



Dynamic landfill management: an introduction to anthropogenic resource management

**Eddy Wille,
Senior advisor-geologist, OVAM**

Overview



- Rawfill-project
- Dynamic Landfill Management
- Conceptual site model versus Complex adaptive systems
- Experiences ?
- The myth of Orion & Cedalion
- DST 1 : Cedalion
- DST 2 : Orion

<https://www.nweurope.eu/projects/project-search/supporting-a-new-circular-economy-for-raw-materials-recovered-from-landfills/>

Raw materials recovered from landfills



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



100.000 landfills in North-West Europe



Most of these sites lack state-of-the-art **environmental protection systems**, leading to local pollution, land-use restrictions and global impacts.

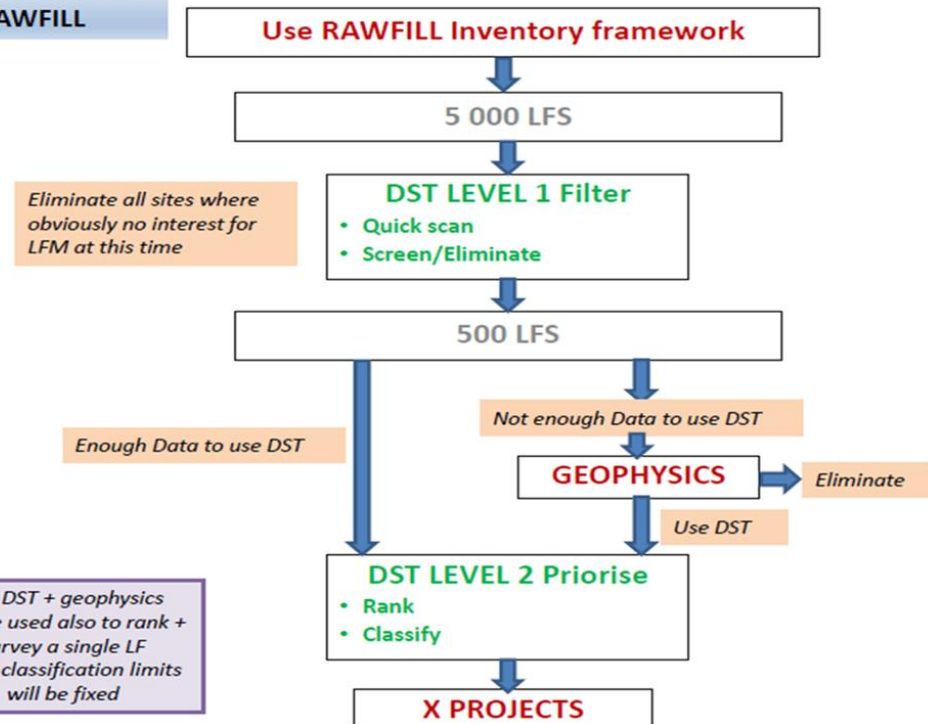
Fortunately, the large volumes of resources can be recovered through **Landfill Mining**.

The main **challenge** for stakeholders is the profitability risk due to the lack of reliable data on the recovery potential of landfills.

Outcomes of RAWFILL

- enhanced framework for private/regional/transregional landfill inventories
- landfill geophysics
- decision support tool

HOW IT WILL WORK AFTER RAWFILL



Waste management in Flanders

Household waste per inhabitant of Flanders

The amount of residual waste we produce is decreasing much more slowly than the waste that is collected separately. Therefore, OVAM wants to improve separate collection even more.

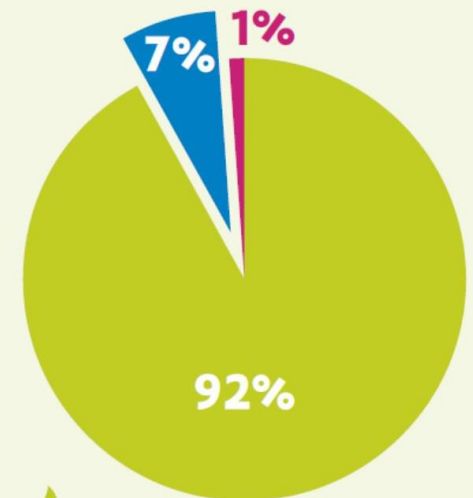


How is residual household waste processed?

950,000 TONNES



This is the amount of non-separated residual waste collected in Flanders each year.



2007

2017

555 KG

490 KG



400 KG

338 KG

- 62 KG

Collected separately

Collected separately

155 KG

152 KG

- 3 KG

Residual waste

Residual waste

How much food are we wasting?

23 KG



Flemish consumers waste up to 23 kg of food per person each year.

94-142 million kilograms



For Flanders as a whole the amount is between 94 and 142 million kilograms.



With this amount of food 30,000 football teams can be fed for one year.

WTF Landfills ?!

What's the future of landfills ?



Final waste disposal ?

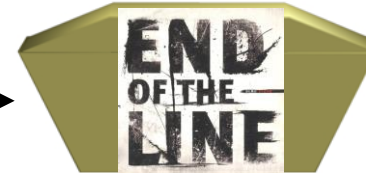


Start of a bright future ?

COCOON objective : develop, integrate and improve relevant cross-cutting policy instruments on landfill management in the EU



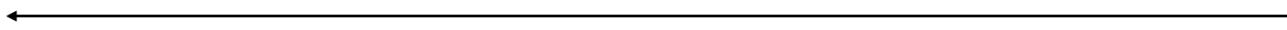
Landfilling : final waste disposal sites as the end of the line in a linear economy



Is this the end of story ?



Risk based approach (source – pathway – target) : install a safe infinite containment



guarding the status quo :

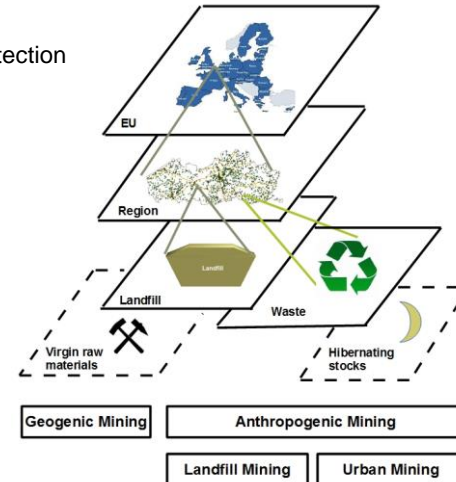
Is this static concept robust to environmental changes ?

COCOON-analysis :

- Poor exchange of data of (former) landfills
- Majority of old landfills (<1999) seldom state of the art; often lacking LT-monitoring & aftercare
- LT-effects not limited to landfill scale: local level to global level
- External impact underestimated: climate change, spatial pressure, flooding, soil sealing, drinking water protection
- Rarely landfilling with regard to re-mining (monofills)

COCOON-conclusion :

- Dynamic landfill management approach required in view of demand and supply
- Integration in broader frameworks : circular economy, resource efficiency, sustainable development

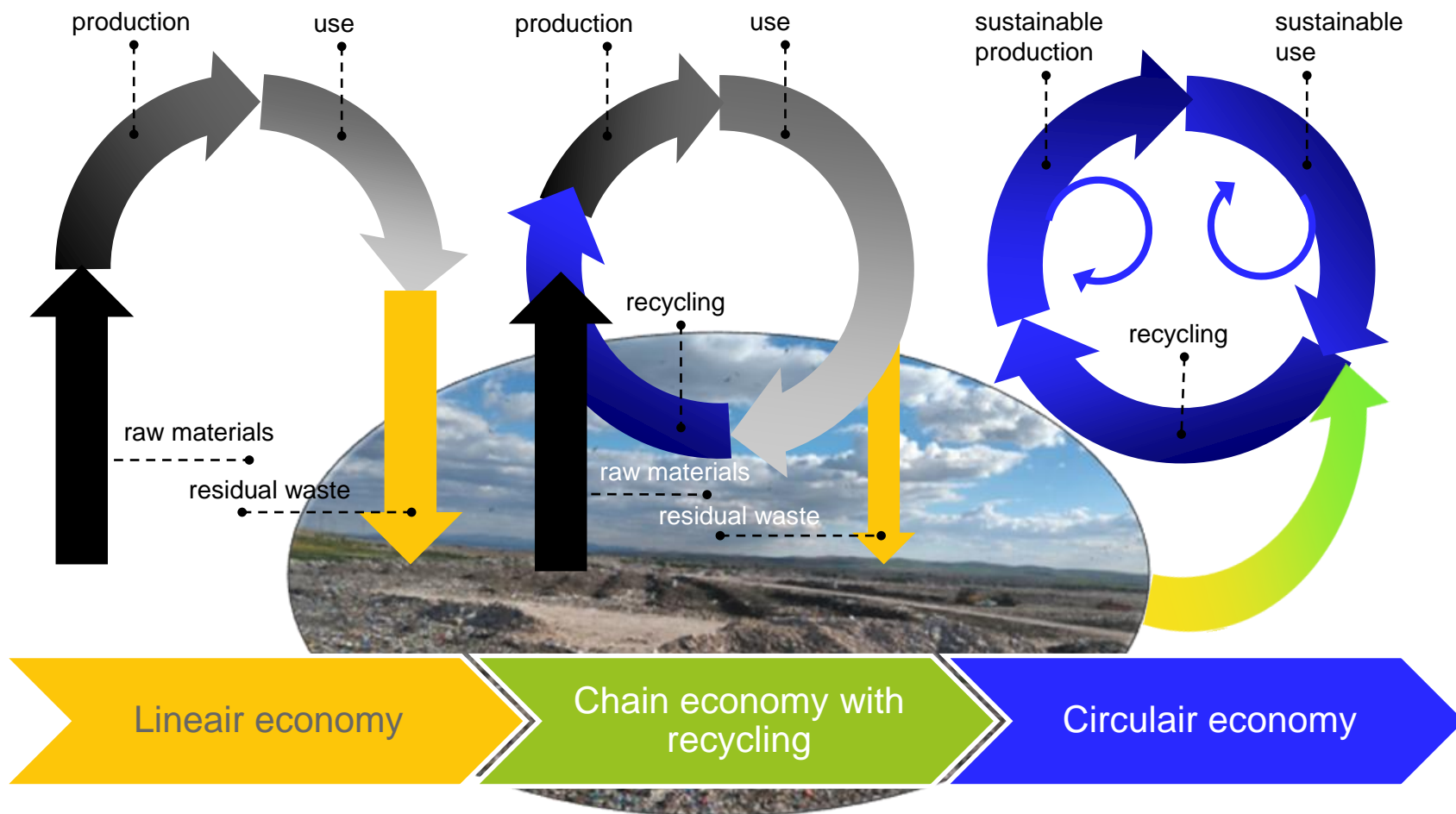


Transition **ON** to a dynamic landfill management focusing on Resources and Reserves in order to provide Waste to Materials/Energy/Land & Protection of Resources.

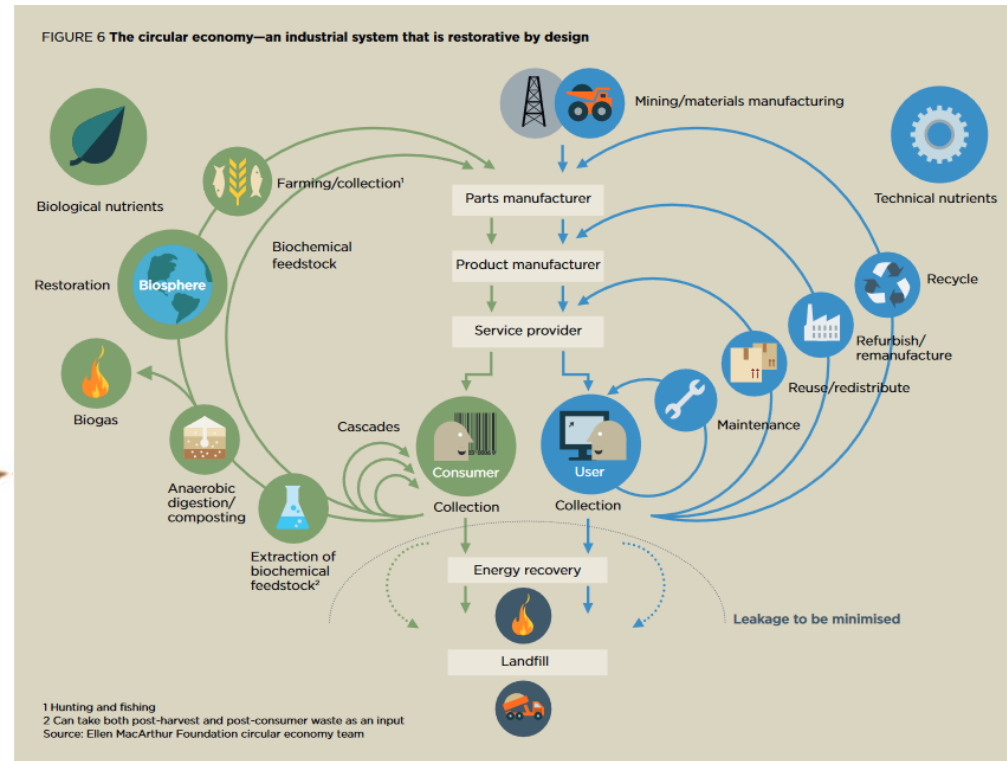
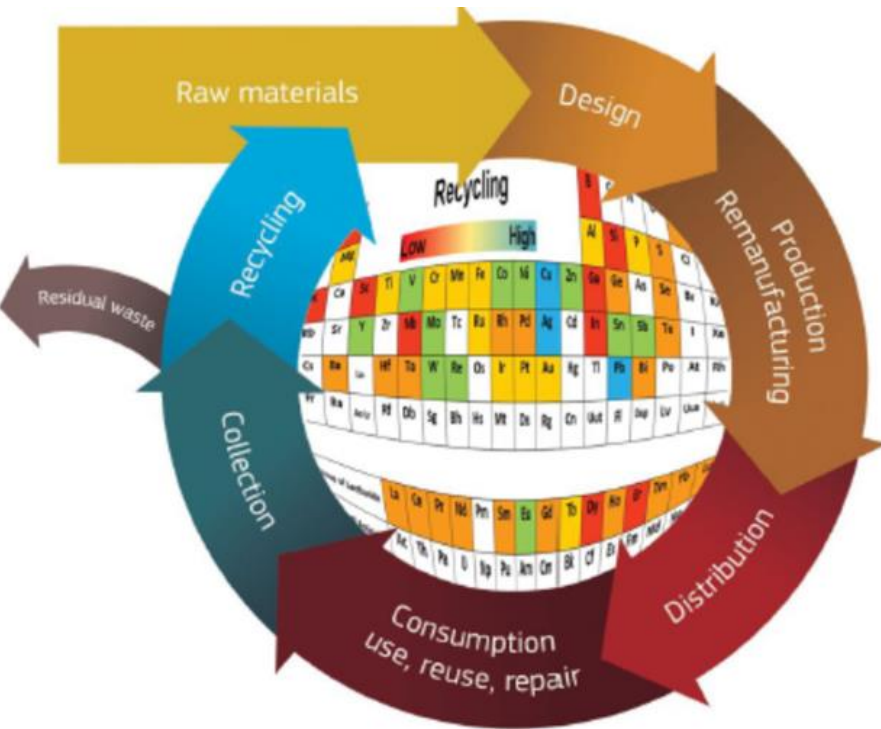


