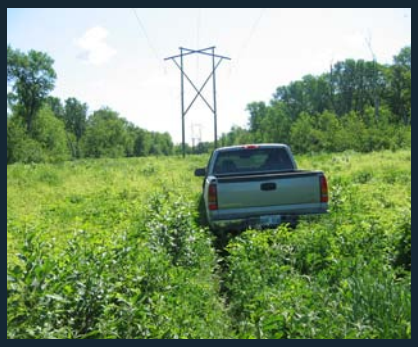
Numerous scientific and health agencies have evaluated this body of research, including the World Health Organization, the International Agency for Research on Cancer, and the Health Protection Agency of Great Britain. In Canada, the topic has been evaluated by the Federal Provincial Territorial Radiation Protection Committee (FPTRPC). The FPTRPC is an intergovernmental committee assembled to harmonize the standards and practices for EMF within federal, provincial and territorial jurisdictions. Health Canada refers to the FPTRPC as the authority on issues related to EMF.

The conclusions of these scientific agencies have been generally consistent. Overall, they concluded that the research does not show that electric or magnetic fields are a known or likely cause of any disease, including cancer.

While Manitoba Hydro is sensitive to public concerns regarding possible health effects from electric and magnetic fields, there is at present no scientific evidence to justify modification of existing practices or facilities for the generation, transmission and distribution of electricity. Manitoba Hydro continues to develop and maintain a reliable technical database and undertakes the following actions to ensure the safety of the public and its employees:

- Responding to enquiries and concerns from the public and employees
- Monitoring worldwide research programs on electric and magnetic fields
- Maintaining active communications and make technical information available to interested parties, including the public and agencies responsible for public health and the environment

Effects of Transmission Line and Right-of-Way Maintenance

Effects of Transmission Line and Right-of-Way Maintenance

Transmission line maintenance includes regular inspection and repairs to the lines and structures. Line maintenance activities are conducted by ground and by air. Whenever possible, Manitoba Hydro conducts maintenance when the risk of **disturbance** to **wildlife** and wildlife **habitat** is low and attempts to mitigate any environmental or ecological effects. Generally, disturbances from line maintenance are infrequent and don't have a lasting effect on wildlife or wildlife habitat.

For inspection and maintenance access, Manitoba Hydro assesses which vehicles will cause the least disturbance while allowing the necessary work to be completed. For example, if a transmission line is accessible by road, a light truck may be used.

There are times during emergency repairs when access to the lines may cause damage to trees, shrubs and the surrounding terrain. And, on occasion, tracked vehicles may disturb the land when accessing transmission lines for routine maintenance. Stream crossings are particularly sensitive to movement of equipment. Manitoba Hydro applies strict maintenance and environmental protection practices to reduce or eliminate potential effects.

Manitoba Hydro also conducts ground patrols using all terrain vehicles, ***soft track vehicle*** *(pictured left) snowmobile (pictured right), or by foot*

What type of disturbances could wildlife experience during line maintenance?

Line maintenance work is infrequent and is only likely to temporarily disturb or displace **wildlife**, if at all. **Disturbances** can be related to noise from equipment or from maintenance worker activities. When it does occur, unfamiliar noise may keep animals (mainly birds and large mammals) away from the immediate area during maintenance activities. However, line maintenance workers often spot wildlife along **rights-of-way**.

Depending on the type of animal, the time of day, time of year and other factors, wildlife may experience different effects from **transmission line** maintenance. These effects may also be influenced by the type and the scale of maintenance activities.

For example, in rare cases, the use of aircraft may frighten birds causing them to leave nests. In most northern areas, birds do not gather in large numbers near transmission lines.

At times, line maintenance workers provide information on animal sightings along or near transmission line rights-of-way (such as the wolves pictured here) to local Natural Resources Officers

When is line maintenance conducted?

Manitoba Hydro typically conducts **air patrols** of transmission lines two or three times per year by airplane or helicopter.

Ground patrols are typically conducted once a year.

Non-scheduled patrols are conducted by air or ground as required.

How does Manitoba Hydro minimize the effects of line maintenance on wildlife?

To minimize the effects of maintenance activities on **wildlife** and wildlife **habitats**, Manitoba Hydro seeks input from **transmission line** maintenance staff, Manitoba Conservation, trappers, hunters, fishers and others to understand local habitat and wildlife sensitivities as well as any logistical constraints.

*Bird nest along **right-of-way***

For example, Manitoba Hydro uses information about areas where nests are active or large groups of wildlife are gathering to determine maintenance schedules and avoid these areas during active times. When line maintenance is conducted, nests are not removed unless they interfere with the lines or if the safety of the workers is in question.

Manitoba Hydro's maintenance procedures and **mitigation** methods are continuously updated to reflect current knowledge and study.

What is vegetation management?

To keep trees and shrubs from interfering with **transmission lines**, and to make sure workers can access the lines to maintain and repair them, Manitoba Hydro has to maintain the **rights-of-way**. This is called **vegetation** management. Machine-cutting, hand-cutting and **herbicides** are used to control **danger trees** but low growing plants are encouraged and can be beneficial to **wildlife.**

How vegetation is maintained depends on what is growing and how fast. It may also depend on how sensitive the site and individual plants are to change. Manitoba Hydro considers site-specific factors to determine vegetation control methods and minimize any negative effects on the surrounding environment.

