The top 10 mitigating measures for ENVIRONMENTAL FRIENDLY SAND MINING

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Introduction

Mining of seasand has become common practice both in developed and developing countries. Seasand is used for all kinds of projects like land reclamations, the construction of artificial islands and coastline stabilization. These projects have economical and social benefits, but seasand mining can also have detrimental effects on local marine ecology, on coastline stability, on fisheries and on other socio-economic activities. Numerous publications have been written with respect to these effects, and the next step is what to do to minimize, prevent or correct these environmental effects: the so-called mitigating measures.
Mitigating measures can be applied before, during and after the sand mining works and are briefly described below.

BEFORE: During the preparations and planning of sand mining projects various mitigating measures can be applied to prevent or minimize potential damage to the marine environment.

1) Selection of the best sand mining areas

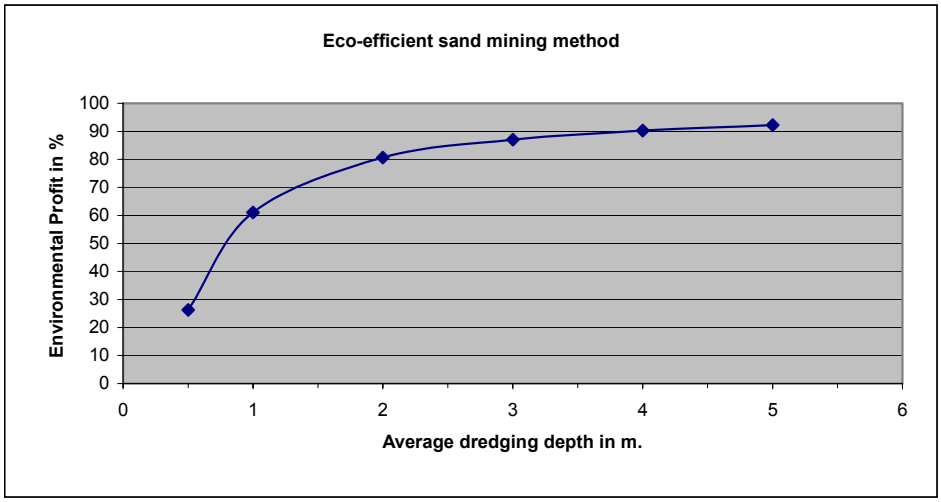
A well-known mitigating measure applied at various locations around the world is selecting sand mining areas, which will cause the least environmental damage. At the Dutch sector of the Northsea this is done by merging sand mining projects with the deepening and widening of the navigational channels. The best locations are the coarse and medium sand areas, because at a Trailing suction Hopper Dredger the overflow will by about 10%. This will reduce the turbidity and will protect the fishes and the benthic communities.
In case the sand will be from fine sand to silt the TSHD will have an overflow of about 40% to 60%. This will cause a lot of turbidity and will damage fishes and benthic communities.

In Hong Kong extensive field investigations were carried with the aim to locate suitable sand deposits, but also to investigate the sand characteristics (percentages of silt) and the presence of sensitive ecosystems like coral reefs and seagrass areas. Based on these investigations several deposits were characterized as suitable for sand mining, whereas other deposits were excluded from sand mining.

2) Eco-efficient surface mining

This is a very important mitigating measure for surface mining, which will be discussed in a bit more detail using field data from the Netherlands. In the Dutch sector of the Northsea sand mining (outside the navigational channels) is allowed up to a maximum depth of 2 m. However, due to the land reclamation for the Maasvlakte 2 at Rotterdam (about 350 million m3 are needed), therefore pits will be created at 5 to 20 meters depth.

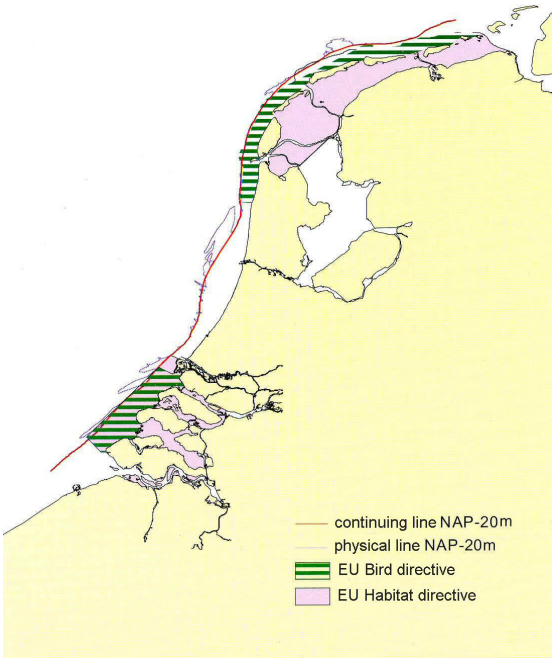
By mining sand in long stretches with a depth of 2 m or pits, the damage to the benthic communities can be reduced by more than 80%. See also the Eco-efficient sand mining at the website “Free downloads”.



