Barriers & solutions for reuse of contaminated land and soils Information-based Strategies for LAND Remediation Task 5.1 Defining barriers and potential solutions for reuse of cont...

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Barriers & solutions for reuse of contaminated land and soils

Document information

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Contaminated land, excavated soils, reuse of land, barriers to contaminated land remediation

Abbreviations and acronyms

Acronym	Description
BF	Brownfield
CoP	Code of Practice
DoW	Definition of Waste
EU	European Union
GA	Grant Agreement
GDPR	General Data Protection Regulation
ITA	ISLANDR Test Area
PPP	polluters pay principle
SRBLM	Sustainable and Risk-Based Land Management
WP	Work package

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Introduction

ISLANDR in brief

ISLANDR, Information-based Strategies for Land Remediation, is a multidisciplinary project, which is aimed at supporting the implementation of the EU mission: A Soil Deal for Europe. The ISLANDR research activities are designed to provide tools and methods to support: (1) the delineation of polluted soils across Europe, (2) an evidence-based assessment of the risks posed by polluted soils, (3) the promotion of sustainable and risk-based land management practices, (4) the inclusion of a wider economic values in investment cases, and (5) a closer integration of land contamination and spatial planning decision-making. Lessons learnt and experience gained throughout the project duration will be used to (6) deliver key policy-relevant findings related to the Soil Strategy, the proposed Soil Monitoring Law, and other areas of policy where soils are crucial.

To road-test the project's findings, seven test areas across Europe have been identified. The ISLANDR Test Areas (ITAs) will provide a real-world context for the planned research activities. The ITAs have been selected to cover different land use types, such as urban, peri-urban, rural, agro-forestry, mining and coastal areas. Furthermore, the ITAs are characterized by both point and diffuse sources of pollution, and by different soil pollution types, such as organic, inorganic, as well as contaminants of emerging concern.

ISLANDR brings a focus to low input remediation, by including ITAs impacted by the consequences of the green transition, such as former mining areas. This will ensure that soil remediation will be facilitated even when the cost of remediation is economically marginal or may even be negative. On the one hand, this necessitates a more thorough understanding of low input remediation approaches from a technological perspective, yet it also requires a wider value proposition for investment cases and financial planning.

Key actors, stakeholders and end-beneficiaries in the ITAs will provide feedback and offer insights to the robustness and effectiveness of the so-called ISLANDR Roadmap (Figure below), and its building blocks, which contain of strategies, frameworks and decision-support tools, and the wider valuation approaches and financing mechanisms to be developed over the course of the project's lifetime. The ITAs are foreseen to bring an iterative feedback loop to the research process, and to ensure the wider uptake of the project's outcomes and achievements.

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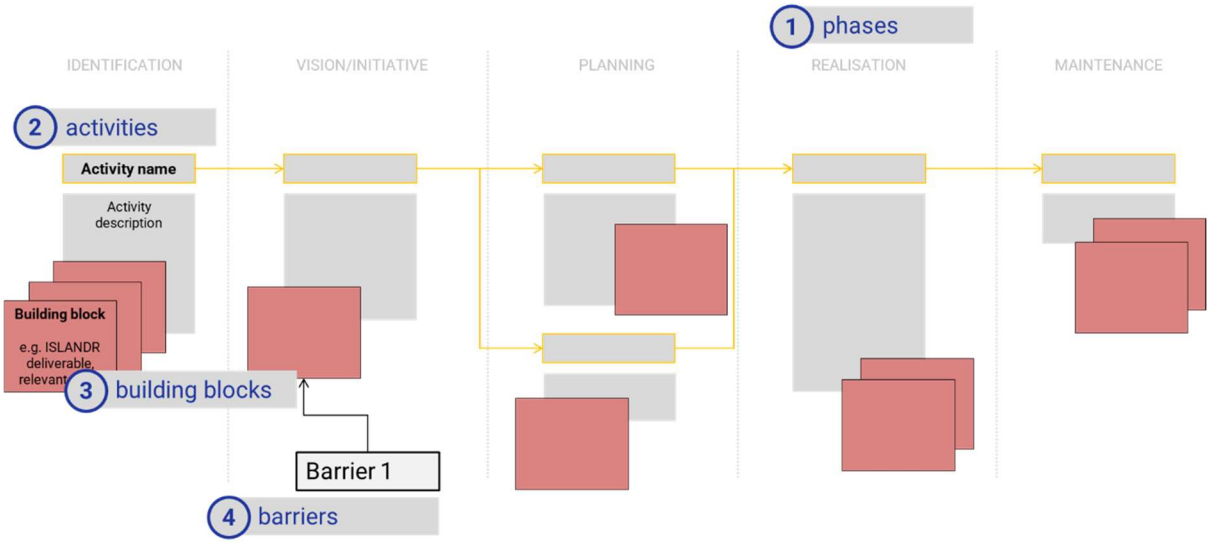

Figure: Impression of the ISLANDR Roadmap

The ISLANDR Roadmap guides different actor groups actors involved in the remediation and redevelopment of contaminated and brownfield land. It contains 4 user stories (single sites, identification of sites, diffuse pollution, portfolios of sites.). the roadmap contains for each of the phases of remediation and redevelopment typical activities for the user group and attached to those the different building blocks (instruments, check lists, decision support tools etc) as developed by ISLANDR.

The barriers and solutions for reuse of contaminated land and soils

WP5 in ISLANDR "Spatial planning models, prioritization and approaches for contaminated soil and land reuse" proposes strategies to promote remediation action and reuse of both land and soil (WP5). This report covers the first step in this WP: to make an overview of barriers for the reuse of land and strategies for maximizing the reuse of excavated soils, based on existing schemes for soil reuse.

Two tasks in this WP5 have been dedicated to identify these barriers and solutions, described below.

Task 5.1 Defining barriers and potential solutions for reuse of contaminated land and soils
The overview of the technical, financial, social, institutional and economic barriers is made by desk research and elaborated with relevant actors, including from the ISLANDR Test Areas (ITAs). Among the main aims of the ITAs is to retrieve best practices and find barriers for implementation of these best practices and ways to overcome them. For example: ISLANDR believes that Sustainable and Risk-Based Land Management (SRBLM) is a solution here (ISLANDR 2024[1]). While SRBLM is widely recognised and supported, its implementation into practice is highly variable across Europe, and even within countries.

[1] ISLANDR: Paul Bardos, Lisa Pizzol, Linda Maring, Begoña Arellano Jaimerena Jenny Norrman, Jennifer Hellal, Lorik Haxhiu, Nazaré Couto, Virginie Derycke, Kirsti Loukola-Ruskeeniemi, Timo Tarvainen; Juha Kaija, Joris Crynen, James Baker (2024) Sustainable and risk based land management – a briefing about the current state of practice and suggested future direction of travel ISLANDR Project DL3.1 31 May 2024 DOI: 10.13140/RG.2.2.19656.33283

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The main barriers to its wider adoption are the challenge of technical capacity building for many practitioners, as well as a belief that somehow sustainable remediation means the remediation will not deal with risks. ISLANDR also contributes to innovative financial instruments, that are required to boost remedial action in the field. A better understanding of the financial, legal and institutional barriers and potential solutions, as well as the gains and losses for the society of decontamination strategies, can support the development of new innovative financial models that can promote remediation in practice.

Task 5.2 Strategies for maximizing the reuse of excavated soils
Large amounts of soil are excavated across Europe as a result of construction and other development projects, at the same time soil and soil components (such as sands) are excavated as virgin materials for applications in e.g. agriculture, construction, horticulture, and landscaping. While some soil is re-used, often there is a failure in circular economy thinking with excavated soil, which is often almost automatically being designated as a waste. This thinking is sustained by the Waste Framework Directive, and its subsequent Case Law, where excavated soil is often interpreted as a waste. Several countries have pioneered soil re-use schemes to facilitate administrative and regulatory conditions for soil treatment and re-use. ISLANDR has reviewed these pioneering schemes and the general context for excavated soil re-use across Europe and developed a template for replicating these soil re-use supporting schemes in other countries and regions.

This deliverable and next steps

This deliverable contains two distinct parts.
Part A covering the work done in Task 5.1 Defining barriers and potential solutions for reuse of contaminated land and soils and;
PART B reporting Task 5.2 Strategies for maximizing the reuse of excavated soils.

It was decided to split up this deliverable in 2 parts because the results of these tasks reflect two separate building blocks for the ISLANDR Roadmap (Figure above). The barriers and solutions focus more on the earlier stages of remediation and redevelopment: the vision/initiative phase. The strategies for maximizing the reuse of excavated soils are of more relevance in the planning phase.

In the next steps for the work on these two topics, further consultation with the ITAs will be done by the ITA and consortium partners to further supplement the material for both PART A and B. For PART A the focus lies on linking solutions to the defined barriers by consulting the different ITAs. For PART B, an open online survey is being transmitted via key stakeholder networks across Europe in parallel with an open consultation on the template which has been developed. The outcomes of the survey will be used to support a cross-cutting review of systems for soil re-use across Europe and their potential for replication in Europe to be submitted to an open access journal. The consultation outcomes will be used to setup a final “Operational Template for Administering Soil Reuse Schemes”.

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This deliverable will be made publicly available. The further evidence base for both Part A and B is planned to be published in open access papers. For both parts A and B, guidance documents will be published as ISLANDR Roadmap building blocks, and links to the open access journals as supporting information.

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PART A

Task 5.1: Defining barriers and potential solutions for reuse of contaminated land and soils

1. Introduction

1.1. Objectives

The objective of this study is to identify (technical, financial, legislative, institutional, social) barriers and potential solutions for sustainable decontamination and reuse of contaminated sites and regions.

2. Method and Results

2.1. Context descriptions of land remediation and regeneration

Countries are different in terms of regulations, institutions, etc. regarding land remediation and regeneration. Therefore, it was deemed necessary to describe the context of each country in different countries/ITAs. This was achieved through the creation of a structured template containing questionnaires, primarily focusing on general perspectives, to describe the legal, institutional, and financial/economic frameworks. The developed template was discussed and agreed upon by all involved partners. Subsequently, it was disseminated to country/ITA representatives for their input, facilitating the compilation of responses pertinent to each respective country/ITA. Data was collected from Finland, France, the Netherlands, Greece, Sweden, Poland, Portugal, Italy, Belgium, the United Kingdom and Kosovo. The summarized questionnaire data is presented in Appendix A1: Questionnaire used in the collection of information for land remediation context description for reference.

The context description uses the Cabernet A-B-C division (Cabernet, 2006), where A sites have relatively low reclamation/redevelopment costs and a high value after reclamation, and C sites have high costs for reclamation and a relatively low land value (Figure 1**Error! Reference source not found.**).

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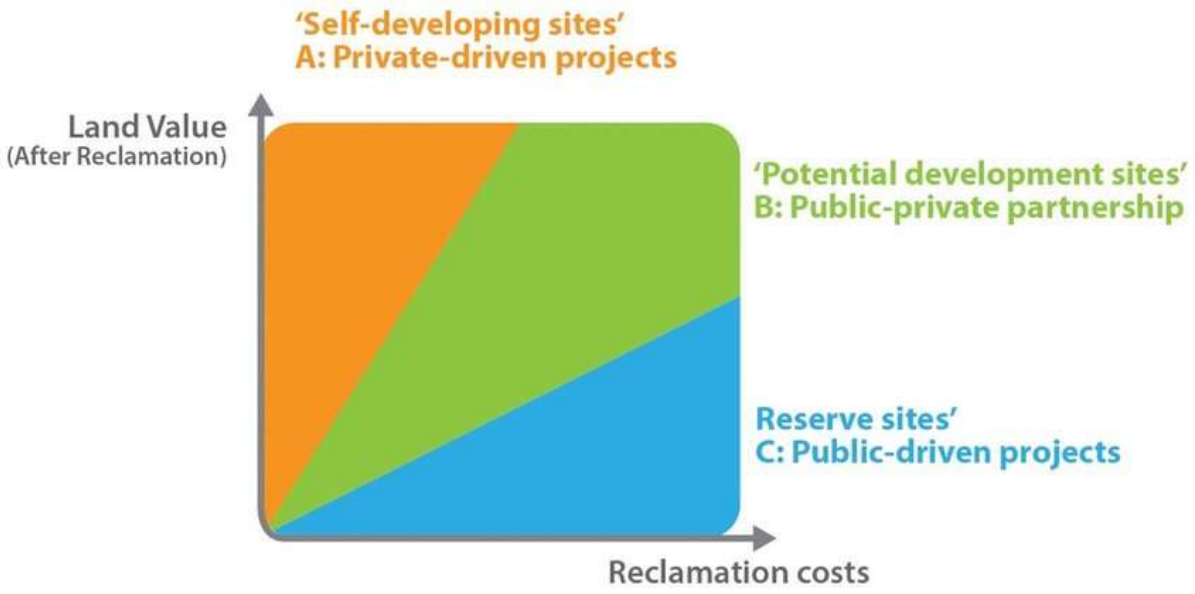

Figure 1 A-B-C sites (Cabernet, 2006)

The context descriptions present how land remediation and regeneration is organized in different countries in terms of institutional, legal, and financial/economic setup. The information provided by country/ITA representatives shows that the frameworks of land remediation are organized differently in the countries/ITAs in this study. However, there are some similarities in frameworks, e.g.: i) the "Polluter Pays Principle" (PPP) is applied in all the countries; ii) the classification of contaminated sites into A-B-C sites according to Cabernet (2006) is established in France, the Netherlands, Belgium (on a regional and local level) and UK, while in Portugal classification distinction is reported only for A and B sites, Italy, Sweden and Poland report only for A sites, while in Finland, Kosovo and Greece there are no classification distinctions between A-B-C sites; iii) except for France, there are no separate regional and local laws and regulations (Appendix A2-A4 provide details). The contexts of land remediation and regeneration for each country are described below.

2.1.1. Finland

Institutional context: The public authorities for soil contamination are at the national level The Ministry of the Environment and at the regional level, The Centres for Economic Development, Transport and the Environment (ELY Centres). The Ministry of the Environment develops legislation for contaminated sites, directs and finances national projects and programs (i.e., Soil Remediation Program). At the regional level ELY Centres act as the state's supervisory authority and are responsible for providing advice on contaminated sites and processing remediation notifications and decisions. Helsinki and Turku are exceptions: in these cities the jurisdiction is transferred to the city's environmental authority which acts as a local authority on contaminated soil sites instead of ELY Centres. The Regional State Administrative Agencies (AVI) act as permit authorities for the remediation of soil or groundwater and the treatment, reuse or landfilling of soil waste in the cases specified in the legislation. The municipal environmental authorities act as supervisory and permit authorities regarding treatment of soil waste, when treatment is out of the AVIs' competence.

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The municipal health protection authorities decide, among other things, on restrictions on the use of areas and on the usability of drinking water. The Finnish Environment Institute (Syke) supports the ministries in the development of national regulations, strategies and guidelines as well as implementation of EU regulation in the national legislation and implements national and international research and development projects related to contaminated sites. Syke is also responsible for the maintenance and development of the National Database System for Soil (MATTI database), while the ELY Centers are maintaining and updating their regional site data in the System. The state and municipalities use the MATTI database in the context of, e.g., groundwater and water body protection, land-use planning, prioritization of sites to be remediated and reporting to EU.

Legal context: In Finland, regulations for land remediation are the same at all levels (i.e. national, regional, and local levels) and include regulation of environmental contamination (including soil and groundwater) which is integrated in the Environmental Protection Act (EPA 527/2014) and the mandatory risk assessment protocol included in the Decree on the Assessment of Soil Contamination and Remediation Needs (VNa 214/2007). Public participation is required during the processing of the environmental permit, especially where remediation is associated with land use planning. During the process of environmental permitting, the people whose rights or interests are affected are given the opportunity to object to the matter. Parties, other than those concerned, shall be offered the opportunity to express their opinions. When preparing the local master plan, the landowners and those whose housing, work or other conditions may be significantly affected by the plan must be informed, as well as the authorities and communities whose field of activity is being discussed in the planning (participatory), to provide them with the opportunity to express their opinion on the matter (The Land Use and Building Act 62).

Financial/economic context: Remediation of sites is financed by the responsible party (i.e., polluter, the owner of the property, site developer or municipality). The state bears the remediation cost (including investigation), in pursuance to the Act on supporting the cleanup of contaminated areas (Act 246/2019, 6), if: i) the polluter cannot be identified or held accountable or is unable to bear the cost of the remediation and ii) investigating or cleaning up the contamination is clearly unreasonable for those parties that are not responsible for it (orphan sites).

2.1.2. France

Institutional context: For A, B and C sites, the ministry in charge of environment has national responsibilities for land remediation and initiates remediation via the department for the prevention of risks (DGPR). At the regional level, the ministry in charge of environment is supported by regional environmental authorities such as the Regional Directorate for the Environment, Planning and Housing (DREAL). The Geological and Mining Research Bureau (BRGM) and the Regional Health Agency (ARS) provide technical support to DREAL in the remediation of A, B and C sites. At the local level, competent authorities depend on the type and level of contamination.

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For A-sites, if the site is registered as a high environmental priority site (ICPE in French), the remediation is supervised by DREAL. Requisite public authorities intervene for B-sites that have no viable private operator (i.e., in the case of bankruptcy) while remediation of C-sites is handled by the French Environment Agency (ADEME).

Legal context: In France, the environmental code and regulations on waste govern land remediation. The main regulations include Articles L. 512-6-1, L. 512-7-6, L. 512-12-1, and L. 556-3. These national regulations are enforced by competent authorities such as the Prefect (regional representative of the state) for ICPE sites and the local Mayor. Currently, there are no regional or local regulations for land remediation. The requirement of public participation does not apply directly to land remediation, instead, public participation is required for spatial planning where the public is given a fixed timeframe to either provide comment or give objection. Additionally, public participation is required for the so-called "Public Constraints' imposed by environmental authorities on contaminated land and where free use would generate exposure and risk.

Financial/economic context: Polluter financed remediation of all sites (A, B and C) where the polluter is known. In some cases, liability can be transferred to another party through a contract. Where the polluter cannot be identified or held accountable, the French Environment Agency (ADEME) takes on the remediation for orphan sites (e.g. old mining sites). The "Brownfield Funds" serves as national incentives to encourage land remediation and to improve soil health.

