Tools

Title: **Guiding Models and Norm Study for Water Storage: A new way of thinking?**

Keywords: Regional; communication; inundation; stakeholder engagement; water management; spatial planning

Audience: Local water managers

Messages in the ESPACE strategy to which the guidance applies:							
	1.X	2.	3.X	4.X	5.	6.X	7.X
	8.X	9.	10.X	11.	12.	13.	14.X

Sentences linking the guidance to relevant strategy messages:

1. The Norm Study and Guiding Models present a strategy for how to increase the water storage capacity of a regional water system to anticipate the effects of climate change. The strategy takes into account both the technical aspects and the interests of other parties.

3. The Norm Study provides evidence that the use of standards for inundation frequencies is useful for the translation of climate change scenarios into operational water management measures.

4. The Norm Study and Guiding Models present a strategy for how to increase the water storage capacity of a regional water system to anticipate the effects of climate change. The strategy takes into account both the technical aspects and the interests of other parties.

6. Guiding models provide a way to engage stakeholders to create water storage by developing a set of examples combining water storage with other land uses.

7. The Norm Study provides evidence that the use of standards for inundation frequencies is useful for the translation of climate change scenarios into operational water management measures.

8. The Norm Study and Guiding Models present a strategy for how to increase the water storage capacity of a regional water system to anticipate the effects of climate change. The strategy takes into account both the technical aspects and the interests of other parties.

10. The Norm Study provides evidence that the use of standards for inundation frequencies is useful for the translation of climate change scenarios into operational water management measures.

14. The Norm Study provides evidence that the use of standards for inundation frequencies is useful for the translation of climate change scenarios into operational water management measures.

Photo/diagram/map:

Overview:
The Guiding Models for Water Storage were developed to assist water managers and spatial developers in weaving water storage with other functions. Strategies like intensification, combining space use, different dimensions of land use, switching in time and transformation can improve land use.

A workshop with stakeholders using the Guiding Models

To put the theoretical Guiding Models into practice the Norm Study is implemented. At first the exact water task was calculated using a hydrological model. With the safety levels in mind the exact required water storage was determined. Within the project several combinations of adaptation measures were generated and planned. Although actual measures might still be difficult to implement, the basis has been a sound discussion on the issue.

Description:

Summary

The Guiding Models for water storage were developed to assist water managers and spatial developers in weaving together water storage with other functions. Water storage is defined as the retention and salvaging of water by making modifications in the spatial planning of an area to create more room for water. Strategies like intensification, combining space use, different dimensions of land use, switching in time and transformation can improve land use. The importance of water storage can be inserted on many occasions in the planning process. The following phases can be distinguished: initiative, design and development, decision making, testing, executing and monitoring and evaluation. In every phase of the policy cycle the water manager can exert influence on the outcome. To have an impact the water manager has to be able to transfer the sense of urgency to the relevant institutions and the populace in an area. Another important instrument for the water manager within spatial planning is force field analysis. To have influence in the process it is important to maintain the proper perspective on the roles and positions of different actors. An understanding of the underlying interests of the actors and a discussion on what one is trying to achieve tends to create more room for new solutions, coalitions and compromise.

To put the theoretical Guiding Models into practice the Norm Study is implemented. A specific area was selected to influence spatial planning with stakeholders. At first the exact water task was calculated using a hydrological model. With the safety levels in mind the exact required water storage was determined. This was done with the stakeholders and therefore they had also a sense of urgency to solve the problem. With a Communication Tool to make sure that everyone was discussing the same issue a shared mindset was created. Within the project several combinations of adaptation measures were generated and planned. Although actual measures might still be difficult to implement, the basis has been a sound discussion on the issue.

Introduction
This paper describes a project within the regional water system in the Netherlands. It shows that reduction of water nuisance in the regional system contributes, in a small way, to reducing flood risk. The way the regional problems are handled might also be effective in a river basin. To show this we elaborate on two projects undertaken within the ESPACE project.