Dynamic Landfill Management

Transition of Landfills : Dynamic Landfill Management
from waste to resources



Landfills & Circular economy

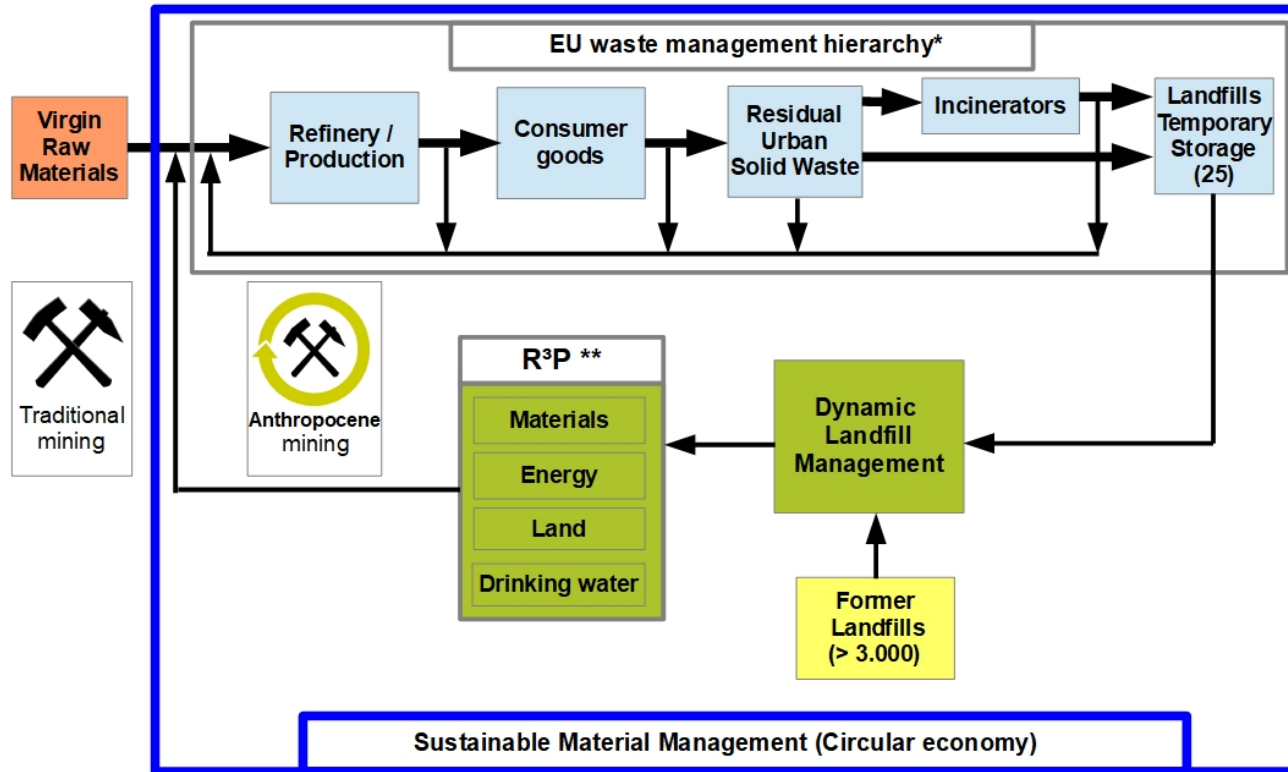


https://publications.jrc.ec.europa.eu/repository/bitstream/JRC116131/aaa_20190506-d3-jrc-science-for-policy-recovery_of_rm_from_mining_waste_and_landfills_4_07_19_online_final.pdf

<https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/critical-raw-materials-and-circular-economy-background-report>

<https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf>

Landfills & Circular economy



*Prevention (Ecodesign, dematerialisation,...), Reuse/ Recycling, Incineration, Landfilling (EU Waste Framework Directive)
 ** R³P = Recycling of Materials, Recovery of Energy, Reclaiming of Land, Preserving Drinking water supplies

Landfills & Circular economy



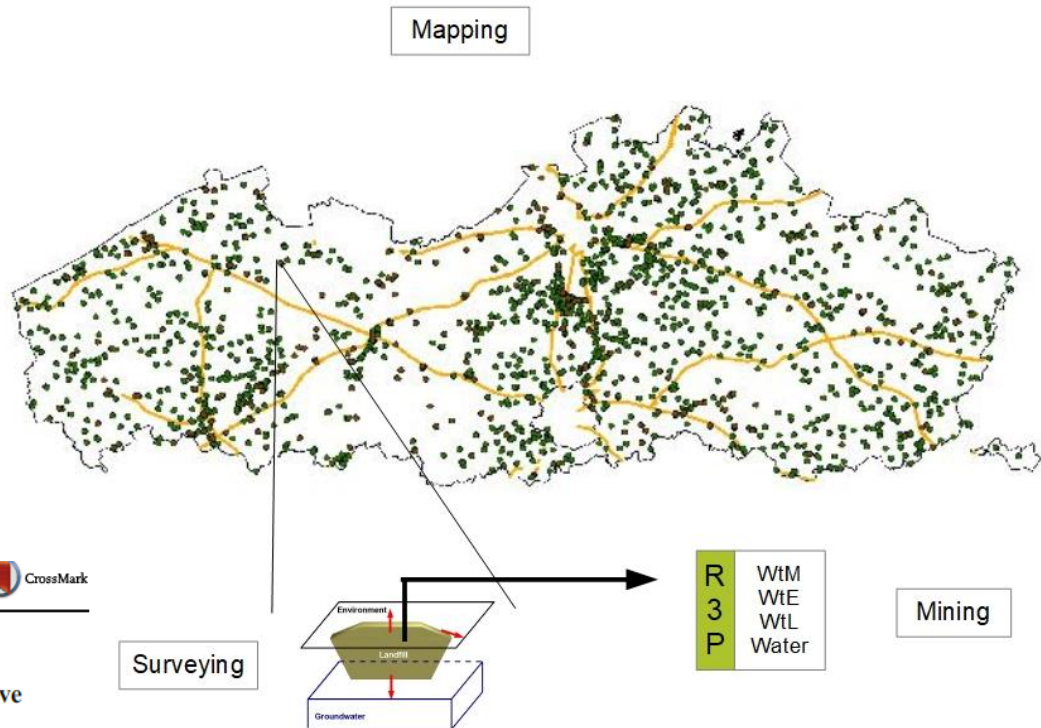
Laboratorium voor
 Toegespaste Geologie en
 Hydrogeologie
 Geologisch Instituut
 Coupures 311, 58
 B-9000 Geel
 Tel: 09 264 44 60
 Fax: 09 264 49 88

Geofysische prospectie
 t.b.v. enhanced landfill mining
 stortplaats: Sint-Truiden
 (Mefveren)

Opdrachtgever
 OVAM

Leiding: Prof. Dr. K. Walraevens
 Studie en verslag:
 Dr. Kristine Martens

 Dossiernummer: TGO 13/01
 Datum: november 2013



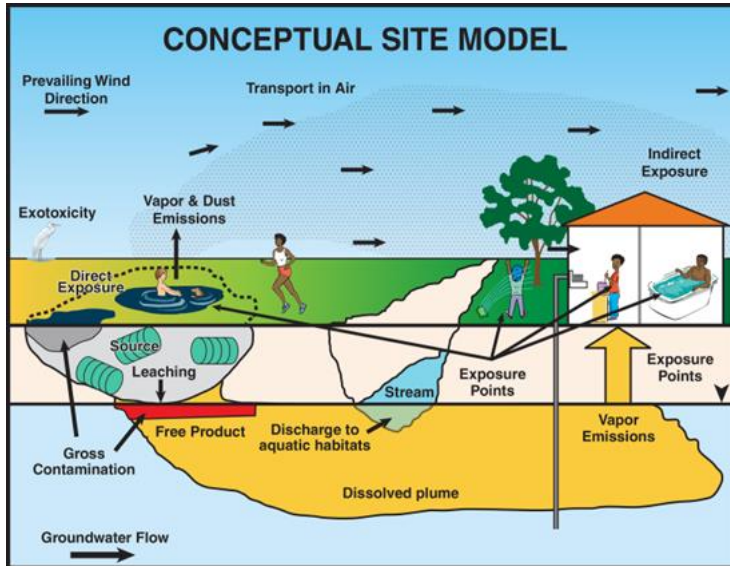
Bull Eng Geol Environ
<https://doi.org/10.1007/s10064-017-1169-2>

ORIGINAL PAPER

Geophysical exploration of an old dumpsite in the perspective of enhanced landfill mining in Kermt area, Belgium

Mero Yannah¹ • Kristine Martens² • Marc Van Camp² • Kristine Walraevens²

Conceptual Site Model



Traditional Conceptual Site Model sets focus mainly on impacts and risks.

Seldom detailed data on waste (quality and quantity), infrastructure, geotechnical characteristics,...

Often limited scales (spatial, timing,...)

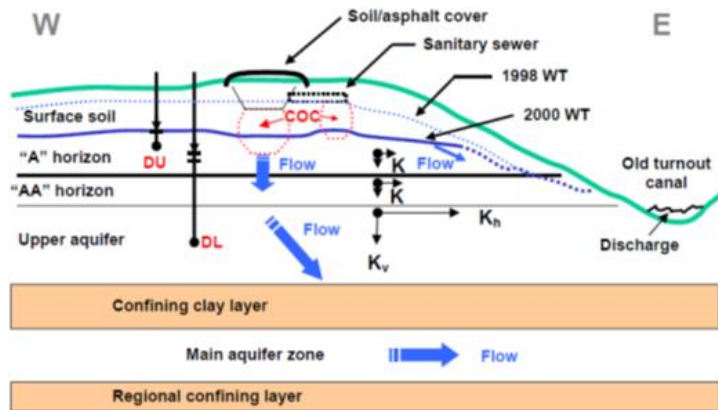


Figure 3-1. Initial conceptual site model showing a confining layer between two aquifers.

Conceptual Site Model

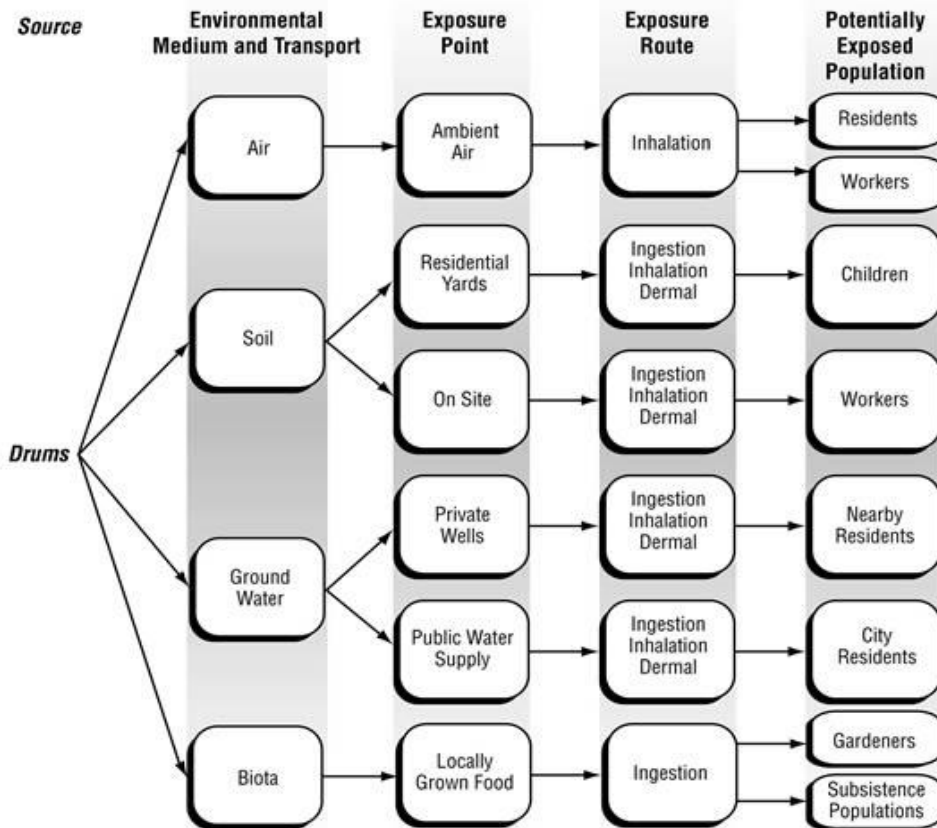
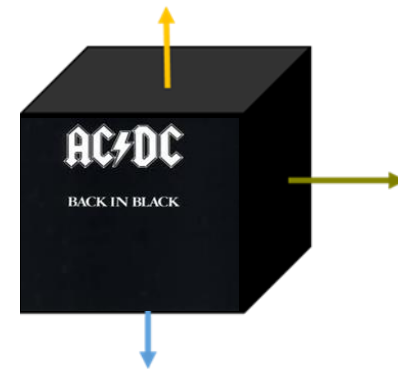


Figure 6-3. Site Conceptual Model—Exposure Pathway Evaluation

Conceptual Site Model identifying :
Source – Pathway – Target

Black box : what's leaving the box ?



