Interreg North-West Europe
RAWFILL
European Regional Development Fund

EUROPEAN UNION

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Cost and benefit analysis of the HADESS methodology:

Examples from two RAWFILL pilot sites

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1. Introduction

- **Traditional landfill content characterization : large number of boreholes and trenches**

- **HADESS** (Acronym for **H**igh-performing **A**cquisition of landfill **D**ata by using a geophysical **E**xploration and **S**urveying **S**trategy) **:** multimethod geophysics and targeted waste sampling

- **Aim:** Comparison between traditional characterization survey by boreholes and trenches and HADESS characterization survey (coupling geophysics and targeted waste sampling).

- Application on two RAWFILL pilot sites : Meerhout landfill (Flanders) and Onoz landfill (Wallonia)

2. Methodology used

Approach 1

- Calculation of the cost of the HADESS methodology to investigate the landfill
- Estimation of the number of boreholes and trenches that can be done for the same amount of money.
- Analysis of the most suitable spatial distribution of the boreholes and trenches on the landfill site in order to see if the number of boreholes/trenches are sufficient to provide accurate data.

2. Methodology used

Approach 2

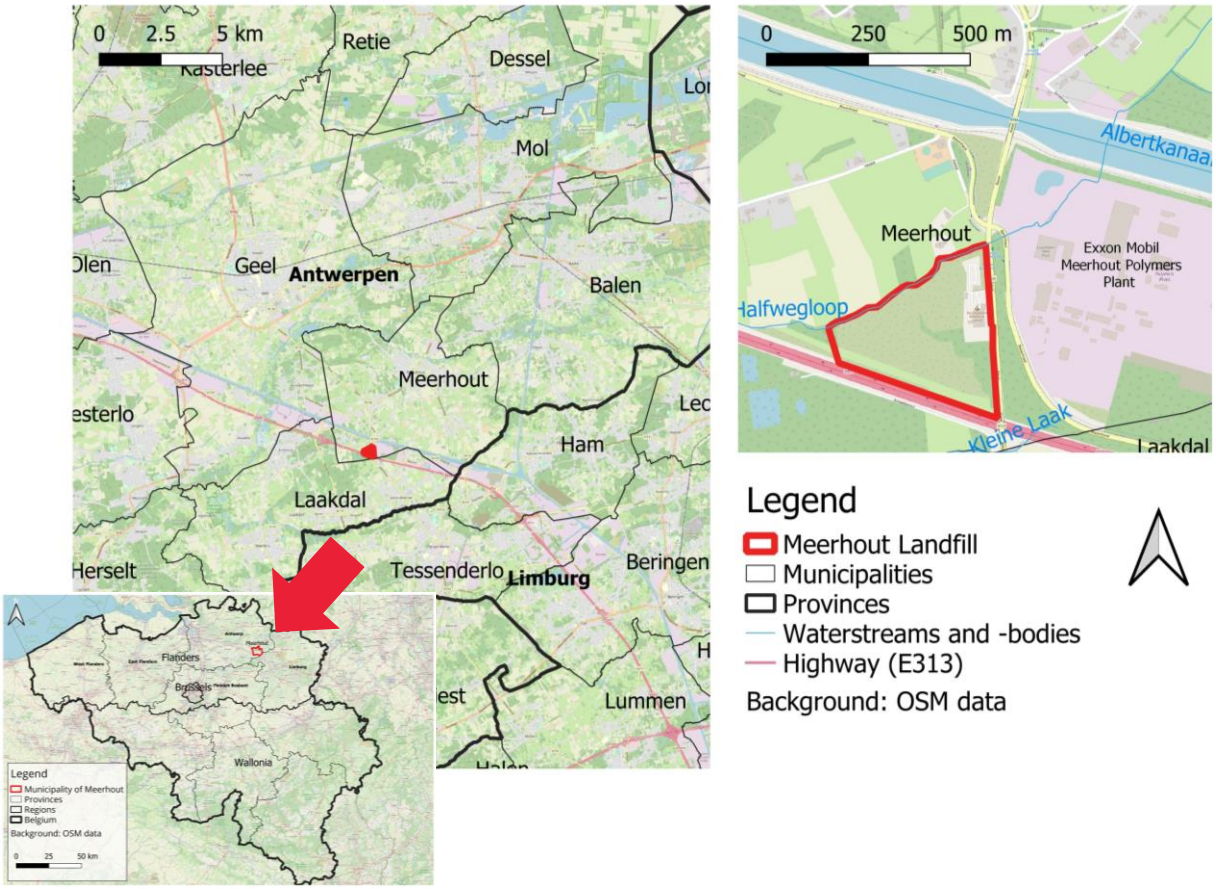
- Calculation of the price for the traditional characterization survey with a borehole/trench every 250 m^2.

