



Channel Stability



Channel Stability Considerations in Organic Soils

David E. Stephenson *Senior Biologist,*
Natural Resource Solutions Inc.
Waterloo, ON, Canada

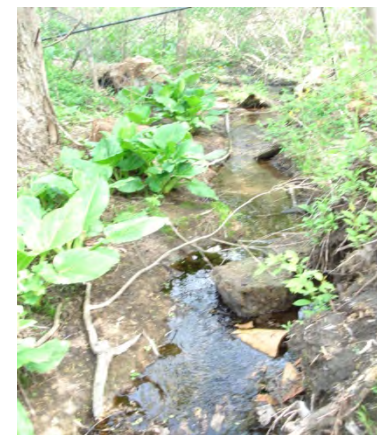


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Natural Channel Systems



Overview

- Introduction
 - Definitions: organic soils, peatland systems
 - Locations of Study Sites
- Characteristics of Organic-Dominated Channels
- Implications of Organic-Dominated Channels
- Potential Impacts on Organic-Dominated Channels
- Possible Mitigation
- Conclusions/Recommendations





Introduction

Organic soils or peats occur where accumulation of dead plant material > decomposition

Various types of organic soils, structure (fibric, mesic, humic)

Aerobic vs. Anaerobic (antehelm and catehelm)

Official definitions reflect depths depending on definition >30-40cm, in OWES >60cm





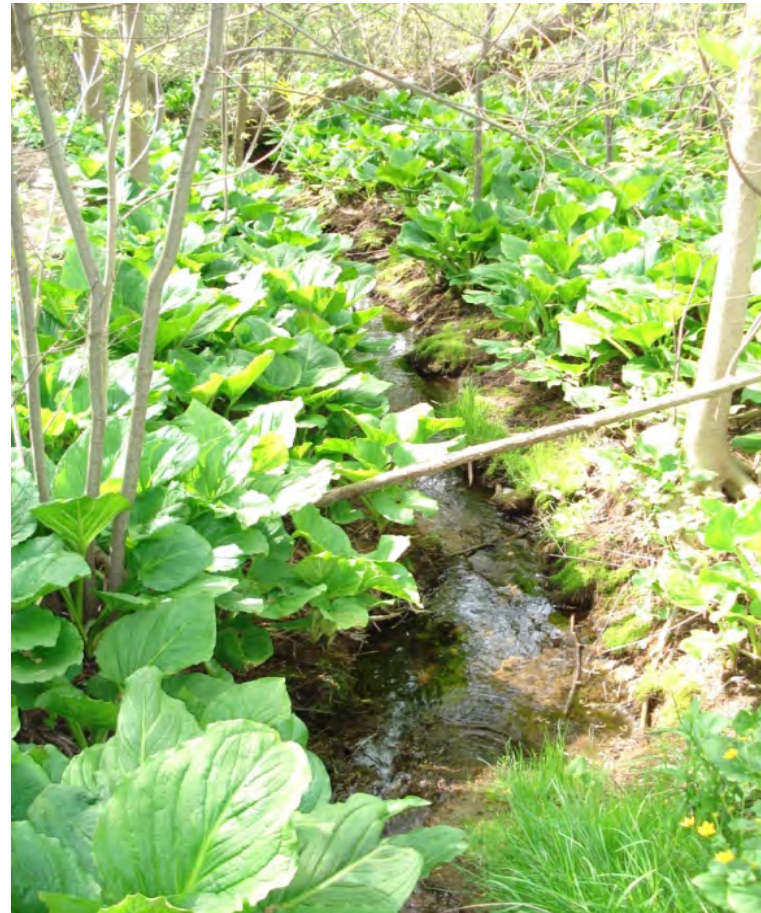
Introduction

Depth of organics relative to channel size is key issue not strict definition of peat or organics as per definition (i.e. 40cm deep)

Organic soils as more than simply a veneer over alluvial soils

Where organic soils are the main determinant of channel conditions

Talking about streams not 'soakways' or 'strings'





