THE IMPORTANCE OF NEAR SURFACE GEOPHYSICS IN GEOTECHNICAL SITE INVESTIGATIONS

Presented by

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THE IMPORTANCE OF NEAR SURFACE GEOPHYSICS IN GEOTECHNICAL SI

TALK CONTENTS

- What is geophysics?
- Benefits and advances in use
- Case study – mine shaft
- So you need a geophysical survey?

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What is geophysics?

"…a suite of measurement techniques that can be used to precisely measure physical "properties of the subsurface and the contrast with the target"

chargeability thermal conductivity resistivity seismic radioactivity velocity density magnetism electrokinesis dielectricity acoustic mass electromagnetic

Benefits of using geophysics

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1. Non-invasive

"Ability to measure subsurface properties without need for excavation or drilling"

- Ideal for urban / developed sites
- Can be used on SSSIs
- No reinstatement costs

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2. Total site coverage

……where would you drill?

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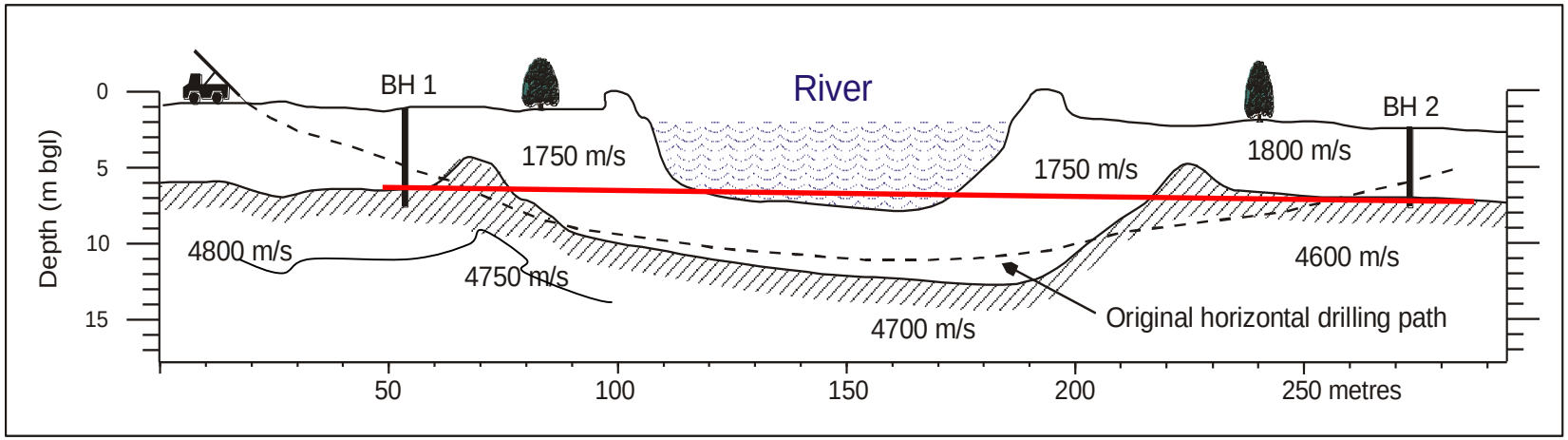
3. Overcome errors in geological interpolation



Geophysical data is continuous over a site or along a profile

Avoids misinterpretation of bedrock e.g. borehole down fracture or into boulder

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4. Low risk to site operatives from hazards

- Chemical contamination
- Unexploded ordnance
- Voids and caverns

- Pipelines or cables
- Soft ground
- Shafts or wells

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ADVANCES

GPS positioning – greater speed & anomaly positioning

In-field analysis of data

- Positioning of anomalies
- Data QA
- Optimal parameters
- Refining survey methodology on the fly

