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Waste Law in View of the Circular Economy

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Terminological Challenges to the Incorporation of Landfill Mining in EU Waste Law in View of the Circular Economy

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Abstract

The concept of Landfill Mining has been around for quite some time. As a result of increased pressure on the use of resources, the concept's prime focus has shifted towards recovery. Technological and economic development has been accelerated in the past few years. A legal viewpoint is however generally lacking in the debate. This study tries to contribute to the legal development of Landfill Mining by explaining why the concept fits the objectives enshrined in the Circular Economy Package and by indicating how the concept could be incorporated in EU waste law. It appears that the temporary storage of waste does not sit well with the definitions of temporary storage. The study further reveals that the storage along with the activities that follow, such as the excavation of the waste, correspond to the terminology used in the Waste Framework Directive: they can be interpreted as recovery processes. The actual recovery (either recycling or energy recovery) can furthermore influence the interpretation of the waste hierarchy. Finally, a new name for 'Landfill Mining' might be worth considering.

I Setting the Scene

Materials underpin the quality of life and are driving forces of the economy. Due to the living standard and consumption levels in developed States and the desire to attain equal welfare in an increasing number of developing States, pressures on natural resources, the environment and human health have increased phenomenal and will continue to rise.¹ Additionally, the world population is expected to increase massively: from 7 billion now to over 9 billion people in 2050.² Hence, a change in many of our existing manufacturing, production, consumption and waste treatment patterns is required to ensure the sustainable use of materials, regardless their form.³ To this end, the concept of a 'Circular Economy' is under development in and by the European Union (EU),⁴ which is a fully integrated approach that starts from a life-cycle perspective.⁵ Legislation plays a significant role in the transition towards a Circular Economy, because it can obstruct as well as stimulate the transition.

Implementing the philosophy of the Circular Economy into EU law poses certain legal challenges. This becomes particularly apparent in the case of the concept of Landfill Mining (hereafter 'LM'), which fits perfectly into the transition towards a Circular Economy. The current application of the LM concept functions as an experiment (a 'niche development') that might, in line with the notion

¹ European Commission, *Roadmap to a Resource Efficient Europe*, COM(2011) 571, 2.

² OECD, *OECD Environmental Outlook to 2050: The Consequences of Inaction*, OECD Publishing, 46 and 50 (2012).

³ See e.g.: OECD, *Sustainable Materials Management; Making better use of resources*, OECD Publishing, 13 (2005); European Commission, *A resource-efficient Europe – Flagship initiative under the Europe 2020 Strategy*, COM(2011) 21, 2; and European Commission, *Closing the loop - An EU action plan for the Circular Economy*, COM(2015) 614 (hereafter '2015 Action Plan').

⁴ In the past two decades, other policy approaches have been initiated and developed by international and other regional actors to facilitate a transition towards the sustainable use of materials. Although the policy differences are not straightforward, they can be explained by various reasons. For a general overview of the approaches, including their similarities, see Sander Happaerts, *International Discourses and Practices of Sustainable Materials Management*, Research Paper n° 5, Policy Research Centre for Sustainable Materials Management, 33-35 (2004). (Note that the Circular Economy concept was not yet adopted by the European Commission at the time this report was published).

⁵ See 2015 Circular Economy Packages provided on the website: http://ec.europa.eu/environment/circular-economy/index_en.htm (assessed 4 March 2016). See in particular the 2015 Action Plan and its Annex.

of transition management, successfully develop into a generally accepted practice.⁶ Below, the work on the Circular Economy by the European Commission is briefly explained whereupon the idea of Landfill Mining is clarified to provide the research context. Subsequently, the aim of this study is put forward.

1.1 A Circular Economy

In essence, the concept of a Circular Economy is very comprehensive: it not only minimizes the environmental impact of materials, but also preserves resources and reduces waste throughout the entire life-cycle(s) of a material, while aiming at economic growth and social equity.⁷ A life-cycle perspective is key to the potential success of a Circular Economy. For many decades, policy and legislation predominantly focussed on the waste stage of a material's life-cycle, whereas the Circular Economy is based on the assumption that one has to look at the *entire* cycle and the cycles to come. As a result, the transition to a Circular Economy challenges us to include many disciplines and to look at an ever-expanding variety of topics outside the scope of waste policy.⁸ Since the Circular Economy contains so many features, it represents almost the entire plethora of legal challenges associated with a successful EU environmental policy.⁹

Even so, improving waste legislation should not be neglected either. In fact, the Barroso Commission even went so far as to predominantly base the initial Circular Economy Package, which comprised of a Communication and a legislative proposal,¹⁰ on waste objectives instead of on other life-cycle stages too. The proposal set forth changes to several Directives, including the Waste Framework Directive and the Landfill Directive. For example, it proposed the gradual increase of the preparing for re-use and recycling target for municipal waste to 70% by 2030, and a landfill restriction of recyclable municipal waste by 2025. Member States were to endeavour to virtually eliminate landfilling by 2030. Notably, the new Juncker Commission withdrew the entire Package just after having been in office for a few months, but promised simultaneously to come up with a 'more ambitious' one in the course of 2015. Indeed, one year later the Commission published a new Package, which, besides now aiming at the entire life-cycle of a material in an Action Plan, included several legislative proposals to amend waste acts individually. Once again, the Waste Framework Directive and the Landfill Directive were amongst them.¹¹ The Commission expresses its desire to increase the preparing for re-use and recycling target for municipal waste to 65% by 2030 and to gradually limit the landfilling of municipal waste to 10% by 2030 of the total amount of municipal waste generated in

⁶ Erik Paradis, Walter Tempst and Johan Moyersoen, *Developing Enhanced Landfill Mining as a transition experiment: context, framing, methodology, questions*, 1st Int. Symposium on Enhanced Landfill Mining, 1-11 (2010). The 2015 Action Plan explicitly expresses that the Circular Economy is a transitional phenomenon on page 2. In other words, that one regime should be replaced by another regime.

⁷ See for a more comprehensive description pages 2-3 of the 2015 Action Plan.

⁸ Topics covered are for example: material and design innovation; novel production, transportation and storage processes; green job growth; and consumption patterns transformation. These examples demonstrate that Directorate-General Environment of the European Commission should (and does) work together with other DGs, such as DG Growth and DG Employment, Social Affairs and Inclusion. This is further enhanced by the applicability of Article 11 TFEU on the integration of the environmental objectives (such as the prudent and rational utilization of natural resources) in other policies than measures based on Article 192 TFEU.

⁹ Geert Van Calster, *Opportunities and Pitfalls for Sustainable Materials Management in EU Waste Law*, 97 (Ioannis Panoussis and Harry Post (eds), *Waste Management in European Law, The Example of Naples and Campania*, Eleven International Publishing, 2014). Note however that the author addresses Sustainable Materials Management (predominantly developed by the OECD) instead of the Circular Economy. Despite that there might be subtle differences between the two approaches, the Circular Economy, too, represents almost every legal challenge associated environmental policy.

¹⁰ European Commission, *Towards a circular economy: A zero waste programme for Europe*, COM(2014) 398 final/2; and European Commission, Proposal for a Directive amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment, COM(2014) 397, respectively.

¹¹ European Commission, Proposal for a Directive amending Directive 2008/98/EC on waste, COM(2015) 595; and European Commission, Proposal for a Directive amending Directive 1999/31/EC on the landfill of waste, COM(2015) 594, respectively.

each Member State. Clearly, these are less ambitious goals than the ones presented in the 2014 Package. That is to say, *only* when you consider landfills as a burden regardless their form and purposes...