Conceptual Site Model



Main objective : preventing/remediating soil & groundwater contamination

Latest news : roadmap New Soil Strategy EU

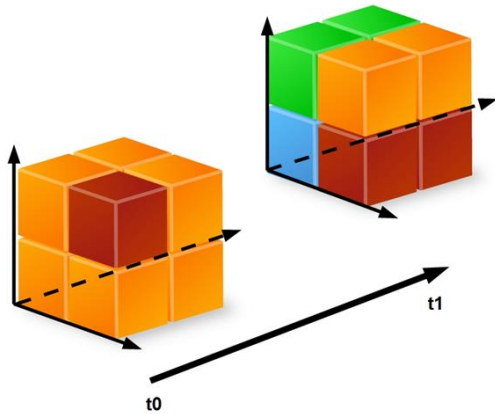
<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12634-New-EU-Soil-Strategy-healthy-soil-for-a-healthy-life>



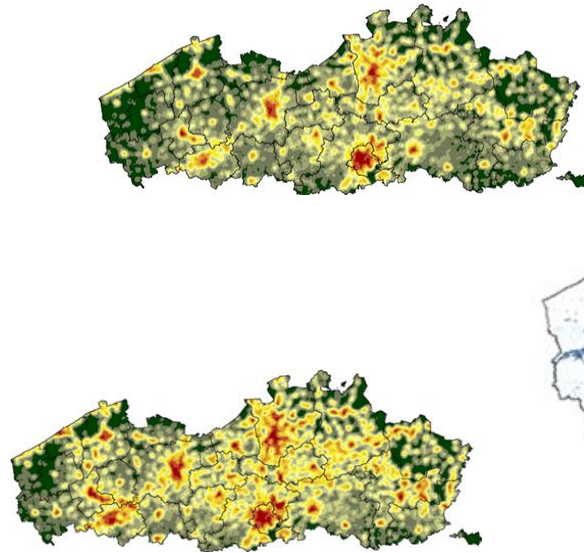
Ref. Ares(2020)6391319 - 05/11/2020

ROADMAP	
Roadmaps aim to inform citizens and stakeholders about the Commission's work in order to allow them to provide feedback and to participate effectively in future consultation activities. Citizens and stakeholders are in particular invited to provide views on the Commission's understanding of the problem and possible solutions and to make available any relevant information that they may have.	
TITLE OF THE INITIATIVE	New Soil Strategy - healthy soil for a healthy life
LEAD DG – RESPONSIBLE UNIT	DG ENV D1 Land use and management
LIKELY TYPE OF INITIATIVE	Communication
INDICATIVE PLANNING	Q2 2021
ADDITIONAL INFORMATION	The update of the Soil Thematic Strategy was announced in the EU Biodiversity Strategy for 2030. ¹

Dynamics of the system



In situ & ex situ landfill dynamics



**External dynamics:
anthropogenic**

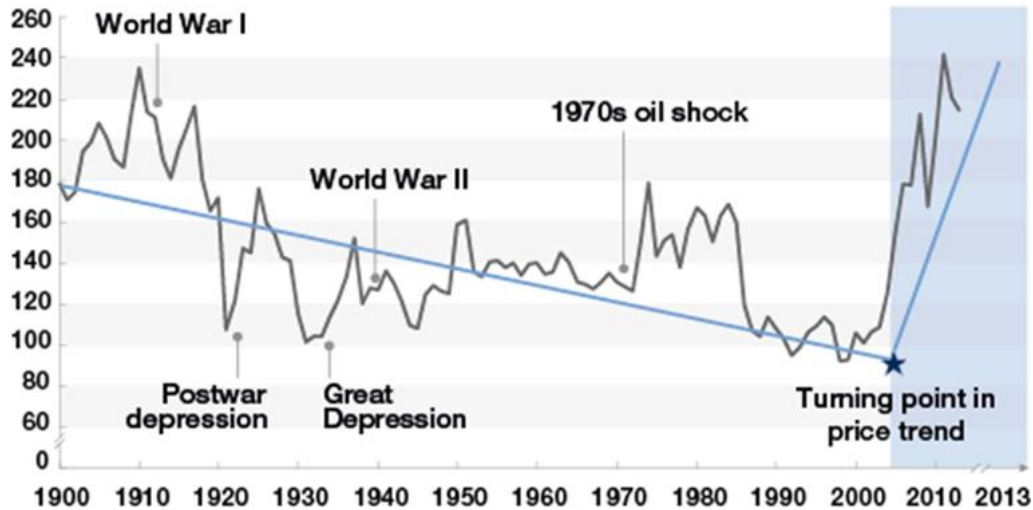


**External dynamics:
Natural / climate**

**Internal dynamics:
degradation**

Dynamics of the system

Keep in touch with the dynamics of the system. Predictions and modelling are part of it and might change.

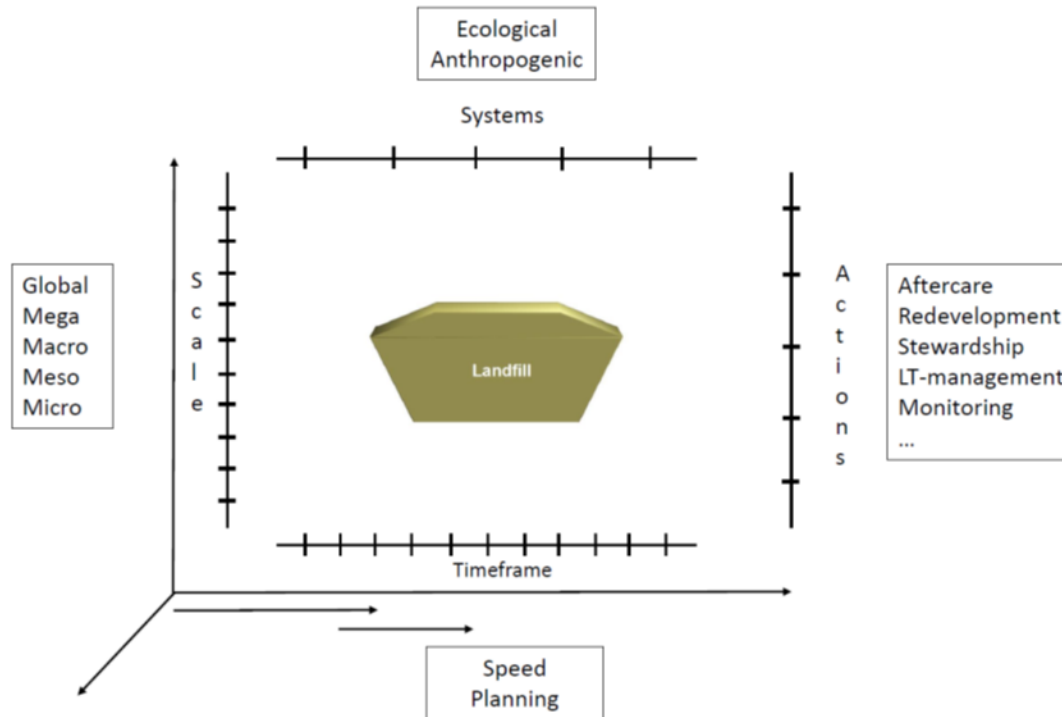


Evolution of Commodity prices (2011)

https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/Resource%20revolution/MGI_Resource_revolution_full_report.ashx

Complex Adaptive Systems

The art of sustainable management



Complexity :

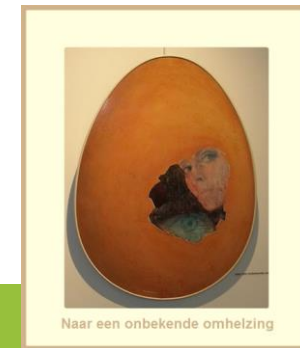
- Diversity of stakeholders;
- Uncertainties about causes, consequences & remedies;
- Different formal & informal laws and levels of government;
- Difficulty to rapid change of configurations;
- Complex dependencies which constantly change.



Salvador Dalí

Flexibility in timeframes (4D)
 & (re)thinking the inside

(an unknown and unexpected
 embrace)

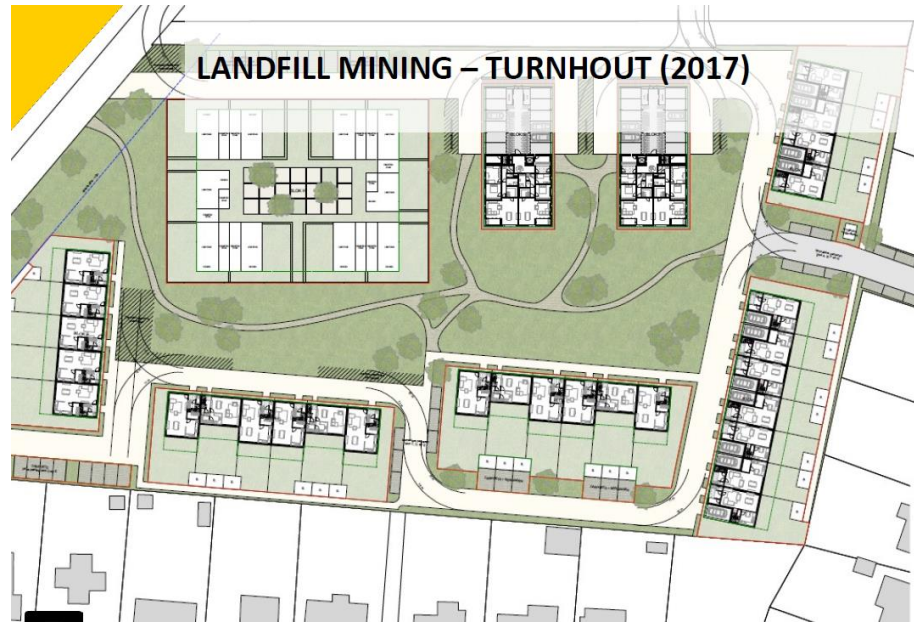


Naar een onbekende omhelzing

Geert De Geyter

Reclaiming Land(fills)

1 MSW LF - Turnhout



Residential land use project

TOGETHER WE
MAKE TOMORROW
MORE BEAUTIFUL

Reclaiming Land(fills) De Lediaan - Diegem



< 1960
Zandwinning

ca. 1960-1977
Stortplaats voor bouwpuin

1977-heden
Braakliggend weiland

2017
Duurzame opwaardering

Tot 1977 werd de voormalige zandgroeve door dertien opgevoeld met sterke afvalstoffen (diverse grond, puin, steen). De familie Desmedt was eigenaar van het terrein tot 2017.

Residential land use project
Incl. park



Reclaiming Land(fills) 3 Industrial LF - Gent

Industrial land use project



Reclaiming Land(fills) 21 Eiland - Zwijnaarde



Mixed land use project
Incl. logistics, research park, nature preservation

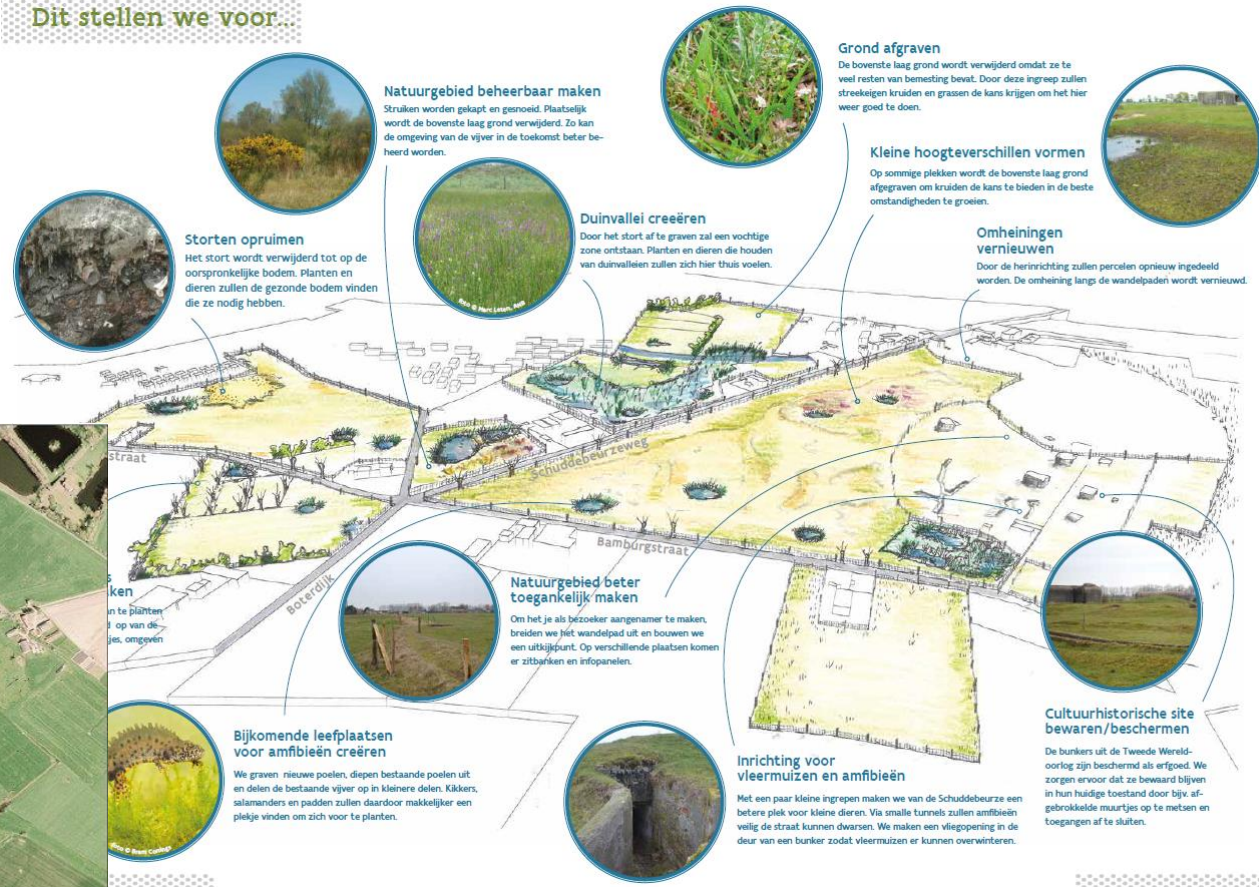


Reclaiming Land(fills)

12 Schuddebeurze - Lombardsijde

Nature preservation project

Dit stellen we voor...



