

## LEGAL ASPECTS FOR THE REUSE OF DREDGED MATERIAL AND THE APPLICATION IN DIKE CONSTRUCTIONS

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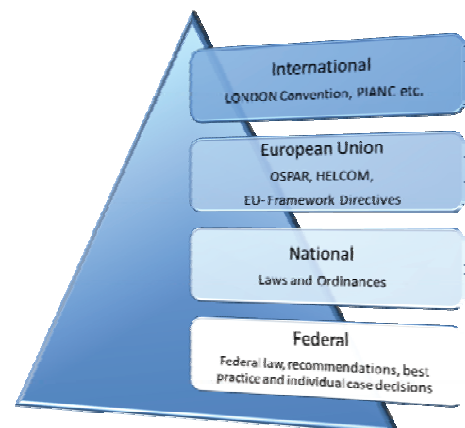
**Abstract.** The legal basis for application of dredged material is manifold and there is no explicit regulation tailored for the reuse of dredged material like for sewage sludge. The actual reuse is subject to different regulations and entails an extensive process of approving. Federal-specific or even cross-federal unified handlings would be important to push the reuse of dredged material. Dike construction measures are based on the water law because they are hydraulic engineering measures in accordance to § 67 Water Management Act (WHG). Therefore the application of dredged material in dike constructions has to meet the requirements of the WHG. The law, though, doesn't mention any limit values for the construction materials. Dredged material is named in the waste law (waste for reuse) as well as in the soil conservation law. An analogue classification according to the requirements of the soil conservation ordinance (BBodSchV, annex 2 table 2, 1999) can be applied for the application in dike construction. So, fine grained dredged material rich in organic matter could be applied in or on a rooting soil layer or for the creation of such a layer. Because there will be no dredged material-specific basic rule for reuse in a foreseeable time yet, technical well-founded, on an individual basis decided solution will still stand in focus. A general basic rule for reuse of dredged material is not advisable because of changing frame conditions of the various ways of reuse and the material composition. Therefore a detailed examination of the conditions for every single application is necessary (compare EAK, 2007). For a simple, more efficient and especially legally certain process of approving a basic flowchart for the application of dredged material would be reasonable.

**Keywords:** dredged material, dike, reuse, legal basics, soil conservation law

### 1. Introduction

The demand of different kinds of earth construction materials increases steadily. Often these natural resources have to be transported over large distances to the construction site, causing a considerable impact on nature. It is quite obvious that the resource-saving use of dredged material (DM) as soil and construction material is an alternative. Since there are considerable amounts of DM available along the Baltic Sea coast and dike construction materials such as limey marl or marsh clay are generally in short supply, the idea of using DM in dike constructions is a logical decision.

At international and national level the conventions for protection of the marine environment e.g. London (1972), HELCOM (1992) und OSPAR (1992), regulate the general handling of DM in different guidelines and recommendations but mostly within water and waterways (**Fig 1**).



**Fig 1.** Hieratic structure of regulations and recommendations concerning DM (according to EDA)

In Germany the choice and application of the existing regulations depends on whether the DM stays in the water body or a disposal or reuse is carried out onshore. According to this decision different legal remedies take effect depending on the way of disposal or reuse and the responsibilities (Köthe, 2002).

The complexity of the legal situation and the special requirements could cause considerable needs and costs in project issues. The use of DM in dike construction is only possible in specific individual cases (compare EAK, 2002/2007). If objective decisions should be made there has to be an understanding for the characteristics of sediments and the system they came from inasmuch as DM applications are single decisions according to broad environmental assessments so far. One aspect when searching for an environmental sustainable and economical adequate solution should be to focus on the essential efforts (Netzband, 2004).

The intended use of DM as substitute material in dike constructions creates different problems which have to be legally clarified.

## 2. European regulation framework

Since the 1970s the European Community follows an active environmental policy e.g. in the field of water protection, air pollution control and waste management. The environmental policy of the EU makes a contribution to preservation and protection of the environment as well as the improvement of their quality and the careful and efficient use of natural resources (Art. 191 AEUV).

Under European law different framework directives rule the handling with subjects of protection e.g. the marine environment or water. Their task is to harmonize the legal frame for the policy within the EU and they are addressed to the national authorities. Purpose is also to heavily align the policy to a sustainable and ecological use of resources.