2. Methodology used

For both characterization methodologies (HADESS vs. traditional)

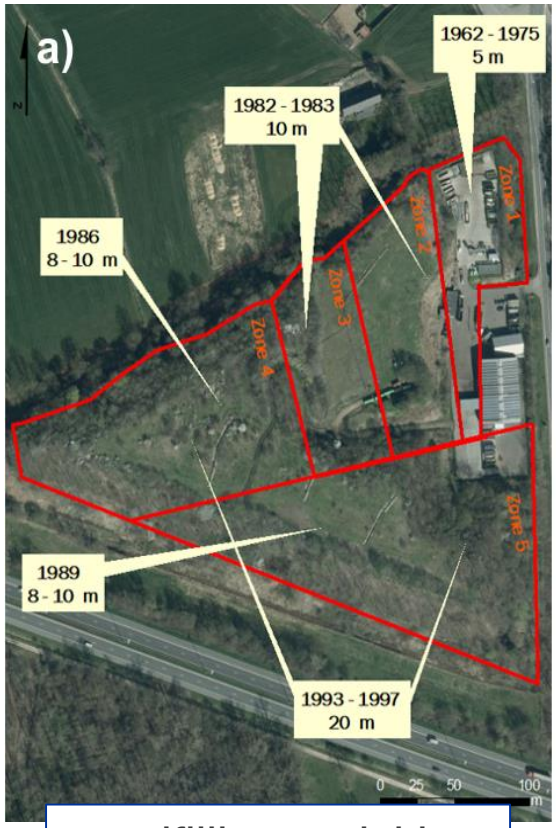
- Hypothesis : the excavated waste materials are not evacuated off-site or valorized but relandfilled.
- The costs prior to sampling (i.e. historical survey, deforestation/clearing, detection of explosive devices, detection of asbestos, research for utilities, safety plan and preliminary meetings) are similar for both methodologies → not included in the comparison.