2.1.3. The Netherlands

Institutional context: The framework of land remediation is organized at national, regional, and local levels. Although at each level, public authorities and institutions are responsible for land remediation and regeneration, the main responsibility lies at the municipal level. The Netherlands uses a system based on urgency of the remediation (risk-based). At the national level, the ministry of infrastructure and water management oversees all urgent remediation, while other sites are facilitated by an agency of the ministry (Bodem+) with a helpdesk for anyone with remediation and soil related questions. Also, SIKB and NEN give technical and practical rules and regulations. At the regional level, the provinces are responsible for historical groundwater pollution. The municipalities are currently competent authorities for all land remediation cases at the local level except for specific sites that are assigned under the transitional law under the Environment and Planning Act. These sites remain under the responsibility of the provinces. The municipalities can ask regional environmental executive services to reinforce.

Legal context: There are different laws and regulations at all three levels (national, regional, and local). Since 1 January 2024 the Environment and Planning Act has been in force, this act replaced the Soil Protection Act, the Decree soil quality and the Water Act and Soil Quality Regulation. In addition to the national laws and regulations, provinces and municipalities regulate land remediation at regional and local levels respectively.

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In the Netherlands, the polluter pays principle (PPP) is applied, but when the polluter/s cannot be identified, then the remediation and restoration of contaminated land become the responsibility of the municipality. This is according to the new Dutch legislations (the Environment and Planning Act).

Financial/economic context: Remediation for contaminated sites are financed by known polluter/s provided the contamination is after 1987. In general, all contaminated sites before 1987 are financed by the national government and between 1975 and 1987, the national government pays provided it is evident that the buyer was unaware of the contamination. In the case where the polluter cannot be identified, the national government takes the responsibility through the regional or local authorities. The national government provides financial incentives for land remediation and regeneration. Additionally, there are knowledge programs which support remediation.

2.1.4. Sweden

Institutional context: Several public authorities and institutions are involved in the handling of contaminated sites in Sweden. Sites are not officially categorized as A, B or C sites as defined in Timbre (2013). Instead, sites are typically categorized according to what is the driving force of land remediation: Exploitation (change of land use), Enforcement (an identified site owner is responsible by law) and Government Grants (no responsible part and no or low exploitation potential). Exploitation as a driver is typically valid for A-sites, whereas the categories Enforcement and Government grants can be both B- and C-sites.

At the national level, the Swedish Environmental Protection Agency (Swedish EPA) serves as an administrative unit and issues guidance documents and soil guideline values to address the risks posed by soil contaminants to human health and the environment. The guidance documents are typically produced by external parties upon request by, and under supervision of, the Swedish EPA. These guidelines need to be updated regularly when new knowledge is available, otherwise, they risk becoming barriers to land remediation. The Swedish Geotechnical Institute (SGI) supports both the Swedish EPA, as well as regional and local controlling authorities with expert support and conducts research and development (R&D) internally, as well as funds R&D in a national funding programme (Tuffo). The Geological Survey of Sweden (SGU) can take on the responsibility for complicated sites with no responsible part (in the category Government Grants) as those otherwise would have had to be managed by a local municipality, which may lack the capacity for managing such projects. At the regional level, the 21 County Administrations act as a controlling body by reviewing sampling plans, risk assessments and remediation strategy selection processes, given the remediation project is being handled by SGU or the local municipality. The County Administration also oversees the allocation of government remediation grants and decides which sites in the region are prioritized and each municipality has to apply for grants from the County Administration. The prioritization is based on a national inventory of all potentially contaminated sites, where each site is allocated a risk class (1 – 4, 1 is the highest risk class) according to the Method for Inventorying/Investigating Contaminated Sites (*in Swedish: Metodik för inventering av förorenade områden MIFO*).

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The national inventory is an open database and contains about 85,000 potentially contaminated sites, although not all of them are allocated to a risk class. At the local level, the 290 municipalities act as a controlling authority and their responsibilities are the same as those for the County Administration. Both municipalities and the County Administrations can ask for expert support from SGI.

Legal context: The polluter pays principle (PPP) is applied in Sweden: when the polluters are known, they bear the financial responsibility of remediation. The environmental legislation is retroactive back to 1969, therefore, a known polluter who is no longer the landowner is still held accountable and thus responsible for the site and its potential clean-up financially. A 'liability investigation' is a typical step to identify the responsible polluter. The environmental code, which governs land remediation, applies to the national, regional, and local levels. This means that land remediation in Sweden is regulated in the same way across the country. Public participation comes in during spatial planning. According to the Build and Plan Act, land must be suitable for the intended use. The municipality, which has a planning monopoly in Sweden, is responsible for ensuring that the land is suitable for the land uses specified in the legally binding detailed plans. In practice, this often means that a site needs to be remediated before a new detailed plan can be enforced to ensure that the level of contamination is in line with the planned use. This can sometimes create a barrier as it introduces a financial risk for exploitation companies because they are required to invest in site investigation and remediation before knowing that the intended land use plan will be approved. Also, exploitation companies typically incentivize intensive excavation remediation to fully remove the source of contamination and potential future liability. This is often solved by adopting a detailed plan with a specific requirement to remediate the land to the extent needed for the new land use.

Financial/economic context: Although the PPP is retroactive to 1969 and is applied to all sites, A-sites may be acquired by developers who can upgrade and sell the land for profits. For sites B and C, where the polluter is known but has a low financial capacity to carry out the remediation, the controlling authorities enforce action. This process is often slow, especially where it is complicated ownership with several different parties that each have some responsibility and there is a juridical process to clarify who is responsible for what. When a polluter cannot be identified, and the site contamination is not too complicated, the municipality in which the site is located takes on the responsibility for managing the remediation project of both A, B, and C sites. B- and C-sites typically require the municipality to apply for funding from the national funding program for sites with no responsible part. Since 2013, there has also been a possibility to apply for a special grant if the (B- or C-site) is planned to be developed for housing. The reason for this extra grant is a general lack of housing in many places in Sweden but also trying to avoid green land take and instead reuse already developed land.

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2.1.5. Portugal

Institutional context: The Portuguese Environment Agency (APA) ensures the implementation of the national strategy for contaminated soils by preventing soil contamination, preserving its functions, and remediating contaminated soils. APA oversees guidance documents and soil guideline values and has oversight responsibilities for the Regional Coordination and Development Commission (CCDR). CCDRs are competent entities in land remediation and regeneration procedures and projects and in spatial planning at the regional level.

Legal context: Until the Portuguese legislation on soil remediation is approved, Portugal's legal framework for contaminated land is governed by various broader environmental regulations, including i) the Legal Regime of Environmental Damage Liability; ii) the Industrial Emissions Directive; iii) Regime for Environmental Impact Assessment; and iv) Waste Management Legal Regime (DL #102-D/2020) which is enforced by the spatial planning authorities (i.e., CCDRs). When the legislation is approved, it will be applied at both national and regional levels, with no specific laws and regulations at the local level. Where the original polluters of the site cannot be identified or held accountable, remediation becomes the responsibility of requisite government entities at different levels. Certain remediation and redevelopment projects in Portugal call for public consultation and voting within the municipalities.

Financial/economic context: The polluter pay principle (PPP) is applied in Portugal, which means remediation is financed by the polluter, provided proof of liability. In the case where there is no liable part, the landowner bears the financial liability and, when not possible (i.e., legacy sites), remediation is performed by the national, regional, or local authority. Depending on the case, there may be some financial incentives to encourage land remediation. For example, some knowledge programs support remediation and restoration projects.

2.1.6. Italy

Institutional context: At the national level, the so-called "Sites of National Interest" (SIN) are managed by various public authorities and institutions. The Ministry of Environment and Protection of Land and Sea (MATTM) is responsible for declaring SIN sites and thereafter initiates the remediation and protection mechanisms in consultation with the concerned region. The National System for Environmental Protection (SNPA) provides technical and scientific support to MATTM as well as being responsible for monitoring, data collection, and environmental impact assessment. At the regional and local levels, provinces and municipalities oversee land remediation by approving preliminary investigation of potentially contaminated sites, characterization plan, risk assessment and analysis, remediation projects and post-remediation monitoring plan. Before approval of such a document, a meeting is held with all concerned parties (i.e., public institutions, developers etc.). There are several guidelines which may act as enablers or barriers depending on the circumstances and the context of the project.

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These guidelines are published by SNPA and include i) guidelines on the application of risk analysis to landfill materials within sites undergoing remediation; ii) guidelines for the management of landfill materials on sites undergoing remediation; iii) guidelines for the excavation, handling and transport of excavated soil and rocks with natural asbestos and for related monitoring criteria; and iv) guidelines on the application of the rules for the use of excavated earth and rocks. Others include the Protocol for the Establishment of Background Values for Inorganic Substances in Groundwater, and the Manual for Environmental Investigations at Contaminated Sites, published by the Higher Institute for Environmental Protection and Research (ISPRA).

Legal context: The legal framework which regulates land remediation is Title V of Part IV of the D.Lgs. n° 152 which was enacted on 03/04/2006. The law applied to both national, regional, and local levels. In Italy, the polluter of a contaminated site bears the financial burden of remediation (i.e., PPP is applied). In the case where the liable parties cannot fulfill their obligations or cannot be identified or held accountable, the remediation responsibility is passed onto the municipality and in some cases the region where the municipality failed. In the case of a SIN site, the MATTM takes on the remediation in consultation with ISPRA, National Institute of Health (ISS) and National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).

Financial/economic context: Remediation of contaminated sites is financed by the polluters. In the case where the landowner who is not held liable for the contamination, carried out the remediation, he may request the polluter for reimbursement of the expenses incurred and this goes for both A, B, and C sites. Where there is no responsible part of the contaminated site, the funding of remediation comes from special funds set up by the region for all sites. There are incentives to encourage land remediation in the form of tax-free and financial benefits for certain projects. The amount and terms of the incentives are different depending on regional regulations.

2.1.7. Poland

Institutional context: Remediation and restoration of contaminated land in Poland for A-sites is organized on the regional level by the Regional Directorate for Environmental Protection, Regional Fund for Environmental Protection and Water Management and District Office. There is no national framework for contaminated sites. For B and C sites institutional context is not defined. At the local level Regional Directorate for Environmental Protection, Provincial Fund for Environmental Protection and Economy and Districts Office oversee remediation and restoration for A sites, while for B and C they are not defined. The remediation method and plan are determined by the Regional Director of Environmental Protection based on the Act of April 27, 2001- Environmental Protection Law (Journal of Laws 2021.1973; 1718 and 2269). The restoration project is reviewed and approved by the appropriate District Office based on the Act of February 3, 1995, on the protection of agricultural and forest land (Journal of Laws of 2022, item 2409; of 2023 items 1597 and 1688). Additionally, there are numerous private companies supporting remediation and restoration processes. Currently, there are no public institution(s) with national, regional or local overall responsibility for soil health.

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Legal context: Polluter pays principle (PPP) is applied in the case of historical pollution where the landowner discovers pollution to the earth surface has occurred prior to transfer of title of ownership of the land. In case of need of immediate remediation due to threat to human health or the possibility of irreversible damage to the environment the Regional Directorate for Environmental Protection is responsible to carry out immediate remediation or restoration of the contaminated land. Also, in case of not being able to identify the polluter the Regional Directorate for Environmental Protection is responsible to carry out remediation or restoration. New pollution is subject to the "Damage Act" Dz.U.2020.2187 but the provisions to the Act do not apply in case of natural disaster, war, activity related to national defense, international security or protection against a natural disaster. At national, regional and local level these laws address remediation and restoration of contaminated land: Act of April 27, 2001 - Environmental Protection Law (Journal of Laws 2021.1973(; 1718 and 2269), Act of February 3, 1995, on the protection of agricultural and forest land (Journal of Laws of 2022, item 2409, of 2023, items 1597, 1688.), Act of 13 April 2007 on the prevention and repair of environmental damage (Journal of Laws 2020.2187), Regulation of the Minister of the Environment of September 1, 2016 on the method of assessing land surface pollution (Journal of Laws, item 1395), Regulation of the Minister of the Environment of September 1, 2016 on remedial actions (Journal of Laws, item 1396), Regulation of the Minister of the Environment of September 1, 2016 on the register of historical pollution of the earth's surface (Journal of Laws, item 1397), Regulation of the Minister of the Environment of September 1, 2016 on the register of environmental damage (Journal of Laws, item 1398), Regulation of the Minister of the Environment of July 22, 2019 on the criteria for assessing the occurrence of environmental damage (Journal of Laws, item 1383). There is no information available on public participation as a legal requirement.

Financial/economic context: When the polluter can be identified the owner, user or entity of contaminated land finances the remediation/restoration of contaminated land for all three types of sites (A-C). In case of being unable to identify the landowner or entity of the contaminated land and/or in case of urgent need to remediate the contaminated land due to threat to human health the Regional Directorate for Environmental Protection takes financial responsibility for the remediation/restoration for all three types of sites (A-C).

2.1.8. Belgium

Institutional context: Remediation framework is organized in Belgium on regional and local levels (i.e., there is no national framework). The three regions include Flanders, Wallonia, and Brussels. The Public Waste Agency (OVAM) oversees A, B, and C sites remediation in Flanders, Soil Remediation Department. (DAS) oversees A, and B sites remediation while Public Waste Management Company (SPAQUE) oversees C-sites remediation in Wallonia. For Brussels, the Brussels Institute for Environmental Management (IBGE/BIM) has oversight responsibility for both A, B and C sites. In Flanders and Wallonia, city governments are responsible for issuance of permits for all sites (A, B, and C).

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Legal context: The polluter pays principle (PPP) is applied in all three regions of Belgium. In these regions, the law requires a transferor to provide information on the state of the soil and groundwater, soil survey report, post-bond, and the completion of remedial actions (where applicable). In Flanders and Brussels, the buyer is also required to request the state of the land prior to acquiring it. This means that if there is any contamination, the land transferor must perform remediation before the transfer, which relieves the buyer of any liability. In Wallonia, in the end the owner is always responsible for remediation. Even older pollution sources fall under the responsibility of the owner. However, In Flanders if liability is unknowingly passed on to the buyer (e.g., very old pollution, uncertainty in risk assessment), the new landowner can mark "innocent owner" on the site, in this case, remediation becomes the responsibility of OVAM. In Walloon region, if remediation is for development purposes, then the law further requires the developer to have a remediation program to obtain a permit.

Financial/economic context: For a site with a responsible party (i.e., polluter can be identified), remediation is financed by the polluter or owner in all three regions and for A, B and C sites. It is not established who finances sites where the polluter cannot be identified or held accountable, however, in Flanders, sites marked "innocent owners" can get compensation or where it is highly polluted OVAM can take the entire remediation responsibility. Land remediation incentives include National Soil Remediation Fund for Gas Station (BOFAS) for all permanently closed gas stations. In addition, Flemish Laboratory for Textile Research (VLABOTEX) contributes 50% of required funding for drycleaning remediation within the Flemish region. In Flanders, Wallonia and Brussels, remediation is considered complete only when controlling authorities (i.e., OVAM, SPAQUE, IBGE) certifies. In the case where remediation situation is found to be different than in the contract, the responsible funder bears the responsibility.

2.1.9. United Kingdom

Institutional context: Environmental policy is legislated for separately in each of the four home countries in the UK (England, Scotland, Wales and Northern Ireland). Although implementation varies the overall legislation and technical approaches to it are rather similar. The rest of this section focuses on England which is by far the most populous country. There are two regimes with a dominant role, the Planning Regime under the Ministry of Housing, Communities & Local Government; and the environmental regime under the Department for Environment Food and Rural Affairs, The UK Environmental Agency sets environmental guidance and statutory positions at a national level, however, implementation of both environmental decisions and enforcement takes place at a local authority level, with the exception of "Special Sites" such as former nuclear or military sites. Planning decisions are also made at a local level in line with policy set by the Ministry. Appeals against planning decisions go to the (national) Planning Directorate. Under the Common Law legal system injured parties can claim damages through the courts. There is very limited national funding for orphan site management, this is in the form of loans to local authorities who have formal responsibility for orphan sites. The tax system (managed by His Majesty's Revenue & Customs - HMRC) provides tax benefits for money invested in contaminated sites management.

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In addition, Land Trust manages land for public open space and takes on brownfield liabilities in exchange for an upfront dowry. However, the vast majority of land remediation takes place as a part of site redevelopment via the planning process which is funded by the interested parties for a site (private and/or public).

Legal context: The two major legal regimes governing land remediation and restoration are i) The Part 2A of the Environmental Protection Act 1990; and ii) The planning regime under a range of legislation that forms the Town and Country Planning system; but here, the legislations give power to the Environment Agency. Part 2A of the Environmental Protection Act of 1990 acts as drivers for land remediation; it encourages operators and landowners to take actions for mitigating contaminated land on a voluntary basis, by providing clarity about the consequences and costs of not acting to remediate a contaminated site. It then provides a mechanism for contaminated sites to be managed on an obligatory basis where voluntary action is not undertaken. At the local level, the two major legal regimes governing land remediation and restoration are i) The Part 2A of the Environmental Protection Act 1990; and ii) The planning regime under a range of legislation that forms the Town and Country Planning system. At the national level, the legislation gives power to the environmental agency while at the local level, the power lies with the local authorities (e.g., county, district, borough, or city councils). Waste regulation (which derives still from the Waste Framework Directive) controls the re-use of excavated soils. Environmental permitting (which derives from the Industrial Emissions Directive) controls the implementation of remediation systems. This system also applies to all operating sites, and in this situation any contamination that occurs has to be reduced to baseline conditions, as opposed to sites managed under Part IIA or the planning regime where remediation targets are risk-based. Remediation for water protection (rivers, groundwater) is regulated based on the Water Framework Directive and its daughter groundwater Directive. In the UK all effective Directives have been transposed into national law.

Financial/economic context: In broad terms, the polluter (i.e., those who caused or knowingly permitted the substances to be present) are responsible for remediation but, if the polluter cannot be found, then liability can (sometimes) be passed on to the site owner or occupier. Where neither can be identified, then either the local authority or (for some Special Sites) the Environment Agency performs the remediation. In practice, most remediation is paid for by developers, although indirect payment through reduced purchase price is an option. It is worth mentioning that liability decisions are more complex as several exclusions are allowed and there can be significant technical difficulties in determining who caused a historic contamination. For sites of no responsible parties, the local authorities (i.e., county, district, borough, or city councils) must nearly always fund the remediation work internally, although a limited amount of funding is available for local authorities to take loans.

