Tsho Rolpa GLOF Risk Reduction Project

RGSL acted as the technical advisers on this project to lower the level of the glacial lake Tsho Rolpa. At 3.2 km long and containing about 100 million m³ of water, Tsho Rolpa is Nepal's largest glacial lake and the first to have undergone emergency remediation work.

Melting glaciers high in the Himalayan mountains are creating unstable lakes that threaten to burst their banks, endangering the lives and livelihoods of those living downstream. Tsho Rolpa in northern Nepal is one such lake that in the mid 1990s was considered to be close to bursting. It was feared that a torrent of water and debris could threaten several villages and a temporary encampment of workers for the Khimti hydropower project downstream.

In 1998 the Dutch Government provided funding for an emergency drainage channel to be cut through the moraine to lower the water level by 3.5 m. RGSL were appointed as the technical advisors to assist the project director’s office, the Department of Hydrology and Meteorology (DHM), His Majesty’s Government of Nepal, with the assessment and monitoring of the site before, during and after the engineering works. Specifically, RGSL staff were responsible for:

- assessment of the physical hazards, including the glacier, moraine dam and surrounding areas through a combination of geophysical, geomorphological and glaciological investigations;
- design of a safety monitoring procedure and response strategy for the construction workforce;
- monitoring the condition of the glacier and moraine dam during drawdown of the lake;
- post-construction assessment of the stability of the moraine dam and glacier/lake system;
- training of DHM’s technical personnel.

TASK
Consultants to the Nepalese Government; responsible for hazard assessment and the monitoring of the glacial lake Tsho Rolpa and the surrounding environment during remediation works.

DATE
1998-2000

CLIENT/FUNDING BODY
- Netherlands Development Agency (Neda)
- Department of Hydrology and Meteorology (DHM), His Majesty’s Government of Nepal
ENGINEERING AT THE LIMIT

The construction work was taxing - the lake lies at an altitude of 4,500 m and is 60 km from the nearest road. Materials and equipment had to be brought in by porters or helicopters and, in the case of larger machinery, re-assembled at site. Construction began in the spring of 1999 and was completed in June 2000. The final channel was lined with a geotextile membrane overlain by gabions, with boulders chained together at the downstream end of the channel for additional erosion protection. A gate was installed to allow the drawdown to be achieved in a controlled manner. Throughout the construction, RGSL were responsible for the monitoring of the physical environment to ensure that the work had no adverse affect on the glacier or moraine dam.

A temporary respite...

The work successfully reduced the lake's volume by one sixth and has allowed part of the moraine to dry out, thereby partially stabilising it. In the meantime, the lake continues to grow as the glacier retreats and the dam is becoming increasingly unstable as two large ice blocks in the moraine continue to melt. If an outburst is to be avoided, the water level needs to be lowered further. Subsequent geotechnical modelling of the moraine dam by RGSL has highlighted the required amount of further drawdown in order to achieve acceptable factors of safety against major failures in the dam. This information has been presented to DHM, who are in the process of scoping the next phase and identifying potential sources of funding.

Publications:
