

UPGRADING THE WATERSYSTEM IN THE SOUTHERN PART OF ARNHEM (the Netherlands) “South Arnhem Water Wealth”

1. Introduction, preface

The city of Arnhem, capital of the province of Gelderland, is situated in the eastern part of the Netherlands near the border with Germany (20 km). The river Rhine ('Neder Rijn') divides the city in two parts; a northern part in which the old centre of the city is situated, and a southern part, in which direction the city extended from the 1940's onwards. Arnhem is also situated at the point where the river IJssel separated itself from the main river, the Rhine. The city (municipality) has about 140.000 inhabitants, from which a little more than half live the northern part of the city.

In Arnhem water has many faces. In the north, on the flanks of the hills of the 'Veluwe', practically no surface water can be found. On the sandy soils only small brooks meander through the suburbs of the city. Closer to the river Rhine and IJssel the soil consists of clay and peat. In these areas the water economy consists of vast watercourses needed to transport the surplus of water to the rivers. The watercourses are well nourished by the brooks mentioned earlier. In periods of drought this steady flow of water has a considerable positive effect on the quantity and quality of the watercourses near the rivers.

In the southern part of the city, on the southern shore of the river Rhine, the situation is somewhat different. In this polder area, of which the soil is peaty and clayish, the city expanded from the 1940's onwards. The main building period has been post-war, the 60's, 70's en 80's of last century¹. The water- and sewer system has been designed in accordance with the standard of that time. This means straight watercourses and ditches designed to transport, again, the water as quickly as possible out of the city and into the river. The water system is also, or is supposed to be, self-sufficient. This means that the water system is not connected to the system(s) in the surrounding polders (other municipalities). Excess of surface water can therefore only be 'pumped' out of the system. In dry summer periods no surface water can be let into the system, resulting in dropping of water levels.

In this area also water quality problems occur. In some parts of the water system the water quality, chemical and ecological, has deteriorated and does not correspond to the present day standards². The problems will only get worse considering the expected climate change that will bring heavier rainfall in smaller time periods and longer periods of drought in the summer season. Summers will become dryer; rain will fall in violent showers of rain. Winters will be wetter. In combination of expected higher water levels in the river Rhine the problems in the southern part of Arnhem will be (become) severe. The measures to be taken to encounter these (expected) problems are costly and can only be implemented in accordance to city renewal or redevelopment. Fortunately, these opportunities are present in the projectarea.

2. Issues to be addressed

In the southern part of Arnhem the following general issues can be addressed:

1. water quantity problems

The water quantity problems in winter and spring are due to high water levels in the river Rhine. High water in the river leads to seepage in the districts close to the river, such as the district of 'Malburgen' build in the 1940s en 1950s. The seepage is considerable because the soil in this

¹ Also the latest district, with over 3.500 new houses to be build, will be situated in this region.

part of Southern Arnhem is quite sandy. This water has to be transported through the watercourses to one of the two pumping stations (pumping engines) that will pump the water back into the river Rhine. These stations have to prevent high water levels in de courses and secure the safety of the inhabitants of 'Malburgen' (in fact the whole southern part of Arnhem) The nuisance of water, surface- and groundwater, should also be limited; no water in basements, backyards and on the streets. Water in the streets is not wanted for a long period of time. When also heavy rainfall occurs the water levels in the courses will rise even more due to problems in transporting the surface water to the pumping stations. For more than one reason all this (high) water causes problems in the southern part of Arnhem:

- a. the percentage of surface water is too low; there is limited space to store the water temporary. It is now about 2 percent; it needs to be about 5 percent.
- b. the transport capability of the water system is limited due to large amounts of sludge in the water courses and disfunctioning of some flood control dams (weirs). The sludge is a result of overdue maintenance.
- c. one of the pumping stations is very old (est. 1933) and has lack of maintenance. The water board 'Rivierenland' and the municipality have agreed to close down the station, but this will only be possible if the transport capability of the water system to the remaining station is increased and/or the surrounding polders (outside the city; outside the self-sufficient water system). Removing the sludge may not be enough.

In summertime, the very dry summer of 2003 is a good example, the water levels in de water courses fall. This is due to the fact that:

- a. the system is, as mentioned earlier, self-sufficient (or should be), meaning that the system has no connection with the water system(s) in the surrounding polders (outside the city; other municipalities). Rain is practically the only source of surface water. When it doesn't rain for a long time the water level in the system will drop. This is/was the case in July and August 2003.
- b. the soil in the areas close to the river Rhine is quite sandy. As water levels in the main river drop the surface water in the courses is drained to the river.
- c. In the southern part of Arnhem the water company Vitens has a main drinking water pumping station (5.5 mio m³/yr). One of the two in the city of Arnhem. The combination with the sandy soil (there are no impermeable soil layers between the surface water and groundwater at great depth) results in dropping of the water levels in the water courses. Vitens plans to increase the capacity of the pumps. This will increase the problems if no extra measures (water compensation) are taken.
- d. the watercourses are overdue in maintenance; they are filled up with sludge which results in shallow water and problems in water circulation. These problems will occur quickly in dry seasons.

