Pillar Point Valley Restoration: Reducing Leachate Production via Groundwater Management

Neal Barretto & Jacques Groenewald, Associated Environmental Consultants

The Pillar Point Valley Landfill (PPVL) in Tuen Mun in northwest Hong Kong received municipal solid waste from 1983 to 1996. The landfill is now closed and is maintained through a contract with the Hong Kong Government. In recent years, more frequent and longer rainfall events have resulted in an increase in groundwater generation, which in turn has increased leachate production. Landfill leachate has the potential to harm the natural environment and community so is treated to reduce contaminant concentrations.

The landfill closure and restoration of PPVL was undertaken between 2005 and 2006, during this time a hydrogeological study was completed to better understand the hydrologic and hydrogeologic regimes in and around the landfill. The study confirmed that the landfill is partially unlined and that the leachate and groundwater collection systems are interconnected.

Leachates from PPVL are characterized as strong or weak. The strong leachate is driven by movement of fluids through the capped waste mass, while the weak leachate is believed to originate from the mixing of groundwater and leachate at the base of the landfill where the original leachate and groundwater collection systems are located. Part of leachate treatment program entails heating the leachate to reduce the concentration of ammonia. Increased leachate generation in recent years have led to a desire to reduce the interaction between groundwater and leachate thereby reducing water treatment costs.

Associated Environmental proposed a groundwater extraction method up gradient of the closed landfill to reduce mixing of clean groundwater with the landfill leachate seeping to the bottom of the old valley and forming weak leachate.

Following a review of historic assessments, rainfall, leachate and chemistry data we designed and implemented a site-wide geophysics program, including magnetics, electromagnetics and resistivity surveys to guide the design of a groundwater extraction system. The analysis of the subsurface bedrock structures identified the areas of structural weakness which had a high probability of introducing groundwater movement below the landfill. Interpretation of the geophysics assisted with more accurate drilling targets to intercept the geological structures likely to be associated with groundwater.

In initial phase 10 groundwater extraction wells were constructed, inspected with a well camera and tested to establish sustainable well yields. The well pumping system with controllers, pumps, pipe network and telemetry were subsequently designed and constructed. Following successful implementation of the initial extraction system, an additional 8 wells were constructed and commissioned, and local staff trained on the operation and maintenance of the system.

Some challenges encountered from the initial drilling programs have identified lessons learned for consideration of different drilling techniques to better attain water production.

Initial results indicate that there has been a significant reduction in the volume of leachate requiring treatment, with more detailed results pending completion of the monitoring period in 2022.

Neal Barretto

Neal Barretto, B.Sc., Geoscientist In Training (G.I.T) is a junior hydrogeologist with 4 years of experience in construction inspection, field hydrogeology and contaminated sites. He has overseen drilling programs, water well installations, and aquifer pumping tests as well as soil and groundwater water sampling for contaminated sites work.

Neals experience with various drilling techniques along with the design and installation of monitoring wells helped the team during the final Phases of the PPVL project. As a field scientist Neal is involved in field surveys, soil and groundwater sampling, laboratory analysis and technical report writing. He is a Geoscientist-In-Training with the Association of Professional Engineering and Geoscientist of Alberta (APEGA).

Jacques Groenewald

Jacques Groenewald, M.Sc., P.Geo., is a hydrogeologist with 28 years' experience in the geoscience industry. His expertise includes mine water supply and dewatering, groundwater contamination investigations, groundwater resource assessment and supply, aquifer hydraulics and dynamics, geophysics and numerical groundwater modeling in both 2D and 3D finite difference and finite element.

Jacques experiences have led him to travel all across the globe to places such as Hong Kong, South Africa, many other countries in Africa, Armenia, Australia and Sweden. As a Senior Hydrogeologist and project manager at Associated Environmental, he is responsible for working with both the environmental and engineering staff to navigate resource assessments for water treatment facilities, dewatering to contaminate transport for waste disposal sites and modelling large- and small-scale groundwater systems.