ARCKP
Alberta Regional Caribou Knowledge Partnership

Improving forestry road network planning and design under aggregated harvest systems for caribou outcomes

Temporary forestry road effects #3

Non-permanent forestry roads are a source of disturbance for caribou, particularly when built through or near sensitive peatland habitat. While aggregated harvest systems may reduce the number and extent of roads (see Note #2 in this series), it is important to minimize road-related effects under both aggregated and conventional harvest systems.

Two ways the forest industry can reduce its footprint in caribou habitat and improve caribou outcomes are:[1]

1. **Avoiding road construction in peatlands wherever possible**
2. **When peatland avoidance is not feasible, improving how roads are planned, designed, used and reclaimed.**

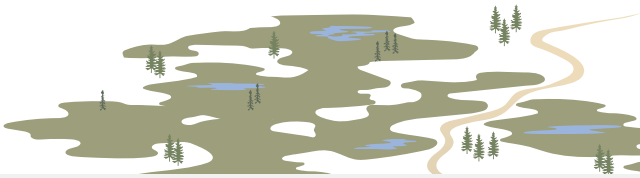


Photo: Weyerhaeuser Canada Ltd.

Highlights

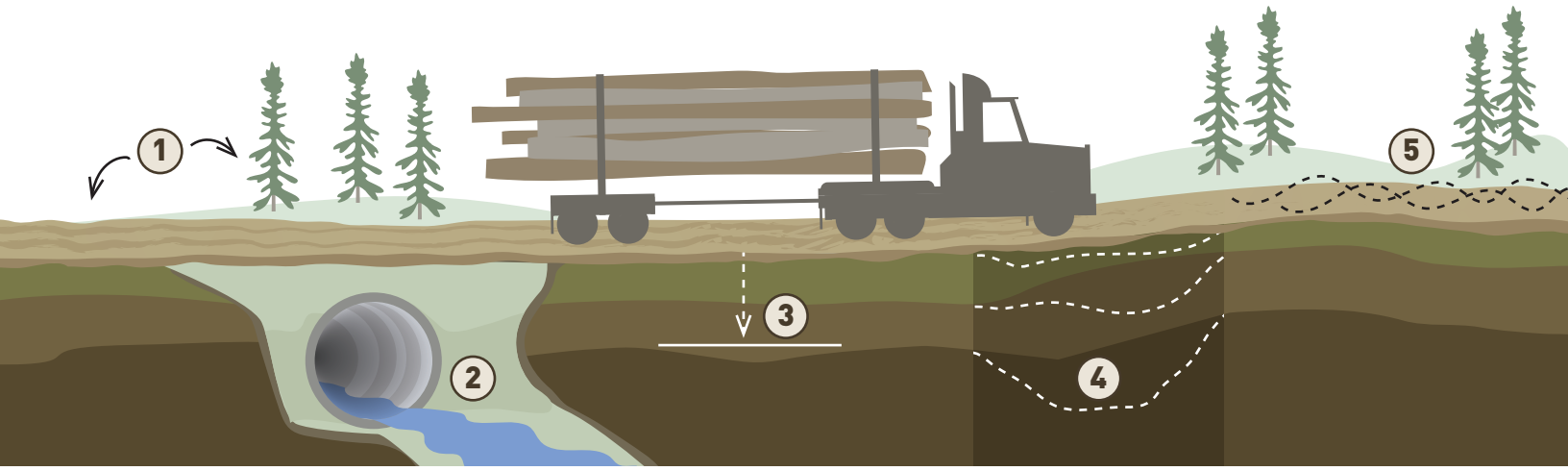
- Non-permanent forestry roads should be avoided in peatlands where possible. Where unavoidable, roads should be built to minimize effects on peat surfaces and reduce reclamation efforts.
- Improved road practices apply to both aggregated and conventional harvest systems.
- Strategic balance between in-block and inter-block roads can reduce reliance on high-standard roads, particularly in areas where reclamation is challenging.
- Seasonal constraints affect planning, use and reclamation. Low-impact winter roads are increasingly constrained by shortened freeze periods, while summer roads often require more intensive reclamation.

