

# WELCOME AT RAWFILL MID TERM EVENT

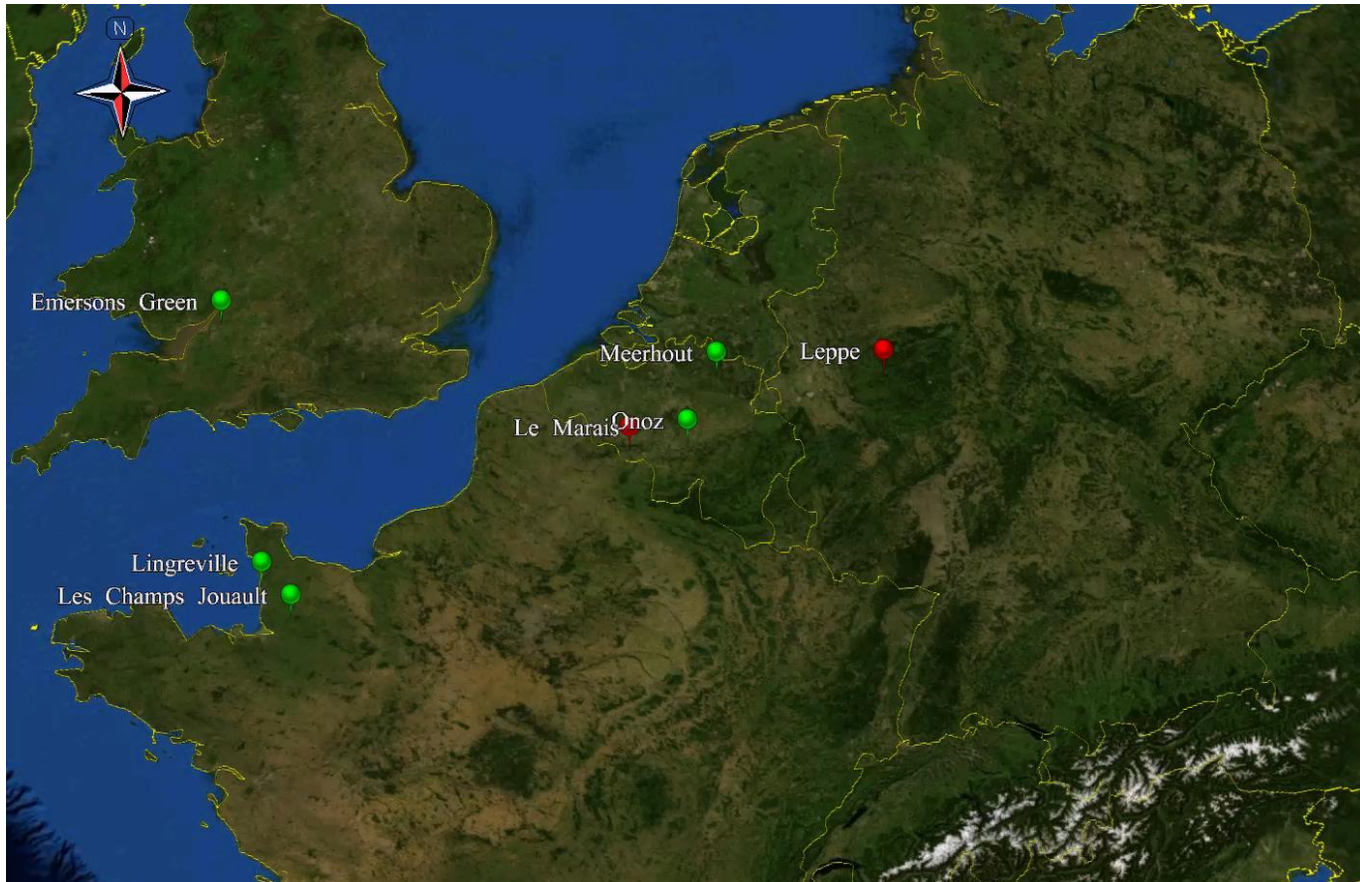


# Applications of geophysical methods in the RAWFILL project

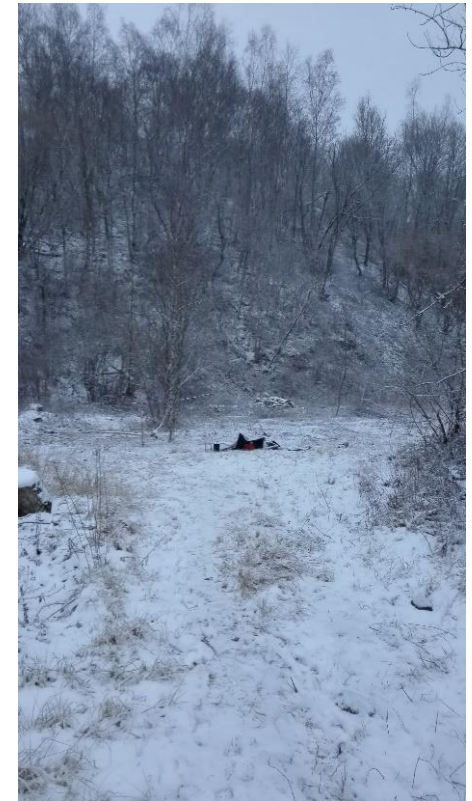


Itzel Isunza Manrique  
Cornelia Inauen  
ULiege and UKRI

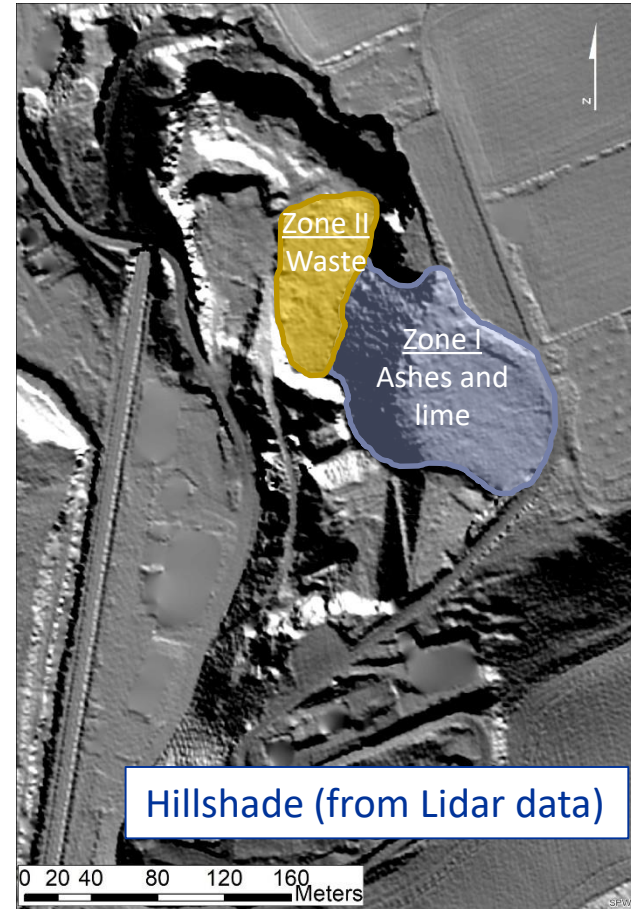
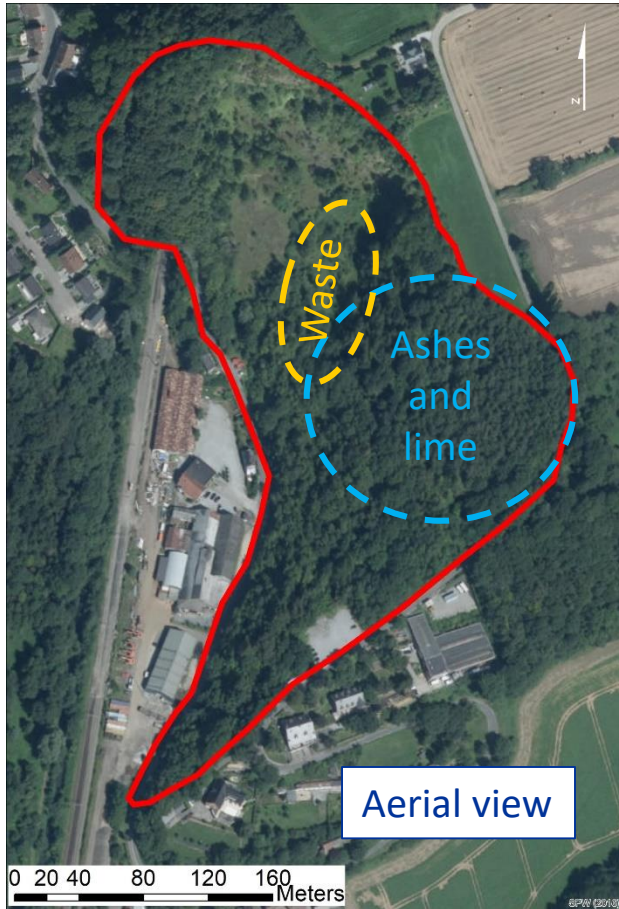
# Geophysics within RAWFILL



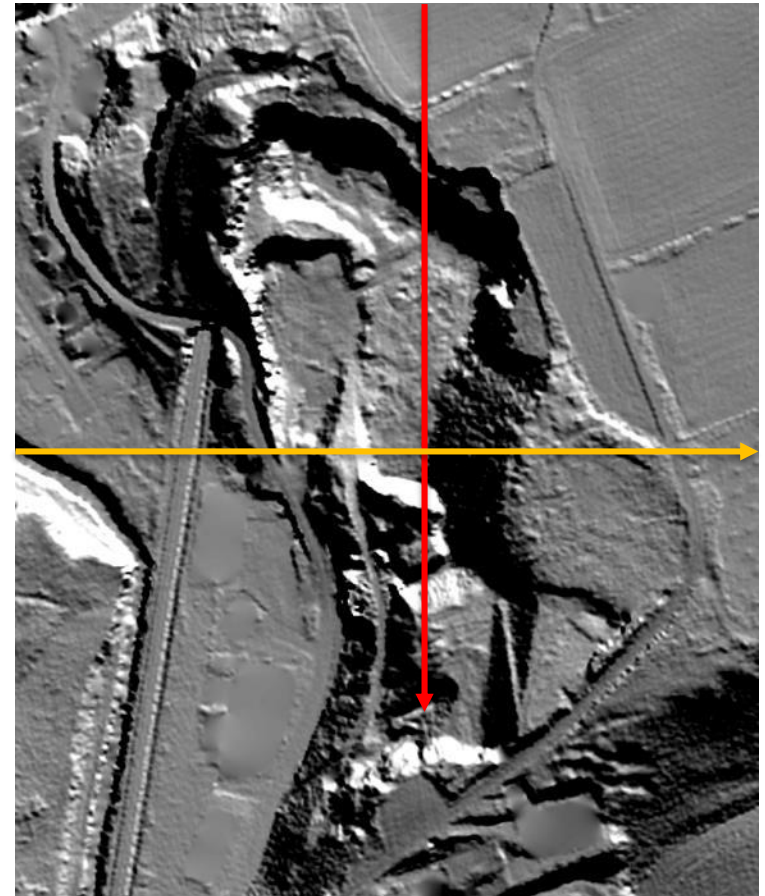
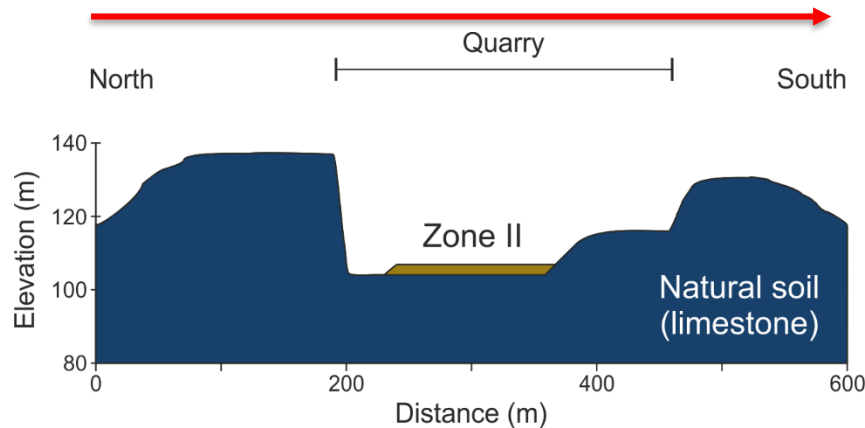
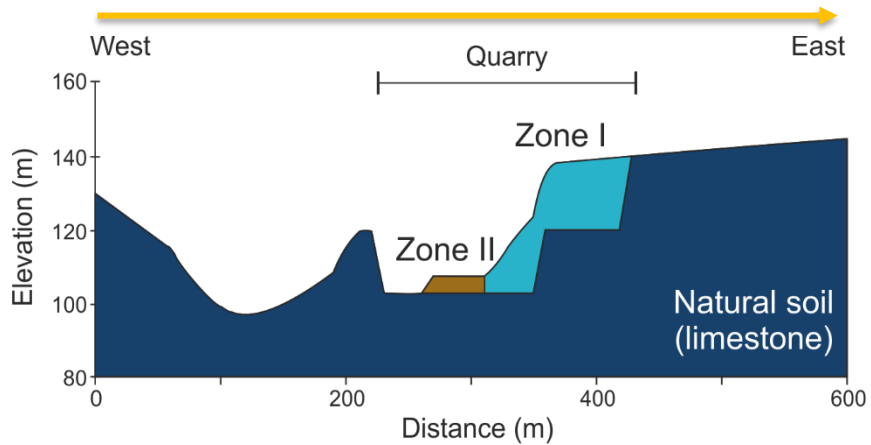
# Landfill investigation: Example of the Onoz site



# Site overview: current state



# Site overview: current state



# Goal of the geophysical survey:

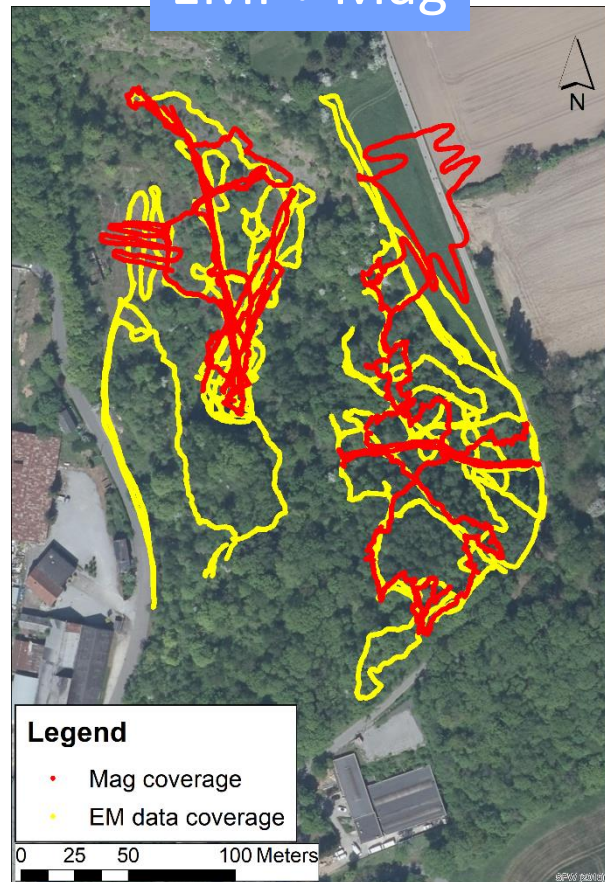


1. Estimate lateral extent of the anthropogenic deposits
2. Delineate horizontal and vertical extent of ashes and lime for future landfill mining activities

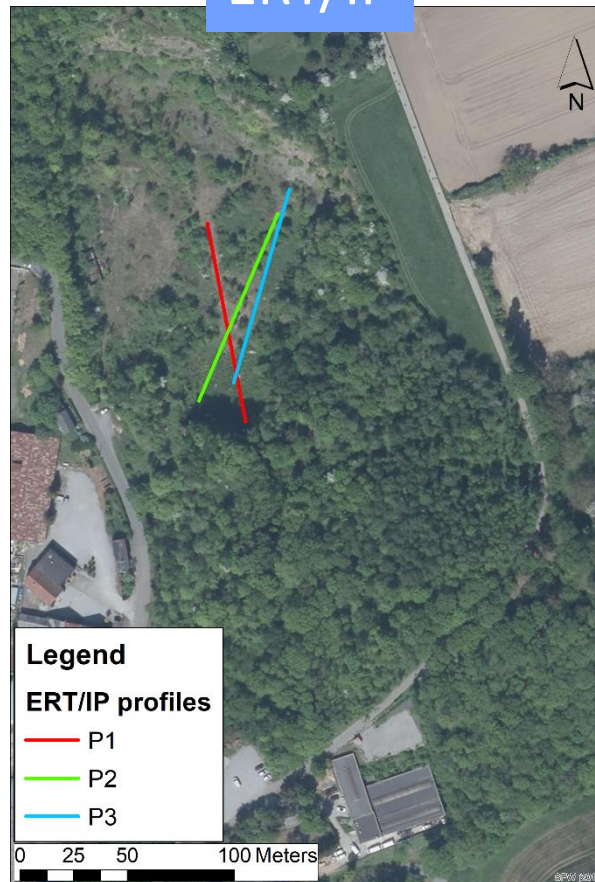
Field measurement survey: February 2018 and January 2019

