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Resource Roads and Wetlands: Practical Applications to Maintain Hydrologic Connectivity

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Outline

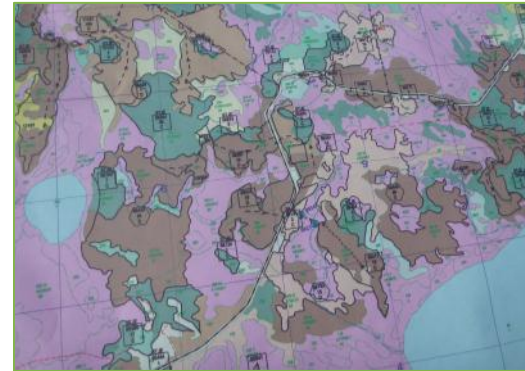
Opportunities to promote continued hydrologic function of wetlands

- Avoid
- Construction methods
- Education



Plan to avoid crossings

- Avoid crossing wetlands where practical
- Extensive landscape planning
 - minimize number of crossings
 - Identify control points
- Utilize maps/images, and inventory data to aid in the planning process
- Reconnaissance flights and ground truthing of planned routes



Protection of wetland during clearing

- Careful operating techniques
- Care taken to preserve forest floor / peat surface
 - Choice of equipment
 - Operating techniques
 - Seasonal timing



Seasonal considerations

- Building access across wetlands during frozen conditions
- Surface material remains relatively intact when frozen
- Subsurface organics frozen to various depths
 - Techniques to promote frost penetration



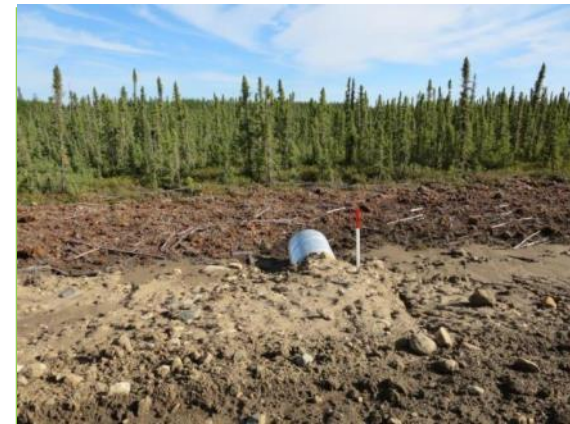
Surface applications

- Matting and light-weight fill
- Used for temp access and removed after use
- Provides wide load distribution which eliminates rutting of travel surface
- Reduced compaction and settlement of underlying organic material



Culverts

- Commonly used for water management
- Number and spacing of culverts need to provide adequate flow (challenge is to meet the hydrologic needs of the wetland)
- Large diameter culverts provide a wider entrance for flow and deeper embedment opportunities
- Embedded culverts will cater to shallow subsurface flows



Culverts with logs

- Logs provide additional flow capacity
 - Wider flow path at low flows
 - Seasonal high flow passage
 - Temporary structure



Culverts

- Location and spacing need to be considered
 - Survey to locate low areas
 - Set spacing
 - Best approximation



Culvert spacing

	Stagnant	Moving – Slow Lateral Flow	Moving – Seasonal / Fluctuating
Culvert spacing range	Widely spaced	Mid – widely spaced	Closely spaced
Minimum culvert spacing - Permanent road	200 m	150 m	100 m
Minimum culvert spacing - Temporary road	250 m	150 m	150 m
Culvert diameter range	250 – 500 mm	500 – 800 mm	>800 mm

^a Where culverts are the chosen conduit, the length of the wetland crossing will help determine the number of recommended culverts. A minimum of 1 culvert should be placed regardless of crossing length.

^b The suggested range in spacing may be further influenced by site specific wetland characteristics. For example, where the crossing is located at a narrow area of the wetland, closer spacing of culverts may be required to accommodate the concentrated / funneled flow through this area. Edges of wetland crossings adjacent to upland dryer soils could provide better bearing with respect to culvert installation and potential settlement over time.

Culvert spacing



Corduroy

- Traditionally used to improve bearing requirements for weak soils; logs aid in distributing load resulting in reduced compaction
- Built on carefully cleared forest floor / peat surface
- Separation layer to prevent water passing voids from being infilled
- Water passing capabilities along entire length of structure



Corduroy

- Additional conduits easily incorporated
- Can be built more than one log high
 - Additional stability and bearing
 - Additional water passage capabilities



Log bundle

- Logs placed in a trench act as a conduit
- Two rows high provides greater flow capacity through lineal voids
- Separation layer
- Number and spacing considerations to match wetland flow characteristics



Permeable fill

- Permeable road base can be built to allow for water passage
- Angularity of aggregate is key to provide a stable interlocked base
- Need to manage the fines within the base and from above
- Water passing capabilities along entire length of structure



Raised access

- Designs have been developed and used to build raised access structures, and raised drill platforms and their associated access roads.
- Surface flow able to pass below structure between piers



Photo courtesy of Canadian Mat Systems and Composite Advantage

Photo courtesy of Landmark Solutions & Cenovus Energy

Education- field workshops

- Provide training and learning opportunities for forest workers
- Better understanding of wetland types
- Exposure to practical water management solutions and construction techniques
- Interaction amongst participants