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2.1.10. Kosovo

Institutional context: In Kosovo, there are two levels of administration (national and local). At the national level, the Ministry of Environment, Spatial Planning, and Infrastructure (MESPI) controls land remediation and regeneration. The responsibilities of MESPI include approval of remediation plans submitted by polluter/developer, and municipal development plans and zone maps. MESPI is also clothed with the authority of approving permits and financing remediation of sites with no responsible parts. At the local level, municipalities govern land remediation with the following responsibilities: i) preparation of remediation plans and cost estimates for environmental legacy sites (polluter unknown); ii) planning of annual budget; iii) preparation of municipal development plans and zoning maps; iv) approval of environmental consents/permits that fall within the jurisdiction of the municipality as defined in the Law on Environmental Impact Assessment.

Legal context: Law No. 03/L-025 on Environmental Protection Article 6 governs land remediation and regeneration at both national and local levels. According to paragraph 10 of the environmental protection law, public participation is required by requesting the public to comment or object to remediation plans within 15 days of submission while Paragraph 11 of the same law requires that all approved remediation plans must be opened for the public to access. Article 34 of the environmental protection law (rehabilitation measure) requires any person, enterprise or public authority who caused environmental disturbance by purpose or by negligence resulting in environmental devastations, to restore the damaging part to the condition not posing risk to the environment and human health or rehabilitation common capacity, of the damaged part while paragraph 9 requires requisite state institutions to take on remediation responsibilities for sites of unknown polluter.

Financial/economic context: For sites of known polluter, the polluter finances the remediation pursuance to Article 34 (explained under legal context). Where the polluter cannot be identified or held accountable, requisite state institutions take on the remediation through state funds, especially when the site presents a clear and on-going danger to human health.

2.1.11. Greece

Institutional context: At national level, the Ministry of Environment and Energy (YPEN) oversees land remediation and regeneration in Greece by planning the national environmental policies which are based on EU Directives and Regulations. YPEN also implements EU legislation, such as the Environmental Liability Directive (ELD 2004/35/EC) and the Waste Framework Directive (WFD 2008/98/EC). At the regional level, the Directorate of Environmental Permitting of Decentralized Administrations issues environmental permits for contaminated sites remediation (Site A). Regional Authorities have its own Environmental Department responsible for issuing permits for smaller-scale projects (typically site B projects, which are considered to have lesser environmental impacts).

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Legal context: Because there is no individual legislation on soil management related to contamination and contaminated sites in Greece, land remediation is governed by more sister laws relating to environmental protection and waste management. Some of these laws include i) Law 1371/1983, (Government Gazette 91/A/8.07.1983) (2) "Ratification of the convention on long-range transboundary air pollution"; ii) Law 1650/1986 on the Protection of the Environment (10); iii) Joint Ministerial Decision 776/92/1992 (Government Gazette 173/A/02.12.1992) (5) for the amendment with Directives 67/548/EEC, 76/769/EEC and 88/379/EEC as regards the elimination of fines on the control of dangerous substances and preparations in harmonization. However, the polluter pays principle is applicable in Greece, though its application varies depending on the specific circumstances and regulations in place. However, the Council of State (High Court) and its E department (Environmental cases) since 1986 has issued all sorts of environmental legal decisions that apply and form a legal precedence on contaminated land remediation. They are legally binding, and the permitting authorities need to take them into account any time that a pollution incidence occurs, or a contaminated land remediation is applied for land redevelopment.

Financial/economic context: The polluter of the site, when known, bears the financial burden for remediation. In the case where the polluter is not known or cannot be held liable (for A and B sites), the site owner, user or developer incurs the cost of remediation. However, where the site owner, user or developer cannot handle the cost, the requisite national, regional, or local authority carries out the remediation if there is urgent need. For C sites, national, regional, or local authorities bear the cost of remediation where the polluter is unknown.

2.2. Barrier and potential solution inventory

For the barrier inventory, templates were designed in Excel and shared with all ISLANDR project partners working with task 5.1. This was followed by an online meeting in which all partners agreed on the final template after discussion. The final template captures the following information:

- Barrier ID (e.g., B1 for barrier no. 1)
- Type of barrier (i.e., general or country/ITA specific)
- The barrier description
- Source / reference(s) where the barrier is reported from
- Category of the barrier (i.e., legal, financial & economic, institutional, technical, environmental, and social)
- Potential solutions
- Contributor(s) (i.e., one providing the information)

To define corresponding potential solutions, the barrier inventory template was complemented with a template to collect potential solutions for the identified barriers. The potential solutions template was designed to capture information as outlined below:

- Potential ID (e.g., BS1 for potential solution to barrier no. 1)
- Type of potential solution (i.e., general or country/ITA specific)
- Potential solution description
- Source / reference(s) where the potential solution is reported from

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- Category of the potential solution (i.e., legal, financial & economic, institutional, technical, environmental, and social)
- Solution to barrier (i.e., matched with barrier/s which can be removed with this solution) and
- Contributor(s) (i.e., one providing the information)

To populate the developed templates, barriers and potential solutions were collected from literature and from partner countries / ITAs through their representatives.

Identification of barriers by desk study (search in literature)

Barriers and potential solutions were identified from both scientific journal articles and grey literature such as previous projects in the EU which have reported barriers to land remediation and regeneration. For examples, the Tailored Improvement of Brownfield Regeneration in Europe (TIMBRE) has reported several barriers and associated solution in Czech Republic, Romania, Poland, and Germany (Timbre, 2013). The 2023 AquaConSoil conference was also a useful source for identification of barriers and potential solutions since one of the major discussions during this conference centred around overcoming barriers in brownfield remediation and regeneration (AquaConSoil, 2023). In April 2019, the European Commission met in Brussels where stakeholders presented various barriers faced in their countries and how these barriers were addressed (European Commission, 2019). These barriers and potential solutions were also captured in task 5.1. In addition to these project reports, barriers and potential solutions were also identified from several journal articles (Adams et al., 2001; Alexandrescu et al., 2014; Fernandes et al., 2020; Hendriks et al., 2018; Maring et al., 2013; P. Rood et al., 2018; Pauline van Gaans et al., 2014; Reinikainen & Sorvari, 2016; Siebielec et al., 2012; Thornton et al., 2007; Tintěra et al., 2015; Vanino et al., 2023).

Identification of barriers and potential solutions from country/ITA representatives

To complement the barriers and solutions identified from literature, specific examples of barriers were identified from countries/ITAs through representatives from these countries/ITAs. To do this, the barrier inventory template was restructured to allow input from the country/ITA representatives. The representatives were asked to first review the pre-defined general barriers and potential solutions and indicate whether they are relevant to their country/ITA and to what level. The level of relevance is indicated by marking an “x” under “not relevant”, “relevant”, “highly relevant” or “not sure”. It is believed that in the case of “not relevant”, the country should have overcome such barrier, in this case, the representatives were asked to provide some examples of solutions that were applied to overcome the barriers.

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2.2.1. Identified barriers

The identified barriers are grouped into 12 categories including i) planning; ii) communication; iii) stakeholders' involvement; iv) experts; v) policy and legislation; vi) politics; vii) cost; viii) taxation; ix) risk assessment and liability; x) enablers/drivers; xi) site ownership xii) mass management and invasive species. The grouping is based on how the barriers are related in terms of the circumstances under which they are triggered. For example, barriers that are related to lack of planning or unclear project goals are grouped under "planning category" and barriers that exist due to lack of communication are grouped under "communication category". The barriers are presented in Appendix A5 and are matched with potential solutions in Appendix A6.

Planning

Three major barriers were identified under the planning category. The barriers are related to i) defining the precise project goals prior to the start of the project; ii) uncertainty during the planning process due to unknown or unexpected contamination level; iii) unavailability of data about the contaminated land. The barriers in this category are mainly connected to financial/economic, technical, and institutional issues. For example, to precisely define the project goals, technical knowledge is required to characterise the site and establish potential risk.

Communication

The two major barriers identified under the communication category are mainly related to i) weak communication towards the community and investors and ii) lack of communication about the significance of the project or the risk of not remediating. Weak/lack of communication is a recipe for less community involvement and weak cooperation among stakeholders which may lead to project delay (sometimes failure) thereby incurring more project cost. These barriers are more connected to financial/economic, institutional, and social issues.

Stakeholders' Involvement

Three major barriers were found to be related to stakeholders' involvement. These barriers include i) lack of clear lead-responsible stakeholders or not wanting to take responsibility which usually leads to postponing the situation; ii) the involvement of many stakeholders (including landowners) creates complexity in remediation thus making it difficult to see possible end-results; and iii) lack of consensus among stakeholders due to conflicting needs and interests. The first two barriers are connected to institutional issues while the last is connected to both financial/economic and institutional issues.

Experts

Barriers in this category are concerned with lack of locally available expertise and fragmented visualization of perspectives of the problem. This creates situation where the developer will have to hire experts from outside (sometimes internationally) which has the propensity to increase the cost of remediation. The barriers in this category are connected to financial/economic and technical issues.

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Policy and Legislation

The policy and legislation category is one of the major drivers for a thorough remediation framework. Major barriers identified under this category include i) incoherent and weak institutional and legal frameworks (i.e., lack of clear and realistic policies for land remediation and regeneration) which creates complexity and uncertainties for investors; ii) lack of policy supports for innovation; iii) absence of consistent redevelopment frameworks; iv) entrenched attitudes among stakeholders; v) absence of identifiable and consistent clean-up standards. All the barriers in this category are related to legal and institutional issues except for barrier ii and iv which are also related to technical and social issues respectively.

Politics

The politics in a country influences remediation framework significantly. The political-related barriers identified are fear of change of heads of competent authorities (i.e. ministries, municipal government, water board etc.) due to change of regime. This may affect the established procedures and project goals thus leading to delayed or failed remediation project.

Cost

The majority of the barriers found in this study is connected to cost of remediation, making it a key contributor to barriers of land remediation and regeneration. The identified barriers related to cost include i) incoherent financial framework (lack of national financial commitment in land decontamination); ii) often costs are higher than expected because the maintenance costs are not taken into account in the design (underestimation of the long-term maintenance costs); iii) insufficient financing, no interested investors or lack of resources, due to lack of incentive; iv) potentially substantial capital costs for remediation and regeneration; v) compare to greenfield redevelopment, brownfield redevelopment involves high level of uncertainty and financial risks; vi) cost of land remediation and regeneration exceeds the benefits of the project. These barriers are connected to financial/economic issues except for barrier (i) which also has connection to institutional issues.

Taxation

The taxation category describes those barriers that exist due to lack of financial incentives or detaxation of land remediation and regeneration. The identified barriers include i) lack of incentives for brownfield redevelopment; ii) unsupportive tax policy (i.e., developers of brownfield properties pay higher tax compared to greenfield developers); and iii) negative values in books. The Barriers in this category are connected to legal, financial/economic, and institutional issues.

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Risk Assessment and Liability

Risk assessment is one of the vital aspects of land remediation. Without a proper risk assessment, it is difficult to successfully implement a land remediation regeneration project. The two major barriers identified in this category are I) site geology and contamination level are complex (e.g., emerging contaminants, multiple contamination etc) and make it difficult to assess potential risk and ii) the uncertainty of risk assessment creates uncertainty in the outcome of remediation (i.e., there is a liability when we do not remove everything). These barriers are connected to financial/economic, technical, and environmental issues.

Enablers / Drivers

Under this category, we tried to identify barriers related to drivers of land remediation and regeneration. Many barriers were identified in this category and include i) remediation causes nuisance for neighbourhood (e.g., air pollution); ii) perception that such development is a private sector issue; iii) limited demand for redeveloped sites (i.e., competition of and availability of greenfield land); iv) market forces are not able to drive redevelopment (i.e., no return on investment); v) relatively long timeframe for regeneration project; vi) lack of interest, thus no urge to anticipate on cessation of use (i.e., lacking sense of urgency); vii) public opposition and negative perception and acceptability of re-using BF land; viii) the site is located within / close to community heritage, and may increase resistance to redevelopment, particularly when these areas hold cultural / generation significance for the community. Barriers in this category are connected to all barrier types including legal, financial/economic, institutional, technical, environmental, and social.

Site Ownership

Only one barrier was identified in this category which is the complexity or fragmented land ownership (e.g., unclear community heirs). This is an institutional and social issue.

Mass Management and Invasive Species

How to manage excavated soil is a critical issue and creates barriers in land remediation and regeneration. The two main barriers identified are i) movement or transfer of soils can transmit problem or invasive species such as Japanese Knotweed; and ii) excavated soils are considered waste under the Waste Framework Directive of the EU and therefore requires adhering to a regulatory system, which creates barriers for brownfield remediation.

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2.2.2. Analysis of identified barriers

Following the compilation of barriers, the comprehensive list was disseminated to country representatives for assessment, wherein they were tasked with evaluating and indicating the level of relevance attributed to each barrier within their respective country/ITA. Although this process lacked a strict scientific methodology in respondent selection, the responses yielded insightful descriptions regarding the advancement of land remediation efforts across ISLANDR countries and in the broader EU by extension. Analysis of the feedback provided by various country representatives reveals notable trends concerning land remediation within ISLANDR countries. Predominantly, issues pertaining to planning, such as the absence of clear and precisely defined project goals, emerged as the primary barrier, indicated by its significance in 8 out of 12 countries surveyed.

For the communication barriers, insufficient communication toward the communities and investors are the contributing barriers with relevance indicated by 7 countries. Moreover, barriers associated with stakeholders' involvement were generally acknowledged across all ISLANDR countries. Among barriers concerning remediation experts, the foremost barrier identified was the "lack of expertise and fragmented visualization of perspectives of the problem." Within the policy and legislation category, "incoherent and weak institutional and legal frameworks" alongside regulatory complexities are the predominant barriers, present across all ISLANDR countries albeit at varying levels.

Political factors, except in Belgium and the Netherlands, were highlighted by all ISLANDR countries as influential in remediation efforts. Issues related to the cost of remediation appeared significantly, with “not considering maintenance costs”, “high cost of soil investigation”, and “financial uncertainties” cited as primary barriers. Conversely, barriers associated with financial incentives and taxation exhibited average relevance, with only half of the ISLANDR countries acknowledging their significance. Barriers arising from risk assessment and liabilities seem to be major issues in the EU with only Belgium and Sweden indicating their non-relevance. In terms of drivers for remediation, the “absence of market forces for redevelopment” emerged as the principal hurdle, followed by “limited demand for redeveloped sites”, “public opposition and negative perception or acceptability of re-using brownfield (BF) land” and “relatively long timeframe for regeneration project”. Less than 50% of the ISLANDR countries indicated the relevance of site ownership which indicates its less contribution to remediation barriers. And finally, handling of excavated soil as waste seems to be contributing to the existence of barriers in only 4 out of 12 ISLANDR countries, which means that more countries have overcome this challenge.

In summary, deficiencies in robust legislation, regulatory frameworks, stakeholder engagement, and the high costs associated with remediation pose significant barriers to land remediation efforts in the EU. However, significant strides have been made by several countries, including the Netherlands, Sweden, Belgium, Finland, France, and the UK, in addressing these challenges. Conversely, countries such as Portugal, Kosovo, and Greece still need to intensify their efforts to address the barriers hindering land remediation.

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2.2.3. Potential solutions to barriers

The identified solutions include examples from specific countries and other solutions reported in literature (i.e., conferences, reports etc.). The solutions are presented in Appendix A6 and matched with appropriate barriers.

Based on the most reappearing barriers, the four most common categories were identified:

1. **Costs**
2. No/ weak **communication** towards the community, financial investors
3. Lack of **policy support** resulting in barriers for overcoming liability and financing barriers
4. Lack of/ **limited data** (information) on contaminated lands (information gap)

Apart from communication, these categories match well with the Report of local soil contamination in EU (Payá Pérez & Rodríguez Eugenio, 2018), where the authors identified data inconsistencies, legislative and policy gaps, financial constraints, progress and inventory management as most common challenges to remediation of contaminated sites.

Potential solutions listed in Appendix A6 revealed that- “Establishment of public brownfield inventories and data" could solve seven of identified barrier categories such as costs, planning, policy support, communication, data gap, risk assessment and liability.

Two other solutions have been identified whose implementation could potentially resolve more than five categories of barriers and they were:

1. Sufficient soil investigations to develop a good conceptual site model
2. Earlier involvement of relevant actors (including soil experts) to draft different scenarios for the site(s)

The potential solutions in Appendix A6 could resolve barriers related to planning, lack of data, communication, lack of experts, costs, risk assessment and liability as well as barriers associated with the change of political heads.

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3. Concluding remarks

The context description and barrier inventory have revealed that land remediation and regeneration face many existing barriers, including legal, financial/economic, institutional, technical, environmental, and social barriers. However, the impact of these barriers varies across nations, likely influenced by the organizational frameworks governing remediation efforts in each country. For instance, countries demonstrating strong legal frameworks, stringent enforcement, and strong national commitment alongside clear policies tend to exhibit notable progress in land remediation compared to those lacking in such regulatory frameworks. This underscores the pivotal role of the barrier inventory in planning remediation projects and mitigating risks associated with land contamination.

The compilation of potential solutions, matched with their associated barriers in Appendix A6, is a potential tool for strategizing remediation and regeneration projects, particularly in countries characterized by weaker remediation frameworks. By imitating successful examples employed in nations with robust remediation frameworks, considerable strides in land remediation within the EU can be envisaged. Specific examples applied to overcome barriers by different countries are also taken up in Appendix A6.

Identification of barriers provided by ITA countries and desk study does not offer a comprehensive overview of all obstacles ITA countries. However, it has given insightful descriptions in land remediation efforts in the ITA countries. In addition, the list of potential solutions associated to identified barriers to remediation of contaminated land may also not fully reflect all possible solutions due to uncertainty that is inherent in the data collection process. Therefore, assessment of linking the identified barriers with potential solution is planned to be further expanded to ensure their alignment.

Bibliography PART A

Adams, D., Disberry, A., Hutchison, N., & Munjoma, T. (2001). Ownership Constraints to Brownfield Redevelopment. *Environment and Planning A: Economy and Space*, *33*(3), 453-477. https://doi.org/10.1068/a33200

Alexandrescu, F., Martinat, S., Klusácek, P., & Bartke, S. (2014). The Path From Passivity Toward Entrepreneurship. *Organization &amp Environment*, *27*, 181-201. https://doi.org/10.1177/1086026614529436

AquaConSoil. (2023). Summary of ISLANDR session during AquaConSoil in Prague 2023. In.

Cabernet. (2006). *Sustainable Brownfield Regeneration: CABERNET Network Report*.

