EXECUTIVE SUMMARY

In 2018, the Petroleum Technology Alliance of Canada (PTAC) initiated a multi-stage project on the reclamation certification process for sites that were constructed using imported mineral soil pads in peatlands (padded sites). Stage 1 of the project has been completed and identified knowledge gaps for making decisions to accept or reject requests for a change in land use for padded sites during the reclamation certification process. Stage 2 is nearing completion and includes a decision framework and support tools for making decisions related to reclamation certification of padded sites; however, some of the factors that the framework and support tools are based upon are knowledge gaps.

Stage 3 is the field research component of the project to address the knowledge gaps. The objective of Phase 1 of Stage 3 is to evaluate abandoned padded sites (between 1940 and 2020) in peatlands within Alberta using well databases, company records, environmental reports, and remote sensing data and techniques to identify and characterize available padded sites.

For the project, sites of interest consisted of abandoned wellsites found in peatland areas in the Boreal and Foothills Region of the Green Area. Using wellsite information and ecoregion layers, the list of all wells licensed in Alberta between 1900 and 2021 were initially filtered down to 103,531 wellsites located in the Boreal and Foothills Region of the Green Area. To avoid redundancy, wells with the same surface location (defined as being within 30 m of one another) were consolidated into one site; oil sand exploration wells were excluded (as these are unlikely to be padded) and only abandoned wellsites were included, resulting in 47,920 sites.

Sites with no available LiDAR data coverage before the drill (spud) date, as noted in the AbaData information, were excluded. In addition, any wellsite that fell within certain active dispositions was excluded, such as a road or pipeline, where the topography was likely to have been disturbed. Finally, only sites found in peatland areas in a buffered query of the ABMI and DEP wetland datasets were retained. This resulted in a final count of 15,083 sites for evaluation.

A supervised classification was run on the assembled datasets. To train the classifier, a set of 181 identified padded and unpadded sites was assembled from a combination of existing wellsite records augmented by expert visual interpretation of airborne and spaceborne imagery. The independent variables consisted of the derived spectral features and ancillary data whereas site type (pad/no pad) acted as the dependent variable. The output consisted of a binary classification of padded/unpadded sites. The classification procedure achieved 81.2% accuracy when predicting no pad and 73.9% accuracy when predicting a pad, for an overall classification accuracy of 78%. As a result, a total of 7,077 padded sites and 8,006 unpadded sites in peatland areas were obtained from the supervised classification.

The accuracy of the classification may be increased through several options:

- Increasing the size of the training dataset used to parameterize the supervised classification would likely improve accuracy and result in more predictive power. This would require additional effort and expert knowledge to visually interpret new sites and re-run the classification.

- Including other predictor variables in the classification, such as side aperture radar or LiDAR-derived texture metrics, additional wetness and greenness indices from different Sentinel-2 acquisition dates, and alternate spectral indices not previously considered.
- Implementing different classification techniques. For instance, a Logistic Regression model could be used to predict the probability of a pad (as a numerical output), which could be further classified into semantic probability classes.