Ministerie van Verkeer en Waterstaat

Purpose and implementation of the economic analysis as set out in Annex 3 of the WFD

Results of the International Scheldt Commission project Cost-effectiveness Analysis

René Boeters, Rijkswaterstaat Zeeland, The Netherlands (r.boeters@dzl.rws.minvenw.nl)
Roy Brouwer, Institute for Environmental Studies, Vrije Universiteit Amsterdam

7 november 2006

Outline of the presentation

- Economic aspects of the WFD
- The WFD organisation in the Scheldt District:
  - The International Scheldt Commission
  - Projectgroup PA6 Cost-effectiveness analysis
- Cost-effectiveness in theory
- Results of PA6 after one year:
  - Approach of PA6
  - Two pilots: measures against Nitrogen loads from agriculture and domestic wastewater

Economic aspects of the WFD

Meeting the overall goal of good chemical and ecological status and sustainable water use through the application of:

- **Economic principles**
  - Polluter Pays Principle
- **Economic analysis**
  - River basin characteristics (Article 5)
  - Cost-effective programme of measures (Article 11 & Annex III)
  - Cost recovery water services (Article 9)
- **Economic instruments**
  - Water pricing policies (Article 9)

Economic analysis

- River basin characteristics (Article 5):
  - Economical analysis of water use
  - Reported in 2004
- Cost-effective programme of measures (Article 11 & Annex III)
  - Program of measures to obtain WFD goals
  - Economic analysis in sufficient detail, to make judgements about
    - the most cost-effective combination of measures, based on estimates of potential costs
    - Cost recovery of water services (further described in Article 9)

Step	Objective	Activity	Time path
1	River basin characterisation (Art.5)	- Economic analysis water use - Trends until 2015 - Current level cost recovery water services	End 2004
2	Identification of relevant water management issues and risk of non-compliance	Identification of problems to reach good status	End 2006
		no problem total costs current measures **problem** identification additional measures	End 2007
3	Identification cost-effective programme of measures (Art.11 and Annex III)	Costs and effectiveness	End 2008
		Disproportionate costs?	End 2009
	Derogation (Art.4)	**Derogation** Yes No	
	Assessment of cost recovery and incentive pricing (Art. 9)	Financial implications measures Total costs additional measures	End 2010