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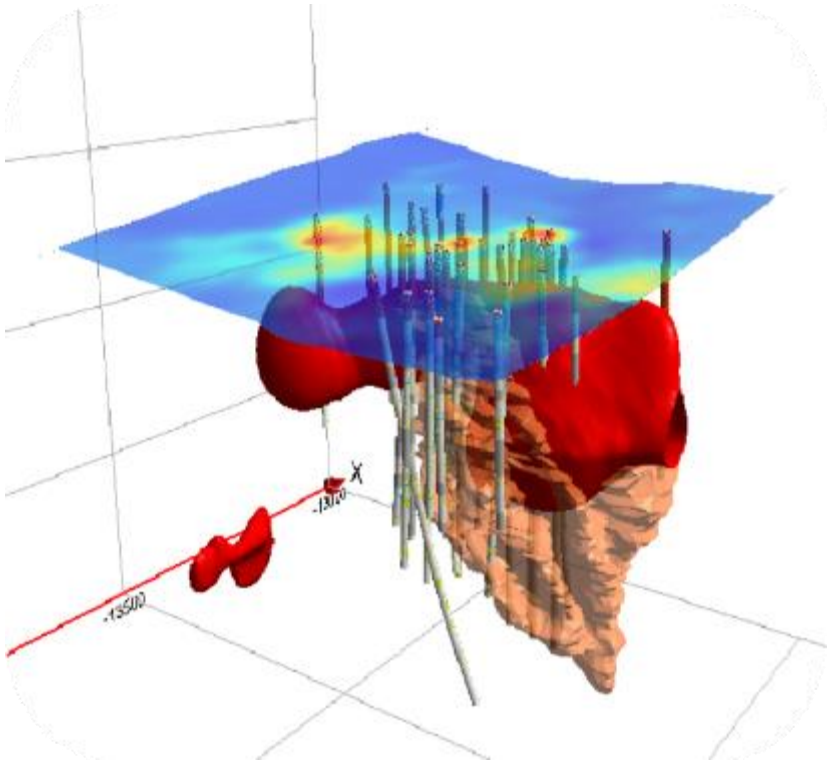

RECENT ADVANCES

GIS and 3D integration of geophysics with other sources of data e.g.

- Surveying
- Historical
- Geochemical
- Geological
- Aerial Photos

Case study - mineshaft

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Case study - mineshaft

Aim: to locate mineshaft under playing field for school extension

Techniques:
conductivity
magnetic
microgravity

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Case study - mineshaft

EM Conductivity

Background:

Induced electromagnetic field gives measure of subsurface electrical conductivity to depths of 0.5-60 metres. Variation in conductivity due to: clay minerals, metal, water saturation, void space

Common Applications:

- Shallow geology
- Contamination plumes
- Foundations and services
- Buried pits or infilled quarries

Limitations

- Noise from services / buildings

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Case study - mineshaft

Magnetics

Background:

passive measurement of anomalies in the Earth's magnetic field cause by buried ferrous objects

Common Applications:

- USTs and drums
- UXO
- Archaeology

Limitations

- Noise from services / buildings
- Non-ferrous metal targets

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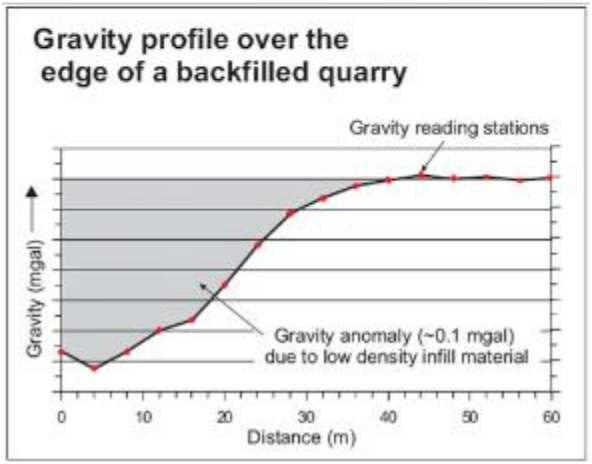
Case study - mineshaft



Microgravity

Background:

Passive measurement of subtle variations in Earth's gravity due to subsurface density changes caused by voids or different geological compositions.

Common Applications:

- Void and fissure mapping
- Buried basements
- Abandoned mine workings
- Buried valleys