Reducing flood risk with regional water management

All the water that eventually ends up in rivers has to pass the regional water system first. As in the future sea levels will rise and river water supply increases due to climate change, solutions have to be found for water management problems at all scales. No net increase in water discharge from the regional system would therefore be one solution to increasing flood risks. The question is whether it is feasible to reduce regional runoff. In the Guiding Models and Norm Study an attempt has been made to reduce runoff. This might provide useful tools for other regions to decrease regional discharge and hence reduce floods. In other areas the method and instruments may not be applicable because other hydrological principles dominate.
In the Netherlands a process had been started to reduce water nuisance and ensure a specific safety level against inundation for different types of land use. Landowners get a certain safety level but when rainfall events occur with a lower degree of probability their land will inundate.
To improve decision making, important principles have been introduced. For instance the objective to make sure that problems are solved within the catchment area. One cannot transfer problems in space or time, so they have to be solved now and within your own area. Another is that the government will provide a minimum safety level. Other needs or requirements are the landowners own responsibility. With that in mind, problems can be faced with a specific direction to solve them.

GUIDING MODELS

Introduction

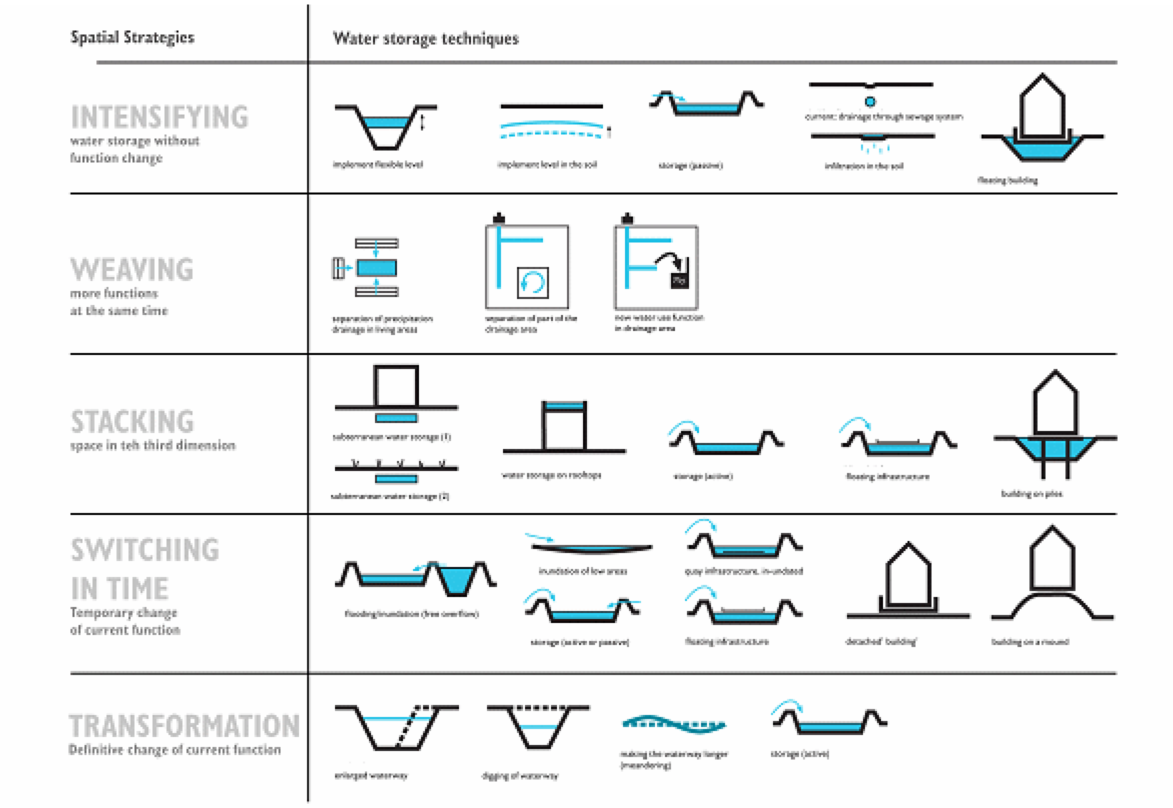

Figure 1 Overview of water storage techniques for each spatial strategy
To aid land use planning an analytical scheme is presented according to the five strategies (See Figure 1). The overview illustrates several water storage techniques which are possible in several spatial strategies.

