

Shaoxing International Forum on Rock Mechanics and Engineering Geology (SXFRG)

Theme: New Technology in investigation of geological hazards

Artesian blowouts – construction issues and management

Large quantities of free flow water under artesian conditions constitute a potentially serious geo-hazard in surface and subsurface excavations. Infrastructure development is replete with numerous such instances where artesian blowouts sent construction schedules haywire. B&R execution could be no exception.

The engineering geological artesian condition may be far from the classic situation where the under pressure subsurface water lies confined between impermeable layers of rock. In differing ground conditions at project sites, subsurface water in highly permeable fracture zones or open discontinuities could act as artesian conduits for perched water bodies with high potentiometric surfaces.

The artesian blowout @ 72m³/min from the invert of an 8.3m dia TBM bored tunnel in the northwestern Indian Himalaya could rank prominently in global occurrences of artesian blowouts in tunnels. Fractured quartzite underlying an impervious layer of phyllite in a Precambrian quartzite-phyllite interbedded sequence provided the artesian setup. The incidence site lay close to a deep buried valley filled with saturated lacustrine deposit of a major Himalayan river, not necessarily responsible for the blowout. The material outwash totaling 4000m³ was predominantly quartzitic and included well rounded and polished “pseudo-fluvial” fractions derived from a churning cauldron. The unconventional tunnel layout design with upstream gradient, optimally suited to the subsurface geological model, facilitated draining under gravity and helped resume excavation with the retrieved partially buried TBM in 186 days.

The artesian blowout in the excavations for a surface powerhouse, peaking @ 70m³/min, turned nightmarish for the execution of the financially constrained and remotely located EPC project that lacked physical access to state-of-the-art technology. The artesian setup comprised an open water bearing weak zone downstream of a waterfall in horizontally bedded soft sandstone of Tertiary age. The vast saturated flood plains behind the waterfall provided the perennial aquifer. Failed attempts of plugging the subsurface water conduit via drifts and shafts left no option but to pump out the 18m³/min discharge. While fresh strategy for plugging the discharge conduit is underway, the artesian flow has been channelized through drainage wells in the backfilled collection pit beside the completed powerhouse.

Yogendra Deva

IAEG Vice President for Asia

ICCS Ltd., Bhilwara Towers, A-12, Sector-1, NOIDA 201 301, Delhi-NCR, India

Handphone: +91-9871178299

Greater Noida, India; 14 August 2017