The river Waal, Nijmegen - Mark Wagenbuur

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SEA for flood protection in The Netherlands – A Case Study

Introduction

Nature of the plan

The plan 'Room for Rivers' aims to define the necessary measures to protect The Netherlands against flooding of the river Rhine, now and in the future. During the 90's on two occasions flooding took place nearly and it is expected that the risk of flooding will only be bigger in the future, when more intense rain fall is predicted up stream. More specifically the plan sets a package of measures for the three main branches of the Rhine: the river IJssel, river Neder-Rijn/Lek and the river Waal[1]. Packages are a combination of two kinds of measures:

1. dike improvement or heightening (the traditional approach);
2. creating more space for water discharge or retention in the river foreland or river bed (new approach; hence the title 'room for rivers'), e.g. through removal of obstacles, deepening of the riverbed, creation of retention ponds, relocation of dikes.

Role of the Strategic Environment Assessment (SEA)

Some of the possible measures may be combined with achieving environmental benefits. E.g. the creation of new nature or improvement of landscape. However, these measures can be more expensive or less safe. The SEA was meant to enable planners and decision makers to find the best possible compromise of safety, environmental benefits and costs. Also, the SEA should take an integral view of the entire river system, since the three branches are interconnected and because upstream and downstream measures may affect each other. (Reference: Project Organisation Room for Rivers, 2005).

Integration of SEA into planning

The plan was subject to a legal procedure provided by Dutch physical planning legislation, the so-called 'physical planning key decision' procedure. This procedure provides for decision making in four phases:

- step 1: publication of the 'preliminary key decision' by the Cabinet;
- step 2: public consultation and publication of its results;
- step 3: Cabinet Decision;
- step 4: approval by Parliament.

The SEA was integrated into this process. Effectively this meant that before step 1 some extra procedural steps were included:

- In May 2002 a starting note was published as a kick off of the assessment, followed by a round of public participation, including an advice of the NCEA, on the required content of the assessment.

- Following this, the Terms of Reference (ToR) for the assessment was formalised by government and the assessment was prepared, as an integral part of the preparation of the preliminary key decision.
- In June 2005 both documents were published, being step 1 of the above mentioned 'physical planning key decision' procedure, again followed by a round of public participation, including an advice of the NCEA. In this round comments and advice were given, both on the quality of the assessment and the proposed decisions by government.
- Cabinet and Parliament decided end of 2006.

In the final plan approximately 40 individual projects are proposed. For approximately 30 of these EIAs have been started – or will be started – for the more detailed design and implementation.

Focus of the case study
This case study aims to give a brief overview of methodology applied in this SEA and its final influence on decision making.

Background: context and issues

Due to its character (potential high impact on lives and goods of people) this plan has a high profile in Dutch society and politics. Also, it is controversial, since – although everybody agrees on the safety issue – the potential measures may have significant negative impacts on different groups of stakeholders. E.g. farmers may lose land, landscape and nature may be affected, large budgets are needed, storage facilities for polluted sludge should be created. On the other hand, when designed thoughtfully, the necessary measures may also mean high potential for creating new nature or recreational facilities.

Starting point for this plan was an earlier decision by Dutch government that new measures for flood prevention should as much as possible be based on creating more space in the river foreland, rather than dike strengthening or heightening. Improving the storage and drainage capacity of rivers was considered a more sustainable and more flexible option for the longer future. A side-benefit is that it opens possibilities for combining safety and enhancing spatial quality.

Approach and methods used in the SEA

Information assembly
Aiming to improve the integration of plan and SEA, a dedicated project agency was set up, responsible for both. The SEA was written by the agency itself, although private consultancies were contracted to compile back ground documents or sections of the assessment.
Overall, the SEA is based on existing information tools, although for the design of alternatives and assessment of impact a dedicated computer model was developed.

Development of alternatives
In a first approach it was decided to start with formulating a number of overarching 'strategies' for improving flood security, such as focus on measures within the dikes versus focus on measures outside the dikes. In a second step then alternatives for a whole river branch should be developed, trying to implement as much as possible the chosen focus. However, this approach proved not to be constructive.
In practice, each segment of a river branch turned out to have its own characteristics and limitations, e.g. because of preferences of local population or local physical parameters. For this reason, it was decided to split each river branch in a number of homogenous sections, and then look at alternatives for each of these sections: the 'building blocks'. An alternative for a whole river branch was then created by a logical combination of building blocks.