# Spatial coverage

EMI + Mag



ERT/IP

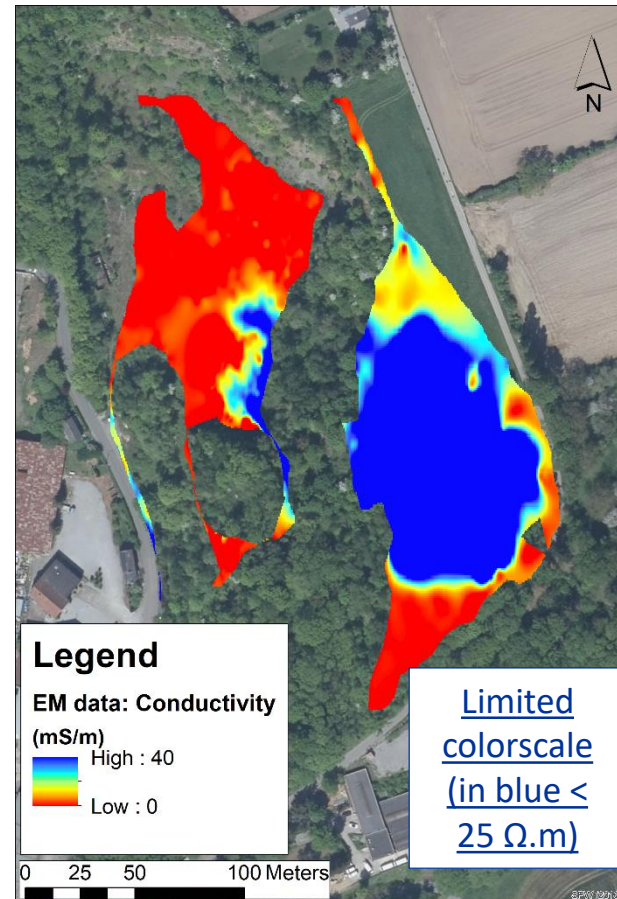
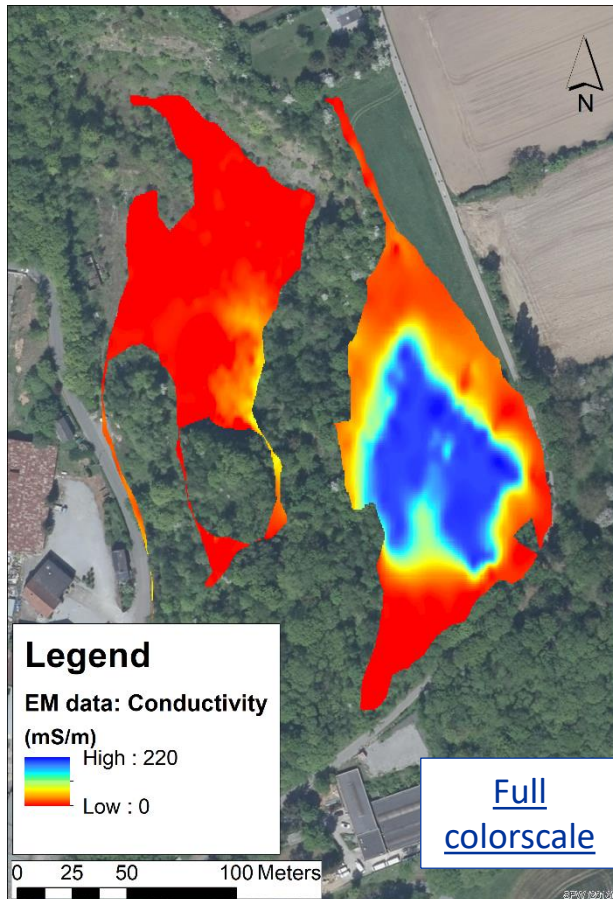


