

CREATING CLIMATE RESILIENT RESOURCE ROADS: WATER MANAGEMENT

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Introduction

The planning, construction and maintenance of resource roads are required in support of various industrial and resource management activities and are often the primary access for remote communities and public recreational experiences.

This is the third Info Note in a series of five focused on the key issues of creating climate resilient resource roads.

Creating resiliency

Climate change is anticipated to have important impacts on the forest sector in Canada principally as a result of forecasted changes in temperature and precipitation patterns. Warmer summer and winter temperatures and an increase in high intensity, short duration rainfall events are expected in many regions. Developing and implementing adaptation practices that reduce the negative impacts and the vulnerability of resource road infrastructure to climate change needs to be a priority for resource road managers.

Drainage and water management

The management of water across the forested landscape is expected to be a greater challenge in

response to predicted climate changes in many regions of Canada.

These changes could bring increases in rain-on-snow events, spring and fall seasonal precipitation, and warmer winters with increased snowmelt runoff. These changes in landscape water movement and seasonal timing could challenge existing resource road drainage infrastructure. Adaptation for future conditions could include:

1. Review current guidelines on cross-drain culvert placement, spacing and sizing. If necessary, increase the density of cross-drain culverts as well as their diameter. A further benefit of enhanced drainage is reduced flow concentration in the ditches leading to less erosion and sedimentation.
2. Avoid sole reliance on ditches and cross drains to provide road drainage through the use of additional methods such as broad-based dips and waterbars (Figure 1).



Figure 1. Consider additional road surface drainage methods, such as broad-based dips, to ensure ongoing road performance.

3. Ensure that erosion resistant materials and slope stabilization methods are implemented in and around cross drain culverts. Short duration, high intensity rainfall events can increase the risk of soil erosion and subsequent culvert blockage.
4. Ensure effective road surface drainage at the time of construction, and with regular maintenance interventions. In-slope or outslope the road surface or crown the road at 3% - 5% to provide for rapid evacuation of water off of the road surface. Ensure that effective grading practices are implemented to remove surface drainage obstructions, such as unbroken roadside berms.
5. Reduce the erosive capacity of roadside ditch water through the application of check dams and off-take ditches to slow water movement and to evacuate the water away from the road (Figure 2).



Figure 2. An off-take ditch can be an effective method to evacuate the water away from the road.

6. In landslide prone areas, implement enhanced erosion and stabilization techniques, such as armoring and vegetating slopes, and, especially, the bottom of slopes. Deepen ditches of roads across talus slopes and other rock fall zones to prevent more ravelling rock from reaching the road surface.

7. Where roads cross debris flow routes, consider installing upstream containment structures, and replacing existing crossing structures with more robust structures.
8. After mass movements (e.g., debris flows) occur, inspect the stream channel, ditches and culverts for residual blockages and bed load accumulations. Inspect containment structures and crossing structures for damage and reduced capacity.
9. Incorporate water management structures into winter roads during construction, when soils are not frozen and are easily worked. Structures, such as log culvert bundles, can be removed during deactivation to create cross ditches; and, structures, such as off-take ditches and ditch blocks, can be left in place during deactivation for subsequent years.

Summary

This Info Note is part of a series of short reports focused on the key issues of creating climate resilient resource roads. The series includes the following reports:

1. Adapting to climate change
2. Planning and construction
3. Water management
4. Water crossings
5. Road maintenance

For further information, please consult the following publication, Partington, M. Bradley, A.H., Durand-Jezequel, M., Forrester, A. (2017). *Adapting Resource Road Infrastructure to Climate Change* (Technical Report 61). Pointe-Claire, Quebec: FPInnovations.