The expected effects of climate change will enlarge the problems mentioned. Summers will therefore become dryer; winters wetter. In combination of expected higher water levels in winter and spring in the main rivers the problems in the southern part of Arnhem will be (become) severe.

2. water quality problems

Besides water quantity problems certain parts of the water system encounters also water quality problems. The water quality has deteriorated due to a number of causes:

- a. the main part of the sewer system is divided (separated transport of rainwater and waste water). Relatively large amounts of unfiltered and therefore possibly polluted storm water (mainly from streets and rooftops) goes directly into the watercourses and can pollute the water. A recent study

² Dutch standards as well as European standards (Water Framework Directive).

indicated the stormwater sewer outlets that are responsible for the main pollution of the water system.

- b. the vast amount of sludge in the water system. This leads to problems in water circulation especially in summer. This is mainly a ecological problem and causes botulisme and the death of fish. The local production of drinking water intensifies this problem.

The study mentioned earlier (2a) showed that leafs falling in the water and food for ducks is locally a considerable source of water contamination.

As may be noticed the problems in water quantity and water quality are strongly connected. For the same reasons the problems and solutions will be linked.

3. Water and spatial planning in build-up areas:

Part of the water problems in the southern part of the city is the result of spatial planning in the past decades. When the districts were build the watercourses were designed mostly in a pure 'technical way' with practically no extra space for water storage. The policy in these days was to 'get rid of the water as soon as possible'. Water was not considered a main structure that contributes to the quality of the environment; which is the public space. The watercourses are mostly straight and alike, and sometimes 'put away' in a corner of the districts / public area. At some places the water is hardly visible. There are some exemptions for instance the swamp area alongside an old dike of the river Rhine with high ecological value.

4. Improving the attractiveness and recreational use of the water by co-operation

Improving the water system, quality and quantity, is not just a goal for the water partners in the southern part of Arnhem: the municipality, the water board Rivierenland, de province of Gelderland and the drinking water company Vitens. These are also the inhabitants goals. They mainly want attractive water with boarders (banks) that can be used for recreation purposes like fishing but especially for walking, jogging and bicycling.

Many cities have limited space for recreation. The constant pressure from 'red' (buildings etc) and the needed room for water leaves little room for green. A group of residents in the southern part of Arnhem have taking the initiative to work out a plan for a so called 'waterpark' (waterpark South Arnhem / Huissen; Huissen is a small town to the southeast of Arnhem). In this plan the existing 'blue and green areas' are linked together resulting in an area that can be used for a variety of recreational purposes. This plan encounters great support from both the municipality and the water board.

3. Main objectives

The main objective of the project is to transform the present day water system into a sustainable and resilient one and by doing so restoring, in fact improving, the (natural) 'water wealth'. For this reason the project is named 'South Arnhem Water Wealth', To reach this overall objective the following goals should be achieved:

1. to create a water system that is able to cope with situations of high and low water including groundwater problems (seepage and excessive amount of rainwater).
2. to improve the chemical and ecological quality of the surface water by purifying polluted storm water runoff and developing ecological structures (zones).
3. to improve the attractiveness and recreational possibilities of the water in relation to (combination with) the surrounding 'green'. Realisation of (parts of the vision of) the 'waterpark South Arnhem – Huissen' is one of the objectives.
4. to integrate the concept of water as a vital and attractive spatial element in the policy of 'urban spatial planning'. It is a common fact that many people want to live alongside open water.
5. to improve the water-awareness of residents, corporations and institutions.

The nature, cause and magnitude of the problems require an integrated approach. Only co-operation between a number of organisations will result in improving the 'water wealth' of South Arnhem. The innovative feature of this project is the integrated approach and participation by inhabitants, districts (inhabitant-organisations), 'recreational organisations' (like angling societies), the water board Rivierenland, drinking water company Vitens and the municipality of Arnhem.