3) Exclusion of specific zones

Sometimes it is desirable to exclude specific zones for sand mining, like for instance: shallow coastal areas and areas near important or sensitive marine ecosystems.
The shallow coastal zone is of great importance to the marine ecology in view of the presence of nursery areas for many young organisms. In addition the coastal zones are important for the stability of the coastline, coastal fisheries and tourism industry.
Along the Dutch coast it is allowed to dredge sand along the coastline at a minimum depth of -20 meter, which will protect the nursery areas and the coastline along the coast. In addition there are EU habitat and bird directives up to -20 meter depth.

Coral reefs, seagrasses and mangrove forests, which can also be found in shallow coastal areas. These are important with respect to biodiversity, but also as natural barriers against coastal erosion. In view of the very strong decrease in these ecosystems, applying so-called no-dredging buffer zones around these areas can be seen as a suitable mitigating measure.

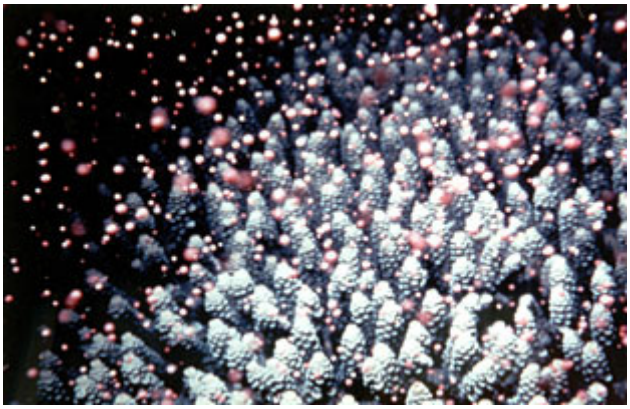


4) No dredging in specific periods

Not carrying out sand mining during specific seasons, months or weeks, or tidal periods can by a way to limit detrimental effects on marine life. From an ecological point of view, it is often recommended to carry out sand mining works during winter periods. The main reason for this is that the population densities are relatively low in wintertime, resulting in less damage. In addition the reproducing period of many species takes place in springtime, which will not be affected if dredging is done in wintertime.

Many species of corals reproduce only during one night of the year. Of course this is a crucial period in the life cycle of these corals. However, it is to be noted that different species of corals have different spawning periods.

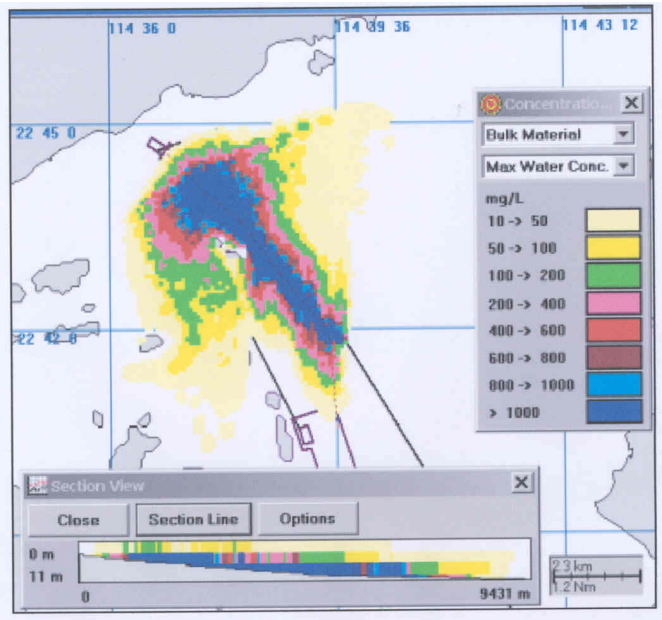
Due to the location of sensitive habitats in relation to the mining area, parts of tidal currents can be favorable or unfavorable with respect to dispersion of suspended sediments.



5) Mathematical model simulations

During the study phase of the project mathematical simulation studies can be applied to investigate the dispersion and settlement of the resuspended sediments during the sand mining process. These simulation models can be used to test various execution methods and strategies in order to minimize ecological effects. As this can be a rather costly exercise

this measure is usually only applied in case of large scale sand mining projects or in case of sand mining projects in or near very sensitive areas.