European Commission. (2019). *Brownfield redevelopment in the EU*. https://commission.europa.eu/system/files/2019-04/brownfield_conference_report_0.pdf

Fernandes, A., Figueira de Sousa, J., Costa, J. P., & Neves, B. (2020). Mapping stakeholder perception on the challenges of brownfield sites' redevelopment in waterfronts: the Tagus Estuary. *European Planning Studies*, *28*(12), 2447-2464. https://doi.org/10.1080/09654313.2020.1722985

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Hendriks, W., G.Roovers, & Haselhoff, A. (2018). *Stimulering gebruik Brownfields - Bodem: van belemmering naar kans. Uitvoeringsprogramma Bodem & Ondergrond- Encouraging the use of Brownfields - Soil: from obstacle to opportunity*.

Maring, L., Blauw, M., Bergh, R. v. d., Ellen, G. J., Oostrom, N. v., Limasset, E., Ferber, U., Menger, P., Smit, M., Wendler, K., Neonato, F., Irminski, W., Nathanail, P., & Garcia, R. B. (2013). *Decision support framework for the successful regeneration of brownfields. HOMBRE Deliverable 3.1* (HOMBRE project, Issue.

P. Rood, T. Praamstra, J. Lackin, L. Maring, Y. Lahkim, & Roovers, G. (2018). *Uitvoeringsprogramma Bodem & Ondergrond (Phase-out of 'Isolation-Maintenance-Control' Locations*.

Pauline van Gaans, Gerald Jan Ellen, Linda Maring, Hans van Duijne, Maaike Blauw, Uwe Ferber, Elsa Limasset, Martijn Smit, Paul Bardos, & Menger, P. (2014). *"Holistic Management of Brownfield Regeneration"* (European Community's Seventh Framework Programme, Issue.

Payá Pérez, A., & Rodríguez Eugenio, N. (2018). *Status of local soil contamination in Europe: Revision of the indicator "Progress in the management Contaminated Sites in Europe* (, Issue.

Reinikainen, J., & Sorvari, J. (2016). Promoting justified risk-based decisions in contaminated land management. *Sci Total Environ*, *563-564*, 783-795. https://doi.org/10.1016/j.scitotenv.2015.12.074

Siebielec, G., Rabl-Berger, S., Bluemlein, P., Schweiker, M., Huber, S., Wieshofer, I., Biasioli, M., Marsan, F. A., Medved, P., Sobocka, J., Galuskova, I., & Vokurkova, P. (2012). *Brownfield redevelopment as an alternative to greenfield consumption in urban development in Central Europe* (URBAN SMS Soil Management Strategy, Issue. E. R. D. F. European Union.

Thornton, G., Franz, M., Edwards, D., Pahlen, G., & Nathanail, P. (2007). The challenge of sustainability: incentives for brownfield regeneration in Europe. *Environmental Science & Policy*, *10*(2), 116-134. https://doi.org/https://doi.org/10.1016/j.envsci.2006.08.008

Timbre. (2013). *Report on Country and State Level Specific Characteristics. Present country and state level specific characteristics for the four states as regards the administrative decision structures from the very first expressionof interest (e.g. by an investor) to the final regeneration steps, Tailored Improvement of Brownfield Regeneration in Europe.*

Tintěra, J., Ruus, A., Tohvri, E., & Kotval, Z. (2015). Urban Brownfields in Estonia: Scope, Consequences and Redevelopment Barriers as Perceived by Local Governments/ Urbánní brownfieldy v Estonsku: rozsah, dopady a revitalizační bariéry z pohledu městských samospráv. *Moravian Geographical Reports*, *22*(4), 25-38. https://doi.org/doi:10.1515/mgr-2014-0021

Vanino, S., Pirelli, T., Di Bene, C., Bøe, F., Castanheira, N., Chenu, C., Cornu, S., Feiza, V., Fornara, D., Heller, O., Kasparinskis, R., Keesstra, S., Lasorella, M. V., Madenoğlu, S., Meurer, K. H. E., O'Sullivan, L., Peter, N., Piccini, C., Siebielec, G.,...Farina, R. (2023). Barriers and opportunities of soil knowledge to address soil challenges: Stakeholders' perspectives across Europe. *Journal of Environmental Management*, *325*, 116581. https://doi.org/https://doi.org/10.1016/j.jenvman.2022.116581

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Appendices PART A

Appendix A1: Questionnaire used in the collection of information for land remediation context description

Questionnaire	Context	Comment
Is the PPP applied?	Legal	PPP: polluters pay principle
Who is responsible (or held accountable) for remediation or restoration of contaminated land if the original polluter(s) cannot be identified?	Legal	
What laws and regulations at national level address remediation & restoration of contaminated land?	Legal	
What laws and regulations at regional level address remediation & restoration of contaminated land?	Legal	
What laws and regulations at local level address remediation & restoration of contaminated land?	Legal	
When is public participation a legal requirement? In what way can public participation be arranged?	Legal	
At a national level, which are the public authorities and institutions involved in remediation & restoration of contaminated land and what role and competence do they have at A, B or C Sites?	Institutional	A=Private-driven sites; B=Public-private partnership; C=Public-driven partnership
At a regional level, which are the public authorities and institutions involved in remediation & restoration of contaminated land and what role and competence do they have at A, B or C Sites?	Institutional	
At a local level, which are the public authorities and institutions involved in remediation & restoration of contaminated land and what role and competence do they have at A, B or C Sites?	Institutional	
Which guidelines are relevant that acts as either enablers or barriers?	Institutional	
Is/are there a public institution/s with a national/regional/local overall responsibility for soil health? Which?	Institutional	
How is remediation/restoration of contaminated land financed when there is a responsible part (a polluter or someone that has taken on the responsibility for the contamination) at A, B or C Sites?	Financial & Economic	

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Questionnaire	Context	Comment
How is remediation/restoration of contaminated land financed when there is no responsible part (a polluter or someone that has taken on the responsibility for the contamination) at … A, B or C Sites?	Financial & Economic	
Are there any financial incentives implemented by national/regional/local authorities to encourage remediation?	Financial & Economic	
During the course of the remediation, who bears the financial responsibility when the remediation situation is found different than in the contract or the remediation technology was less effective than expected at A, B or C Sites?	Financial & Economic	

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Appendix A2: Institutional context description for land decontamination and regeneration in selected EU countries

In this table, the national, regional, and local public authorities, and institutions responsible for land Remediation and soil health are listed. The table also provides information on how contaminated sites are classified.

Country	National Institution	Regional Institution	Local Institution
Finland	Ministry of the Environment, Finnish Environmental Institute (Syke)	Centers for Economic Development, Transport, and the Environment (ELY Centers)	In Helsinki and Turku municipal environmental authorities
France	The ministry in charge of Environment	Regional Directorate for the Environment, Planning and Housing (DREAL), The Geological and Mining Research Bureau (BRGM) and the Regional Health Agency (ARS)	Municipalities and French Environment Agency
The Netherlands	Ministry of infrastructure and water management, Foundation of Soil Quality Assurance Infrastructure (SIKB),	Provinces	Municipalities
Sweden	Swedish Environmental Protection Agency (SEPA), Swedish Geotechnical Institute (SGI), Geological Survey of Sweden (SGU)	County Administrations	Municipalities
Portugal	Portuguese Environment Agency (APA)	Commissions of Coordination and Regional Development (CCDR).	
Italy	Ministry of Environment and Protection of Land and Sea (MATTM), National System for Environmental Protection (SNPA)	Regional Environmental Protection Agencies, Provinces	Municipalities
Poland	National Fund for Environmental Protection and Water Management, General Directorate for Environmental Protection	Regional Directorate for Environmental Protection, Regional Fund for Environmental Protection and Water Management, District Office	Regional Directorate for Environmental Protection, Provincial Fund for Environmental Protection and Economy, District Office

Country	National Institution	Regional Institution	Local Institution
Belgium	Not applicable	The Public Waste Agency (OVAM)-Flanders, Public Waste Management Company (SPAQUE)-Wallonia, Brussels Institute for Environmental Management (IBGE/BIM)-Brussels	
UK	UK Environmental Agency	County Councils	City, District and Borough Councils
Kosovo	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI)		Municipalities
Greece	Ministry of Environment and Energy (YPEN)	Directorate of Environmental Permitting of Decentralized Administrations	Regional authorities

Appendix A3: Legal context description for land decontamination and regeneration in ISLANDR countries

In this table, the national, regional, and local public authorities and institutions responsible for sites of "no responsible parts" are listed for each country. The table also lists national, regional, and local laws and regulations governing land remediation in each country.

Country	Responsible Institutions for "No Responsible Parts" Sites	National Laws and Regulations	Regional Laws and Regulations	Local Laws and Regulations
Finland	Municipalities provided the owner is not required by the law. For sites prior to 1994, the current owner or developer	Environmental Protection (EPA 527/2014) and mandatory risk assessment protocol in the Decree on the Assessment of Soil Contamination and Remediation (VNa 214/2007).		
France	Ministry of the Environment via the local DREAL, and the French Environment Agency (ADEME)	Environment Code: Articles L. 512-6-1, L. 512-7-6, L. 512-12-1, and L. 556-3 and Article L, 556-1 and L, 125-6		Local urban guidelines
The Netherlands	With the Environment and Planning Act (January 2024), municipalities are the competent authority in all cases (except for specific sites that are assigned under the transitional law under the Environment and Planning Act. These sites remain under the responsibility of the provinces). (Before that: mainly provinces and some larger municipalities were appointed as regulator in relation to soil protection Act).	since Jan 2024: Environment and Planning Act (Before January 2024: Soil Protection Act, Decree soil quality and the Water Act)		

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Country	Responsible Institutions for "No Responsible Parts" Sites	National Laws and Regulations	Regional Laws and Regulations	Local Laws and Regulations
Sweden	Polluter is held accountable for historic contamination, even if not landowner anymore because the legislation is retroactive until 1969. Where this is not possible, the legal processes about responsibilities become difficult, especially when there have multiple owners over the years.	The Environmental Code		
Portugal	While there is no designated competent authority for land remediation, the Ministry of Environment and Energy Transition enforces environmental policies. For orphan sites, governmental entities at different levels take the responsibilities	Legal Regime of Environmental Damage Liability, Industrial Emissions Directive, Regime for Environmental Impact Assessment, Waste Management Legal Regime (DL n.º 102-D/2020), II Ontario rules (threshold values) II. Until the approval of soil legislation, APA has published some guidelines in the thematic: •Reference values •Sampling and monitoring plans •Risk analysis and risk acceptability criteria •Methodology for determination of natural background values and Reference matrix to present analytical results		
Italy	According to the order of priorities established by the regional plan for the reclamation of polluted areas, municipality takes the responsibilities and, if the municipality fails to do so, then regional authority comes in. For Sites of National Interest (SNI), Ministry of Environment and Protection of Land and Sea, assisted by National Institute of Health (ISPRA, ISS) and National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).	Title V of Part IV of the D.Lgs. n° 152 of 03/04/2006 which regulates the remediation process at both the national and local level.		
Poland	Regional Directorate for Environmental Protection	• Act of April 27, 2001 - Environmental Protection Law (Journal of Laws 2021.1973(; 1718 and 2269), • Act of February 3, 1995, on the protection of agricultural and forest land (Journal of Laws of 2022, item 2409, of 2023, items 1597, 1688.), • Act of 13 April 2007 on the prevention and repair of environmental damage (Journal of Laws 2020.2187), • Regulation of the Minister of the Environment of September 1, 2016 on the method of assessing land surface pollution (Journal of Laws, item 1395),		

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Country	Responsible Institutions for "No Responsible Parts" Sites	National Laws and Regulations	Regional Laws and Regulations	Local Laws and Regulations
		• Regulation of the Minister of the Environment of September 1, 2016 on remedial actions (Journal of Laws, item 1396), • Regulation of the Minister of the Environment of September 1, 2016 on the register of historical pollution of the earth's surface (Journal of Laws, item 1397), • Regulation of the Minister of the Environment of September 1, 2016 on the register of environmental damage (Journal of Laws, item 1398), • Regulation of the Minister of the Environment of July 22, 2019 on the criteria for assessing the occurrence of environmental damage (Journal of Laws, item 1383).		
Belgium	**Flemish Region:** The enforcement section of the Environmental Department and the Flemish Waste Agency **Walloon Region:** Department for Police and Controls **Brussels Metropolitan Region:** Brussels Institute for Environmental Management	Not applicable	The regulation/law applied in all three regions requires a transferor to provide information on the state of the soil and groundwater and also requires soil surveys and, post-bond, the completion of remedial actions. This relieves the buyer of any liability. **Flemish region:** In some cases, liability can be passed onto the buyer unknowingly (e.g., old pollution, uncertainty in risk assessment). In this case OVAM becomes liable for the remediation. **Walloon region:** it is required to have a remediation program to apply for permit. **Brussel region:** if you can prove that the source of contamination is qualified as "orphan", remediation liability is handed over to IBGE	
UK	Liability can (sometimes) be passed on to the site owner or occupier). Where not possible, then either the local authority or (for some Special Sites), the Environment Agency performs the remediation: though liability decisions are more complex.	Though EU Directives and Regulations are not applied as direct legal instruments in the UK but are transposed by Parliament into national legislations. The two major legal regimes governing land remediation and restoration are i) The Part 2A of the Environmental Protection Act 1990; and ii) The planning regime under a range of legislations that forms the Town and Country Planning system		Same as national laws and regulations but local authority is the enforcer.
Kosovo	Requisite state institutions take on remediation responsibilities where polluter cannot be identified.	Law No. 03/L-025 on Environmental Protection Article 6: Basic principles for environmental protection Paragraph 9: Principle of responsible subsidiary		

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Country	Responsible Institutions for "No Responsible Parts" Sites	National Laws and Regulations	Regional Laws and Regulations	Local Laws and Regulations
Greece	There is no specific legislation on soil management and contaminated sites, therefore land remediation is governed by more sister laws relating to environmental protection and waste management.	• Law 1650/1986 on Environmental Protection Government Gazette: A 160/16-10-1986 • Law 4014/2011 on Environmental Permitting Government Gazette: A 209/21-09-2011 • Law 3199/2003 on Water Resource Management Government Gazette: A 280/09-12-2003 • Law 2971/2001 on the Protection of Coastal Areas and Beaches Government Gazette: A 285/19-12-2001 • Law 998/1979 on the Protection of Forests and Forest Areas Government Gazette: A 289/29-12-1979 • Law 4042/2012 on Waste Management Government Gazette: A 24/13-02-2012 • Law 2939/2001 on Packaging and Waste Management Government Gazette: A 179/06-08-2001 • Presidential Decree 51/2007 on the Conservation of Natural Habitats and Wild Fauna and Flora • Government Gazette: A 54/08-03-2007 • Law 3851/2010 on Renewable Energy Sources (RES) Government Gazette: A 85/04-06-2010 • Law 3422/2005 on the Protection of the Marine Environment Government Gazette: A 303/13-12-2005 • Law 3468/2006 on the Development of Renewable Energy and High-Efficiency Cogeneration Government Gazette: A 129/27-06-2006 • Law 4414/2016 on the Support Scheme for Renewable Energy Sources Government Gazette: A 149/09-08-2016 • Law 4685/2020 on Modernization of Environmental Legislation Government Gazette: A 92/07-05-2020 • Law 3937/2011 on Biodiversity Protection Government Gazette: A 60/31-03-2011		

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Appendix A4: Financial / Economic context description for land decontamination and regeneration in selected EU countries

The table contains information about how land decontamination and regeneration is financed for sites with no responsible parts and sites with responsible parts; "No Responsible Parts" means the polluter cannot be identified or held accountable.

Country	How are Sites with "Responsible Parts" Financed?	How are Sites with "No Responsible Parts" Financed?	What are the Financial Incentives for Remediation?
Finland	For all types of sites (A, B and C), responsible part (i.e., polluter, site owner, municipality, or developer) finances remediation	For all sites, the State may grant aid for the investigation or remediation of a contaminated site if: i) the polluter cannot be identified, or is unable to bear the costs of the action; and 2) investigating or cleaning up the contamination is clearly unreasonable for anyone other than the person responsible for it.	The Act 246/2019, 6 state aid can be granted when, in order to find out and control the danger or harm caused to health or the environment, it is justified to find out the contamination of the area, assess the need for remediation and, if necessary, remediate the area. The grant of support can be precondition that a responsible company or other entity or natural person contributes to the action or its costs. The Pirkanmaa Business, Transport and Environment Center operates as a state aid authority as referred to in the State Aid Act (688/2001).
France	For A-B-C sites, the PPP applies. However, liability can eventually be transferred to another party by contract according to Allur Law, (2014).	For A-B-C sites, the French Environment Agency (ADEME) takes on the remediation of sites qualified as "orphan sites". For old mining sites, a specific department of BRGM that manages the sites.	"Brownfield Fund" supports remediation and recycling of brownfield to improve soil health and reduce land take. Funding is on the order of 750 M€/annual
The Netherlands	Polluter pays (after 1987). Generally, all contamination caused before 1975 is funded by the national government including contamination caused between 1975-1987 provided the buyer was a non-expert and unaware.	With unknown polluter, remediation is financed by the owner, user, or developer of the land, otherwise the national /regional/local authority covers the cost.	There have been financial incentives for the 'finalization of the remediation operation' in the Netherlands. Currently there are still funds (e.g., SPUK) for speeding up remediation. There are also knowledge programs supporting the remediation and restoration operation (e.g. on emerging contaminants)

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Country	How are Sites with "Responsible Parts" Financed?	How are Sites with "No Responsible Parts" Financed?	What are the Financial Incentives for Remediation?
Sweden	For A-B-C sites, the polluter pays for remediation. Additionally, land developers can acquire polluted **A-sites** and earn money by remediating and selling or developing the upgraded land, thus taking on the responsibility. In the case of B and C-sites where there is a responsible part but no economic incentive to initiate remediation, the process is initiated by the environmental legislation and in practice by the controlling authorities. However, the process can be rather slow, especially with unclear responsibility such as different actors throughout the years, only parts of the pollution from the current owner etc.).	For A-B-C-sites, the responsibility for these sites lies with the municipality within which they are located. The cost of remediation is covered by national funding program for sites with no responsible part. In addition, there may be private initiatives to redevelop A-sites (i.e., a developer can buy a site, redevelop, and sell).	There is a national funding program which focuses on sites of highest risk class (1 and 2). All potentially contaminated sites are registered in an inventory with their risk classes. Depending on their priorities, county administrations (i.e. all municipalities within the county administration) applies for funding at the Swedish Environmental Protection Agency (SEPA).
Portugal	For A-B-C sites, the polluter pays provided there is a proof of responsibility. National government may pay for orphan sites (e.g. phase-out mines)	For A-B-C sites, owner/user of the land pays for remediation, if this is not possible, the national or regional or local authority takes the responsibilities.	Depending on the case, there are some knowledge programs which support remediation and restoration projects.
Italy	For A-B-C sites, the polluter pays for remediation, However, the site owner (who is not responsible for the contamination) may willingly undertake remediation. In this case the site he can have recourse against the polluter for the incurred expenses.	Regions, provinces, and municipalities identified take on the remediation through the in-house companies of the Ministry of Environment and Protection of Land and Sea. The funds such remediation comes from special funds set up by the region.	Companies can receive incentives to remove and reclaim asbestos. Other incentives include tax and financial benefits, which can vary according to regional regulations and available calls.
Poland	For A-B-C sites, the owner/user/entity of contaminated land pays for the remediation.	For A-B-C sites, in special cases when the owner of contaminated land cannot be identified and/or in case of need of urgent intervention due to threat to human health the remediation/restoration is conducted by Regional Directorate for Environmental Protection.	None to our knowledge.