4. Description of the Action Plan as part of the InterregIII B project 'Urban Water'

On a local scale the water partners in Arnhem set up a policy plan for the water in Arnhem, the so called 'Water plan Arnhem 2003-2007'. For the southern part of Arnhem the municipality, the water board Rivierenland and Vitens are the main partners. In this plan the partners decided to subscribe the following goal:

"In the southern part of Arnhem there are problems in several areas concerning water quality, water quantity and localised nuisance from groundwater. The water partners are currently developing a number of different plans for southern Arnhem. Some plans are aimed at modifying and improving the water system (dredging, environmentally friendly banks), other plans that may lead to deterioration (increased extraction of drinking water). The water partners believe it is possible to achieve the different goals by combining the plans. These are not just the goals of the water management partners (authorities). They are also the residents' goals. After all, improvement of the quality of the water system and water management is by and large in line with the needs of the residents. They want more recreational opportunities. Public spaces in South Arnhem offer good tie-ins for this and, by linking public spaces and water to each other more effectively, water can play an important role for the residents of South Arnhem. It is against this backdrop that residents are already taking the initiative to work out a plan for a waterpark 'South Arnhem – Huissen'."

The actions or activities for the project 'Southern Arnhem Water wealth' can be divided into four topics. All of these activities are mentioned in the 'water plan Arnhem 2003-2007'. Not all actions, especially the costly investments, will be part of and financed by Interreg. The financial magnitude of the project as a whole is too big for that. Those investments will be financed otherwise³. These specific actions are mentioned below but indicated with an * and written down in a smaller letter.

The four topics of the project are:

1. creating a sustainable, resilient water system:
 - a system that is able to cope with situations of high water and drought including groundwater problems (seepage and excessive amounts of rainwater).
 - a system with a good chemical and ecological water quality.
2. Improving the attractiveness and recreational opportunities of the water (in combination with the surrounding 'green').
3. Integrating the concept of water as a vital and attractive spatial element in the policy of 'urban spatial planning'.
4. Improving the water-awareness of and co-operation by residents and others concerned.

Each topic contains different activities of (sub)actions, numbered from A to O:

1. Creating a sustainable, resilient water system:

³ By the municipality, the waterboard or the housing companies.

- A. (subaction 3.1.10 in the application form) determining the way to change the present water system into a sustainable one during periods of high water levels in the river and heavy rainfall and periods of drought in the summer season, taking into account the suspected climatic change. This action will focus mainly on the water quantity problems and contains the following sub actions:
- A1. making a study in which will be determined which options can be taken into account, considering the actions (measurements) that will be implemented in the project area anyway (for instance several sub actions C and D).
 - A2. making a specific study on the environmental, social and economical impact of purifying the effluent of the sewage treatment plant and the use of this water in the urban area of South Arnhem (subaction 7.1.1 in the application form). This plant is situated in the southern part of Arnhem.
 - A3. implementing the chosen measurements which will lead to a sustainable water system. This probably will lead to the adjustment of some weirs. This could also mean the adjustment of the present sewage treatment plant and the connection to the surrounding water system (with an extra purification phase) so that effluent water can be used in dry periods. 'Additional' means 'additional to the actions mentioned in subactions C and D.'
- B. Determining which innovative solutions can be implemented in order to improve the water quality of the water system. Besides dredging (action D) and improving the water circulation specific measures have to be taken in the sewer system (storm water system) and/or the water system itself. This action contains the following sub actions:
- B1. determining which measurements can be taken to decrease the amount of pollution from the storm water sewer system to the water system (subaction 3.2.3 in the application form). This could mean changing or altering the sewer system and/or taking specific measures on the receiving watercourses of ponds; for instance planting helophytes nearby pollution outlets.
 - B2. Construct the chosen solutions of action B1 on three sites (locations) in order to measure the effects on the water quality (subaction 8.2.3 in the application form).
 - B3. Determining which innovative solutions can be used to 'remove wrong (illicit) connections' in the sewer system (subaction 5.2.5 in the application form). A divided sewer system means that the stormwater system should not receive waste water. However, studies show that at some places polluted waste water is wrongly connected to the storm water system. Some households and/or factories should therefore have 'wrong connections'. This sub action contains of a study to investigate how these wrong connections can be removed. If this is not possible or financially achievable innovative measures should be taken to purify the polluted water from these outlets; an end-of-pipe solution (see sub action B2).
 - B4. realise the chosen solution(s) as a result of action B3: remove the wrong connections from the sewer system or take measures at the outlets of in the watercourses. If is chosen to remove the connections a pilot will be held in one specific district (subaction 8.2.4 in the application form). If the results are good the pilot will probably be extended to more areas in Arnhem (not a part of the project)