The Guiding Models for Water Storage were developed to assist water managers and spatial developers in The Netherlands and their surrounding countries in weaving water storage with other functions. Water board Rivierenland worked together with VROM, Province Gelderland, Novioconsult Van Spaendonck and Robbert de Koning on the project. Weaving water storage with other functions is not limited to the Netherlands; other countries are also struggling with it. Guiding Models for Water Storage are practical examples of possible combinations between the function of water storage and other functions. On a regional and urban level, problems arise with storing water from heavy rainfall events. The Guiding Models are designed to contribute in;

- Providing input for the roles of the water manager
- Improving the spatial quality of an area
- Increasing the amount of water storage.

Water storage

Water storage is defined as the retention and salvaging of water as determined by the three-part-process of Retention, Storage and Drainage. The emphasis lies on the second part of the process, water storage. Storage can be defined as making modifications in the spatial planning of an area to create more room for water, such as increased surface waters or the temporary inundation of the land surface. Retention includes infiltration into the soil, increased groundwater levels etc.

Strategies for multiple space use

On a regional scale, several functions exist that demand space next to or above each other. The function of water storage is just one of many possibilities of space use. The Guiding Models are especially geared towards combining water storage with other functions. The Olierook Committee distinguished four strategies:

- Intensification of space use (improving efficiency of the land use of a particular function);
- combining space use (use of the same space by multiple functions);
- the third dimension of land use (use of underground and/or surface space);
- the fourth dimension of land use (subsequent (in time) use of the same space by multiple functions);

a fifth strategy has been added, i.e.;

- transformation: complete replacement of existing functions, through which new possibilities arise for multiple use of the same space.

Processes and instruments

The importance of water retention and storage can be inserted on many occasions in the planning process. Usually, such processes include the following phases:

1 initiative
2 design and development
3 decision-making
4 testing
5 execution
6 monitoring and evaluation

In every phase of this policy cycle, the water manager can exert influence on the outcome of the process. However, the chance of success is greater when the manager is involved in the early phases of the planning process. The water manager especially has to keep his agenda focused on the 'sense of urgency'. It is obvious that the sense of urgency (the commonly held belief that it is necessary to undertake certain actions) with the relevant institutions and the populace in an area should be sufficiently present, to realise water storage. Without the conviction that it is both useful and necessary to take action for water storage and without accepting the role of the government (water manager and spatial planner) to make the relevant decisions, every discussion will be useless if it takes place at all. It is the task of the water manager to clarify the added value of combining water storage with the planned spatial development.

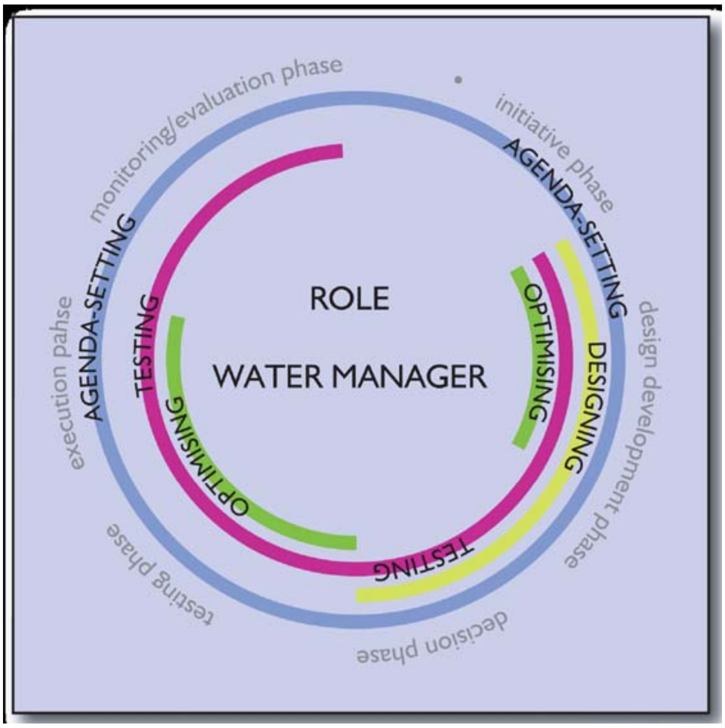

Figure 2 Roles of the water manager

A stakeholder can support a solution for the water storage problem more or less intensively and actively. There is a sliding scale of acceptance (i.e. no resistance), a negative opinion on alternatives and a positive opinion on the effect of the guiding model, to satisfaction and eventually the realisation of being partially responsible for realising and supporting policy.

