

Session #6 - Integrated Remediation Practices

Time 1050am-1110am

Topic **Placer Mined Permafrost Wetland Reclamation Best Management Practices**

Abstract Placer mining has been a cornerstone of the Yukon's economy and modern culture since the great Klondike Gold Rush of 1898. Currently there are over 150 family based placer mines with a combined gross revenue in excess of \$90 million annually. All Yukon placer mines are privately financed operations. Placer mining is especially vital in the Yukon's small communities. Placer mining disturbs the ground due to the removal of overburden with heavy equipment, the diversion of streams and the construction of roads. Some placer mines are located on wetlands and the disturbance or destruction of these wetlands often cannot be avoided.

Wetlands are lands that are saturated with water or covered in shallow water. Wetlands are recognized as very important ecosystems and are highly valued. The five classes described by the Canadian Wetland Classification System (bogs, fens, marshes, swamps and shallow open water) are distributed throughout the Yukon. The broad goal of wetland reclamation after placer activity is to re-establish the appropriate saturation and/or flooded conditions, soils and topography to allow the natural establishment of a self-sustaining marsh or shallow water wetland habitat. Marsh and shallow water complexes are by far the most significant wetlands in terms of wildlife diversity (National Wetlands Working Group, 1988).

Reclaiming wetland areas into a variety of wetland and upland habitats is preferable. Most species require a mix of wetland and uplands which are often more productive. Some swamps, bogs and fens will form without active reclamation measures; however this is most likely over extremely long time frames. These best Management Practices (BMP) identify topographic and reclamation features which are added to the post-mining landscape to encourage and enhance their natural reclamation to marshes and shallow water wetlands.

A lot of literature regarding wetland construction is available, but most of it relates to the exacting restoration of specific types of wetlands which have not been excavated to mineral soils and not to the general reclamation of heavily disturbed sites. There is very limited information regarding the restoration of northern wetlands, particularly those in permafrost areas. Most of the relevant research has come from the restoration of mega oil sands mining projects in Northern Alberta where complex peat land bogs and fens have been reclaimed to marshes and shallow water wetlands.

The re- establishment of reclaimed wetlands should take in the order of 10 to 15 years. At that point, the system should be well covered with succession vegetation and be "free to evolve." Reclaimed wetlands should not require long-term maintenance and management.

Monitoring and adjustments will be required from time to time to these best management practices to optimize the reclamation of placer mined permafrost wetlands.

Presenter(s) Randy Clarkson, NEW ERA Engineering Corporation

Bio(s) Randy Clarkson is a Canadian and resident of Whitehorse, Yukon since 1980. Mr. Clarkson is a professional mining engineer registered in the Yukon Territory (since 1982) and British Columbia (since 1983). He has both a bachelor of applied science in mining engineering from the University of British Columbia (1979) and a diploma of mining technology from the B.C. Institute of Technology (1974). He has over thirty years of diversified worldwide experience in underground and surface mining engineering, mineral processing, reclamation, effluent treatment, permitting and small hydro development. Mr. Clarkson is recognized as a world leader in placer mining and gravity recovery. He is also the designer, co-owner/operator of NEW ERA Hydro Corporation's 250 kW Fraser Micro hydro station (since 1990).

Mr. Clarkson's interest in wetlands started thirty years ago when he purchased a rural residential lot and built his home adjacent to a marsh and shallow water wetland south of Whitehorse. Recently he worked with Anne Michon for two years undertaking field and literature research; and co-authored a guide to best management practices for reclaiming placer mined wetlands.