The disposal of DM in water bodies is widely regulated through the international and European conventions through the protection of the sea. Within the conventions DM guidelines (LC 2000; OSPAR 2009; HELCOM 2007) regulate the environmentally sustainable

directives (Fig 2) are harmonized and will disposal/relocation in the water bodies. The develop consistently (DGE, 2003).

### 2.1 Water framework directive

The EC Water framework directive (WFD, 2000/60/EC) arranges aims of water quality and specifies methods how to achieve them. Until 2015 a good chemical and ecological status of surface water bodies should be achieved. A good water quality cannot be regarded detached from a good sediment quality. Therefore the sediments have to be considered in the water management plans of the member states even if little attention is given to it in the WFD.

The commission recommends only the development of quality criteria for the concentration of the substances with priority in surface water, sediments and biota. An effective sediment management should also include an understanding for the system, the integrated management for soil, water and sediment as well as the direct correlations up and downstream, among others (SedNet, 2010).

Under the umbrella of the WFD the ground water framework directive (80/68/EEC) coordinates the protection of ground water for harmful contaminations. This aspect has to be kept in mind regarding onshore disposal or reuse and because of the potential discharge (particularly via leachate) to the ground water.

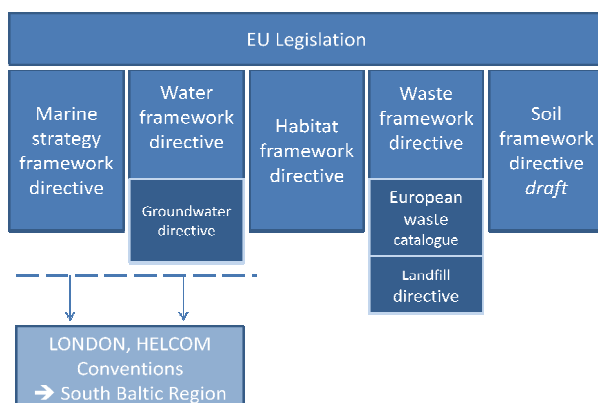
### 2.2 Waste Framework Directive

The Waste Framework Directive (2008/98/EC) plays an important role when using DM. Through this directive harmful impacts of production and management of waste shall be avoided, the total impact of using resources reduced and the efficiency of using resources improved (2008/98/EC).

At European and national level there is consensus that DM which will be used onshore directly or reused after treatment is waste and subjects to the regulations of waste law by disposal, treatment and beneficial use. The directive contains the European waste catalogue (2000/532/EC) and mentions DM under the numbers 170505 (containing hazardous substances) and 170506 (excluded DM under 170505) in chapter 17 "construction waste and demolition waste". Until the end of 2020 defined recycling rates have to be achieved. For DM this means that 70 % of the material coming on shore will have to be reused. If the sediments are contaminated or another reason such as different compositions or the same to same principle (according to HELCOM Guidelines for the Disposal of DM at Sea) is arguing against relocation in the water bodies, the DM have to be taken on shore.

### 2.3 Soil framework directive draft

The soil framework directive exists only as draft so far. An aim should be to implement the principle of sustain-



**Fig 2.** EU Framework Directives concerning handling DM with subordinated directives

ability in the field of soil protection. The basic aims follow general specifications of soil protection: avoidance of further aggravation of soil quality, conservation of soil functions and restoration (under functional aspects and consideration of costs). This means among others protection against erosion, compaction and salinization as well as acidification, loss of organic matter and contamination (COM(2006)231). Cohesive and highly organic DM could fulfil many of these requirements when reused. It improves surface soils in their structure and the supply with nutrients. It could also increase the stability against erosion and decreases the discharge of contaminants.

#### 2.4 International guideline for handling DM

There are different international recommendations for handling DM. PIANC gives recommendations for the use of less contaminated DM of harbours and rivers (PIANC, 2009). The Central Dredging Association CEDA and the International Association of Dredging Companies IADC give general guidelines for DM management. For example, guideline 5 of CEDA is engaged in reuse, recycling and relocation (CEDA, 1999). Further recommendations for handling DM are the Dutch-German-Exchange (DGE) and the Environmental Impact of Human Activities (EIHA).

### 3. Implementation of European legislation in national law

The European environmental policy strongly influenced the German law. Member states can decide how legal acts will be implemented in domestic law. In Germany formal laws or ordinances are necessary by implementation of practical obligations. Directives set a deadline for the implementation in the law system. Many of the EC directives are implemented in German law already.

