

## EXECUTIVE SUMMARY

This project will demonstrate the ability of Earth Observation (EO) Data missions supported by the Canadian Space Agency (CSA) to monitor effects and support response to terrestrial oil spills. Known spill locations in a forested wetland and an agricultural area will be evaluated by combining electromagnetic (EM) sensor data of soil conditions with both optical and polarimetric radar data of vegetation condition. A pre-event baseline will be established, followed by successive monitoring through spill response and remediation stages. Novel object-based analysis techniques will be demonstrated to assess the inter-related impact of soils condition and vegetation stress.

There are three main objectives to this project:

- Determine the earliest time a pipeline breach may be detected using CSA supported EO Data;
- Determine the greatest fidelity of impact delineation using CSA supported EO Data; and
- Evaluate the effectiveness of remediation monitoring capabilities using CSA supported EO data.

Availability of multi-source data including high resolution optical imagery, polarimetric synthetic aperture radar (SAR), and EM survey measurements provides a unique opportunity for detecting pipeline leakage and finding its impact on surrounding vegetation and wetland areas affected by oil spill and waste water. To be of benefit, EO data support must be shown to provide an improvement to current operational practices. Ideally it must provide a combination of improved accuracy of the information reported, decreased cost of operations and/or more timely and efficient response to an event.

This study will contribute to technological advancement in the following ways:

- Integrated analysis of ground survey EM data and satellite imagery will provide understanding of optical and radar satellite image response mechanisms in land-based oil and waste water leakage environments.
- Time series analysis will provide complete information on the oil/waste water leakage process and its effects on soil and vegetation throughout a spill event and subsequent remediation.
- Object based signature analysis creates a profile of soil resistance and related vegetated changes measurable by earth observation techniques. This will in turn improve the ability to detect and delineate events using earth observation.

The novel automatic approach of land-based oil/waste water leakage detection and impact analysis based on signature profile collected from time series satellite imagery may significantly lower operational monitoring costs and improve efficiency of operations.