

EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) was engaged by Yukon Community Services to undertake a Flood Assessment and Abatement Options Study of the Marsh Lake and Upper Liard areas. Major support for the study was provided by EBA's Vancouver office including Hay & Company Consultants (Hayco), a Division of EBA. Additional support was provided by the KGS Group (Winnipeg) regarding the assessment of flood damages. Survey services were provided by Challenger Geomatics Ltd.

The study was initiated as a result of floods in 2007 which caused extensive flood damage to the Marsh Lake area south of Whitehorse where record flood levels occurred. A large emergency response was organized to combat the rising flood water which peaked on August 13. The flooding at Upper Liard, west of Watson Lake, was less severe and limited to 7 homes on the east bank of the Liard River north of the Alaska Highway.

The purpose of the flood study was to assess the flood hazard at the Marsh Lake and Upper Liard areas including an assessment of potential damages faced by these communities for a range of floods with return periods from 20 to 200 years.

The flood hazard assessment included a review of the project hydrology in order to establish design floods and corresponding flood levels at the two project areas. At Marsh Lake, a wind-wave analysis was undertaken in order to establish design waves and associated wave run-up conditions for design of bank protection options. Dyke crest design levels together with riprap and underlayer gradations were established for the Army Beach, South McClintock and Swan Haven sites. Options to mitigate the flood risk were subsequently developed including conceptual designs and cost estimates to complete the works. Dyke designs included 12 typical cross sections at surveyed locations along the lake shoreline. Road upgrades were included as part of the flood mitigation works at the Army Beach and South McClintock sites. It is proposed that roads be raised a minimum of 0.3 m above the 200-year lake level. At Swan Haven, the development is well above Marsh Lake flood levels and erosion of the shoreline is the only concern.

Flood mitigation options at Upper Liard are of a preliminary nature due to lack of survey data. Flood levels have been estimated at the highway bridge; however, a hydraulic model of the river is required to establish the design profile upstream of the bridge. The May 29, 2008 assessment of the left bank dyke works at Upper Liard has revealed these works to be more substantial than shown on the McElhanney topographic plan.

The impact assessment of flood damages at Marsh Lake was based on field work carried out in December 2007 by KGS Group staff together with survey data for the main floor building elevations. Damages were estimated based on property assessment rolls and flood damage data developed elsewhere in North America. The damage estimates were based on graphical relationships linking the inundation flood level to the resulting flood damage as a percentage of the assessed value of the buildings. At Marsh Lake the flood damages were estimated to range from \$1,354,000 to \$1,966,000. The flood damage estimates for Upper Liard were less precise due to a lack of current survey data. Flood damage estimates for Upper Liard ranged from \$644,000

to \$1,281,000. The assessment by the KGS Group indicates the proposed Marsh Lake flood protection works to be marginally justifiable in terms of benefit/cost analysis.

Regulatory approval strategies were also prepared as part of this study including YESAA requirements. General requirements are presented and a refined plan can be prepared once a decision is made on which option will be adopted for final design.