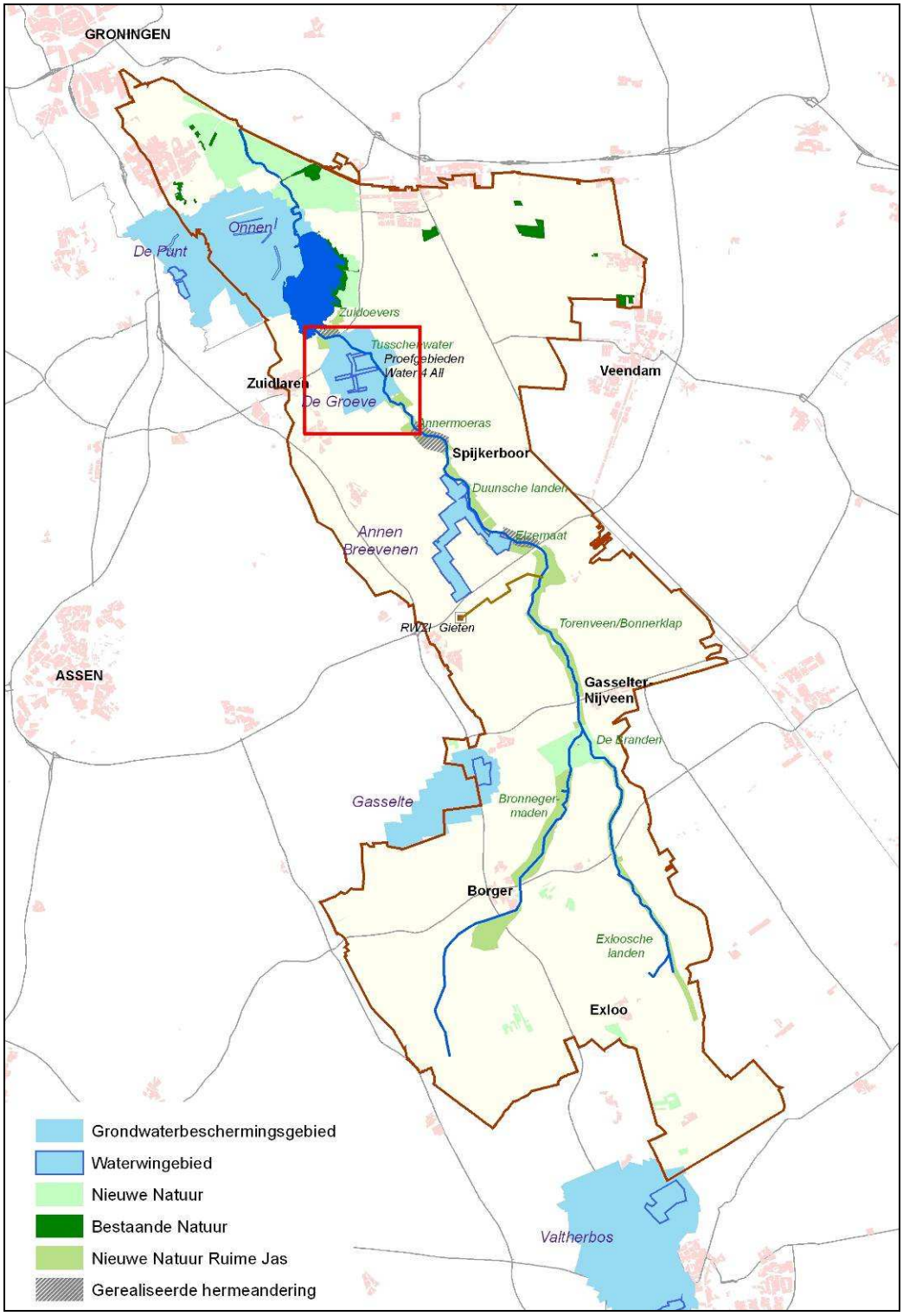
Report on the HUNZE PROJECT
for WATERCOST workshop
Hamburg 23 August 2007



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1. Starting point for the Cost Effectiveness Analysis (CEA) exercise

Earlier WaterCost workshops concluded that each region would develop and test its own CEA methodology. The overall project would then be able to recommend useful methodology to other (non partner) regions involved in developing and deciding on different measures/ projects that improve the quality of water.

It was also concluded that so called **side effects** of water related measures, often positive and not always possible to monetarise, would be included in the CEA methodology and taken into account when subsequently choosing the most effective measures.

Why?

Looking only at costs of (alternative) effective measures is too narrow an approach, as if water and other authorities are only interested in costs so that they can be passed on to consumers / polluters. A broader approach recognises that many other effects of the measures, be they ecological, social or economic, should be made visible so that decision makers can take them into account too. Examples of such side benefits are; new landscapes as a result of newly planted forests or created wetlands, more recreation facilities, lower risk of inundation, higher value of houses near new nature, additional tax revenues for local councils, increased income and number of jobs in the tourism sector.

In a standard CEA there are several steps: first we define the problem that is affecting the quality of the (ground) water, then we identify, describe and calculate the cost of effective alternatives (i.e. measures that will solve the problem). The finals step is to identify the most efficient alternative (i.e. the alternative that does the job but at least cost).

Most CEAs have the following (common) structure:

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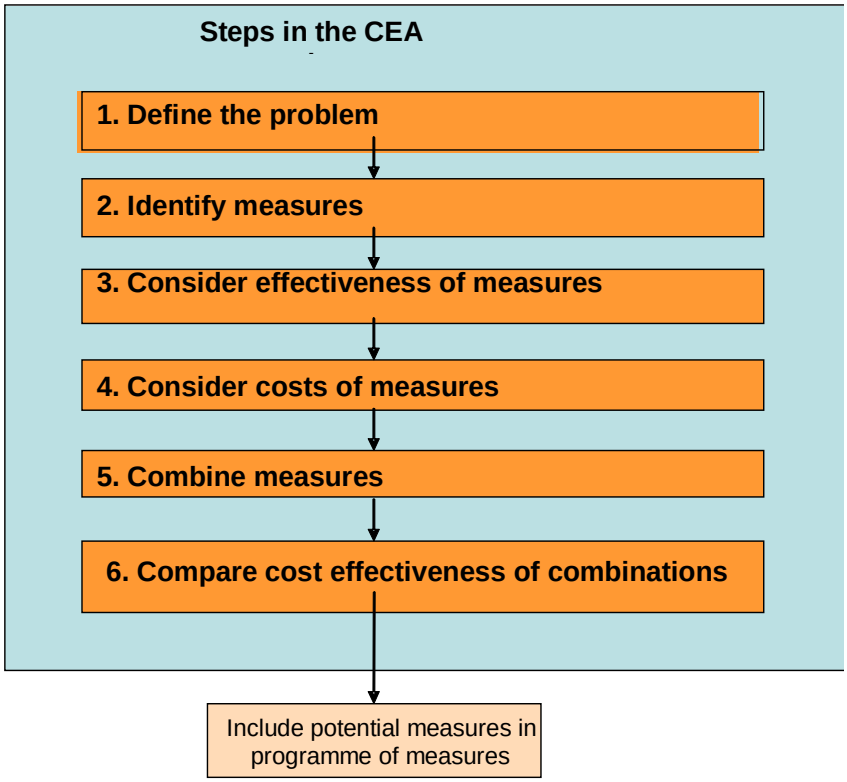

2. Applying this CEA framework to the Hunze case

The Hunze case has some characteristics that challenge a straightforward application of the diagram above. The following explains why.

Step one- Defining the problem.
As there are many different stakeholders in the Hunze project, there are also different perceptions of what the problem is.

- For the **nature organisations** it was the fact that the Hunze valley was drying out and former wetlands, vegetation and birds were disappearing. This was the result of 'water management' policies taken in the past to please the farmers. The waterworks (the Hunze was transformed into a canal) "imprisoned" and straight-jacked the Hunze and made the valley drier.
- Pollution from farmland and faster running waters (because of the canalisation) were causing sedimentation and a plague of toxic blue algae's in the lake downstream. This lake was loosing its attractiveness for tourists. Pressure was put on **local authorities** (councils, province) to solve this social and economic problem.
- **Water companies** were pumping clean groundwater, descending in the valley from a higher wooded ridge to the west of the valley. Even though this clean ground water resource did not seem to be threatened, strategic concerns for the future made the water companies buy land in the valley in order to protect these resources. The goal is NOT to infiltrate surface water. On the location of the groundwater production field, surface water may infiltrate as a result of the abstraction of groundwater. The Breevenen groundwater production field was realised to prove in practice that it would be possible to produce groundwater in combination with recreating wetlands. This

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way the groundwater production field Breevenen contributed to the reduction of the "dried-up" part of the province of Drenthe. In case of the "De Groeve" production field, the infiltration rate seems to be much higher that previously expected. When the Tusschenwater area will be flooded, more surface water will infiltrate. This led to the idea that more groundwater can be produced, without causing more groundwater effect in the surrounding area, because the increased production will be compensated by the increased infiltration.

- For the local **water authorities**, and especially in the Netherlands, the problem is, how to manage the quantity of water in the valley: enough in the summer and not too much in the winter. Another concern was the fact that beyond the lake, parts of the larger city of Groningen were periodically at risk of being flooded. Now climate change (more rain) has exacerbated this problem, as further north of the city (where the water is pumped into the Eems-Dollard, projects for higher dikes are being studied. (Interreg project ComCoast). Possibilities for water retention in the Hunze area itself have recently been taken into account.

Step two- Identifying the measures

The first identification of what was needed in the valley was done by the Nature organisations in the two provinces concerned and by WWF, as early as 1993.[1] They sued the local water company WMD and blamed it for extracting too much clean groundwater coming from the ridge into the valley. The NGOS made a plan to bring back the old meanders in the river so that water would flow more slowly in the valley, retaining water there for nature development. The dikes around the river would be removed and lower ones would be built further out so the river would be able to flow more naturally. As the NGOs have paying members, they started to buy land in the valley. They also made deals with individual farmers to exchange their lands near the water for drier land to the East. Two engineering companies, keen to do the infrastructural works and the University of Groningen (doing research) promptly participated in a European project (Interreg Water4all) coordinated by the province. The three municipalities in the area also saw possibilities in bringing more water and nature into perspective, creating new and attractive sites for up market houses. At the same time the water board Hunze & Aa recognized the possibilities to combine restoration of wetlands with water retention and an improvement of water quality in the Hunze area. The river Hunze and the lake "Zuidlaardermeer"are both important water bodies in terms of the European Water Framework Directive.

So, despite the fact that stakeholders had different perceptions of the problem, and different interests, what happened is that the measures proposed by the nature NGOs were gradually accepted and further developed as more stakeholders got involved. The role of the Province was essential in bringing together the stakeholders, maintaining interest and momentum over a period of more than 10 years, and applying for two EU programmes (Water4all and WaterCost).

[1] The 1993 study led to an action plan (Hunze Visie) in 1995.

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THE MEASURES IN THE HUNZE VALLEY SINCE 1995

GOALS: Re-establish a more natural water system in the whole area, combining nature and (economic) water interests but also social ones like new opportunities for recreation, flood prevention and new housing projects.

MEASURES in the whole valley:

- In one area (Annermoeras) the old dams and embankments around the Hunze have been removed and placed further outward to create a new nature/water area of 165 hectares. (see picture 1)
- 110 ha land has been bought from farms and added into the plan for the new valley at this location.
- A new parking place has been built at the old lock gate at Spijkerboor (now a café) and new jetties for rafters. (See pictures 2 and 3)
- At several other places along the river, land has been bought so that new nature can develop at the borders.(see illustration 1)
- Further away from the river, at Breevenen and Tusschenwater, where water companies pump up ground water, farmland has been bought and land is gradually becoming idle and open for recreation (walking, cycling).
- New cycle paths have been built in the valley (and planned around the lake). (see picture 4)
- The lake is being dredged.
- Plan Zuid Oevers: on the south east shore of the lake, a new nature area has been created (by the nature NGO and by the city nearby) and a new building site is now available for the construction of (large) new homes.
- Plan Meerwijk: on the eastern lake shores: renovation of the harbour and upgrading of the camping and holiday resort: 14 new bungalows, 15 new places for campers, improving the beach area.
- New water ways have been made to link the lake to other water areas in the eastern part of the Groningen Province, so boats can leave the lake.

