Assessing Defence Integrity using Geophysical survey methods

Dan Normandale, Humber Strategy Team

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Background

- December 2013 – worst coastal & estuary flooding for 60 years
- Many damaged defences on the Humber estuary
- Rapid response to visually inspect & carry out emergency repairs
- Uncertainty over hidden structural problems, such as buried features being weak points

Survey requirements

- Rapid, mobile, non-intrusive, cost effective
- To understand why banks failed, needed to survey banks that performed well
- Traditional SI methods not suitable – too many sites, banks still damaged, needles in haystacks

Geophysics to the rescue

- Electrical and electro-magnetic methods can be used to identify sub-surface anomalies – think archaeology
- These anomalies can be identified by relative differences in material resistance (in ohms) to electrical flows and electro-magnetic fields
- Hard objects resist more; voids and loosely filled areas and seepage pathways resist less
- Proven technique in Europe – Germany and Czech Republic especially; Pioneered here in Lincolnshire in 2010 and 2012

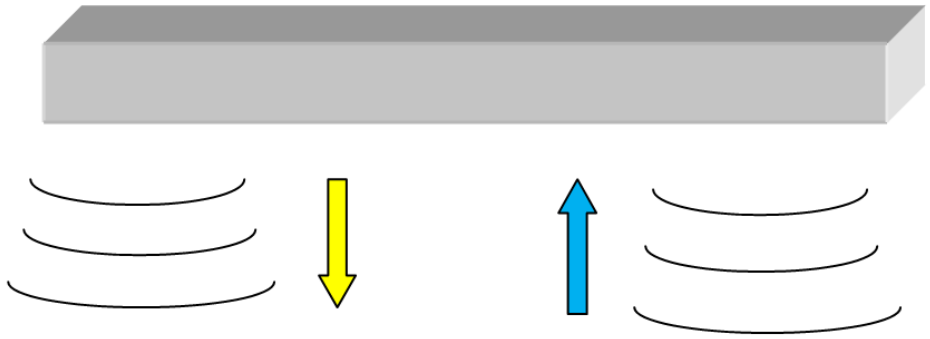
Results & conclusions

- 10% of estuary defences surveyed in 3 weeks
- Anomalous ‘risk factor areas’ identified in 10 of 15 locations
- Buried features; backfilled redundant drainage channels; Bank construction chronology; Potential seepage routes
- Majority have been verified by cross-referencing with historic maps
- Influence of salinity better understood & bank composition better understood

What next?

- More Humber surveys
- Trial techniques inland
- Identify more service providers
- Limitations of each technique but many options, e.g. ground penetrating radar for hard defences