A number of preconditions were set for each of the alternatives. The most important were:
- each alternative should fulfill legal requirements, both safety and others;
- the current distribution of water between the three branches should not change;
- there should be no effect on the current maritime functions of the river.

In addition to the preconditions, a number of starting points were defined, such as:
- sufficient support by local government and other stakeholders;
- in line with current government policy;
- in line with international agreements of flood prevention;
- in line with existing or already planned projects in the river basins;
- production of polluted soil to be stored should be minimized;
- highest possible cost effectiveness of measures.

The above process led to the final development of 4 alternatives:
1. reference: creating safety, solely through dike strengthening and improvement;
2. alternative 1: creating safety, without trying to combine safety with better spatial and environmental quality[2];
3. alternative 2: creating safety, combined as much as possible with achieving spatial and environmental quality[3];
4. on the basis of a first assessment of alternatives 1 and 2, a so-called 'preferred alternative' was constructed by selecting the best scoring elements of both alternatives. In the SEA this alternative turned out to be (for each of the three branches):
   - for river IJssel: preferred alternative is almost identical to alternative 2;
   - for river Neder-Rijn/Lek: preferred alternative is combination of alternative 2 with dike improvements;
   - for river Waal: preferred alternative is combination of alternative 2 with removal of obstacles such as groynes.

Selection of issues and indicators
Both for the development of the alternatives, and for the assessment of the impacts of these alternatives, the following issues were selected. For each of these issues a number of indicators were defined (see Box 1).

Methods for impact analysis
Assessment of high water levels and climate change
As a basis for the development of alternatives, first the high water levels to be expected in the near future (2020) were calculated. This calculation included possible developments in the upstream sections of the river in other countries, e.g. in Germany.

Then, for the longer term (2100) the expected future high water levels in the river were calculated on the basis of the 'medium' scenario of the Intergovernmental Panel on Climate Change. In this scenario it is expected that in the

Box 1: issues & indicators in the SEA

Issue	Indicators
safety management & maintenance	impacts of measures on lowering of expected high water levels need for dredging operations
spatial quality	utility value of the area perceived quality of the area (on the basis of objective criteria) robustness to change/flexibility
relation with long term vision	in/not in line with long term vision timing (how easy is it to delay measure?) no-regret (how easy is it to 'undo' the measure later?)
(polluted) soil	feasibility to carry out operation within planning term transport hindrance capacity needed in existing storage facilities new storage facilities needed production of usable raw materials: clay and sand improved soil quality: vulnerability to pollution and cleaning of existing polluted spots
nature	impact on protected areas under European regulation impact on other protected areas and species contribution to realization of the Dutch 'ecological main structure' increase of nature areas use of ecological potential
landscape	spatial appearance landscape quality
cultural history	damage to valuable cultural or historical elements or areas damage to the coherence of the cultural/historical structure of an area
functions	housing industry size of agricultural areas influence on agriculture potential, opportunities and risks recreation maritime functions (depth of the river)
ground- & surface water	production of drinking water from ground water impact on ground water management production of drinking water from river water
perception (on the basis of perceptions of people)	perception of nature and (cultural) landscape beauty perception of river dynamics perception of opportunities for recreation

year 2100 average temperature will rise with 2 degrees Celsius and sea level will rise with 60 cm.

Assessment of alternatives
Assessment of the impacts of alternatives took place as follows. For each indicator an appropriate methodology was chosen. Within the context of this case study it is not possible for each of the indicators to fully describe the methodology used. Therefore, below only the main contours of the methodology used are described.

First, as a reference, the existing situation is described, including the flood prevention projects that have already been decided or planned (the so called 'autonomous development'; in other SEAs often called 'o-alternative'). Impacts of alternatives are compared to the impacts of this reference.

Impacts have been predicted per segment of the river, i.e. the combined impact of all the measures proposed for that segment. As much as possible, impacts were described quantitatively. The impact analysis focused on permanent impacts, with the exception of soil operations, where also the hindrance during operation was described.

Also, the impact analysis focused on the direct impacts of alternatives, and less on the 'opportunities' that the newly created situation in the river area created. E.g. the potential for nature to develop autonomously in the years to come. For this reason, the impact description, especially as to nature issues, should be regarded as 'worst case'.

