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PGC Geophysics

EM34 Application - Mapping Covered Landfill

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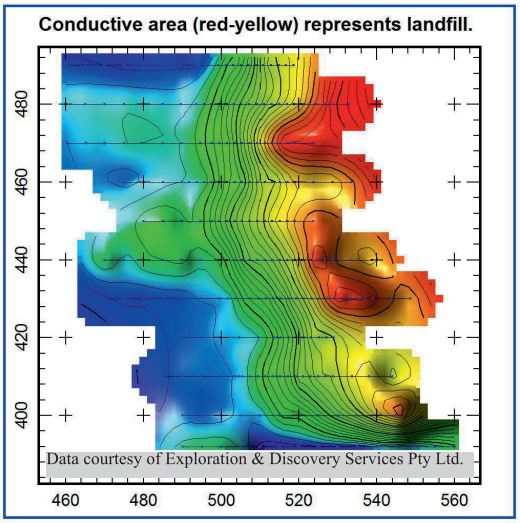
One particularly useful application of the EM34 is the detection of edges of landfill in historic waste dumps. The detection is based on one of several common conditions: any old waste will weather to clays and or various types of salts; less dense material will retain moisture leading to clayification; and higher level of moisure in the disturbed ground. Each of these conditions produces conductive material, whether the moist soil, salts or clay.

PGC Geophysics specialises in resistivity surveys in the minerals, and near-surface engineering geophysics markets. PGC owns and operates an ABEM Terrameter LS2 and for smaller profile style investigations, an EM34.

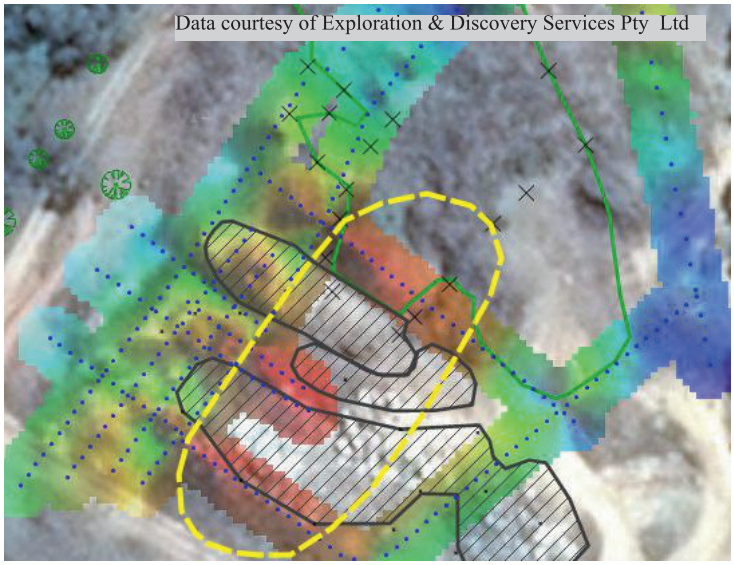


Case Study 1, Covered Edge of Quarry

The survey aim was to locate the edge of a covered landfill in an old quarry. The landfill area is more conductive (red-yellow) than the country rock (blue), and the edge is clearly visible, see image on the left. This image also includes the survey lines and with commonly >200 stations per day in single survey configuration, it also illustrates the simplicity and the speed of an EM34 survey.

Case Study 2, Covered Waste Site

The survey area was an old waste dump which required testing for any polluting leachates originating from the older fills. The site was still in operation.



The initial model consisted of 2-3 trenches oriented WNW-ESE, similar to the current inaccessble elongated piles of waste (black outlines, with hashing). The survey result produced a NNE-SSW elongated area of higher conductivities (red) and one larger trench (yellow outline) which was later successfully drilled and tested. The image to the right presents a satellite image of the area overlaid by inaccessible areas (black, with hashing) and green waste (green outline). Survey reading locations are in blue and colour bands along these lines are measured conductivity. The conductive areas (old waste trench) are in red and resistive in blue.

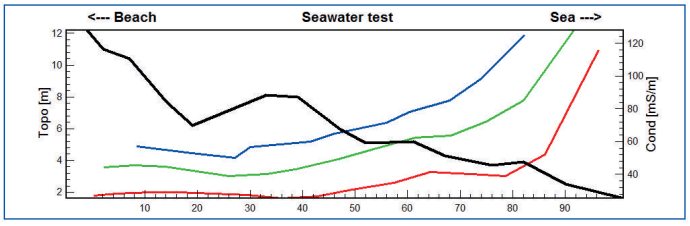
EM34 surveys are fast, non-intrusive surveys that produce an estimate of the bulk conductivity of the ground. The survey consists of two coils about 60cm in diameter moved by two survey operators. During readings they are kept at a specific separation with the assistance of a reference cable, 10m, 20m or 40m in length. The wider the separation, the deeper the instrument will investigate.

The survey is commonly measured along lines traversing the target, with line spacing and station intervals set to optimise the likelihood of success and the time frame for acquisition. Survey parameters can be tightened during acquisition in areas of interest to increase the success of the survey.

After some initial testing a preferred survey configuration, coil orientation, reference cable length and station interval, are set. The Horizontal Dipole is preferred to the Vertical Dipole given its lower sensitivity to misalignments of the coils, see text box below. 10m and 20m reference cables are those most commonly used, and with a single reference cable and Horizontal Dipole, daily production rates in the order of 200+ are likely in open country.

Case Study 3, Seawater test

To demonstrate its increasing depth of detection with a longer reference cable, the result of a sea water test on a sandy beach is included below. The thick black line represents the topography, sloping to the sea on the right. The three lines are the three reference cables used, 40m (blue), 20m (green) and 10m (red). The readings using the longer cables clearly detected the conductivity of the saline ground water at greater depth, further inland than those using shorter cables.



EM34-3 is a conductivity mapper that has been successfully used all over the world. The instrument measures a "bulk" conductivity in the ground between two coils. The results are directly given in conductivity [mS/m], and it is a very rapid non-intrusive survey instrument.

The two coils are connected by a reference cable of 10m, 20m or 40m. Increasing the coil separation increases the depth of investigation as indicated in the table below. The coils can be kept vertically standing up (Horizontal Dipole, HD) or flat on the ground (Vertical Dipole, VD), with different sensitivities and depth of investigation.

Coil spacing (metres)	Exploration Depth (metres)	
	HD	VD
10	7.5	15
20	15	30
40	30	60

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PGC Geophysics offers near surface ERI in geotechnical applications:

- Contamination plumes, seepages
- Faults, shears, alterations
- Depth of weathering
- Groundwater, salinity
- buried objects, tanks cavities

Ron Palmer PGC's principal consultant, offers 30 years experience in geophysics and exploration/project management. Ron and his crew are based in Brisbane and operates in all States and Territories as well as New Zealand.

Ron Palmer
0413 579 099
ron.palmer@pgcgroup.com.au

www.pgcgroup.com.au