LATEST PLANs: Plan Tusschenwater.

Tusschenwater is the lowest area in the valley (South of the lake between the small village of de Groeve and Zuidlaren, (see map on the cover of this report) and one of the locations where one water company extracts groundwater. The company, the nature NGO and the Water board already own most of the grasslands in this area, previously agricultural land. The plan is to buy all the land, remove existing embankments / dikes and build safety dikes further away, allow for periodically inundation of an area 480 ha in total (1st phase: 250 ha) so that the area will become a wetland with a lot of flooded area during winter and high ground water levels throughout the year. Plans include the removal of a road, building a new bridge, making a new inflow site to the lake with a new harbour for yachts (so the city will be nearer the water and have a new waterfront).

This will increase the water catchment area from which water infiltrates to deeper layers from where it is extracted as drinking water. Besides water catchment and groundwater recharge, other functions of the project are regulation of runoff (less sedimendation of the lake) and flood prevention downstream (city of Groningen). Most of the land has been purchased already and the whole area has been designated as a nature area and a water catchment area in the latest physical plans of the Province.

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Picture 1- New meanders in the Hunze valley

Picture 2- New jetties

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Picture 3- New parking places

Picture 4- New cycle paths

Picture 5- New recreation possibilities

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Step three- Considering the effectiveness of the measure(s).

As there were several different "water problems" in the area, judging whether or not a particular measure would be effective as a solution was also a problem in the Hunze case. Each stakeholder judged the measures from their point of view: will it solve my problem? For the **nature NGOs** the question was: "Will it bring more clean water in the valley and improve nature (more habitats, higher biodiversity, greater dynamics, etc)"? For the **water companies**: "Does it threaten the groundwater quality (either chemically or biologically), or can the infiltration capacity be used to increase the abstraction rate"? For the **water regulating authorities**: "Does it allow easier water regulation, is there enough retention capacity in the Hunze area to solve the problem of down stream regulation, does it provide for a safer environment for citizens, has wetland restoration sufficient positive effects on the water quality of the river Hunze and the Zuidlaardermeer"? For the **tourism board** and related recreation companies in the valley and on the lake: "Will sedimentation be avoided, will it make the water cleaner, will it bring back fish, will the blue algae problem remain under control, will the new wetlands in the valley bring new forms of recreation and possibilities"? For **the farmers**: "Can we exchange lands on a voluntary basis? Will the area remain agricultural or can we possibly make more money with nature and tourism related activities"?

One study is now being done to look at the effect of the new wetlands on the quality of the surface waters in the valley itself and in the lake further downstream. Will the helophyte vegetation act as a filter? And will the new meanders slow down the speed of the water and avoid sedimentation downstream?
Another study looks at whether the new wetlands and the extra amount of water in the valley, on former (polluted) agricultural land, will not negatively influence the clean ground water in the valley, coming from the ridge on the West side of the valley.

We can conclude that at this stage, the question about effectiveness of the planned measures has not yet been fully answered. But all partners see the benefits that the measures can bring and are participating in one way or another. The whole set of measures (see list above) make a unique combination of goals possible: nature protection and development, water conservation and protection against floods, new opportunities for farmers, tourists and new building sites, etc.

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Step four- Considering the costs of the measures

The Hunze case shows there were many water related economic, ecological and social problems. Different stakeholders took forward the original plan (by the nature NGOs) to bring back the original river with meanders and space for wetlands, making the Hunze flow in a more natural and dynamic manner.

The preliminary analysis of the effectiveness of these measures looks positive and the province has played an important role in finding and providing finances. The investment and other recurring costs of the measures have been assessed. Funding will come from the EU, from the Dutch Programme "Living with water" and from partners in the valley (province, nature NGOs, water companies)

As stated earlier, we will not look exclusively at costs (for the Tusschenwater phase of the Hunze project, these have been estimated at €11.6 mn.) but also at side effects and the ecological, social and economic benefits. How to do so will be explained further on in section 3.

Step five- Combining measures

In the Hunze case the so called "alternative measures" in the flow chart above were not available. The plan has many different components, not mutually excluding, and are already incorporated in an integrated plan.

The contribution of the Hunze case in the WaterCost project lies therefore particularly in developing a methodology to identify and quantify the side effects of the water related measures, that is, the ecological, social and economic effects. Our emphasis does not lie in comparing the costs of alternative measures, as the project developed on its own before this could be done. Our emphasis will be more on how to assess the side effects, as these are important inputs for democratic and political decision making. We think and hope that a good description of how to identify and quantify important side effects will be useful for other regions that are still at the start of making plans, looking at costs, and choosing best solutions.

3. Identifying and valuing side effects

In this section we will present a methodology and give the most important results of a quick scan of side effects. This section is subdivided in ecological side effects, social and economic, giving all available relevant variables and quantitative data. This methodology and some of the quantitative results can be used in other regions as a guidebook (what to look for) and as a handbook (which data is needed and how to collect it).

3.1 Social effects

In the Hunze case study the following social effects have been identified:

- Greater security against inundations
- More and better nature related tourism opportunities
- More nature near existing homes
- More nature friendly locations and building sites for new houses
- New opportunities for farmers to broaden or even replace existing activities, and move to more nature related activities such as tourism.[2]

[2] This is seen as a social effect and not as an economic effect given the fact that many farmers can then stay on their own land, instead of having to move out as incomes in the agriculture have decreased quite drastically as a result of lower EU agricultural subsidies.

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- Less unemployment due to the above. This is seen as a social and not as an economic effect. (The extra income generated by the new situation will be counted as an economic effect in 3.2).

At this stage of the WaterCost project we cannot quantify each and all of these effects. We focus here on the tourism and on the water safety effects.

3.1.1. Effects on Tourism:

EXTRA DAY TRIPS

Upstream
A new area (165 ha) was created upstream, around Spijkerboor. Because of the new meanders in the river, new jetties, parking place and cycle path, many more tourists come to the area for walking, cycling and rafting. The local café at Spijkerboor estimates that there are now 10% more tourists, in particular cyclists, in the area compared to a few years ago. The cyclists in the area are usually elderly couples who stay overnight in the area.