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Country	How are Sites with "Responsible Parts" Financed?	How are Sites with "No Responsible Parts" Financed?	What are the Financial Incentives for Remediation?
Belgium	For A-B-C sites, the polluter pays for remediation in all three regions.	There is no established channel for liabilities transfer for sites of "no responsible part". However, in Flanders, sites marked "innocent owner" can get contribution from OVAM	National Soil Remediation Fund for Gas Station (BOFAS) is a national incentives for all permanently closed gas stations. In addition, Flemish Laboratory for Textile Research (VLABOTEX) contributes 50% of required funding for drycleaning remediation within the Flemish region.
UK	In practice, the polluter does not always pay directly as most remediation is paid for by developers, although indirect payment through reduced purchase price is an option. Applies to A-B-C sites.	Local Authority (i.e., county, district, borough, or city councils) pays for remediation which is nearly always funded internally. However, a limited amount of money is available for local authorities to take loans.	The central government supports local authorities across through a "block grant" mechanism through property value-based taxation (the "Council Tax")
Kosovo			
Greece	For A and B sites the owner/user/developer of the land pays for remediation. If this is not possible the National/regional/local authority finances the remediation.	The National/regional/local authority.	None to our knowledge.

Appendix A5: List of identified barriers

This table presents the barriers description, their type, and level of relevance in each country. Each barrier is identified by an ID. LE = Legal, F/E = Financial/Economic, IN = Institutional, TE = Technical, ENV = Environmental and S/C = Social Cultural; FI = Finland, FR = France, NL = The Netherlands, SE = Sweden, PL=Poland, PT = Portugal, BG = Belgium, GR = Greece; IT = Italy; XK = Kosovo;

Barrier Description	Type of Barrier					
Description of Category	Planning	Level of Relevance in Countries				Barrier ID
		Not Relevant	Relevant	Highly Relevant	Not Sure	
Lack of clear and precisely defined project goals	F/E, TE	IT, NL, FR, PL	BG, GR, XK, SE, FI, PT			B1
Uncertainty in the planning process and subsequently in costs for redevelopment and maintenance	F/E, IN, TE	BG, PL	SE, FI	IT, GR, XK, NL, FR, PT		B2
Lack of / limited data (information) on contaminated lands (information gap).	F/E, TE	IT, SE	BG, NL, FN, PL, FI, PT, XK	FR, GR		B3

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Barrier Description	Type of Barrier					
Description of Category	**Communication**					
No / Weak communication towards the community, financial investors (banks)	F/E, IN, S/C	BG, FR, SE, PL	GR, XK, NL, FI, PT	IT		B4
Lack of / limited communication about the significance / benefits of the project or risk of base scenario	IN, S/C	BG, NL, SE, PL	GR, XK, PT	IT, FR	FI,	B5
Description of Category	**Stakeholders**					
No clear lead-responsible or not wanting to take responsibility therefore postponing the situation	IN	NL, PL	IT, BG, FI, SE	GR, XK, FR, PT		B6
The complexity of these projects, and the involvement of many different stakeholders (incl. different landowners).	IN, TE	IT, SE, PL	BG, GR, XK, NL, FI,	FR, PT	FI	B7
Lack of consensus between the main stakeholders, due to conflicting interests	F/E, IN	SE, PL	BG, GR, XK, NL	IT, FR, PT	FI	B8
Description of Category	**Experts**					
Lack of locally available personnel/experts	F/E, TE	IT, BG, NL, PL	GR, SE	XK, FI, FR, PT		B9
Lack of expertise and fragmented visualization of perspectives of the problem	F/E, TE	BG, SE, PL	IT, GR, NL, PT	XK, FI, FR		B10
Description of Category	**Policy and Legislation**					
Incoherent and weak institutional and legal frameworks (lack of clear and realistic policies on land decontamination)	LE, F/E, IN	BG, NL	XK, FI, PL	IT, GR, FR, PT		B11
Complexity in regulation (i.e., confusing national, regional, and local environmental and legal policies.	LE, IN	BG, FR	XK, NL, FI, PT	IT, GR, PL		B12
Lack of policy support for innovation	IN, TE	BG, FR, PL	XK, NL, FI, PT	IT, GR		B13
Absence of a consistent redevelopment framework	LE, IN	BG, NL, PL	IT, XK, FI, FR	GR, PT		B14
Entrenched attitudes among regulators;	LE, IN	FR	FI, NL	GR		B15
Absence of identifiable and consistent clean-up standards	LE	IT, BG, NL, FI, PT, PL	GR, XK	FR		B16
Lack of policy support resulting in barriers for overcoming liability and financing barriers.	LE, F/E, IN	PL	BG, FI, PT	IT, GR, NL, FR		B17
Description of Category	**Politics**					
Change of heads within competent authorities due to change of government (lack of political will)	LE, IN	BG, PL	NL, FR, PT	IT, GR, XK	FI	B18
Fear of change: e.g. neighborhood, community, municipality, water boards.	IN, S/C	NL, PL	IT, BG, GR, FR		FI, PT	B19
Description of Category	**Cost**					
Incoherent financial framework: lack of national financial commitment in land decontamination.	LE, F/E, IN	BG	FG, SE, PL	IT, GR, NL, FR, PT		B20

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Barrier Description	Type of Barrier					
Often costs are higher than expected because the maintenance costs are not taken into account in the design.	LE, F/E	FR, SE	IT, BG, GR, NL, FI, PT, PL	XK		B21
Insufficient financing, no interested investors or insufficient communication; Lack of resources, due to missing urge;	F/E		FI, SE, PT, BG, PL	FR, NL, GR, IT, XK		B22
Potentially substantial capital costs (marketability of BF land);	F/E, IN	PL	FI, GR, SE, PT, XK	FR, NL, IT		B23
High cost of soil investigation and regeneration	F/E, TE, ENV.	BG, PL	XK, NL, PT, SE,	IT, FI	GR	B24
There is high level of uncertainty and financial risks in brownfield redevelopment compared to greenfield redevelopment	F/E	FR, PL	BG, GR, PT, SE	IT, XK, NL, FI		B25
Short-term thinking about investments and revenues (due to quick results and election cycles);	F/E	BG, PL	SE, PT, XK	NL, GR, IT	FI	B26
Cost of land decontamination and reuse exceeds the benefits of decontamination.	F/E, S/C	BG, PL	FR, PT, SE	IT, NL, FI	GR	B27
Original polluter/s cannot be identified / reached or cannot be held countable.	LE, F/E	IT, BG, GR, FR, PL	NL, FI, SE	XK, PT		B28
Description of Category	**Taxation**					
Lack of incentives/detaxation for brownfield redevelopment.	LE, F/E, IN	BG, FR, PL	IT, GR	NL, PT	FI, SE	B29
Unsupportive tax and other policy: developers of brownfield properties generally pay higher property taxes than developers of greenfield sites.	LE, F/E	IT, BG, FI, FR, PL	NL, PT		GR, SE	B30
Negative value in books (=can also be an incentive to do something).	F/E	BG, GR, FR, PL	NL, FI		IT, XK, PT, SE	B31
Description of Category	**Risk Assessment and Liability**					
Site geology and contamination level are complex (e.g., Emerging contaminants, multiple contamination etc.	F/E, TE, ENV.		IT, BG, NL, FI, FR, PL	GR, PT		B32
The uncertainty of risk assessment and outcome of remediation (i.e., there is a liability when we do not remove everything).	F/E, TE, ENV.	BG, SE,	IT, GR, FI, FR, PL	NL, PT	XK	B33
Description of Category	**Enablers/Drivers**					
Remediation causes nuisance for neighborhood (e.g., increase GHG emissions).	F/E, ENV., S/C	BG, GR, NL, FI, SE, PL	IT, FR, PT		XK	B34
Perception that such development is a private sector issue	L, F/E	FI, NL, SE, PT, IT, BG	FR, GR		XK	B35
Limited demand for redeveloped sites; Competition of and availability of greenfield land.	F/E, IN, ENV.	BG, GR, PT, PL	FL, FR, SE	IT, NL		B36
Market forces are not able to drive redevelopment (no return of investment).	F/E	BG, PL	IT, NL, FR, PT, SE		FI	B37
Relatively long timeframe for regeneration project.	F/E	BG, PT,	IT, GR, FL	NL, FR		B38
Lack of interest, thus no urge to anticipate on cessation of use; Lacking sense of urgency;	S/C, L, F/E, S/C	FI, NL, SE, BG	FR, IT, XK, PL	GR, PT		B39
Public opposition and negative perception, acceptability of re-using BF land.	S/C	BG, PT, PL	IT, XK, NL	GR, FR	FI	B40
The site is located within / close to community heritage, viewed as a sacred place or proximity to protected area.	F/E, TE, ENV., S/C	BG, NL, PL	PT	IT, GR, FR	XK, FI	B41

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Barrier Description	Type of Barrier					
Description of Category	**Site Ownership**					
Complexity or fragmented land ownership (e.g., unclear community heirs)	IN, S/C	IT, BG, SE, PL	GR, XK, NL, FR, PT		FI	B42
Description of Category	**Mass Management and Invasive Species**					
Movement or transfer of soils can transmit problem or invasive species such as Japanese Knotweed.	LE, F/E, TE, ENV.	IT, BG, NL, PT, SE, PL	FR	GR,	XK, FI	B43
Excavated soils are considered waste under the Waste Framework Directive of the EU. This requires adhering to a regulatory system, which creates barriers for brownfield remediation.	LE, F/E, IN, TE, ENV.	BG, GR, NL, SE, PL	XK, FI, FR, PT		IT	B44

Appendix A6: List of potential solutions matched with barriers that they can potentially overcome

Colors of types of barriers matched with solutions are as follows: planning = black (B1-B3), communication= blue (B4-B5), stakeholders= red (B6-B8), experts= green (B9-B10), policy and legislation= yellow (B11-B17), politics= pink (B18-B19), costs= orange (B20-B28), taxation = brown (B29-B31), risk assessment and liability= purple (B32-B33), enablers/drivers= grey (B34-B41), Site ownership= turquoise (B42), Mass management= olive green (B43-B44).

Description of Potential Solution	Potential Solution	Source	Potential Solution to Barrier
Proactive planning including a feasibility study with assessment of different scenarios	General solution proposed during conference	European Commission, 2019	B1, B2, B10, B21, B22, B25, B26
Phased approach to spread the financial burden	General solution proposed during conference	European Commission, 2019	B2, B20, B21, B22, B24, B25, B26
Initiate and implement subsidies, tax reduction and Loans schemes for developers	General solution proposed during conference	European Commission, 2019	B2, B17, B18, B19, B25, B26, B35
Establishment of environmental insurance	General solution proposed during conference	European Commission, 2019	B17, B28, B30, B34
Sufficient soil investigations to develop a good conceptual site model	General solution proposed during conference	European Commission, 2019	B1, B3, B4, B9, B10, B24, B32
Investments in research and development	General solution proposed during conference	European Commission, 2019	B3, B5, B10, B22, B26, B32, B39
Invest in risk-based and sustainable remediation and regeneration contaminated lands	General solution proposed during conference	European Commission, 2019	B20, B22, B25, B26, B27
Invest in and hire soil manager to coordinate the reuse of soil	General solution proposed during conference	European Commission, 2019	B4, B5, B9, B39, B43, B44
The definition of liability must be clearly stated in contracts or legislation	General solution proposed during conference	European Commission, 2019	B1, B11, B12, B17, B28, B32
Invest in robust and coherent regulatory framework to provide legal certainty	General solution proposed during conference	European Commission, 2019	B11, B12, B17, B18
Integration of soil protection in land-use planning	General solution proposed during conference	European Commission, 2019	B20, B22, B25, B26, B39
Development of a common, long-term, and integrated vision	General solution proposed during conference	European Commission, 2019	B4, B5, B6, B10, B18, B26
Invest in public-private partnership (4P = PPP + people)	General solution proposed during conference	European Commission, 2019	B7, B17, B39
Stakeholder involvement and multi-disciplinary cooperation from the start, during and after the project	General solution proposed during conference	European Commission, 2019	B1, B2, B3, B4, B5, B6, B8, B10

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Description of Potential Solution	Potential Solution	Source	Potential Solution to Barrier
Visualization of current and future situation by stakeholders and developers	General solution proposed during conference	European Commission, 2019	B4, B5, B10, B15, B20, B26, B39
Establishment of public brownfield inventories and data sharing	General solution proposed during conference	European Commission, 2019	B3, B10, B11, B15, B18, B23, B32, B39
Invest in training and capacity building with focus on new technologies	General solution proposed during conference	European Commission, 2019	B4, B9, B10, B26, B32, B39
Invest in development of decision support tools and design solutions	General solution proposed during conference	European Commission, 2019	B2, B3, B10, B17, B32
Integration of the cultural heritage in the project	General solution proposed during conference	European Commission, 2019	B39, B41
Connect remediation to urban planning – i.e. plan areas according to what is in the ground and do not place sensitive land-use where there are high levels of contamination	General solution proposed during conference	AquaConSoil, 2023	B2, B15, B20, B22, B23, B25, B36, B40
Polluter pays principle (i.e., the responsible part of a contaminated site is held accountable for remediation	General solution reported in literature		B11, B12, B42
Temporary uses / interim use: Mean to create benefits and value on short term when long term BF redevelopment solutions are considered non-viable or not technological feasible at the moment. In times of absence of economic drivers to redevelop land, interim uses may be an opportunity to restore some functionalities to land (and hence value) during this period and prevent surrounding areas to depreciate	General solution reported in literature	Maring et al, 2013 European Commission, 2019 Rood et al., 2018	B21, B26, B27, B31, B37, B38
Using other types of contracts, like DBMO (design, built maintenance and operation) or DBFM (design, built, finance and maintain) contract. With such contracts the long-term conditions are included, thus the maintenance costs. By including the life after realisation, actions and technologies for redevelopment can become more efficiently, time and cost-wise.	General solution reported in literature	Hendriks et al., 2018	B2, B21, B22, B26, B33, B38
Being allowed to make use of the factor 'time' (waiting for windows of opportunity, flexibility in 'end uses', temporal uses, long-term storage of excavated soil, etc), good connection with the legal decision makers / policy makers	Applied in the Netherlands	Hendriks et al., 2018	B17, B18, B23, B31, B36, B37, B38
Earlier involvement of relevant actors (including soil experts) to draft different scenarios for the site(s)	Applied in the Netherlands	Hendriks et al., 2018	B2, B3, B4, B19, B32, B35, B39, B40
Finding adequate financing; financial arrangements and division of costs and benefits (over time, over projects); public investments	Applied in the Netherlands	Hendriks et al., 2018	B2, B22, B25, B26, B31
It is a requirement that prior to commencing any remediation project, planning of the area, (including objectives for the area) should be extensively clarified. This requires discussions between those who are responsible for remediation, authorities, and land use planners at early stage of project planning, as well as consideration the views of any relevant stakeholders (e.g. residents	Applied in Finland	Reinikainen et al. 2016	B2, B3, B5, B6, B7, B8, B21, B40

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Description of Potential Solution	Potential Solution	Source	Potential Solution to Barrier
Branding of the area, function combinations (including Ecosystem services e.g. climate adaptation, temporary uses)	Applied in the Netherlands	Hendriks et al., 2018	B23, B25, B36, B39
In the Czech Republic, a national contact point was established, represented by the company Czech Invest. The company is responsible for holding all information with direct links to all local municipalities.	Applied in Czech Republic	Timbre, 2013	B3, B32, B35, B39, B40
In Germany, there is detailed local knowledge on brownfields where developers can obtain pertinent information about brownfield	Applied in Germany	Timbre, 2013	B3, B32, B39
Brownfield database is organized by OVAM since more than 30 years and accessible to all actors	Applied in Flanders, Belgium	Joris Crynen	B3, B32, B26
If you are responsible for a desolated brownfield, after 3-5 years of desolation, you will receive a tax-letter for 'desolated areas. The tax is relatively high and increases every year by 10% until action is taken.	Applied in Flanders, Belgium	Joris Crynen	B28, B29
There is so-called 'brownfield covenant' which is a contract where all stakeholders are involved (i.e., local authorities, landowner, neighbours, national authorities) and have to communicate in a very open debate what their issues are so they are captured before the launch of the project	Applied in Flanders, Belgium	Joris Crynen	B3, B4, B19, B32, B35, B40

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PART B

Task 5.2: Strategies for maximizing the reuse of excavated soils

1. Excavated soils management consultation document - Background

In the linear economy that has been dominant since the Industrial Revolution, materials move from cradle (initial extraction from the environment) through use, to their grave (disposal when a product reaches the end of its life). This approach is now seen as an unacceptable waste of resources. In a circular economy the environmental costs of economic activities are reduced by re-using products or their components at the end of use. In this cradle to cradle (C2C) approach products or their components re-enter the economy after their use, rather than leaving it as waste. In March 2020 the European Commission adopted A new Circular Economy Action Plan For a cleaner and more competitive Europe (European Commission, 2020). While the public focus has tended to be on a circular economy for consumer products, the size of waste streams from construction and redevelopment dwarf these. An EU protocol for construction and demolition waste was published in 2016 (European Commission, 2018) partly to promote a more circular use of materials. However, excavated soils are excluded from this protocol, despite being also a very large amount of material. Indeed, the amount of excavated rock and soil entering the waste stream in Europe is enormous, >400 million tonnes in 2020 (European Commission. JRC, 2023b).

