

CASE STUDY

CLOSED LANDFILL, DENTON, UK: AN INTEGRATED GEOPHYSICAL GROUND INVESTIGATION TO MAP THE EXTENT OF THE WASTE



Tameside Metropolitan Borough Council commissioned RSK to provide information on the physical extent of a closed landfill and the depth and distribution of the waste to characterise the site and inform the design of subsequent remedial work. Previous limited intrusive investigation had indicated waste in the gardens of numerous properties abutting the site. Given the sensitive nature of the residential environment, the use of non-intrusive surveying techniques was preferable.

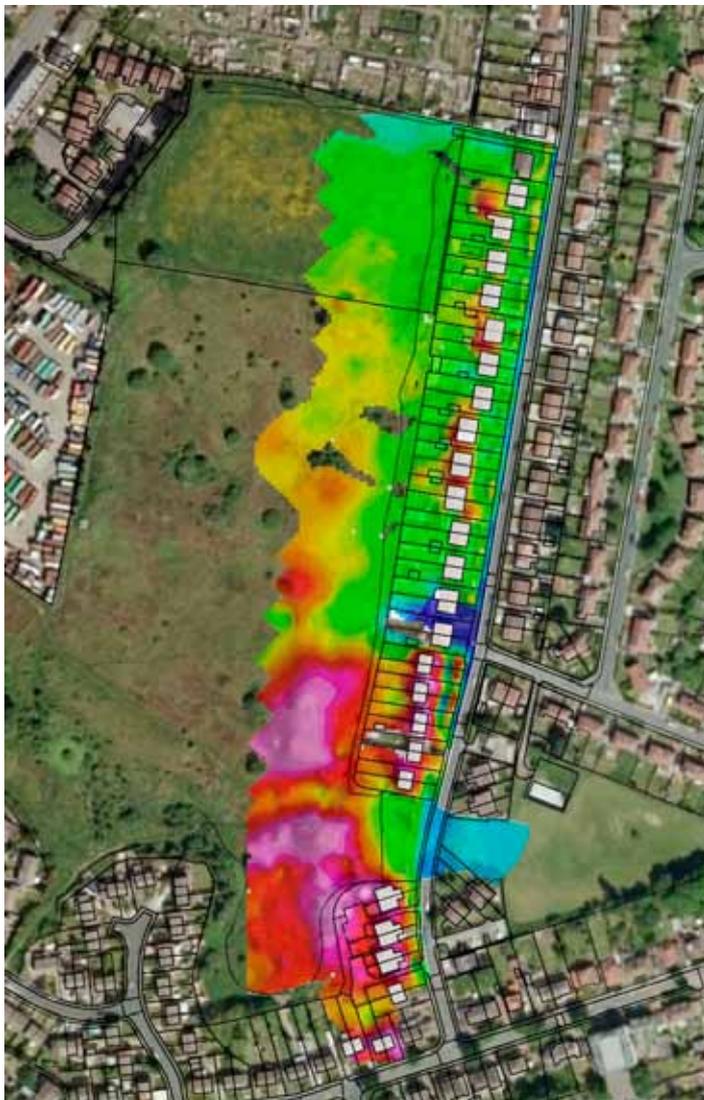


Fig 1. The eastern boundary of the landfill was covered by EM31 mapping. The most conductive waste (coloured red and pink) likely highlights areas subject to greatest leachate content.

Project background

A closed landfill in Denton, near Manchester, covering an area approximately 300 by 500 m was previously a brickworks with a large open clay pit. A mixture of industrial, commercial and household waste, and sludge was deposited in the pit in the 1970s, after which housing was built adjacent to the site. By the late 1980s, issues with landfill gas migration and leachate were being reported. A gas extraction system was installed but was ineffective. The site continues to suffer from gas migration to nearby residential properties. The problems have arisen because the landfill boundary was not fully defined.

Survey details

The principal geophysical technique used for surveying the site was resistivity imaging. Six resistivity profile lines were acquired across the eastern landfill boundary, along with a single north-south line to tie all the other lines. Ground penetrating radar and electromagnetic conductivity measurements were also taken in as many residents' gardens as possible to supplement the resistivity data. We calibrated all the geophysical data using the data from previous intrusive investigations to constrain and validate our interpretations.