Case study : Meerhout landfill

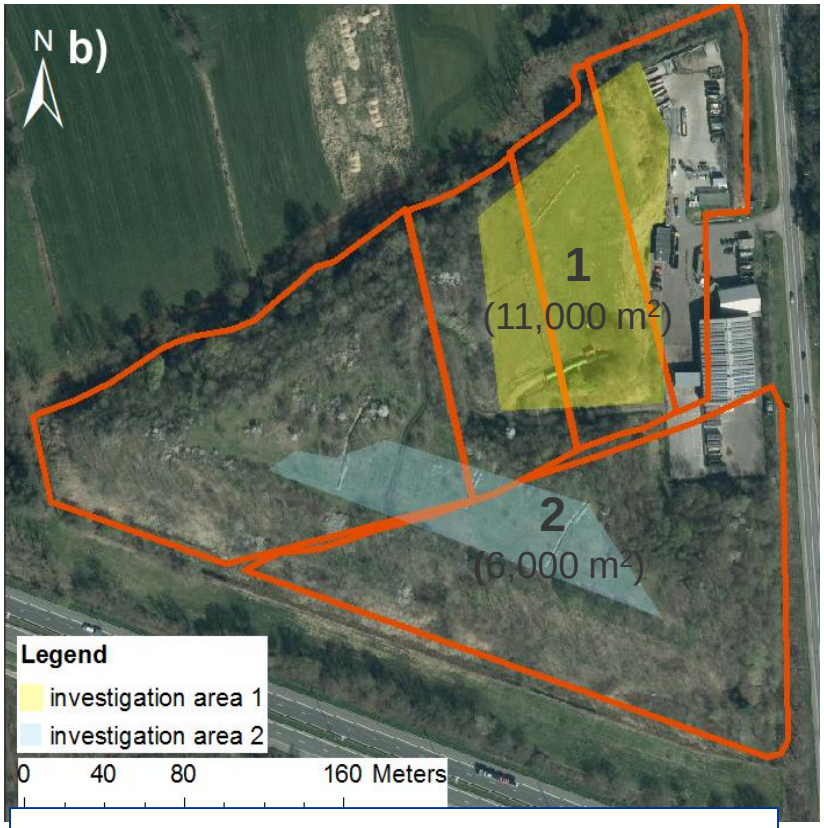


- Site area: 7.5 ha
- in operation between 1962 until 1997.
- more than 1.3 million m^3 of household and industrial (up to 30%) waste materials were deposited on the site.
- The thickness of the waste deposits varies between 5 m up to 20 m.

Case study : Meerhout landfill



Landfilling activities



Areas investigated by geophysics

Landfilling activities:

- Zone 1: 1962-1975
- Zones 2-3: 1982-1983
- Zone 4: 1986 & 1993-1997
- Zone 5: 1989 & 1993-1997

Case study : Meerhout landfill

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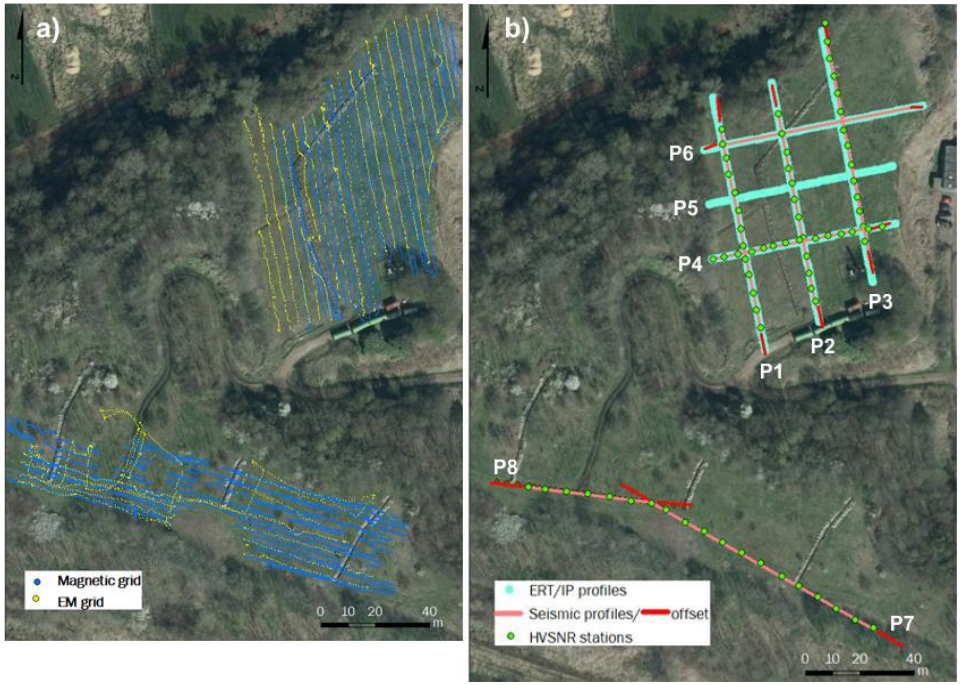
- **Approach 1**:

➢ **LANDFILL CHARACTERIZATION WITH HADESS:**

Geophysics

- Electrical resistivity tomography & Induced polarization : 6 profiles
- Horizontal to vertical noise spectral ratio : 72 measurements
- Multi-channel Analysis of Surface Waves : 7 profiles
- Electromagnetic : 19,300 m^2 in total
- Magnetometry: 9,650 m^2 in total