#### 3.1 Water law

The German water law changed with the introduction of the EC-WFD (2000/60/EC) in 2000 and received new impulses. Until now the theme DM does not attract much attention in the continuous national process of implementation. The WFD names sediments in their meaning as habitat not in their role as medium of contaminants. So far it was not apparent that sediment management plans were integrated in the river management plans (BMU, 2013).

In Mecklenburg – West Pomerania (MV) sediments are evaluated according to quality criteria of the WFD implementation decree (heavy metals: copper, zinc and arsenic) in its river management plans (LUNG, 2009).

The priority placing of DM is achieved through relocation in water bodies which is ruled by the water management law (WHG, 2010) or the waterway law (WaStrG, 1968). This concerns all slightly contami-

nated sediments at the North Sea and the Baltic Sea coasts, in MV generally sand and marl.

Due to the onshore disposal, treatment and reuse of DM the protection of groundwater obtains a special meaning because influences through leachate may occur. The groundwater protection is regulated by the EC-WFD and the WHG as well as the ground water ordinance (GrwV, 2010). The criteria for land disposal can be found in regulations of waste and soil law (Köthe, 2002).

#### 3.2 Waste law

In Germany the recycling management act (KrWG, 2012) forms the common legal basis. By this act the specifications of the EU Waste Framework Directive were implemented in German law.

A possible reuse of this waste -if technically feasible and economically reasonable- has to be proper and harmless (i.e. no deterioration of the public interest, in particular, no accumulation of pollutants in the recycling process, § 7 Recycling Management act (KrWG, 2012)).

The application of DM in technical constructions (dike constructions) can be realized according to the technical regulation LAGA M20 part II (beneath the rooting zone). DM is explicitly named as mineral waste for reuse but is subject to the restriction that it should then be gravelly DM with less than 10% fines. Only gravelly DM classified as Z0 (unrestricted installation in soil-like applications) can be reused without restrictions; then the TOC content is limited to 0.5% (restricted application in technical structures Z1 – 1.5%) (TR LAGA, 2004).

The beneficial use of waste materials like DM can also be realized through the landfill ordinance (DepV, 2009) as restoration material in the recultivation and water storage layers. Previous measures (14 disposals in MV) with application of DM have already been realized. The conditions mostly complied with the DepV. The guidance values (DepV) of conductivity, chloride and sulfate were exceeded due to the origin of DM (brackish water) and therefore the location specific application was subject to single authorizations. The heavy metal values of the DM (Rostock) were significantly below the limit values of DepV for restoration layers. Also the organic contaminants were inconspicuous (Morscheck & Henneberg, 2012).

#### 3.3 Soil conservation law

Germany adopted suitable regulations by implementation of the soil conservation and contaminated site act (BBodSchG, 1998) and ordinance (BBodSchV, 1999). In both act and ordinance as well as in the discretionary implementation help to §12 (2002) DM is named and an application on and in top soils is allowed if the conditions comply with the precautionary values (table 2, annex 2 BBodSchV).

