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Protecting the Environment: Mine Clearance in Skallingen, Denmark

Denmark has long been affected by landmines. Environmental factors such as landscape, wildlife and endangered species make mine clearance difficult. However, through environmental legislation and mine clearance, Denmark has reestablished areas in Skallingen for use.

by Martin Jebens [Danish Coastal Authority]

Until 2012, Denmark was one of many countries affected by landmines. During World War II, German forces placed mines in Denmark as a part of the Atlantic Wall to prevent Allied Forces from invading Europe.

After the war, most of the 1.2 million mines buried on the west coast of Denmark were removed. In Skallingen, the dynamic nature of the coastal zone made it impossible to clear all the mines using the methods available at the time and the area was fenced off. Over the next 60 years, mine awareness in Denmark decreased at the local and national levels, mainly because the remaining mines did not cause any casualties or impact the economy. By the early seventies, the fence preventing the general public from accessing the area had fallen into disrepair, and the marsh areas were used for grazing livestock. Parts of the area became accessible to the public, who used the area for recreational purposes. Scientists also used the area to study the unique fauna and wildlife.

During this time, Skallingen experienced both physical and legal challenges. Extensive erosion from the North Sea led to a 1.5 kilometer (0.93 mi) retreat of the coastline, thereby removing large areas of the minefield.¹ The erosion led to the migration of sand dunes, which buried the mines deeper. When Denmark signed the *Anti-personnel Mine Ban Convention* (APMBC) in 1999, the boundary of the minefield, as well as the number of mines in Skallingen, were unknown. The repeated flooding of the area altered the functionality of the mines. Analysis of the explosives and mechanical parts showed that mines in the areas that experienced flooding lost their functionality.^{2,3,4} This had a major impact on how the mines were cleared.³

Due to the unique nature and wildlife of Skallingen, the legal status of the area changed significantly. Prior to clearance, Skallingen was protected by a number of



Protected seals and birds resting at the clearance area.
All graphics courtesy of the Danish Coastal Authority.

international directives and conventions due to its environmental value. Any activities that could disturb or deteriorate fauna or wildlife had to proceed in accordance with regulations. Therefore, an environmental impact assessment (EIA) was essential. Together with the EIA, surveys were conducted by the Danish Coastal Authority on the depth and functionality of the remaining mines. The analysis of the functionality of the mines and explosives was done by the Danish Coastal Authority in conjunction with Netherlands Organization for Applied Scientific Research, which was responsible for the functionality test, impact sensitivity tests, and analysis of the chemical composition of explosives. These three assessments resulted in clearance where different methods were used in different areas, all with a low environmental impact.



This picture was taken during the reconstruction of the dunes after the mines had been cleared. Without the environmental constraints and rehabilitation of the area it would have had limited value for the wildlife and population following mine clearance.

Denmark finished and released the minefield in the summer of 2012. During clearance, Denmark had to apply for an extension to meet APMBC requirements. One of the main reasons for the extension was the complex and time-consuming environmental legislation implemented by Denmark.

Environmental Constraints

Skallingen is a unique environment. The marshland on the eastern side of the peninsula is part of the largest undiked salt marsh in northern Europe. The dune and beach areas on the western and southern part of the peninsula, which face the North Sea, are untouched and are not protected from erosion. The migrating dunes and tidal flooding of the marsh areas create a highly dynamic situation, which is impacted by storm surges that often reach 4 m (4.37 yd) above normal sea level.¹

The landscape offers a rich fauna consisting of a number of endangered species.⁵ A large number of birds use Skallingen to feed, mate and rest during migration. Like the local fauna, many of the birds are endangered and therefore are protected by Danish law.⁵ Additionally, the area is home to a large population of seals and reptiles species protected by Danish law.

To conserve the flora and fauna, the area of Skallingen is protected by international and national legislation. It belongs

to the Wadden Sea National Park, and most of Skallingen is a Natura 2000 area, a European ecological network of conservation areas. Any project that is likely to have a significant environmental impact on a Natura 2000 site must undergo an assessment of its implications for the site before being approved. If it is deemed harmful, the project is rejected or redesigned. Exceptions can be made if there are reasons relating to human health and safety but only if alternative solutions cannot be identified.