1.2 Landfill Mining

Landfills have long been a final way to get rid of waste at a minimum cost. In spite of people becoming more aware of the fact that landfills go hand in hand with a whole host of environmental and social problems, the practice is still rife around the world.¹² Hence, most States and regions accommodate closed as well as operational landfills.¹³ Even though the EU now carries out a comprehensive waste management policy that severely restrains landfilling, it is estimated that there are still between 150,000 to 500,000 landfills located on EU territory.¹⁴ According to Eurostat, on average 30,3% of municipal waste in the EU (27-EU, 2013) is still landfilled.¹⁵

Landfill Mining has been proclaimed to address the environmental, social and other concerns, such as the rapidly growing competition for resources and the increasing prices for raw materials.¹⁶ There are different ways to define Landfill Mining. For example, it can be defined as ‘a process for extracting minerals or other solid natural resources from waste materials that previously have been disposed of by burying them in the ground,’¹⁷ or as an activity ‘where already landfilled waste is re-excavated, processed, classified and among other things, subjected to impurity and hazardous substances removal in order to obtain the highest possible amount of potential recyclable materials.’¹⁸ Traditional landfilling is in that sense drastically changed: landfilling is not the *final* solution for waste anymore. On the contrary, landfill sites should be considered as ‘temporary storage’ sites at which waste awaits further treatment after a certain period.¹⁹ This idea derives from the fact that current incineration and dumping (i.e. badly managed landfilling) practices reduce the possibility to recycle waste properly or effectively valorise waste through energy recovery in future scenarios when technologies have become better than today’s possibilities and when economic markets allow these practices.²⁰ The reclamation of valuable materials from previously landfilled waste should thus be seen as a decisive purpose of Landfill Mining.²¹

¹² The impacts such as groundwater pollution, occupation of valuable land and major costs for society (e.g. by the contribution to global warming) are today acknowledged. Peter Tom Jones, Daneel Geysen, Yves Tielemans, Steven Van Passel, Yiannis Pontikes, Bart Blanpain, Mieke Quaghebeur and Nanne Hoekstra, *Enhanced Landfill Mining in view of multiple resource recovery: a critical view*, 55 *Journal of Cleaner Production*, 45 (2013).

¹³ Joakim Krook, Niclas Svensson and Mats Eklund, *Landfill mining: A critical review of two decades of research*, 32 *Waste Management*, 513 (2012).

¹⁴ William Hogland, Marika Hogland and Marcia Marques, *Enhanced landfill mining: material recovery, energy utilisation and economics in the EU (Directive) perspective*, 1st Int. Symposium on Enhanced Landfill Mining, 1 (2010).

¹⁵ See http://ec.europa.eu/eurostat/statistics-explained/index.php/Municipal_waste_statistics (assessed 4 March 2016); and COM(2015) 594, 2.

¹⁶ Krook et al., 517 (2012).

¹⁷ *Ibid.* 513.

¹⁸ Tanja Wolfsberger, Jörg Nispel, Renate Sarc, Alexia Aldrian, Robert Hermann, Daniel Höllen, Roland Pomberger, Andreas Budischowski and Arne Ragossing, *Landfill mining: Development of a theoretical method for a preliminary estimate of the raw material potential of landfill sites*, 33:7 *Waste Management & Research*, 67 (2015).

¹⁹ The idea of ‘temporary storage’ is actually not entirely new; it is standard practice for low to moderate polluted soils with limited applications. Peter Tom Jones, Daneel Geysen, Ans Rossy and Katrin Bienne, *Enhanced Landfill Mining (ELFM) and Enhanced Waste Management (EWM): essential components for the transition to Sustainable Materials Management (SMM)*, Proceedings of the Global Landfill Mining Conference 2010, 8 (2010).

²⁰ See i.a. *Ibid.* p. 8; and Jones et al., 48 (2013).

²¹ This has generally been a subordinate aim in comparison to other objectives in older explanations of Landfill Mining. Back then, Landfill Mining was generally restricted to land reclamation, methane and a limited number of valuable metals (e.g. copper and aluminium); recovery efforts were frequently inferior to that of landfill management issues. Krook et al., 516 (2012).

Several concepts have been developed that build upon this explanation. The differences between them and their suitability depend on various aspects,²² but they can all be summarized as follows: the collected and processed – up till then – non-recyclable waste is temporary stored (i.e. the old landfilling practice). When technological innovation and the economical viability allows recovery, the waste materials are excavated and further processed, whereupon the actual recycling or energy recovery takes place.

One of the pioneering LM approaches is called Enhanced Landfill Management & Mining (hereafter 'ELFM'),²³ which is being developed by the (previously Flemish but now endorsed on a European scale) ELFM Research Consortium to integrate landfilling in an integrated, systematic resource recovery practice since 2008.²⁴ Because its scope is very comprehensive and well-documented in several academic publications, it serves as a reference point in this analysis. ELFM is defined as:

the safe conditioning, excavation and integrated valorization of (historic and/or future) landfilled waste streams as both materials (Waste-to-Materials, WtM) and energy (Waste-to-Energy, WtE), using innovative transformation technologies and respecting the most stringent social and ecological criteria.²⁵

In a nutshell, the temporary storage includes *in situ* activities such as 'resource recovery activities (e.g. methane extraction [and other gasses, which can be valorized as energy sources,] and [the] elimination of contaminants from soil and water), which occurs on the landfill site without mining excavating the stored waste streams.'²⁶ These activities further include the shredding, screening, sorting, separating, extracting (already) usable materials, conditioning, cleaning, drying, (biological) stabilizing, heap-leaching, aerating and flushing of the waste materials in view of future mining.²⁷ The actual excavation and following activities which show great similarities with the activities just mentioned, ultimately aim at the recovery of the waste to either materials or energy. Other objectives are land reclamations (preferably for nature conservation and ecosystem restoration), local job growth, lower net CO₂ and other greenhouse gasses and the reduction of the use of fossil fuel and (other) non-renewable natural resources.²⁸ The combination of all these objectives undoubtedly corresponds with the Circular Economy goals and distinguishes ELFM from other LM approaches.

1.3 Aim and Method

Despite the continuous need to explore the barriers for the implementation of Landfill Mining, various technological, social and economic challenges have been detected so far.²⁹ Legislation also plays an

²² For an overview on Landfill Mining concepts (e.g. also called Urban Mining, Sustainable Landfill, Secondary Mining or Enhanced Biodegradation) see: Jones et al., 46-48 (2013); *ibid.* 513-520; and Nils Johansson, Joakim Krook, Mats Eklund and Björn Berglund, *An integrated review of concepts and initiatives for mining the technosphere: towards a new taxonomy*, 55 Journal of Cleaner Production, 35-44 (2013). The latter study places Landfill Mining under the umbrella of the concept of 'technospheric mining', defined as 'the extraction of technospheric stocks of minerals that have been excluded from ongoing anthropogenic material flows'. All things considered, there is great overlap between the (Landfill Mining) concepts and often their exact definition and scope is unclear.

²³ Previously it was called Enhanced Landfill Mining. They added 'management', see e.g. the presentation: Eddy Wille, *Sustainable stock management and landfills. Introduction to Enhanced Landfill Management & Mining (ELFM²)*, 3th Int. Symposium on Enhanced Landfill Mining (2016).

²⁴ See the website: <http://www.elfm.eu/en> (visited 8 March 2016).

²⁵ Jones et al., 48 (2013). It adds that 'the "integrated" aspect refers to a maximum valorization of materials and energy, rather than a cherry picking approach.'

²⁶ *Ex situ* activities, on the other hand, 'involves resource recovery by partially or fully excavating the waste materials for further treatment'. *Ibid.* 46. Anticipating on what will be postulated in the course of this study, it is worth mentioning that the authors envisage both practices as 'recovery' in these quotations.

²⁷ Jones et al., 46 and 47 (2013).

²⁸ See i.a. in Jones et al., 11-12 (2010); and *Ibid.* 53.

²⁹ For example, potential obstacles are detected regarding the affected communities (because of additional industrial activity) and the frequently lacking knowledge on the content of the wastes (which is however often known to new and well-managed landfill sites). Marc Craps and Koen Sips, *Enhanced Landfill Mining as a*

important role in this regard, because it can enable or hinder the initiatives. Thus far, a legal perspective on Landfill Mining has only been marginally included in the debate,³⁰ arguably because most LM projects are still pilot-projects and because older LM approaches did not focus that much on waste recovery. This study analyses where difficulties and opportunities arise when the contemporary (general) concept of Landfill Mining is incorporated in EU waste legislation. Despite the numerous challenges in other disciplines, this study is written on the assumption that the concept will be implemented in the EU. The remaining question is: *how*?

In answering this question, it appears that the choice of wording is decisive. An interpretive method is therefore used in this study, based on grammar and legal text analysis, as is the adoption of a more systematic approach that reconsiders the entire legal framework for LM. The study requires an external societal systemization of the applicable legislation, because the current resource and environmental challenges and the evolving waste treatment techniques influence the way we look at waste management practices. It is therefore important to integrate the Circular Economy philosophy in the current legal framework; these new understandings may change its interpretation. Consequently, also an evaluating and normative approach is adopted.³¹

This study continues with a brief description of the most important definitions in the Waste Framework Directive (hereafter 'WFD') and the Landfill Directive (hereafter 'LFD').³² These explanations are only the prelude to the discussion on the legal challenges encountered, which are put forward in the third section. The last section contains the conclusion.

