Seymour Falls Dam Explosive Compaction Project:
General Background on Specialist Sub-Contractor: Explosive Compaction Inc.

Explosive Compaction Inc. (ECI) is a specialist sub-contractor awarded the explosive compaction portion of the work for the Seymour Falls Dam seismic upgrade. ECI was formed in 1999 as a partnership between Foundex Explorations Ltd. and Pacific Geodynamics Inc. ECI uses exclusively the blasting services of Pacific Blasting Ltd. With this group of companies, ECI has assembled the necessary drilling, blasting and engineering expertise to provide EC services to its clients throughout the world. General technical background to EC and projects the personnel of ECI have worked on over the last several years are provided separately.

The Seymour Falls Dam project requires a high level of blasting, drilling and instrumentation expertise in carrying out EC activities at the site, working under the direction of the design engineers Klohn-Crippen Ltd. and the owner GVWD. The technical specifications for the EC work are based on a prescribed methodology in which blast hole spacings, charge loadings and patterns of detonations have been specified by KCL. The final time delays used in the blasting were based on what had been previously successfully used at the site during field trials carried out in 1998, as well as more recent reviews carried out jointly by ECI and KCL. The technical specifications state limiting peak particle velocity (PPV) levels at various locations throughout the site and the blasting time delays finally used for the project were designed to keep PPV levels recorded during production EC to acceptably safe levels. Other EC requirements for the project include:

- Development of specialist drilling systems to place PVC blast hole casings within the bouldery sand and gravel deposits at the site. These soils represent some of the most challenging geotechnical conditions in the world. The drilling systems used are based on a Symmetrix system which advances drill casing using a combination percussion and reverse circulation rotary drill system. This system has functioned well and has permitted ECI to complete blast holes in a timely manner. The speed of drilling is critical in ensuring that project schedules are met.

- Developing systems to constrain upward movements of blast casings as detonations proceed in order to ensure that charges are detonated at specified elevations.

- Development of blast monitoring systems to confirm that all charge detonations have occurred for a particular blast pattern (“pass”). ECI therefore developed the use of high speed, downhole blast monitoring systems involving the use of coaxial cable. When the cable is sheared at a particular level by an explosive detonation, this results in a resistance change in the cable and a corresponding voltage spike, which is monitored on a high speed data acquisition system. Other back-up blast detection systems are also used, involving hydrophones placed in water filled steel casings near a particular blast array, as well as vertical geophones placed near the blast area.

- Monitoring of pore pressures at various elevations at the toe of the earth fill dam using both slow and high speed rates of data acquisition. Pore pressures are recorded prior to, during and after each phase of blasting activities to ensure that pore pressure levels within the dam foundations are acceptably small, as determined by KCL.

- Monitoring of peak particle velocities at various locations throughout the site, including vibration sensitive areas such as the fish hatchery, chlorination building, and water main.

- Installation of water wells prior to the start of blasting, and subsequent water well monitoring (carried out by KCL and GVWD) to ensure that there are no deleterious blast product residues in the

groundwater (primarily nitrates and ammonia). Water quality testing to date has indicated that the explosive products used during production EC have performed satisfactorily and have not produced any deleterious products in the ground water. This is also indirect evidence that all charges have been safely detonated since any unexploded product in the ground would be expected to leach various blast product residues.

The above data must be reported by ECI to KCL in a timely manner to confirm that all charges have detonated successfully, that pore pressures are not excessive, and that PPV levels during a blast are at or below acceptable limits. To date, PPV and pore pressure levels have been within acceptable limits and all charge detonations have been confirmed. This monitoring has confirmed that EC can be carried out safely at the toe of an existing dam. The densification results of the EC are reported separately by KCL.