After estimating the quantitative impact, for each indicator a tailor made methodology was established to 'value' the impact, on the basis of expert judgment. Should it be regarded negative or positive? Should it be regarded substantial or insignificant? Basic criteria in this were:
- is the expected development (in the o-alternative) positive or negative, and how will the impact influence this?
- will the impact of an alternative be positive or negative, and what is its magnitude?
- how sensitive is the area to this impact?

The impact prediction is given on a 5-point scale: very negative, negative, neutral, positive or very positive. This with the exception of maritime and perception impacts, where a 3-point scale was used. For each indicator it is explicitly explained and substantiated how an impact is valued within the 5-point scale. For example, as to safety (the first indicator in the box on the left):
- if measures will result in lowering or fixing high water levels in 80% of the river branch or more: very positive;
- the same in 60-80% of the river branch: positive;
- the same in 40-60%: neutral;
- the same in 20-40%: negative;
- the same in less than 20%: very negative.

Cost benefit analysis
For this plan, also a cost benefit analysis was done, although not in the traditional way (Reference: Central Planning Agency, 2005). Traditionally, a cost benefit analysis for main infrastructure in the Netherlands gives a full overview of all costs and benefits (both monetarised and non- monetarised, quantitative and qualitative, economic, social and environmental costs and benefits). However, due to the scale of this plan, this was judged impossible nor strictly necessary.

For this reason the following cost benefit analysis was made:
1. For each segment of the river it was estimated:
   - what the costs would be of flooding;
   - what the costs were of the expected measures to prevent this.

   If costs of flood prevention were less than flood damage, the cost-benefit ratio was judged as positive.
2. For each measure in a segment of a river the 'cost effectiveness' was estimated, i.e.:
   - what is the cost of the measure;
   - what is the increase in safety, nature (in hectares), spatial quality and options for recreation.

Methods to compare alternatives
In the SEA the alternatives are compared, using a number of methods:
1. Per indicator: for each segment of the river, the SEA compares per indicator the scores of the alternatives, using the 5-scale.
1. Overall, qualitatively: each alternative is qualitatively described as to its main strong and weak points, compared to the reference and the other alternatives.
3. Overall, quantitatively: for each alternative the main quantitative figures as to measures realized and resulting impacts are given in separate boxes.
4. In order to decide which of the alternatives is best from an environmental viewpoint, the alternatives are compared to each other in a separate table, using their scores on the 5-point scale, on the issues that were regarded most important from an environmental perspective:
   - contribution to improving spatial quality (qualitative);
   - nature: impacts on protected area and increase in ha of nature area;
   - landscape improvement (qualitative);
   - impact on cultural history (qualitative);
   - soil: necessary excavation, improvement of soil quality (qualitatively), number of necessary new deposits;
   - in/not in line with long term vision government.

Sensitivity analysis: for each of the alternatives it is judged separately, which measures would be possible to further improve the environmental performance of alternatives, and whether these could change the ranking of alternatives on environmental aspects.

Public participation
Public participation took place during both the early stage of planning and a later stage. A first round of participation focused on the information the SEA should contain, e.g. what alternatives to examine and what impacts to assess. A second round of participation took place after the SEA and the draft plan were ready and focused on the quality of the SEA and the proposals in the draft plan.

The organisation of each of the two rounds of participation was as follows:
- At 15 locations along the river branches full day meetings were organised, where everybody willing so could participate.
- The first part of the meeting was a so-called 'information market', where each citizen could ask questions, get explanations, information, etc.
- The second part of the meeting was then the formal 'hearing session', during which everybody willing so could make formal comments, to be recorded and responded to in the SEA or the final decision.

In addition to this, continuous participation took place during plan and SEA preparation. The most involved (local) governments, agencies and organized NGOs (e.g. agriculture, environment) were continuously consulted during the development of alternatives. For this, two regional 'steering groups' were established. As much as possible the design and selection of measures was done jointly. In this, local stakeholders appeared to be concerned most of all with the selection and construction of sites for deposit of polluted soil.

Quality review
Part of the Dutch SEA process is a legally mandatory quality review of the SEA by the NCEA. This Commission is a private foundation, with no ties to government or any of the other stakeholders in plan or project decision making, subsidized by government. In its review of the SEA the NCEA concluded that overall the SEA was clear and of good quality. However, on one aspect the SEA contained an omission that was regarded by the NCEA as an essential one.