Reclaiming Land(fills) 10 Gipsberg - Zelzate



Mixed land use project
Incl. interim use, nature preservation



Reclaiming Land(fills)

22 Coal tip - Beringen

Mixed land use project
Offices, recreation, housing, nature preservation

Interreg 
North-West Europe
RAWFILL



Reclaiming Land(fills) Lingreville - Normandie

Coastal erosion restoration project

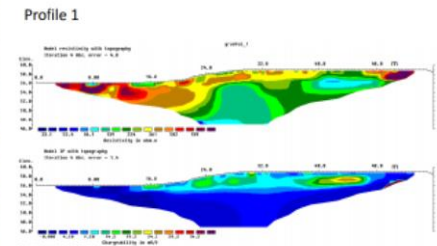
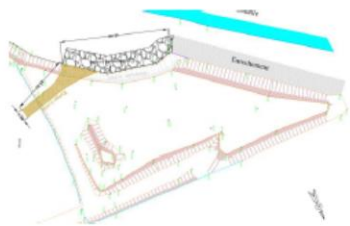


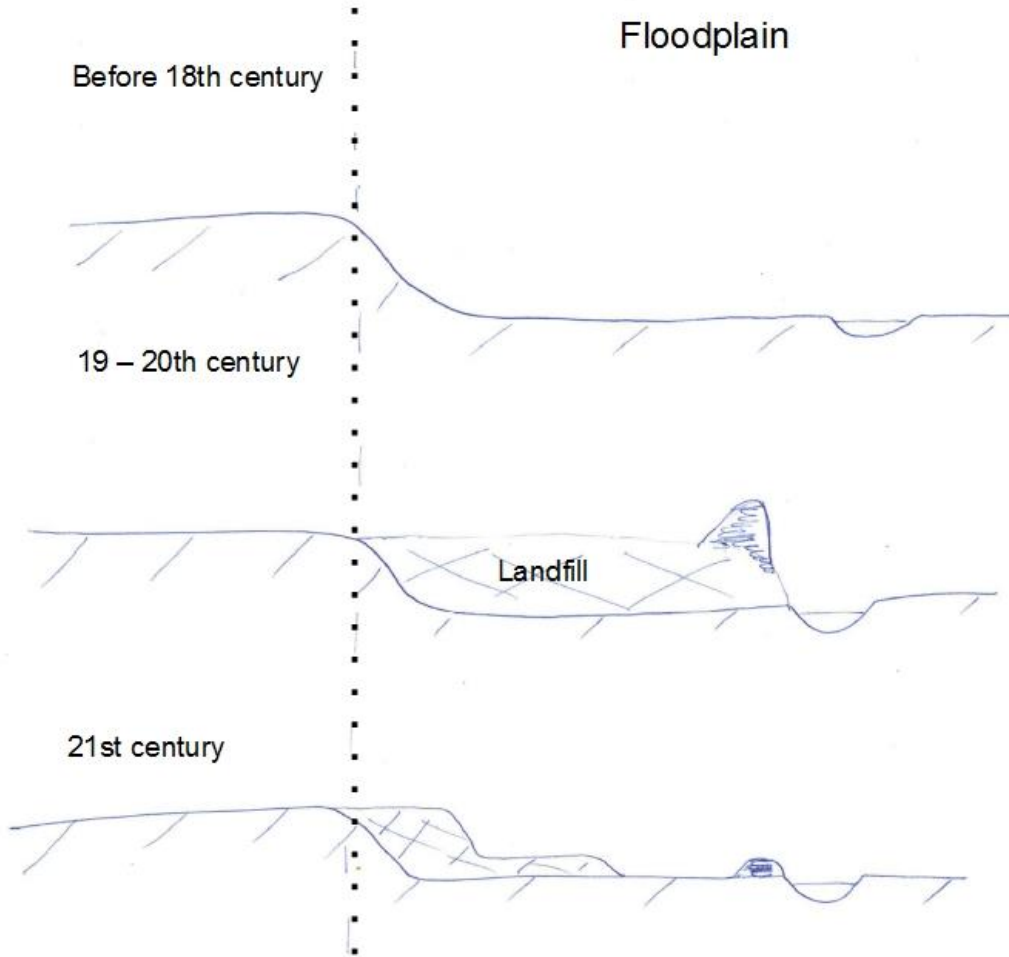
Fig. 2. Normal gradient array measurements.



Crédit photo : Ouest-France



Integrating Land(fills) and flooding protection

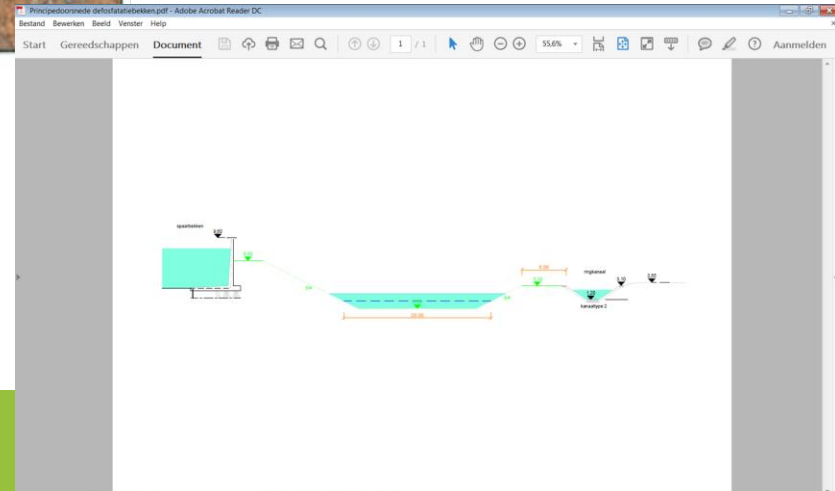
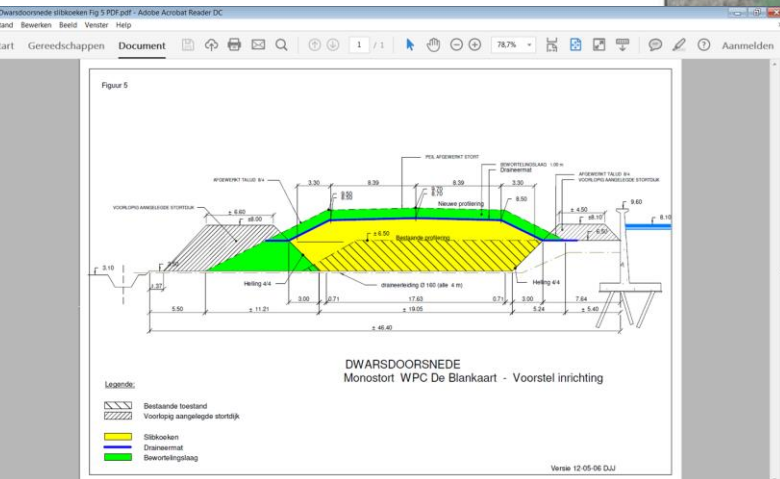


Reclaiming Land(fills)

15 Mono LF - Diksmuide



- ELFM-project :
- 100% valorization of landfilled waste;
 - 100% land reclamation;
 - Future use: phosphate recovery unit;
 - Drinking water production.



Sharing experiences

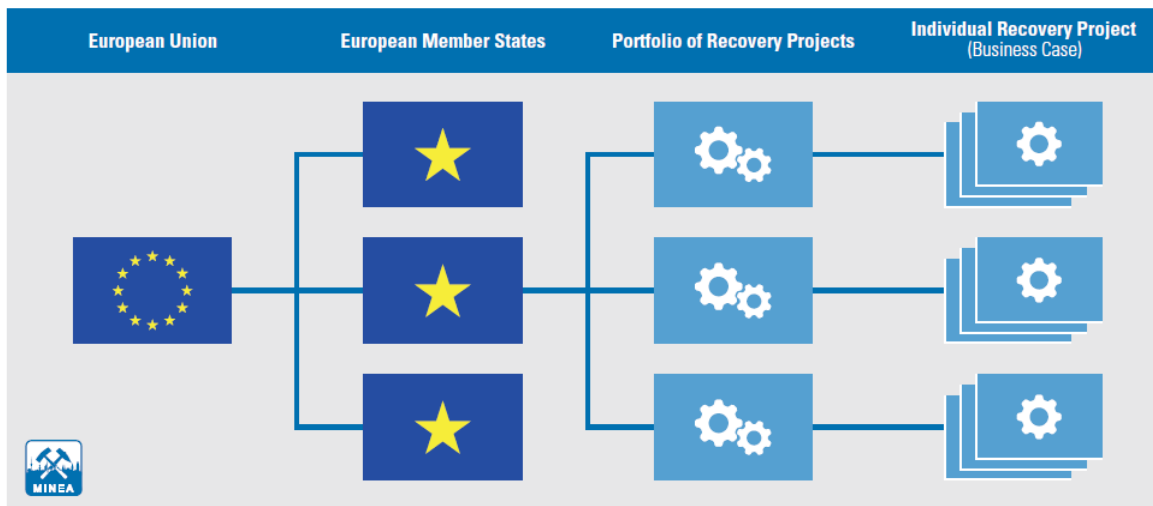
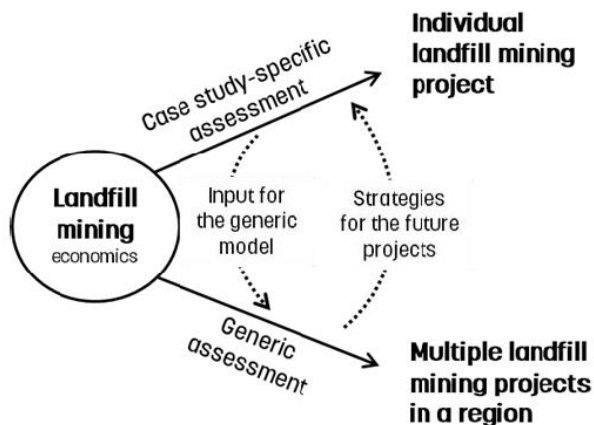


Figure 12. Illustration of the recommendations for the future use of economic assessments and their interactions towards a strategic development of cost-efficient LFM projects and directing future research.

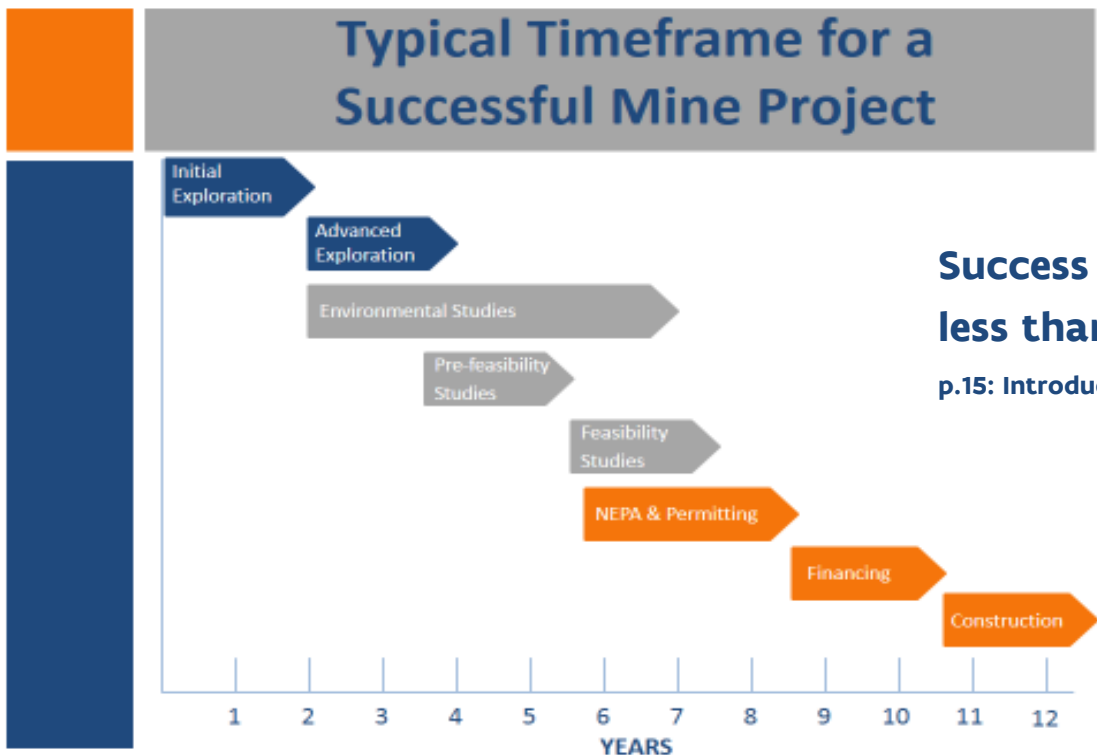
Uit: Economics of landfill mining. John Laurence Esguerra, April 2020. (New-Mine)
<http://new-mine.eu/>

FIGURE 4
Perspectives on different levels of anthropogenic resource management (courtesy of Eddy Wille, PublicWaste Agency of Flanders (OVAM)).