Another recreation business in the area, which rents rafts, organises survival events, has a restaurant and overnight accommodation, has seen an increase in the number of visitors from around 9,000 in 2002-2, to 10,000 in 2003-4 to 23,000 in 2005, a doubling over the past few years.[3]

From a Dutch Source book containing reference data related to nature (see annex 3) we know that in such wet areas the average capacity and use by tourists is an average of 1 cyclist per ha per day and 3 hikers per ha per day.[4]

The extra 120 ha of nature would therefore lead to an estimated extra 44,000 cyclists and 130,000 extra hikers per year = **175,000** extra day trippers. If we make a conservative estimate (we exclude 5 colder months) the extra number of tourists would be **100,000 (low estimate)**:
210 days x 120 ha x 1 cyclist = 25.200 and extra cyclists per year
210 days x 120 ha x 3 hikers = 75.600 extra hikers.

A study in another (similarly wet) area in Holland showed that an increase of the nature area by 120 ha led to an increase in the number of tourists by an estimated 60.000 per year (from 40.000 to 100.000).[5]

Downstream
The new nature area downstream (plan Tusschenwater) will be even larger, almost 500 ha (250 ha in its 1st phase).

With the same accounting method as used above, we would get the following number of additional day trippers:

Tusschenwater	Extra cyclists per year	Extra hikers per year	Total
1st phase only- 250 ha	91,000	273,750	364,000
All the works- 480 ha	175,000	525,600	700,000

[3] Breeland, Table 8.7 Drenthe in cijfers 2006.
[4] Kentallenboek 2006.
[5] Horstermeerpolder study.

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Total	266,000	799,000	**+/- 1 mn (high estimate)**

If we leave 5 months out (colder months):

Tusschenwater	Extra cyclists per year (7 months only)	Extra hikers per year (7 months only)	Total
1st phase only- 250 ha	52,500	157,500	210,000
All the works- 480 ha	100,800	302,400	403,200
Total	153,300	459,900	**+/- 600,000** (low estimate)

This would imply that in the first phase of the plan, and per year, around **210,000** extra hikers and cyclers would come to the area. We note that many of these hikers and cyclers might be the same as those who visit the Spijkerboor area. On the other hand, as the Tusschenwater area is much nearer the larger town of Zuidlaren (where once a year a large horse fair takes place which attracts 150.000 visitors) and the University city of Groningen, this new nature could attract new tourists from there.

A previous study made for this same area of the Hunze, estimated that each year, around 60,000 additional tourists (mostly hikers) would access the new (dry) nature areas. The study used a reference capacity of 0-3 tourists per ha per day but estimated that 110 new ha would be created.[6] If they had used 250 ha (of the updated plans) reference, their estimate would have been around **120,000**. Our estimate is higher: **210,000.**

So we think that at least **175,000** additional hikers and day visitors would be a realistic figure for the first phase.

As the Tusschenwater plan also includes a new yachting harbour near Zuidlaren, new camping facilities and holiday homes at the recreation centre Meerwijck on the lake, and cleaner water in the lake, many more water tourists will be attracted to the lake area. The previously mentioned tourism study estimated that the improvements at Meerwijck would attract an extra 5.000 cyclists to the area (15% increase), the 14 new bungalows would attract an extra 11.700 overnight tourists per year (if 45% of the capacity is used), the extra 15 places for campers would lead to 2.000 extra overnights tourists and the new places in the harbour an extra 500.[7] Together: **20,000**.

Adding these 20,000 to the 175,000 hikers in the water catchment area, we arrive at a figure of around **195,000** extra day tourists per year.

Total extra day trips
Taking the upstream and downstream (1st phase only) works together (100,000 plus 195,000, for 7 months only), we get a conservative estimate of **295,000** added day trips for cycling, hiking, swimming, rafting, survival etc. This refers to 120 + 250 = 375 ha only of new nature.

Checking these figures from another perspective, we see the following:

[6] Toeristische Ontwikkelingsvisie benedenloop Hunze, 2005.
[7] Recreatie in het Hunzedal.

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The Dutch reference book gives 355 day trips / ha/ y as an average for nature areas (all types of nature). This would mean for the Hunze (the two areas of new nature mentioned above= 370 ha) an added **131,500** day trips. This is lower than the figure we arrive at.

Looking at the whole valley and all its projects gives yet another result. The provincial coordinator of the Hunze works estimates that the measures will increase the area of water and nature with a total of 1,600 ha. If we use the reference figure of 1-3 extra tourist per day par ha on new nature of this type, we get a much higher figure: **1,2 mn** (per year, counting only the 7 warmest months) additional day tourists.

Looking at the whole province of Drenthe, 26 million day trips are counted[8], 9 million of which are for swimming, sunbathing, pick-nicks and sports (hiking, cycling, surfing, sailing etc)[9]. We extracted these specific activities from a much longer list, as these are the activities that are relevant for the Hunze valley.[10] The number of daytrips in Drenthe related to the type of nature of the Hunze valley and lake is about 1/3 of the total day trips in Drenthe. As Drenthe has more water areas like the Hunze, the figures relating to our case are maybe half (**3,5 mn** day trips for the Hunze, the higher wooded ridge and the lake).

From this perspective, an extra **1,2 mn** mentioned above does not seem exorbitant at all.

At this stage we would like to maintain our estimate of an extra 295,000 or **300,000** day trips per year due to the two largest nature creation projects up- and downstream.

Total extra overnight tourists
As for the expected increase in numbers of tourists that will stay overnight due to the new area of nature and water, we have a few inputs. The Reference book gives an average of 100 overnight tourists per ha nature: in the wet nature areas of the Province of Overrijssel 104 overnights are counted per ha per year[11] and on the dry nature areas of Drenthe the reference book gives an average of 97 overnights per ha per year. So for our 370 extra ha nature (Spijkerboor and 1st phase Tusschenwater) this would mean **37,000** extra overnight stays.