II Terminology Toolkit for Landfill Mining

The Waste Framework Directive provides for a horizontally based approach for the management of waste and lays down 'measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use' (Art. 1 WFD). Besides recovery targets, requirements on waste treatment permits and certain restrictive rules on hazardous waste, the Directive includes several essential instruments and definitions (Art. 3 WFD).

2.1 Waste Hierarchy

Article 4(1) WFD expresses the waste hierarchy, which had originally been developed to divert waste from landfilling. Today, two other steps have been added that links the hierarchy with the least environmental impact and the saving of resources.³³ It provides a priority list for policy-makers and

governance challenge: managing multiple actors, interests and perspectives, 1st Int. Symposium on Enhanced Landfill Mining, 2 (2010); and Jones et al., 46 (2013), respectively. Other challenges relate to the technological aspects of the excavation, separation and processing methods. In addition, Landfill Mining is neither self-evident from an economic point of view. For example, it is claimed that government intervention is under current circumstances vital for Landfill Mining, which justifies support mechanisms – the economic benefits simply need to outweigh the costs. Steven Van Passel, Maarten Dubois, Johan Eyckmans, Serge de Gheldere, Frederic Ang, Peter Tom Jones and Karel Van Acker, *The economics of enhanced landfill mining: private and societal performance drivers*, 55 Journal of Cleaner Production, 99 and 100 (2013); Krook et al., 517 (2012); and Maheshi Danthurebandara, Steven Van Passel, Ive Vanderreydt and Karel Van Acker, *Assessment of environmental and economic feasibility of Enhanced Landfill Mining*, 45 Waste Management (2015). Challenges like these contribute to the slow process of implementation of Landfill Mining concepts, such as ELFM, since waste operations, governments and investors cannot yet oversee the final consequences of these projects. Krook et al., 517-518 (2012).

³⁰ So far, two papers on ELFM (partly) investigate the legal barriers: William Hogland et al. (2010); and John Wante, *A European Legal Framework for Enhanced Waste Management*, 1st Int. Symposium on Enhanced Landfill Mining (2010). Generally, other literature only recognizes the fact that there are legal barriers, without going into much detail.

³¹ The methods are based on Lina Kestemont, Paul Schoukens, Karl Hendrick and Evelyne Terryn, *Rechtswetenschappelijk schrijven*, Uitgeverij Acco, 38-56 (2012).

³² Directive 2008/98 of 19 November 2008 on waste and repealing certain Directives, OJ L 312/3; and Directive 1999/31 of 26 April 1999 on the landfill of waste, OJ L 182/1, respectively.

³³ Steven Van Ewijk and J.A. Stegemann, *Limitations of the waste hierarchy for achieving absolute reductions in material throughput*, Journal of Cleaner Production, 3 (2014).

legislators, and reads as follows: prevention, preparing for re-use, recycling, other recovery (including energy recovery) and disposal. The hierarchy's order could either be seen as a mere policy orientation, which makes it very difficult to 'breach' by Member States,³⁴ or as a more mandatory obligation, despite being policy influenced.³⁵ All the same, the hierarchy can be 'customized' aiming at the best overall environmental outcome. According to Article 4(2) WFD, departing from the hierarchy is justified by life-cycle thinking.³⁶ As long as Member States follow the waste hierarchy, life-cycle thinking is thus assumed to be included.³⁷ The Article further dictates that Member States must take account of the principle of sustainability, as well as the 'technical feasibility and economic viability, protection of resources ... the overall environmental, human health, economic and social impacts, in accordance with Articles 1 and 13 [i.e. the Directive's objectives]'.

Considering the connection between the waste hierarchy and Landfill Mining, Article 3 WFD contains four crucial definitions. The paragraphs are quoted below and are further clarified in the course of section 2.2. It is complemented by the description of landfilling and four types of storage.

14. 'treatment' means **recovery or disposal** operations, **including preparation prior to recovery or disposal**;

15. 'recovery' means any operation the **principal result** of which is waste serving a **useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy**. Annex II sets out a **non-exhaustive** list of recovery operations; ...

17. 'recycling' means **any recovery** operation by which **waste materials are reprocessed into products, materials or substances** whether for the original or other purposes. It includes the reprocessing of organic material but does **not include energy recovery and the reprocessing into materials that are to be used as fuels** or for backfilling operations; ...

19. 'disposal' means any operation which is **not recovery even where the operation has as a secondary consequence the reclamation of substances or energy**. Annex I sets out a non-exhaustive list of disposal operations.³⁸

2.2 Treatment

Waste treatment can either be a recovery operation or a disposal operation (*see* sections 2.2.1 and 2.2.2 *infra*). In line with case law,³⁹ this is initially also the point of departure in the Guidance on the Waste Framework Directive.⁴⁰ Nevertheless, the guidance document slightly alleviates this strict division by affirming that there is a third option: the 'preparation prior to recovery or disposal'. Because paragraph (14) contains the word 'including', the third option would actually better be called a *semi-third* option, for, indeed, this option is either part of recovery *or* part of disposal. Nonetheless, it gives a broader interpretation of waste treatment than perhaps initially expected. Although this semi-third option has not been explained in the Directive itself, the guidance document clarifies the operation as the 'processing of waste which still results in a waste which subsequently undergoes other waste recovery

³⁴ Ludwig Krämer, *EU Environmental Law*, 335-336 (ed. 7, Sweet & Maxwell, 2012).

³⁵ Elizabeth Fisher, Bettina Lange and Eloise Scotford, *Environmental Law. Text, Cases and Materials*, 702-704 (Oxford University Press, 2013).

³⁶ Because the idea of life-cycle thinking is not specified in the Waste Framework Directive, nor in any other EU measure, national authorities have quite some room to interpret the life-cycle perspective and the waste hierarchy. Wante, 5 (2010); and Carl Dalhammar, *The application of 'life cycle thinking' in European Environmental law: theory and practice*, 12 *Journal for European Environmental & Planning Law*, 106 and 114-118 (2015).

³⁷ European Commission, *Guidance on the interpretation of key provisions of Directive 2008/98/EC on waste*, 49 (2012) (hereafter 'Guidance on the WFD').

³⁸ Emphasis added.

³⁹ Case C-6/00 *Abfall Service AG (ASA) v Bundesminister für Umwelt, Jugend und Familie* (2002) ECR I-1986, para 63. In many academic publications on Landfill Mining, the definitions of certain waste treatment operations are used incorrectly. A common mistake is to call an operation 'recovery' even though only one type of recovery is meant, e.g. recycling or energy recovery (which falls under 'other recovery'). Also, some authors use the different types of incineration operations interchangeably: however, as noted below, it is either energy recovery *or* disposal.

⁴⁰ Guidance on the WFD, 30.

steps.⁴¹ Under the precondition that the resulting material remains waste, these processing activities include the dismantling, sorting, crushing, compacting, pelletizing, drying, shredding, conditioning, repackaging, separating, blending or mixing of waste. The Guidance on the Waste Framework Directive further states that these activities do not have a particular place in the waste hierarchy and can instead be regarded as precursors to the specific types of recovery and disposal.⁴² Alternative terms to describe the semi-third option of waste treatment are ‘pre-processing’ and ‘pre-treatment prior to further recovery’.⁴³

2.2.1 Recovery

There are a number of significant components in the term ‘recovery’.⁴⁴ Firstly, the fact that waste has to serve a *useful purpose* as a *principal result* of the recovery had been introduced to prevent misuse and fake recovery.⁴⁵ Secondly, the passage ‘in the wider economy’ aims at the fourth step in the waste hierarchy and addresses energy recovery in particular (see below).⁴⁶ Thirdly, the Guidance on the WFD stresses that according to Article 3(15) WFD, ‘these provisions apply not only where a material is actually substituting other materials, but also to processes preparing a waste material in such a way that it no longer involves waste-related risks and is ready to be used as a raw material in other processes.’⁴⁷ Hence, the ‘processes preparing materials’ are different than ‘pre-treatment prior to further recovery’ because in the former situation one deals with non-waste materials after treatment, whereas in the second situation one (still) deals with waste. Fourthly, Annex II WFD sums up a list of recovery operations that is open-ended: there may be more waste treatment operations that fall under the definition of recovery. Finally, waste can be used in an operation combining two recovery types at the same time, also called ‘co-processing’.⁴⁸ As a matter of fact, there are three types of recovery operations according to the waste hierarchy: preparing for re-use, recycling and other recovery. Only the latter two categories are important with regard to ELFM and are briefly explained below.