Handcutting

When is vegetation management conducted?

Vegetation management is typically conducted during the summer by foot, ATV or **soft track vehicle**. Transmission lines in isolated areas are typically maintained in winter when the ground is frozen.

When possible, line and vegetation maintenance are done at the same time to reduce effects on **habitat**.

Workers use machine-cutting, hand-cutting or selectively apply herbicides to control vegetation and to encourage lower growing shrubs, grasses and herbs. Mechanical treatments such as selective hand-cutting or **"K-G" blading** during winter are the most common types of vegetation maintenance in northern Manitoba.

Mulching

K-G blading

Global warming is bringing more broadleaf plant species into northern boreal forests. As this occurs, herbicide use may become more common in areas where chemical vegetation management is permitted.

Herbicides are used to target tall growing species, leaving shorter species such as hazel, alder and lower growing shrubs and grasses to flourish. By encouraging lower growing plants, taller trees are less likely to grow.

Herbicides can be applied to individual trees or sprayed depending on the density of trees in the area. The herbicides used by Manitoba Hydro are themselves selective and only affect broadleaf plants leaving other nearby trees and plants to grow and thrive. They are rarely used in northern boreal forests.

Manitoba Hydro follows national and provincial guidelines when using herbicides. To use them, Manitoba Hydro must obtain a provincial permit, and must inform local people in advance. Herbicides are always applied by trained and licensed applicators.

Manitoba Hydro has explored the control of danger tree species through **allelopathy**, where specific plants emitting chemicals that discourage the growth of other plants are encouraged.

Stump treatment involves the application of a herbicide solution to a recently cut tree stump to prevent tree roots from sending up new shoots or suckers

What effects does vegetation management have on wildlife and wildlife habitats?

Transmission line and **right-of-way** maintenance have less of an affect on **wildlife** and wildlife **habitat** than construction activities. However, all forms of **vegetation** management change wildlife habitat by producing stable, low-growing vegetation. These rich low growing plants often benefit wildlife by providing food and cover and may increase foraging and nesting opportunities[30].

Improper use of **herbicides** for controlling vegetation can have a negative effect on primary fish production. Manitoba Hydro's environmental protection practices reduce the likelihood of herbicide-related effects. If herbicide use is required, Manitoba Hydro follows provincial and federal regulations for application and handling to mitigate potential effects. For example, herbicides are not applied within the **buffer** zone of any water body and are stored in secured locations at least 100 metres (328 feet) from any water body.

Although mechanical mowing in winter removes all trees and shrubs present on a site, it minimizes the effects on nesting birds, though nesting habitat may be temporarily disrupted.

Low growing shrubs, grasses and herbs are encouraged through vegetation management

Monitoring the Effects of Transmission Lines

Monitoring the Effects of Transmission Lines

Manitoba Hydro conducts monitoring to gain further insight into potential effects of **transmission lines**, to measure the effectiveness of the **mitigation** measures being used, and to identify any unanticipated effects in order to adapt practices. Monitoring practices for each transmission line project are conducted in accordance with the conditions of project licenses and are identified in an **Environmental Protection Plan**. Monitoring may involve site inspections and information gathering from environmental inspectors, community environmental monitors, local residents or even pilot programs or other studies. By following environmental protection practices, utilizing an Environmental Protection Plan and conducting follow-up inspections, Manitoba Hydro minimizes the possibility for long-term effects on the environment.

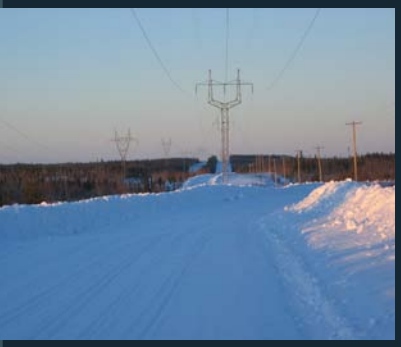
Depending on the nature of a project, Manitoba Hydro may establish a variety or combination of monitoring plans such as compliance monitoring, baseline monitoring and environmental effects monitoring. Monitoring activities are described in Table 3.

Data gathered from monitoring studies provides important information about the behaviour of different ***wildlife***

Table 3: Transmission line monitoring practices

TYPE OF MONITORING	DESCRIPTION	EXAMPLES
Baseline	Pre-construction monitoring to help identify any potential avoidable effects and appropriate mitigation measures of transmission line construction	• Land analysis of proposed transmission line route, water crossings • Botanical and rare plant surveys • Assessment of heritage resources and potential effects
Compliance	Monitoring to ensure commitments made to regulatory authorities and others are implemented	• Visual inspection of environmental conditions by air and ground patrols • Examination of transmission line water crossings to identify any potential effects such as soil erosion or contamination
Environmental Effects	Monitoring that assesses the environmental effects of transmission lines and verifies the effectiveness of mitigation methods	• Stream crossing inspections to assess the status of natural **vegetation** and check for signs of erosion • Monitoring the use of artificial nesting structures placed near **rights-of-way** • Evaluating the effectiveness of bird diverters