Seismic + HVSRN

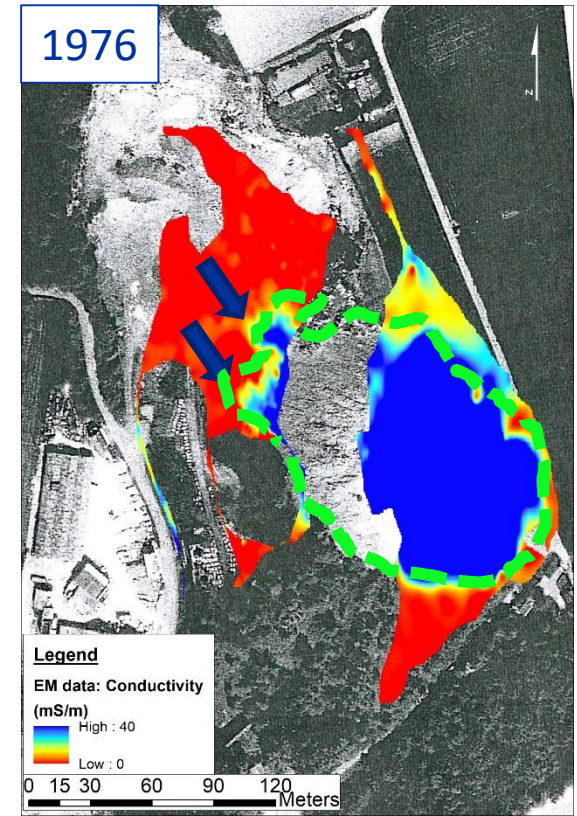




# Results: EM



# Interpretation: EM



# Results: Magnetometry

Total magnetic field

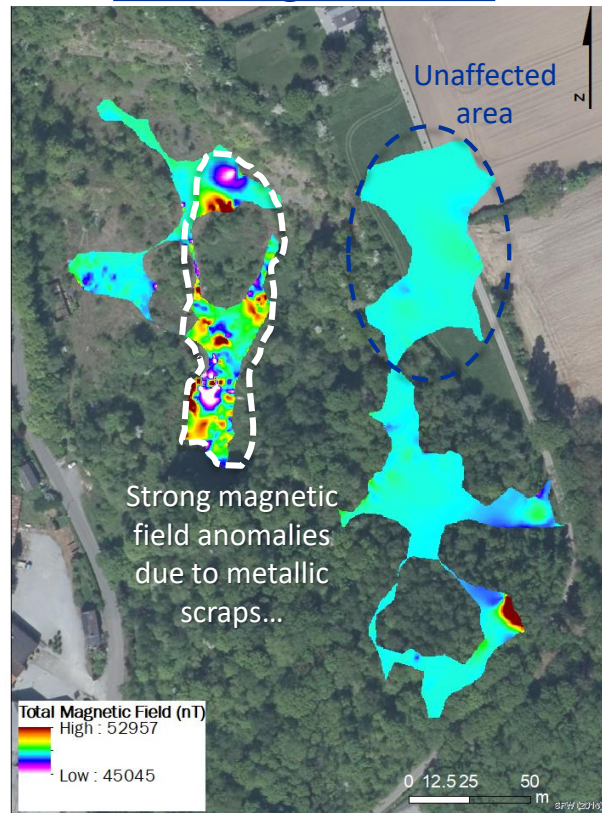


Vertical magnetic field

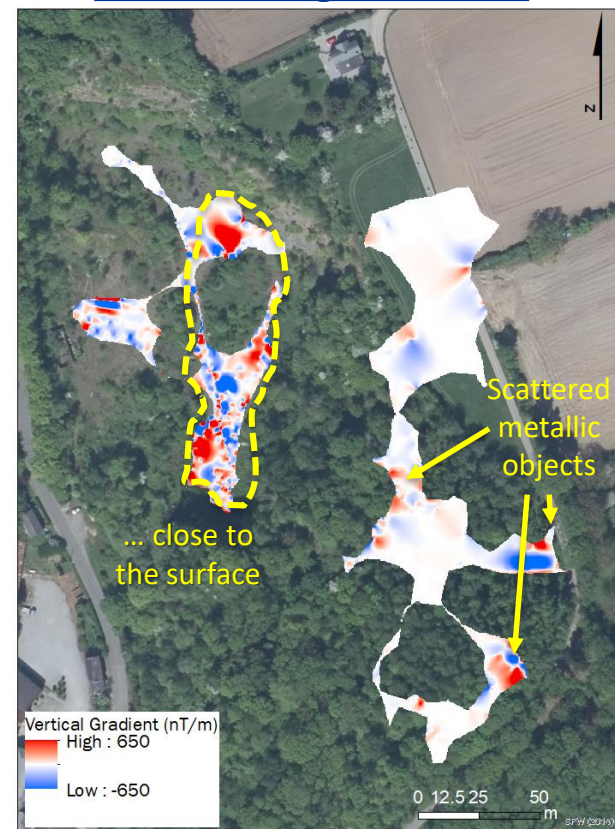


# Interpretation: Magnetometry

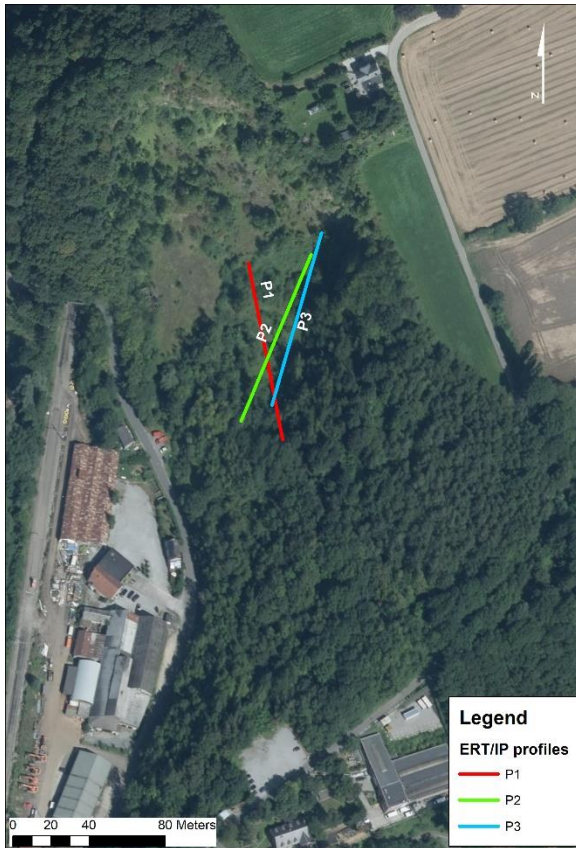
## Total magnetic field



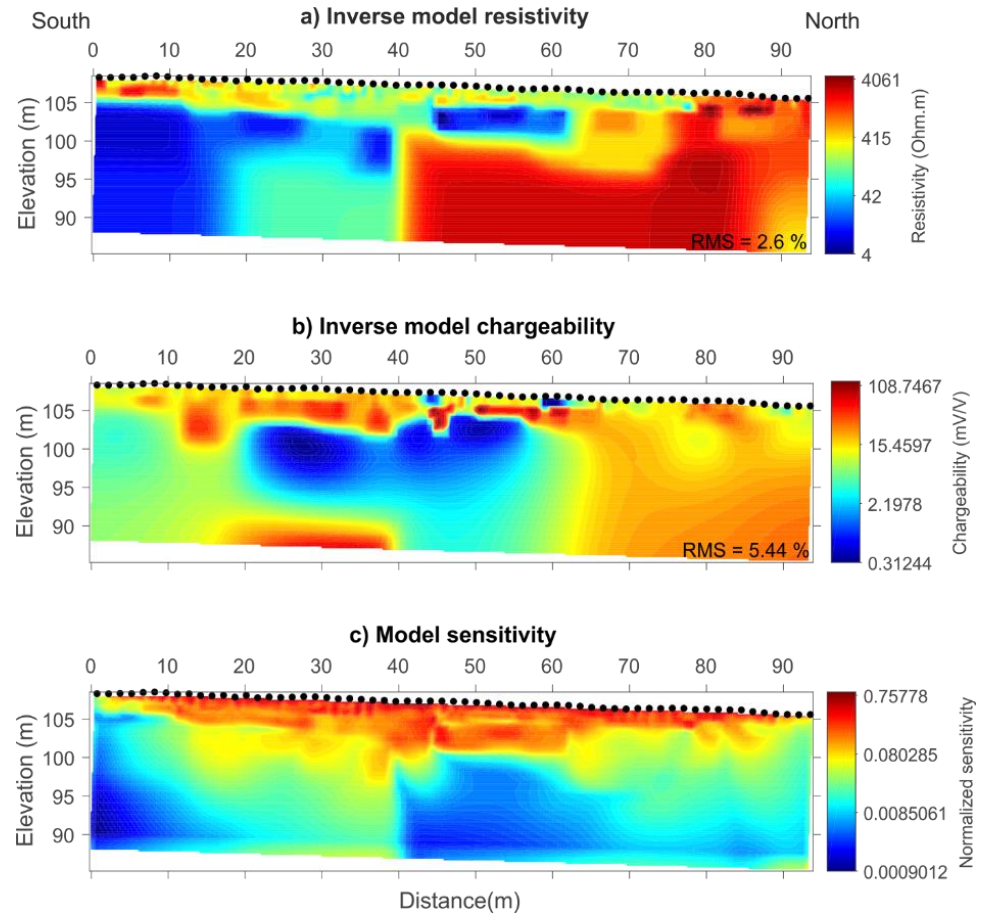
## Vertical magnetic field



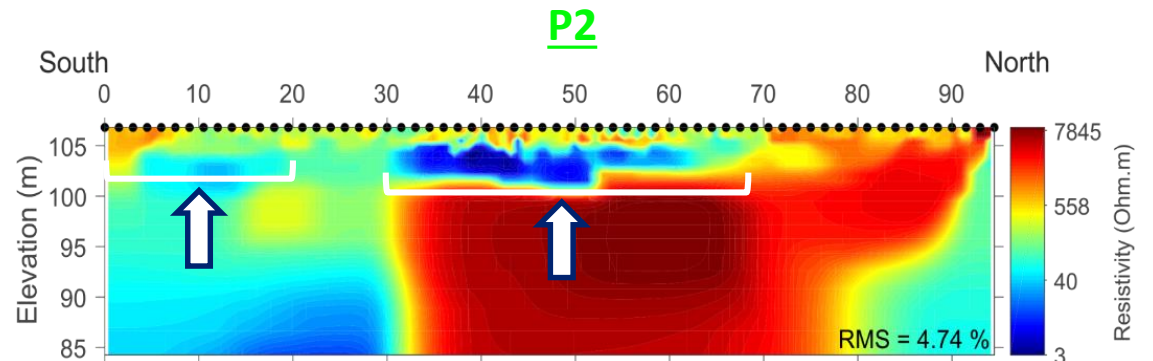
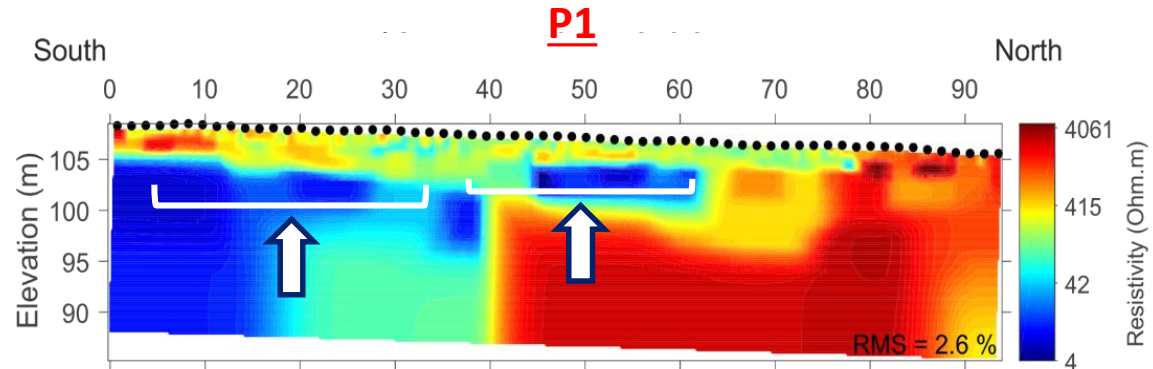
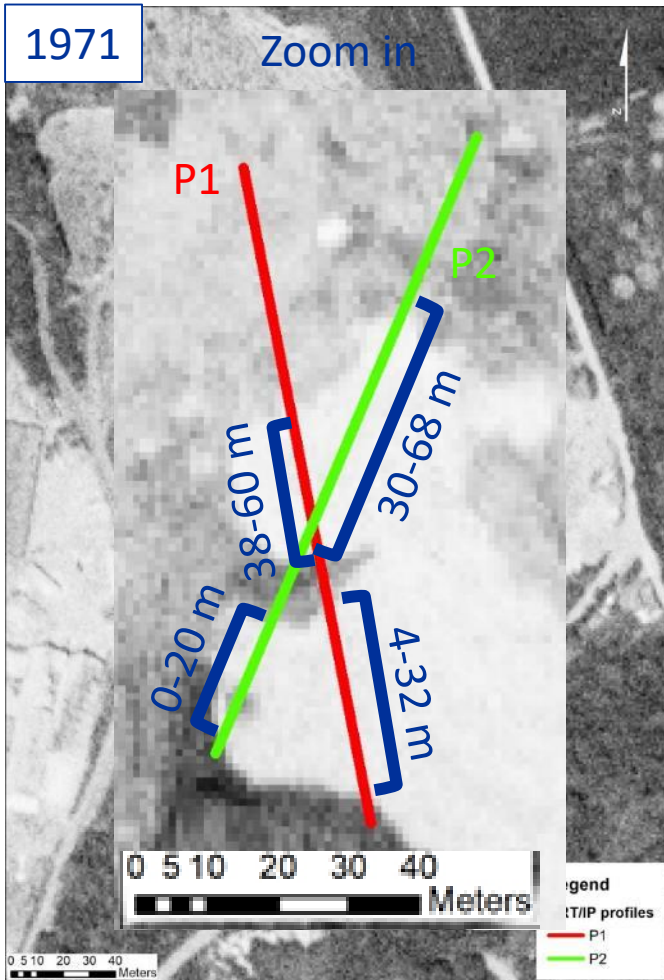
# Results: ERT/IP