Along with waste prevention, recycling (Art. 3(17) WFD) really lies at the heart of current waste policy and forms one of the backbones of the 2015 Circular Economy Package. Annex II WFD contains several examples of recycling activities. It is explicitly stated in Recital (28) WFD that the EU should become a ‘recycling society’, seeking the usage of waste as a resource. Waste materials should thus be processed ‘in order to alter its physico-chemical properties allowing it to be used again for the same or other applications.’⁴⁹ In other words, recycling means the processing of waste materials into products, substances and (non-waste) materials; the final aim of recycling is closing the life-cycle of the particular material and beginning a new one.⁵⁰

Article 3 WFD does not contain an explicit definition of ‘other recovery’: for that reason, one has to look at the general description of recovery *minus* the requirements for recycling and preparing for reuse. This residual category includes in any case energy recovery (Art. 3(15) in conjunction with (17) WFD). More examples can be found in Annex II WFD. Entry R 1 explains for example that ‘incineration or co-incineration where the principal use of the waste is as a fuel or other means to generate energy’, is an energy recovery operation.⁵¹ The 2015 Circular Economy package recalled that

⁴¹ *Ibid.* 33.

⁴² *Ibid.* The reason for not explaining the semi-third treatment option in the Waste Framework Directive could possibly be the mere fact that it is not often contested in practice.

⁴³ Interestingly, even though Art. 3(14) WFD explicitly mentions the semi-third option also in the case of disposal, these terms are only used in the light of recovery operations in the Guidance on the WFD.

⁴⁴ The definition of recovery has been inserted into the WFD of 2008 and is based on CJEU case law. See e.g. *Abfall Case* and *Case C-228/00 Commission v Germany* (2002) ECR I-1466.

⁴⁵ *Case C-228/00 Commission v Germany* (2002), para 43, as has been cited on page 31 of the Guidance on the WFD.

⁴⁶ Guidance on the WFD, 31.

⁴⁷ *Ibid.*

⁴⁸ *Ibid.* 32.

⁴⁹ *Ibid.*

⁵⁰ Hence the difference between recycling and ‘pre-treatment prior to further recovery’: in the latter treatment the outcome material remains waste. As a result, only the *final* activity of the recovery process fulfills the definition of recycling.

⁵¹ Guidance on the WFD, 33 and 34. Entry R 1 further contains other requirements for the processing of municipal solid waste and a method to calculate the energy efficiency, which determines the recovery or disposal

energy recovery can play a role and create synergies with EU energy and climate policy but it should be guided by the principles of the EU waste hierarchy, meaning that decision-makers must first look at the possibilities to recycle the waste.⁵²

2.2.2 Disposal

Disposal brings up the rear when it comes to the waste hierarchy. It clearly follows from its definition that any waste treatment operation which does *not* meet the criteria of the recovery definition is by default considered a disposal operation. Operations could therefore still be determined as disposal when they have as a secondary consequence the reclamation of materials or energy on condition that it does not meet the criterion of ‘the principal result of which is waste serving a useful purpose’ (i.e. recovery). Annex I WFD sets out a non-exhaustive list of disposal operations, including: an ordinary landfill (entry D 1) and a specially engineered landfill (D 5)⁵³; physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (D 9)⁵⁴; permanent storage (D 12); blending or mixing prior to submission to any of the operations numbered D 1 to D 12 (D 13)⁵⁵; and storage pending any of the operation under D 1 to D 14, but excluding temporary storage pending collection on the site where the waste is produced (D 15). Despite the Annex, there is no one-size-fits-all approach when deciding on whether an operation is recovery or disposal: according to case law, a case-by-case approach should be followed for each operation – the Annex is no absolute.⁵⁶

Although the Waste Framework Directive does not explicitly define landfilling, it highlights in Recital (29) that incineration and landfilling of (potential) recyclates is an old-fashioned practice and that instead we should be heading towards a recycling society. In view of the core objectives of the Waste Framework Directive, the overall aim of the Landfill Directive is ‘to prevent or reduce as far as possible negative effects on the environment from the landfilling of waste ... during the whole life-cycle of the landfill’ through stringent operational and technical requirements on the waste and landfill sites.⁵⁷ The Landfill Directive is therefore applicable to all landfills.⁵⁸ Besides posing several controlling and monitoring mechanisms, the Landfill Directive makes considerable efforts to reduce biodegradable waste going to landfills and to ban certain types of waste.⁵⁹ It further lays down certain strict requirements for the closure of and aftercare for landfill facilities in Article 13 LFD. Additionally, it provides transitional provisions for existing landfills at the time of transposition of the Directive.⁶⁰ Last but certainly not least, since the Waste Framework Directive lacks to do so, the Landfill Directive defines a landfill instead as:

a waste **disposal** site for the deposit of the waste onto or into land (i.e. underground), including:

status of the waste treatment installation. *See also the Guidelines on the interpretation of the R1 energy efficiency formula for incineration facilities dedicated to the processing of municipal solid waste according to Annex II of Directive 2008/98/EC on waste* (2011).

⁵² 2015 Action Plan, 10.

⁵³ Such as ‘placement into lined discrete cells which are capped and isolated from one another and the environment’.

⁵⁴ Such as ‘evaporation, drying, calcination’.

⁵⁵ If there is no other D entry appropriate, this can include ‘preliminary operations prior to disposal including pre-processing such as, inter alia, sorting, crushing, compacting, pelletising, drying, shredding, conditioning or separating prior to submission to any of the operations numbered D1 to D12’.

⁵⁶ In the *Abfall* Case, the national Court questioned whether the deposit of waste in a disused mine necessarily constitutes a disposal operation (para. 51). The CJEU decided that this is not the case: the assessment on case-by-case basis is required, because the Annexes on recovery operations as well as on disposal operations (back then called Annex IIA and Annex IIB) listed only the most common operations. Some methods are simply not practised at the time of adoption of the Annexes (paras. 59-61 and 64). The Court held that the deposit did not necessarily constitute a disposal operation for the purpose of D12 of the old Annex IIA.

⁵⁷ Art. 1(1) LFD.

⁵⁸ Art. 3(1) LFD. Art. 4 and 6 LFD further explain that there are three categories of landfills: (1) landfills for hazardous waste; (2) landfills for non-hazardous waste; and 3) landfills for inert waste.

⁵⁹ Art. 12 and Annex III and Art. 5(1), (2) and (3) LFD, respectively.

⁶⁰ Art. 14 LFD.

- internal waste disposal sites (i.e. landfill where a producer of waste is carrying out its own waste disposal at the place of production), and
- a **permanent** site (i.e. **more than one year**) which is used for **temporary storage** of waste, but **excluding**:
 - facilities where waste is unloaded in order to permit its preparation for further transport for recovery, treatment or disposal elsewhere, and
 - **storage of waste prior to recovery or treatment** for a **period less than three years** as a **general rule**, or
 - **storage of waste prior to disposal** for a **period less than one year**⁶¹

2.3 Storage

The explanations of recovery and disposal brings us to four distinguishable meanings of storage in the waste regime. First, ‘temporary storage of waste pending its collection’ is a storage type to which entries D 15 Annex I and R 13 Annex II refer and that takes place at the site of waste generation. According to both entries, ‘temporary storage’ has the same meaning as ‘preliminary storage’ and falls under the definition of collection. It should therefore *not* be seen as a waste treatment.⁶²

Second, Recital (16) WFD states that ‘preliminary storage of waste as part of the collection process’ should be understood as a ‘storage activity pending its collection in facilities where waste is unloaded in order to permit its preparation for further transport for recovery or disposal elsewhere’. This storage type is therefore a logical follow-up of the first type and is likewise a form of temporary storage and a collection activity.

Third, ‘storage of waste pending treatment’ is storage at the facility where the previously collected waste undergoes disposal or recovery ‘or its storage at any other point subsequent to its collection point; e.g. a waste transfer station which would constitute a D 15 or R 13 operation’.⁶³ We now know that this type of storage is a waste treatment activity until the waste is stored either for more than three years pending recovery or for more than one year pending disposal. In the first case (pending recovery), the time frame functions as a general rule, which means that there are exceptional cases that allow longer storage.⁶⁴ In both cases, the activity is defined as a landfill operation and enjoys therefore automatically the status of a disposal operation.