Checking these figures from another perspective, we see the following:

For overnight trips we can also look at the proportion of all overnight stays in Drenthe in relation to those in the three municipalities in which the Hunze valley runs.[12] About 1/3 (2.3 mn) of all overnight stays (7.7 mn in the province) take place in the three municipalities.[13] These are tourists that stay in the valley and in villages on the wooded and higher ridge to the West of the valley. The new water works in the valley and the new cycle path will certainly attract some of these tourists for their day trips, but we do not know how many.

3.1.2. Effect on safety

[8] Toerdata 2007, for the years 2002-3. In the Ecorys study they say the total of daytrips in Drenthe is 29,3 mn, of which 10,9 mn for the above mentioned activities, for the year 2000.
[9] Kentallenboek.
[10] In Drenthe, 1,3 mn daytrips take place in the city of Emmen, not in the Hunze valley, where a large zoo is situated.
[11] Kentallenboek.
[12] Tynaarlo, Hunze en Aa, Borger/ Odoorn.
[13] Both data from: Drenthe in cijfers 2006.

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The water measures, in particular in the Tusschenwater project downstream, with the creation of large new wetlands, will have a new function, i.e. flood prevention. In a first phase 250 ha will be created which can be flooded if necessary. Later a larger area will serve as an emergency water basin (480 ha).

All the water related measures in the valley will allow to store an additional 6,4 mn m^3 according to the water authorities. [3]

From a social point of view, the question is whether the new nature and water areas will be able to retain enough water to substantially decrease the probability of flooding or prevent flooding altogether. If so, the works have a positive social effect, improving the safety of citizens and their property in the valley, around the lake and even further downstream, in the city of Groningen.

According to the latest calculations by the meteorological service and water authorities in the area[14], it is expected that the increased rainfall caused by climate change, will require an extra catchment capacity of 5,6 mn m^3 by 2050. This figure of 5,6 M m^3 is based on an estimated 10% increase in rainfall, which would raise the water level by 14 mm in the whole Hunze valley, which is 40.000 ha large.

As the needed water retention area required in the “climate change scenario” is smaller than the water retention capacity created by the water plans in the valley (= 6,4 mn m3) the Hunze valley plans have a definitely positive social benefit.

Besides the Tusschenwater plans, a few more areas can be reserved for flooding in case of a real emergency (floods that may happen once every 100 years), with an estimated 0,7M m^3 extra retention capacity. These (now) agricultural and nature areas are designated as flood areas in case of occurrence of such rare emergencies.

We can therefore conclude that the Hunze valley plans, in particular the Tusschenwater plan, are more than sufficient as a safety measure against flooding. We would like to quantify the derived social benefit, but have no data on how citizens value the extra security they are getting because of the plans. The gain in extra safety can however be quantified by asking citizens in the area on how they perceive the risk of flooding (in the valley and in the city) plus the added risks caused by climate change and how they value the increased safety. In many studies, the Willingness to Pay Method (WPM) is used. Citizens are asked to quantify how much the extra safety measures are worth to them (in monetary terms) i.e. how much they would want to pay (per year) to avoid the risk of flooding. Of course one should use these data carefully (saying is not the same as really paying). The real figure can also be approximated by the value of their property and how much they would want to pay an insurance company. (we could do this later)

3.2. Economic side effects

3.2.1. A long list

Like we did in section 3.1.for the social side effects, in this section we would like to identify and quantify the most relevant economic side effects. In the Hunze case, the following economic side effects of the water measures have been identified:[15]

[14] Waterschap Hunze & Aa’s, mei 2006. Watersysteemplan Hunze, Fase 1- Verkenningennota.
[15] Where possible we give an indication of the size of the effect. The tourism related economic boost is quantified in more detail in 3.2.2.

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For tourism related businesses:

- Income generation from the additional tourists that are attracted to the new nature areas and upgraded tourism facilities. The amount spent by tourists give a direct boost to the local economy, but the expenditures also have a secondary (multiplier) effect.(see section 3.2.2. for an estimate)

For citizens:

- Increase in the value of houses that are situated near the new nature areas: between 3% higher value in an area that already has a lot of nature, 7-11% higher value than similar houses not on the waterfront, + 9% for looking out on nature, + 10-30% where there are nice landscapes.[16]
- Less damage from floods, usually impossible to insure against.
- Nicer nature in the area: citizens show a willingness to pay of € 0,59-1,60 per visit to a nature area nearby. (Reference book)
- Enough clean drinking water. Lack of water would incur costs of € 15,93 per day per household. (Reference book).
- Living new nature means walking more and less medical expenses. (Reference book).
- More local employment opportunities (was already mentioned as a social side effect).

For local authorities/ water authorities:

- Increase in tax revenues of the three municipalities (Tynaarlo, Aa en Hunze, Borger/ Odoorn) from tourism related taxes and property taxes.
- New sites for building new (luxury) homes near new nature areas. In the Netherlands this is quite exceptional as only in a very limited number of regions new houses can be built. The plan will therefore raise the profile of the respective villages/towns, making them more attractive for wealthier (senior?) citizens.
- More money from Europe (integrated regional development, Natura 2000, Interreg).
- Less costs incurred for waste water treatment and removal of phosphate: € 8.50 / kg P. The cleaning capacity of grassland is 1.3kg P / ha/ year. Idem for reeds 20kg P/ ha/ year (Reference book).
- Same for nitrate: price of removal from waste water € 2.20 / kg N, P. The cleaning capacity of grassland is 55 kg N/ ha/ year. Idem for reeds: 227 kg N/ ha/ year (Reference book).

For local authorities/ water authorities:

- Less costs to pump water in and out of the area: average cost of $€\ 0.002/\ m^3$. [17]
- Less costs for purification of the water (see above)

For the region:

- The new nature areas and the large and innovative water works will make “branding and marketing of the region” a possibility. From another Interreg project, a study on the benefits of a regional transition to more nature shows the economic potential of this type of branding.[18]
- Multiplier effect of increased economic activity. This has been estimated at approximately 1.5 for areas rich in nature in the Netherlands and Flanders.[19]
- Avoided costs of dredging out the lake: € 8 mn.