Locations

Much of research into peatland channels comes from areas such as Ireland, Scandinavian, Australia and specific locales in North America

Fens tend to be associated with flows and are often diverse and include distinct channel systems

Research comes from peat drainage/peat as energy/carbon source, agricultural situations

Instances in which peat areas have been inundated with alluvial soils and form an underlying layer





Locations

Organic-dominated systems are often found in southern Ontario, more urbanized portions of the province

Headwater, small order streams

Mid watershed locations resulting from modifications to system, flows

Some differences and similarities to peatland systems





Characteristics

Peat channels have a number of characteristics that are different from alluvial systems:

- resistance to erosion
- steep banks
- vegetation control over bank/channel
- no bedload
- low width to depth ratios
- low energy systems

Channel form is governed by groundwater and biology of peat accumulation as opposed to channel discharge and sediment supply

Often get unusually long relatively straight reaches

Extremely sharp curves with acute angles, reaches with high sinuosity

Rapid changes in channel width





Characteristics

Anastomosing channels characterized by low gradients, very low stream power, cohesive banks and low width to depth ratios

Unusual long term planform stability due to dense vegetation

Variable thalweg location, sometimes in the middle and even inside of meander

Absence of pool-riffle sequences

Irregular side pools





Characteristics

Peat quantity and quality (e.g. fiber content, susceptibility to decomposition, bulk density) vary depending on plant source

Microbial activity affects preferential groundwater flow paths due to differences in hydraulic conductivity





Soil Moisture Considerations

Bankfull flows are frequent

Soil moisture is high and substantial relationship to sustain vegetation

Groundwater discharge can be associated with looser organic sediments, not as 'solid' as other peat areas

Results in a channel profile with a flatter profile on one side of channel and deeper area on other side of channel

Seep channels where groundwater enters system





Organic-Dominated Channels in Urbanized Areas

Reaches found throughout the system,
especially headwater and groundwater-fed
areas

Commonly found associated with swamp
conditions, infrequently marshes or fens

Presence of groundwater has a substantial
affect on organic soil resistance

Root zone influences are different from true
peatland systems





Implications of Organic Channels

Organic dominated channels cannot be managed the same as alluvial channels

Classic meander patterns and channel cross sections often do not apply

Presence of organic dominated reaches needs to be determined

Frequency of bankfull flows needs to be considered

Introducing bedload can have substantial impacts

Buried organic layers can influence channel morphology





Potential Impacts

Manmade changes in drainage or changes during drought cycles – allows oxygen to penetrate deeper into peat

Often considered as receivers of stormwater in urban settings

Changes in depth of aerobic zone due to changes in flow regime especially depth and frequency of bankfull flows. Results in:

- Disconnect between channel flows and vegetation
- Reduced survivorship of vegetation
- Loss of bank resistance
- Subsidence of organic soils
- Loss of channel shape
- Release of tied up nutrients such as N and P





Potential Impacts

Stored carbon being converted to CO_2 or CH_4 is a concern especially with respect to climate change

Drier oxygenated conditions promote rapid microbial breakdown

Increase fire susceptibility

Mass wasting

Erosion

Changes to hydrology well off-site may influence channels





Possible Mitigation

Organic soil types must be assessed

Presence of groundwater discharges needs to be understood

Riparian vegetation must be assessed (to accurate species level)

Well-designed restoration projects can be used to restore modified hydrologic regimes and peat-forming vegetation

Summer precipitation is important to maintain water levels





Conclusion

Channels that are dominated by organic soils consist entirely of biological materials

We can learn from peatland research, but caution when interpreting in urban settings

Organisms can actually shape the physical state of landscape

Problem of channel morphology in organic-dominated channels is fundamentally ecological

Understanding the geomorphology of organic-dominated channels must go beyond the normal physical processes that usually dominate geomorphic research into the realms of biology and ecology



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Questions?