To strengthen the sense of urgency with the most important actor, and to improve support for incorporating water storage in the planning process, the water manager can use many different types of instruments. Apart from communication instruments, such as informing and transfer of knowledge, legislative instruments can also be used to great effect (such as conferences and participation in plans and licenses). In addition, one can contribute to civil (legal) and financial constructions to fulfil the water task. The emphasis should be put on the communication instruments, in which guiding models can be used to illustrate the possibilities for function combination and / or the position within the current spatial design.

Force field analysis

Several actors are involved in a spatial planning process, whose interests can be categorised using the following typology:

1. initiator: initiates the planning process;
2. problem-owner: promotes water storage;
3. facilitator: qualified authority that has to decide on the spatial plan;
4. executor: land owner, project developer who is responsible for the execution of the plan;
5. participant/coalition member: stakeholder who supports the realisation of the water task;
6. opponent: stakeholder who is opposed to the water task.

In every phase, the initiator, facilitator and executor can be both supporters and opponents of water storage, or be entirely neutral on the subject.

The water manager has to maintain the proper perspective in each phase of the planning process, over the roles and positions of the different actors. Changes in the actions of parties involved are primarily caused by the interests one has in a particular situation. The chosen roles and positions can be categorised according to interest (see Figure 3 below).

The practical aspects of planning processes demonstrate the self elected positions of the people involved. When attention is only paid to these aspects, the discussion between actors can quickly deteriorate to fixed and known positions or lead to polarisation. An understanding of the underlying interests of the actors and a discussion on what one is trying to achieve, tends to create more room for new solutions, coalitions and compromise.

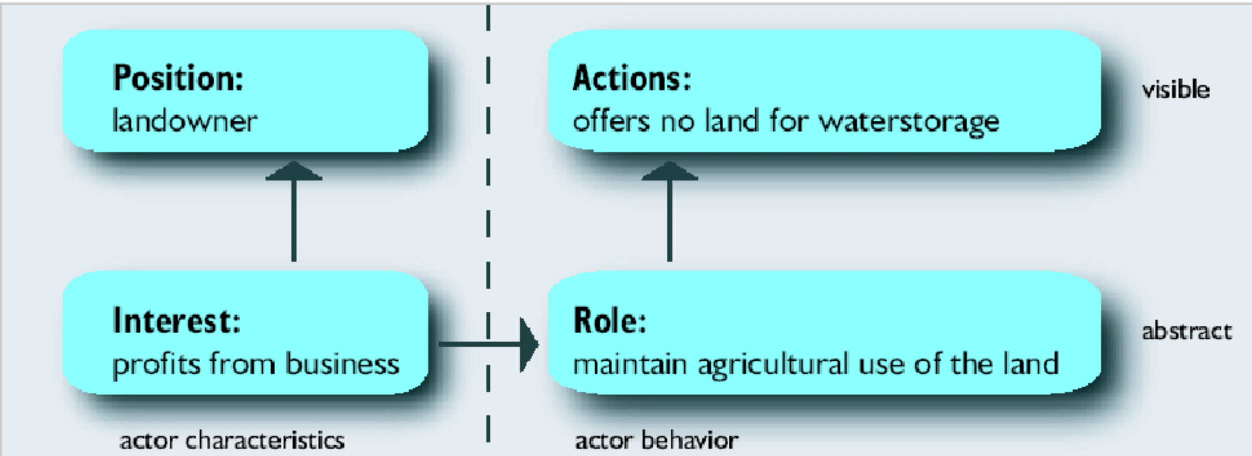

Figure 3 The PAIR-matrix (Positions, Actions, Interests, Roles)

Depending on his role, a party in the planning process will be of greater or lesser importance. The force field analysis offers an indication for each actor of his interests, advantages, disadvantages and conditions.

The force field analysis demonstrates where possible resistance can be encountered, who supports the water task and who has little interest (yet) or is neutral. Based on the force field analysis a strategy will have to be devised on how the strengths can be combined in the best manner; how resistances can be overcome, how supporters can be rallied, how possible opponents should be countered etc.
In real life, actors can take different positions at the same time. For example, the municipal authorities can act as a public party and represent the common interest of the civilians in a municipality, while at the same time acting from the position of land owner.