Mine clearance on Skallingen would inevitably have caused impacts on some of the endangered species within the Natura 2000 area. Therefore, it was crucial to conduct an EIA specifying what kind of impact clearance activities would have on the environment and suggesting how these impacts could be mitigated. Based on the EIA made on Skallingen and the suggested methods for mine clearance, the environmental authorities in Denmark approved the mine clearance project, provided that a number of restrictions were followed.

Mitigation Measures

The environmental mitigation measures made on Skallingen mainly focused on protecting wildlife, minimizing erosion and reestablishing the area including removal of waste generated from the clearance work. Therefore, clearance was carried out

under the supervision of a geologist who could address concerns relating to the aforementioned mitigation measures.

Wildlife. The wildlife protection influenced working hours and accessibility to the minefield. A large challenge to the operational planning stemmed from a ban on vehicles and the use of explosives in the southern part of the minefield from April to August to avoid disturbing the breeding season of endangered birds and seals.⁵ These months were the most productive due to the weather conditions and because a large part of the area was under water for the remainder of the year. Furthermore, clearance had to be carried out between sunrise and sunset from the period of 15 March to 1 October so as to avoid disturbing the wildlife.⁵ In order to ensure that porpoises, seals and fish species were not injured or killed, the contractor was obligated to carry out scare-off actions before detonating mines on the seabed, just as demolitions close to the coastline (300 m/328.08 yd) were prohibited between April and August.

Erosion. The area is subject to a large degree of erosion and will (in the span of 100,000+ years) completely erode away, as a consequence of the dynamic environment.¹ Ensuring that

the mine clearance would not increase erosion was therefore important. To avoid erosion, a number of mitigation measures were introduced. Marsh areas are very sensitive to mechanical and human activity, so detection and equipment transportation had to be done on foot. Moreover, to avoid damaging the area's topsoil, driving was only allowed on pre-existing roads.

Since the remaining areas entirely consist of sand, the rework of the sediment could easily lead to a loss of sand due to wind erosion and flooding. As a result, sand was stored in areas where it would not be subject to erosion and was used to rebuild the area after the clearance.

Reestablishment of the area. Dune and beach areas had to be reestablished after clearance using sand from the existing areas. Since the dune area was excavated to an average depth of approximately 4 m (4.37 yd), contours of this area had to be reshaped with a tolerance of 0.5 m (0.55 yd) after clearance was completed. Some dunes could be reestablished with a higher tolerance but only in agreement with the Danish Coastal Authority.

After the dunes were reshaped, the area was replanted. Since a survey had shown that the mines had become



Reestablishing of the dune area in Skallingen.



After approximately one year, the old vegetation that was spread on top of the dune has started growing again and the dune appears undisturbed. The former cleared area is seen in the upper left corner.

submerged at a considerable depth after 60 years, the vegetation on the dunes prior to the clearance was removed and stored during clearance activities. After reestablishing the dune, it was possible to spread the old vegetation over the top of the dune. The effect was highly positive, and the dunes today appear green (see images above).

Incorporating Environmental Protection into Clearance

Together with the EIA, the Danish environmental laws had a large impact on the methods chosen during planning and clearance operations. To fulfill the requirements of the EIA and finish the mine clearance in compliance with the APMBC, the importance of surveys and contract management cannot be underestimated.

Survey

In addition to the EIA submitted to the Danish environmental authorities, the two surveys that were conducted—defining the depth and functionality of the remaining mines—had a major impact on the way the area was cleared.

These two surveys made it possible to use different clearance techniques in different areas, resulting in a low environmental impact (Figure 1, page 43).⁶ The depth of the mines influenced the clearance and detection method whereas the

functionality of the mines determined the security level. It was therefore possible to choose methods in compliance with the EIA. Further, the survey results made it possible to data-log large areas of the marsh, which made clearance more efficient and cost-effective.

The surveys conducted in Skallingen will not necessarily be easy to replicate in other areas. However, the surveys emphasize that mine clearance operations should support a flexible approach to different minefields that necessitate the targeting of specific threats, which is preferable to implementing a standard response.^{2,3}

Contract Management

The environmental restrictions and mitigation measures were implemented as part of the legally binding documents made between the Danish Coastal Authority and the contractors. Moreover, references were given to Danish environmental legislation and International Mine Action Standards. A number of requirements concerning protection of the environment were also given to the contractors.

