Overall view of Cleveland Dam during rehab construction.

Dam gets new

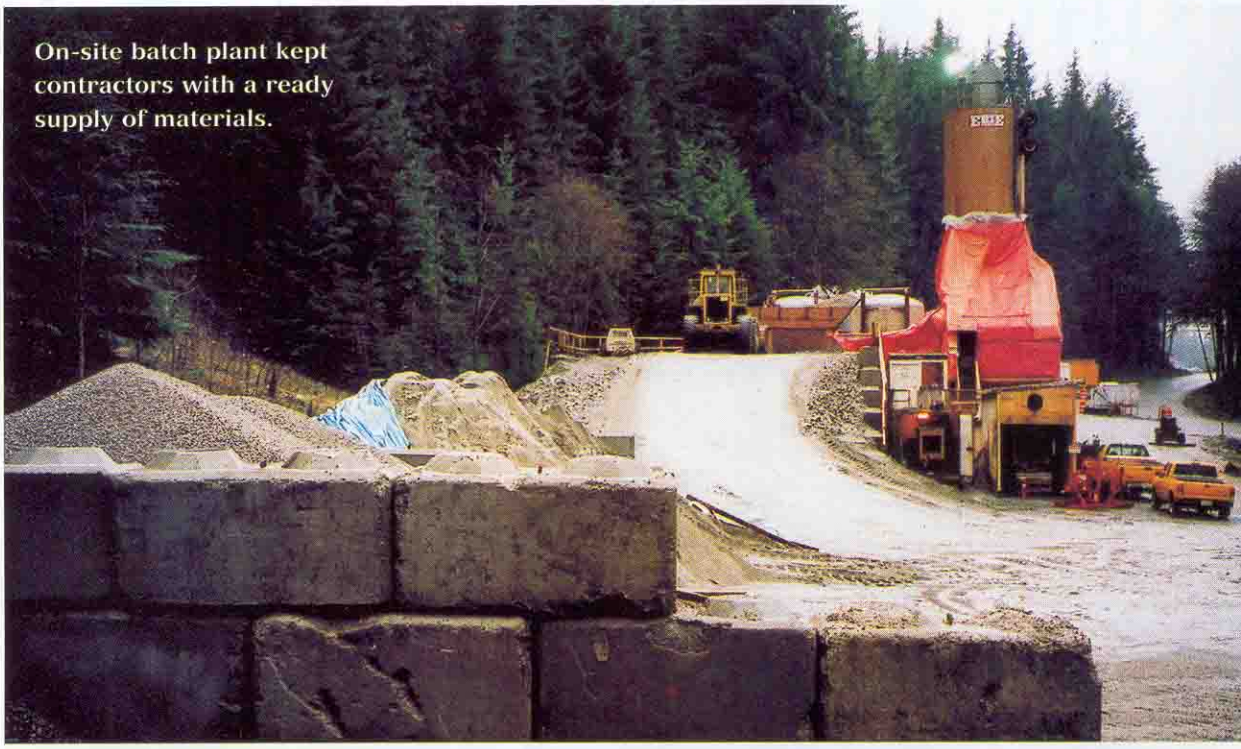
By Correspondent Tonia Jurbin

The Cleveland Dam in North Vancouver, BC is located at the south end of the Capilano Lake reservoir. The concrete structure, commissioned in 1954, holds back just over one third of Greater Vancouver's drinking water supply, about 34 billion litres over 312 hectares.