**P1**

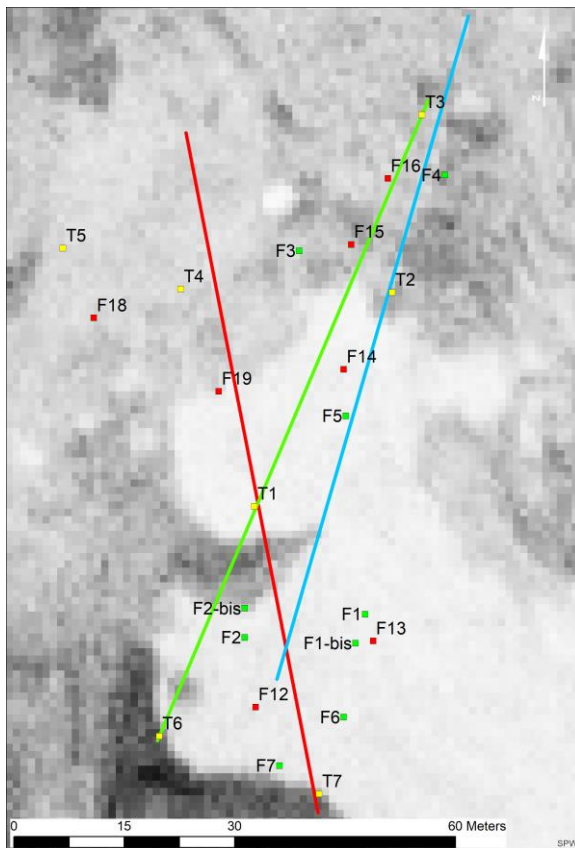


# Interpretation: ERT/IP

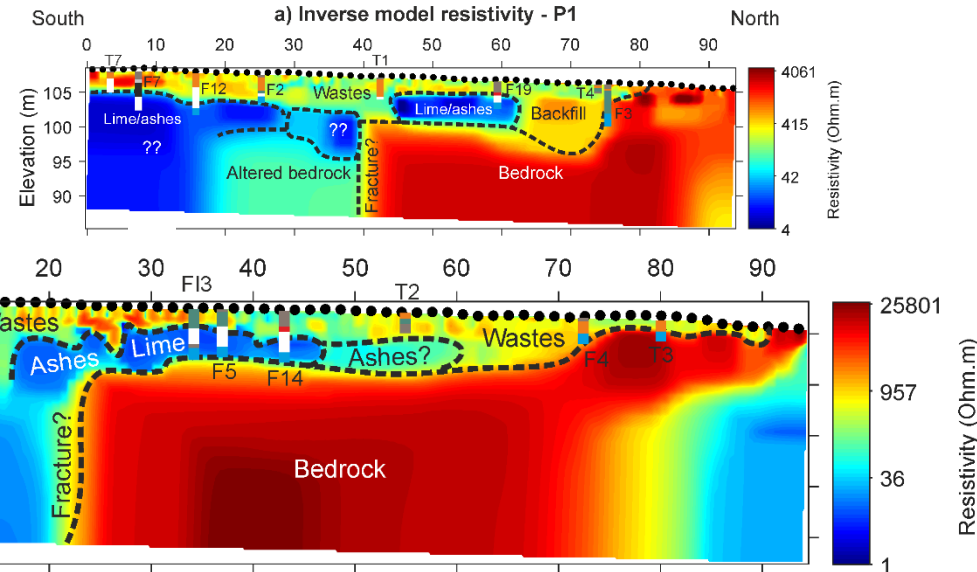


# Interpretation: ERT/IP

Three sampling phases:  
1993 (Verdi), 2012 (Nonet) and  
2018 (IRCO)



**P1**



**Legend**

- |                                      |                  |               |              |            |
|--------------------------------------|------------------|---------------|--------------|------------|
| F2 to F7 = Trenches made in 1993     | Brown soil       | Wastes        | Backfill     | Lime/ashes |
| F12 to F19 = Trenches made in 2012   | Brick foundation | Cherry stones | Black powder | Bedrock    |
| T1 to T7 = Trenches made in 2018     |                  |               |              |            |
| F11 and F13 = Boreholes made in 2018 |                  |               |              |            |

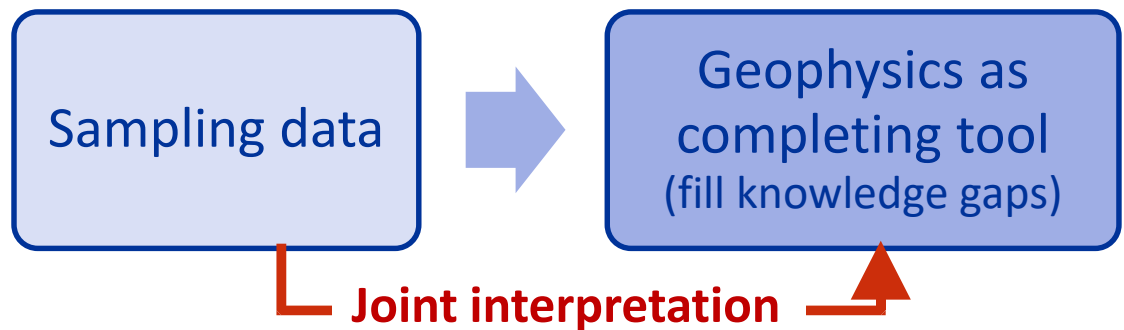
**Legend**

- |                                      |                  |               |              |            |
|--------------------------------------|------------------|---------------|--------------|------------|
| F2 to F7 = Trenches made in 1993     | Brown soil       | Wastes        | Backfill     | Lime/ashes |
| F12 to F19 = Trenches made in 2012   | Brick foundation | Cherry stones | Black powder | Bedrock    |
| T1 to T7 = Trenches made in 2018     |                  |               |              |            |
| F11 and F13 = Boreholes made in 2018 |                  |               |              |            |

# Summary - Onoz

Information gained:

- Lateral extent
- Vertical extent
- Waste inhomogeneity

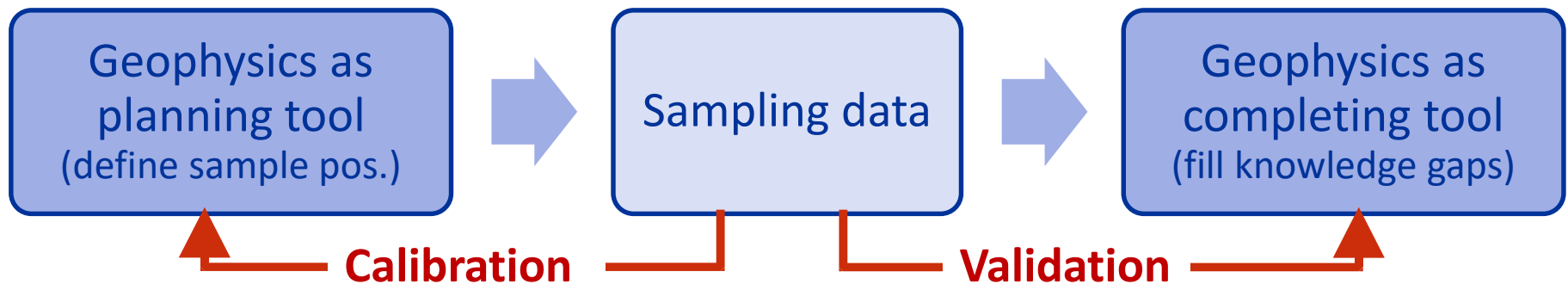




# Other Rawfill sites

Information gained:

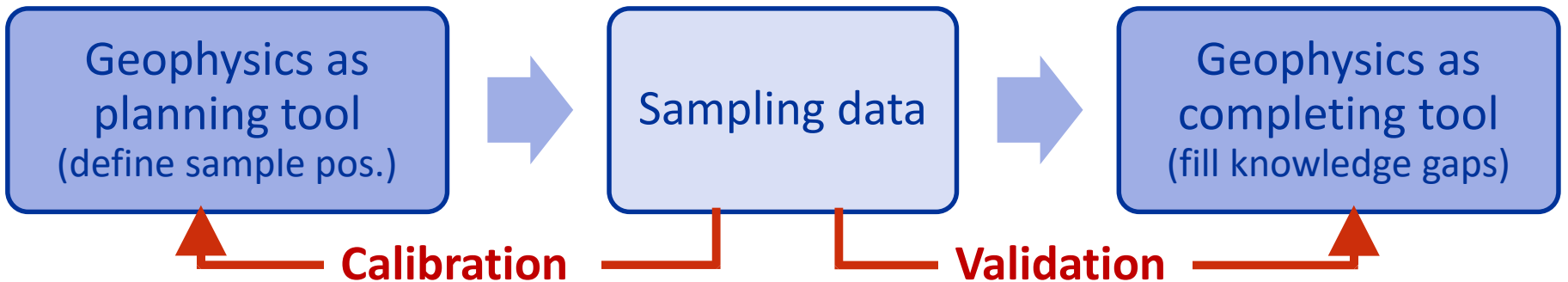
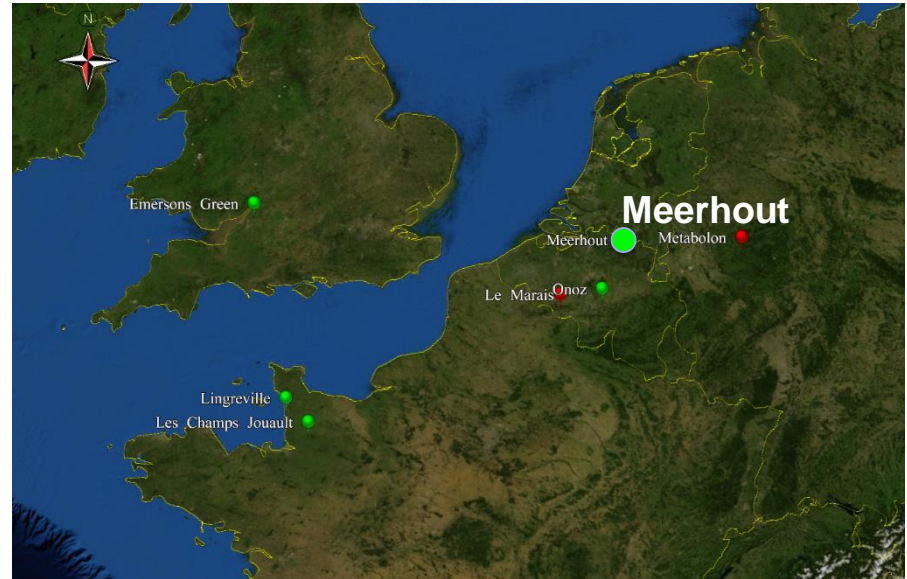
- Lateral extent
- Vertical extent
- Waste inhomogeneity
- Landfill structure
- Cover layer thickness
- Buried infrastructure



# Meerhout landfill

## Information gained:

- Lateral extent
- Vertical extent
- Waste inhomogeneity
- Landfill structure
- Cover layer thickness
- Buried infrastructure