- B5. determining which 'source measurements' can be taken in order to improve the water quality (subaction 3.2.4 in the application form). A recent study showed that falling leaves and nutrition's from duck food decrease the quality of the water. But also the use of herbicides or fungicides (mainly by residents) has a negative effect on the water quality. Another study is necessary to determine if specific (extra) measures should (and can) be taken and if so which measures that will be.
- C. upgrading watercourses in certain districts, mainly in Malburgen close to the river Rhine (not a part of the project).
- * The effects of this action will be taken into account in the actions A and B. This upgrading will consist of i.e. increasing the amount of surface water by broadening and/or deepening existing watercourses and creating new ones including ponds. Another good example is the intention to 'bring above ground' a subsurface watercourse or culvert (called 'Arkel'-culvert) in the centre of the district of Malburgen. This subsurface watercourse, with a length of about 1 kilometre, is an important link between the eastern and western site of the water system in the district of Malburgen. By realising this aim not only the storage capacity and the quality of the water system will increase, but also the quality of the environment will be upgraded. This will have an main effect on this, nowadays somewhat degraded neighbourhood.
- D. dredging the sludge out of all the watercourses in the southern part of Arnhem (not a part of the project). This action
- * will not only improve the water circulation and water storage capacity but also increase the water depth and therefore the water quality (chemically and ecologically). The effects of this action will be taken into account into actions A and B. This action started in november 2003 and will last until the end of 2007.
- E. Reconstruction of the banks of specific watercourses into ecological structures / zones (not a part of the project). This
- * will improve both the (ecological and chemical) quality and value of the water system. The effects of this action will be taken into account into actions A and B.
- F. monitoring the chemical and ecological structure of the water system in order to measure the effects of all the actions (mentioned above) taken (subaction 8.2.5 in the application form). This monitoring will be a on a yearly or 6 months basis, starting with a measurement of the present situation. The monitoring makes it possible to change or alter actions during the course of the project.

2. Improving the attractiveness and recreational opportunities of the water (in combination with the surrounding 'green')

Activities / actions:

- G. Realisation of (parts of the vision of) the 'water park South Arnhem – Huissen' together with all the people and organisations concerned (not a part of the project). The vision contains also of historical landmarks such as 'wielen'⁴ and recreational opportunities as routes for walking, jogging and bicycling. The project aims in realising one or two walking and bicycling routes through the 'green' alongside the 'blue' (water).
- H. Setting up a maintenance plan for the water and the green alongside it (subaction 7.1.2 in the application form). This plan will be set up together with the inhabitants (living alongside or near the water), districts (inhabitant-organisations) and 'recreational organisations' (like angling societies). Part of this plan is an inventory and description of the intrinsic value of the water in relation to the human activities in the area. We will taken into account the 'waterbodies' mentioned in the Framework Directive.
- I. Combining all initiatives of other organisations. An environmental organisation for instance wants to link the so called 'wielen' in an recreational route. Some of these 'wielen' are situated in the south of Arnhem.

3. Integrating the concept of water as a vital and attractive spatial element in the policy of 'urban spatial planning'

Activities / actions:

- J. Implementing the 'watertoets' (water check), a since novembre 2003 obliged Dutch legal (process) instrument to * safeguard the water aspect in every spatial new of re-development. A sort of 'water-minded' spatial planning in which water is taken into account in a very early stage in urban planning. The use of this instrument has to make sure that the Netherlands (and Arnhem) is 'waterproof'. The municipalities, water boards and provinces are the main players in this instrument. This action will be implemented together with all the project partners.
- K. Emphasize the value in water in urban areas. "Room for water" is not only a necessity; visual water, like * watercourses and ponds, also has an positive effect on the quality of the public space (neighbourhood).
- L. Realise all the actions mentioned in 1 and 2, as far as possible in line with the planned rebuild-up (redevelopment) of * certain district in the southern part of Arnhem. This will concern mainly the district of Malburgen, which will undergo a serious facelift in the next 8 year (up to 2012). However in the next years the quality of the 'public space' in several other districts in the southern part of Arnhem will be improved. This is a high political aim. This means that the activities as mentioned in A up to E will be part of redevelopment plans en time schedules. Combining different actions:
 - will improve the quality of public space in the districts. This result of one big operation will be better and the residents will encounter less inconvenience from all the planned activities;
 - will make it possible to do more with the same amount of money (1+1 = 3);
 - will make it sometimes possible to finance the most expensive 'watermeasurements'

⁴ Remains of dike bursts in the 16th – 18th century, nowadays often ponds.

4. Improve water-awareness of and co-operation by residents and others concerned.

- M. broad and regular communication about the progress of the project (subaction 7.3.5 in the application form). The 'Waterservicepunt Arnhem' as one of the key initiatives of the water plan Arnhem (and opening at the end of 2003) will play a role (part) in this subaction.
- N. Invitation to the inhabitants (all persons and institutions concerned) to take part in specific actions (subaction 7.3.5 in the application form). This will lead to durable contacts between residents and authorities (municipality, water board, drinking water company) in order to improve the water system and its recreational value.
- O. some of the meeting will coincide with one of the regular working group meetings with our Interreg-partners or invite participants in actions to join the meetings of Interreg.