For farmers:

- When they sell their land: € 25,000 per ha (Reference book), € 18,000 per ha (information province) in Hunze valley. Also compensation is available if the whole

[16] Respectively: Horstermeerpolder, Alterra, Kentallenboek, Geld als water.
[17] Horstemeerpolder study.
[18] Study on Transition to nature by Helena Berends, for Interreg project “Boundless parks, naturally!
[19] Regenboog Advies study Achterhoek and Kempen: in both cases 1,5. Ecorys study for Drenthe: 1.7. Study Recreation Hunze: 1.7.

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farm has to be moved: € 2,725 per ha + 10% value of all farm buildings (up to a maximum of € 45,378).[20]
- When land is sold: lost farm income. Average value added per ha: € 5,000. Value added per farm: € 91,000 in province North Holland, € 57,000 (province Utrecht).[21] For dairy farms: average value added € 1,909 per ha grassland.[22] Average net income: € 26,000.
- Increased productivity when land is exchanged for drier land further away from the river.
- Less risk of flooding and loss of production: € 2,300 per ha.(Reference book).
- New opportunities for farmers to broaden or even replace existing activities, and increase their incomes (nature conservation subsidies, tourism on the farm, etc).[23]

For water companies:
- When owner of the land: increased income from the sale of nature by- products (sand, reed etc). Production in wetlands: 250 bushels / ha/ year. Price reed: € 2 / bushel. (Reference book)
- Longer term conservation of water supplies.
- Reduction or avoidance of purification costs (see prices mentioned above, under local authorities/ water companies). In the Hunze case: ground water is still clean. Making new wetlands on ex-farmland might influence negatively the quality of the groundwater. A study is now being made on this subject.
- Reduction in costs to compensate farmers for production loss due to lower groundwater tables in summer, or for extra costs related to the protection of groundwater quality.

For Nature organisations:
- When they are the owner of the land, they will increase their income from the sale of nature by- products (sand, reed etc). Production in wetlands: 250 bushels / ha/ year. Price reed: € 2 / bushel. (Reference book).
- Increased costs for nature management. For wetlands (Horstermeerpolder study): € 1,600 / ha/ year, based on the assumption that wet reeds do not need to be cut, but when they dry up (approx 1/3 after 20 years) then once every 3 years, so in average 1/3 of the area each year.
- The Vecht region study (also transition from farmland to wetlands) estimates that management costs € 450/ ha / year for new wet nature.
- As nature organisations have many paying members, an increase in the surface of nature (and higher quality nature) will probably increase membership.

At this stage of the WaterCost project we cannot quantify each and all of these effects. We focus here on extra income generated by the extra tourists (in 3.2.2) and on more global quantifications on the value of nature areas (in 2.3.3.).

3.2.2. Economic effect of additional tourism

In section 3.1 (social effects and more in particular in section 3.1.1.) the number of additional tourists expected to come to an area due to new nature was presented. We counted approximately 100,000 extra upstream and 195,000 downstream, a conservative estimate of 300,000 additional tourists per year, making day trips. We want to know what the economic

[20] DLG, LEI.
[21] Vecht area study.
[22] Horstermeer study.
[23] The Interreg transition study by Berends showed that many farmers were willing to sell their land for nature development, or to move to other activities such as nature conservation (which is subsidised).

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effect is of this increase. For this we need extra data, i.e. data on expenditures per day. From several different sources listed in the footnote, the average expenditure by people making day trips to nature is around € 12. [24]

Multiplying this figure by the 300,000 extra day tourists, we count an extra **€ 3.6 mn** of revenues in the region due to the water works and new nature areas.

We still have to count the tourists staying overnight in the area, and this group spends a lot more per day.[25] With data from the Reference book we calculated that 370 extra ha of nature would mean 37,000 extra overnights in the area. With an average expenditure of € 26 per day, this would mean an extra expenditure of **€ 926,000** per year in the area.

The total would then come to an amount of **€ 4.5 mn** extra per year (for 370 added ha nature). To this direct effect in expenditures we should add the indirect effects. Part of the money spent by tourists in the hotel, café, cycle repair shop, sports shop, etc will be spent again in the region for buying the inputs needed to produce these services and goods. Also the wages earned in the tourism businesses will also be (partly) spent in the region, at the baker's, butcher's, etc. This recirculation of money in the region makes for a so called multiplier effect that has been calculated for several nature areas.[26]

Using the lowest multiplier empirically derived from the regional Input output studies mentioned in the footnote (1.5) this means that the € 4,526 mn expenditure by the extra (new) tourists would give an annual boost of € **6.8 mn** (€ 4,536 direct effect plus 50% of this amount indirect effect).

Another way of arriving at a monetarised value for the additional value brought by tourism to new nature areas can be found in a study in the Vecht region in the Netherlands. Like in the Hunze valley, farmland was transformed into (wet) nature. The specific added value of tourism was calculated to be € 5,300 per ha.[27] If we use this finding in our case (370 extra ha nature in first two big projects, 1st phase only), this would represent almost **€ 2 mn** per year extra income for the region (370 ha x 5300 = € 1.961.000). With the multiplier effect this would be € 3 mn, about half of the effect we had calculated!

These computations show how to estimate the monetary effects from investments in new nature, in this case by looking only at the increased expenditures by (new) tourists.
It also shows that one has to be very precise and honest when making assumptions, doing these calculations and using the results.

3.2.3. Overall transition economic effects

According to the Vecht area study, were a transition was made from farmland to nature as in the Hunze valley, the overall economic result is a positive value of **€ 140 per ha per year**. This figure takes the following into account: [28]

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[24] Expenditure pp on daytrips: Kentallen book: € 11.70, Regenboog Advies for region Achterhoek: €12.70, for region Kempen: €10.50, for region Uitkerksepolder: € 12.50.
[25] Expenditure per day, per person, on overnight trips: Kentallen book: € 26.00. Ecorys study for Drenthe: overnight € 24.70; Regenboog Advies for region Achterhoek: overnight €21.00, for region Kempen: overnight € 21.00, for region Uitkerksepolder: in flat or caravan €30.00, in hotel € 70.00.
[26] Regenboog Advies study Achterhoek and Kempen: in both cases 1,5. Ecorys study for Drenthe: 1.7. Study Recreation Hunze: 1.7.
[27] Figure 2, Vecht study.
[28] Vecht area study.