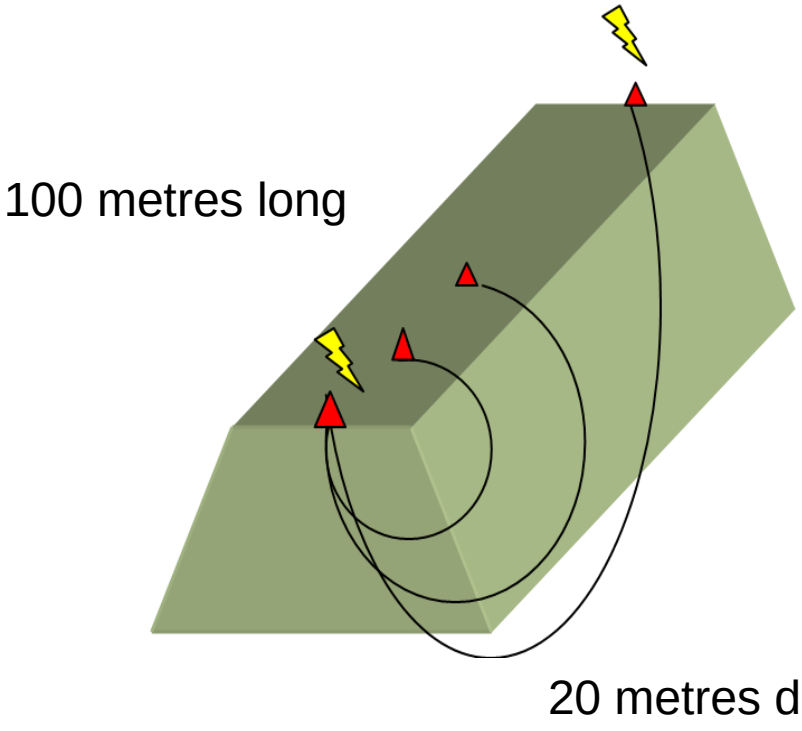
Dipole Electromagnetic Profiling

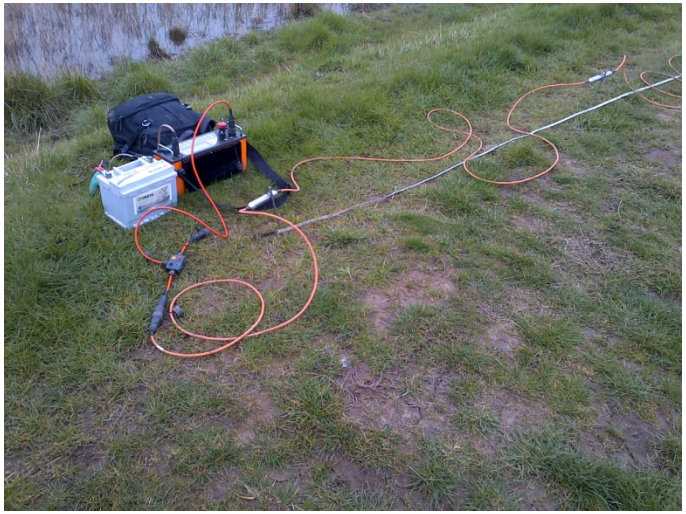


Primary Field