The available statistics on excavated soils re-use are variable. Media reporting suggests the amount of waste from soil excavated on construction sites is estimated to be five times larger than that of household waste produced across Europe, and of this the majority (perhaps as much as 80%) goes straight to its “grave” (Simon, 2021). However, statistics reported in the EU Soil Strategy (see below) are more optimistic, suggesting “two thirds” of excavated soils were somehow re-used. A 2023 assessment of construction and demolition waste management (European Commission, 2023b) estimated that 35% of “soil waste” was somehow recycled, 40% “backfilled” and 25% landfilled in 2020. However, the data used included large uncertainties. This same study concluded that “100% recycling” is feasible.

In parallel, there are multiple demands for soil and aggregates including: infilling materials, land-raising, engineering such as embankments, ecological engineering (for example for flood management), horticulture and landscaping, both domestically and commercially. Although there are no detailed statistics for the scale of demand and sources of supply for soil, it is clear that a large proportion of this demand is met from primary resources leading to land take and environmental impacts of excavation.

Substitution by creating a more circular economy that better re-uses excavated soil and rock and dredged materials has been tentatively estimated to have the potential to reduce greenhouse gas emissions by 3.6 million tonnes CO2 equivalent each year and generate annual economic savings in excess of €12 billion (Cristóbal et al., 2024).

An obstacle to creating a circular economy for soil is the legal status of excavated soil consequent to the Waste Framework Directive (European Commission, n.d.-b). Case law following the Directive has generally found that excavated soil is assumed to be a waste unless the following conditions prevail:

- It is clean naturally occurring soil that will be reused on its site of origin
- It is demonstrably a byproduct
- It is a recyclate, which meets suitable end-of-waste criteria
- It can be demonstrated that there was never intention to discard the soil (as the definition of waste turns on the intention to discard.

In addition, the Waste Framework Directive sets out some key principles for waste management. It requires that waste be managed:

- Without endangering human health and harming the environment
- Without risk to water, air, soil, plants or animals
- Without causing a nuisance through noise or odours
- And without adversely affecting the countryside or places of special interest.

These have important impacts on soil re-use, for example that the re-use of soils should not lead to net deterioration of the receiving environment, including that they should not exceed background trace element levels at the receiving site.

Revisions to the Directive are under consideration (European Commission, 2023a), but these basic conditions and principles will remain.

Member State regulatory interpretations tend to follow an assumption that there is always an intention to discard simply as a direct result of the act of excavation, consequently – except for the emption for on-site use - the excavated soil is inevitably a waste and not a serviceable resource or even byproduct. Moreover, excavated soil management does not always seem to be deeply considered in the developing debate on soil priorities, for example with just a single mention in a recent review of soil priorities by JRC and EC authors (Panagos et al., 2022). Moreover, statistical information on waste generation and fate is limited because excavated soils and dredging spoils are usually excluded because they do not count towards the recovery rate estimations imposed by the Waste Framework Directive.

Several schemes in Europe (especially Belgium, the Netherlands and the UK) have been set up. Their goal is to facilitate the management and re-use of excavated soils and so encourage a more circular economy approach to soil. Broadly speaking, they formalise the management of excavated soil in a way that is traceable and transparent to regulators that excavated soil is a resource (no intention to discard), a byproduct and/or has achieved end-of-waste.

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These re-use schemes tend to centre on excavated materials from urban and development projects and encompass a wide range of materials, and not only "A" and "B" horizon soils[2], but variously, other naturally occurring subsurface materials such as geological strata, including from tunnelling projects; in-ground demolition materials such as crushed concrete and aggregate; sediments, depending on the particular scheme.

2. Cross-cutting analysis of existing national mechanisms

2.1. Scope of the analysis

A survey has been developed to collect information on soil reuse schemes, guidelines, or processes among different European countries. The collected data is going to be used to perform a cross-cutting analysis, with the following aims:

- Assessing similarities and differences between the soil reuse schemes across European countries;
- Identifying best practices and challenges in the implementation of the requirements of these schemes.

The development of the survey started with a preliminary literature review on the most advanced soil transfer and reuse frameworks adopted in European countries. The reviewed literature consists of the main documents forming the soil reuse schemes and the related policies and regulations. The information gathered with this review helped identifying the most relevant features of the assessed schemes. Once the main characteristics of the schemes had been identified, data was collected from multiple countries, and bilateral discussions and meetings for the Definition of Waste: Code of Practice developed by CL:AIRE in England, and a collection of different guidelines for the management of excavated soil managed by Grondbank in Flanders. The entries for these two different schemes have been validated by the leading representatives from the organisations through an interview process.

The information being collected comprises the following.

- Name of the scheme/guideline/process to follow;
- Purpose, regarding the stated main objectives that the schemes aim to achieve;
- Application level, which distinguishes between regional, national, or international level;
- Legal context, addressing whether the schemes are voluntary or mandatory and what policies and/or regulations allow them to operate;
- Development level, covering the first publication of the schemes and any updates it has had;
- Requirements that define the following three key-aspects of the object of the schemes:
    - Allowed inputs: types of materials covered by the schemes;
    - Allowable applications: permitted and excluded applications of the transferred materials;

[2] Topsoils and subsoils respectively

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    - Allowable land use: where the transferred materials are permitted to be reused;
- Soil health, which investigates if the schemes provide any explicit soil health reference;
- Contamination provisions about general and specific (chemical, physical, biological, and radiological) objectives;
- Exemptions (e.g. minimum volume below which the requirement of the schemes do not apply, other schemes or alternatives that cover specific transfers);
- Documentation or records generated as part of the process that allow for the excavated soil to be transferred and reused, covering the following areas:
    - Project outline and objectives;
    - Lines of evidence;
    - Mass balance;
    - Materials tracking;
    - Verification of the material transfer and reuse;
    - Contingency planning;
    - Applicable planning and regulatory approvals required;
    - Authorization record.
- Traceability considerations (about tracing records in place, or soil history);
- Involved parties, specifically:
    - Organization(s) that produced the schemes and/or manage them;
    - Public bodies involved in the implementation of the schemes;
    - Private stakeholders involved in the implementation of the schemes;
    - Actors responsible for checking the information provided for the Authorization Record;
    - Actors responsible for complying with the schemes.

2.2. Cross-cutting review

At this stage, the schemes operating in the United Kingdom, Belgium (for the regions of Flanders and Wallonia), and Italy are presented in Appendix B1 to illustrate the survey work. Following are the details of the investigated features for the schemes, with a brief comparison.

The information presented illustrates how an independent scheme has only been developed and adopted in the United Kingdom, while the other countries refer to guidelines or to the inherent regulations on excavated soil management.
In the United Kingdom a technical and verifiable approach is adopted, that focuses on a detailed assessment to determine the status of the excavated materials (waste or non-waste), and ensures that the treated materials are used appropriately; in Italy there is a move towards national harmonization, with the aim of ensuring that the excavated materials management and control systems (under the responsibility of each Region) are in compliance with the requirements of existing national and supranational regulations; the two regions of Belgium present more concise objectives: Wallonia adopts a general regulatory approach that only establishes rules for land management and land use, in Flanders a specific environmental protection principle is emphasised.
The scheme adopted in the United Kingdom is also offered on an international basis.

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The assessed schemes differ in terms of compulsoriness and time implementation. While the scheme adopted in the United Kingdom is voluntary, Italy and Belgium adopted more stringent and binding approaches. The oldest of the analysed schemes is the one adopted in Flanders, followed by the one in the United Kingdom, the Walloon one and the Italian one.

The scheme adopted in United Kingdom is characterised by considerable flexibility in both the inputs and the permitted applications. Some specific land uses, such as agricultural or recreational projects, may be excluded. In Italy, the guidelines focus on broadly defined materials and applications that integrate economic and environmental objectives, with an approach that reflects attention to regulatory compliance. The system in Wallonia is characterised by stricter criteria and a focus on soil quality, with a conservative approach, aimed at ensuring quality and environmental safety. The framework adopted in Flanders covers a wide range of materials and possibilities for utilisation, with a strong focus on "utilisation areas" and the allowed land uses. A key consideration is that imported soils must not lead to a deterioration of receiver sites, for example, contain trace element loadings above the background levels at the receiver site. Moreover, materials must be suitable for their use to qualify as a legitimate re-use / recovery process. Otherwise, their application would be considered a (possibly illegal) waste deposit.

The scheme adopted in the United Kingdom is focused on suitability for reuse of excavated materials (the need for treatment is required by the intended use) and on compliance with risk management guidelines, with a specific attention to materials contaminated by Japanese knotweed that must be treated as waste. The Italian guidelines do not have any specific requirements with regard to contamination management, but refer to the relevant national legislation. The system in Wallonia combines a preventive system based on inspections with the regulatory framework for soil quality management. The framework in Flanders is based on the standstill principle (similar to the scheme in the United Kingdom), while providing more detailed requirements for physical contaminants.

Almost all assessed schemes set specific thresholds for the volumes of soil that can be moved without requiring documentation or strict controls, providing simplifications for moving small quantities of soil (thus avoiding tracking or control obligations). The only exception is the Italian context, where there is no clear exemption regime.

All the investigated schemes consider documentation essential to ensure environmental safety. Tracking and verification documents are common to all schemes, although with variations in details and procedures. The scheme adopted in the United Kingdom stands out for its centralised approach through the Materials Management Plan (MMP).

Almost all reviewed schemes require a traceability system to be in place for monitoring the movement and use of soil materials. The only exception is represented by the framework adopted in the Flanders region, in which traceability is not mandatory although strongly desirable.

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The scheme adopted in the United Kingdom shows a centralised approach, with direct responsibility and auditing by independent experts. In Belgium, both in Wallonia and Flanders, governance is more formally integrated with regional licensing bodies, which oversee operations and issue permits. In Italy, the National Environmental Protection System and the Regional Agencies play a major role.

3. Template for a model excavated soil management system

3.1. Legal basis

An excavated soil management system will need to comply with three European policy and legislative frameworks:

- The Waste Framework Directive and its upcoming targeted revisions
- The European Soil strategy for 2030 and the proposed Directive on Soil Monitoring and Resilience (Soil Monitoring Law)
- A new Circular Economy Action Plan For a cleaner and more competitive Europe

Together these frameworks will establish the underpinning principles (see below) for any excavated soil management system. The developing debates in the proposed Soil Monitoring Law on Soil Passporting (Questions and Answers on the EU Soil Strategy, 2021) and Soil Health (see below) will influence the development and management of any Member State implementation of an excavated soil management system.

3.2. Underpinning principles

1. The management of excavated soil should always accord with a set of agreed underpinning principles to ensure that is beneficial. A suggested set of principles follows, drawn from the Waste Framework Directive and sustainable and risk-based land management (SRBLM) guidance documents, in particular the ISLANDR project Briefing on SRBLM (Bardos et al., 2024). The management of excavated soils should not give rise to unacceptable risks to human health and protect the wider environment now and in the future for the agreed land-use.
2. Where the excavated soils arise from the management of contaminated sites, and are themselves contaminated, they should be treated until they are proven to be suitable for their envisaged use in compliance with the European and local environmental permitting regulations.
3. The suitability for use of excavated soils (whether treated or not) should be clearly demonstrated: it should be technically for its purpose (e.g. landscaping, geotechnical etc.) and this use should not result in a net deterioration of the soil or water environment of the site where it is being used.
4. Soil health should be explicitly considered in relation to the required function of the soil being re-used, for example as a productive soil in landscaping, for land raising, as a fill etc. The soil re-use should not reduce the soil health of the receiving location, taking into account its current / planned use.
5. The process of re-use of the soil should maintain safe working practices for all workers and for local communities, and should minimise its impacts on the environment.

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6. Decisions on re-use of soil should be consistent, clear and evidence-based and made on the basis of sound science, relevant and accurate data, and clearly explained assumptions, uncertainties and professional judgment. This will ensure that decisions are based upon the best available information and are justifiable and reproducible.
7. Decisions and implementation should be supported by accurate record keeping and transparent reporting. Decisions, including the assumptions and supporting data used to reach them, should be documented in a clear and easily understood format in order to demonstrate to legitimately interested parties that a suitable solution has been adopted. Moreover, documented verification reporting should describe the implementation and its outcomes and any contingency actions that were undertaken and relate these back to the original re-use decision goals.
8. As part of verification reporting, the re-use of soil must demonstrate traceability, detailing its origin; its handling, treatment (if any), transportation and application at the receiving site; and how suitability for use has been validated throughout the soil transfer process (soil passporting).
9. The re-use decision making must include a clear legal and regulatory rationale compliance with the requirements of the site of origin and site of use (receiving site).
10. The process of site re-use should have clear planning for maintaining soil traceability (soil tracking) and for the management of contingencies, such as the presence of substandard materials or delays.
11. Local solutions are best. Wherever possible it is advantageous to find local re-uses for excavated soils to minimise transportation distances and so improve overall sustainability.

As a general comment, too often planning for the management of excavated soil is left as an after-thought and is not explicitly considered at the planning stage of a project, for example a site redevelopment or infrastructure project. This late consideration greatly restricts opportunities to re-use soil and the sustainability gains that accrue from this, with the outcome that soil is disposed of or not optimally re-used. Early consideration of soil management should be seen as a prerequisite for **any** project where excavation work may take place. Moreover, considering excavated soil management versus soil import needs over multiple sites within (say) an urban area may generate substantial sustainability gains.

3.3. Components of an excavated soil management system

Our suggestion is that the key requirements of an excavated soil management system able to fulfil the principles described above are:

1. A scope
2. A management mechanism
3. Oversight and monitoring
4. Agreed actors and roles

The exact details for each component will depend on the regulatory and policy context of the country and region where the excavated soil management system is to be established.

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However, the functionality of each component is likely to be similar. Initial suggestions for this functionality follow.

3.3.1. Scope

Schemes in Belgium (Flanders and Wallonia), the Netherlands and the UK (England and Wales) have successfully re-used large volumes of soil, soil products and other excavated materials. For example, in the Netherlands in 2020, 2.7 million tonnes of contaminated soil was processed by cleaning, immobilisation or landfill. 46.2 million tonnes of soil was applied directly, for example in noise barriers or for road foundations. 1.8 million tonnes of dredged material was processed and 6.3 million tonnes was directly applied in (water) soil. In the UK scheme (https://claire.co.uk/projects-and-initiatives/dow-cop) recovered over 240 million m^3 of "soil" from 2008 to 2022, with accelerating recovery rates year on year. The regulatory demand for excavated soil re-use is potentially very high with multiple small projects that are fairly diverse in their nature, distribution and configuration to very large infrastructure projects such as road and railway building. An important factor in the success of the schemes in Belgium, the Netherlands and the UK has been the removal of day to day regulatory workload from national and regional regulators to self-standing, self-financing and self-auditing schemes. The regulators' workload is then one of ensuring a correct foundational framework and oversight. Obviously, where there is an unsuitable deployment, the regulator may step in to bring forward prosecutions or other penalisations such as fines or taxation.

The schemes in Belgium, the Netherlands and the UK are all multi-actor, developed on the basis of interactive and thorough consultations between all key practitioner types (site owners / managers, service providers, regulators, financial interests etc). They have continued to evolve on the basis of ongoing debate between these parties. This has the benefit that schemes have "shared ownership" and the boundaries of compromises are clearly understood. Another feature that these schemes have in common is that they are established by a not for profit membership organisation, and managed by them or a subsidiary of them. All of the schemes have a basis in a shared published operating document that sets out amongst other things:

- The purposes of the scheme
- The materials and material uses
- How potential contamination is to be dealt with
- Requirements for scheme users, for example for ensuring materials traceability through appropriate tracking systems, contingency planning, verification reporting
- Application process, its scrutiny and record keeping
- Key actors
- Monitoring and oversight
- Ensuring compliance, auditing and consequences of improper usage
- The operational details of how the scheme works.

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3.3.2. Key system management needs

The overall assumption for ISLANDR is that the requirement is for an overarching system to ensure effective and suitable soil re-use projects. The soil management system needs are written in this regard and ISLANDR is not making recommendations about the operation of individual projects, other than that they need to comply with a regional / national legal and regulatory context.

Fundamentally an excavated soil management system needs to:

- Fulfil an agreed set of underpinning principles as suggested above.
- Be established on the basis of published documentation (as suggested above) that is agreed by its key participants and is in compliance with the prevailing legislative, policy and regulatory context of where it is established.
- Be hosted by a neutral party (the "co-ordinator") that is knowledgeable about soil re-use but is not a commercial actor, in Belgium (Flanders) and the Netherlands schemes were established by industry networking organisations, and in the UK, by the contaminated sites information charity CL:AIRE.
- Have a robust operational approach, with a clear set of procedures relating to application for soil re-use, evaluation of applications, documentation of accepted and declined applications; governance of the soil re-use implementation and verification reporting.
- Maintain accurate statistical records of the volumes of material handled, and (albeit confidentially) individual soil re-use projects to ensure long term traceability.
- If it is delegated, be operationally self-standing so it is removing regulatory and planning workload from public authorities. Moreover, the system must offer a similar and robust level of environmental protection as a directly regulated approach.
- Be fair, auditable and monitored, i.e. it operates to a published set of processes, ensures independent and neutral evaluation of soil re-use applications, ideally prior to excavation as far as possible, it is transparent and auditable by regulators and allows straightforward regulatory oversight and monitoring, ideally auditing its own work and agreements, self-reporting any deviations or potentially unsuitable excavated soil re-use projects to the regulator.
- Be self-financing with the cost burden met by the users of the scheme, the potential for self-financing is strongly related to the tax burden on soil disposal, an excavated soil management scheme is unlikely to be successful in countries where there is no landfill or similar soil waste taxation.
- Consider the sites both at the points of soil excavation and the points of soil re-use.

Note schemes may also incorporate soil treatment facilities or repositories where soil or soil components are stockpiled for future use and may be mixed during processing. Stockpiling and proposing pose additional challenges for demonstrating traceability. However, treatment facilities and repositories offer enormous circular economy benefits by buffering peaks and troughs in soil demand.

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3.3.3. Oversight and monitoring

There are several components to oversight and monitoring:

- Scrutiny of individual applications by the management scheme
- Verification
- Regular auditing of this scrutiny process
- Collating statistics and maintaining records
- Reporting to stakeholders
- Oversight by regulatory, planning and taxation authorities.