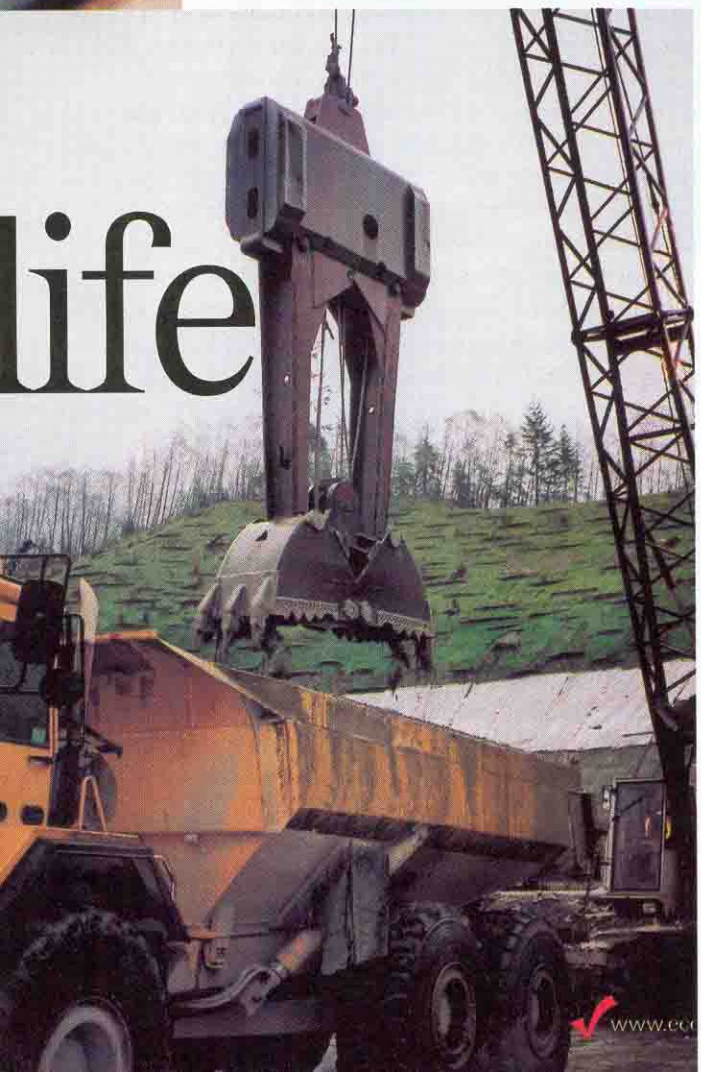
When the dam was built, a 200 m-long, 1.5 m-thick clay blanket was constructed along the east abutment to reduce the potential for seepage and loss of fines as groundwater moved through one of the natural aquifers. It had long been recognized that changes in water pressure and long-term seepage would eventually remove enough fines from the slope to compromise the safety of the abutment.

The Cleveland Dam is located in an upscale residential neighbourhood adjacent to the Grouse Mountain Ski area, one km uphill of the Capilano Salmon Fish Hatchery, and a couple of kms uphill from the Capilano Suspension Bridge.

Because of the neighbours, the dam repair project had to be well contained within the 200 square kilometre watershed, about 10% of which was active during the construction. This activity included placing almost 300 000 m of excavated material that was



On-site batch plant kept contractors with a ready supply of materials.



removed to flatten the steep slope above the work bench, quarrying, and processing all of the concrete and rock products.

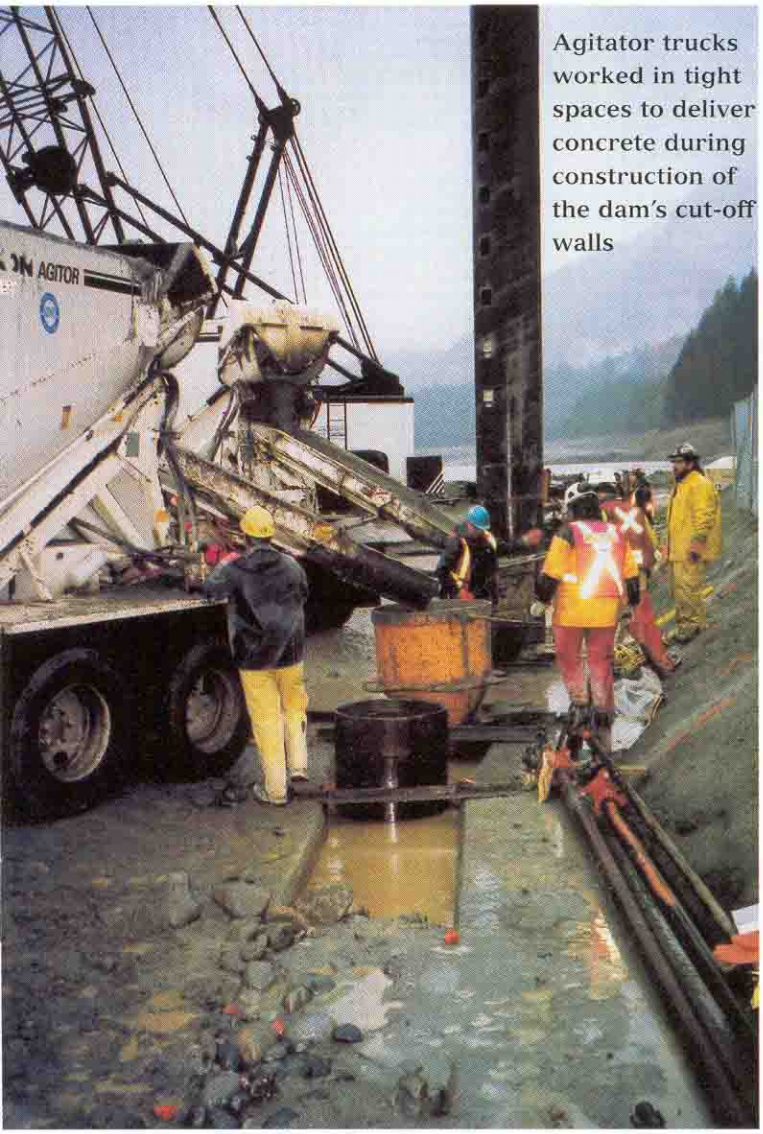
The Cleveland Dam Seepage Control Project involves installing a 260 m-long extension to the original clay seepage control blanket along the lower slope by building a shallow cut-off wall constructed of a flexible, low strength concrete, and a roller compacted concrete blanket.