Uit: Strategic roadmap on sustainable management of anthropogenic resources. April 2020 (Minea)

<https://zenodo.org/record/3739164#.X3SNAO1cKUK>
<https://zenodo.org/record/3739269#.X3SOJ-1cKUK>

Timeframes & expectations



**Success rate of exploration :
less than a tenth of a percent is the norm.**

p.15: Introduction to mineral exploration. Ed. Moon, Whateley, Evans.

https://clu-in.org/conf/tio/NEPAandMining101-1_051216/

https://clu-in.org/conf/tio/NEPAandMining101-2_052416/

<https://slideplayer.com/slide/10266650/>

The myth of Orion, Cedalion



Servant Cedalion is leading the temporary blinded giant Orion to the light Eos.

The metaphor of dwarfs standing on the shoulders of giants (Latin: *nanos gigantum humeris insidentes*) expresses the meaning of "discovering truth by building on previous discoveries".

Isaac Newton in 1675: "If I have seen further it is by standing on the shoulders of Giants."

The myth of Orion, Cedalion



Decision Support Tool 1 : **Cedalion**

Easy to use application (no specific expertise required).

- Quick scan & overview

Decision Support Tool 2 : **Orion**

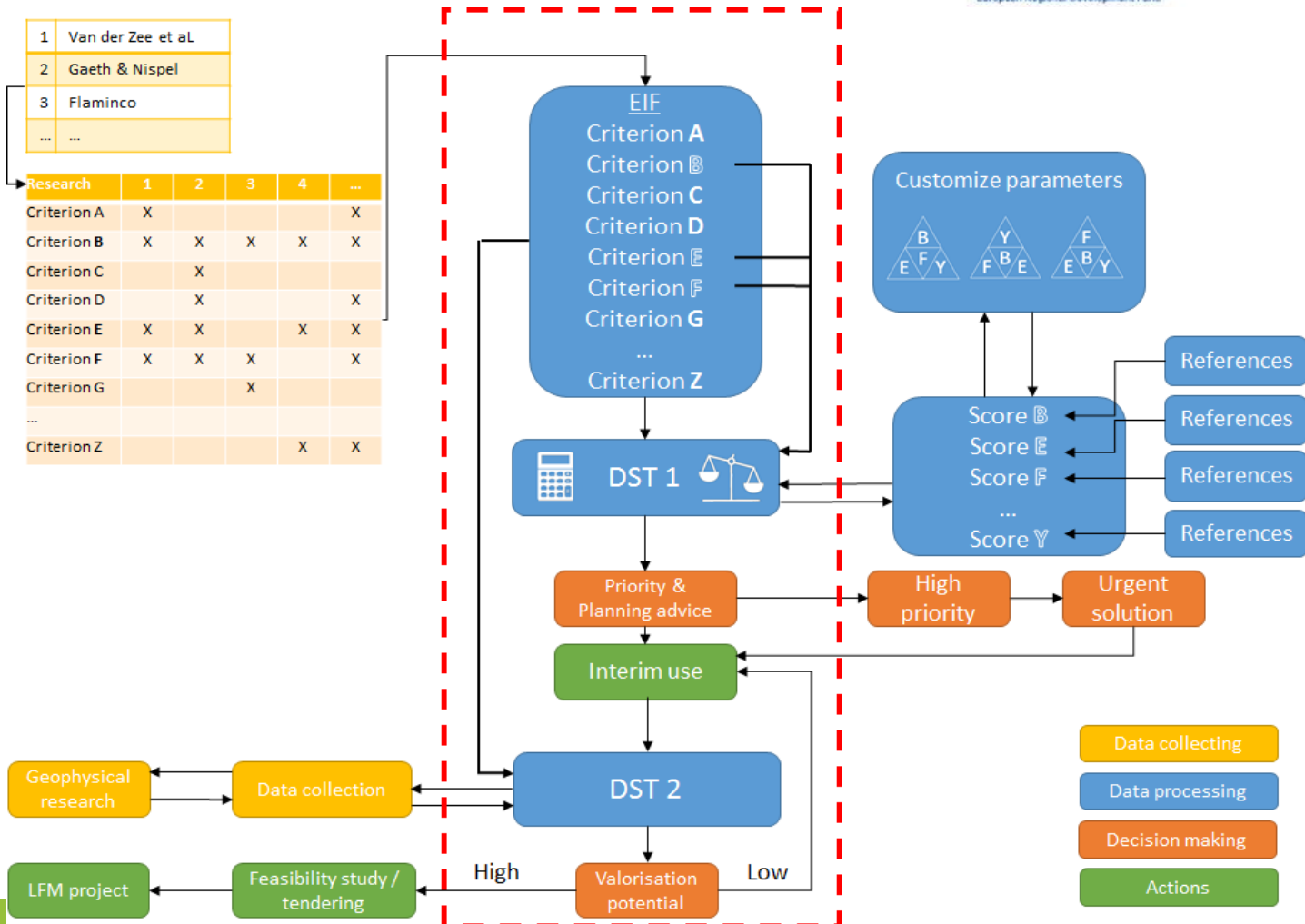
Roadmap and dashboard to facilitate detailed analysis by using specific tools (expert level required). Complex, only for most promising landfills.

- Ranking & preparation business cases

The myth of Orion, Cedalion

1	Van der Zee et al					
2	Gaeth & Nispel					
3	Flaminco					
...	...					

Research	1	2	3	4	...
Criterion A	X				X
Criterion B	X	X	X	X	X
Criterion C		X			
Criterion D		X			X
Criterion E	X	X		X	X
Criterion F	X	X	X		X
Criterion G			X		
...					
Criterion Z				X	X



Cedalion: the ranking tool

Principle: basic criteria will give a scoring on 4 main concepts.

- Waste to Materials (WtM)
- Waste to Energy (WtE)
- Waste to Land (WtL)
- Interim Use (IU)

Interreg RAWFILL

Cedalion-tool

Decision support tool to evaluate the Enhanced Landfill Mining Potential of landfills.

The aim of the RAWFILL methodology is to evaluate the landfill mining potential for the 4 scenario's Waste to Energy, Waste to Land, Waste to Materials and Interim Use.

Hereunder you can find a schematic overview on how the tool works. In the header of every sheet, you can find additional information on how to use the tool. The RAWFILL methodology is a re-evaluation of the FLAMINCO-methodology.

The general Cedalion database is delivered by a RAWFILL partner. To evaluate the potential for the landfills you are interested in, the data can be copied into the work database. To update certain information in the database, you are kindly asked to evaluate data during a site visit, to register the actual field situation more accurately.

```
graph TD
    A[Cedalion general database] --> B[Cedalion work database]
    A --> C[Data fieldvisit]
    B --> D[Updated work database]
    C --> D
    D -- "Compare data" --> E[Updated work database]
    E -- "x" --> F[RAWFILL scoring]
    F -- "=" --> G[ELFM potential]
```

Curious to discover the landfill mining potential? Follow the **guidelines** in the heading of the different sheets. Check out *Follow the advise of the Quick Response and share your information with the OVAM. Mail the sheets 'compare_field_data' and ... to the OVAM a*

Thank you for the contribution to a sustainable use of landfills!

RAWFILL partners.
OVAM, Les Champs Jouvault, Altrasol, Cleantech Flanders, Spaque
Bergischer Abfallwirtschaftsverband, British Geological Survey, Liège Université

Interreg North-West Europe
RAWFILL
European Regional Development Fund

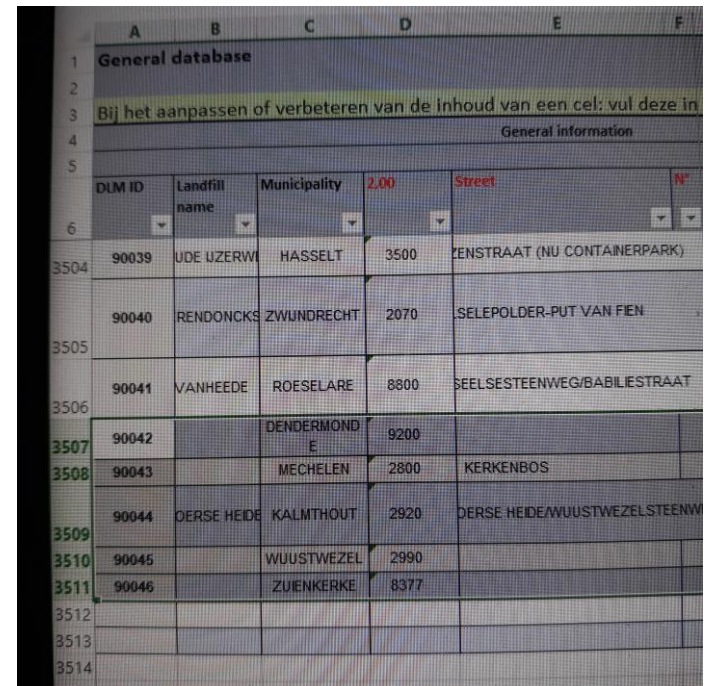
Introduction General_database Working_database Results_field_visit Compare_field_data ELFM_ranking ELFM_site

Cedalion: general database

- Capacity ? Huge : over 3.500 records in region of Flanders.

General database
 You cannot change the content of the general database. Do not manually copy data from general to worki

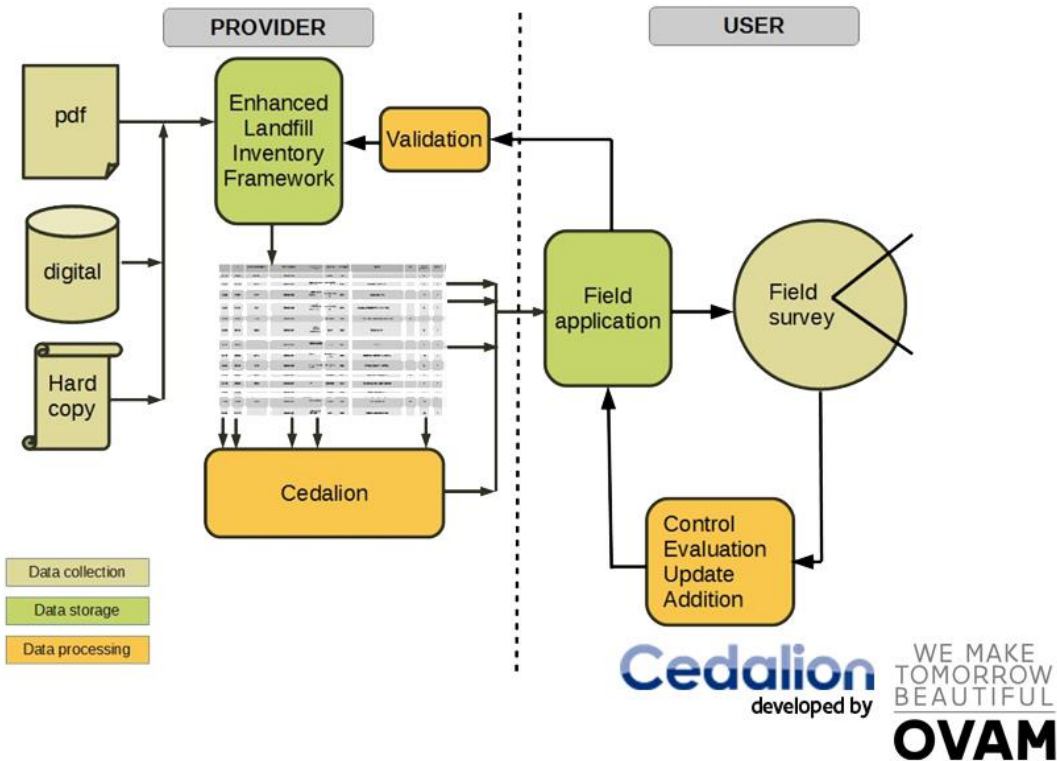
General information								
DLM ID	Landfill name	Municipality	Postal code	Street	N°	Cadastral codes	X coordinate	Y coordinate
1	LF1	Vlierzele	9520,00	Street 1	2		0	0
2	LF2	Rumbeke	8800,00	Street 2	32		64516,75	176360,53
3	LF3	HouTHALEN-HELCHTEREN	3530,00	Street 3	Z/N		0	0
4	LF4	Antw ERPEN	2030,00	Street 4	99		0	0
5	LF5	ANTWERPEN	2030,00	Street 5	5		0	0
6	LF6	Doel	9130,00	Street 6			0	0
7	LF7	GENT	9000,00	Street 7	50		0	0
8	LF8	Zw evegem	8550,00	Street 8	1		0	0
9	LF9	OVERUSE	3090,00	Street 9			157389,19	163106,69



General database					
Bij het aanpassen of verbeteren van de inhoud van een cel; vul deze in					
General information					
DLM ID	Landfill name	Municipality	Postal code	Street	N°
90039	UDE IJZERW	HASSELT	3500	ZENSTRAAT (NU CONTAINERPARK)	
90040	RENDONCKS	ZWINDRECHT	2070	SELEPOLDER-PUT VAN FIEN	
90041	VANHEEDE	ROESELARE	8800	SEELSESTEENWEG/BABILESTRAAT	
90042		DENDERMOND E	9200		
90043		MECHELEN	2800	KERKENBOS	
90044	OERSE HEIDE	KALMTHOUT	2920	OERSE HEIDE/WUUSTWEZELSTEENW	
90045		WUUSTWEZEL	2990		
90046		ZUENKERKE	8377		

Data management & Cedalion

Objective : Getting actors interested in landfills by providing information and viable options which they can evaluate and customize.



