Building Better Crossings: incorporating wetland knowledge into road planning and construction

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Introduction

- Ducks Unlimited Canada's (DUC) Boreal Program works with government, industry and other stakeholders to promote the use of practices that avoid or minimize impacts to boreal wetlands.
- Resource roads are known to affect the ecosystem functions of wetlands[1] and can lead to increased greenhouse gas emissions[2].
- Wetlands pose environmental, economic, and safety challenges for resource road planners, for construction and maintenance crews and for users.
- By understanding these potential effects and the tools available, we can better incorporate wetland knowledge into road planning and construction.

Goals

Maintain ecosystem functions

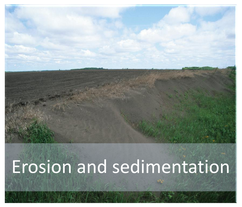
Improve road performance and reduce maintenance costs

Improve road and operator safety

Effects of roads on wetlands

Rutting

Blocked flow

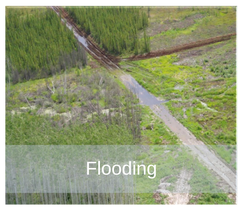


Erosion and sedimentation

Effects of wetlands on roads

Perched or sunken culverts

Photo Credit: LP Canada



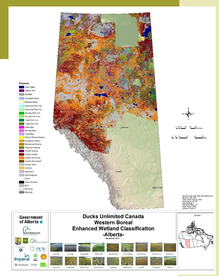
Flooding

Road settlement

1

Inventories for informed decision making

- Knowledge of wetland presence and type can be used to avoid wetlands or mitigate potential impacts.
- Remotely sensed wetland inventories, such as DUC's Enhanced Wetland Classification (EWC) can be used to incorporate wetlands into road planning [3].
- Photo imagery, other GIS information, and field reconnaissance can also assist with planning.



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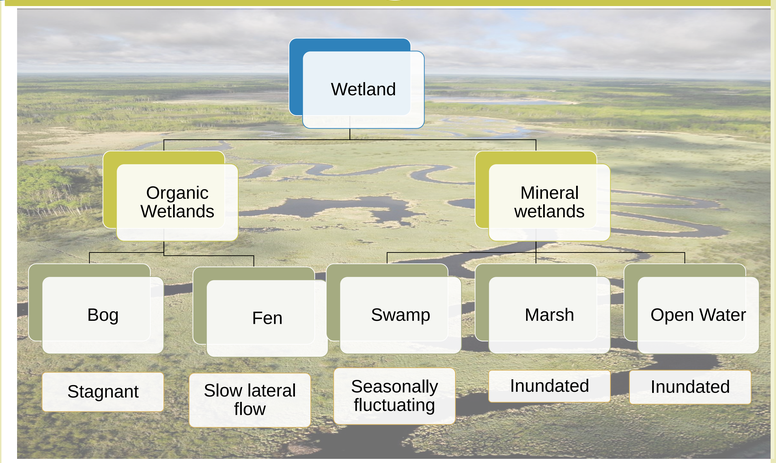
Understanding wetland flow



- **Stagnant** wetlands may be isolated with minor water table fluctuations. However, depending on climactic and surficial geology conditions, these wetlands may transmit water to adjacent areas.
- **Slow lateral flow**ing wetlands are typically connected to adjacent wetlands and move water at and below the surface.
- **Seasonally fluctuating** wetlands have water levels that fluctuate seasonally or during runoff events and have slow water movement at or below the surface.
- **Inundated/flooded** wetlands have water levels that fluctuate seasonally or annually.

3

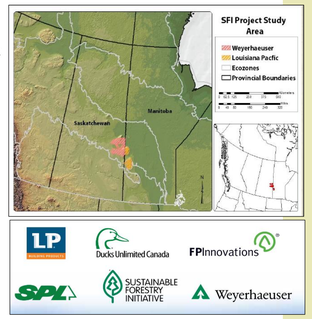
Using knowledge of wetlands as a decision support tool

When planning and constructing resource roads through wetlands, consider:

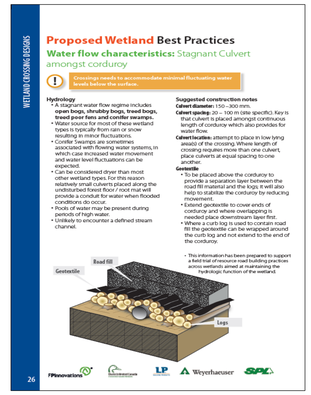
- Wetland presence and type determined using wetland inventories and/or field identification.
- Avoiding wetlands where feasible.
- Hydrologic regime based on wetland type or assessed in the field.
- The amount of water expected to move through the wetland, inferred from the hydrological regime, taking into account the season and climate cycle.
- Designing the road to accommodate the expected flow. For example, culvert size, number, and spacing and/ or other water passage structures (e.g., geogrid, aggregate, or corduroy).
- Additional information such as season of construction and proposed lifespan.
- Approaches to minimize other associated impacts to wetlands. For example, using erosion and sediment control structures and procedures and equipment to avoid rutting and compaction.

A case study

- In 2011, a collaborative project was undertaken to develop wetland road crossings that maintain water quality and flow through wetlands[3].
- The project team developed road crossing to maintain water quality and flow of three different wetlands:
  - Shrub swamps (seasonally fluctuating)
  - Treed fen (slow lateral movement)
  - Conifer swamp (stagnant)



- Crossing designs considered the type of wetland, flow characteristics, and infrastructure needed to accommodate water passage requirements.
- Project team conducted two years of post-construction monitoring.



- Key outcomes:
  - Crossings did not significantly impede water flow.
  - Sedimentation occurred; crossings would benefit from additional erosion control structures[4].
  - No reported operational issues. Anecdotal evidence that crossings are the driest parts of the road and allow access sooner after wet weather[4].
  - Development of an operational guide for forest road wetland crossings[5].

Conclusions

- Wetlands are diverse aquatic systems that should be considered in all stages of road construction to minimize impacts to the wetland and the road.
- Wetland inventories and/ or field reconnaissance provide information about wetland presence, type, and expected flow regime.
- There are a variety of tools and approaches available to aid in planning a wetland road crossing.
- Resource roads designed to incorporate wetlands may increase road and operator safety, reduce maintenance, and save costs.

References

- [1]Willier, Caitlin. 2017. Changes in peatland plant community composition and stand structure due to road induced flooding and desiccation. (unpublished masters thesis, University of Alberta).
- [2]Strack, M., Softa, D., Bird, M., and B. Xu. 2017. Impact of winter roads on boreal peatland carbon exchange. Global Change Biology:00:1-12.
- [3] Smith, K., Smith, C., Forest, S. and A. Richard. 2007. A field guide to the wetlands of the boreal plains ecozone of Canada. Ducks Unlimited Canada.
- [4]Badiou, P. and B. Page. 2014. SFI Wetland crossing BMP project hydrological monitoring design and data summary: final report.
- [5]Operational guide for forest road wetland crossings. 2014. Ducks Unlimited Canada