A previously approved environmental plan ensured that the contractors' operations were in line with the mitigation measures and reestablishment of all areas. Equally important, the timeframe had to account for environmental protection,

especially pertaining to how the work would not influence restricted areas during the summer months yet still be able to complete the clearance in accordance with the APMBC.

A standard operating procedure (SOP) concerning the environment was made and incorporated into other SOPs where possible. This standardization allowed all employees involved in clearance activities to be aware of the environmental and legal stipulations involved in the clearance of Skallingen.

Finally, the contractor conducted separate environmental quality assurance/quality control (QA/QC) measures, the documentation of which was submitted and accepted. Notably, the Danish Coastal Authority made QA/QC related to the environmental impact.

Use in Other Clearance Projects

The environmental legislation in Denmark proved to be an excellent tool in assuring the implementation of environmental mitigation measures. However, the extensive environmental legal system maintained by Denmark can potentially have a negative impact on the success and implementation of a project. The processing time involved in approving construction work can be extensive and last up to two years in Denmark due to the number of public hearings and standstill periods. However, there is a possibility to adjust the

normal procedures if the population is at risk. In an international mine clearance context where funding often has to be implemented immediately, problems can emerge if strict environmental legal acts are in place. Therefore, if environmental legislation is implemented, there should be exceptions in the timeframe for getting the legal permission to clear the mines. Funding can then be used faster, and land can be returned to the population more quickly. However, this action will demand a higher focus on monitoring and QA/QC of the clearance work.

A number of countries affected by landmines do not have extensive environmental legislations; however, accounting for environmental concerns while planning clearance projects can be done with a high degree of quality by conducting an EIA as well as other relevant surveys. Ensuring that stakeholders provide input is an important part of the EIA. Hence the mitigation measures are likely to include problems faced by the local population.

The EIA will give rise to a number of environmental criteria and mitigation measures that should be included in the terms of reference as well as other legally binding documents. Additionally, environmental protection could be included in the criteria (e.g., by 10 percent) for the tender evaluation process. Environmental protection is a cross-cutting issue linked



Data-logging in the marsh had little impact on the environment and increased the pace of clearance.



Figure 1. Using knowledge gained during surveys and analysis on functionality and depth of mines, together with the EIA, it was possible to divide the area into five subareas (beach, dune, marsh covered with dune, low marsh, and high marsh). Each of these areas was cleared using different methods hereby fulfilling the mitigation measures. Some areas had to be subdivided as they were part of the restricted wildlife area. The surveys not only led to clearance having a low environmental impact but also reduced overall expenses as marsh and beach areas were safe to walk across.

to a large number of processes during clearance activities. Awareness should therefore be raised among contractors and employees, which can be done by underlining the importance of environmental protection at contract, QA/QC and HFS meetings and among personnel during inspections.

The importance of promoting awareness for environmental conservation among donors cannot be underestimated since implementation could affect the budget and should be reflected in the funding. It is important to emphasize that whenever new demands and criteria are introduced to a clearance operation, the budget will increase or resources will need to be transferred from one part of the project to another. Furthermore, it will increase the need for QA/QC inspections, which could potentially draw on valuable resources.

The alternative would be to neglect the environment and release the land in

a state it was not originally purposed before the mines had been placed. An environmental plan should therefore aim to release land to a level in which wildlife and the population are not harmed and are no longer in danger while ensuring that the increased expenses will not negatively impact the security of those involved in clearance activities. Mines are cleared so that the population can get access to and use the land again. Not returning the land back as it was before the mines were buried will not benefit the local population who use the land, and the clearance will not lead to an improved life. Therefore environmental mitigation measures should be included in clearance projects. ©

See endnotes page 66



Martin Jebens worked as geologist and GIS manager for six years during the mine clearance at Skallingen, Denmark. He worked with environmental mitigation, topographical models, QA/QC and the functionality of landmines. He holds a Master of Science in geology and a master's degree in disaster management and currently works with flood risk management and climate change adaptation at the Danish Coastal Authority.

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