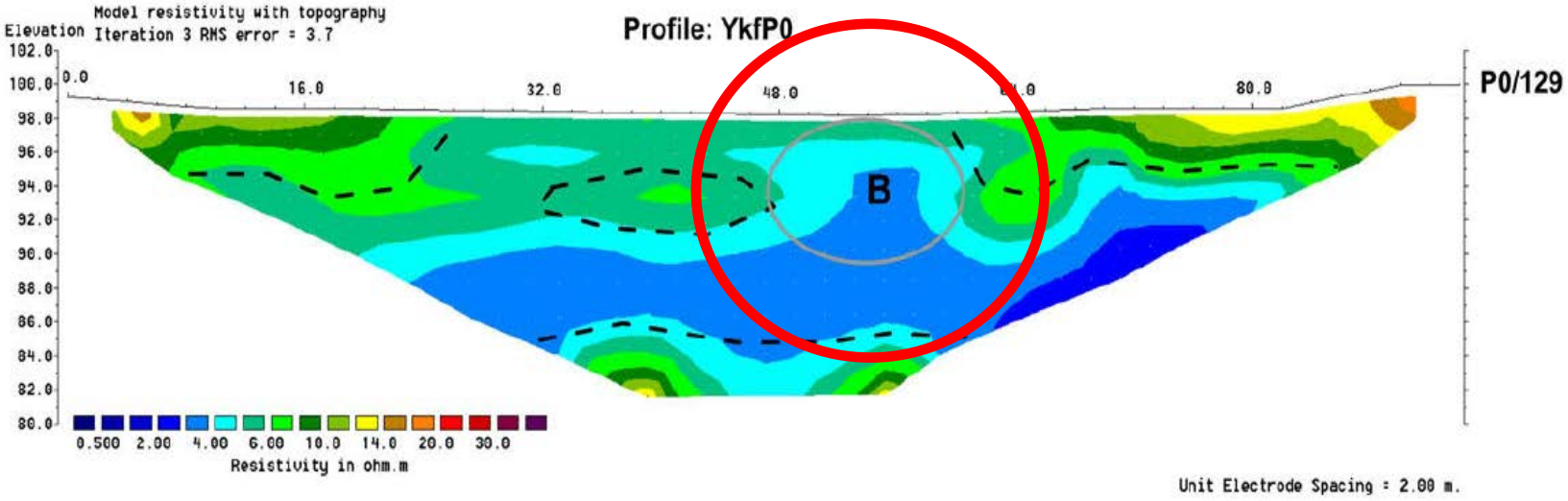
Induced Secondary Field

Electrical Resistivity Tomography

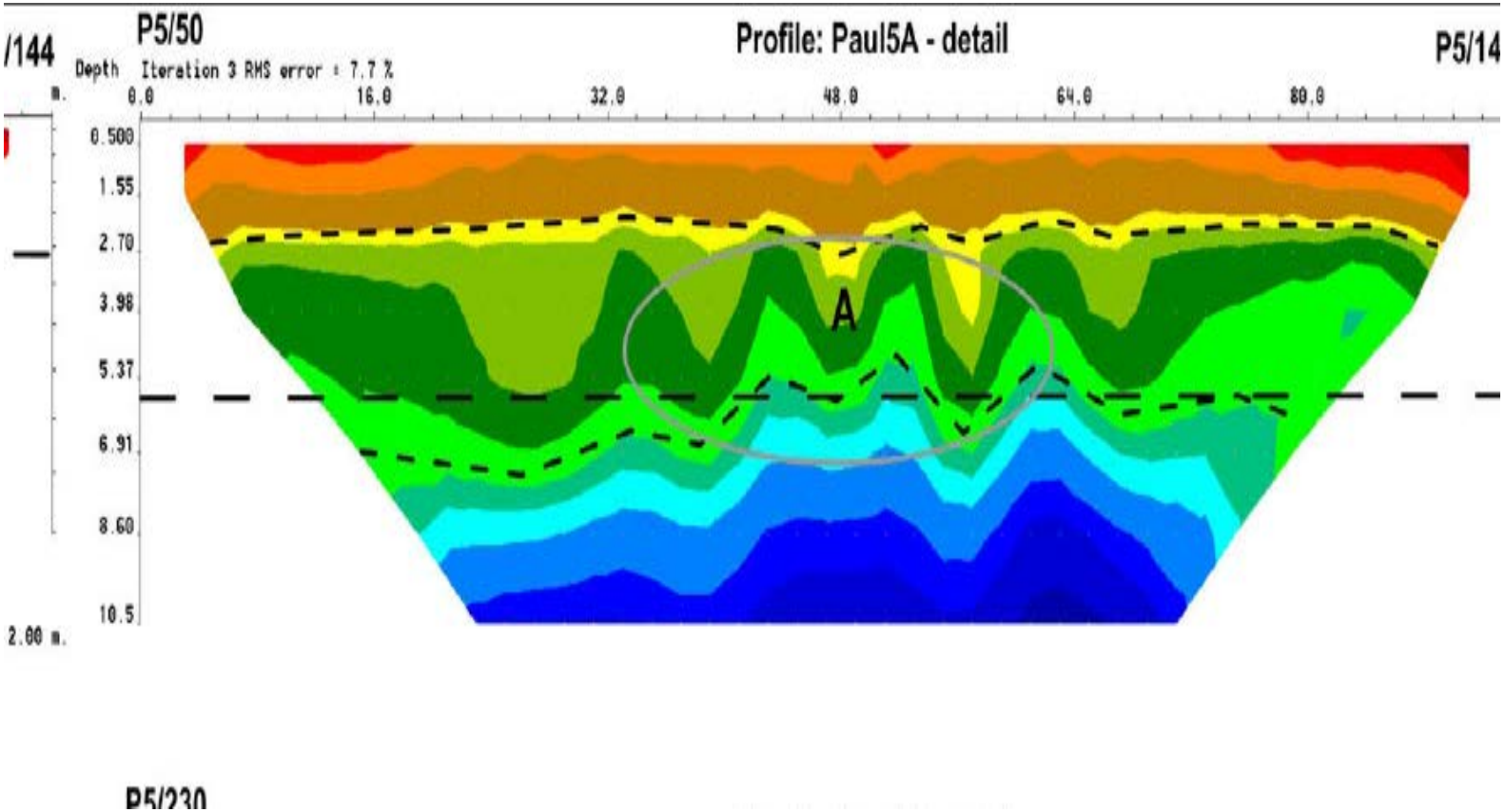




