



## EM-Slimflex

### Flexible monitoring of fresh-saltwater interface

**EM-Slimflex is a flexible borehole sounding tool, developed for small-diameter piezometers ( $\varnothing \geq 1''$ ). EM-Slimflex enables to monitor fresh-saltwater interfaces cost-effectively. Other possible applications include the detailed measurement of lithological profiles in existing boreholes and piezometers.**

#### **Why monitor fresh-saltwater interfaces ?**

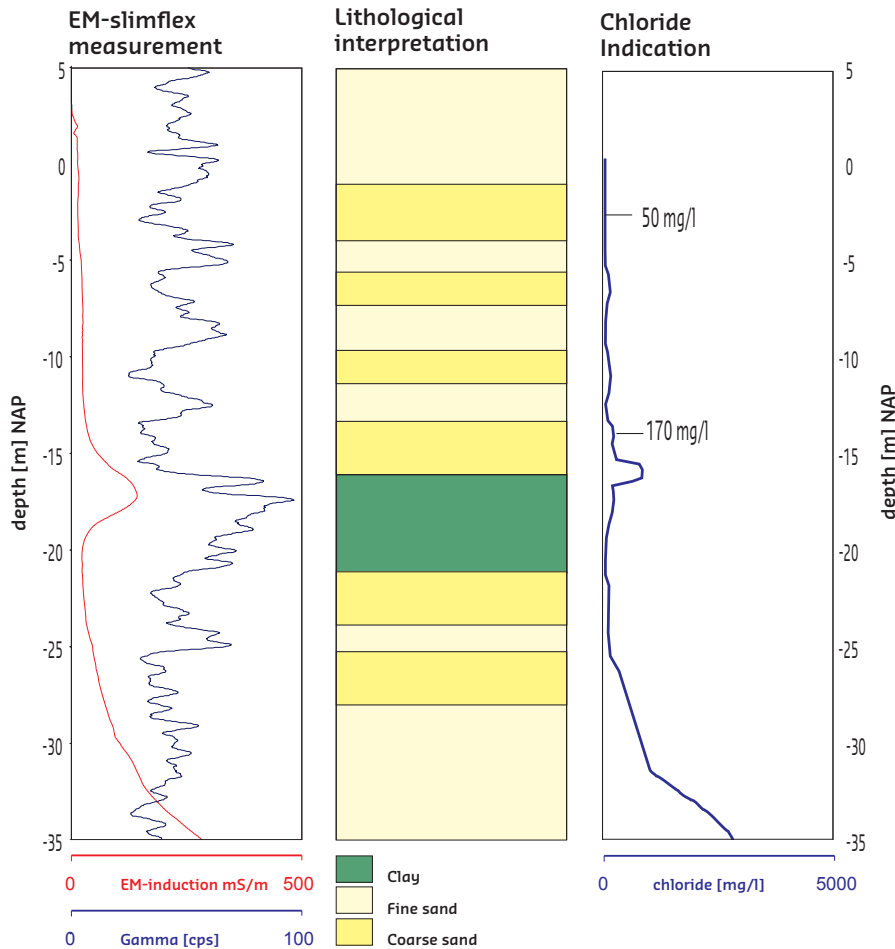
The European Water Framework Directive states that human-induced changes in groundwater flow directions may not cause saltwater intrusion. This provokes a growing need for knowledge about the extent of fresh groundwater bodies. This knowledge can be generated by mapping and monitoring transition zones from fresh to brackish and saline groundwater. Data about fresh-saltwater interfaces is scarce and costly to obtain. Up till now, these interfaces are determined using chloride analyses or "salt detection cables". Such methods can be applied in many piezometers, but at a limited number of depths. Alternatively, a conventional EM-39 sounding

tool enables depth-continuous measurements, but its application is limited to large-diameter standpipes ( $\geq 2''$ ). We developed the EM-Slimflex which combines the best of both worlds.

#### **EM-Slimflex**

The EM-Slimflex emission spool generates an electromagnetic field that is shaped such that the apparent soil resistivity is measured outside the borehole only. The signal is not disturbed by the water quality inside the borehole or piezometer. Fig. 1 shows an example of an EM-SlimFlex measurement which enables a continuous groundwater salinity profile with depth at a high resolution.





Example of an EM-SlimFlex measurement of a saltwater intrusion over a clay layer at 20 m depth. The chloride indication agrees well with chloride analyses at two depths.

Since EM-SlimFlex is both slim and flexible, it fits into small-diameter standpipes, even when the pipe is distorted, e.g., by soil deformations. Furthermore, its limited weight enables the field campaign to be run with little more than a van and a small winch. The use of existing piezometers is an important advantage of this tool. This significantly reduces mapping and monitoring costs.

### Other EM-Slimflex applications

EM-Slimflex can also be applied to monitor groundwater contamination, using chloride or other dissolved ions as a proxy-indicator. The tool also measures natural gamma radiation, enabling lithological profiles around boreholes to be determined in detail. Useful applications with this respect are:

- detailed profile descriptions in flush-drilled boreholes;
- detailed profile descriptions in older piezometers with absent or low-quality lithological data;
- control of clay sealings in pumping wells.

### Versie 1 operational

By April 2012, EM-Slimflex version 1.0 will be validated. This type fits into standpipes with diameters down to  $\pm 28$  mm.

### Contact

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