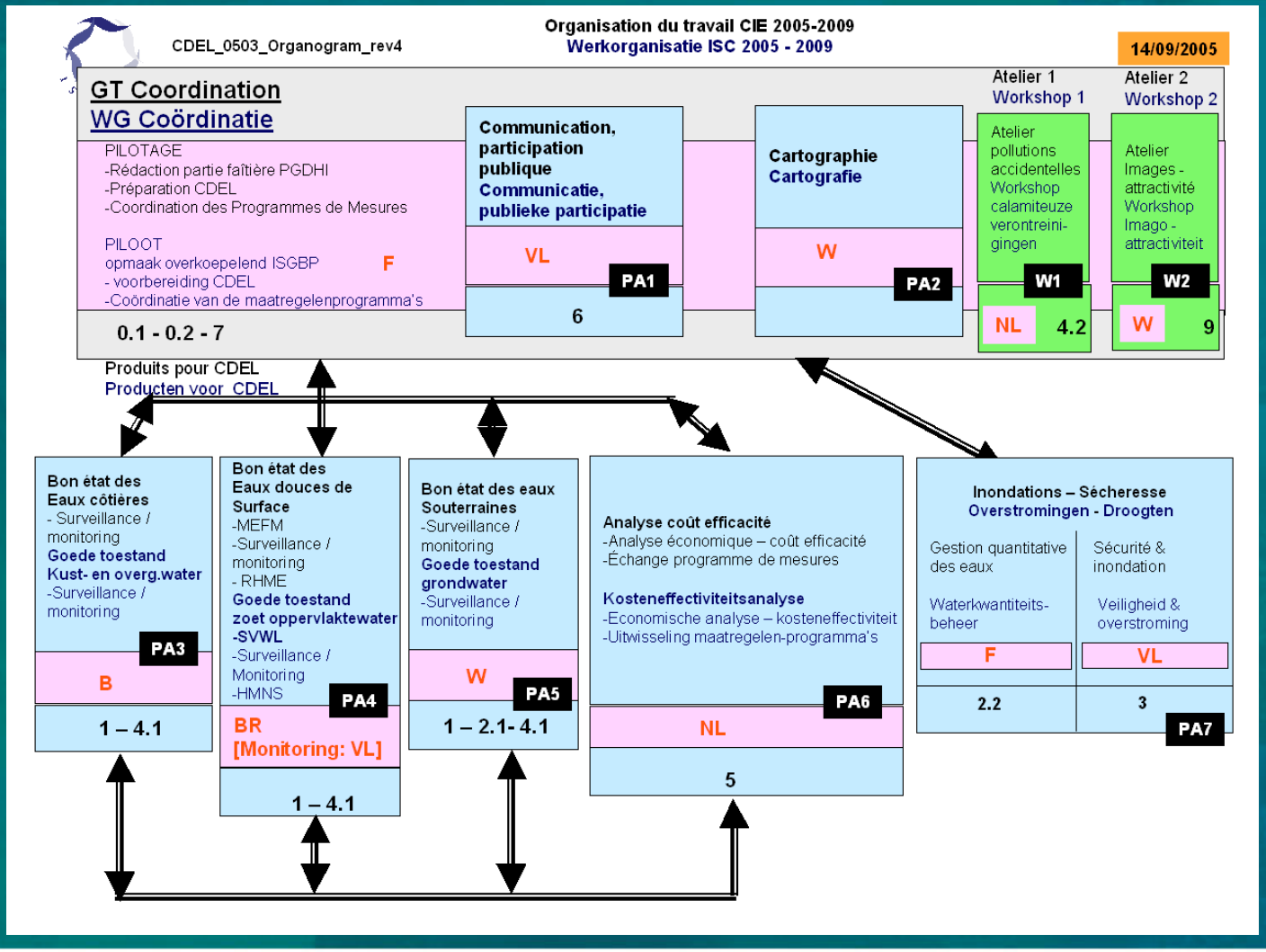
The Scheldt river basin district

- 5 regions are involved:
- France: Artois-Picardie
- Belgium: Wallone, Brussels and Flanders
- Netherlands: Zeeland


Scheldt River Basin District
Stroomgebiedsdistrict van de Schelde
District Hydrographique de l'Escaut
NEDERLAND / PAYS-BAS
NORTH SEA / NOORDZEE
MER DU NORD
Middelburg
Vlissingen
Brugge
Oostende
Antwerpen
Gent
Dunkerque
Calais
Kortrijk
Schelde/Escaut
Bruxelles/Brussel
BELGIË / BELGIQUE / BELGIUM
Lille
Mons
Namur
Charleroi
Douai
Valenciennes
Arras
FRANCE / FRANKRIJK
La Somme
Amiens
Saint-Quentin
N
0
50
100
km

7 november 2006

International Scheldt Commission; executive organisation



7 november 2006

Objectives projectgroup PA6:

- Exchange of information between sub-basins about:
  - Methods for analyzing cost-effectiveness
  - Cost recovery of water services
  - Indication of Heavily Modified Water bodies (on economical grounds)
  - Application of exemptions based on disproportionate costs
- Comparing the results of applying the methods on basic and supplementary measures
- With special attention paid to measures which have an effect on the level of the international river basin

Activities in PA6 regarding CEA

- Exchange of information about methods for the analysis of cost-effectiveness used by each region
- Comparison of the results of the methods for individual measures
  - Applied to the measures foreseen in each sub-basin to achieve a cost-effective reduction of nitrogen loads from agricultural runoff and domestic wastewater

Nitrate loads in the Scheldt district

Region	Total arable land use		Nitrate load to surface water	
			Agriculture	Domestic wastewater
	hectares	%	Tons N-tot/year	Tons N-tot/year
Artois-Picardie	1.281.187	69	10.220	12.059
Wallone	233.196	62	6.411	4.817
Brussels	482	47	22	4.571
Flandres	561.435	3	21.000	14.094
Netherlands	131.482	65	1.841	1.771