It is important to provide independent scrutiny of proposals for soil excavation/re-use to provide regulatory and market confidence that soil is being re-used in a way that is suitable and appropriate. This process depends on individuals who can assess a proposal or application free with the necessary level of expertise from conflict of interest. Different organisations have different approaches to this. For example, in the UK scheme, individual consultants train and qualify to carry out this scrutiny as independent experts call "Qualified Persons" and are paid for this scrutiny process by the applicant. In the Belgium (Flanders) schemes scrutinisers are experts employed by the scheme co-ordinator.

Verification on a project by project basis that suitable and appropriate re-use of soil has taken place is a vital check. Verification ensures that the plans described in application have been carried out in reality. Each application needs to be benchmarked against a verification reports before a soil re-use can be formally signed off. This verification benchmarking is typically carried out by the co-ordinator.

No scrutiny process can be absolutely perfect, so it is important that the co-ordinator of an excavated soil management scheme audits its scrutiny process. The outcome of this auditing process needs to be reported to the regulator and, in an aggregated way, also the scheme's wider stakeholders, such as its users. As an example, within the UK scheme this is achieved by calling in a proportion of signed-off projects. The project documentation and application is then assessed against a set of auditing criteria and a judgement is made of whether the soil re-use has met the requirements of the scheme, whether there are weaknesses or whether they are non-compliant, in which case the applicant and/or the Qualified Person may be sanctioned and in extremis reported to the regulator.

Statistics that might be compiled include the scale of use (e.g. number of projects, volume of materials recycled), the types of re-use projects and their geographical distribution, data about levels of contamination found, the proposition of soils treated, and the distribution of material types re-used (soil, soil components, aggregate etc). Additional to this the co-ordinator needs to maintain an information system that enables scrutiny of individual projects to take place at a later date, for example in the event of a legal claim or a further site redevelopment.

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Excavated soil management systems may therefore require users to upload extensive supporting documentation such as site investigation reports and risk assessments, or place a duty on applicants to retain these records in a way that allows long term access. The length of time records needs to be maintained will vary across countries and regions.

Excavated soil management schemes need to regularly report to their stakeholders, such as the regulators with oversight requirements, the users of the scheme and potentially other information users such as research organisations. There are two broad types of oversight. Firstly, it is likely that there will need to be engagement with local regulators / spatial planning authorities to gain their agreement that the soil re-use project can be managed by the soil management scheme. Secondly, regulators and other authorities will likely want to monitor the general activities and performance of the scheme. Typically, this can be achieved in summary form during annual reporting, although rights of access to more detailed records may be permitted on request, depending on who is making a request and why.

The re-use of soil crosses several authority domains: environmental regulation, spatial planning and, in many countries, taxation. All of these authorities will require detailed reporting of a schemes operation so that they can provide the necessary authoritative oversight to satisfy regional / national government. They will also require access to individual project details, for example in the case of a disputed soil use.

3.3.4. Actors and roles

The following actors and roles are likely for an excavated soil management scheme. However, this can vary according to specific context of a particular region or country.

- Promoter: the promoter of the scheme is the entity that initiates discussions and drives an excavated soil management scheme proposal forward. The promoter may then become the co-ordinator, but this is not inevitably so. Promoters have included: networking organisations (for example of construction companies or soil processing contractors); professional institutions, nongovernmental technical organisations, or government agencies. Promoters may be collaborative including authorities and private sector organisations. A scheme proposal may undergo several iterations before a scheme is successfully established and those involved in the promotion may change over this process.
- Co-ordinator: the co-ordinator manages and operates the scheme after its establishment, hosts its staff, develops and maintains its operations, collates its statistics, maintains its records and reports back to the authorities with overall oversight for the scheme as well as more generally.
- Evaluators: evaluators provide independent scrutiny of applications to the soil re-use scheme and may be in-house or external actors with suitable (and recognised) qualifications under the scheme.
- Users: users may be diverse including site owners / managers, developers, and service providers (consultants / contractors); operators of soil processing facilities. Users may include multiple additional actors in a particular action, for example transportation, waste management, local regulatory and planning authorities.

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While these additional actors may not be formal applicants it is useful to record their roles and responsibilities within the application process documents, for example in case of future dispute.

- Society: Society needs to be a beneficiary of an excavated soil management system, deriving benefits from reduced costs for public budgets (e.g. because of reduced administration); accelerated re-use of land and a more circular economy, and a high level of public and environmental protection.

3.4. Sustainability

Table 1 below suggests a series of potential sustainability gains (and losses) organised using the "headline" categories in the SuRF-UK sustainable remediation guidance (CL:AIRE, 2020). This guidance complies with ISO 18504:2017 - Soil quality — Sustainable remediation (ISO, 2017) and provides the most detailed published checklist of sustainable remediation indicators.

Table 1 potential sustainability gains and losses

Environmental sustainability gains and losses	
Greenhouse gas emissions and other emissions to air	**Reduced** fossil carbon footprint from: • Reduced direct and indirect land use changes at virgin material extraction sites • Reduced waste deposition • Reduced materials transportation (reduction in materials volume and potentially use of more local sites) **Reduced** SOx, NOx and particulate emissions from: • Reduced use of diesel plant and vehicles as a result of avoided virgin materials extraction and reduced haulage
Soil and subsurface impacts	**Reduced** impacts of virgin materials extraction **Enhanced** protection of soil health on a suitable for use basis
Surface and groundwater	**Reduced** impacts of virgin materials extraction
Wider ecology	**Reduced** impacts of virgin materials extraction
Use of resources / energy / water	**Reduced** use of resources / energy / water • Reduced land take (from virgin materials extraction) • Reduced resource intensity based on avoided use of virgin materials, based on recyclates instead • Reduced energy intensity from the avoided use of virgin materials and reduced haulage • Reduced water consumption from the avoided use of virgin materials
Social sustainability gains and losses	
Risks to humans	**Effective risk management** from • Ensuring suitability for use and traceability • Potentially reduced risks to workers from avoided extraction of virgin resources

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	• Potentially reduced risks to the public from reduction in materials haulage
Ethics and Equity	**Avoidance** of inter-generational transfer of resource scarcity and future waste management volume
Neighbourhood impacts	**Avoided** nuisance from excavation and material movements from virgin materials extraction **Reduced** nuisance from traffic
Communities	**Compliance** with societal demands for a more circular economy and avoiding controversy for land take for materials extraction
Uncertainties	**Improving certainty** of outcomes by: • Ensuring suitability for re-use and traceability to avoid environmental deterioration • Validated and recorded soil re-use projects
Economic sustainability gains and losses	
Direct financial outcomes	**Economic gains** for soil re-use compared with disposal-based options (depending on prevailing landfill taxation)
Wider economic gains and losses	**Development of new economic activity** in a circular economy industry.
Employment and employment capital	Development of circular economy **employment** and development of circular economy **skill base**.
Innovation	**Platform** for innovation in materials substitution and sustainable soils management
Project resilience	**Reduced reliance** on primary resources and greater certainty for project outcomes based on clear suitability for use principles.

4. Online survey and consultation Process

The EU Soil Strategy for 2030 and its implementation strategy (European Commission, n.d.-a) foresee the use of soil health certification and soil passporting to facilitate the re-use of excavated soils by providing confidence in soil quality and traceability of supply and use. It states that "clean" excavated soils should be reused in the same or another appropriate location and, if that is not possible, e.g. because the soil is contaminated, it should be prioritised for recycling or some other form of recovery rather than landfilling.

A survey of project partners (including ITAs) and external stakeholders was launched at the NICOLE meeting in Bilboa November 2024 which will run until mid-January 2025. The goal of this survey is to supplement the literature resources and initial in-person enquiries carried out by ISLANDR over 2024 (summarised above). The on-line consultation was launched at the beginning of December 2024. It is initially being disseminated via the NICOLE and COMMON FORUM stakeholder networks and via social networks and other channels operated by ISLANDR and its partners. It is/was available at: https://r3environmental.co.uk/consultations/excavated-soils-management-consultation.

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The aim of the consultation is to test the template set out above in chapter 3. This template is based on lessons learned by the leading European innovations in schemes for facilitating soil re-use in Belgium, the Netherlands and the UK, as well as the state of practice more generally across the EU to suggest a template or model procedure for excavated soil management in European countries that would be compatible with soil passporting as a contribution to this developing policy debate. ***This consultation is paired with the on-line survey*** which provides an opportunity for contributors to add to the available information about state of practice in their own country or region.

The consultation comprised:

- A draft model excavated soil management procedure
- A preliminary and qualitative sustainability assessment of potential gains and losses

The consultation asks questions about the template and preliminary sustainability assessment (see above) as well as a series of more open questions about the scale of the opportunity, barriers to implementation and offers the chance for general comments to be made.

The consultation questions, the online consultation and survey approach and their layouts are found in Appendix B2 and Appendix B3.

Bibliography PART B

Bardos, P., Pizzol, L., Maring, L., Arellano Jaimerena, B., Norrman, J., Hellal, J., Haxhiu, L., Couto, N., Derycke, V., Loukola-Ruskeeniemi, K., Tarvainen, T., Kaija, J., Crynen, J., & Baker, J. (2024). *Sustainable and risk-based land management – A briefing about the current state of practice and suggested future direction of travel.* https://doi.org/10.13140/RG.2.2.19656.33283

CL:AIRE. (2020). *Supplementary Report 2 of the SuRF-UK Framework: Selection of Indicators/Criteria for Use in Sustainability Assessment for Achieving Sustainable Remediation (SR2; SuRF-UK Framework, p. 34).* https://claire.co.uk/component/phocadownload/category/16-surf-uk-bulletins?download=720:sr2-selection-of-indicators-criteria

Cristóbal, J., Foster, G., Caro, D., Yunta, F., Manfredi, S., & Tonini, D. (2024). *Management of excavated soil and dredging spoil waste from construction and demolition within the EU: Practices, impacts and perspectives. Science of The Total Environment, 944,* 173859. https://doi.org/10.1016/j.scitotenv.2024.173859

European Commission. (2018). *EU construction and demolition waste protocol.* European Commission. https://single-market-economy.ec.europa.eu/news/eu-construction-and-demolition-waste-protocol-2018-09-18_en

European Commission. (2020). *A new Circular Economy Action Plan for a cleaner and more competitive Europe.* European Commission. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0098

European Commission. (2023a). *Proposal for a targeted revision of the Waste Framework Directive.* European Commission.

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https://environment.ec.europa.eu/publications/proposal-targeted-revision-waste-framework-directive_en

European Commission: Joint Research Centre, Cristóbal García, J., Caro, D., Foster, G., Pristerà, G., Gallo, F., & Tonini, D. (2023b). *Techno-economic and environmental assessment of construction and demolition waste management in the European Union : status quo and prospective potential*, Publications Office of the European Union. **https://data.europa.eu/doi/10.2760/721895**

European Commission. (n.d.-a). *Soil strategy for 2030—Reaping the benefits of healthy soils for people, food, nature and climate.* European Commission. Retrieved 5 December 2024, from https://environment.ec.europa.eu/topics/soil-and-land/soil-strategy_en

European Commission. (n.d.-b). *Waste Framework Directive.* European Commission. Retrieved 5 December 2024, from https://environment.ec.europa.eu/topics/waste-and-recycling/waste-framework-directive_en

European Commission. Joint Research Centre. (2023). *Techno-economic and environmental assessment of construction and demolition waste management in the European Union: Status quo and prospective potential.* Publications Office. https://data.europa.eu/doi/10.2760/721895

ISO. (2017). *Soil quality—Sustainable remediation (ISO 18504:2017; Version 1).* https://www.iso.org/standard/62688.html

Panagos, P., Montanarella, L., Barbero, M., Schneegans, A., Aguglia, L., & Jones, A. (2022). *Soil priorities in the European Union. Geoderma Regional, 29,* e00510. https://doi.org/10.1016/j.geodrs.2022.e00510

Questions and Answers on the EU Soil Strategy. **(2021**, November 17). [Text]. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_5917

Simon, F. (2021, January 13). Excavated soils: The biggest source of waste you've never heard of. Euractiv. https://www.euractiv.com/section/circular-economy/news/excavated-soils-the-biggest-source-of-waste-youve-never-heard-of

Appendices PART B

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Appendix B1 Preliminary Survey Status

Table 2 Names of the schemes, purposes, and application level

Country	Name of the scheme, guideline, or process to follow	Purpose of the scheme	Application level		
			Regional	National	International
United Kingdom	Definition of Waste: Code of Practice	The DoW: CoP sets out good practice for the development industry to use when: i. assessing on a specific basis whether treated excavated materials are classified as waste or not; ii. determining on a site-specific basis when treated excavated waste can cease to be waste for a particular use. Describes an auditable system to demonstrate that this scheme has been adhered to.		X	X
Italy	Guidelines on the application of regulations for the use of excavated soil and rocks	The guideline aims at ensuring the harmonisation, effectiveness, efficiency, and homogeneity of the control systems and their management throughout the national territory, as well as continuous updating, in accordance with the national and supranational regulatory framework, of the operating methods of the National System and the activities of the other technical subjects operating in the environmental field.		X	
Belgium - Wallonia	AGW Terres Excavées	The decree regulates the management and use of land on Walloon territory.	X		

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Country	Name of the scheme, guideline, or process to follow	Purpose of the scheme	Application level		
			Regional	National	International
Belgium - Flanders	Decree on soil remediation and soil protection; VLAREBO; Different practical guidelines exist for e.g. soil quality characterization or defining cadastral zones for on-site soil reuse.	Do not spread contamination on clean soils (standstill principle).	X		

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Table 3 Jurisdiction and stage of development

Countries	Legal context	Development level	
		Scheme start date	Most recent version date
United Kingdom	Voluntary scheme; Based on the WFD.	Version 1 issued in 2008.	Version 2 issued in 2011 (current version).
Italy	Legally required verification; also implementing the "by-product" and "end-of-waste" definitions from the WFD. Reference legislation: art. 184 bis of D.Lgs. 152/06; art. 185 sub-s 1 lett. b) and c), and 4 of D.Lgs. 152/06; DM 10/10/12 n. 161; DL 25/01/12 n. 2; DL 21/06/13 n. 69; DL 12/09/14, n. 133; DM 05/02/98.	Version 1 issued in 2019.	
Belgium - Wallonia	Mandatory scheme. Reference legislation: *Arrêté du Gouvernement wallon du 5 juillet 2018 sur la gestion et la traçabilité des terres excavées.*	Decree issued in 2018, effective from 2020.	Amendment in force from 17/07/2021.
Belgium - Flanders	Mandatory. Reference legislation: Soil Decree 10/2006 and VLAREBO.	First version issued in 01/04/2004 (VLAREBO).	Last major changes added on 01/04/2019.

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Table 4 Requirements

Countries	Requirements		
	Allowed inputs	**Allowable application**	**Allowable land use**
United Kingdom	Soil; dredgings (soil and mineral); ground based infrastructure (capable of reuse); made ground; aggregate materials; excavated materials.	Any development project; Cluster Projects and Fixed Soil Treatment Facilities; These land uses may be restricted: agriculture, waste site management, land uses with gate fees charged, golf courses and other leisure sites.	Site of origin; Direct Transfer to a receiving site.
Italy	Excavated soils and rocks coming from: earthworks, foundation, trenching, drilling, pile driving, consolidation, infrastructure works, removal and levelling of earthworks.	For backfilling, filling, reshaping, embankments, land or road improvements, environmental reclamation or other form of environmental restorations and improvements; in production processes, replacing quarry materials.	On-site and off-site reuse.
Belgium - Wallonia	Excavated soil mobilized as part of public road works and reused in another public road (waste code 170504-VO), provided that it meets the exemption criteria of art. 6, §3, 2° of the *AGW Terres*; Excavated soil mobilized in the course of railroad works and reused on another railway line (waste code 170504-VF), provided that it meets the exemption criteria of ar. 6, §3, 6° of the *AGW Terres*;	The possible applications depend on soil quality.	On-site reuse; Off-site reuse is possible if there is proven compatibility.

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Countries	Requirements		
	Allowed inputs	Allowable application	Allowable land use
	Soil excavated as part of remediation work on land subject to a remediation project approved by the Administration, an Immediate Management Measure (IMM) or a SPAQuE remediation plan, and transported to an authorized facility for the treatment of polluted soil.		
Belgium - Flanders	Excavated, dredged or remediated soil materials that have been generated throughout any kind of development project; Soil from washing activities of agricultural products; Soil mixed with bentonite.	Natural landscaping, land development or landscape design, development of a building work, infrastructure or civil engineering application, or a combination of these; Quarry fillings.	All land on which the project is carried out constitutes the project area. The project area includes not only the sites to be excavated, dredged or cleaned up, but also the sites where the excavated materials can be used. These sites constitute the utilisation area and are three-dimensional (surface, depth or thickness). The utilisation area may differ from the excavation areas. The concept of utilisation area includes, in addition to filling (or backfilling) areas, all areas to be raised or filled. On-site and off-site reuse; Transportation to a temporary storage facility (TOP/CGR); Soil flow outside of Flanders boundaries.

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Table 5 Management of contamination

Countries	Contamination				
	General objectives	Chemical	Physical	Biological	Radiological
United Kingdom	Materials must be suitable for use; treatment may be required.	Remediation activities must comply with "Land contamination risk management" (LCRM) guidance / no elevation above backgrounds in the receiver site allowed.		Soils infested by invasive species (e.g. Japanese knotweed) are not subject to remediation and must be disposed as waste. (from the DoW: CoP main document - The following materials are outside the scope of the CoP: soils which have been contaminated with injurious invasive weeds except for soils that are used on the site of production in accordance with relevant best practice guidance.)	Remediation activities must comply with radiological risk management guidance.
Italy	Pollutant concentration must not exceed the limits prescribed by LD 152/06 for the specific use (i.e., contaminated soil must be treated before reuse).				

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Belgium - Wallonia	Excavated materials that originates from "suspected" land plots (highlighted in lavender blue and peach pink within the BDES) undergo a quality inspection.	Requirements set in Soil Decree "*Décret relatif à la gestion et à l'assainissement des sols*" from 01/03/2018			
Belgium - Flanders	Standstill principle applies. Contamination is dealt with based on the type of reuse and the land use that is planned for the excavated materials (e.g. naturally clean soil can be used anywhere; slightly polluted soil has to be used in specific constructions projects, like bridges or other buildings projects, also to make bricks). Contaminated soil to be reused has to be treated before reuse.	Threshold values in Annex to the VLAREBO.	Asbestos (from 100 mg/kg): has to be treated; and debris (5%) and other waste (1%) within the excavated soil; it depends on type of reuse.	There is some attention towards invasive species, but it still is not regulated.	Regulated at the national level.