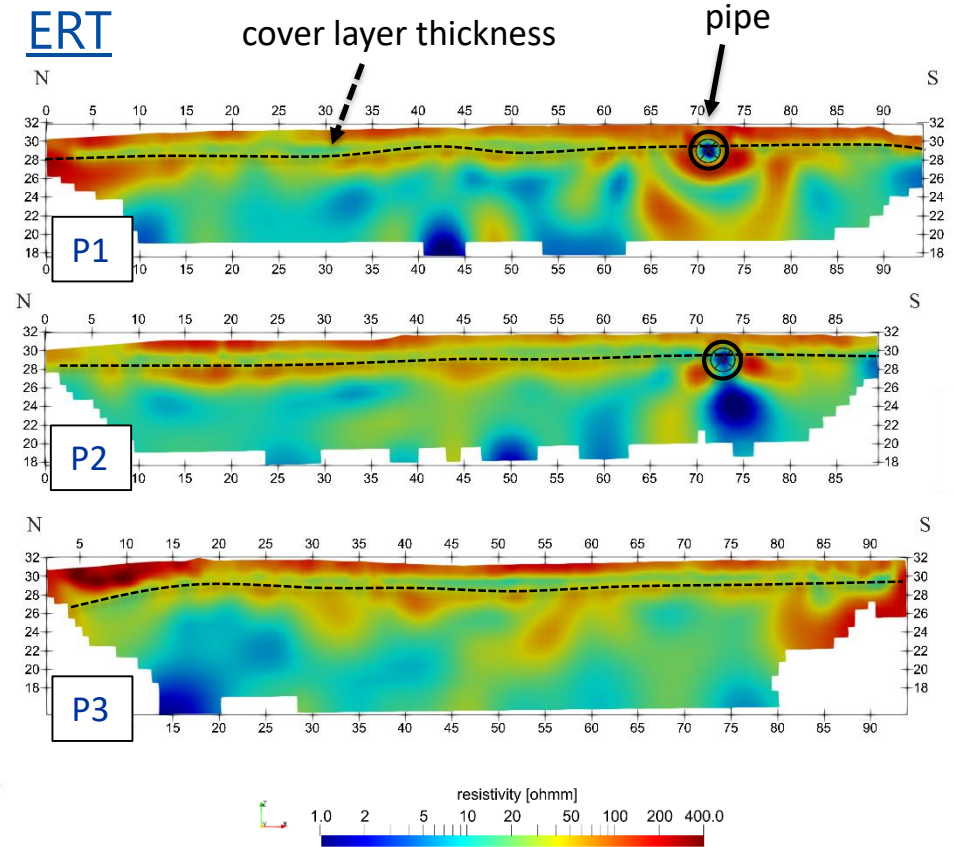


# Meerhout - buried infrastructure

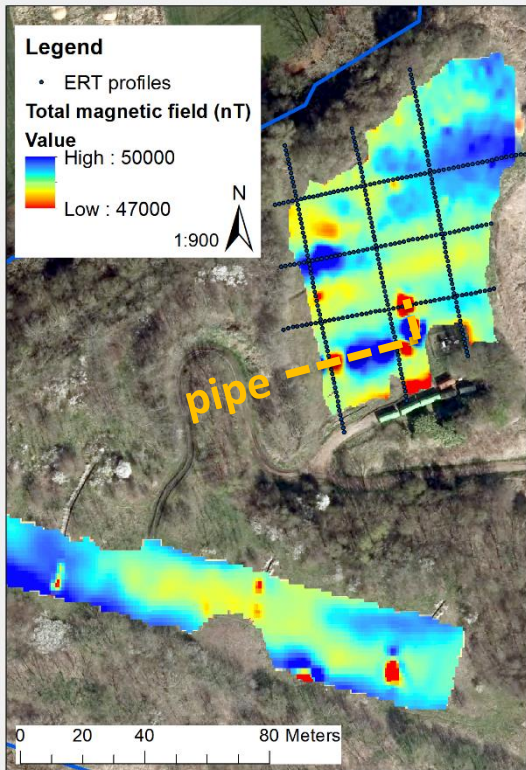
- cover layer



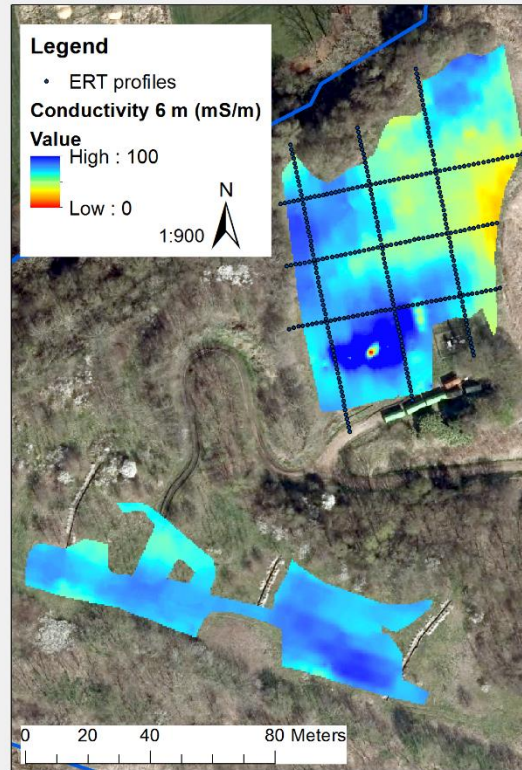
## ERT



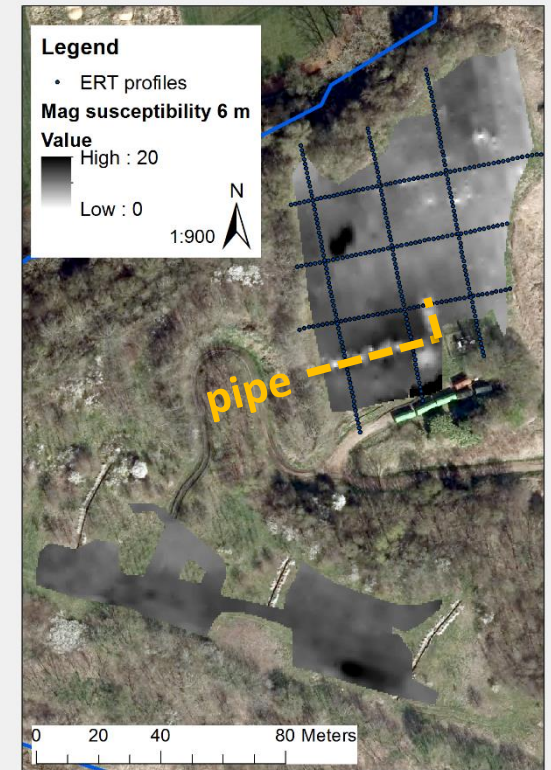
# Meerhout - waste inhomogeneity



*Total magnetic field*



*Electrical conductivity (EMI)*

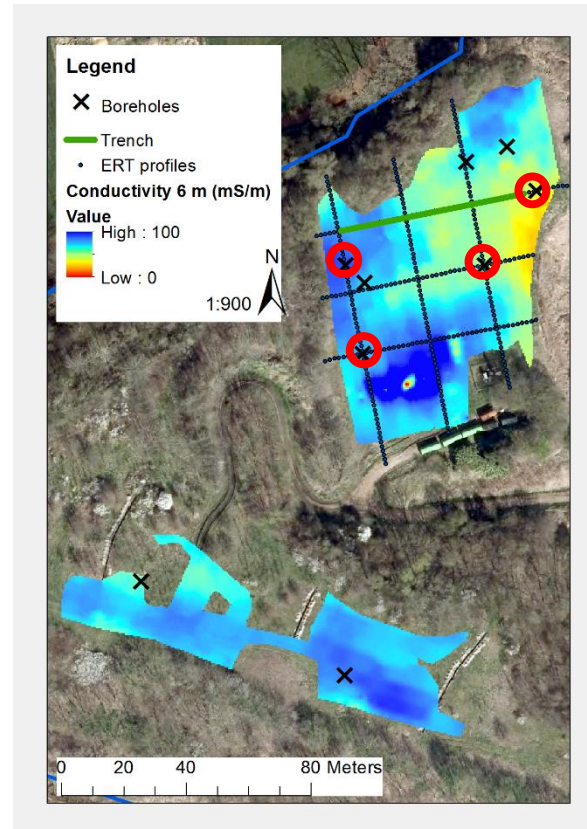


*Magnetic susceptibility (EMI)*

# Meerhout – define sampling positions

High conductivity anomaly

Sampling plan  
based on  
geophysical results

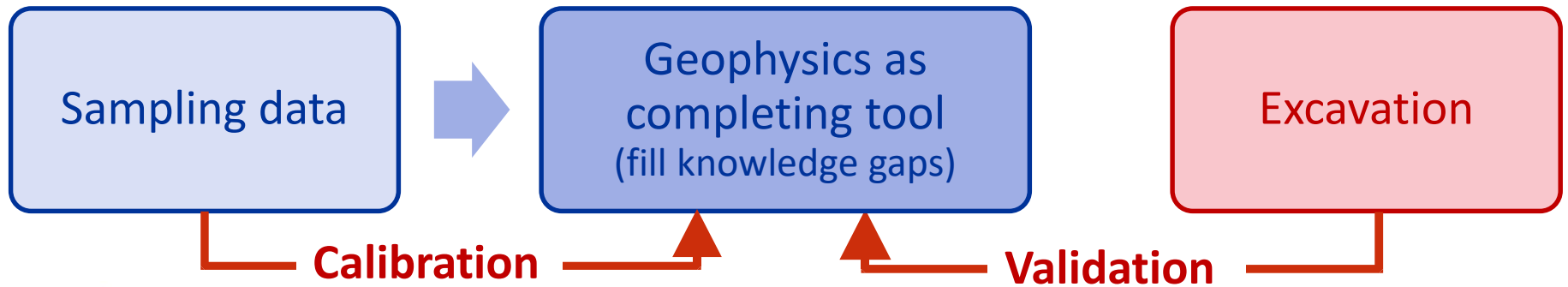


*Electrical conductivity (EMI)*

# Emerson's Green landfill

Information gained:

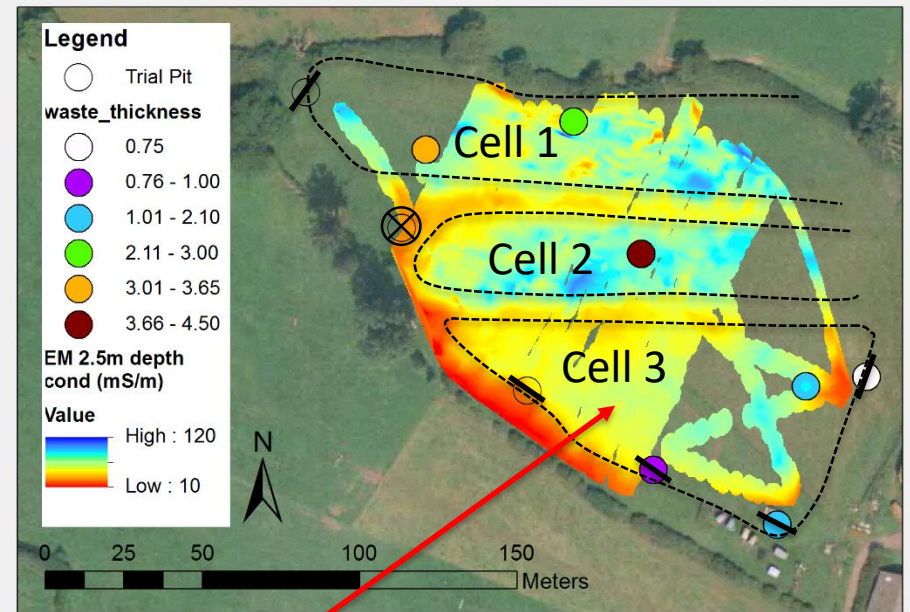
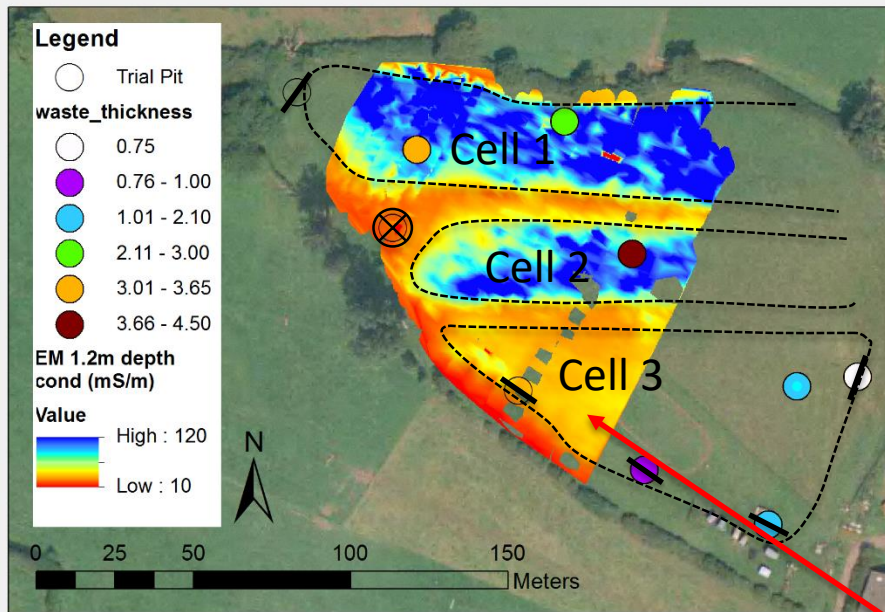
- Lateral extent
- Vertical extent
- Waste inhomogeneity
- Landfill structure
- Cover layer thickness
- Buried infrastructure