Guiding model: Historical kades (low dykes)

This paragraph gives an example of one of the guiding models. The example involves the historical *kades* (traditional low dykes) which are present in profusion in the area of Waterschap Rivierenland.

Background
The river landscape has been shaped by river water. To protect themselves from the water, inhabitants through the ages have constructed many different *kades* and dykes, such as seepage water *kades*, and other land separations. Many of these works have lost their water repelling tasks and in some cases, have been lost entirely.

Water goal
The most recognised feature of these characteristic landscape elements can be enhanced by constructing water storage as a (not too wide) “wet foot”. This could be combined with the construction of recreational bicycle and hiking trails. A few specific locations could offer opportunities to reconstruct the *kades* that have now been lost, in order to create a continuing

water structure.

Process and instruments

Great care must be taken to maintain both historical and ecological values. Many parties are involved, since many different properties are involved. The water fluctuations that have to be absorbed in the area are relatively small. The investment costs are relatively high and the water storing effect is rather low.

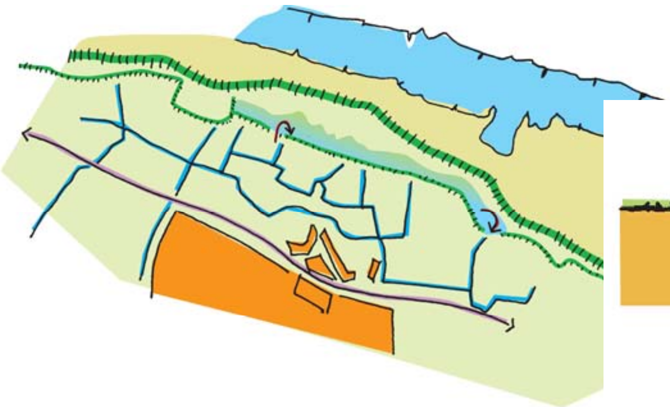

Figure 4 Water storage along a historical *kade*

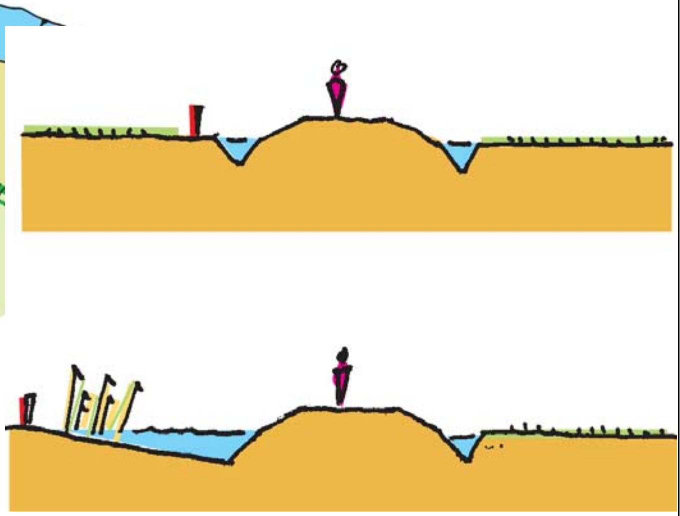

Figure 5 Cross-section of the historical *kade*

In addition, the management costs are high. However the *kades* are part of the landscape and can be used for different uses as well. Financing from different actors is therefore a possibility. In cooperation with municipal and provincial governments, the water board can determine whether (agenda setting) and how (designing) water storage can take shape. Agreements will have to be made with landowners concerning the functions and management of these lands and the necessary measures for development.

Conclusion

The Guiding Models give the water manager a tool for how to act within the process of water storage and spatial planning. It gives examples of how to use other land uses to your advantage and shows the best ways to take control of that process.

NORM STUDY

As mentioned earlier, Guiding Models and the Norm Study are part of a larger programme. They are complementary to each other. Whereas Guiding Models is the theoretical basis of a discussion with stakeholders, problem owners and problem solvers, the Norm Study is the actual implementation of water storage in a spatial planning process.

