



Report Partner Document

ANNUAL REPORT ON THE ALBERTA BACKGROUND SOIL QUALITY SYSTEM PROJECT
PHASE 3
PTAC

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This partner document has been created to provide a non-technical summary of information presented in Annual Report on the Alberta Background Soil Quality System Project Phase 3 (2024) referred to in this document as “The Report”, prepared by InnoTech Alberta Inc., University of Saskatchewan, and Statvis Analytics Inc. (Statvis), for and with funding by Petroleum Technology Alliance Canada (PTAC). Additional background information is provided in this partner document to supplement the readers understanding of progress presented in The Report.

Introduction

The Report presents the results of an initiative conducted by InnoTech Alberta, University of Saskatchewan, and Statvis. The primary objective of The Report is to refine and validate Alberta-specific soil quality standards for use in reclamation assessments, with a particular focus on addressing situations where naturally occurring soil conditions exceed generic regulatory criteria. Phase 3 builds on earlier work by expanding datasets, refining evaluation methods, and developing practical approaches to support the demonstration of naturally elevated concentrations of salinity and metals in Alberta soils.

Background Information

In Alberta, soil quality standards are a cornerstone of determining whether a reclaimed site meets regulatory requirements for equivalent land capability. However, these standards are often exceeded in undisturbed, natural soils due to inherent geological and ecological factor, particularly for parameters such as salinity and certain metals. This natural variability presents challenges for reclamation certification, as sites may appear to fail based on criteria that are not representative of local background conditions.

To address this, Alberta-specific soil quality standards have been developed to reflect natural ranges in soil chemistry across different ecological regions. This ensures that regulatory thresholds are both protective of environmental function and realistic for the province’s varied landscapes. Earlier project phases established baseline datasets, identified key soil properties for monitoring, and created preliminary screening thresholds.

Phase 3 was designed to expand the soil quality dataset, refine the thresholds for key parameters, and strengthen the scientific basis for demonstrating naturally elevated concentrations of salinity and metals. The work also examined practical approaches for applying these standards in regulatory processes, ensuring that assessments can reliably distinguish between human-caused contamination and natural background conditions.

Project Summary

EXPANSION OF SOIL QUALITY DATASET ACROSS ALBERTA

The project team collected additional soil samples from a variety of ecological regions, including grasslands, forested uplands, and saline-prone areas, to improve statistical confidence in the thresholds. The expanded dataset captured a broader range of natural conditions, particularly for parameters such as electrical conductivity, sodium adsorption ratio, and naturally occurring trace metals. This increased coverage strengthens the ability to identify when elevated values are due to natural background levels rather than industrial disturbance.

REFINEMENT OF SOIL QUALITY THRESHOLDS

Using the expanded dataset, statistical analyses were applied to refine thresholds for salinity and metals, along with other key parameters such as pH and organic carbon. The goal was to ensure that these thresholds accurately reflect natural soil conditions while still providing a protective standard for ecosystem function. For parameters with substantial natural variability, such as sodium or certain metals, the refinements emphasize region-specific benchmarks instead of a single province-wide limit.

FIELD VALIDATION OF STANDARDS

The refined thresholds were tested at reclaimed and undisturbed reference sites to determine their applicability in distinguished natural conditions from potential contamination. Field validation involved comparing measured values to the proposed standards and assessing whether these results aligned with observed vegetation health and site function. The testing confirmed that the refined thresholds can more accurately account for naturally elevated concentrations, though certain adjustments were recommended for specific soil types and climatic zones.

IMPLEMENTATION CONSIDERATIONS AND GUIDANCE

This task addressed how the refined standards can be integrated into reclamation certification workflows. Guidance was developed for selecting representative sampling locations, determining appropriate depths, and ensuring laboratory consistency. The report also provided strategies for building a defensible case when elevated salinity or metal concentrations are shown to be naturally occurring, including the use of reference site data and statistical comparisons.

Conclusion

Phase 3 of the Alberta-specific soil quality standards project advanced the development of practical, scientifically defensible criteria for reclamation assessments in environments where natural soil conditions often exceed generic regulatory thresholds. By expanding datasets, refining thresholds, and validating their applicability across diverse site conditions, the project has strengthened the scientific basis for demonstrating naturally elevated concentrations of salinity and metals.

These refined standards may help prevent the misclassification of naturally saline or metal-rich soils as contaminated, reducing unnecessary remediation costs and focusing reclamation efforts where they are truly needed. The project emphasized the importance of standardized sampling protocols, robust laboratory analysis, and the use of representative reference sites to support defensible decision-making. Collectively, the work provides a more accurate, regionally relevant, and practical framework for evaluating soil quality in Alberta's reclamation certification process.