Limitations

- Acoustic noise & vibrations, wind, earthquakes
- Speed of acquisition

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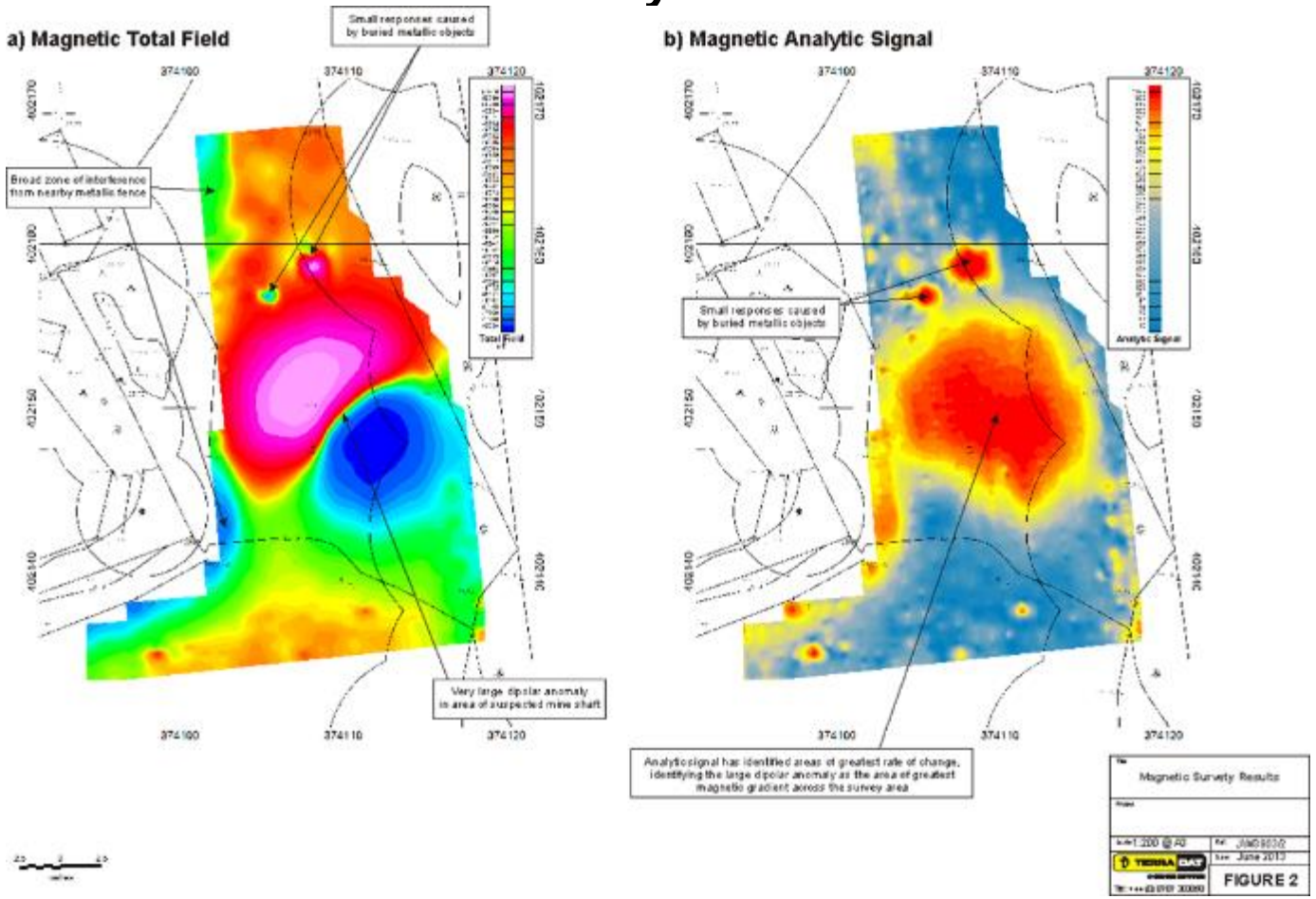
Case study - mineshaft