Cost-effectiveness in theory

The way in which a specific goal, i.c. the environmental WFD objectives, can be achieved against the lowest costs possible

Cost-effectiveness in theory

- Important element in the whole WFD decision-making process
  - Selection program of measures
  - Derogation: disproportionate costs

- Integration physical characteristics water system and economics
  - Sources, pressures and impacts
  - Effectiveness of measures
  - Direct and indirect costs of measures

Cost-effectiveness in theory: example for Dutch Scheldt Estuary

Measure	Pressure reduction (1000 kg/year)	Costs (mln €/year)	Cost effectiveness (1000€/kg)	
Sanitation industrial discharge	1435	4,3	3,0	(5)
Agricultural runoff	7057	38,0	5,4	(7)
Drinking water purification	663	0,7	1,1	(2)
Coating	200	1,8	9,0	(8)
Tertiary treatment WWTP	3276	12,0	3,7	(6)
Dislocation effluent outside estuarium	4681	5,4	1,2	(3)
Replacement Zn containing paint ships	1467	2,2	1,5	(4)
Replacement Zn anodes	13	0,3	22,5	(9)
Dredging	11000	7,4	0,7	(1)

Ranking

Steps in a Cost-effectiveness analysis

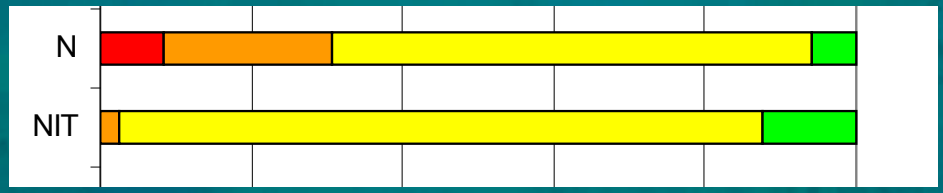
- Definition of environmental objectives
- Gap analysis
- Identification of measures
- Assessment of effectiveness of measures
- Assessment of unit costs of measures
- Ranking of measures in terms of cost-effectiveness
- Estimation of total costs of measures

Definition of environmental objectives

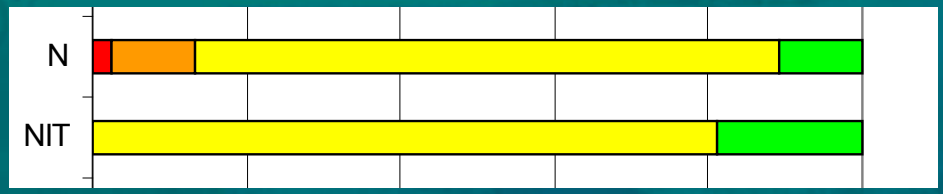
Region	Current threshold values between 'good' and 'poor'
Artois-Picardie	SW 10-50 mg NO3/l GW 50 mg NO3/l
Wallone	SW 25 mg NO3/l GW 50 mg NO3/l
Brussels	SW via NH4 2mg/l GW 50 mg NO3/l
Flandres	SW 10 mg NO3/l GW 50 mg NO3/l
Netherlands	SW 9.74 mg NO3/l GW 50 mg NO3/l

Gap analysis

Current situation (reference year 2000)



Situation in 2015 with no change of policy upstream



Bars indicate percentage of water bodies with a specific water quality for nitrogen (N) and Nitrate (NIT)