Planning roads to support caribou habitat

Boreal caribou are highly sensitive to predation risk and habitat degradation, both of which are influenced by the design and placement of forestry roads. While reusing linear features can reduce total linear disturbance, the location and type of terrain are important to consider. These factors can influence how hard it will be to successfully reclaim roads, and the extent of their effects on caribou while they are active.

One of the clearest opportunities to reduce adverse effects to caribou is to avoid peatland road crossings wherever possible. Caribou depend on peatlands as areas of refuge from predators. Reducing pathways into peatlands for predators, and direct disturbance in peatlands, are therefore important for caribou. Tools like Wet Areas Mapping (WAM) can help road planners select routes that minimize not only disturbances in peatlands, but also stream crossings and soft, unstable soils.

[1] The findings reported in this note are based on literature review and interviews with forest industry staff.



When crossings are unavoidable, key principles for constructing environmentally and cost-effective roads on peatlands include:

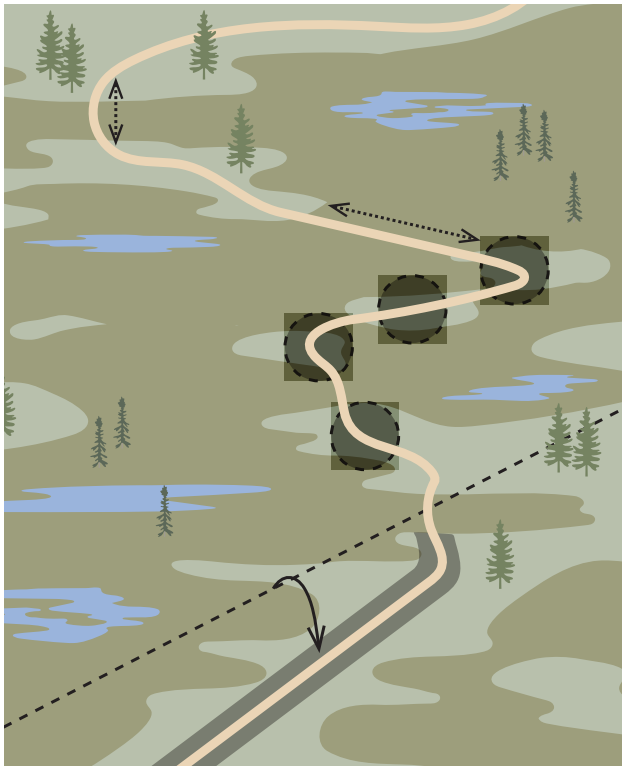
1. **Know your wetlands:** Identifying wetland types and applying this knowledge can improve both environmental outcomes and road/pad performance.
2. **Maintain wetland flow:** Operators who understand local flow conditions can make better site-specific decisions to accommodate water movement and reduce damming adjacent to infrastructure.
3. **Understand peat bearing capacity:** Recognizing the factors that affect bearing capacity, and how to manage them, can help reduce peat failure during construction.
4. **Predict settlement:** Consolidation graphs can be used to estimate expected settlement and the timeframe over which it may occur.
5. **Understand broader environmental impacts of wetland development:** Altering or compressing natural hump and hollow microtopography can affect surface vegetation and increase methane emissions.

Additional tips:

Routes should be planned for the shortest possible distance across peatlands, even if this means deviating from the most direct route.

A strategy known as **"island hopping" can reduce impacts** by routing roads between small areas of well-drained soil. These "islands" can also provide fill material for peatland crossings.