# Emersons Green – lateral extent

Conductivity map at 1.2m

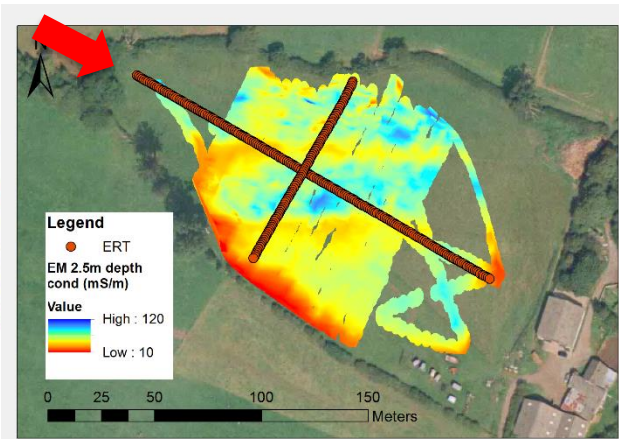
Conductivity map at 2.5m



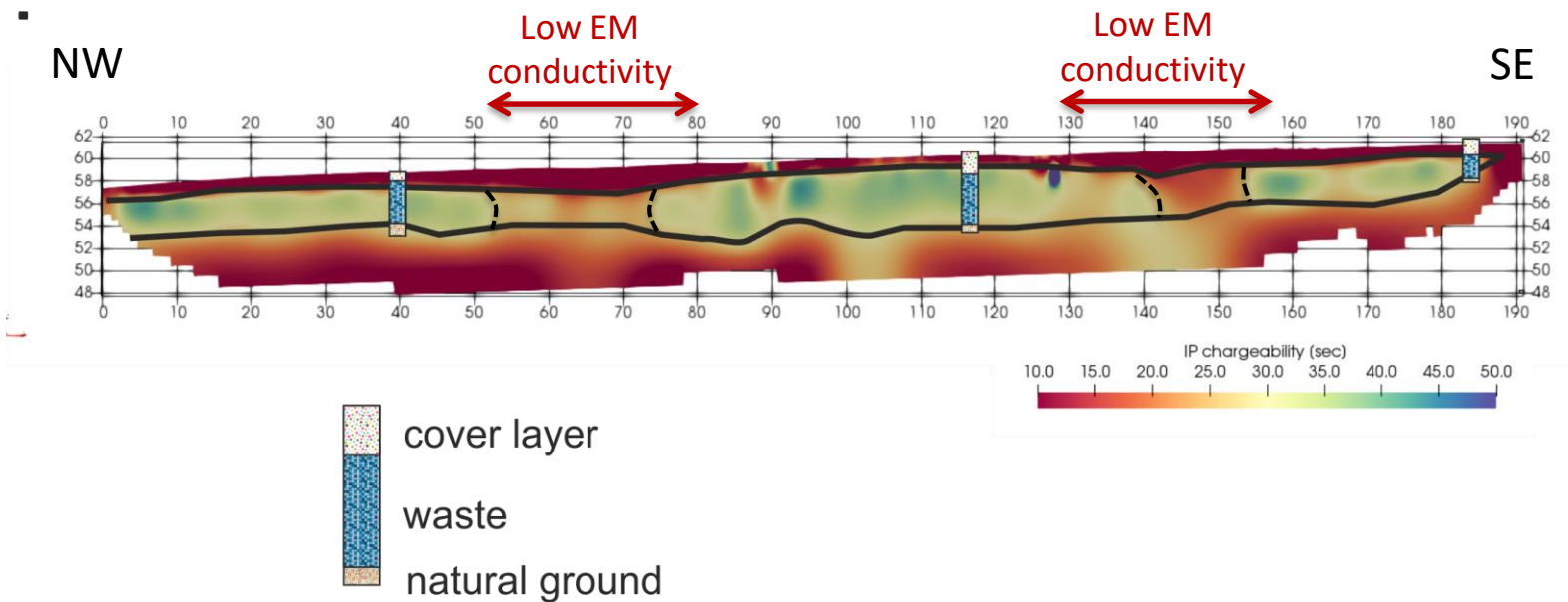
- ⊗ No waste found
- Edge of landfill found

Lower conductivities probably due to thicker cover layer

# Emersons Green – landfill structure



IP data delineate the waste layer



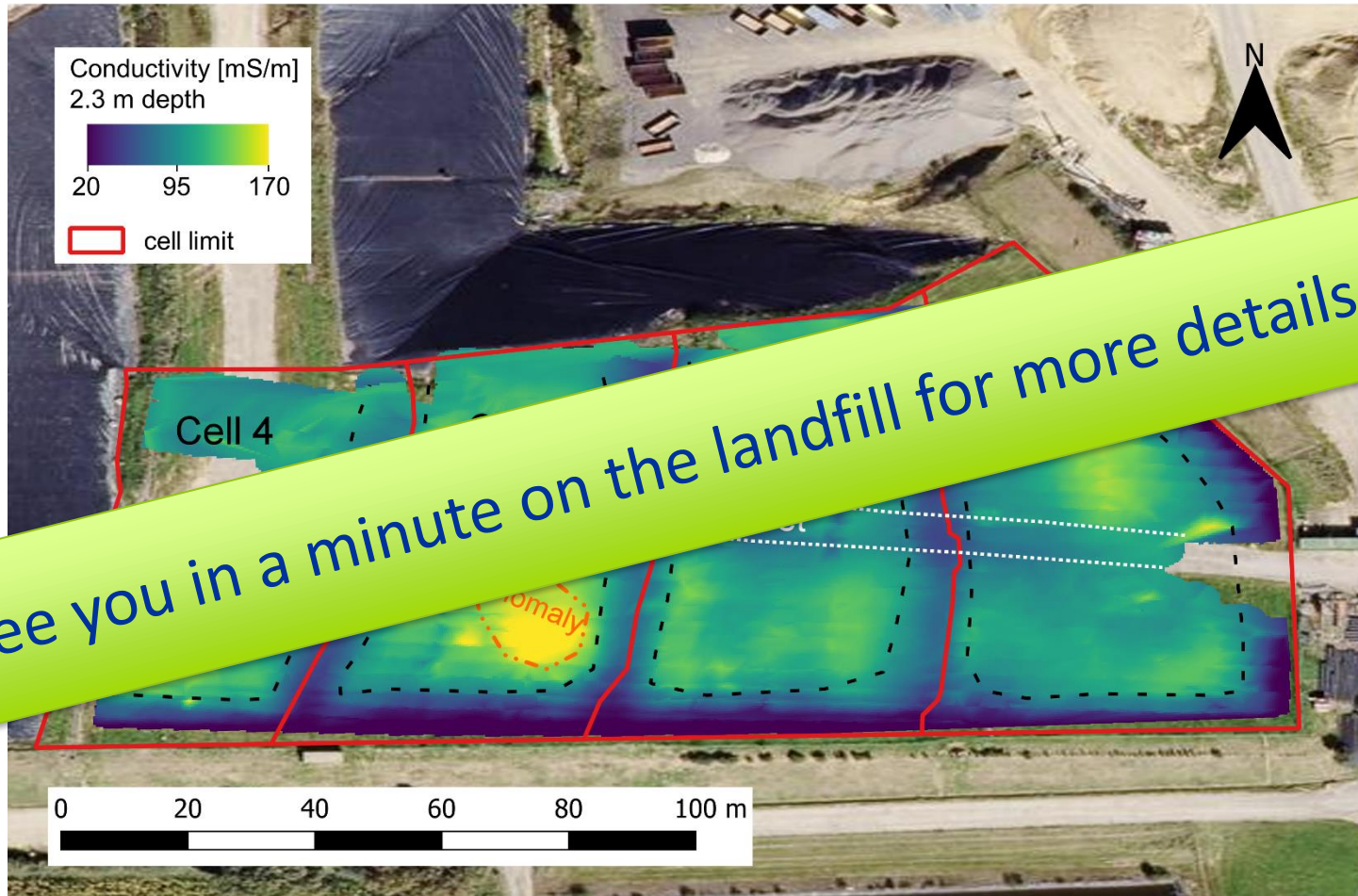


# Take home message



- 1) Plan based on a-priori information about:
  - landfill structure
  - expected geophysical properties contrasts
    - ➔ choose optimal combination of geophysical methods
    - ➔ choose optimal measurement parameters
- 2) Use mapping methods (e.g. EM & Mag) to quickly identify anomalies and decide upon location for more detailed 2D or 3D-surveys
- 3) Use ground truth data to calibrate and verify geophysical data

# Les Champs Jouault



# Q & A



# Raw materials recovered from landfills



The Interreg North-West Europe Project is coordinated by SPAQuE and unites 8 partners from 4 EU regions.



# Interreg



EUROPEAN UNION

# North-West Europe

# RAWFILL

European Regional Development Fund

# Thank you!