

# SHORELINE MANAGEMENT GUIDELINES

Karsten Mangor, Nils K. Drønen,  
Kasper H. Kærgaard and Sten E. Kristensen



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### Authors:

Karsten Mangor, Nils K. Drønen, Kasper H. Kærgaard and Sten E. Kristensen, DHI with contributions from Per Sørensen, Danish Coastal Authority and Aart Kroon, Geographical Institute, University of Copenhagen

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The publication is prepared by  
Karsten Mangor, Nils K. Drønen, Kasper H. Kærgaard and Sten E. Kristensen, DHI with contributions from Per  
Sørensen, Danish Coastal Authority and Aart Kroon, Geographical Institute, University of Copenhagen

Check by Ida Brøker

Technical assistance by the following DHI staff:

Rolf Deigaard and Berry Elfrink

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**DHI headquarters**

Agern Allé 5  
DK-2970 Hørsholm  
Denmark

+45 4516 9200 Telephone

[dhi@dhigroup.com](mailto:dhi@dhigroup.com)

[www.dhigroup.com](http://www.dhigroup.com)

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## Preface

The Shoreline Management Guidelines is a basic handbook on coastal processes and shoreline management presented in common language providing a basic understanding for processes and shoreline management issues, however it is not a design manual for coastal protection. We have attempted to prepare a practical handbook suitable for all stakeholders working with or interested in coastal processes and shoreline management, such as private stakeholders, planners, authorities and engineers providing all parties with a common knowledge base.

The present handbook is the 4<sup>th</sup> edition of the Shoreline Management Guidelines, which was originally published in 2001. This revision supplements with issues related to effects of climate changes on the coast and how adaptation to these changes is handled in a sustainable and optimal way.

The PIANC publication: "Countries in Transition (CIT): Coastal Erosion Mitigation Guidelines, Report no 123 – 2014" was published in 2014 by a Working Group headed by Karsten Mangor. This publication was heavily inspired by the Shoreline Management Guidelines 2004 but also much new stuff was developed. The present update of the Shoreline Management Guidelines from 2004 is similarly heavily inspired by the PIANC Report no 123 – 2014 but again containing much new information.

The most important climate change parameter related to shoreline management is the expected Sea Level Rise (SLR) but changed pattern of storminess will also have an impact on the coasts.

The SLR has mainly two impacts along our coasts:

- Increasing risk of flooding of low lying coastal areas, which is catastrophic in nature because it may hit large areas with very short notice
- Increasing risk of coastal erosion. However, this will come gradually as the sea level rises

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# 1 Background

Coastal engineers, planners, administrators, private landowners and politicians should have a common basis as background for planning sustainable human activities along the coasts. In particular the following issues are important:

- coastal processes
- goals for management strategies
- management possibilities and solutions
- adaptation to climate changes

These subjects have been dealt with in numerous textbooks and scientific papers; however these media are not easily accessible to planners, decision-makers and other interested parties, as most of these publications are written and read mainly by researchers. Many of the textbooks are too scientific and too voluminous (and thus time-consuming) for non-specialists to access, and many of the papers are very specialised, either as regards scientific topic or geographical setting. Furthermore, they are published in conference proceedings and journals, which are not - and should not be - standard references for planners and decision-makers.

Most of the required knowledge is therefore only available to specialists. However, the authorities make decisions concerning shoreline management based on their understanding of the subject. Consequently it is the responsibility of scientists and engineers to communicate their knowledge to the public so that it is easily understood.

The recipients of this knowledge are:

- The landowners facing the problems, who often are the main contributor for financing coast protection schemes
- The authorities responsible for planning and approval of shoreline management schemes
- Consulting engineers, who are responsible for designing shoreline management schemes
- The decision-makers, public officers and politicians

*Shoreline Management Guidelines* aims to fill the gap between the professional coastal scientific community on one side and the above mentioned parties on the other. It offers a relatively short but scientifically correct guide to:

- coastal processes
- holistic management concepts
- environmentally sound shoreline management interventions
- coastal adaptation to climate changes
- up to date investigation methodology

## 1.1 What are the problems - and how to address them

The problem we face is the accelerating number of conflicts between development on the coast and coastal erosion/coastal flooding; these conflicts are further aggravated by the climate changes. The development pressure on land in combination with the progressing coastal erosion leads to requirements for coast protection, and in many cases subsequent deterioration of our shores. There are many reasons why most coastal regions throughout the world suffer from these problems despite the high level of coastal engineering and the science of coastal processes available today.