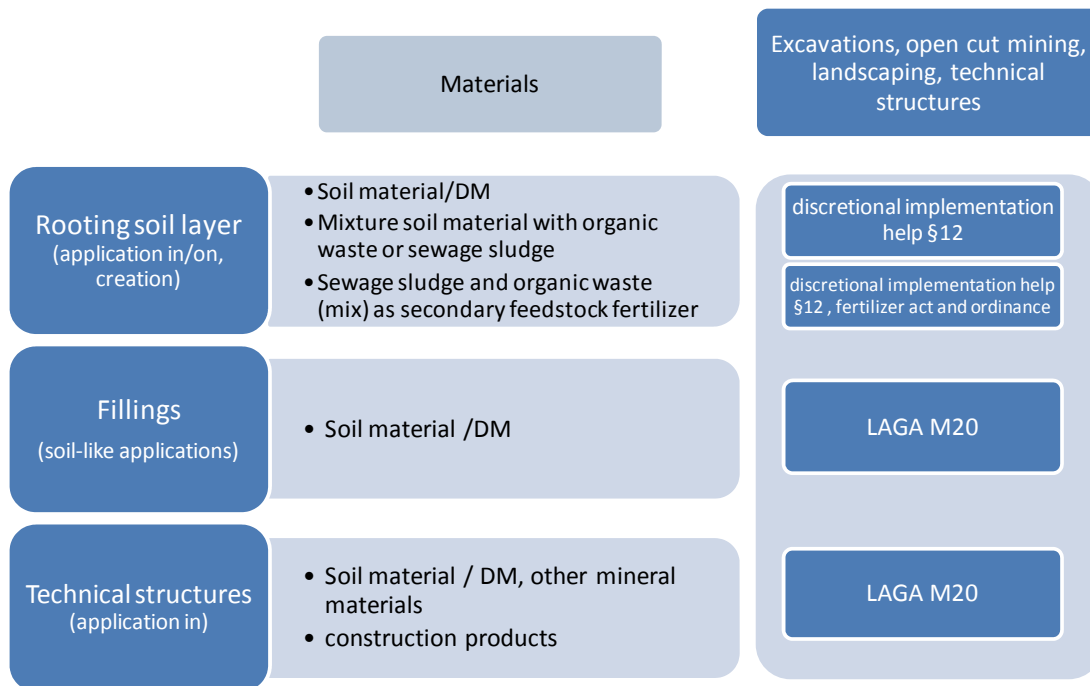


Fig 3. Shortened schema of ambits and regulations from the discretionary implementation help §12, annex 3

The soil ordinance is to be applied if DM shall be brought in a rooting layer or a new rooting layer is created with DM, e.g. as greening aid in technical structures (discretionary implementation help to §12, 2002).

#### 4. Legal requirements for the reuse of DM in dike construction

Dike construction measures have to be carried out on the basis of the water law because they are considered hydraulic measures according to § 67 WHG. Therefore the application of DM in dike construction has to comply with the requirements of the water law. A sustainable change in the water bodies' condition has to be avoided. § 68 WHG rules the planning permission.

However, limit values for construction materials are not listed in these paragraphs. „An explicit regulation tailored for the application of DM in dike construction in the soil conservation or waste management law does not exist yet or rather there are no guidance or limit values referring to this for the application of DM“ (EAK, 2002/2007).

Which official approval is required for a reuse measure depends on the kind of reuse, e.g. approval according to construction law. The reuse of DM under the waste law (ECC/170506) does not need a special waste law approval procedure. For the process of application, the waste legislation requires an obligation to provide proof and to keep records.

In the following general view are specified the ambits and regulations for an application of DM in technical structures (Fig 3).

Previous materials for sealing in dike constructions, e.g. marl or marsh clay, are evaluated according to LAGA M20 or used because they were used for hundreds of years in a proved method. The idea to officially apply treated DM in dike constructions is relatively new and there are many unanswered questions. The individual characteristics of the DMs are partly completely different to other used materials. The humus content of DM in the project DredgDikes differs from 4 – 8% and the classified material is very fine grained.

The application of sandy DM with almost no humus in a construction (underneath the rooting layer) has to comply with the waste regulations (e.g. harmless reuse). The supreme waste authority in MV recommends as discretionary implementation help the LAGA M20. If evidence is provided that the common good is not in danger the divergence of assignment criteria could be allowed in individual cases (oral note StALU, 14.01.2011). The investigated DM cannot evaluate with the LAGA M20 because of the grain size with high parts of fines and the high humus content.

For the greening/rooting layer the application of DM according to the BBodSchV is possible if it complies with the precautionary values. The discretionary implementation help to §12 BBodSchV restricted the layer thickness to 30 – 15 cm due to the humus content (4- 8%) in the material.

Examples of successful reuse measures with DM were carried out in the federal state of Bremen. The water resources agency (Bremischer Deichverband, 2014) has raised the height of different dike sections applying DM as sealing layer. In Bremerhaven a dike with a DM core instead of sand was built in 2005. The

evaluation of the used DM was conducted after the criteria of EAK 2002/2007 for DM and an evaluation procedure of Weißmann (2003) for marsh clay in an expert's opinion. The reuse of this alternative material was positively influenced by the statement of the senator for environment, construction, traffic and Europe (SUBVE) in which the application of DM under defined criteria as federal specific regulation is recommended. Besides, he explicitly suggested the application of DM as preferred alternative to traditional clay if the criteria, e.g. requirements of LAGA M20 and BBodSchV, were fulfilled. Reasons for non-reuse of DM in concrete projects have to be justified. Through the federal specific regulation the DM with generally higher parts of fines will implement in the ambit of the LAGA M20 (Arnold & Krause, 2008). This year further reuse of DM in dike construction measures is envisaged in Bremen. In Hamburg the department for water management gave recommendations in the 1980s for the application and compaction of marsh clay. The values of the glowing loss should be between 10-15%. These values correspond with the recommendation of the EAK 2002/2007.