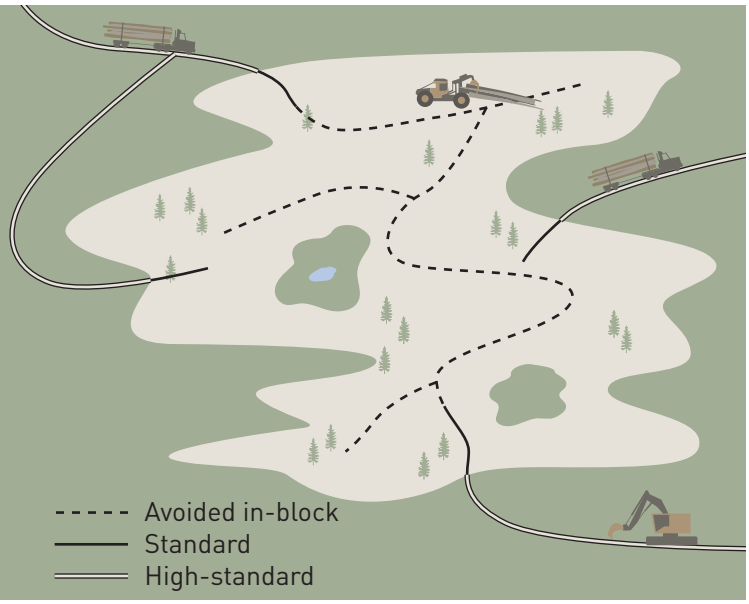
In some cases, **creating new roads on mineral soils may be preferable** to reusing old linear features through peatlands, which can delay recovery and concentrate disturbance in sensitive areas.



Because in-block and inter-block roads are less likely to cross peatlands, these planning strategies are especially important for main access and inter-planning unit roads.

Balancing in-block and inter-block roads

There are inherent tradeoffs in how roads are distributed within harvest areas. While fewer roads overall are beneficial, this must be balanced with operational feasibility and impacts on caribou recovery.



Reducing in-block roads can minimize linear disturbance but may require longer skid distances or specialized forwarding equipment.

Fewer in-block roads may shift more traffic onto inter-block or inter-unit roads, which often need to be constructed to higher standards (e.g., thicker fills, stronger drainage structures, wider alignments) to support sustained truck traffic under aggregated harvest systems.

Higher-standard roads are more expensive to build and reclaim, and they slow forest recovery — lengthening the impacts of roads on caribou habitat.

In some contexts, it may be better to build more in-block roads, especially if these roads are easier to reclaim and are in areas where caribou are less likely to be present. This could reduce the need for longer, high-standard access roads that have longer term impacts on caribou habitat.

Designing roads for recovery and resilience

For forest road planners working in caribou habitat, **the biggest design opportunity lies in minimizing hydrologic disruption and speeding up reclamation**. This is especially important for roads crossing high-value caribou habitat in peatlands, as roads in peatlands are more difficult to restore.

Consideration	Summer Roads		Winter Roads	
Construction impact	 **HIGH**	Requires drainage, fill, and consolidation planning.	 **LOW**	Built on frozen ground.
Predator access risk	 **HIGH**	During construction and use.	 **HIGH**	After melt if not deactivated.
Key mitigation	 **HYDROLOGY**	**Improve** cross drainage, preserve flow and avoid compression.	 **PREDATORS**  **RECOVERY**	**Deter predator movement** by maintaining topography and covering roads with felled trees or brush. **Accelerate recovery** by considering the Hummock Transfer Technique.
Reclamation focus	 **HYDROLOGY**	Restoration and compaction relief	 **PREDATORS**	Reduce visibility and access post-use.

Access and Seasonal Use

For seasonal timing guidance and recommendations for low-impact construction during sensitive periods (February 15th to July 15th), see Note #1 in this series.

Maintaining some controlled hunter access after forest harvesting may also help manage moose and wolf populations attracted to new browse, ultimately reducing predation pressure on caribou.

Reclamation Considerations

Where roads are built or reopened on old seismic lines, lessons from seismic line restoration may offer useful guidance. On mineral soils, deeper fill and long-term soil compaction make reclamation more complex. Decompaction, careful salvage of overburden and selecting the right tools and timing are essential to support regeneration and minimize effects. **On peatlands, effective low-impact winter road construction can significantly reduce or even eliminate the need for reclamation.**

See Note #1 in this series on practical implications for:

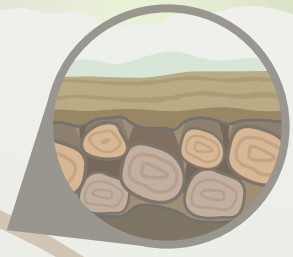
- Blocking roads following operations to limit predator access.
- Maintaining hydrology and wetland integrity in peatland areas.
- Planning for faster reclamation from the outset.