yellow = poor quality
green = good quality according to provisional standards

Gap analysis

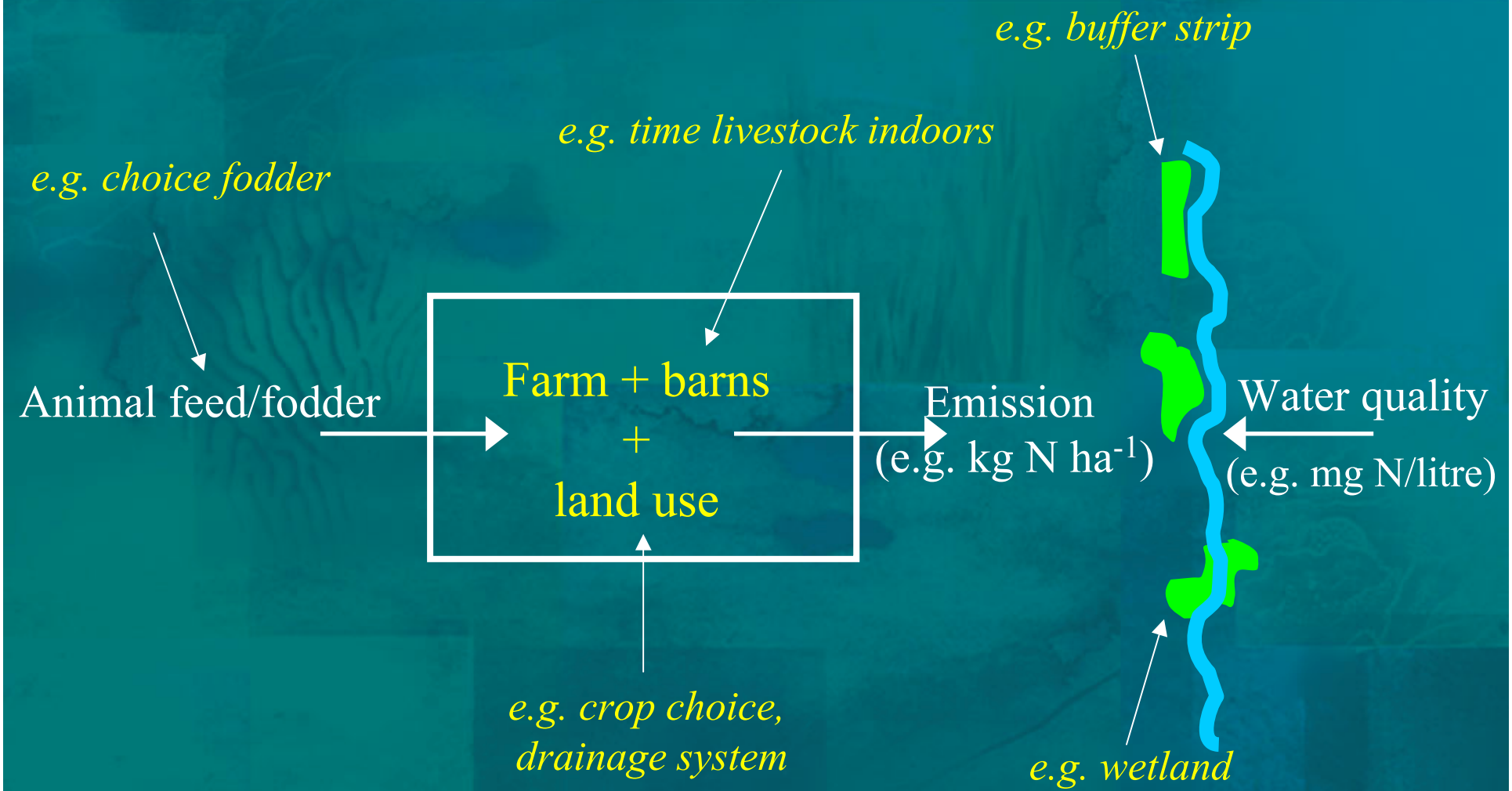
Gap between current state and objective can not be quantified, because:

- effects of autonomous trends are difficult to predict
- effects of basic measures on water quality unknown

Identification of measures

- 150 measures collected in a database
- Many similar measures in different regions

