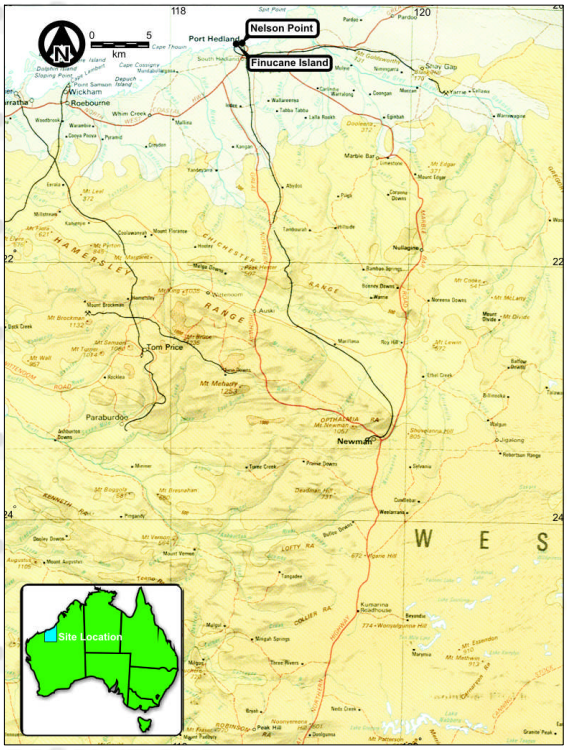
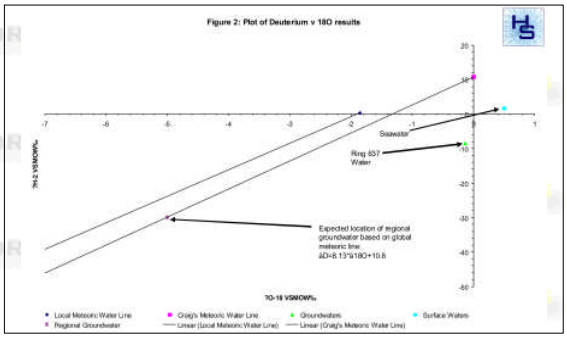
Hydro 26

Major WA Based iron Ore Miner

Assessment of the causes of hypersaline inflows into an under-harbour tunnel, Pilbara region, Western Australia.



Part map courtesy of Ordnance Survey



An under-harbour tunnel was built linking the two rail and port facilities of a major WA based iron ore miner, to more efficiently utilise the ship berthing facilities. A major geotechnical investigation had established the rock properties that would be encountered during the tunnel boring, and to provide design and construct parameters for the tunnel.

Shortly after opening the tunnel experienced hypersaline (I.e. Total Dissolved Solids>35,000mg/L or greater than seawater) seepages which had not been anticipated. The tunnel was constructed with concrete rings with steel reinforcement, which would be liable to corrosion at the observed salinities.

Hydrosolutions was commissioned to assess the possible causes of the hypersalinity. A desk study was undertaken to review the detailed geotechnical investigation, and the local hydrogeological conditions. It was concluded that hydrogeological conditions within the Tertiary marine sediments were unlikely to have been adequately characterised, with limited or no groundwater monitoring undertaken within the deeper discrete aquifer units, and the groundwater conditions not adequately identified.

A seepage sampling and analysis exercise was undertaken, to determine the chemical characteristics, including isotopic analysis:
-Deuterium
-Oxygen 18
-Tritium
-Carbon 14
-Major ion analysis

The results indicated the following:
-The seepages were a mixture of between 50-76% seawater and 50-25% groundwater
-The seawater had a radiocarbon age of c7000 years, while groundwater was >>55,000 years old (i.e radiocarbon dead).

-The groundwater was likely to be ‘connate’ in origin, entrapped within sediments formed in an arrid, tidally influenced depositional environment
-Hypersalinity may have been contributed to by membrane filtration through low-permeability aquitards above the basal sediments above granite bedrock
-Seepage into the tunnel was likely to have occured due to the release of confined hypersaline groundwater possibly from the tunnel construction &/or investigation works
-A possible solution was proposed via depresurisation of the underlying confined aquifer units via pumping to promote normal seawater intrusion.

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