Education- resources

- Use of guides and design / schematics aid in the use and construction of appropriate water management options for wetlands
- Continued development of guides to be used as SOP's

Proposed Wetland Best Practices
Revised March, 2014

**Water flow characteristics: Moving - fluctuating
Embedded culvert amongst corduroy**

! Crossing needs to accommodate seasonally fluctuating water levels and ongoing below surface flows

Hydrology

- Wetland types with these flow characteristics include mixedwood swamp, tamarack swamp, hardwood swamp, shrubs swamp (all seasonally fluctuating and typically part of a flowing system).
- Water level will fluctuate seasonally or semi-annual, and may fluctuate widely flooding above the root mat. This is followed by continuous slow lateral water movement at and below the surface from adjacent areas.
- Often sites will have hummocky terrain with pools of water present.
- Water table is typically maintained below the surface requiring the need for continued subsurface flows through a road. Embedded / countersunk culverts can help maintain subsurface flows.

Suggested construction notes

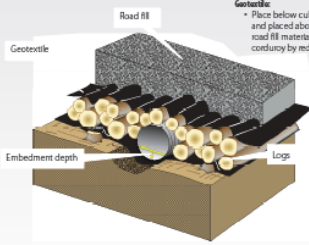
Culvert diameter: 400 - 800 mm
Culvert spacing: 20 - 100 m (site specific). Key is that culvert is placed amongst continuous length of corduroy which also has a water passing capability.

Culvert location: attempt to place in low lying areas of the crossing. Where length of the crossing requires more than one culvert, place culverts at equal spacing to one another. Where a defined stream channel is present, an appropriate sized culvert or bridge crossing may be required.

Embedment / countersunk depth of culvert: 25 - 40 % of culvert diameter (see yellow arrow). Excavation (for culvert placement) through the natural forest floor / root mat should be kept to a minimum with the undisturbed areas provide greater strength / bearing capacity.

Geotextile

- Place below culvert to provide additional bearing capacity, and placed above the corduroy to provide a separation of road fill material from the logs as well as to help stabilize the corduroy by reducing movement.
- Extend log layer to cover ends of corduroy and where overlapping is needed place downstream layer first.
- Where a curb log is used to contain road fill the upper layer of geotextile can be wrapped around the curb log and not extend to the end of the corduroy.



* This information has been prepared to suggest a field trial of resource road building practices across wetlands aimed at maintaining the hydrologic function of the wetland.

Logos: FPInnovations, Sustainable Forestry Initiative, LP, Weyerhaeuser, SPA.

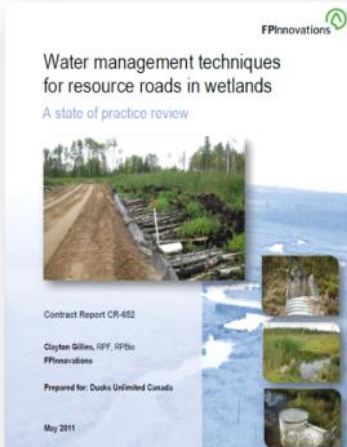
Water management techniques for resource roads in wetlands
A state of practice review

Contract Report CR-462

Clayton Gillies, P.F.F., R.P.D.
FPInnovations

Prepared for: Ducks Unlimited Canada

May 2011

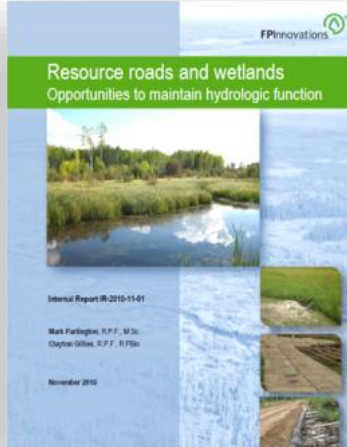


Resource roads and wetlands
Opportunities to maintain hydrologic function

Internal Report IR-2010-15-01

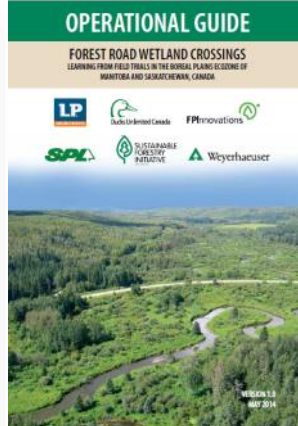
Mark Farlington, P.F.F., M.Sc.
Clayton Gillies, P.F.F., R.P.D.
FPInnovations

November 2010



OPERATIONAL GUIDE
FOREST ROAD WETLAND CROSSINGS
LEARNING FROM FIELD TRIALS IN THE BOREAL PLAINS ECOSYSTEM OF MANITOBA AND SASKATCHEWAN, CANADA

Logos: LP, Sustainable Forestry Initiative, FPInnovations, SPA, Weyerhaeuser.



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MAY 2014

Education- continued efforts

- FPInnovations has ongoing research in the field of wetland crossings
- Partnerships help to further the knowledge and resources available
- FPInnovations has an MOU with Ducks Unlimited Canada
- Forest industry in Canada will benefit from such cooperative efforts





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Thank you

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<http://wetlands.fpinnovations.ca>

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www.fpinnovations.ca