When complete, the seepage will be controlled making the dam safe for decades to come. The prime contractor for this $16.3 million, 14 month-long job is Peter Kiewit Sons Co. Ltd. out of their Richmond, BC branch. Subcontractor for the slurry-supported excavation cut-off wall was Petrifond Foundations Company Limited of Montreal partnered with Vancouver Pile Driving Limited out of North Vancouver, BC.

The elevation of the working bench is 126 m. The normal full service high water level of the Capilano Reservoir is 146 m, but during this project the level of the reservoir was maintained at 120 m.

"By far one of the biggest challenges on this job was scheduling. In fact, there was zero float in our schedule for about a seven month period," says Brad Mytko, project manager for Peter Kiewit Sons.

Hauling materials in and around the dam required a large fleet of trucks and cranes equipped with special attachments.



Agitator trucks worked in tight spaces to deliver concrete during construction of the dam's cut-off walls

During the installation of the cutoff wall, the crews were working 7/24's. An evacuation in early January didn't help, when heavy rainfall brought the reservoir level 4 m above the workbench.

The first major component of the project was to stabilize the slope above the east abutment so that the crews could safely work at the base and excavate the material where the wall would eventually be poured. About two-thirds of the 290 000 m^3 removed was placed in five engineered disposal sites strategically located within the watershed. The rest was processed at the batch plant and used for concrete aggregate or riprap. The remainder of the required aggregate and riprap came from a quarry within the watershed. This slope had to be landscaped and vegetated before the heavy rains started in the late fall.

The cut-off wall is about 300 m long and made up of 51 – 6 m-long panels that are 0.8 m wide and vary in depth from 6 to 22 m. The depth of each panel being governed by the location of the stiff, low permeability silt layer.

Location of the silt layer was confirmed by exploratory drilling at 30 m intervals. If the depth of the silt layer varied by more than 2 m within a 30 m section, intermediary drilling was required. Confirmation samples were also taken after each panel was excavated. Foundex Explorations Ltd. out of Surrey BC was on site full time for a third of the job.

The cut-off wall panels had to be staggered with at least 40 m between any opened panels to insure stability of the upper slope.

A guide wall (open-bottomed trench) was built with concrete to guide the excavation clamshell. As the clamshell excavated towards the silt layer, the hole is backfilled with a thick bentonite slurry that keeps the excavation from caving so that the concrete can later be tremied in. The concrete displaces the bentonite that is collected, de-sanded, reused in another panel excavation and eventually removed from site.

Concrete for the cut-off wall was transported from the on-site batch plant using small 6 m agitator trucks. Because of their size, they are manoeuverable in a tight spot. This site was so tight the truck drivers had to take turns driving in reverse up the access road because there was not enough room for both trucks to turn around. The agitator trucks are also able to pour their load much faster than a mixing truck, they can batch a load in 3 to 4 minutes and dump a load in under a minute.

After the cutoff wall is complete it will be capped with conventional concrete from elevation 126 – 127. About 11 000 m of roller compacted concrete will be installed in a 3 m thick layer (in 300 mm lifts) from elevation 127 to 138. Before the reservoir is filled, about 40 000 m^3 of fill and riprap will be placed over the works. At the end of the project, all that will be visible will be some of the riprap protection and the landscaping of the upper slope.

The three major concrete products called for on this project were all processed and tested at the on-site batch plant. Aggregates not available from the first excavation were found elsewhere within the watershed. The only imported material was the cement and the bentonite. The only material hauled off-site was the bentonite slurry and the contaminated material from the excavations as it was not considered prudent to dispose of these products within the watershed.

About 450 m^3 of regular 30 MPa concrete was used for the guide wall. Almost 5000 m^3 of plastic 1 to 2 MPa concrete was used in the flexible cutoff wall and about 1200 m^3 was used in the cap over the wall. ◆