

## FROM MAP AND ATLAS TO GIS AND MULTIMEDIA FOR WATER AND COASTAL MANAGEMENT

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### Summary

This paper deals with the changing need for geo-information for water and coastal management in the Netherlands and the new ways to meet this demand.

For a length of time maps and atlases have been produced for this purpose. Automation was introduced in the early sixties, was intensified during the last decade and has now replaced all handmade mapping.

Also the last decade GIS was introduced, first for research, but soon for mapmaking too. The use of GIS is not only a logical next step in automation, but is also indispensable in handling the more complex questions nowadays in the field of water and coastal management.

With the growing use of GIS, new tools are being developed, like multimedia, map generators and meta-information systems. Also research is done on how electronic maps can replace paper maps in the coming years.

### 1 Introduction

The Netherlands is a low lying country: 25% of the land lays below main sea level. It has a sandy coast, partly re-enforced with dikes. The Netherlands is also the place where the rivers Rhine, Meuse and Scheldt flow into the sea.

The management of the large inland waters, the coast and the sea is a main concern of the Rijkswaterstaat (Directorate-General for Public Works and Water Management). From old the emphasis was laid on the protection against flooding. This is done by building dikes and surge barriers, sluices and pumping stations, and also by re-enforcement of natural beaches and dunes. In the sixties and seventies this task was extended with the protection of the water quality. Finally this resulted in the concept of integral water management: the multifunctional and sustained use of the waters, in close relation with the environment. Next to that, due to decentralisation, several other authorities became involved in the management of the diverse functions in the inland waters and the coastal zone.

To channel all the activities of the various authorities, much spatial information is needed in the form of maps, atlases, official plans and documents. The changes in technology and in policy have their impact on the nature of the spatial information needed for water and coastal management and on the way it is processed and presented. This will be illustrated with examples, mainly from the practice of the Survey Department of the Rijkswaterstaat. The Survey Department is responsible for the supply of geo-information (paper maps as well as digital files), but also for consultancy and policy support on GIS within the Rijkswaterstaat.

### 2 Maps and atlases

A short overview of recent maps and atlases is given below. A more detailed description - especially on the coastal zone - is given in (Damoiseaux & van Heuvel, 1994).

## 2.1 The coast

The *Kustkaart* (Coastal Map) scale 1:2,000 consists of 825 sheets on A0-size. 667 Sheets cover the entire coast of the North Sea and the Wadden Sea and 158 sheets the banks of the Western and Eastern Scheldt. It covers an area from 800 m seaward to 200 m behind the foredunes or seadike. It is a topographical map with strong emphasis on the main sea protection works and on the heights of dunes, beaches and sea bed. The sheets are compiled by photogrammetry and the recent ones are available in digital form.

*Vegetation maps*, usually on scale 1:5,000 or 1:10,000 are produced on demand by the Survey Department for the management of dunes, backshores and other outer dike areas. The maps have an extensive table-shaped legend and are accompanied by a separate booklet.

The vegetation is surveyed by interpretation of false-colour air photographs and by sampling in the terrain. Since 1992 ARC/INFO is used for data-processing and the mapmaking is done on a Barco system. The database will be used for monitoring the evolution of the vegetation.

*Kustlijnkaarten* (Coastline Maps) on scale 1:25,000 appear since 1992 every year. Each map covers an area of 4 by 4 km and the entire coastline is presented in 105 maps. Main purpose is to give a quick overview of the position of the coastline and the local trend: erosion or aggregation. The Coastline Maps are entirely made with ARC/INFO and reproduced by colour-photocopier.

The map *Nederlandse Kustwateren* (Dutch Coastal Waters) scale 1:100,000 and consists of three sheets. The series started in 1984 and recent revisions were made on a Scitex-system. It is a general topographic map in colour, with detailed depth contours, many water names and water-related topographical elements on or near the coast. The map is often used for general overview, but is not suitable for navigation.

The *Wadatlas* (1989) offers a handy overview of the existing knowledge of the Wadden Sea on subjects as soil, water, air, flora and fauna, shipping, fishing, recreation, monitoring and management, all with references to the sources and literature. The atlas has an oblong A4-size and contains 81 coloured maps on scale ca. 1:690,000. It was intended for use by policy makers. (Damoiseaux, de Kuyper and Vroom, 1990).

The *Wadatlas* has been a trend-setter for quick mapmaking with a Macintosh/Freehand system. And although not comparable with a GIS, multiple use of data is possible: the graphic files are easily adapted for new publications and so many maps from the *Wadatlas* reappeared in new policy documents, management plans and reports.

The *North Sea Atlas* (1992) is in contents, design and production comparable with the *Wadatlas*. It has maps on three scale-levels: the North Sea 1:5 000 000, the Netherlands Continental Shelf 1:2 000 000 and the Netherlands Coast 1:1 500 000. A Dutch and an English edition have been published. From the *North Sea Atlas* too a number of maps have been re-used in other publications.

## 2.2 Inland waters

The *Rivierkaart* (River Map) consists of 157 sheets on scale 1:2,000 for the western part of Rhine, Meuse and main branches, and 209 on 1:5,000 for the eastern part (Boode, 1979). It is a photogrammetrically compiled topographic map, with emphasis on river dikes and other defence works. The very first sheets were engraved on stone in 1930 and printed in colour, later sheets were issued in black-and-white and recently in digital form too.