## 5. Discussion

Due to the classification as waste and the associated problems within the planning process and because of the undetermined legal situation there are only few projects in which DM was used as substitute material in dike construction. These measures were carried out according to the recommendations of the EAK. In MV many experiences for realization and completion were derived from the application in gardening and landscaping to produce or improve the rooting layer or the restoration layer of landfills.

In the case of an application of DM from the Baltic Sea coast of MV in dike construction, heavy metals or organic contaminants play a less important role than the contained salts and the high amount of organic matter. The concentrations of heavy metals and organic contaminants are mostly below the substrate specific precautionary values of BBodSchV respectively the limit values of LAGA M20.

The authorities evaluate the required layer thickness of a technical structure as critical. If DM shall be used to produce a rooting layer on technical structures it has to comply with the requirements of §12 BBodSchV. In the corresponding implementation help the maximum thickness of layers depending on the humus content are listed. Only a 15 – 30 cm top soil could be applied with a TOC content of 4 to 8%. On the other hand the thickness of a rooting layer corresponds with the rooting depth that the typical vegetation could achieve at this site. The standard thickness of a rooting layer under grassland (grass seeding at dikes) could be 50 to 100 cm (discretionary implementation help §12 p.12 ff.).

The authorities' concern also is the possible negative impact on the common good through nitrogen

leaching and an endangering of the ground water. It seems to be important in this topic that there is evidence that only a small part of the total nitrogen is available and there is no increasing discharge compared to top soils. Partly this aspect has been proven in lysimeter experiments for 10 years where DM was applied for agricultural use (Henneberg & Neumann, 2011). These results and results of a follow-up of recultivated disposal sites provide positive information about the stability of the organic matter in DM (Henneberg & Morscheck, 2012).

The possibility of the construction of a homogeneous layer with the function of sealing and greening according to the BBodSchV is not seen from the responsible authorities at this point. The separation of LAGA M20 for sealing and BBodSchV for greening layers in the planning approval of dike constructions in MV is clarified again from the authorities. To achieve an approval new test codes have to arrange for the application of DM as sealing layer in dike constructions.

Since there is no specific DM regulation for direct use or reuse yet, solutions which are well-founded and decided on an individual basis be in the foreground in the future. A general guideline for the reuse of DM is not practical because of varying conditions of reuse options and material composition. Therefore, a detailed monitoring of the application conditions is indicated for every project (compare EAK, 2002/2007). The application of DM should therefore always be an individual case decision. Though for a simplest, efficient and legally secure approval of DM reuse the development of a basic flowchart for the process approval (compare e.g. flowchart annex 1 of the discretionary implementation help of §12 BBodSchV) would make much sense. In this way the requirement of the EU to reuse 70 % of the construction wastes (including DM) can be fulfilled until 2020.

## 6. Conclusions

1. Depending on the disposal options and the responsible authorities there are different regulations from different legal fields but only partially technically justified recommendations which could be used.
2. The evaluation of fine-grained DM for the application in dike constructions as rooting layers is possible after the BBodSchV, 1999. The layer thickness is restricted depending on the humus content of the DM.
3. The high humus content of the DM avoids the application as sealing material or homogeneous layer in technical structures according to LAGA M20.
4. The application of DM in dike constructions is always an individual case decision of the responsible authority because of the changing frame conditions and changing material compositions. A detailed monitoring/control of the conditions is

urgently indicated in every case (EAK, 2002/2007).

5. For a simplest, efficient and legally clear approval the development of a basic flowchart for the process approval to apply DM would make sense.

## Nomenclature

DM – dredged material

BBodSchV – soil conservation and contaminated site ordinance

BMU - Federal Ministry for the Environment, Nature

EDA – European Dredging Association

LAGA M20 – interstate working group for wastes, requirements on the reuse of mineral wastes, part II

MV – Mecklenburg-Pomerania

StALU – State Agency for Agriculture and Environment

TOC – Total Organic Carbon

WFD – Water Framework directive

WSV – Federal water and shipping administration

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