Case study : Meerhout landfill

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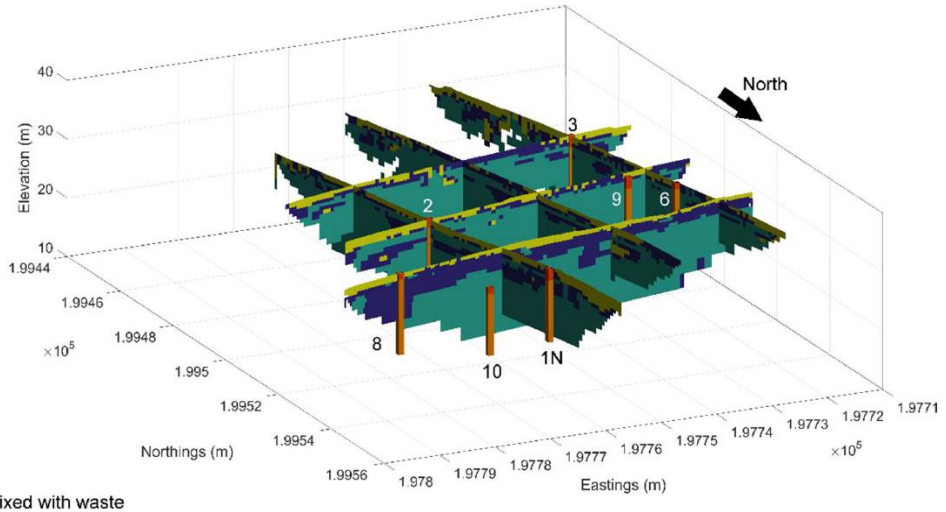
- **Approach 1**:

➢ **LANDFILL CHARACTERIZATION WITH HADESS:**

Waste sampling

- Drilling Boreholes
  - Between 0 and 15 m depth : 97.5 m in total
  - Between 15 and 30 m depth : 50 m in total
- Trenches : 8



From boreholes
- Cover layer
- Waste

From geophysics
- Cover layer
- Cover layer mixed with waste
- Waste

TOTAL: 50,399 €

Case study : Meerhout landfill

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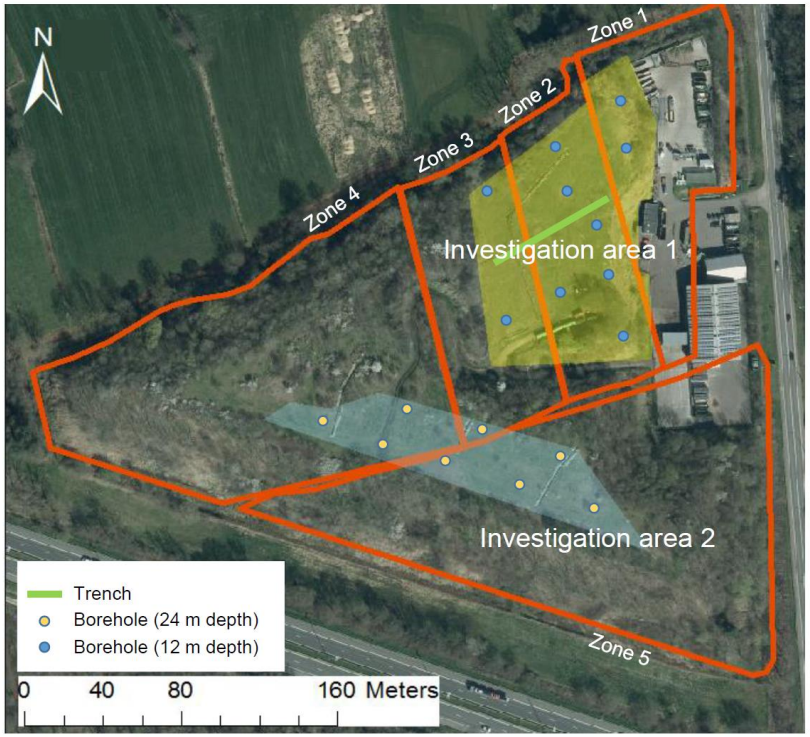
- **Approach 1**:

➢ **LANDFILL CHARACTERIZATION WITH HADESS:** 50,399 €

➢ **TRADITION LF CHARACTERIZATION:**

- 10 boreholes of 12 m depth
- 8 boreholes of 24 m depth
- 16 trenches (4m x 4m x 4m)



Investigation area 1: 1 borehole per 1,100 m^2 → It will be not sufficient to identify lateral variation.