Cedalion: online questionnaire

- Application: smartphone, tablet, laptop,...
- Target: collect up to date info about the landfill, by doing a 360° prospection on site
- Output: mail with Excel-file
- Receivers: user of field app (and administrator)

Interreg RAWFILL outil Cedalion - Visite de site

Questionnaire à importer dans le tableur Cedalion

* Obligatoire

Information générale

1. DLM ID *

Comme mentionné dans la base de données "espace de travail"

2. Nom de la décharge *

Comme mentionné dans la base de données "espace de travail"

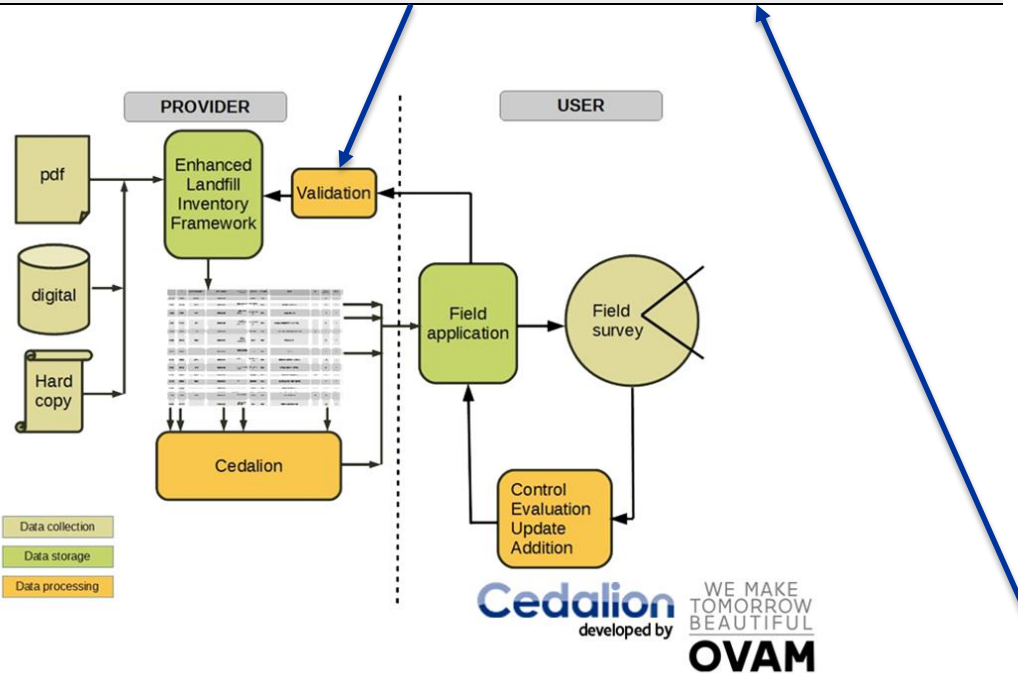
Suivant

Cedalion: online questionnaire

Results of the site visit

Please copy the results of your site visit here. An Excel table has been sent to your e-mail address, after submitting the form. If you haven't received

General information		Criteria 3 - Volume			Criteria 4 - Use			
DLM ID	Landfill name	Surface area (m ²)	Depth below ground level (m)	Height above ground level (m)	Type of cover	Surface conditions	Slope angle	Erosion
2	LF2	86000	4		2 Soil		Less than 15°	



Cedalion Survey Response for 8-IMOG

Van : Microsoft Power Apps and Power Automate
<microsoft@powerapps.com>

di 15 sep 2020 14:29

1 bijlage

Onderwerp : Cedalion Survey Response for 8-IMOG

Aan : eddy wille <eddy.wille@ovam.be>

Cc : donotsend@any.one

Externe afbeeldingen worden niet weergegeven. [Afbeeldingen onderaan weergeven](#)

Dear user,

Thank you for using the Cedalion tool developed by the RAWFILL project. To use the data acquired during your field visit, please follow the instructions:

1. Open the attached spreadsheet.
2. Paste the single row in the attached spreadsheet in on the Results_field_visit" sheet of the Cedalion tool.
3. In the "Compare_field_data" sheet of the Cedalion tool, press the button "Get data from field visit" to compare the data collected on site with the original data from your database.
4. If you want to update your database with the new data, change the content of the pale green cells and press the button "change fields in working database".
5. Start the ranking calculation.


A copy of your field observations have been also sent to the organisation managing the Cedalion in your region. These data will help them to update their database.

For more information regarding the RAWFILL project, please visit the [RAWFILL website](#).

Thank you again for using our tool,

The RAWFILL project partners.

If you want to unsubscribe from these emails, please use this [form](#).


RAWFILL Interreg NWE - Cedalion - Field visit results.xlsx
 23 kB

Cedalion: ranking sheet

Ranking per ELM scenario

Recalculate ranking

Ranking based on data in working database

Ranking Waste-to-Material

Minimum	46,0
Maximum	72,5
Average	63,9
Median	66,0

Ranking Waste-to-Energy

Minimum	44,0
Maximum	63,0
Average	52,6
Median	52,0

Ranking Waste-to-Land

Minimum	64,0
Maximum	106,3
Average	91,1
Median	95,5

Ranking Intermediate Use

Minimum	38,5
Maximum	63,0
Average	48,6
Median	45,0

Ranking per ELM scenario

Recalculate ranking

Ranking based on data

Landfil	WtM
4	72,5
5	72,5
3	68,0
6	66,0
9	66,0
1	65,0
7	62,0
8	57,0
2	46,0

Landfil	WtE
1	63,0
4	60,5
5	60,5
3	54,3
7	52,0
6	47,0
8	46,3
9	45,5
2	44,0

Landfil	WtL
6	106,3
4	106,3
5	106,3
7	98,7
9	95,5
8	91,0
3	85,3
1	67,0
2	64,0

Landfil	IU
1	63,0
2	58,0
9	56,5
7	52,3
3	45,0
8	44,7
6	40,7
4	38,5
5	38,5

Ranking Waste-to-Material

Minimum	57,0
Maximum	74,0
Average	67,0
Median	66,0

Ranking Waste-to-Energy

Minimum	45,5
Maximum	65,0
Average	54,9
Median	54,3

Ranking Waste-to-Land

Minimum	67,0
Maximum	106,3
Average	94,1
Median	95,5

Ranking Intermediate Use

Minimum	38,5
Maximum	63,0
Average	47,8
Median	45,0

Landfil	WtM
2	74,0
4	72,5
5	72,5
3	68,0
6	66,0
9	66,0
1	65,0
7	62,0
8	57,0

Landfil	WtE
2	65,0
1	63,0
4	60,5
5	60,5
3	54,3
7	52,0
6	47,0
8	46,3
9	45,5

Landfil	WtL
6	106,3
4	106,3
5	106,3
7	98,7
9	95,5
2	91,0
8	91,0
3	85,3
1	67,0

Landfil	IU
1	63,0
9	56,5
7	52,3
2	51,0
3	45,0
8	44,7
6	40,7
4	38,5
5	38,5

Viability of the LFM-Project

DST 2 is a tool in the evaluation process of a potential Landfill Mining Project.

Main Question :

Will the LFM-project be viable?

3 sets of criteria must be evaluated :

- Technical criteria. Is the project technically feasible?
- Socio-economic criteria. Is the project sustainable and economically viable?
- Information-quality criteria. Is there enough info to make a reliable evaluation ?

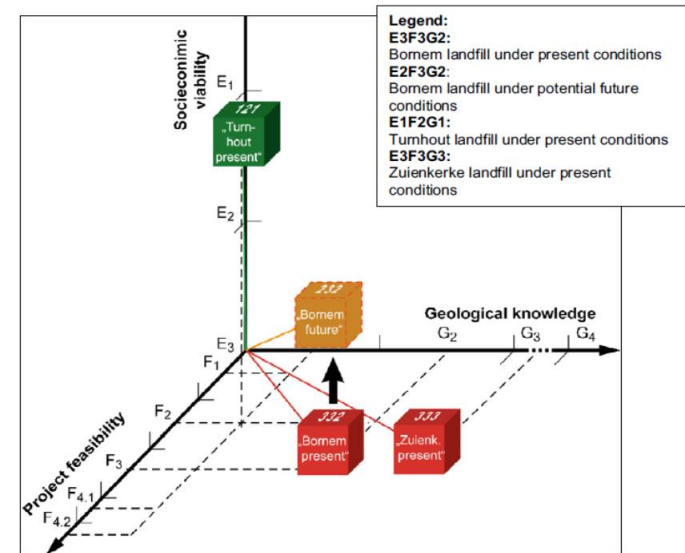
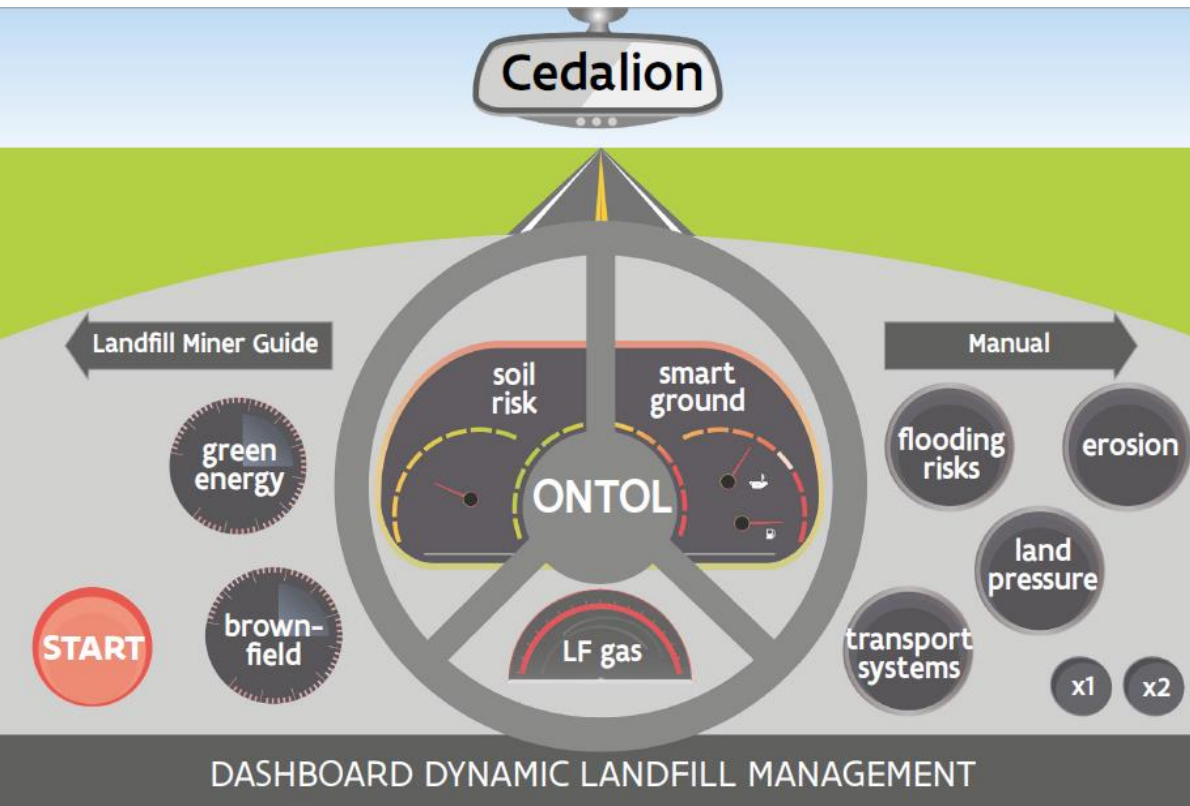


Fig. 6. Classification of the three landfill-mining projects under UNFC.

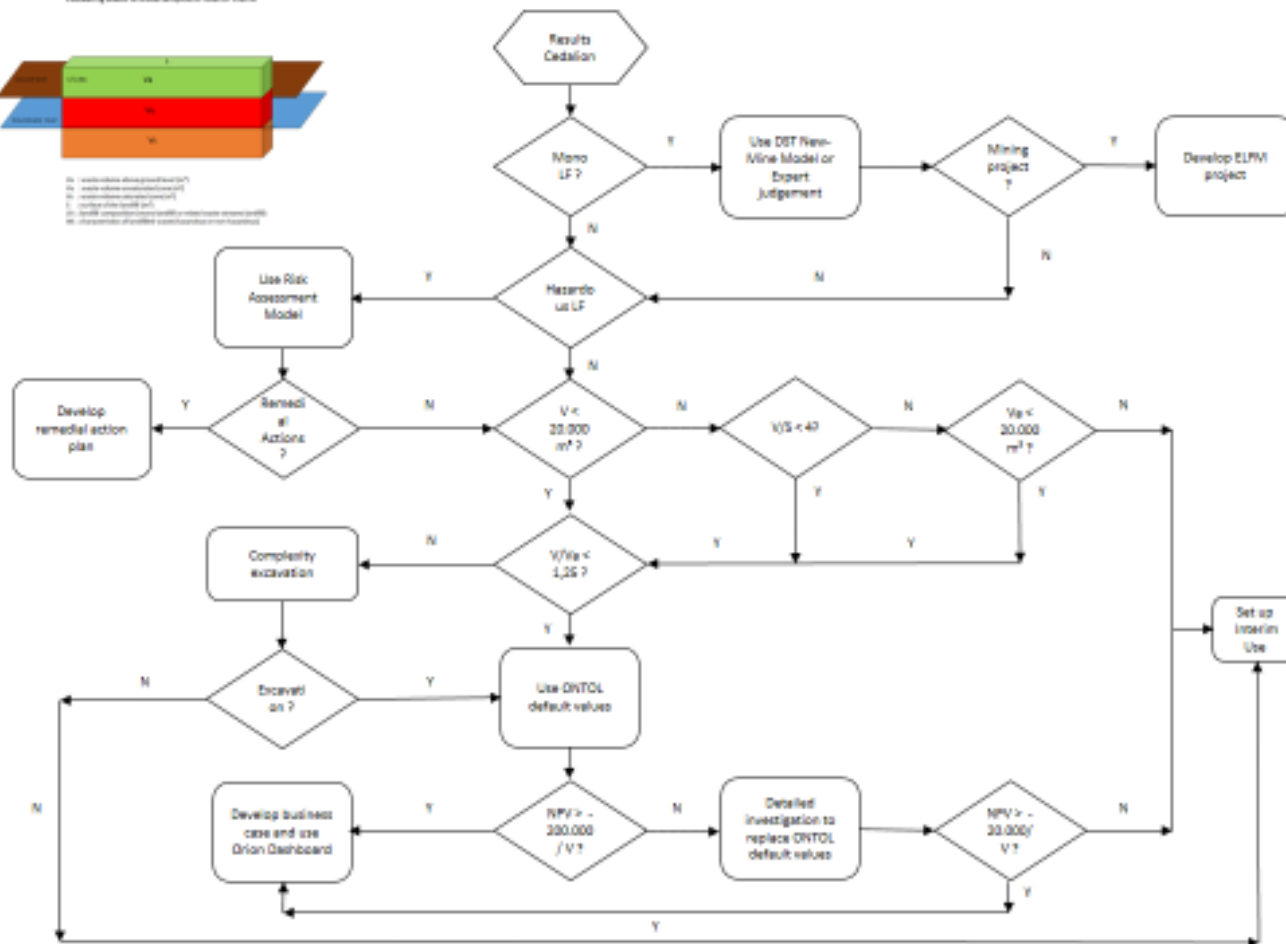
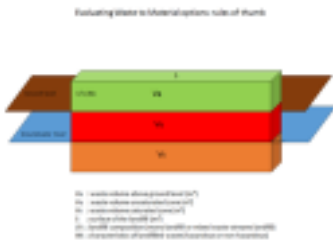
DST 2: optimizing good ideas



- Not reinventing the wheel but acting circular;
- Look back and use results of Cedalion;
- Dashboard offers you a set of valuable tools;
- Press start to take control and get customized info.

powered by

DST 2: optimizing good ideas



Select landfill with high scores in Ceditation.

