5. CRACROFT CAVERNS RESERVE – ADDITIONAL RING LASER

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The purpose of this report is to seek approval for a proposed new ring laser to be constructed in the Cracroft Caverns situated below Cracroft Caverns Reserve.

The University of Canterbury (Physics and Astronomy Department) has made an application for a Resource Consent to construct a new ring laser in the Cracroft Caverns. A Resource Consent is needed for this activity, because it is situated on a reserve area owned by Christchurch City Council that is a Class 4 Historic Site.

A BRIEF HISTORY TO DATE

In 1995 the Parks Unit acquired, through subdivision of the Cracroft Estate, a 7111m2 recreation reserve to the south of Princess Margaret Hospital (PMH), which includes part of the historic World War II Caverns by strata title. The Reserve provides important walkway linkages between Nehru Place, Hackthorne Road, Bengal Drive and Delhi Place. Revegetation and construction of the walking linkages is underway.

Thirty metres below this Reserve, but on the same certificate of title as the Reserve, are the underground World War II caverns, designed to be the South Island's defence headquarters for 'Southern Group'; a combined Air Force, Navy and Army intelligence unit during the war. The armed forces commandeered the old Cracroft Wilson Estate and, using it as a base, began construction of the bunkers in 1942. Two years later, when it became apparent that an invasion of the South Island was unlikely, the partially completed caves were sealed and left until being officially rediscovered by a TVNZ journalist in 1987. When the news was released the Physics and Astronomy Department of the University of Canterbury sought and received the permission of the owners to conduct experiments in the caverns. The University required the most stable environment for their ring laser gyroscope experiments and the underground caverns, with an almost constant temperature and humidity, so close to the University's Ilam campus, were ideally located. Although extremely precise, the experiments use low power lasers similar to supermarket barcode reading lasers and have no military applications. The first ring laser experiment ('C-I') was housed in a building constructed inside the caverns before they came into Council ownership.

After the success of the first model, the University has installed two more ring lasers in the caverns. 'C-II' was installed in an extension to the building which houses C-I and more recently a 4 metre square laser ('G-O') was installed on a vertical wall near the entrance to the caverns, this one being the prototype of a ring laser to be installed in Germany after trials and refinement at Cashmere.

NEW RING LASER ULTRA – G

The proposal is to place the whole device in the open air of the cavern, bonded solely to the floor. No new building, nor any work affecting the cavern walls is proposed. Nineteen concrete piles for mirror and gain tube support near the corners of the cavern (plus a few intermediate points), together with smaller supports for a connecting pipe, will be placed upon the cavern floor (see attached plan).

The cavern has been re-surveyed for this purpose by Roger Dawe (Civil Engineering, University of Canterbury) so that the outline given here is more accurate than on previous maps. The outermost line for the cavern on this plan is accurate on the east part of the north wall, the south wall and the west wall, but for the east wall and the west part of the north wall a line is projected from the existing military concrete walls, and therefore in these areas there is a bigger gap than indicated here between the proposed pipeline and the physical rock wall.

Each corner requires a concrete pier 600mm x 600mm x 250mm as a stable support (for an optical table – a square stainless steel plate – to mount the corner mirror, its mounting box and collimating and detection equipment), plus two smaller concrete anchor points 400mm x 400mm x 250mm one metre away for supporting micrometers. These position the ends of the mirror adjustment levers. This adjustment, like the mirror mounting itself, is highly sensitive and needs a stable reference. The main corner positions are linked by a plastic or stainless steel pipe, of 90mm in diameter, mounted at regular intervals (4 metres) on smaller concrete supports; these do not need to be substantial, since they simply take the pipe weight. Finally, a concrete pier 1m x 400mm x 350mm, centrally placed on and adjacent to the concrete wall behind the present huts is needed to support the gain tube. The height of the concrete is kept low (25cm) and also the beam pipe (37cm), so as to minimise conflict with other users of the cavern. Access from the tunnel will be ensured by ramping the present concrete path on each side of the eastern pipe to the height of 45cm.

Two possibilities are covered by this application: A rectangle enclosing the whole of the main cavern (linked through the eastern cross tunnel) and a smaller rectangle with two common corners but enclosing the western section only (linked through the western cross tunnel). These choices have a common section near the western wall, behind the present huts, where the gain tube will be placed. Each rectangle may have to be tested in practice, the final preference depending on the future results of this research programme.

The nineteen concrete pillars need to be placed solidly in contact with the basalt rock at or below the floor of the cavern. Some removal of loose material is needed to obtain solid bearing (which will be minimal). The concrete would not be bonded to the rock, but laid upon and in contact with it.

As far as the University of Canterbury is concerned, this is the ultimate project for Cashmere. The University of Canterbury has discussed this project for a year with their German collaboration partners, who are extremely keen to see this machine become a reality. Its possibility was not dreamed of when the ring laser project was started, but the various successes in each stage so far have exceeded expectations. This work at Cashmere has been a vital testbed for the Grossring (a well-engineered 16 square metres), which has clearly been justified by this research and is currently being built in Germany. In addition, a scientist in Conway, Arkansas, Professor Bob Dunn, working with very inferior equipment, has shown that a very crudely engineered ring laser gyro with a perimeter of 40 metres can operate successfully. He is expected to visit our University during July and August 2000, and the University will aim for having a simple version of Ultra-G in operation during his time here.

PUBLIC TOURS

The project will have little or no impact on the conducted tour programme of Christchurch City Council. The ramps allowing access for the public into the main area, whilst the positioning of the pipeline relatively close to the walls puts it away from the public tour path, which deliberately avoids the walls.

The extent to which the alterations have an irreversible effect:

When the project is completed, the cavern can readily be returned to essentially its former state; the concrete can be crowbarred off the rock cleanly, and the present loose floor material restored.

The University propose a lifetime for this project of 15 years, before or on completing it they undertake to return the cavern to its present state.

Recommendation: That the Board recommend to the Parks and Recreation Committee that the Council grant the University of Canterbury permission to construct the proposed ring laser as detailed in the attached application subject to the following conditions:

1. The University of Canterbury to obtain all necessary Resource and Building Consents before any development commences upon the site.

2. The leased/construction area being maintained by the University of Canterbury in a safe and tidy condition at all times.

3. All costs associated with the development, and subsequent maintenance of the associated buildings and structures upon the site being paid for by the University of Canterbury.

4. The University of Canterbury is to show proof of having an Occupational Safety and Health Hazard Plan in place, before commencing operations upon the site to the Area Parks Officer (Consents).

5. Before any tenders are let or work commences upon the site, discussions are to be held with the Parks Manager's designate, the Area Parks Officer – Sockburn to ascertain the Council's requirement through the development phase of the construction of the facility.

6. A bond of $2,000 is to be paid by the University of Canterbury or successful principal contractor to the Christchurch City Council / Area Parks Officer – Sockburn before work commences upon the site. The bond less any expenses incurred by the Council will be refunded to the payee upon the completion of the work.

7. All rock excavated for the foundation of the piles is to be stored behind the Laboratory, to be used to restore the site when the piles are removed at the end of the project in approximately 15 years time.

8. That a steel frame protection tent for personnel use be used within the small areas during construction and maintenance work in the three corners that are not under the existing concrete roof and that this be written into the University's Health & Safety Plan.

Chairman's Recommendation:

1. That the above recommendations be adopted.

2. That the Parks Unit cease perpetuating the myth of the "rediscovery" of the caverns by a TV journalist, the existence of the caverns having always been known by the territorial local authority, the owners of the land, and local residents.