Practical Implications

While aggregated harvest may inherently reduce road density, targeted improvements in planning, design, use and reclamation practices are still necessary to minimize long-term effects to caribou habitat. Consider:

Avoiding roads through peatlands wherever possible, and prioritizing routing through upland mineral soil where low-impact construction can be implemented more effectively — even if this might mean longer roads or not using legacy seismic lines through peatlands.

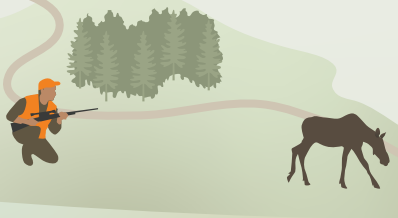
Using in-block roads strategically to reduce density of higher-standard inter-block roads, especially when reclamation is expected to be difficult.



Evaluating where and when high-standard roads are truly necessary and seek opportunities to substitute with lower-impact options (e.g., winter roads or corduroy-style crossings) where possible.

Using improved planning tools (e.g., Wet Areas Mapping) to identify road routes that minimize effects in sensitive peatland areas.

Maintaining some hunter access after harvest to manage increased moose and deer populations, and by extension wolf presence, in areas with abundant browse.



Applying consistent low impact construction and reclamation practices, including minimizing fill, preserving overburden for reclamation, and reinforcing soft soils to prevent rutting and compaction.

Implications Summary

- Avoid roads through peatlands
- Use in-block roads strategically
- Evaluate where/when high-standard roads are truly necessary
- Use improved planning tools
- Maintain some hunter access after harvest
- Apply consistent low-impact construction and reclamation practices

Future considerations

- **Planning tools**, including artificial intelligence and wetland mapping, to reduce roads and avoid sensitive peatland areas across forestry and non-forestry sectors.
- **Establish consistent, long-term monitoring and research** of caribou, predator and prey responses to roads and access management.
- **Standardize road practices** and expand training to improve consistency and effectiveness across operations and regions.
- **Support reclamation research** on peatland mineral soils, especially where fill and compaction are involved (e.g., lichen transplanting to support caribou food sources).
- **Collaborate with Indigenous communities** on shared stewardship of access and habitat.

Further reading

The following resources are intended to support training and education for forestry operators and contractors, and to inform the development of practice standards for operations on peatlands. They cover key topics such as road planning, construction and reclamation.

Peatland Knowledge and General Practice Guides

Ducks Unlimited Canada. 2018. Field Guide: Boreal wetland classes in the boreal plains ecozone of Canada.

FMWSI. 2019. Wetland best management practices for forest management planning and operations practitioner guide.

FMWSI. 2018. Guiding principles for wetland stewardship and forest management practitioner guide.

Resource Roads on Peatlands: Planning, Construction, Peatland Crossings

Alberta Watercourse Crossing Collaborative. 2024. Alberta Watercourse Crossing Guidebook.

Partington et al. 2016. Resource roads and wetlands: a guide for planning, construction and maintenance.

Nason et al. 2019. Recommendations for a Wetland Crossings Monitoring Protocol: A report for the Foothills Stream Crossing Partnership.

Resource Roads on Peatlands: Reclamation

Kleinke et al. 2022. How mounds are made matters: seismic line restoration techniques affect peat physical and chemical properties throughout the peat profile. Canadian Journal of Forest Research.

Osko, T. 2016. Suncor Firebag Pad 106 Road reclamation ancillary projects: road fill reusability assessment, reclaimed sub-road natural revegetation assessment, and preliminary assessment of construction over shallow peat as an alternative to peat salvage. Technical report prepared for Suncor Energy, March 2016. 42 pp.

Peatland Operations: Construction and Reclamation in the Energy Sector

Osko, T., Gilles, C. and Pyper, M. 2018. COSIA in-situ oil sands shared practices for working in and around wetlands.

Osko, T. and Pyper, M. 2018a. Improving OSE reclamation performance through enhanced construction and reclamation practices. Technical report prepared for Canadian Oil Sands Innovation Alliance, Faster Forests Program. November 2018. 61 pp.

Osko, T. and Pyper, M. 2018b. A visual guide to improved construction and reclamation practices on oil sands exploration sites. Technical guide prepared for Canadian Oil Sands Innovation Alliance, Faster Forests Program. November 2018. 32 pp.

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