

FACTS ABOUT

Dredged Material as a Resource

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CAN DREDGED MATERIAL REALLY BE A RESOURCE?

Many people all over the world think of dredged material as dirty, unwanted soil – something that is unclean. This is by and large erroneous. Dredged material is predominantly a clean, usable product; in many cases akin to the soil in one's garden, in which vegetables are grown.

Only in limited, generally industrialised, places in the world are there appreciable quantities of dredged material that have been affected by industrial contaminants. By and large most dredged material is clean or only lightly contaminated and can be used as a resource by project developers in effective and economic ways.

WHAT ARE THE BENEFITS OF USING DREDGED MATERIAL AS A RESOURCE?

Using dredged material as a resource is important, one could almost say urgent, because use – rather than disposal – has broad societal, environmental and financial benefits. It contributes to global sustainability. Worldwide millions of cubic metres of material are dredged annually from ports, harbours and waterways in order to optimise navigation, remediation and flood management. Disposal and placement of this dredged material is often one of the greatest challenges facing a dredging project.

When these materials are treated as a waste, as though they had no value, their destination on land or at sea often becomes controversial. Over the last 15 years, however, research and experience have demonstrated that dredged material is not inevitably a waste, but can in many cases have added value. The focus has now shifted to finding uses for dredged material and for coordinating the supply of dredged material with a concurrent demand.

IS USING DREDGED MATERIAL AS A RESOURCE COST-EFFECTIVE?

Although cost is not the only obstacle that prevents the use of dredged material, it is certainly an important hindrance. Realistically, at first glance, traditional disposal may be less expensive than transporting and/or treating dredged material for another use. The need for new legislation and enforcement may also add costs. Moreover, finding appropriate destinations or markets for the materials requires planning, and quite regularly negative public perceptions can be difficult to overcome. In the long run, however, studies have identified

a wide range of uses and these more often than not provide a cost-efficient, sustainable, win-win scenario for the client, contractor and community.

For instance, implementing a use option often means saving valuable primary resources and avoids creating more borrow pits. In addition, the combination of two activities can create a cost-effective solution by accomplishing two things at once, like maintaining port depth and developing a natural habitat area. The economic consequences for each particular use of dredged material must be thoroughly evaluated and all costs and benefits, both long-term and short-term, must be weighed.

CAN ALL DREDGED MATERIAL BE USED AS A RESOURCE?

Not all dredged material is suitable as a resource, but in some countries, like Japan, more than 90 percent of dredged material is ultimately put to good use. Generally speaking, dredged material is categorised into five sediment types: Rock, gravel and sand, consolidated clay, silt or soft clay and a mixture of rock, sand silt and soft clay. All these materials can to varying degrees depending on their characteristics be a resource.

Rock may range from soft marl like sandstone and coral to hard rock like granite and basalt. Depending on its size and quantity rock can be a valuable construction material.

Gravel and sand are perhaps the most valuable resource and are routinely used for beach nourishment, wetland restoration and many other purposes.

Consolidated clay, if the water content is low, can be used for engineering purposes.

Silt and soft clay usually come from maintenance dredging, are rich in nutrients and thus are good for agricultural purposes such as topsoil and for wildlife habitat development.

Mixed materials are somewhat more restricted in use options but may still be used for filling, land improvement and topsoil.

CAN CONTAMINATED DREDGED MATERIAL BE USED AS A RESOURCE?

When dredged material is lightly contaminated, direct use may be an option if the environmental risks are low, taking site-specific conditions into account. For heavily contaminated dredged material treatment will be necessary. Although gravel and sand, as well as consolidated clay, are the least likely to be

contaminated, a relatively small percentage of dredged material is heavily contaminated. As a first step, dredged material is separated into a usable sand portion and a contaminated silt portion in separation fields or by dewatering or in hydrocyclones. The resulting contaminants then need to be reduced, removed or immobilised before the dredged material can potentially be considered as a resource. Treatments include:

- Chemical immobilisation is when contaminants are bound by adding clay, cement, lime or fly ash.
- Thermal immobilisation causes organic contaminants to be broken down at high temperatures. Products such as bricks, artificial gravel and artificial basalt can then be created. These are costly processes and are therefore not widely used at present.
- Bioremediation techniques include using micro-organisms to degrade contaminants. This technique is in an experimental stage.
- Biodegradation of organic contaminants can also be stimulated by aeration and spreading materials out over large tracts of land. This has practical limitations in densely populated areas where land is at a premium.