Investigation area 2: 1 borehole per 750 m^2 →It would have been interesting to have some trenches to delimit the exact location between the cells 3, 4 and 5.

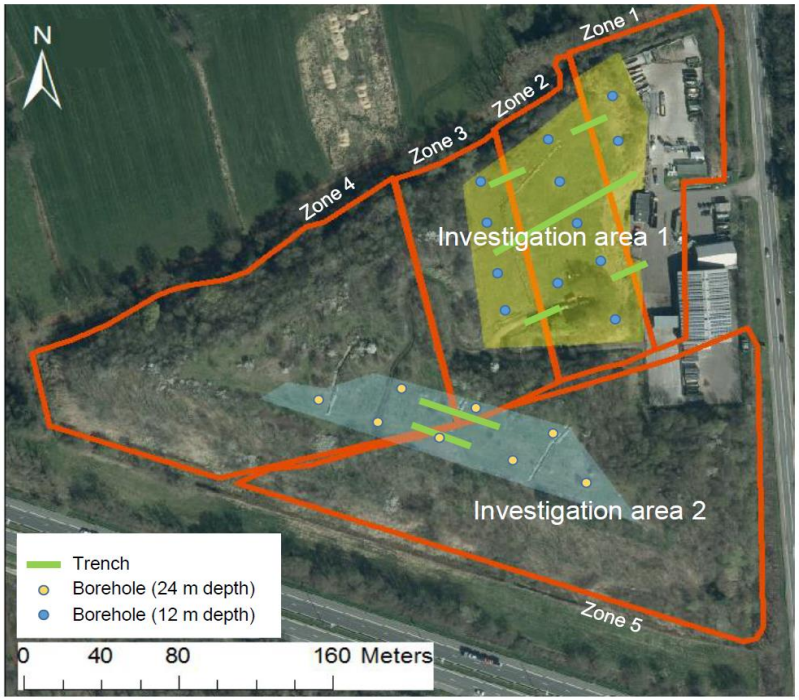
Case study : Meerhout landfill

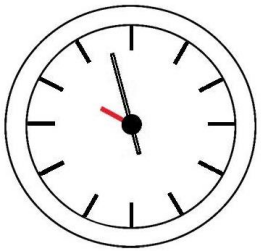
- **Approach 2**:

➢ **LANDFILL CHARACTERIZATION WITH HADESS:** 50,399 €

➢ **TRADITION LF CHARACTERIZATION:** 73,778 €

→ **min. 32% of saving costs**





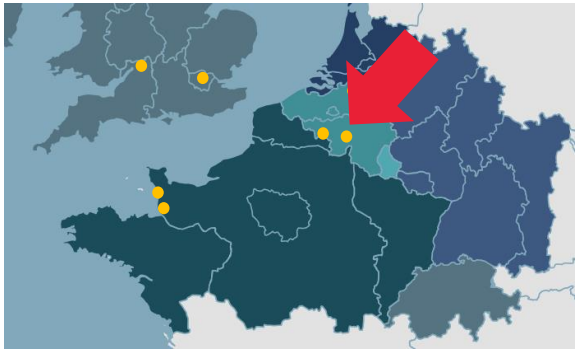
Duration investigation on site

RAWFILL LF characterization methodology (HADESS): 9.5 days
Traditional LF characterization methodology: 13 days

Case study : Meerhout landfill

HADESS	Traditional methodology
• Vertical extension in the thickest part of the landfill; • Identification of lateral variation; • Detection of buried pipes; • Faster methodology • More safety.	• More details regarding the waste composition. • Possibility to take more samples for laboratory analysis

Case study : Onoz landfill



Onoz (BE) – Landfill ID

Site area: 5.8 Ha
Landfill morphology: old quarry
Type of waste: industrial waste
Status: illegal

1971

History of the Onoz site

1902-1967: Quarry (limestone extraction)
1967-1976: Lime and fly ashes deposits
1982-1987: Heterogenous waste deposits (tyres, inert, plastics, etc.)