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Lost: value added of agricultural production: € 4,707 per ha
Gained: added value because of the increase in tourism: € 5,318 per ha / year
Lost: higher expenditures for nature management: € 471 per ha/ year.

According to a study on the value of Natura 2000 sites, the benefits of nature in valleys and hills in the Netherlands can be valued at an average of € 4,399 /ha per year. Lakes and wetlands are valued at **€ 5,257 / ha**.[29] The latter value is based on an analysis and valuation of several types of benefits: the value of raw materials produce by nature, tourism and recreation, nature as an amenity for the quality of life, environmental services, non use values. Many of these functions of nature are valued with methods like the earlier explained Willingness to Pay. Other methods are the Travel cost method, Contingent valuation, etc.

In this report for WaterCost we have focussed mostly on economic data that can be collected, like the number of tourists and real expenditures, and less on what people say they would like to pay for new nature, for landscape. But if we used the Natura 2000 data, we would estimate that the value of the 370 ha of new nature in the Hunze (the two projects mentioned earlier and only 1st phase) have an annual value of **€ 1,945,090** (taken over a period of 20 years, using a net present value of 4%).

In the Reference book, the same values are given for lakes and wetlands as in the Natura 2000 book.

3.3. Ecological side effects

From a hydrological point of view, the quality of the ground water was not a direct problem in the case of the Hunze valley. However, the chemical and ecological quality of the surface water in the valley and in the lake was/ is very poor, due to pollution from farmland and in some places untreated waste water. There was also a concern that too much clean ground water was being pumped up by the water companies, not leaving enough for nature in the valley.

The water measures that had been undertaken earlier (straightening of the river) had caused the valley to dry up, original wetlands vegetation to die, and the fish population to diminish strongly as the water works gave them less possibility to migrate. As the water flowed too quickly into the lake, sedimentation increased. The nutrient content (N, P) of the water, notably of the lake also went up (eutrophication), leading to an increased occurrence of (blue) algae, less oxygen and rising fish mortality.[30]

Official measurements and assessments of the chemical and ecological quality for waterways in the whole catchment area were made in 2004, as required by the European Water framework directive. [31] The Hunze is part of the Eems water catchment region.[32] The water ways in the Hunze valley and the lake were labelled as “modified” or “strongly modified” and “at risk”.

[29] In the Netherlands there are 2,000 lakes and wetlands under the Natura 2000 regime, with a total of 260,000 ha.
[30] Hunze Visie 1995, IWACO Beheersplan Hunzedal 1999.
[31] Deelstroomgebied Nedereems- rapportage 2004, Stuurgroep Water 2000+
[32] The others in the Netherlands are: Maas, Rijn and Scheelde.

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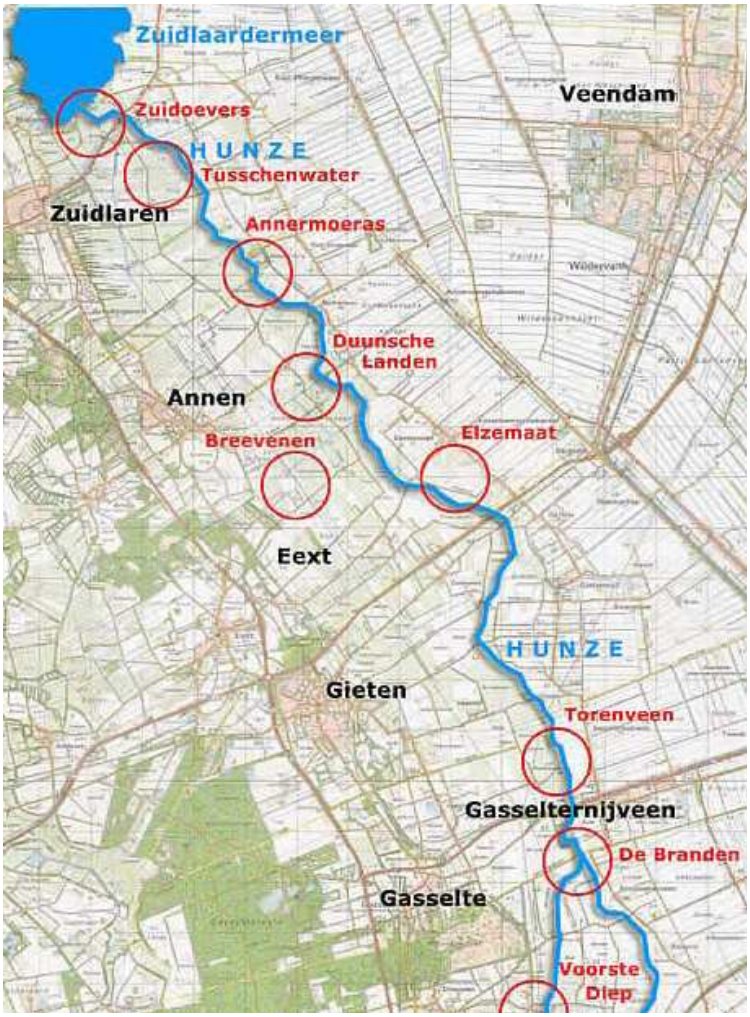
In this analysis of the ecological side effects of the water related works, we want to be able to say whether these works will positively affect the nature in the area. For the quality of the water this is done in step 3 of the CEA analytical framework (assessing the effectiveness of the measures).[33] Here we focus on other side benefits.

Ecologically, the starting point in 1993 was that there was still some original vegetation in the few remaining meanders, like *Carex Cespitosa* and birds like *Lucinia Svecica*. [34] The nature NGOo wanted these to come back in the whole valley as a result of the new measures.

Objectively speaking, the new measures have and will increase the size of the water and nature areas. Illustration 1 shows where and how much more nature areas have been/will be created it the whole valley.