Clearly whilst using contaminated sediments is more complicated because of the costs and time involved in treatment, it should not be ruled out or overlooked and the cost of treatment should be weighed against the costs of other disposal options.

WHEN AND WHERE CAN DREDGED MATERIAL BE USED AS A RESOURCE?

The potential uses for dredged material depend on the type of dredged material, where it is dredged, how it is dredged and its overall acceptability. Legislation and local conditions must also be considered. Two broad categories of use are often distinguished: Engineering uses and environmental uses. In both cases, criteria must be established that ensure that extensive testing is done for suitability of materials, that the potential use site is in reasonable proximity to where the dredging is planned and that a thorough physical and chemical evaluation is done.

WHAT ARE SOME EXAMPLES OF ENGINEERING USES?

The physical characteristics of the sediment and its level of contamination, as well as legislative stipulations, will determine whether the material is suitable for engineering uses. These uses include:

- *Construction projects* including landfill and foundation materials such as sand and clay for roads and buildings;
- *Isolation of contaminated materials*, such as sub-aquatic capping contaminated sediments, capping disposal sites and landfills and rehabilitating brownfields;
- *Flood and coastal protection* which may include beach nourishment and creation, submarine dike construction and offshore berms and recharging of marshes;

- *Land improvement* which includes fertile topsoil, restoration of quarries, and park and garden improvement;
- *Placement on the banks of waterways* which can raise the land level and improve soil for agriculture.

WHAT ARE SOME EXAMPLES OF ENVIRONMENTAL USES?

Using dredged material for environmental enhancement projects will require extensive testing to determine physical and chemical acceptability. In addition, strict legislative requirements must usually be met. International guidelines have not yet been created for testing suitability, but some countries have developed their own protocols. If these are met, then sediment may be used for:

- *Habitat creation and improvement* which includes reclamation, regeneration, rehabilitation and remediation;
- *Sustainable relocation* in which dredged material is carefully introduced into river or near coast systems where sediment has been depleted;
- *Filling of borrow pits* which have been excavated earlier for other purposes and may have reverse the stagnation caused by anoxic “dead zones” and improve the ecology;
- *Water quality improvement* at engineered wetlands that use natural processes to treat waste water and organically enriched water, remove bacteria and alter the metal contaminants and in some cases enhance the development of wildlife habitats and wetland plants;
- *Aquaculture* to build fish farm impoundments near shorelines to supplement wild fishing which is rapidly depleting the oceans;
- *Agricultural purposes* such as new topsoil and nutrient enrichment of soil, which imitates the natural occurrence on floodplains where flooding carries nutrients on land thus fertilising adjacent fields;
- *Recreational amenities* such as non-intrusive trails through marshlands or other sensitive habitats.

HOW CAN THE SUPPLY OF DREDGED MATERIAL BE MATCHED WITH A DEMAND?

Finding a supply of dredged sediment that matches the needs of a nearby concurrent construction project is no easy task. Matching supply and demand requires an overall management strategy at the earliest possible moment preferably during the project design phase. Mechanisms to coordinate linking a supply with a demand, to create a connection between the customer for a potential use and the supplier of dredged material, requires careful preparation.

One such mechanism that has been successfully applied is a specialised, so-called “incentivising” contract. This contract establishes incentives for the dredging company itself to seek opportunities for potential uses. The essence of such a contract is to provide positive outcomes for the



Dredged material can be an important resource as seen in this aerial view of a former contaminated brownfield site at Fasiver, Belgium.

The site, which had been abandoned, is in the process of being rehabilitated in order to be used as an industrial area.

owners of the dredging project, the construction users and the dredging company. To be most effective, the terms of the contract should be known prior to the tendering process.

WHAT ISSUES NEED TO BE CONSIDERED WHEN MATCHING DREDGED MATERIAL WITH A USE OPTION?

Several critical issues to consider when trying to match a specific dredged material with a potential use option are:

- The *quality and sufficiency* of sediments is crucial. Is the material physically and chemically suitable? Is it environmentally acceptable? Will there be enough suitable material available?
- The *time frame* of both the dredging project and the use destination must be coordinated. If they are not concurrent, are there interim holding areas for the sediment whilst waiting for a particular use? Or does the timing of the dredging project need to be adapted. Can or should the start of the project be delayed or pushed forward?
- *Location* also plays a role. Is the sediment nearby or does it need to be transported for long distances? What equipment is available to transport the dredged material?
- *Flexibility* may be necessary. Can an engineering or environmental project be modified to match the characteristics of the available supply of dredged material?
- And lastly, *costs and benefits* need to be carefully evaluated.