Geophysical findings

The electromagnetic conductivity measurements (Figure 1) showed a wide distribution of conductive materials, particularly in the southern end of the site where a zone of active leaching seems to be concentrated. The waste appears to underlie several houses. The results of the ground penetrating radar survey (Figure 2) indicated that the edge of the landfill generates dipping reflection anomalies (possibly the former side of the clay pit) and high-amplitude discontinuous reflectors indicative of a heterogeneous mix of waste. The results of the resistivity survey indicated three layers within the landfill (Figure 3). The thin top layer is interpreted to be covering material. The second layer is a low-resistivity material likely to have high leaching activity. The bottom layer is moderately resistive and probably represents the glacial clay underlying the site. The depth of waste was shown to be about 7–10 m.

Outcome

In combination with borehole data, the geophysical data has greatly improved the conceptual site model of the landfill. Its geometry and the areas of leachate are better defined, which is vital in determining the proximity of the landfill to properties and for future remediation

“THE GEOPHYSICS FOR US IS REALLY USEFUL AS IT FILLS IN THE GAPS AND INDICATES WHERE THE LANDFILL STARTS AND USEFUL IN DETERMINING THE RISK TO PROPERTIES FROM GASES AND VAPOURS ”

Tameside Borough Council Environmental Services Officer

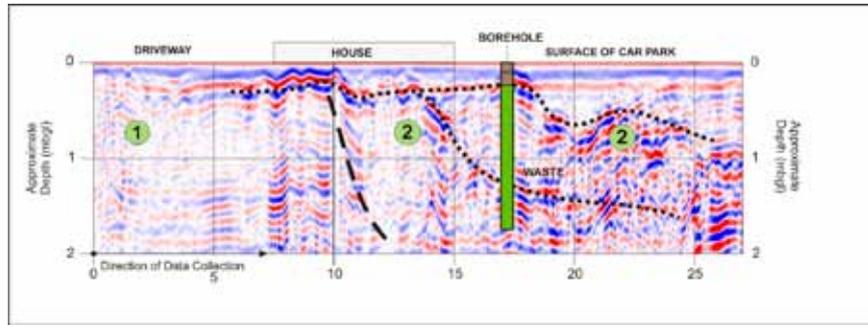
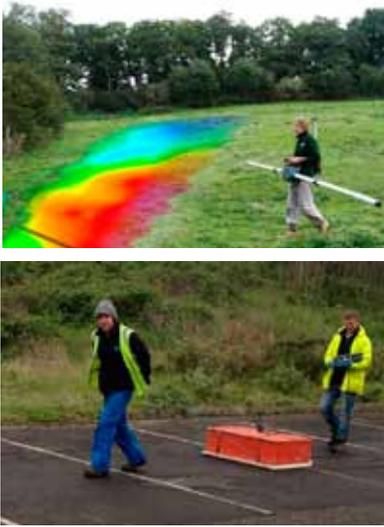


Fig 2. GPR data collection. Example radargram across the landfill edge. Dipping, discontinuous reflectors show likely waste.

