



# LANDFILL LEACHATE MOVEMENT

Solid-waste management facilities such as landfills can affect the quality of underlying groundwater and surface water. Modern engineering standards for landfills have reduced this potential in recent years, but there are many solid-waste facilities still in operation that were designed to less stringent standards.

Assessment of the extent and nature of landfill impact on groundwater quality is a specialised field of environmental practice. C. M. Jewell & Associates Pty Ltd (CMJA) has a strong background in this field. Our experience with landfills has ranged in scale from desktop analysis through to geophysical surveys, drilling investigations with hydraulic testing, hydrochemical/contaminant characterisation of groundwater, long-term monitoring design, containment system design and remediation design.

Some of our more interesting projects in this field are described below.

## ***Contamination assessment, Homebush Bay / Newington, Sydney, NSW***

This major investigation of the Sydney Olympic site was commissioned by the Department of Defence and NSW Property Services Group. It required us to assess the progress of stabilisation in a number of former landfills, and to finalise the risk assessment and remediation strategy. CMJA provided specialist hydrogeological input and project management services as a member of a multi-disciplinary consortium including CH2M HILL ICF/Axis, GHD and Douglas Partners.

We also modelled the inflow to a leachate collection drain, which was to be constructed as part of remediation work on the former landfills at Homebush Bay. This work was completed for Thiess Environmental Services.

## ***Groundwater contamination risk assessment, Yarrowlumla Landfill, southern NSW***

This preliminary investigation was restricted to a desktop assessment, involving hydrogeological assessment, identification of groundwater users, identification of potential off-site movement of contaminants, and preparation of a program for follow-up investigations. We assessed the fate of contaminants from the landfill leachate, estimated the potential risk to surrounding groundwater users, and examined the compliance of on-site operations with the management guidelines applicable to landfills.

## ***Hydrogeological investigation, Ophir Road Landfill, Orange, central west NSW***

The objectives of this investigation, commissioned by Terra Sciences, were to compile a detailed characterisation of site hydrogeology and to identify any off-site movement of leachate-affected groundwater. Mapping of localised hydrogeological features was complemented by the drilling and construction of five monitoring bores. We could then define the profile of the water table within fractured basement rocks, and estimate permeability. Groundwater sampling and analysis demonstrated that down-gradient groundwater on the landfill margins had elevated concentrations of nutrients and hydrocarbon contaminants, and high salinity. It was assessed that groundwater beneath the landfill ultimately discharged to the nearby creek. These hydrogeological findings were used in the development of engineering design recommendations for the existing and proposed landfill extension areas.

***Hydrogeological investigation for proposed landfill extension, Narrandera, NSW***

The investigation, commissioned by Terra Sciences, involved the drilling and completion of three monitoring bores across the proposed landfill extension area. In addition, hydraulic conductivity was measured using slug-test methods, and groundwater sampling and analysis were undertaken. We could then define of the geological profile, depth to groundwater, hydraulic gradient, hydraulic conductivity of aquifer materials and groundwater chemistry and quality. CMJA concluded that the risk of contamination of usable groundwater arising from construction of the proposed landfill would be very low. These findings were used to support an Environmental Impact Statement, which accompanied a development application for the proposed landfill extension.

***Hydrogeological investigation for proposed new landfill, Coonamble, NSW***

This investigation, commissioned by the Coonamble Shire Council, involved the review of existing regional geological and hydrogeological data, in addition to site-specific information gathered during the drilling and completion of three monitoring wells, testing of soil engineering characteristics, assessment of aquifer hydraulic conductivity and gradient, and groundwater sampling and analysis. The assessment concluded that the risk of contamination of usable groundwater arising from construction of the proposed landfill would be very low. These findings were used to support an Environmental Impact Statement to accompany a development application for the proposed new landfill.

***Landfill Gas Investigation, Dubbo, NSW***

To address Dubbo City Council's concerns regarding the potential risk of off-site migration of landfill gas into adjacent lands, CMJA installed a soil gas collection system at six locations. After a stabilisation period, soil gas was extracted from each of the system's monitoring points and passed through a landfill gas analyser to record concentrations of carbon dioxide, methane and oxygen. The study concluded that the toxicity hazard and potential for explosion due to the low methane concentrations detected would be very low.

***Unanderra Landfill, south coast, NSW***

CMJA has also provided expert opinion (as a court-appointed expert) for Supreme Court proceedings relating to the Unanderra Landfill. This involved an assessment of geological and hydrogeological conditions across the site, based on information collected by other consulting firms, including borehole and well completion logs, geophysical data, groundwater analysis results and other relevant hydrogeological data.

**Specialist Equipment And Methods**

CMJA is fully equipped for the field assessment of landfill hydrogeology. Our equipment includes:

- Grundfos MP1 variable-speed, electro-submersible sampling pump, suitable for use in purging standard 50-millimetre diameter sampling bores.
- Hydrolab H2OG down-hole hydrochemical probe.
- Soil vapour probes.
- Electrical conductivity, pH, DO and redox meters.
- Specialist sampling pumps and bailers.
- Hydraulic conductivity (slug-testing) equipment.

In addition, where applicable, CMJA uses the following groundwater geophysical methods.

- Electromagnetic (TEM) sounding.
- Electromagnetic (FEM) ground conductivity surveys.
- DC resistivity soundings and traversing.
- Down-hole geophysics (gamma, neutron, caliper, EM and resistivity).

CMJA can also offer groundwater flow and contaminant transport modelling, where appropriate.

### **How CMJA can help you**

We have considerable depth of expertise and capability to deal with all facets of hydrogeology related to landfill investigations. Whether it be assessing the risks of leachate migration, assessing the suitability of a site earmarked for a proposed new landfill facility, or installing groundwater monitoring systems for existing landfill operations, CMJA has the experience, knowledge and technology to help you.

Each project is tailored specifically to the requirements and goals of the client, and also takes into account the need to provide supporting information to regulatory authorities or operational planners.

CMJA also offers a full-service consultancy in hydrogeology, which extends from water sampling to expert testimony.