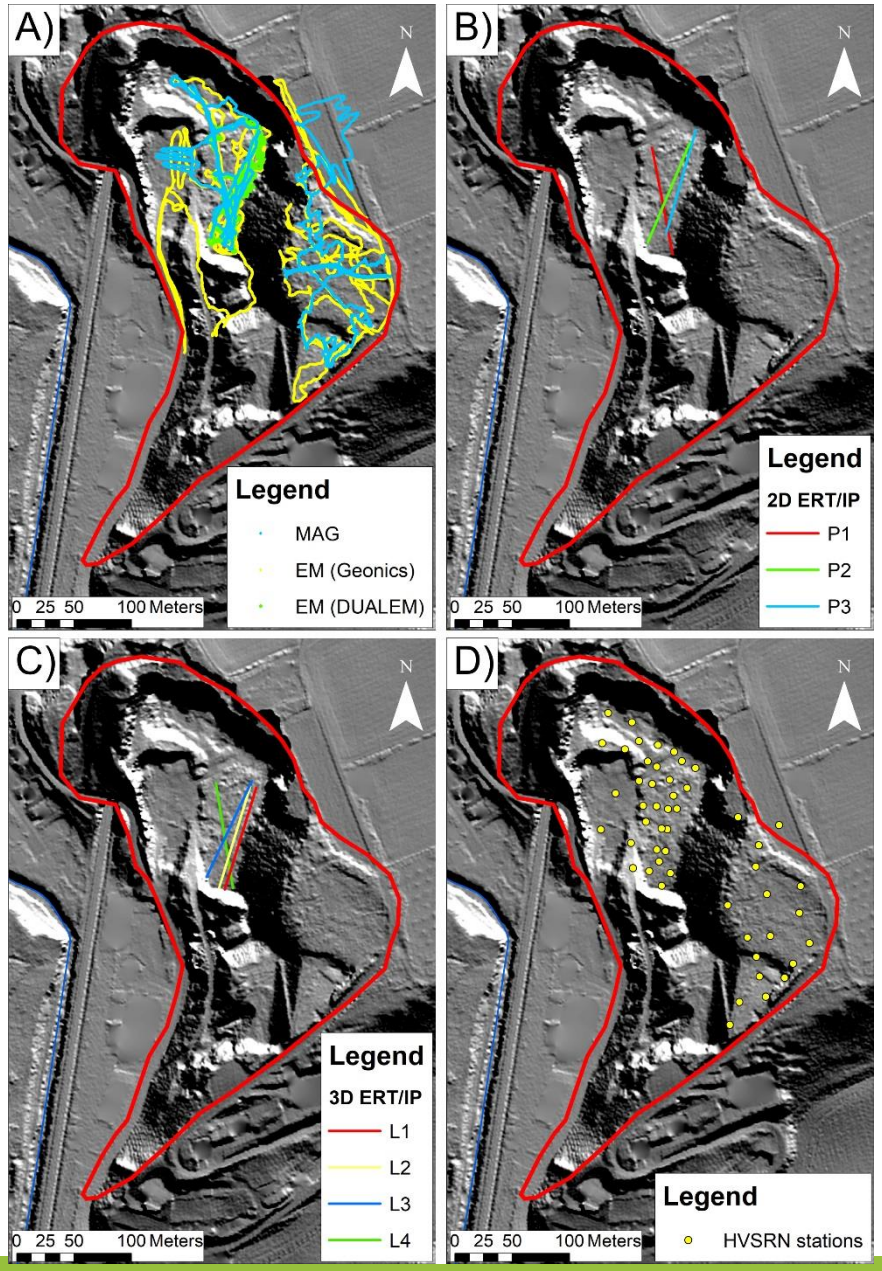
Case study : Onoz landfill

- **Approach 1**:

➢ **LANDFILL CHARACTERIZATION WITH HADESS:**

Geophysics

- Electrical resistivity tomography & Induced polarization (2D) : 3 profiles
- Electrical resistivity tomography & Induced polarization (3D) : 4 profiles
- Horizontal to vertical noise spectral ratio: 51 measurement points
- Multi-channel Analysis of Surface Waves: 1 profile
- Electromagnetic Mapping (Dualem 2 m antenna): 2,275 m^2
- Electromagnetic Mapping (M31 K Geonics): 21,050 m^2
- Magnetometry: 15,500 m^2