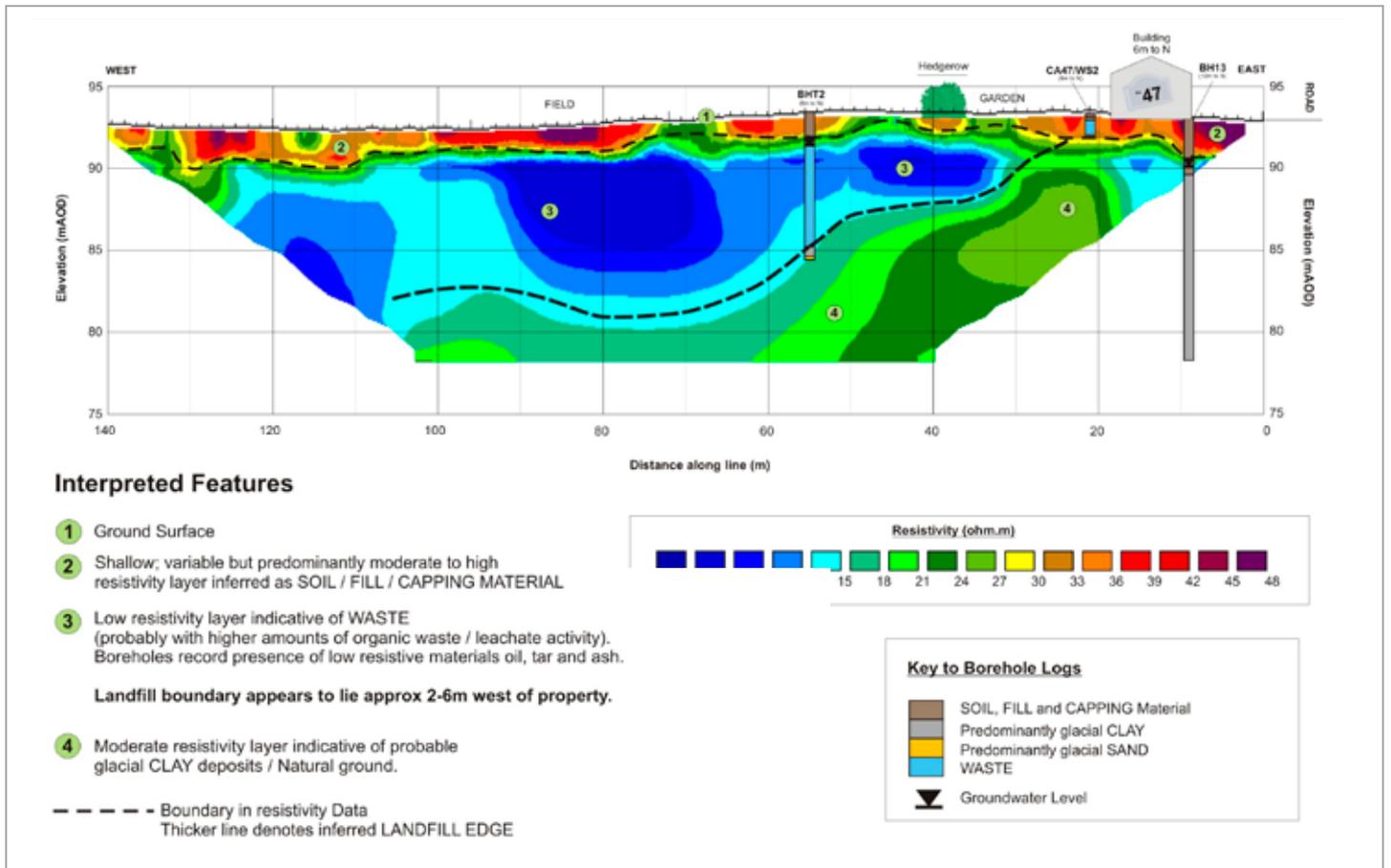
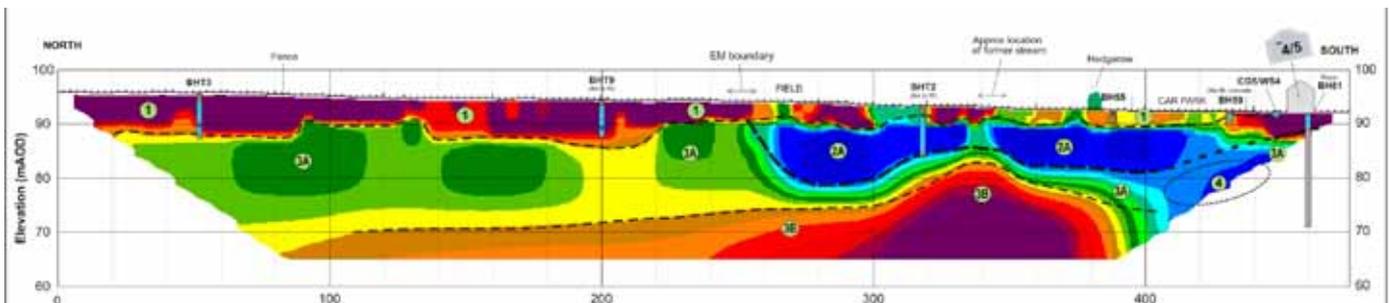


Fig 3. Resistivity data showing landfill waste in blue – note proximity to house.



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