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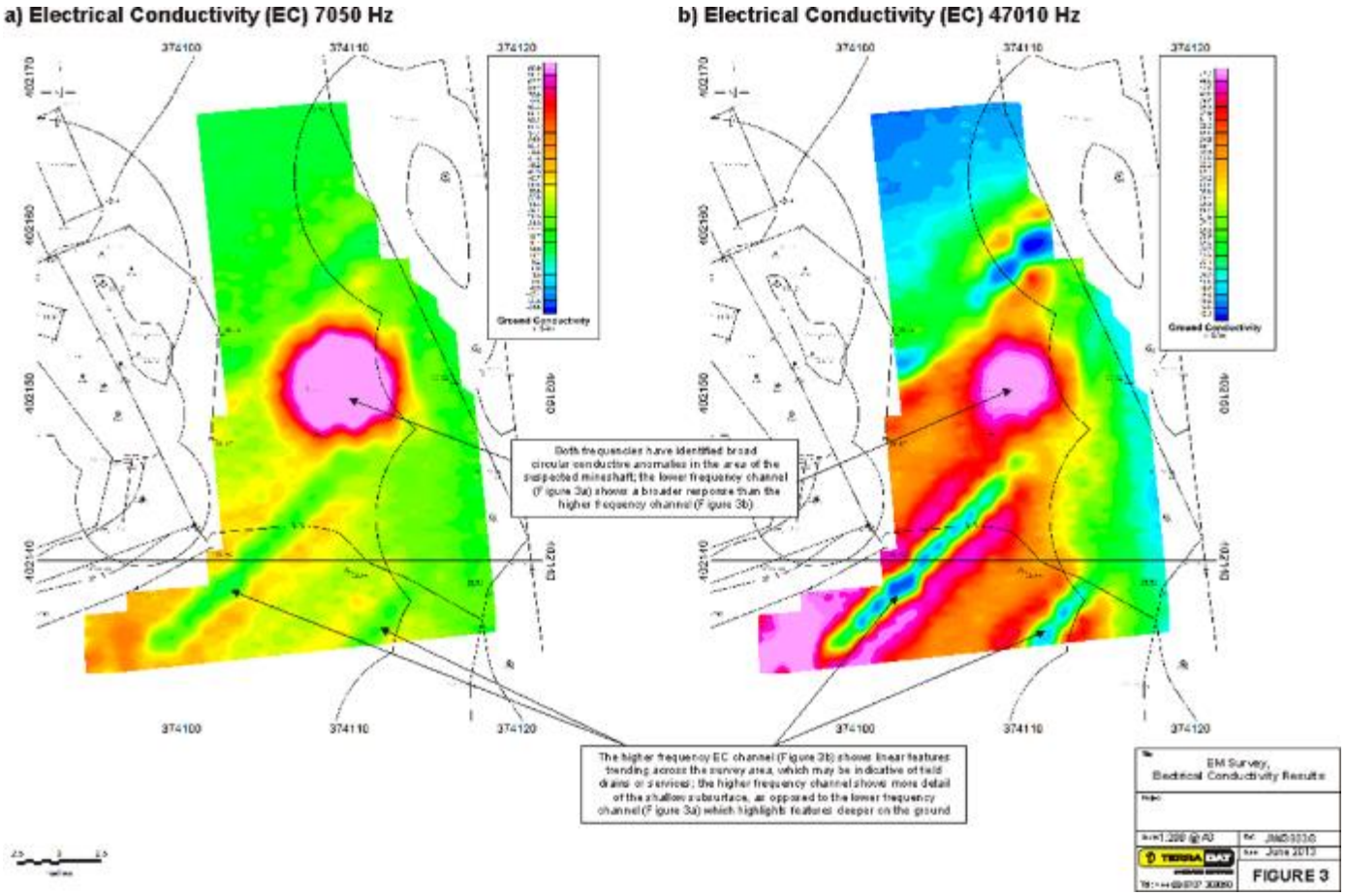
Case study - mineshaft