Mono landfills indicate high grade content; prospective projects. Specific approach required unless small volume.

New-Mine aims specifically at Waste to Materials. Types of waste define viability.

If not feasible, use other criteria in flow chart.

Prevention of pollution remains essential goal. First step is defining risks and remedial actions.

If no remedial actions needed, investigate redevelopment potential of small volume landfills.

If larger volumes, low thickness might offer opportunities for evacuation of landfilled waste.

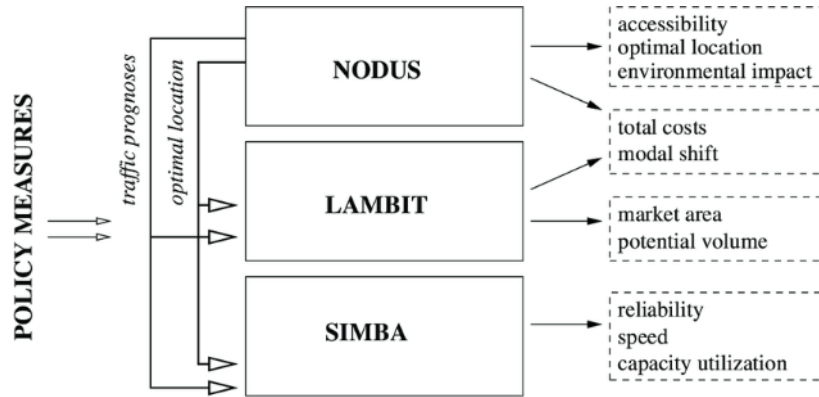
High volumes below ground level have negative impact on feasibility.

In order to lower costs, first assessment uses ONTOL default values. If losses lower than 200.000 euro/total volume, a business case is set up. The Orion Dashboard guides the users to relevant (free) models detected by Rawfill.

If losses are bigger, invest in more detailed research and refine the ONTOL-input.

Non-viable projects will be submitted to the analysis of Interim use.

Orion: assembling good quality



LANDFILL MINING DECISION TOOL



START

NOTES:
This tool allows the user to have a first understanding of the feasibility of mining a landfill, by estimating the net income of the project, as well as the social and environmental impacts. The user enters the characteristics of the landfill on the "user input" tab. The results are displayed on the "Results" tab. Also, the tool allows the estimation of the amount of Rare Earth Elements present in the landfill, as well as the potential value.

A tool developed by Camacho-Dominguez V., Pastre G., Tasiu A. and Val J.
Co authors: Coulen F. and Wagland S.

Brownfields Opportunity Matrix	Risk Mitigation of Contaminated Land and Groundwater		Soil Improvement
	Remediation (Includes Linear (sub)soil)	Water Remediation (Not/optional)	Remedy
Gentle Remediation Options	Phyto-remediation		
	Amendment Addition		
	Natural Attenuation		

A high level decision support tool designed to demonstrate the value and opportunities for redevelopment of a brownfield site for a soft re-use

Mouse over the top half of the box to get a description of the example

Click on the bottom half of the box to go to the example



RE-Powering America's Land



GasSim 2.5 available from February 2012

4-Results on resource classification of LFM project

	SNFV 3000 Euro/Mg	SNCI 600 kg CO ₂ -eq/Mg
E1	0	0
E2	-30	0
E3	-50	-30

Project status
F1 approved
F2 approval phase
F3 approval not started
F4 pre-exploration phase

Waste composition data
G1 very good
G2 medium

Figure 6: Simple Brownfield Opportunity Matrix Variant ©

Orion in detail: OnToL

Online Tool for the Evaluation of Landfill Mining Projects

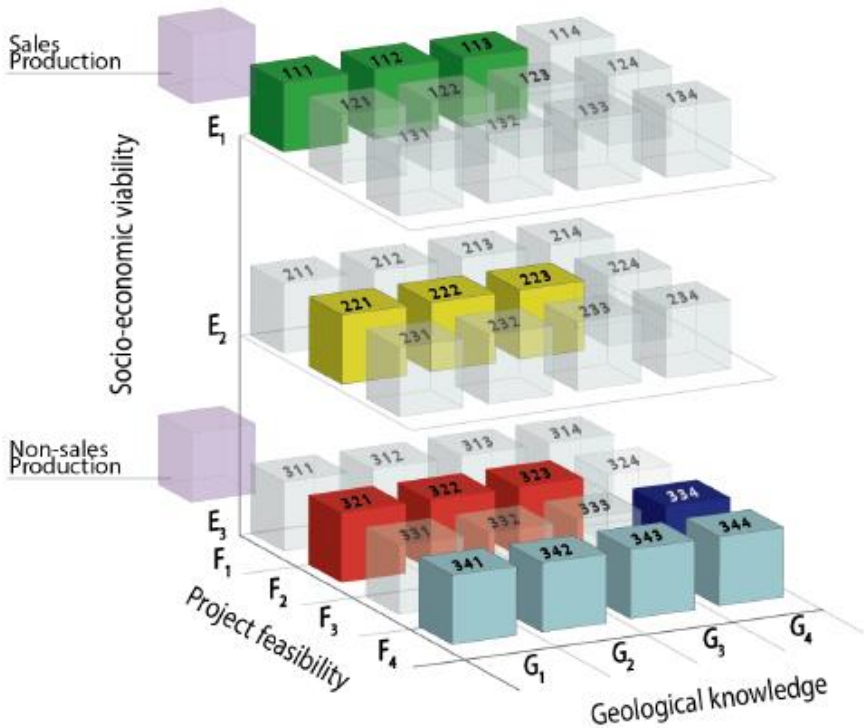










- **Rapid** environmental and economic **evaluation** of LFM- projects;
- Facilitating of further **prioritization of LFM-projects**;
- **Comparison of different scenarios** for implementing a LF-mining project;
- Streamlined format (e.g. agreed economic calculation methods; United Nations Framework Classification for Resources (UNFC))
- **Provision of default datasets** (e.g. waste composition, sorting technology efficiencies, waste-to-energy efficiencies, etc.; Orion provides guidance to more specific tools & models)
- screening assessments without the need for extensive data generation
 - Free software available at : <https://www.ovam.be/landfill-mining>

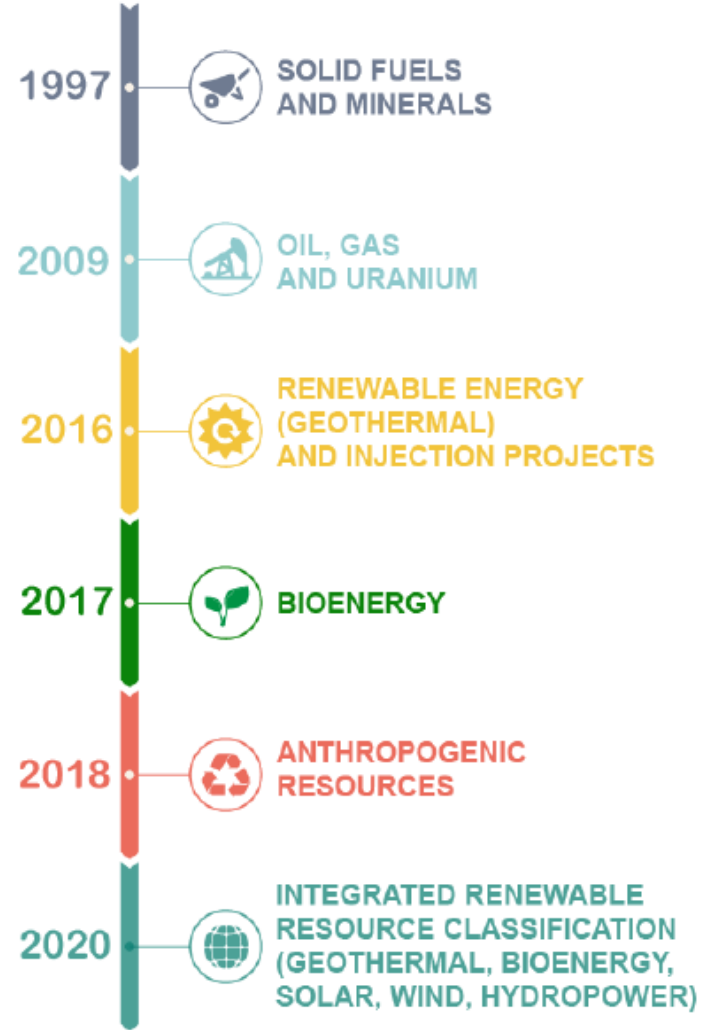
Ontol : developed by team of prof. Johann Fellner (Christian Doppler Laboratory for Anthropogenic Resources, TU Vienna - Austria), in collaboration with prof. David Laner (University Kassel - Germany) and Dr. Andrea Winterstetter (University Antwerp & VITO - Belgium). Co-Funded by OVAM (Public Waste Agency of Flanders - Belgium) & BMNT (Austrian Federal Ministry for Sustainability - Austria).

Classification of resources

A whole lotta Resources

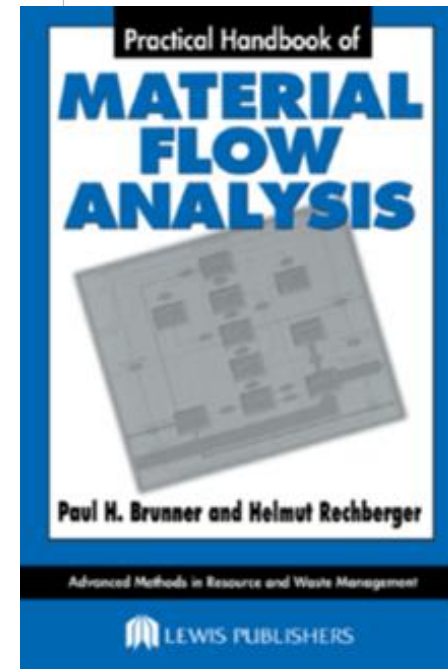
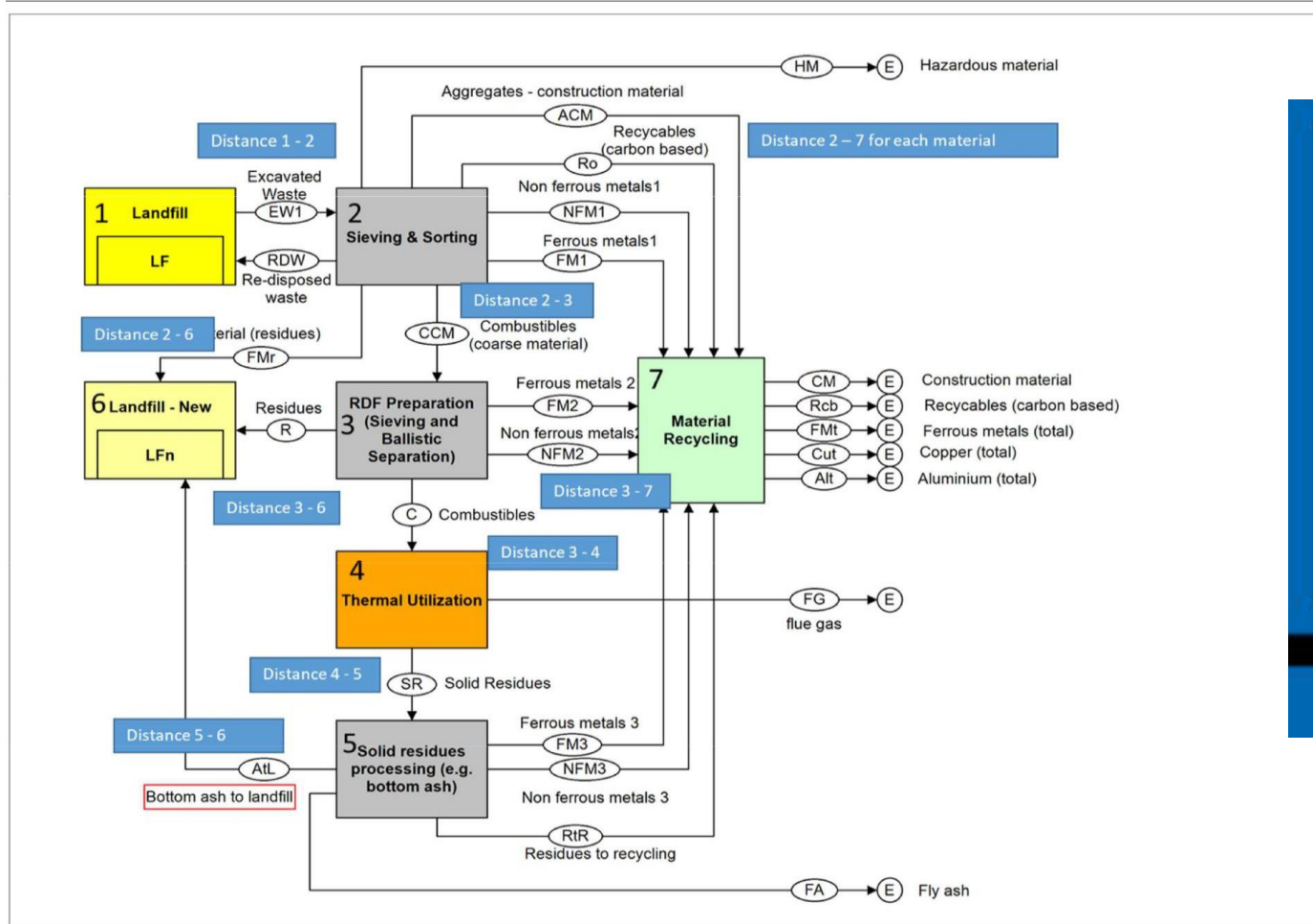