Examples of agricultural activities and measures



Assessment of effects and effectiveness of measures

Region	Effects criteria	Commentary
Artois-Picardie	Implementation area, direct and indirect effect, effectiveness (1-3), difficulty (0-4); responsible authority; source of financing	Mainly qualitative; effectiveness in terms of emission or load reduction, not water quality
Wallone	Probability of reaching good status, ecological efficiency, time to reach good status	assessment of effectiveness on water quality based on the model "Pegase"
Brussels	Estimation based on the objective of the Regulation	Mainly qualitative
Flandres	Implementation scale, min-average-max effect, current implementation degree, min-max implementation	Mainly quantitative; effectiveness in terms of emission or load reduction, not water quality SENTWA model emission losses
Netherlands	Implementation time, short (<5yr) and long term (<10 yr) effectiveness, responsible authority, time for effectiveness to manifest itself, risk and uncertainty	Mainly quantitative; effectiveness in terms of emission or load reduction, not water quality; Expert judgement (workshops)

Common database

Source	Households
Load	Nitrate
Measure	Enlargement waste water treatment capacity
Measure description	Further enlargement current capacity wwtp's with ± 50%
Scale of implementation	entire region/regional part of the river basin
Measure/instrument	Measure
Basic or supplementary measure	Supplementary measure
Estimate of costs	Appr. €45 per population equivalent per year (in 2006)
Cost estimate method	Indicator values based on expert judgement
Effect estimate	Up to 10 mg N-tot/l
Effect estimate method	expert judgement estimation of effluent concentrations
Cost-effectiveness estimate	Average of about €45 per i.e. per year
Scale of cost-effectiveness estimation	Mainly on the level of the water body; also some effect on entire regional part of the river basin
Further remarks	Concerns rough estimate; precise estimate depends on many other factors