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Table 6 Exemptions

Countries	Exemptions
United Kingdom	Up to 1,000 t of different types of soil waste (02 04 01, 17 05 04, 19 13 02, 20 02 02) can be used for construction over any 3 year period, with a U1 waste exemption.
Italy	
Belgium - Wallonia	If the movement involves volumes below 20 m^3, there is no tracking obligation; If the volume of moved soil is between 20 m^3 and 400 mc a notification of soil movement (NMT) must be produced; If the volume of moved soil exceeds 400 m^3 a certificate of soil quality control (CCQT) must be produced. The control should be done on the site of origin (option 1), where the contracting authority is in charge of the soil quality report (RQT), or on an authorised installation site (option 2), where the NMT is mandatory; Exceptions for RQT procedure: soil excavated in a Type I (natural) or Type II (agricultural) zone and reused in an area with the same type of use. This reuse zone must be designated by the project owner, who has a real right or a lease on the specified receiving site.
Belgium - Flanders	Volumes under 250 m^3 of transferred soil do not need to follow the requirements for soil reuse (traceability requirements still apply). If the excavation is only needed for cables and pipes placement activities: the activity is not considered proper excavation because the soil stays on the same place where it has been excavated. If soil from a bed river is moved within the limits of the same water flow, the activity is not considered excavation.

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Table 7 Documentation

Countries	Needed documentation for a reuse scheme						
	Objectives	Mass balance	Tracking	Verification	Contingencies	Planning & regulation	Authorization record
United Kingdom	Summarized in Material Management Plan.	Summarized in Material Management Plan.	Summarized in Material Management Plan.	Plan summarized in: Material Management Plan; Verification Report;	Summarized in Material Management Plan.	Summarized in: Material Management Plan; Supporting evidence (site investigations, remediation strategy/design statement, risk assessment).	Declaration signed by a QP.
Italy	Utilization plan.		Transport document.	Declaration of use (for small development sites); Declaration of actual use.			
Belgium – Wallonia	Utilization permit given by the local environmental authority (SPW).	The maximum capacity of soil allowed to be reused on the receiver site is stated in the permit.	Soil passport (transport document); CMR.	Soil quality control certificate.	General approach, not project-specific.		

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Countries	Needed documentation for a reuse scheme						
	Objectives	Mass balance	Tracking	Verification	Contingencies	Planning & regulation	Authorization record
Belgium - Flanders		Technical report.	Only mandatory in the executive transport phase. Embedded in the traceability procedure (see VLAREBO). Transport document.	Report of soil reuse provided by Grondbank (final approval document).	Any changes to the project must be notified to the accredited organization.		OVAM conducts the audit process.

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Table 8 Traceability

Countries	Traceability
United Kingdom	The Material Management Plan requires to ensure a tracking system is adopted. (from the DoW: CoP main document - All materials subject to excavation, disposal, treatment and/or reuse must be tracked throughout and evidence generated to provide an auditable trail. [...] The tracking system must include: annotated plans of the site(s) identifying different excavation areas, stockpile locations, treatment areas, and placement locations; inspections procedures; registered waste carrier and non-waste haulier; tracking form/control sheets; movement through any authorised treatment facility will also have to be tracked; treatment results; delivery tickets for non-waste materials; acceptance procedures for non-waste materials.)
Italy	The Declaration of Use/Declaration of Actual Use and the Transport document are required to ensure the traceability of reused excavated materials.
Belgium – Wallonia	Soil passport ensures the traceability of excavated materials.
Belgium - Flanders	A digital transport document is desirable but not mandatory. The regulation does not specify any mandatory requirements for tracking excavated materials.

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Table 9 Parties involved

Countries	Involved parties					
	Main involvement (scheme manager)	**Regulatory and policy stakeholders (public bodies)**	**Private stakeholders**	**Auditing**	**Other project actors**	**Responsibilities**
United Kingdom	CL:AIRE	Environment Agencies (in England and Wales); Local authorities; Courts (make the final decision in extremis).	All private subjects involved in development projects.	Qualified Person		The person commissioning the excavation works is responsible for complying with the scheme. In addition to tax - any person who knowingly permits or deposits waste at an illegal site faces a separate criminal prosecution.

Countries	Involved parties					
	Main involvement (scheme manager)	Regulatory and policy stakeholders (public bodies)	Private stakeholders	Auditing	Other project actors	Responsibilities
Italy	National System for Environmental Protection (SNPA)		All private subjects involved in development projects.	Regional Environmental Protection Agency (ARPA).		
Belgium - Wallonia	Walterre	Public Service of Wallonia Region (SPW)	Owners of the sites from where the excavated soil is extracted; Contractors (in charge of getting the approval to move the soil); Transporters (in charge of the transport of excavated soil from the site of origin to the receiving site);	Soil experts		The responsibility is transferred between the key stakeholders (?)

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Countries	Involved parties					
	Main involvement (scheme manager)	Regulatory and policy stakeholders (public bodies)	Private stakeholders	Auditing	Other project actors	Responsibilities
			Soil experts (in charge of helping the contractors to introduce the notification of movement of polluted soil in the system managed by Walterre).			
Belgium - Flanders	Grondbank	OVAM	Contractors, commissioners, soil experts.	OVAM	Temporary storage and treatment facilities.	The commissioner needs to produce a technical report; The contractor has the obligation to notify all transports to accredited organizations, and obtain authorizations;

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Countries	Involved parties					
	Main involvement (scheme manager)	Regulatory and policy stakeholders (public bodies)	Private stakeholders	Auditing	Other project actors	Responsibilities
						The accredited organization is responsible for delivering the authorizations and keeping an eye on the mass balance.

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Appendix B2: Consultation questions

The question set is arranged around the key segments of the template, as follows.

Legal basis:

Question 1: *What additional European level legal and policy contexts should be considered?*
Question 2*: What prevailing national frameworks in your country also impact the management of excavated soils? What conflicts do you see between regulatory regimes, e.g. where schemes are regulated under both waste and contaminated land regulatory regimes?*
Question 3*: For your policy and regulatory jurisdiction which of the following rationales are most likely to be used: exemption for uncontaminated soil and other naturally occurring material re-use at the site of origin; exemption as there is a planned use and so no intent to discard; qualification as a byproduct; or meeting end-of-waste criteria? Please also explain why.*
Question 4*: which of the following soil re-use contexts do you consider appropriate and why? Would you add any contexts? Construction and development; urban soil supply; flood management; landfill mining and soil recovery from wastes; ecological applications such as habitat creation; agricultural or horticultural applications including turf production; supply of soil to retail markets?*

Underpinning principles

Question 5: *How far do you support these principles? Are there those you would exclude? If so, please tell us why.*
Question 6*: Would you like to add a principle? If so, what principle(s) would you add? Maybe something about soil health?*
Question 7*: What would you like to see as a principle related to emerging threats such as emerging contaminants (e.g. pharmaceutical products, PFAS), physical contaminants (e.g. litter) biological contaminants (e.g. Japanese Knotweed)?*

Components

Question 8*: How far does the model system suggested above meet requirements in your country or region for supporting excavated soil management? What features are missing, if any? What features are redundant, if any? It would help us if you could structure your answer by scope, management mechanism; oversight & monitoring; and actors & roles. Thanks!*
Question 9*: What is the applicability of an excavated soil management scheme, such as the one proposed, in your region or country*

Sustainability

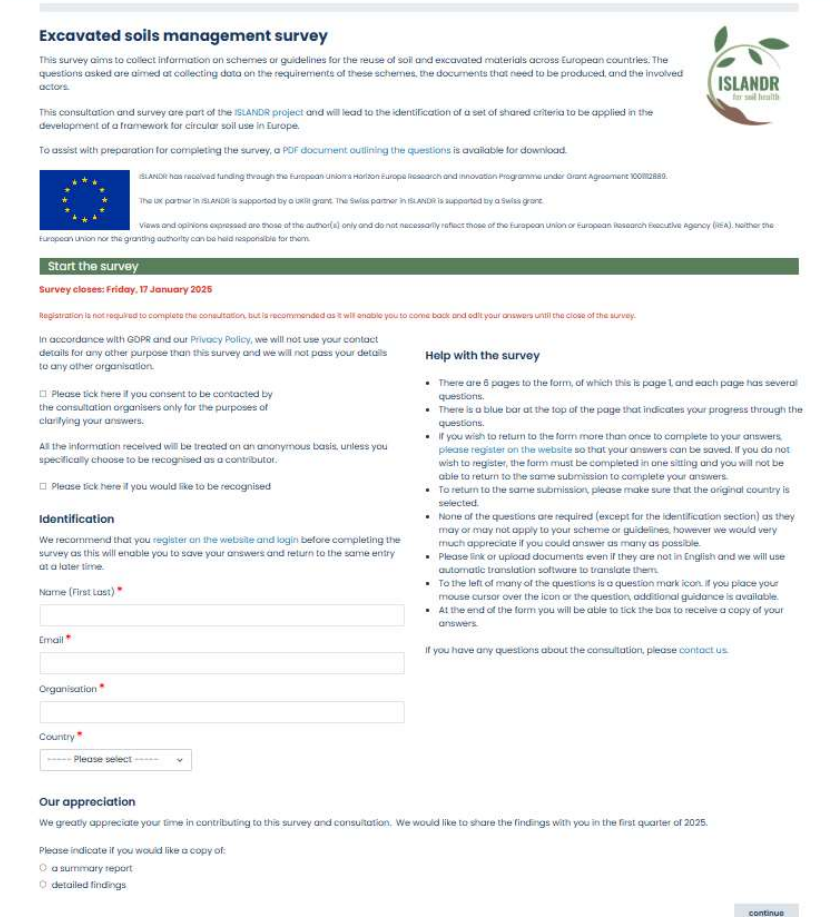
Question 10: *What additional sustainability gains or losses do you think are worth considering?*

Open questions

***Question 11**: In general terms how do you think the circular use of excavated soils can be better promoted?*
***Question 12**: What are your thoughts about key organisations that need to be involved in discussions about excavated soil management, in particular in your own country?*
***Question 13**: What do you think are the most important attractors for using an excavated soil management scheme, and the most significant blockers to its deployment in your region or country?*
***Question 14**: What general recommendations do you think we should make about excavated soil management schemes?*
***Question 15**: What general thoughts would you like to add?*

Appendix B3: On-line consultation and survey approach

The consultation and the survey have been designed as online forms, making it convenient for the people completing the forms and saving the data directly into a database for later retrieval and analysis.



Excavated soils management survey

This survey aims to collect information on schemes or guidelines for the reuse of soil and excavated materials across European countries. The questions asked are aimed at collecting data on the requirements of these schemes, the documents that need to be produced, and the involved actors.

This consultation and survey are part of the ISLANDR project and will lead to the identification of a set of shared criteria to be applied in the development of a framework for circular soil use in Europe.

To assist with preparation for completing the survey, a PDF document outlining the questions is available for download.

ISLANDR has received funding through the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement 100112889.

The UK partner in ISLANDR is supported by a UKRI grant. The Swiss partner in ISLANDR is supported by a Swiss grant.

Start the survey

Survey closes: Friday, 17 January 2025

Registration is not required to complete the consultation, but is recommended as it will enable you to come back and edit your answers until the close of the survey.

In accordance with GDPR and our Privacy Policy, we will not use your contact details for any other purpose than this survey and we will not pass your details to any other organisation.

☐ Please tick here if you consent to be contacted by the consultation organisers only for the purposes of clarifying your answers.

All the information received will be treated on an anonymous basis, unless you specifically choose to be recognised as a contributor.

☐ Please tick here if you would like to be recognised

Identification

We recommend that you register on the website and login before completing the survey as this will enable you to save your answers and return to the same entry at a later time.

Name (First Last) *

Email *

Organisation *

Country *

----- Please select -----

Help with the survey

- There are 6 pages to the form, of which this is page 1, and each page has several questions.
- There is a blue bar at the top of the page that indicates your progress through the questions.
- If you wish to return to the form more than once to complete to your answers, please register on the website so that your answers can be saved. If you do not wish to register, the form must be completed in one sitting and you will not be able to return to the same submission to complete your answers.
- To return to the same submission, please make sure that the original country is selected.
- None of the questions are required (except for the identification section) as they may or may not apply to your scheme or guidelines, however we would very much appreciate if you could answer as many as possible.
- Please link or upload documents even if they are not in English and we will use automatic translation software to translate them.
- To the left of many of the questions is a question mark icon. If you place your mouse cursor over the icon or the question, additional guidance is available.
- At the end of the form you will be able to tick the box to receive a copy of your answers.

If you have any questions about the consultation, please contact us.

Our appreciation

We greatly appreciate your time in contributing to this survey and consultation. We would like to share the findings with you in the first quarter of 2025.

Please indicate if you would like a copy of:

○ a summary report
○ detailed findings

continue

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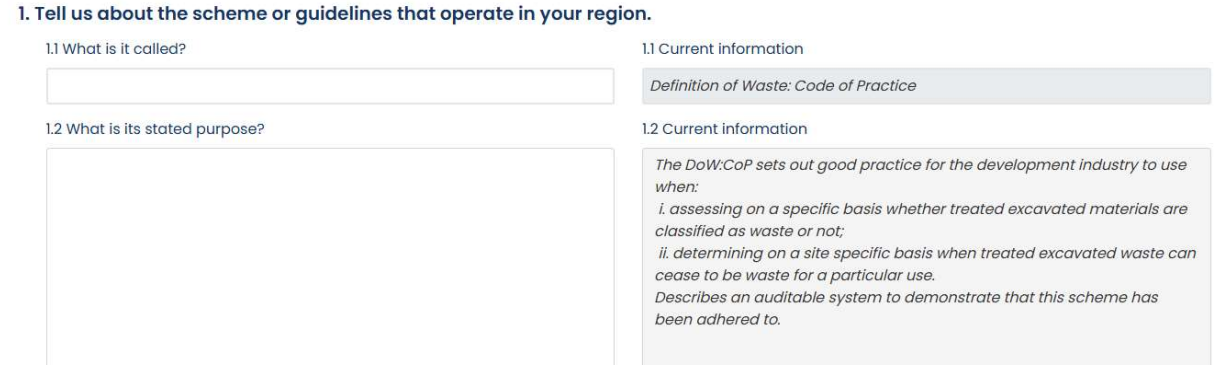
Functionality for both forms is consistent so that if the user is registered and logged in, they may save and return to the form later in order to modify or complete their answers. Data is collected and stored in accordance with GDPR and consents are requested for any further contact.
In appreciation of the time invested to provide their answers, users who complete either the survey or the consultation may choose to receive either a summary report or detailed findings at the conclusion of the data collection and analysis.

Survey layout

As the user starts the survey, they will choose a country and if some information is already known in answer to the question for that country, it will be shown in the right-hand side of the page. The ”current information” text cannot be edited, and the expectation is that the user will correct or add to the information shown. Not all countries have current information and if not, the text ”No data” will be shown on the right.



Excavated soils management survey question 1 for UK: England.

After the survey closes, the data will be collated and analysed.

	A	B	C	D	E	F
1	Country	Name of the scheme, guideline or process to follow	Purpose of the scheme	Application level		
2				Regional	National	International
3	submitter_country	1_1ci	1_2ci	1_3ci		
4	United Kingdom	Definition of Waste: Code of Practice	The DoW:CoP sets out good practice for the development industry to use when: i. assessing on a specific basis whether treated excavated materials are classified as waste or not; ii. determining on a site specific basis when treated excavated waste can cease to be waste for a particular use. Describes an auditable system to demonstrate that this scheme has been adhered to.		X	X

Excavated soils management survey collation

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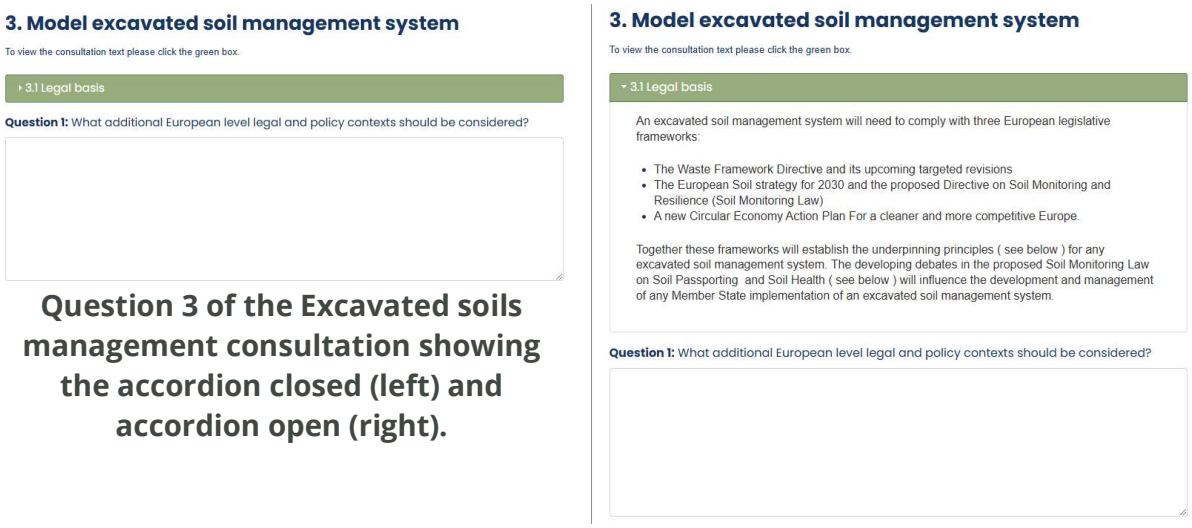
Consultation layout

To ensure the consultation is easy to follow, the text to be considered for each question is initially shown as a closed accordion (see figure below, left). When the green box is clicked, the accordion will open (see figure below, right), allowing the text to be read.



Question 3 of the Excavated soils management consultation showing the accordion closed (left) and accordion open (right).

On completion of both the consultation and the survey, the user may request a copy of the answers they have provided, and this will be automatically emailed to them.
The survey is linked to from the consultation and similarly, the consultation is linked to from the survey, ensuring that if the user starts with either one, they will be encouraged to complete the other.

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