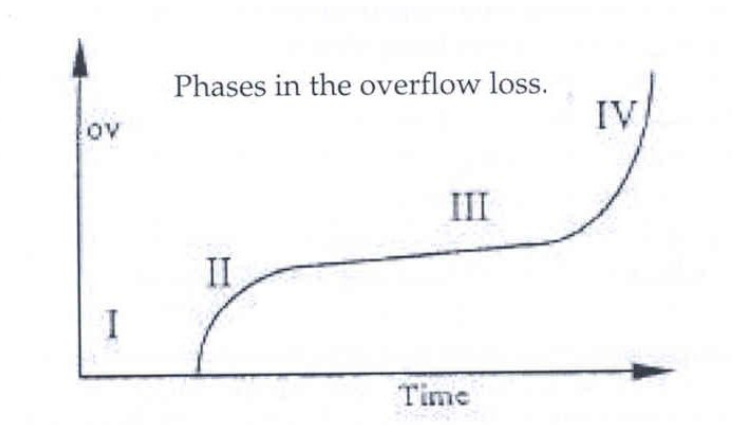


DURING: The generation of suspended sediments and the subsequent dispersion of these sediments are the most important aspects to be managed and controlled during the execution of the works. Therefore the mitigating measures during the sand mining works are oriented at: minimizing the concentrations of suspended sediments, limiting the dispersion of the suspended sediments, and minimizing the resettling of suspended sediments in sedimentation sensitive areas.

6) Limiting the overflow losses

Selecting a modern trailing suction hopper dredger, which has a central overflow system and releases the overflow mixture underneath the bottom of the dredger, can minimize overflow losses.

A more technical mitigating measure, which is to be carried out by the dredging contractor, is to adjust the loading process. By reducing the pumping flow during the final stages of the loading process or by reducing the total loading time (stopping earlier) the overflow losses can be reduced significantly. This will result in reduced suspended sediment levels.



7) Application of production limits and water quality criteria

During sand mining the increase in concentrations of suspended sediments determine to a large extent the effects on sensitive ecosystems like corals and seagrasses. One of the mitigating measures, which can be used, is to put limits on the daily production levels of the dredging process. Another method is to put limits on specific water quality criteria, like a maximum level of suspended sediment in front of sensitive areas, which need protection.
It is to be noted that these mitigating measures require sufficient knowledge with respect to the local environmental characteristics and the relation between the production levels and the resuspension of sediments.

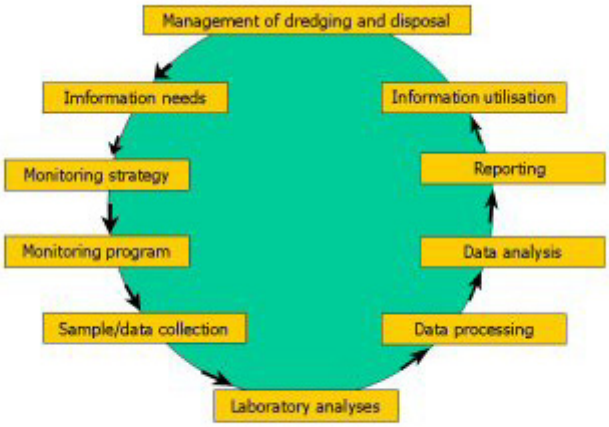
8) Usage of silt screens

A method to limit the dispersion of suspended sediments is the placement of silt screens. Silt screens are made of flexible geotextiles and form vertical barriers in the water column. Silt screens can form excellent barriers for many kilometers, but cannot always be applied. Today, the strongest silt screens can only be applied when the maximum wave height does not exceed 1,5 m and water currents are less than 0,5 m/s. In open sea areas these conditions are often exceeded.

9) Monitoring relevant ecosystems

Field monitoring of sensitive habitats before and during the dredging works can be done by means of temporary or permanent measuring systems and sensors, sampling, visual observations and surveys. The advantage of regular field monitoring is that the predicted effects can be verified. In addition it will provide information with respect to the results of the

applied mitigating measures and whether or not the level of the mitigating measures is too high or too low. In case the level is too high, certain mitigating measures can be eliminated (cost-savings), whereas in case the applied mitigating measures are not sufficient for the planned protection, additional measures can quickly be incorporated into the project.



AFTER: Once the sand mining works have been completed, options are available to restore or accelerate the restoration of the original habitats.

10) Restoration of soft seabed, seagrass areas and coral reefs

As a consequence of sand mining local benthic communities and ecosystems will be slowed down in their development or will be partly or completely destroyed. Usually the ecological situation of soft seabeds, corals and seagrass areas will improve again in time, due to natural recovery and re-colonization. However, it is possible that recovery may take a very long time.

A sound mitigating measure after completion of the dredging works is to speed up the recovery process by human interventions. Deep dredged pits can be filled up again with other sediments originating from maintenance dredging or the removal of unsuitable overburdens from other areas.

To speed up the recovery process of soft seabeds young organisms, like shellfish eggs and species known as quick colonizers, can be collected at other locations and placed in the bare mined areas. Damaged seagrass areas can be replanted, whereas the recovery of coral formations can be improved by placing young coral polyps or by transplanting healthy coral formation from other areas.

A frequently used method for both the recovery of coral formations as well as the support of reef fishes is the placement of so-called “Reefballs”. These concrete balls form artificial reefs and have been placed in large quantities all over the world.