Background

The Norm Study is a first step to actual realisation of the water task to avoid regional flooding. The goal is to have a general sense of urgency with the stakeholders and general public within a specific catchment area that they are willing and make an effort to combine water storage with spatial planning and / or multiple land use.

Water task

The first step in the process is to determine the actual water task. This is the amount of water which has to be stored within the catchment area to ensure that landowners do not experience flooding. A key element is that every area has to solve its own problem and cannot pass it onto another area.

To determine the water task a detailed hydrological model was made. Every waterway and known factors which influence flood risks were incorporated in the model. After that the model was calibrated with measurements taken of water levels within these waterways. Once the model was calibrated and verified it was run with different climate change scenarios. Precipitation which occurs once in every 10, 25, 50 and 100 years were run with the model. In combination with accurate data on ground levels, the actual inundation was calculated. This resulted in areas which were inundated with the above mentioned frequencies.

Inundated lands do not have to be a problem. Only when it causes damage and is unwanted, is inundation a nuisance. Specific land use also requires a specific inundation frequency. Inundation of urban areas is less desirable (since it causes more damage) than inundation of rural areas. To cope with these differences, for every land use a specific inundation frequency (norms) was determined (at the national level). Urban areas should not inundate more often than once every 100 years whereas greenhouses should have a safety level of once every 50 years, and so on. A map was created with the different land uses and the climate change scenarios. This gave the total area that was inundated more often than the norms would allow. In combination with accurate ground levels, the total amount of water that has to be stored could then be calculated. This was the amount brought into the discussion with stakeholders and helped to create a sense of urgency to find a water storage solution with stakeholders. The objective of the water board was to create sufficient storage capacity so that all land uses have the proper level of safety.

Stakeholder involvement

An important aspect of the project is to translate the required amount of water storage into spatial planning and combined land use. The water board started an intensive communication with stakeholders in the area and therefore started with agenda setting. In this it was aided by the national government since the issue of water storage is a national theme.

Since the water storage function has to be incorporated in spatial plans, public servants of both municipalities and the provincial government were involved and initially asked to reflect on the models and amount of water that has to be stored. For them it was unusual to be involved at such an early stage. But by doing so the exact amount of storage was not the issue any more. Everyone was convinced of the need for water storage.

With that in mind a discussion has started on the measurements that need to be taken. Can we use urban areas, should we focus on integration in landscape plans, or should we invest in private initiatives like mineral extraction. The mind set of the stakeholders involved is towards solving the problem and not disputing the necessity of measures.

Once the measures have been shown on maps and implemented, the water board will generate a map with the safety norms. This way landowners can see what level of protection they can expect. When they want to use the land for a purpose that requires a higher level of protection they know that the water board will not guarantee such a level of protection. The landowner will have to buy private insurance to protect their property or take on the risk themselves.

Communication

To convince the stakeholders and general public a lot of effort was made to generate a communication tool. Spatial planners, water managers and civilians do not readily understand each other. To make sure we were discussing the same issues, a digital tool was created in which all the problems could be visualised and discussed. It included the base maps and also the hydrological model and estimates of effects of certain water storage measures. Once a combination of measures was suggested this could be shown and immediately the contribution to the solution of the problem was known. This helped the discussion tremendously. A combination of measures could be implemented virtually and everyone knew what other parties and themselves were contributing. The last step is to have the measures actually agreed upon, put into spatial plans and implemented. This will still be difficult since organisations and individual landowners might have problems with it, although the basis has been a sound discussion.

Conclusion

This paper presents a strategy to increase the water storage capacity of a regional water system to anticipate the effects of climate change. The strategy takes into account both the technical aspects and the interests of other parties. Guiding Models and the Norm Study complement each other - where the first starts off with a theoretical discussion the latter puts it into practice. Both can be of help to think of strategies to reduce runoff within a particular catchment area. How much this contributes to flood risk management depends entirely on the way it is implemented and at how large a scale it can be used.

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Further information:
Novioconsult Van Spaendonck / De Koning, September 2004. *Guiding models for water storage*. Nijmegen/Oosterbeek.

English
Dutch, Page 1-40, page 41-50, page 51-60, page 61-70, page 71-end

Figures
All figures were created by Robbert de Koning, Landschapsarchitect BNT.