Looking at the alternatives, the NCEA concluded that all alternatives focused very strongly on measures that tried to combine flood prevention and improvement of spatial quality. Although this was only logical in line of the previous government decision that combination was the preferred option, in practice this had a significant down side. Combination measures are relatively expensive: the overall budget for each of the alternatives was around 2.2 billion Euros. Both the NCEA and the cost benefit analysis concluded that for this money a better alternative existed. If 1 billion would be spend on dike strengthening, this would leave 1.2 billion for measures specifically aiming at improving spatial quality. Overall, this alternative would be equally safe, with a bigger contribution to for example nature, landscape and recreation in the river area. This alternative, however, was not examined in the SEA (References: Netherlands Commission for Environmental Assessment, 2005; Central Planning Agency, 2005).

Results and lessons

Contribution to decision making
The conclusion of the comparison of alternatives 1 and 2 was that, overall, alternative 2 proved to be the best combination of providing security and improving spatial quality. However, the cost-effectiveness of alternative 2 could be further improved by incorporating certain elements of alternative 1 into alternative 2. Particularly dike strengthening and removal of obstacles in certain segments of the river.

The cost benefit analysis showed that for most segments of the river the costs of measures were reasonable, when compared to the flood damage that was prevented. However, for a number of segments improvement of cost effectiveness was possible, though choosing a different package of measures. In particular, in these segments it could be economically more wise not to select measures that combined safety and spatial quality, but formulate a package of measures aimed specifically at safety (such as dike strengthening) and spatial quality (e.g. nature and landscape development and recreation facilities).
On the basis of both comparison of alternatives 1 and 2, the results of the cost benefit analysis and the comments of regional and local stakeholders, a 'preferred alternative' was developed and assessed. During decision making a formal decision was taken to implement almost 100% of this alternative.

All in all, this decision was accepted by all parties, without much controversy. This with the exception of the siting of some deposits for contaminated soil, which raised much resistance, especially where these were not combined with nature and landscape improvement.

Outcome: influence of the SEA
The influence of the SEA is uncertain. On the one hand, the fact that the alternative developed in the SEA was finally almost 100% formally adopted indicates that the SEA had a big influence on decision making. On the other hand, the ministries responsible for the plan took a very open, transparent and participative approach to the development of the plan from the start. It's hard to judge whether such approach in the absence of SEA would have been chosen, and if so, whether this approach alone would then have had the same environmental results. (Reference: Runhaar & Driessen, IAPA, 2007).

The recommendations of the NCEA and the Central Planning Agency (who conducted the cost benefit analysis) to take a closer look at an alternative with a potentially bigger contribution to spatial quality, was not taken up by govern-

ment. One of the main arguments for this was the fact that this alternative was not in line with the approach formally established earlier by government that measures should aim at the creation of space rather than dike improvement. To develop an alternative approach in a relatively late stage of planning might hamper the credibility of government to stick to its decisions. A second argument was that government was not convinced such alternative overall would have a bigger contribution to spatial quality, because of the negative impacts of dike improvements to, in particular, landscape quality.

Conclusion: lessons for SEA good practice

This SEA shows that it is possible to organise an open and participative integrated SEA/planning process to successfully develop a highly controversial plan, that takes environmental issues fully into consideration. Also, it is clear that this SEA has influenced significantly the finally adopted plan. One of the main reasons for this was the fact that SEA and plan were developed interactively and in parallel with the negotiations between stakeholders. Another reason was the creation of a so-called 'project-directorate' within the ministries, responsible for both SEA and plan development, and in which the main responsible ministries worked together.

It's hard, however, to identify exactly how influential the SEA was. The 'open' and positive attitude towards participation and environmental integration of the main responsible ministries clearly also contributed significantly to the final outcome.

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Role of the NCEA

- **The NCEA advised on the Terms of Reference of the SEA for the Spatial Plan Key Decision 'Room for the River' in 2002.**
- **The NCEA reviewed the quality of the SEA report and issued her advice in 2005.**
- **In 2005, the government agreed on the Spatial Plan Key Decision 'Room for the River'. This plan is followed in 40 projects. In most of these cases the NCEA has or will review an EIA, preceded by an advice on the Terms of Reference.**

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(1) The plan also looks at a small part of the River Merwede; this, however, is not discussed in this case.

(2) This included measures such as removal of obstacles in the river foreland , deepening of the river bed and dike improvement.

(3) This included measures such as broadening river forelands by relocating dikes, creation of extra river beds, creation of retention ponds of deepening of river forelands.

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