

# RESILIENT RECLAIMED LAND AND WATER SYSTEMS - LAND

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## BACKGROUND

- Land reclamation is the process of returning disturbed sites to former or other productive uses.
- Reclamation includes contaminant remediation, soil building, recontouring and revegetation.
- Appropriate reclamation techniques depend on the type, size, intensity and location of the disturbance.
- Progressive reclamation allows for adaptive management and development of new techniques and greater success.
- Environmental issues associated with energy development, management and supply must be addressed for all energy systems; reclamation will be an integral component of all future, current and legacy energy systems, addressing land and water use, management and conservation.



Active coal mine disturbance

## OBJECTIVES

- Assess future energy systems environmental impacts and reclamation requirement.
- Adapt current reclamation techniques or develop new ones to address new energy systems.
- Conduct life cycle assessment and cost analyses of various reclamation approaches.
- Incorporate tailings and other mass by products of energy systems into reclamation soils to reduce or eliminate capping and its subsequent issues associated with surface and ground water.
- Understand the processes needed to sustain the biota and support ecosystem function in reclaimed landscapes using landscape scale processes.
- Develop and implement soil water reclamation techniques with those of soil reclamation techniques to address the soil and water interactions necessary in a resilient reclaimed ecosystem.

## PROJECT OVERVIEW

Novel soil materials and amendments for reclamation

- Assess the remediation and use of by products and waste materials in building reclamation soils to increase their productive use rather than necessitate their removal from a disturbed site and their disposal, often in overcrowded landfills and dig and dump scenarios.
- One novel reclamation material is biochar, a group of materials produced from a variety of biomasses through pyrolysis under low or no oxygen conditions.
- Biochar may be useful in a wide range of applications, including contaminant removal through adsorption and improvement of soil fertility and soil physical properties.

Use process water treatments to redirect remediated water back into the land and water system

- Develop end pit lakes using interdisciplinary approaches such as embedding water treatment systems in the short term and soil reclamation in the long term for a dual purpose reclamation option.
- Utilize adsorbents as secondary soil reclamation amendments.

Revegetation impacts on reclamation soil development and soil water systems

- Assess effects of various revegetation options as reclamation techniques to be used early in the reclamation process rather than simple end land use necessities.
- Better understand plant response to and incorporation into soil water treatment processes.



End pit lake



Reclaimed oil sands soil profile

## EXPECTED OUTCOMES

- Development of novel amendments to accelerate soil building on disturbed sites.
- Development of a toolbox with the best available remediation and reclamation approaches and tools for different legacy and future energy system scenarios.
- Use of achieved knowledge and appropriate methods and tools developed to inform and train land reclamation practitioners.



Diverse plant community on reclaimed well site



Forest community on reclaimed oil sands site

## EXTERNAL PARTNERS

- Alberta Environment and Parks
- Alberta Innovates
- Northern Alberta Institute of Technology
- Brandenburg University of Technology Cottbus-Senftenberg
- GFZ German Research Centre for Geosciences
- Helmholtz Centre for Environmental Research
- Canada's Oil Sands Innovation Alliance (Syncrude Canada Ltd., Canadian Natural Resources Ltd., Suncor Energy Inc., Imperial Oil Ltd., Teck Resources Ltd.)

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This research has been undertaken thanks in part to funding from the Canada First Research Excellence Fund.