The *WIS* (short for Watermanagement Information System) gives for the whole of the Netherlands detailed information on drainage areas and their streams or canals, pumping stations, sluices, weirs and dikes. It is the digital successor of the former Water Management Map on scale 1:50.000 (Damoiseaux, 1990) and (Damoiseaux & vd Guchte, 1992) and is entirely built in ARC/INFO.

### 3 Policy documents and management plans

In accordance with the Water Management Act, the coming Embankment Act and other laws, every four or five years certain planning documents have to be made. These documents are intended for a larger public and therefore well illustrated. The demand for more information and for clear and simple maps and diagrams was met in time by the introduction of Macintosh/Freehand systems. These official publications are accompanied by many technical reports, made for the smaller group of specialists. The maps in these reports are often straight plotted from GIS or other applications and multiplied by colour-copier.

### 4 Geographical Information Systems

In 1988 the first real GIS-programmes have been introduced at the Rijkswaterstaat. Soon ARC/INFO was chosen as standard, but other programmes are also in use. On most sites, GIS was introduced through pilot projects. From start of a pilot to an operational system, it takes at least five years. Building and updating of databases take often more time than planned. And the implementation of a GIS demands often a different way of working and has thus an impact on the organisation too.

#### 4.1 GIS for management and research

Several GIS-projects on water and coastal management have passed their prototyping and are now being developed for a more definite use. Some examples are:

The *RIVGIS* project (short for RiverGIS), where filling the topographic database is accelerated through digitising existing river maps and combining them with scanned recent air photographs. This information is supplemented with waterlines under several conditions, depth contours, land-use and information on land property, licences for discharge and so on.

The *KUSTGIS* project (Eng. CoastGIS) intends to meet new demands for information to manage the coastal zone. It also incorporates new technics like digital photogrammetry to keep the GIS up to date.

Both projects will lead to new products, that may replace the present River Map and the Coastal Map partly or completely.

New is the *DIJKGIS* project (Eng. DikeGIS), which is recently set up for the technical and juridical management of sea- and river dikes. This GIS will be developed in close relation between de Rijkswaterstaat, water boards and provinces.

#### 4.2 GIS for map production

The introduction of GIS took mainly place in research offices, where many maps were made with GIS and without help of the drawing office. This was in favour of speed but not of the quality of maps. GIS systems are poor in cartographic functionality and researchers are often not aware of the rules for making well readable maps. But more and more GIS is now also used in drawing offices. For the production of good maps is, next to a GIS, a cartographic system indispensable. The vegetation maps for example follow already this procedure, although the link between GIS and

cartographic systems is still cumbersome. For the time being, vegetation maps on paper will still be needed for the overview, beside files for selection and analysis. But sometimes it is more rational to produce no more paper maps, since more and more people can and will access data by computer. For that reason the Coastline Maps are more likely to evolve to a paperless digital system.

To meet the increasing demand of GIS-users for simple maps on A4-size for reports and the like, a map-generator with the name *RWSmap* is under development. This application will be build around ArcView2 and will guide the user through the proces of mapmaking by hiding unwanted possibilities of ArcView2 and by providing extended legend drawing facilities. This application is due to be ready at the end of 1995.

## 5 GIS and multimedia

Next to maps and alphanumerical data, more and more other information is incorporated in GIS, like (air-) photographs, scanned documents, 3D-models, time-sequences of monitoring data and so on. So many a GIS is growing towards a multimedia tool.

A good example is *Shoman* (short for: SHOreline MANagement tool): a recent GIS application to investigate the impact of management actions on the development of a "slufter": a wet dune valley which is regular influenced by the tides. In SHOMAN several datasets are used, like a digital terrain model, a digitized topographic map and scanned oblique air photos of the coast. Recently the entire Dutch coast is covered by 450 of such photos and recorded on Photo-CD.

For most GIS projects, a demo-version has been built to promote the project within the organisation. These demo's require a workstation with ARC/INFO and scilled people to show them, which is not always available. Therefore, the University of Utrecht was asked, to investigate the possibilities of multimedia authoring software to build an interactive GIS-demo for a MP2-standard PC without addition software. They succeeded to tranfer most of the functionality of the existing RIVGIS-demo into a stand-alone PC-demo. This was done with the help of Macromedia Director (Koop & Stroeven, 1994).

Very recently, a CD-I has been produced on integral water management. Aimed for use by a large public, this CD-I is made available for the low price of DFL 15.- (about US \$ 10.-).

## 6 The future

Modern water and coastal zone management needs actual information on many themes. To deal with this, a GIS has proven to be indispensable. The use of GIS started, as often happens with new technics, autonomous on several places. In the coming time much attention must be paid to tune all these activities to one another. This asks for more co-operation, but also for a sound meta information system that will answer questions such as: who has which dataset and how is that structured. For this purpose the Rijkswaterstaat has acquired an application with the name GE•O•KEY, which is now customised for the Rijkswaterstaat.

With GIS access is possible to more and more information, but the access to GIS itself is also made more convenient by new user-interfaces. An example of this is ArcView2, which also has multimedia potentions.

These developments will result in less maps on paper for coastal zone management and more on screen. And where paper maps are still needed, these will be plotted straight from a GIS. On the long run, official publications for the general public may be issued on CD-ROM and/or CD-I.

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