Example outputs



Example output



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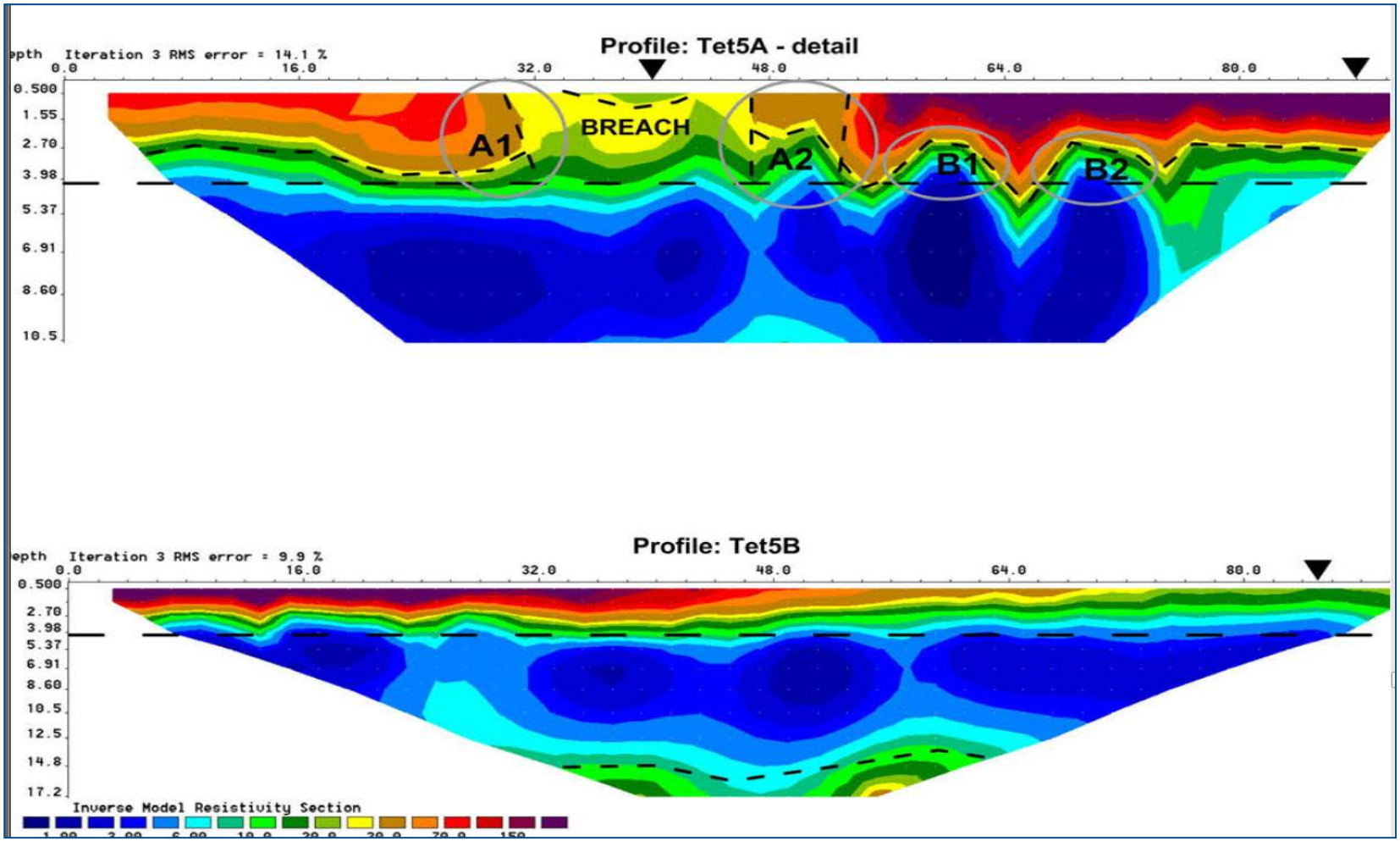