The final type of storage is ‘permanent storage’ and is only enumerated in D 12 of Annex I WFD, indicating that it is a disposal activity. The entry provides an example activity: the emplacement of containers in mines.

III Incorporating Landfill Mining in EU Waste Law: the Challenges

Using law to introduce, stimulate and expand the practice of Landfill Mining in the Union seems to be a reasonable strategy, because a top-down approach has already been successful in the past: restrictions on landfilling resulted in an increasing amount of waste being recycled and has thus also resulted in a growing recycling industry.⁶⁵ It appears, however, that the concept of LM does not sit well with the current Waste Framework Directive and Landfill Directive, which can be generally attributed to certain terminology constraints. In order to streamline the explanation of this thesis, the following sections correspond to three LM stages: (1) temporary storage, (2) activities prior to the actual recycling and energy recovery, and (3) recycling and energy recovery.⁶⁶ (When referring to these stages, ‘LM’ has been added to the corresponding activities to avoid confusion with the temporary terminology). A final reflection is being made about the use of the term ‘Landfill Mining’.

⁶¹ Art. 2(g) LFD, emphasis added.

⁶² Based on (***) of D 15 Annex I and R 13 Annex II in conjunction with Art. 3(10) WFD. According to Art. 3(10) WFD, collection means ‘the gathering of waste, including the preliminary sorting and **preliminary storage of waste** for the **purposes of transport** to a waste treatment facility.’ Emphasis added.

⁶³ Guidance on the WFD, 37.

⁶⁴ No examples of exceptions are however provided by the Guidance on the WFD.

⁶⁵ Johansson et al., 42 (2013).

⁶⁶ In fact, this interpretation is also reflected in the ELFM definition of the ELFM Consortium: ‘safe conditioning, excavation and integrated valorization’.

3.1 Temporary Storage

The 2015 Circular Economy Package contains guidelines and proposes provisions that are in essence in line with Landfill Mining. In the 2014 Package, the Commission proposed a ban on landfilling recyclable wastes as from 2030, which would result in a practically complete ban on landfilling by only sending residual waste to (non-hazardous) landfills.⁶⁷ Concerns had been raised in the media that the definition of a ‘recyclable material’ is too vague, as it would result in different interpretations in the Member States, and, additionally, that every waste material is in theory recyclable provided money and time.⁶⁸ Even though the 2015 Package does not include a virtually complete ban on landfilling recoverable municipal waste anymore, the latter argument remains extremely important regarding the introduction of Landfill Mining, as it emphasized the need to temporarily store non-recyclable waste instead of the traditional landfilling. Indeed, economic benefits and time are crucial factors in deciding on whether or not to store the waste. In this respect, it is important to stress that an LM operator may only assess these storage possibilities when ‘primary’ recyclers do not process the waste materials. In other words, the waste can only be temporary stored after *direct recycling*.⁶⁹ When the waste materials are not immediately recycled but stored instead, time and money are also important factors to decide when to excavate and recover the waste in the future (*see* sections 3.2 and 3.3 *infra*).

If Landfill Mining is to be incorporated in the current legal framework, one first needs to determine whether the LM temporary storage corresponds to one of the four types of storage clarified in section 2.3. The first type of storage (temporary storage of waste pending its collection) does not comply with the ELFM temporary storage activities, because these activities do not take place at the site of waste generation. Consequently, the first type is not applicable, even though it is the only one actually using the adjective ‘temporary’. The second type (preliminary storage of waste as part of the collection process) can neither be associated with the LM temporary storage concept, since the LM temporary storage is not a collection of activities primarily aiming at further transport for recovery or disposal elsewhere; the LM storage site is where the actual recovery takes place in order to lower transport emissions.⁷⁰ The third type of storage (storage of waste pending treatment) fulfills only partially the description of LM. On the one hand, it takes place at the facility where the (by then already) collected waste undergoes its treatment. In addition, the storage occurs prior to the treatment. On the other hand, the storage is merely called ‘storage’ (not ‘temporary storage’). Semantically speaking, LM temporary storage does not correspond to the third type of storage either. The fourth type of storage (permanent storage) is clearly not corresponding to the ELFM description, as it represents exactly what Landfill Mining is not: the permanent disposal of waste. All in all, since there are no matching definitions available in the Waste Framework Directive, EU waste law does not provide a clear legal basis for LM temporary storage.⁷¹

An obvious way to overcome this problem is to add the word ‘temporary’ to the third storage type, which would make it ‘temporary storage of waste pending treatment’. The amendment does not draw a distinction between the waste treatments options explained in section 2.2, as LM temporary storage paves the way for a variety of treatments. Adding ‘temporary’ does not however solve all problems. Indeed, after more than three years pending recovery, LM storage changes its general waste

⁶⁷ Art. 3(2)(a) COM(2014) 397. Note that it was an aspirational goal and should have been turned into a legally binding target after a Commission review in 2025.

⁶⁸ Valerie Flynn, *Waste experts warn of landfill ban problems*, ENDS Europe, December 2014, <http://www.ends europe.com/38179/waste-experts-warn-of-landfill-ban-problems> (assessed 4 March 2016).

⁶⁹ Some authors mean by ‘direct recycling’ only the recycling processes that deal with manufacturing scrap flows (pre-consumer waste). ‘Urban mining’ or just ‘recycling’ is then used to indicate the recycling process dealing with End-of-Life products (post-consumer waste). E.g. in: Koen Binnemans, Peter Tom Jones, Bart Blanpain, Tom Van Gerven and Yiannis Pontikes, *Towards zero-waste valorisation of rare-earth-containing industrial process residues: a critical review*, 99 *Journal of Cleaner Production*, 17-38 (2015). This study uses the term ‘direct recycling’ in both cases. It makes a difference, however, between direct recycling and recycling, but this is only to indicate the difference in timing. In does not have any impact on the waste hierarchy.

⁷⁰ At least, this is aimed at by the ELFM practice.

⁷¹ Wante, 7 (2010). Geysen suggests therefore to change the ELFM’s terminology for temporary storage into ‘temporary stock’ or ‘transitory storage’. Daneel Geysen, *Implementation of temporary storage at the REMO landfill site*, 2nd International Academic Symposium on Enhanced Landfill Mining (2013).

treatment status to the specific waste treatment of disposal (i.e. landfilling), which would result in the application of the Landfill Directive. According to the waste hierarchy, sticking to the existing three-year period means that direct recycling and energy recovery have priority over temporary storage unless life-cycle thinking proves the opposite.⁷² The disposal status is, without doubt, however *not* the purpose of Landfill Mining: it is an operation the principal result of which is waste serving a useful purpose by replacing other materials. In other words: recovery.

Another issue relates to the uncertain exception possibilities provided for the storage of waste prior to recovery. Surely, if the general rule is three years, exception would not be approved for waste storage longer than double that timeframe, would not it? In theory (but which is not desirable), waste can be eternally stored under the LM concept, which in effect would paralyze the provisions on landfilling completely. For these reasons, EU legislators may wish to consider abolishing the three-year limit that triggers the application of the Landfill Directive. Such a radical decision would in essence mean that the Directive is to be repealed all together, making current and future landfilling (based on current practices, as a way of disposal) legally not existing.⁷³ Of course, it is essential in this scenario to implement guarantees in the Waste Framework Directive, e.g. that the highest level of environmental protection during the storage is warranted, that the waste will be recovered as soon as possible when technology and the cost/benefit analysis allows it,⁷⁴ and that the risk of fake recovery is significantly minimized (these are all principles under the ELFM concept).⁷⁵ The latter principle is particularly important, because if there are no guarantees to stop fake recovery, it invites fraud. More research is necessary to control this issue, *inter alia* on the effectiveness of legal (e.g. permits) and economic (e.g. taxes) instruments, or on a combination of both (e.g. extended producers responsibility [hereafter 'EPR'])⁷⁶. The prime question is how to motivate LM operators to recover the stored waste and to search for and develop new recovery opportunities. At the end of the day, decision-makers do not want the waste to be stored for ever, because that would practically make the practice a disposal operation. Here again, time and money are critical factors.

Many provisions of the Landfill Directive could moreover be added to these 'new' provisions in the Waste Framework Directive, for example concerning the monitoring and bans on certain waste types, sources and properties, which would encourage the direct recycling of particular waste streams and diminishes the risk of cross-contamination of the stored wastes. Additionally, internal waste disposal sites could be taken into account as well. Even the provisions on the aftercare of the sites are still valid, because the LM concept also aims at land reclamation, preferably for nature and ecosystem restoration. It goes without saying that it is imperative that an exhaustive screening of the LFD provisions should be carried out.