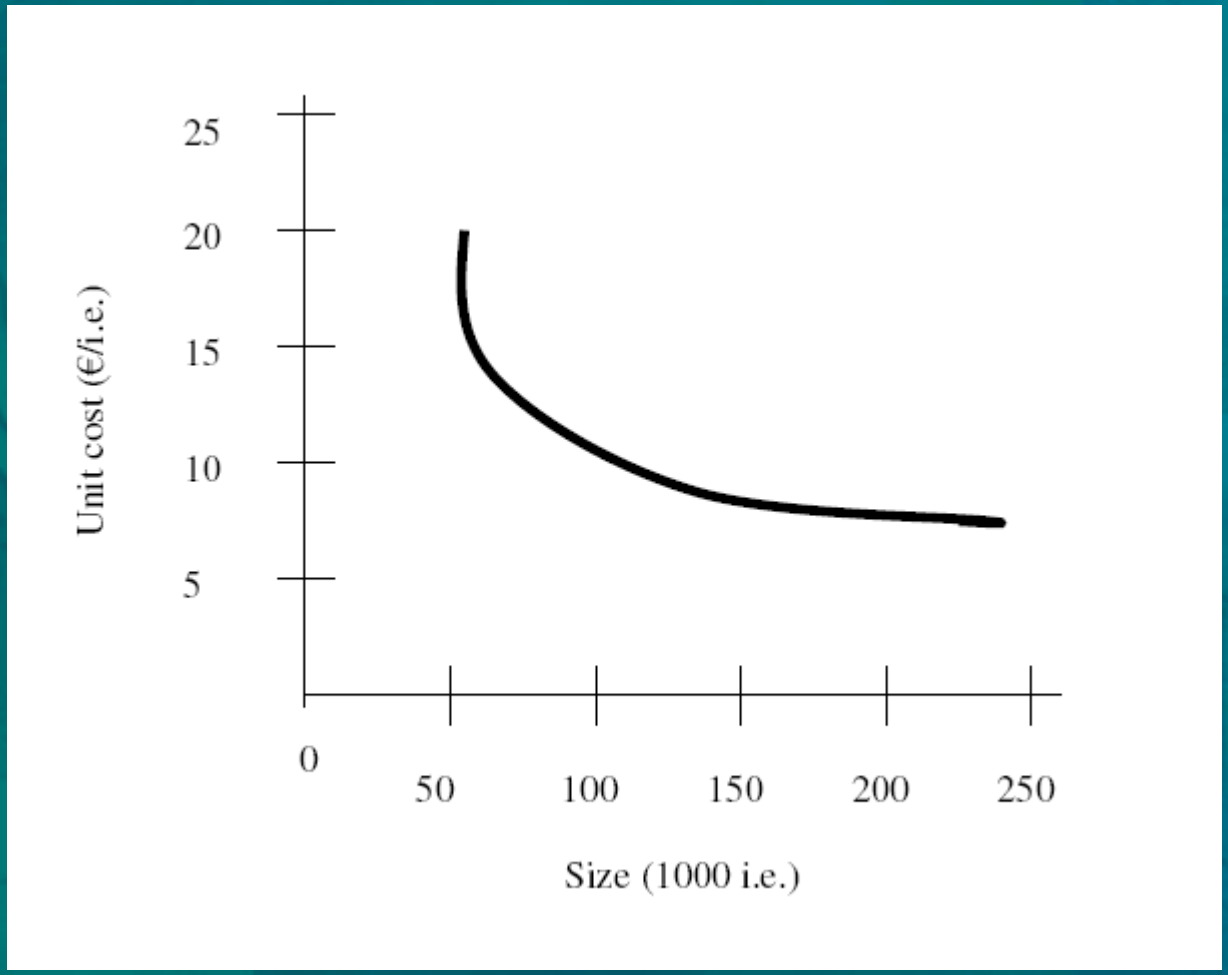
Common database

Source	Arable farming – dairy farming - horticulture
Load	Nutrients
Measure	Fertilizing free zone
Measure description	5 meter wide stretch of land along ditches and canals is kept free of fertilizers and pesticides
Scale of implementation	entire region/regional part of the river basin
Measure/instrument	Measure
Basic or supplementary measure	Supplementary measure
Estimate of costs	€822/ha grass-land; €466/ha arable land
Cost estimate method	Expert judgement and cost indicators by agronomics institute
Effect estimate	Short term: 0; long term: 10-25% reduction of loads
Effect estimate method	Expert judgement (emission reduction as % of total load)
Cost-effectiveness estimate	33-82 Euro/ha/percent load reduction grass-land en 19-47 Euro/ha/percent load reduction arable land
Scale of cost-effectiveness estimation	Mainly on the level of the water body; also some effect on entire regional part of the river basin
Further remarks	Success of measure depends a.o. on the way in which financing is dealt with (= compensating the farmers)

Assessment of unit costs of measures

- Each region considers direct investment costs and yearly recurring exploitation, maintenance and control costs
- Unit costs depend on the scale of implementation of a measure (e.g. the size of a waste water treatment plant where costs per p.e. decrease with increase of capacity)
- Unit costs are expressed in different units (per ha, per meter, per unit cattle, per i.e.), thereby making a comparison of measures and a complete count of costs difficult
- Need for some degree of standardization

Example economies of scale in WWTP



Steps in a Cost-effectiveness analysis

- Definition of environmental objectives
- Gap analysis
- Identification of measures
- Assessment of effects and effectiveness of measures
- Assessment of unit costs of measures
- Ranking of measures
- Estimation of total costs of measures

Ranking

- Information about unit costs or effectiveness incomplete or qualitative in nature

- Hence ranking of measures within and between
  - Sub-basins
  - Pollutants (or ecological objectives)
  - Sources and sectors

currently incomplete

Estimation total costs

- Uncertainty size ‘gap’ between expected and desired situation
- Difficulty quantification ‘gap’ in terms of water quality objectives (concentration levels)
- Uncertainty about necessary additional measures
- Uncertainty about indirect economic costs
- Hence impossible currently to estimate total economic costs

Conclusions after one year

- Much information gathered about the measures and methods; resulting in an EXCEL database with approximately 150 measures and the methods used for the estimation of costs and effectiveness
- Much resemblance in the type of measures each region is considering/planning/executing
- Gap analysis in many cases not yet quantifiable

Conclusions after one year

- Effectiveness of measures mostly expressed in terms of reduction of loads or emissions, and not directly linked to water quality improvement
- In many cases only assessed qualitatively (based on expert judgement)
- In many cases only local impact assessments
- Costs of different types of measures are expressed in different unit costs, making a comparison or a complete count impossible
- More attention needed to the spatial scale at which measures can be effective in order to be able to identify measures with an effect on the scale of the river basin district