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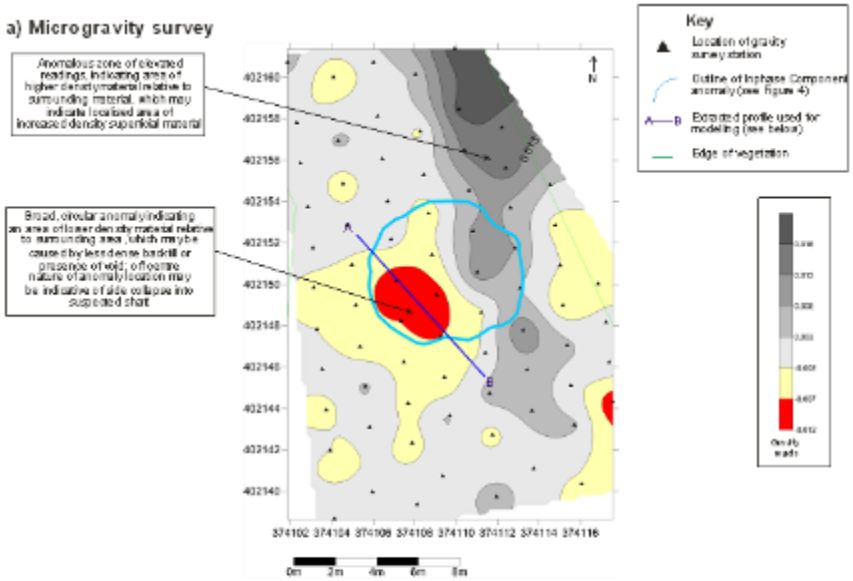
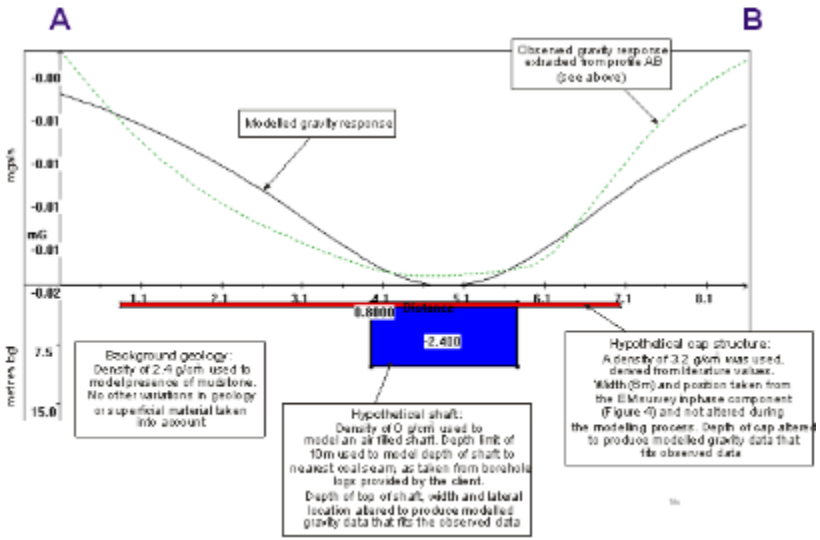
Case study - mineshaft

a) Microgravity survey



b) Modelled mine shaft and cap



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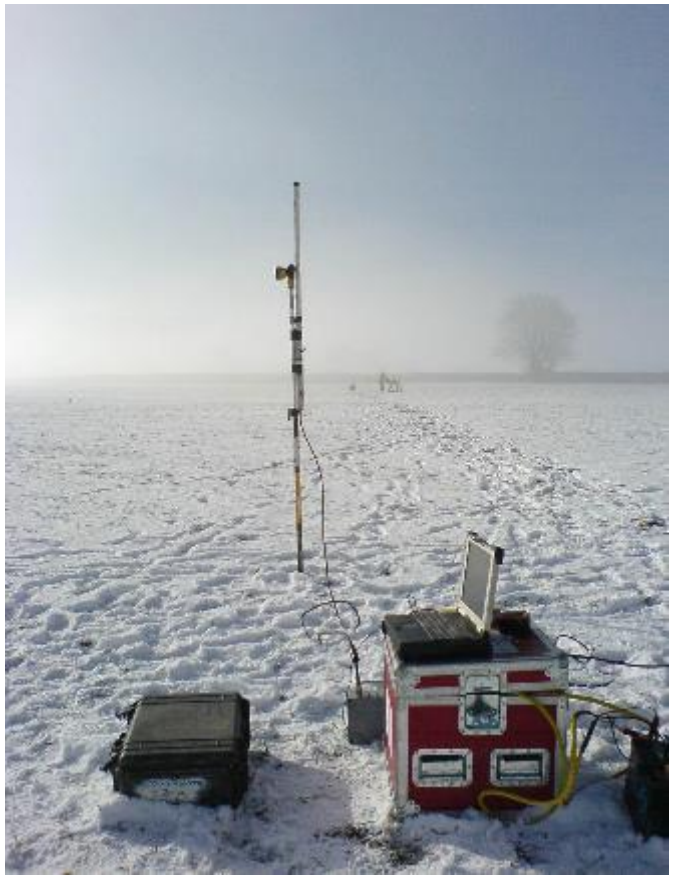

SO, YOU NEED A GEOPHYSICAL SURVEY……

- Aims and why - depth, size and nature of targets if known?
- Size of the site?
- Site cover (vegetated, building, rebar…)?
- Geological setting?
- Geographical setting?
- Any existing desk study data?
- Access limitations?

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WHEN TO USE GEOPHYSICS

- Desk study
- Site visit
- **GEOPHYSICS**
- Optimal design for borehole / sampling
- Integration of data
- Final conclusions

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……WHAT YOU GET BACK…….

- Rapid / large site coverage
- Non-intrusive
- Low risk
- Low environmental impact
- Allows optimum use of intrusive investigations
- Determination of sub-surface properties

But only if appropriate techniques are used and the survey designed to match survey aims