Looking at the virtual⁷⁷ elimination of the Landfill Directive from a broader perspective, amending the Waste Framework Directive with provisions on ELFM rather than setting up a special legal framework for the new ELFM temporary storage sites⁷⁸ actually seems to correspond to the development of the EU waste regime. Waste legislation has come a long way since environmental problems emerged in the 1970s. Various laws and policies had been adopted to regulate different aspects of waste management. An extensive patchwork of waste legislation was created. Over the years, however, a countertrend has emerged to integrate and simplify the laws to a more coherent framework. To date, EU waste law consists of three clusters: (1) framework legislation; (2) legislation on waste treatment operations; and (3) legislation on specific waste streams, being the bulk of the laws. The second cluster comprises of the Landfill Directive and the Incineration Directive. The WFD is a *framework* directive, which is for obvious reasons situated in the first cluster, and forms the

⁷² Wante, 7 (2010).

⁷³ This scenario would require a clean-up of Annex I WFD.

⁷⁴ For example when enough waste mass has been collected of similar quality.

⁷⁵ Wante advises the same guarantees for new ELFM sites. *Supra* footnote 72.

⁷⁶ EPR is an economic policy strategy to strengthen the re-use of materials, and the prevention, recycling and other recovery of waste by integrating environmental costs related to products throughout their life-cycles into the market price of the products. Such measures can take many forms. *See* Art. 8 WFD.

⁷⁷ Virtually because there will always be a fraction that must be landfilled (albeit neglectable in the case of ELFM). Hence, the Landfill Directive can probably be still applicable to this small share. This would correspond to the situation aimed after by the axed 2014 Circular Economy Package: virtually no landfilling by 2030.

⁷⁸ Which is suggested in: *Supra* footnote 72.

starting point for national waste policy and establishes the basics for the other clusters. Since ELFM pursues an *enhanced* approach to reduce the overall impacts of resource use and to improve the efficiency of such use, the concept embraces an awful lot of aspects of waste management. Previously, it had been effective to have a separate law regulating landfilling, because the practice evolved from uncontrolled to controlled landfilling. Today, both ELFM and current waste policy however aim at recycling and the phasing out of landfilling. In addition, temporary storage heralds the following waste treatments that are predominantly taken care of in the Waste Framework Directive: waste recovery. For these reasons, why should ELFM not be an integral part of the Waste Framework Directive?

A less drastic solution to the ‘recovery-disposal transition’ problem would be to increase the three-year limit for waste pending recovery to a significant longer period. Hence, after – by way of example – thirty years the ELFM temporary storage site becomes a conventional landfill site, which would trigger the application of the Landfill Directive. After thirty years, the disposal facility must be called a ‘specially engineered landfill’ (D 5, Annex I WFD). In any event, legislators still have to amend the Waste Framework Directive to include LM guarantees in this scenario. An argument in favour of abandoning landfilling, however, is linked with an inherent flaw of having a priority order in waste management. Really, the inclusion of an option in the waste hierarchy legitimizes its existence. Even though landfilling has not been mentioned in the waste hierarchy as such, it is well-known and confirmed by other provisions and the Annexes that landfilling falls under the final tier: disposal. Hence, the hierarchy basically proposes two extremes: on the one hand it shows that landfilling can be the best option under certain circumstances, and on the other hand it stimulates a zero landfill policy because landfilling comes last in the order. In effect, it may fail to achieve both aims, as there is ‘no indication as to when landfill is an acceptable means, nor does it inspire radical change.’⁷⁹ Opting for the (virtually) zero landfill approach is therefore most attractive, because it would send out a strong message; it is not desirable to merely prolong the three-year period.

Both the 2014 and the 2015 Circular Economy Packages did not however contain a slight indication of emerging parts of the Landfill Directive or elements of LM into the Waste Framework Directive.⁸⁰ One of the reasons could possibly be the mere fact that the implementation of the LFD and other waste laws proves already very difficult for many EU Member States.⁸¹ In two recent cases (both from December 2014), the Court of Justice of the European Union (CJEU) even levied multi-million euro fines against Greece and Italy, following court judgments against them in 2005 and 2007, because they failed to significantly upgrade or close and clean up particular landfill sites.⁸² If the majority of Member States cannot even comply with the Landfill Directive and the Waste Framework Directive, why expect them along with the better performing Member States to implement the strict(er) LM requirements, enquiring a much more comprehensive waste management than is currently obliged? Evidently, major investments must be made by the waste treatment facilities throughout the entire Union, which is not very attractive for many parties, including the Commission. On the other hand, the transition towards a Circular Economy requires fundamental transformational changes to the current material system, also as regards the legal framework. Changing landfills into LM sites could be one of those sweeping changes. To manage the transformation, the Commission might want to strengthen its guiding and coordinating role.⁸³ Furthermore, to ease the burdens on the actors involved, a suggestion would be to impose a fair (i.e. long) transitional period. All the more if you consider that to come to a real fundamental change, incremental steps are required.⁸⁴ In addition, the transformation (and extraction, *see* section 3.2 *infra*) of the sites can in practice take decades,

⁷⁹ Steven van Ewijk and J.A. Stegemann, 5 (2014).

⁸⁰ Under the broad scope of ‘stockpiling’, the Commission is nonetheless already familiar with the idea of Landfill Mining. See: Risk & Policy Analysts Limited, *Stockpiling of Non-energy Raw Materials*, final report, C-10 (2012).

⁸¹ COM(2014) 397, p. 0. *See also* COM(2011) 13, 2,3 and 6; and C. Jackson and E. Watkins, Institute for European Environmental Policy, *EU waste law: the challenge of better compliance*, no. 5 Directions in European Environmental Policy, 6 and 7 (2012).

⁸² C-378/13 *Commission v Greece* (2014) and C-196/13 *Commission v Italy* (2014).

⁸³ COM(2014) 397 already contained the introduction of early warning systems and ways to exchange BATS and other information. COM(2015) 594 on the proposed amendments of the Landfill Directive maintained this.

⁸⁴ Erik Paredis, *A winding road. Transition management, policy change and the search for sustainable development*, PhD dissertation, Political Science Ghent University, 28 (2012-2013).

which would simultaneously give some time to the many actors involved to get used to the new LM mentality. Moreover, a transitional period would also provide the landfill operators enough time to go through a learning process and to attract specialists.⁸⁵

3.2 Activities Prior to Recycling and Energy Recovery

The activities that follow the first LM stage are the actual ‘mining’ activities. These activities can be defined as the previously discussed semi-third option of waste treatment: the legally undefined and in literature often neglected ‘preparation prior to recovery’. Because the Waste Framework Directive does not give any details on this particular option, it leaves significant room for interpretation. In fact, the pre-processing activities summed up in the Guidance document on the WFD show great similarities with the activities in this second LM stage (e.g. shredding, screening, sorting, drying, pelletization, conditioning, cleaning and separating). Even though ‘excavation’ is not included in the list of examples in Annex II WFD, it can still be added in the light of scientific and technical progress: it is a non-exhaustive list after all. Notably, since the Waste Framework Directive is based on Article 192 TFEU, Member States are also permitted to recognize recovery operations other than those listed in Annex II.⁸⁶ Moreover, a decisive argument in favor of defining the second LM stage as a pre-treatment prior to further recovery is that the resulting materials remain waste, whereas recycling or energy recovery processes eventually result in non-waste.

For reasons of consistency, it seems only commonsense that the activities in the first LM stage can be equally defined as pre-treatments prior to recovery. Hence, the *in situ* energy valorisation that takes place in the first LM stage could be added to the list of recovery operations in the Guidance in addition to ‘excavation’. A suggestion would be to explicitly mention the semi-third option, including a list of activities, in the Waste Framework Directive, for example in Annex II. Note that in principle each waste treatment operation must be assessed on a case-by-case basis to decide upon whether it constitutes a recovery or a disposal operation. Moreover, the CJEU held that it does not follow from the terminology used in the Waste Framework Directive that the fact that waste has been subject to prior treatment is a necessary condition for classifying an operation as recovery.⁸⁷ The decisive condition is that the waste serves a useful purpose, i.e. the conservation of natural resources (as aimed at by the Waste Framework Directive as also Landfill Mining and the 2015 Circular Economy Package).