Tetney Humberston

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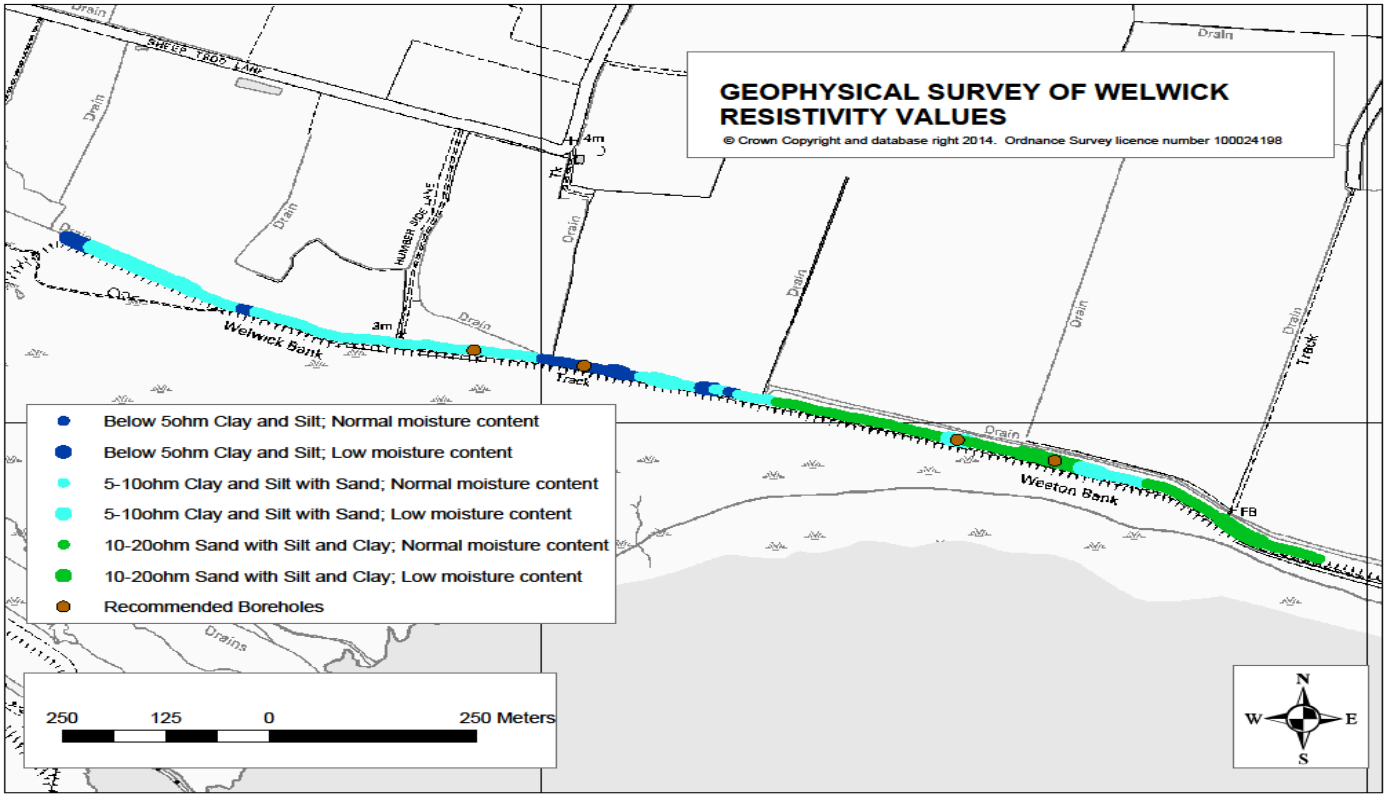

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