Illustration 1- New nature in the Hunze valley (red circles)
Note: the whole valley and the lake (to the north) with main cities and villages (on the wooded higher ridge to the West and in the wet old peat extraction areas to the East).
Source: Drents Landschap



[33] As said earlier, this has not yet been fully done. Two studies are under way: on the effect of the new wetlands on the quality of the surface water in the valley and in the lake and on the quality of the groundwater.
[34] Natuurontwikkeling in het Hunzedal 1993 (for Douwenerzand and de Branden)

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A more dynamic and natural system has been and will be created. It is more robust and this will increase the number of habitats, the number of species and the size of their populations.[35] All these variables can and should be used to show how a proposed measure will affect the ecology of an area. However, we don't have a lot of concrete data for these variables. From one article we know that a number of species have returned and others are expected to do so too. They are listed in annex 4, but we have not been able to quantify this effect.

4. Summary and conclusions

In this report, on the WaterCost case study Hunze, we have used the standard methodology for Cost Effectiveness Analysis (CEA- see page 1) to identify problems, solutions and effective water related measures.

We have seen that in the Hunze case this is not straightforward as there were more than one problem, many stakeholders, and not a set of alternative effective solutions which could be compared to find the most efficient (with least costs). In the Hunze cause a quite complex programme of measures was developed by all stakeholders, under the coordination and facilitation of the Province. Some of these sub-projects or plans are still being tested on their effectiveness.

Besides this description of the Hunze case, the goal of this report was to show that besides costs, there are always side effects which one can identify, be they social, ecological or economic. These side effects will always influence decision making.
We have described which side effects we could identify in the Hunze case and we have shown how one can quantify some of these effects.

What we did was:

- Describe the Hunze project and the way in which it is being implemented,
- Charted a large number of side effects, related to the implementation of the project,
- Quantified these effects whenever possible,
- Provided value indications for all cases where prices, monetary information or other value indicators are available,
- Further explored some social, economic and ecological effects.

From the work done so far the following tentative conclusions can be drawn:

- The "Hunze approach" has allowed all stakeholders to actively participate in the process,
- In doing so all relevant (partial) interests have become clear,
- All these interests have been satisfied in a process of mutual exchange,
- Choosing an approach that is not exclusively financial, but also takes a number of social, ecological and other economic side effects into account, provides for a higher quality solution,
- This approach also leads to improved results from an economic (welfare) point of view,

[35] In his study of wetlands in the Netherlands, Blok says many wetland birds are endangered, like the (in Dutch): roerdomp, woudaapje, kwak, purperreiger, blauwe kiekendief, porseleinhoen, zwarte stern, snor, grote karekiet en baardmannetje. In nature policy plans, the lepelaar, krooneend en blauwborst are bird species to be protected.

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- This approach also leads to a clear picture of non-monetary, e.g ecological, effects, that may influence the decision-making process.
- Being aware of all stakeholders, their interests, their perception of the problem at hand and their different views on the validity of solutions helps to direct policy developers and decision takers towards a solution that's acceptable to all.
- Although many data will require further local research and/or verification, existing reports provide insight in a large number of potential solutions to a number of problems and indicators of their costs and effects. These data can prove helpful in other regions and situations.

THANK YOU!

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Annex 1- Areas with particular recreational use or potential:

- In the Hunzebeek valley: rafting, rowing, fishing, walking, cycling, a large camping site with restaurant and conference facilities and survival trails, a few hotels
- Lake: on the southern shores of the Zuidlaarder lake and the village Groeve: restaurants/ party centres/ hotels, cafes and summer residences on the waterfront, fishing, swimming, sailing, yachting, wind surfing, water skiing. In nearby Zuidlaren: horse fairs and trading, hotels.
- Higher lands on the West side of the valley: small quite wealthy picturesque villages, hotels, camping sites, second homes.
- Old peat extraction villages to the East of the valley: agriculture and small villages, lots of canals and wooded areas, nature camping sites, forestry service tree top walk.

Annex 2- The data used, including the Reference book.

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Note to Sourcebook indicators (Kentallen boek July 2006)

The sourcebook has been assembled for the Dutch Ministry of Agriculture, Nature and Food Safety in order to facilitate research into the economic effects of infrastructural projects in the Netherlands by means of cost-benefit analysis. The general idea is to provide both quantitative and monetary indicators for different types of nature, water, soil and landscape. These indicators relate to a broad spectre of welfare benefits that the distinguished types of nature, water, soil and landscape may produce and which can be affected in a positive or negative way by the implementation of a project at hand.

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As a benefit is calculated by multiplying quantity and price , we need economic values (price tags) as well as quantities (the size of the effect on welfare) in order to include relevant effects in Cost Benefit Analysis. Quantitative indicators can be expressed as a quantity per hectare, but also as a rule of thumb, a formula or a graph.

Next to these indicators the "sourcebook" offers tables showing a large number of possible effects for each category of nature, water, soil and landscape.

For example:

Possible effect: Nature serves as natural treatment facility to remove nitrates.

Quantity removed on e.g. heath:	67kg/ha/yr
Benefit valued at:	€ 2.20 per kilo in avoided treatment costs

Annex 3- New species seen in the valley since the works started

DUTCH	**LATIN**
Tiendoornige stekelbaars	Pungitius pungitius
Brempje	Barbatula barbatulus
Jonge Zeelt	Tinca tinca
Serpeling	Leuciscus leuciscus
Jonge Snoek	Esox lucius
Groene kikkers	Rana esculenta synklepton
Bruine kikkers	Rana temporaria
Gewone pad	Bufo bufo
Visdief	Sterna hirundo
Watersnip	Gallinago gallinago
Grutto	Limosa limosa
Tureluur	Tringa totanus
Slobeend	Anas clypeata
Zometaling	Anas querquedula
Kleine plevier	Charadrius dubius
Kleine zilverreiger	Egretta garzetta
Grote zilverreiger	Casmerodius albus
Tengere grasjuffer	Ischnura pumilio
Steenrode heidelibel	Sympetrum vulgatum
Blauwe breedscheenjuffer	Platcynemis pinnipes
Weidebeekjuffer	Calpteryx splendens
Kemphanen	Philomachus pugnax
Zwarte stern	Chlidonias niger
Oeverloper	Actitus hupoleucos

Are expected in the future:

Roerdomp	Botaurus stellaris
Ooievaar	Ciconia ciconia
Kwartelkoning	Crex crex
Porseleinhoen	Porzana porzana
Kiekiendieven	Circus sp.

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