-  Commercial projects
-  Potentially commercial projects
-  Non-commercial projects
-  Exploration projects
-  Additional quantities in place
-  Other combinations
-  Extracted quantities
-  123 Codification (E1;F2;G3)

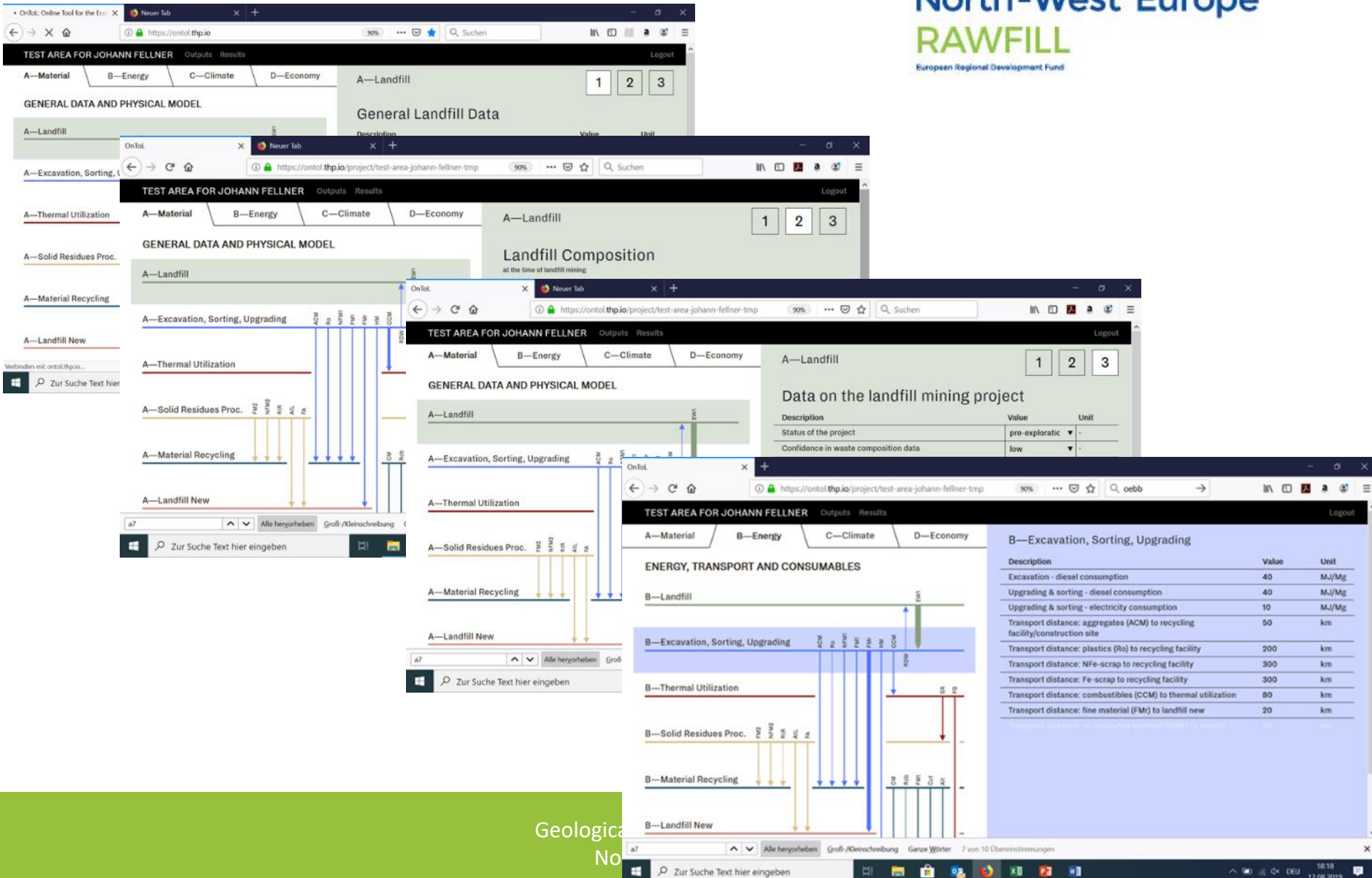


Growing Applications of UNFC

Standard MFA-scheme



Input & output of OnToL



The screenshot displays the OnToL web application interface, showing multiple overlapping windows for the 'TEST AREA FOR JOHANN FELLNER' project. The main window shows the 'GENERAL DATA AND PHYSICAL MODEL' for 'A—Landfill' with 'General Landfill Data' and 'Landfill Composition' sections. A table titled 'Data on the landfill mining project' is visible:

Description	Value	Unit
Status of the project	pre-exploratic	-
Confidence in waste composition data	low	-

Other windows show 'ENERGY, TRANSPORT AND CONSUMABLES' for 'B—Excavation, Sorting, Upgrading' with a table of values:

Description	Value	Unit
Excavation - diesel consumption	40	MJ/Mg
Upgrading & sorting - diesel consumption	40	MJ/Mg
Upgrading & sorting - electricity consumption	10	MJ/Mg
Transport distance: aggregates (ACM) to recycling facility/construction site	50	km
Transport distance: plastics (Ro) to recycling facility	200	km
Transport distance: Nfe-scrap to recycling facility	300	km
Transport distance: Fe-scrap to recycling facility	300	km
Transport distance: combustibles (CCM) to thermal utilization	80	km
Transport distance: fine material (FM) to landfill new	20	km
Transport distance: Fe-scrap (thermal energy) to incinerator	80	km

The interface also features a flow diagram on the left side showing material flows between different stages: A—Excavation, Sorting, Upgrading; A—Thermal Utilization; A—Solid Residues Proc.; A—Material Recycling; and A—Landfill New. The bottom of the image contains the text 'Geologica No'.

Input & output of OnToL


OnToL Results: Test Area for Johann Fellner X

https://ontol.thp.io/project/test-area-johann-fellner-tr

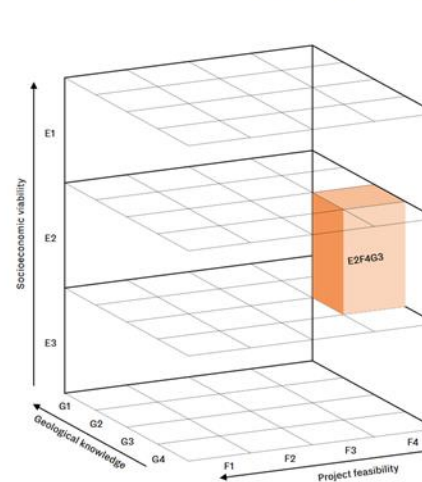
Final results

Description	Value	Unit
Net present value of costs	-5.59	Mio Euro
planning and permits	-0.065	Mio Euro
intermediate use	0.0	Mio Euro
landfill management - intermediate use	0.0	Mio Euro
purchase of site & installations	0.0	Mio Euro
excavation & sorting & upgrading	-1.43	Mio Euro
thermal utilization	0.0	Mio Euro
solid residues processing	0.0	Mio Euro
landfill & disposal	-3.74	Mio Euro
transport	-0.335	Mio Euro
landscaping, env. supervision & overhead	-0.0235	Mio Euro
Net present value of avoided revenues	0.0	Mio Euro
Net present value of revenues	1.62	Mio Euro
intermediate use	0.0	Mio Euro
landfill management - intermediate use	0.0	Mio Euro
electricity & heat from LFG	0.0	Mio Euro
electricity & heat from WIE	0.0	Mio Euro
materials	0.972	Mio Euro
recovered land	0.494	Mio Euro
recovered landfill space	0.0	Mio Euro
used machinery	0.155	Mio Euro
Net present value of avoided costs	0.0	Mio Euro
Total net present value of the project (TNPV)	-3.97	Mio Euro
Specific net present value (SNPV)	-39.7	Euro/Mg

Net present value of costs [Mio Euro]



4-Results on resource classification of LFM project



Socioeconomic viability

	SNPV -39.72 Euro/Mg		SNCI -0.11 kg CO _v eq/Mg	
	>=	<	>=	<
E1	0	∞	-	-
E2	-30	0	-	-
E3	-50	-30	0	∞
	-∞	-50	-	-

Project feasibility

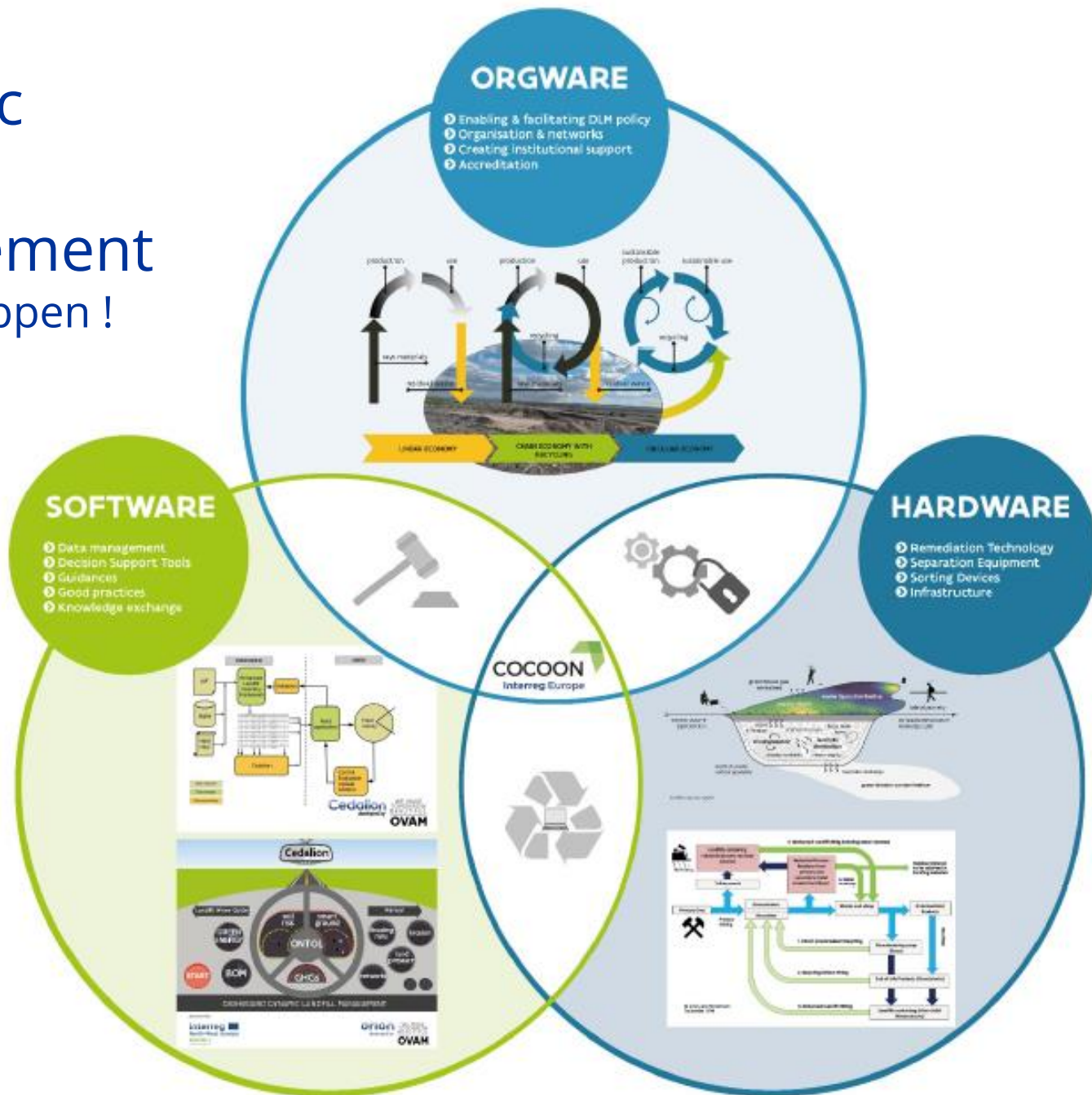
Project status	
F1	approved
F2	approval phase
F3	approval not started
F4	pre-exploration phase

Geological knowledge

Waste composition data	
G1	very good
G2	medium

Dynamic Landfill Management

Make it happen !



Dynamic Landfill Management

A summary



Interreg



EUROPEAN UNION

North-West Europe

RAWFILL

European Regional Development Fund

Thank you!