WHAT IS THE ROLE OF STAKEHOLDERS IN FINDING USES FOR DREDGED MATERIAL?

Stakeholders do not always readily accept alternative uses of dredged material. Active guidance is necessary to maxi-

mise the consideration of these uses in order to encourage and promote more successful outcomes. Good communication is necessary to overcome negative perceptions and build trust between the industry, client, regulators and stakeholders. Fear of contamination and environmental risks leads to the “not in my back yard” (NIMBY) attitude. This attitude can be overcome by explaining policy, listening to stakeholders’ fears, paying attention to actual environmental risks, developing programmes that raise awareness amongst stakeholders and government agencies, and by involving them all at an early stage of the project.

WHAT IS THE ROLE OF THE DREDGING INDUSTRY IN FINDING USE OPTIONS?

Good management of technical aspects of dredging will help avoid inconsistencies in the quality and quantity of dredged material. This includes planning and management of the design and construction phases, knowledge of site-specific characteristics, sampling and analyses of sediment. Environmental benefits and risks must be thoroughly understood and all effort should be made to find uses that enhance the environment. Monitoring can also help avoid unintended consequences. Communication and transparency will help create and maintain public trust.

IS THERE REGULATION CONCERNING THE USE OF DREDGED MATERIAL?

The London Convention on the Prevention of Marine Pollution (1972) is the prevailing guidance on assessment of dredged material for disposal at sea. Regional conventions exist as well, including the OSPAR Convention (2004), the Helsinki Convention (2002), Barcelona Convention (1976) and the Bucharest Convention (1992). These



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regional conventions also regulate disposal at sea and thus require the consideration of options other than sea disposal. In that way they can lead to encouraging the search for alternative uses of dredged material. In fact, very few countries have developed specific regulations to define the use of dredged material. Instead authority is spread out over various regulatory agencies for coastlines and marine areas, agriculture and fisheries, and nature reserves and recreation.

CAN BETTER LEGISLATION ENCOURAGE USING DREDGED MATERIAL AS A RESOURCE?

Basically, the stigma that dredged material is a waste persists. This can result in unnecessary legal obstacles to obtaining licences. It often increases the requirement for monitoring programmes, even where prior tests have established the viability of the designated use. This “red tape” increases costs and time and works against using dredged material as a management strategy. It works against long-term sustainability.

The lack of specific legislation that addresses the use of dredged materials also complicates finding uses. If there is no legislation or a patchwork of regulations from national, provincial and local government, it may lead to confusion. Sometimes legislation is even contradictory.

Legislation that views dredged material as a resource, not a waste, should be encouraged on all levels. Striving to modify legislation that classifies dredged material as a waste by default is essential. In addition, legislation which supports source control is a strategy which will produce higher quality dredged material and increase the available quantity of dredged material for use without pre-treatment. The better the source control, the less contaminated the dredged material will be, the greater the chances for creating sustainable long-term solutions.

IS USING DREDGED MATERIAL AS A RESOURCE ALWAYS A SUITABLE SOLUTION?

Contrary to popular beliefs, the vast majority of dredged material around the world is not significantly different from the sediment found naturally in rivers, estuaries and seas. In many cases the dredged material is actually the sediment that forms part of the dynamics of the river, estuary or coastline in which it resides. In such cases, it may be preferable to return it to the same sedimentary system at an appropriate location. Whether the dredged material is from a dynamic or static part of a sedimentary system, its relocation must be carefully considered from an engineering and environmental viewpoint.

IS IT WORTH THE EFFORT TO USE DREDGED MATERIAL AS A RESOURCE?

Disposal and placement of dredged material remain one of the most difficult discussion points in planning a dredging project. Viewing dredged material as a resource and finding suitable uses for it changes the perception of dredged material and usually leads to win-win situations. The necessary dredging of the port, harbour or waterway is accomplished and an added value of a restored beach, new natural habitat or other use is achieved.

Economically and environmentally a holistic approach where dredged material is utilised contributes to a more sustainable system. Primary resources such as sand at sea will be preserved. Therefore, although constraints exist, creating a management strategy to use dredged material as a resource is well worth the effort and, despite the challenges, is usually possible. Indeed, to paraphrase an old saying: “Where there’s a (political) will, there’s a way”.

FOR FURTHER READING AND INFORMATION

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This brochure is presented by the International Association of Dredging Companies whose members offer the highest quality and professionalism in dredging and maritime construction. The information presented here is part of an on-going effort to support clients and others in understanding the fundamental principles of dredging and maritime construction.