Categorizing the first and second ELFM stages as preparatory activities prior to recovery – and thereby placing them into the existing legal framework – would be appropriate nonetheless because it contributes to the development of the definitions used in EU waste legislation by the EU legislators, which the CJEU generally very much insists on,⁸⁸ and provides for an explicit legal basis for the activities. Some believe, in contrast, that the mining of *existing* landfills is actually already allowed, just *because* of the absence of a clear legal basis. Consequently, there are no legal constraints to it.⁸⁹ This a contrario rationale does however not fly in my opinion. If the legislator had in mind to allow the excavation of landfilled wastes, it would have had introduced it in the first place. Due to the increasing awareness of unsustainable material use, the introduction of a specific legal basis for landfill mining is therefore a desirable matter, particularly since a number of Member States have already started the mining of existing landfills through pilot projects.

3.3 Recycling and Energy Recovery

The third stage of ELFM concerns the final recovery activities which result in complete recovery.⁹⁰ This stage is clearly not to be regarded as ‘preparation prior to recovery or disposal’, as the resulting

⁸⁵ Johansson et al., 41 (2013).

⁸⁶ Ludwig Krämer, 350 (2012).

⁸⁷ *Abfall* Case, para. 67.

⁸⁸ Geert Van Calster, *EU Waste Law*, 60 (ed. 2, Oxford University Press, 2015).

⁸⁹ *Supra* footnote 72. Nonetheless, he advises to establish a specific framework of ‘environmental conditions or BAT that can be used as a basis for granting environmental permits. This is to avoid that ELFM is prohibited because there is no suitable legal framework available or because it has to comply with inappropriate rules,’ page 7. In my view, the final sentence in fact shows the need of a legal basis for landfill mining in the first place.

⁹⁰ The term ‘complete recovery’ (where the recovery operation has produced a substance ‘analogous to a raw material’ in terms of its properties and characteristics and its ability to be used in the same conditions of

material would be non-waste. There are three recovery options: (1) energy recovery (energy or fuels); (2) recycling (resulting in products, materials or substances); or (3) both (by means of co-processing). As explained before, the current waste hierarchy gives priority to recycling.

When incorporating Landfill Mining into EU waste law, however, I argue that the hierarchy in its present form has to some degree been exhausted if we want to continue the transition towards a Circular Economy and that we might want to develop another more fluid list instead. The reason basically boils down to the development that the distinctions between policies regarding waste, products, resources, energy and related topics are becoming increasingly blurred.⁹¹ The integration principle, as expressed in Article 11 TFEU and being one of the touchstones for the Circular Economy in EU primary law,⁹² further enhances this development. The fact that the Guidance on the WFD provides for co-processing of waste is a glaring signal of the existence of the life-cycle perspective in the current legal framework. This is especially important in the case of ELFM, because that LM concept specifically combines recycling and energy recovery in an all-embracing *enhanced* operation. Using Life Cycle Assessments⁹³ and other assessment methods, ELFM operators should be able to decide on whether a certain waste fraction or waste stream is better used for recycling or (/and) energy recovery.⁹⁴ By way of example, the data of the REMO site reveals that at most 40-60% of the total amount of municipal solid waste is suitable for recycling.⁹⁵ The recovery opportunities vary greatly, depending on the preparation prior to recovery processes and the specifics of the (former landfill) sites, e.g. age of the site, type of the site, country or region of location and therefore also the types of waste stored, i.e. the waste composition and characteristics.⁹⁶

Generally, the LM operator enjoys large discretion to estimate whether it is better for the overall environmental outcome to use the waste materials for recycling and/or energy recovery, or to store the original waste or residual waste again at the site through redisposition or to dispose it.⁹⁷ The

environmental protection) has been introduced by the CJEU in: Joined Cases C-418/97 and C-419/97 *ARCO Chemie Nederland Ltd v Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer and Other* (2000) ECR I-4512, para. 93.

⁹¹ Wante, 4 (2010).

⁹² Thomas de Römph, *Pressing Forward—Developments in the Transition Towards Sustainable Materials Management in EU Environmental Law*, 521-522 (Volker Mauerhofer (eds.), *Legal Aspects of Sustainable Development: Horizontal and Sectorial Policy Issues*, Springer International Publishing, 2015).

⁹³ See in this regard the International Organization for Standardization (ISO) 14040 series.

⁹⁴ To date, only few studies have been carried out in relation to Landfill Mining that evaluate a variety of environmental concerns, including waste recovery, and they all use different approaches, which also take into account the particular circumstances. See e.g.: Per Frändegård, Joakim Krook, Niclas Svensson and Mats Eklund, *A novel approach for environmental evaluation of landfill mining*, 55 *Journal of Cleaner Production*, 24-34 (2015). Hence, also for ELFM there are various choices available of how to assess the environmental impacts. On the one hand, the benefit of life-cycle thinking could be that it provides an approach for resolving conflicts between the waste hierarchy steps, but on the other hand one could say that the variety of methodology is a problem: which assessment is best in the specific context to justify deviation from the waste hierarchy? Carl Dalhammar, 15-16 (2015).

⁹⁵ The assessments are *inter alia* based on the characteristics of the individual fractions and the composition of the waste material, and depend on the duration of storage. Mieke Quaghebeur, Ben Laenen, Peter Nielsen and Daneel Geysen, *Valorisation of materials within Enhanced Landfill Mining: what is feasible?*, 1st Int. Symposium on Enhanced Landfill Mining, 13 (2010).

⁹⁶ Mieke Quaghebeur, Ben Laenen, Daneel Geysen, Peter Nielsen, Yiannis Pontikes, Tom Van Gerven and Jeroen Spooren, *Characterization of landfilled materials: screening of the enhanced landfill mining potential*, 55 *Journal of Cleaner Production*, 72-83 (2013). Other estimations not specifically directed at the concept of ELFM but similarly based on large-scale research, also show that the varying opportunities for Landfill Mining depend on numerous variables. See e.g. regarding Sweden: Per Frändegård, Joakim Krook, Niclas Svensson and Mats Eklund, *Research and Climate Implications of Landfill Mining. A Case Study of Sweden*, 17:5 *Journal of Industrial Ecology*, 748-752 (2013); and Per Frändegård, Joakim Krook and Niclas Svensson, *Integrating remediation and resource recovery: On the economic conditions of landfill mining*, 42 *Waste Management*, 137-147 (2015).

⁹⁷ Residual waste is described in COM(2014) 397, 25 as ‘waste resulting from a recovery, including recycling, operation which cannot be further recovered and as a result has to be disposed of’. Evidently, in the light of LM, the last clause should be changed into ‘which cannot be further recovered at that moment’, because it is a

second option may be preferable to the final one when there is a genuine possibility of recycling or energy recovery in future a scenario due to new treatment techniques, economic prospects or more volume of the same quality waste. As regards the latter reason, the LM temporary storage may not only be sensible in the light of economic considerations, but also from an ecological and health perspective. It could namely be used to filter out hazardous waste materials (substances) in LM sites in order to establish ‘clean [material] cycles’. This idea also addresses the issue of downcycling (recycling in lower value/quality than the original), because the outcome materials of direct recycling are then less contaminated.⁹⁸ Depositing hazardous waste materials – until better techniques emerge that can safely deal with them –⁹⁹ ticks several important Circular Economy boxes and offers some flexibility in law, which is necessary because of the discrepancy in location, actors involved, technology in place, waste characteristics *et cetera*.

Evidently, the third stage of Landfill Mining must not facilitate a cherry picking approach in the sense that an operator can randomly choose between the three treatment options (i.e. recycling, energy recovery or temporary storage), nor should it facilitate a direct competition between the options. After all, the requirement of ‘the best overall environmental outcome’ provides for a benchmark to decide the preferable option, be it a somewhat vague one. The LM recovery stage rather tries to *maximize* the valorisation of historic and future wastes. This line of reasoning invites decision-makers not clinging to the current waste hierarchy in a too restrictive manner. They should apply a life-cycle perspective which is more thoroughgoing. The consequence would be that the principle of life-cycle thinking is more integrally inserted into the waste hierarchy *but after direct recycling*. Europe’s ambition to become a Circular (quantitative and qualitative recycling) Economy will by no means be ditched by the introduction of Landfill Mining – on the contrary: it will be safeguarded and underlined.