Many human activities deprive our shores of a natural supply of sand, such as river regulation works - often far away from the coast – and sand mining in rivers. In addition, the construction of harbours, inlet regulation jetties, maintenance dredging, hard coast protection works and the ongoing Sea Level Rise, all add to the problem. With less sand available our formerly natural and stable sandy beaches will suffer from erosion.

Lack of sustainable planning has, in many cases, permitted urbanisation and infrastructures too close to eroding coastlines, which has aggravated the consequences of chronic erosion. Nowadays, most countries have a legislation, which enforces restrictions on construction activities near the coastline and forces project developers to perform impact assessment studies for coastal projects and to implement remedial measures as part of the project if negative impacts are identified. In most cases there is also nature protection legislation, which promotes sustainable development through requirements to re-establishment of recreational beaches and requirements to preservation of natural beaches. The main problem is that there is normally no budget for fulfilling the requirements to re-establishment and preservation of the coastal resources (sandy beaches).

The climate changes are global problems, which will cause a general Sea Level Rise in the future and which will add to coastal erosion and flooding problems.

Many causes of past and present coastal erosion have a long history and a geographically complex background. It is evident that most of these causes *cannot* be removed within the scope of a typical coastal protection project.

The important elements when dealing with coastal erosion and beach restoration problems are:

1. To investigate the causes of the problem
2. To define the goals for the shoreline management project and to resolve conflicting interests. This phase can also be described as *definition and acceptance of the shoreline management strategy for the project area*
3. To define the financing of the project
4. To engage a qualified group of consultants to assist in achieving the goals of the agreed shoreline management strategy

Coastal engineers' expertise lies especially within items one and four, but items two and three are just as relevant.

This means that:

- coastal engineers must improve their communication and management skills, and
- all other involved parties must improve their basic understanding of the coastal area and of the engineering possibilities

These Guidelines are intended to facilitate this process for the benefit of our valuable shores.

## 1.2 Some thoughts on Shoreline Management

There is always a delicate balance between the requirements of primary protection against coastal erosion on one hand and protection of the dynamic coastal landscape and sandy shores on the other hand.

Historically, protective measures have been reactive in nature and have concentrated on preventing loss due to coastal erosion. This type of protection has, throughout the world, resulted in loss of the beach and it has had a serious impact on the dynamic coastal landscape. Such protection measures are “coast protection”, not “shore protection”.

## 1.3 How to read these guidelines

These Guidelines are separated into three parts but the chapters are numbered continuously through the various parts:

- PART 1: Metocean Conditions, Coastal Processes and Coastal Classification, Chapters 2 through 9
- PART 2: Guidelines, Chapters 10 through 19
- PART 3: Hydraulic Study Methodology as Support for Shoreline Management, Chapters 20 through 22
- References and Index are presented in Chapters 23 and 24.

The purpose of Part 1 is to give the reader a basic understanding of the metocean forces acting on the coast and the coastal processes resulting from these forces and how these processes results in coastal changes. Part 1 is opened with a definition of coastal terms to ensure common understanding and meaningful communication and Part 1 is terminated by coastal classification, which is a very useful concept to summarise the status of a coastal section. Part 1 is mainly intended for the interested, non-specialist reader who wants a better understanding of what is happening and why and for the engineer who is venturing into an unfamiliar area and wants an introduction to the subject. The focus is therefore not on the theoretical and numerical side of issues, but on provision of a general understanding of the coastal processes. Practically only very few equations are included in order not to exclude non-scientists from understanding the text. Part 1 should be read from start to finish at least once and can then later be used to look up specific topics or words.

The experienced coastal engineer can skip Part 1 and go directly to Part 2, which contains sections on the following subjects:

- Causes of coastal erosion and coastal flooding including impact of climate changes
- Vulnerability and risk classification for erosion
- Vulnerability and risk classification for coastal flooding
- Planning concepts in the coastal zone
- Coastal projects
- Design philosophy including adaptation to climate changes
- Shore protection, coast protection and sea defence methods with special emphasis on coastal adaptation to climate changes

- Water front development schemes
- Environmental Impact assessment and Morphological Impact Assessment

Part 2 will assist the reader, whether an engineer or a planner, in formulating a suitable strategy for the problem at hand and in selecting realistic solutions. This part can be read from start to finish or used as a reference book.

Part 3 provides guidance in study methodology as support for shoreline management projects divided in data collection and field investigations, numerical modelling and physical modelling

Chapter 23 presents a list of references common for all chapters. In order to make the Guidelines easier to read there are only few references in the text. Chapter 24 presents a subject index.

Results from numerical modelling have been used throughout this book to illustrate coastal processes. The DHI software “MIKE Powered by DHI” has been applied to make these illustrations.