Glossary




Allelopathy - a plant's ability to emit chemicals that influence the growth of other plants

Alternating Current (AC) – the oscillating back and forth flow of electrical current. AC is the common household electrical current and is used in transmission lines

Anchor – device used to secure the tensioned cables or guy wires that support a transmission tower to the ground

Bird strike mortality – fatal collision between a bird and man-made structure, including transmission lines

Borrow pit – area where construction materials (usually sand or gravel) are excavated for construction purposes

Buffer – area of land separating two distinct land uses that acts to soften or mitigate the effects of one land use on the other

Conductor – any material that will readily carry a flow of electricity; in the context of transmission lines, each of the three wires comprising a circuit is referred to as a conductor

Corona – electrical discharge around a conductor that can electrically charge air molecules

Danger trees – trees that are too high or are dead, diseased and are likely to be blown over by wind, posing a danger to the normal operation of a transmission line

Deciduous – refers to plants, especially trees, which shed their leaves at the end of every growing season

Dieback – death of shoots, branches and roots of trees and plants, generally starting at the tips and usually resulting from insect or fungal attacks on a damaged or cut limb

Direct Current (DC) – flow of electrical current in a single direction; DC is used in some transmission lines

Disturbance – disruption or change in the normal functioning of an organism or system

Edge effect – the transition between two ecological communities and the resulting effect

Electric and Magnetic Fields (EMFs) – invisible lines of force surrounding any wire carrying electricity. EMFs are produced by all electric tools and appliances, household wiring and power lines. Electric fields are measured in volts per metre; magnetic fields are measured in milliGauss

Environmental Protection Plan – a user-friendly guide that describes the implementation of a project which may involve environmental effects. It may includes information such as a brief project description, construction schedule, summary of environmental sensitivities and mitigative actions, listing of federal, provincial or municipal approvals, licenses, or permits that are required for the project, a description of general corporate practices and specific mitigating actions for various construction and maintenance activities, emergency response plans, training and information, and environmental/engineering monitoring plans and reporting protocols

Feller-buncher – harvesting machine used to clear vegetation with an attachment that can rapidly cut and gather several trees before felling them

Furbearer – mammal species such as marten, fox or beaver that are trapped for the useful or economic value of their fur

Guy wire – supporting wires that are used to stabilize some transmission line structures

Habitat – area where a plant or animal lives. The primary attributes that define habitat for a terrestrial plant or animal are vegetation, soils, surface water, ground water, permafrost, disturbance regime (e.g. highly variable water fluctuations, frequent large fires) and vegetation age. A combination of similar habitat attributes is similarly referred to as a habitat type

Habitat fragmentation – occurs when natural or human features such as rivers or roads break up habitat into smaller fragments

Herbicide – product used to inhibit or kill plant growth

High Voltage Direct Current (HVDC) – used to transmit large amounts of power efficiently over long distances

Insulator – material that resists the passage of electricity

Invasive plant – plant species which may spread into, and takes over, an ecosystem to the detriment of other species; often the result of a disturbance

K-G blade – blade that is front-mounted on tractors and used to shear woody growth without disturbing root masses; often used on frozen ground conditions

Marshalling yard – open area used to stock-pile, store and assemble construction materials

Merchantable timber – timber that is salvaged where economically feasible, consistent with construction and environmental protection requirements and Manitoba Conservation work permits

Mitigation – actions taken during the planning, design, construction and operation of works to reduce or avoid potential adverse effects

Ordinary High Water Mark – usual or average level to which a body of water rises at its highest point and remains long enough to change the characteristics of the land

Registered Trapline – allocated to trappers who maintain a right to trap within the designated boundary of the trapline

Right-of-way – strip of land controlled and maintained for a transmission line, road or other linear feature

Riparian – habitat along the banks of rivers and streams

Sediment – material, including soil and organic material, that is deposited on the bottom of a water body

Sky wire – metal cables strung above transmission line conductors designed to channel lightning to the ground; also called a groundwire

Soft track vehicle – tracked vehicle (also called track-type tractor or soft-flex vehicle) that runs on continuous tracks instead of wheels and is used to help navigate difficult terrain where wheeled vehicles are not practical

Salvage – Refers to the practice of saving cut timber that may otherwise be discarded

Sustainable Development – environmentally sound and sustainable economic development that meets current needs without sacrificing the ability of future generations to meet their own needs

Towers – transmission line structures which provide support for conductors and ensure clearance from the ground

Traditional Knowledge – Refers to the wisdom that primarily Aboriginal peoples have accumulated during their lives, by learning from Elders and others, and from personal experience acquired while interacting with the environment

Transmission Line – linear arrangement of towers and conductors which carries electricity from generating stations and transmission stations to meet electrical needs

V blade – ”v”-shaped blade that is front-mounted on tractors used to clear vegetation

Vegetation – general term for all plants or plant life of an area or region; it refers to the ground cover provided by plants

Wildlife – free-ranging birds, mammals and fish living in their natural environment

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