3.4 Using the Right Words for Landfill Mining

Final challenges to the introduction of LM into the legal waste framework that are addressed in this study relate to the choice of wording for Landfill Mining.¹⁰⁰ While landfilling is currently considered as a *disposal* operation, the final aim of LM is the *recovery* of waste through recycling and/or energy recovery. Moreover, I have argued that the temporary storage and excavation of waste streams can be classified as a recovery. Notably, it has explicitly been stated in the *Abfall* Case that a waste treatment is either a recovery operation *or* a disposal operation.¹⁰¹ The term ‘Landfill Mining’ is therefore rather ill chosen. To avoid confusion, more appropriate terms for LM site are ‘recovery deposits’ or ‘resource reservoirs’, as there would be no association with disposal practices and there would be no priority to one particular recovery operation.¹⁰² They can be used for any kind of ‘mining’ of the technosphere.¹⁰³

temporary disability and the materials should not necessarily have to be disposed of through incineration or landfilling.

⁹⁸ Ulrich Kral, Katharina Kellner and Paul Brunner, *Sustainable resource use requires “clean cycles” and safe “final sinks”*, Science of the Total Environment, 820 (2013).

⁹⁹ *Ibid.* 819-822, the term ‘final [manmade] sinks’ is being used instead of LM temporary storage sites to indicate the places where harmful wastes are put in order to ‘clean up’ the material chains. These final sinks, however, are based upon the idea of sinks (‘a process that receives anthropogenic material flows that have no positive value for present societies’) that ‘either destroys a substance completely, or that holds a substance for a very long time period’ (page 821). As such, final sinks can better be associated traditional landfills, because LM sites are considered temporarily in nature.

¹⁰⁰ Considering the bigger picture, the implementation of Landfill Mining in EU law triggers many other legal (often Member State-specific) challenges, e.g. on topics as: landfill taxes, waste treatment permit systems, state aid mechanisms, Environmental Impact Assessments and EPR. The integration of EPR into ELFM, for example, is well-discussed in Jones et al., 8 (2010).

¹⁰¹ See footnote 39. See also Joined Cases C-307/00 to C-311/00 *Oliehandel Koeweit BV and Other v Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer* (2003) ECR I-1821, paras. 100-103.

¹⁰² The latter term is used in Krook et al., e.g. pp. 514 and 518 (2012); and Johansson et al., e.g. 36 (2013).

¹⁰³ Note that there is arguable also a nuance between ‘resources’ (reasonable prospects for eventual economic extraction in the foreseeable future) and ‘reserves’ (current economic extraction possible). This difference is based on the natural resource classification framework UNFC-2009. Landfill Mining projects can also be classified using this framework. See: Andrea Winterstetter, David Laner, Helmut Rechberger and Johann Fellner, *Framework for the evaluation of anthropogenic resources: A landfill mining case study – Resource or*

In addition, a different name might improve the acceptance of local communities and participating actors.¹⁰⁴

To build upon this issue, the reference in Landfill Mining to the *mining* of waste demonstrates the intentionally link with conventional mining. Making this parallel is however debatable. On the one hand, in line with the values of the Circular Economy, it is often argued that there is a great synergy between virgin (or ‘primary’) and waste (or ‘secondary’) resources,¹⁰⁵ and that they should be treated alike.¹⁰⁶ The term ‘*resource reservoir*’ perfectly reflects this idea. Moreover, existing terminology that indicates the extraction of material flows from the technosphere already uses the mining metaphor quite frequently. As a response to the expectations and in view of the coherence in terminology, it is therefore attractive and justifiable to refer to mining activities.

On the other hand, the mining of waste stored at LM sites (i.e. ‘waste mining’) should not be confused with conventional mining or ‘mining waste’. The management of waste generated in the extractive industries is regulated by the Mining Waste Directive and applies to waste resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries.¹⁰⁷ The Directive further contains several important definitions. A mineral resource is defined as:

a **naturally occurring** deposit in the earth's crust of an organic or inorganic substance, such as energy fuels, metal ores, industrial minerals and construction minerals, but excluding water.¹⁰⁸

Additionally, it is further determined that ‘extractive industries’ are establishments engaged in surface or underground extraction of those mineral resources for commercial purposes or the treatment of these extracted materials.¹⁰⁹ Landfill Mining should not be understood in the same way as conventional mining, because waste materials are no *naturally occurring deposits in the earth's crust*.¹¹⁰ Consequently, LM operators cannot be seen as an extraction industry to which the Directive refers. Nevertheless, ‘extraction’ is *not* necessarily linked to natural mineral resources in everyday language. The word ‘extracting’ has many meanings, two of which are: to remove or take out, especially by effort or force; and to obtain form something by a special method.¹¹¹ These explanations would actually fit the idea of Landfill Mining quite well.

Everything considered, ‘recovery deposits’ or ‘resource reservoirs’ are good options for LM sites. If you want to convert the noun into a verb to refer to LM, adding ‘extraction’ would be a just solution, making it: Recovery Deposit Extraction and Resource Reservoir Extraction. Any reference to ‘mining’ would only promote obscurity.

IV Conclusion

The ambition to transform current practices to a Circular Economy is gaining ground and influences our ideas on waste management. In view of this transition, new ‘landfill’ concepts are being developed

Reserve, vol. 96, Resources, Conservation and Recycling, 19-30 (2015). Even though the framework is not legally binding, it could be taken into account when renaming Landfill Mining.

¹⁰⁴ The disapproval of traditional landfills are one of the identified social barriers: Marc Craps and Koen Sips, 7-8 (2010).

¹⁰⁵ The Raw Materials Initiative states that, apart from primary raw materials, the EU relies heavily on *secondary raw materials*, which should be encouraged and professionalized even further. European Commission, *The raw materials initiative — meeting our critical needs for growth and jobs in Europe*, COM(2008) 699. See also page 8 of the 2014 Circular Economy Communication.

¹⁰⁶ Hence the creation of End-of-Waste criteria in Article 6 WFD, and the aim to the *substitute* natural resources in the economy and the recognition of the potential benefits to the environment and human health ‘*of using waste as a resource*’ (Recital 19 WFD).

¹⁰⁷ Art. 2 Directive 2006/21 of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC, OJ L 102/15.

¹⁰⁸ Art. 3(5) Directive 2006/21, emphasis added.

¹⁰⁹ Art. 3(6) Directive 2006/21.

¹¹⁰ If the Directive is applicable, however, the waste streams that are excavated and stored once more at the ELFM site would have been understood as mining waste, according to Art. 3(1) Mining Waste Directive in conjunction with Art. 3(1) WFD.

¹¹¹ See the Oxford English Dictionary, <http://www.oxforddictionaries.com/>, consulted on March 3, 2016.

under the heading of Landfill Mining. Although not expressly recognized by the Commission in its 2015 Circular Economy Package, Landfill Mining seems to fit the Circular Economy movement, as it promotes the circularity of materials in the economy in various ways. First, it leaves direct recycling untouched. Second, by storing waste instead of disposing it, valuable resources can still be reinjected through recycling or energy recovery in the wider economy in the future. Third, traditional landfilling is virtually non-existing. Fourth, some LM concepts aim at a whole host of other Circular Economy objectives. Even though Landfill Mining looks very promising, there are still many technological and non-technological uncertainties regarding its implementation. The incorporation of Landfill Mining in EU waste law triggers reconsiderations of the current interpretation and application of the Waste Framework Directive and the Landfill Directive. The terminology used is key in this regard.

This study showed that the temporary storage of waste does not match the existing definitions of storage under the Waste Framework Directive. One particular type of storage, i.e. the storage prior to recovery, could however be adjusted by deleting the three year limit after which the storage operation automatically changes its status from a recovery to a disposal operation. It thereby avoids the applicability of the Landfill Directive. Further research is however necessary on how address fake storage in legislation. The temporary storage and the following activities (e.g. the excavation, drying, washing and sorting of the temporary stored waste) could be interpreted as ‘preparation prior to recovery’ which already exists in the Waste Framework Directive. The final stage of Landfill Mining is the actual recovery. The fact that Landfill Mining aims at recycling as well as energy recovery is a challenge – or rather an opportunity – for the concept’s implementation. According to the existing interpretation of the waste hierarchy, recycling comes prior to energy recovery. In the LM situation this does not change for direct recycling. However LM operators could be given a bit more discretion concerning the choice of recovery, based on the life-cycle perspective already available in the Waste Framework Directive. All things considered, a new name for ‘Landfill Mining’ might be worth reconsidering in an attempt to align the concept with the definitions already used in EU waste legislation and to move away from the negative connotation of disposal.