Case study : Onoz landfill

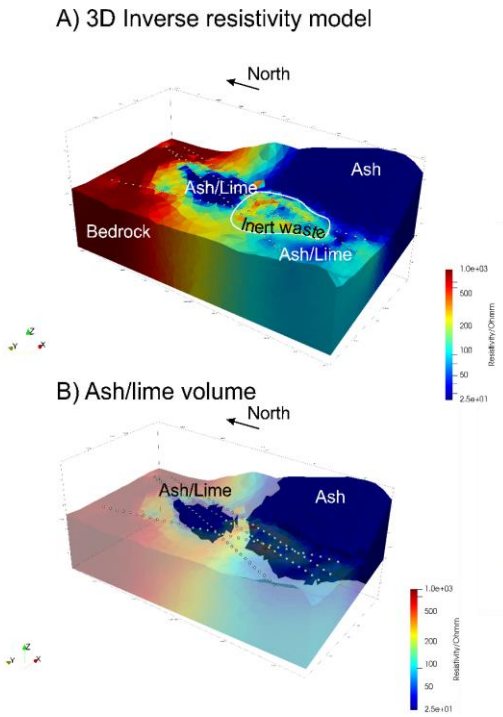
- **Approach 1**:

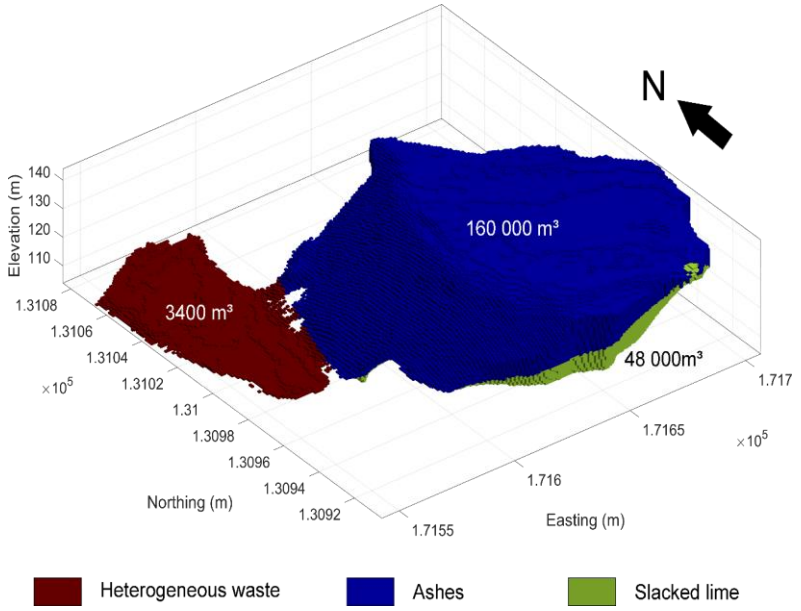
➢ **LANDFILL CHARACTERIZATION WITH HADESS:**

Waste sampling

- Drilling Boreholes
  - Between 0 and 15 m depth: 13.5 m
  - Between 15 and 30 m depth: 52 m
  - Trenches: 12

TOTAL: 37.288 €





Case study : Onoz landfill

- **Approach 1**:

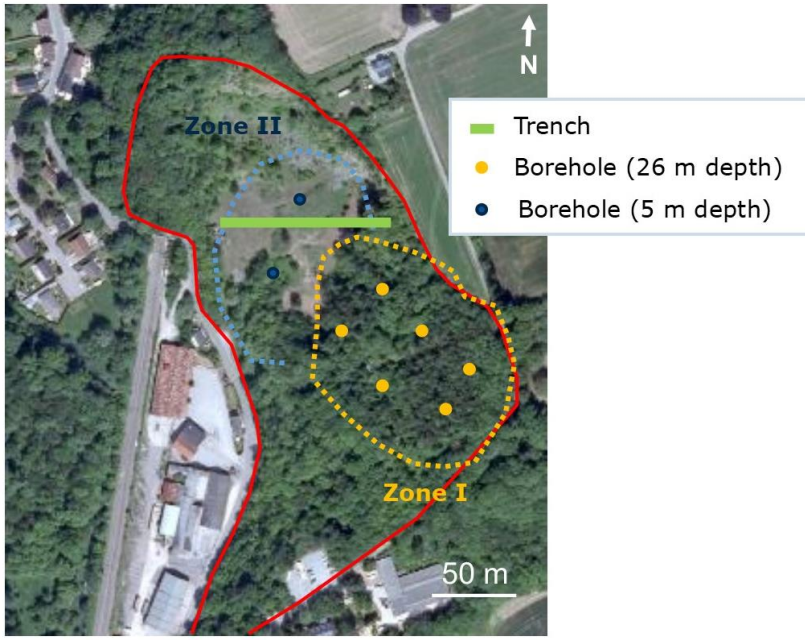
➢ **LANDFILL CHARACTERIZATION WITH HADESS:** 37.288 €

➢ **TRADITION LF CHARACTERIZATION:**

Zone I:
- 6 boreholes of 26 m depth

Zone II
- 2 boreholes of 5 m depth
- 24 trenches (4m x 4m x 4m).

→ It will be not sufficient to identify lateral variation.



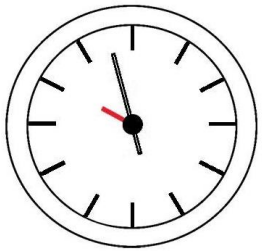
Case study : Onoz landfill

- **Approach 2**:

➢ **LANDFILL CHARACTERIZATION WITH HADESS:** 37.288 €

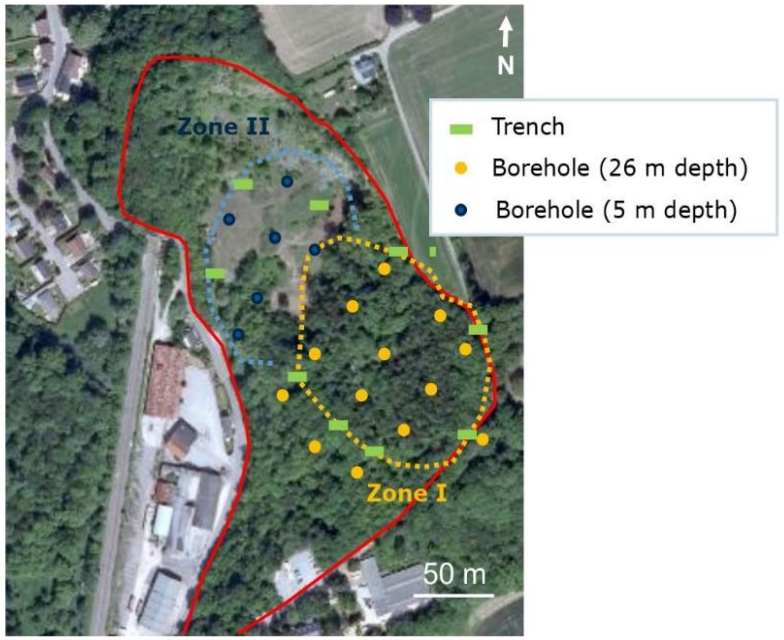
➢ **TRADITION LF CHARACTERIZATION:** 61.592 €

→ **min. 39% of saving costs**



Duration investigation on site

RAWFILL LF characterization methodology: 9.5 days
Traditional LF characterization methodology: 12.5 days



Case study : Onoz landfill

HADESS	Traditional methodology
• Definition of the landfill vertical and lateral extension • Refine the volume of landfill waste material deposits (210,000 m^3 instead of 185,000 m^3 of lime and fly ash) • Faster • More safety • Non-destructive methods	• Identification of the water table • Thickness of the waste deposits in the thickest part of the landfill • More details regarding the waste composition (Zone II – municipal solid waste) • Possibility to analyze more samples • More destructive

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Thank you!