Can proceswater be used as an alternative for groundwater?

A case study in Flanders
(Belgium)

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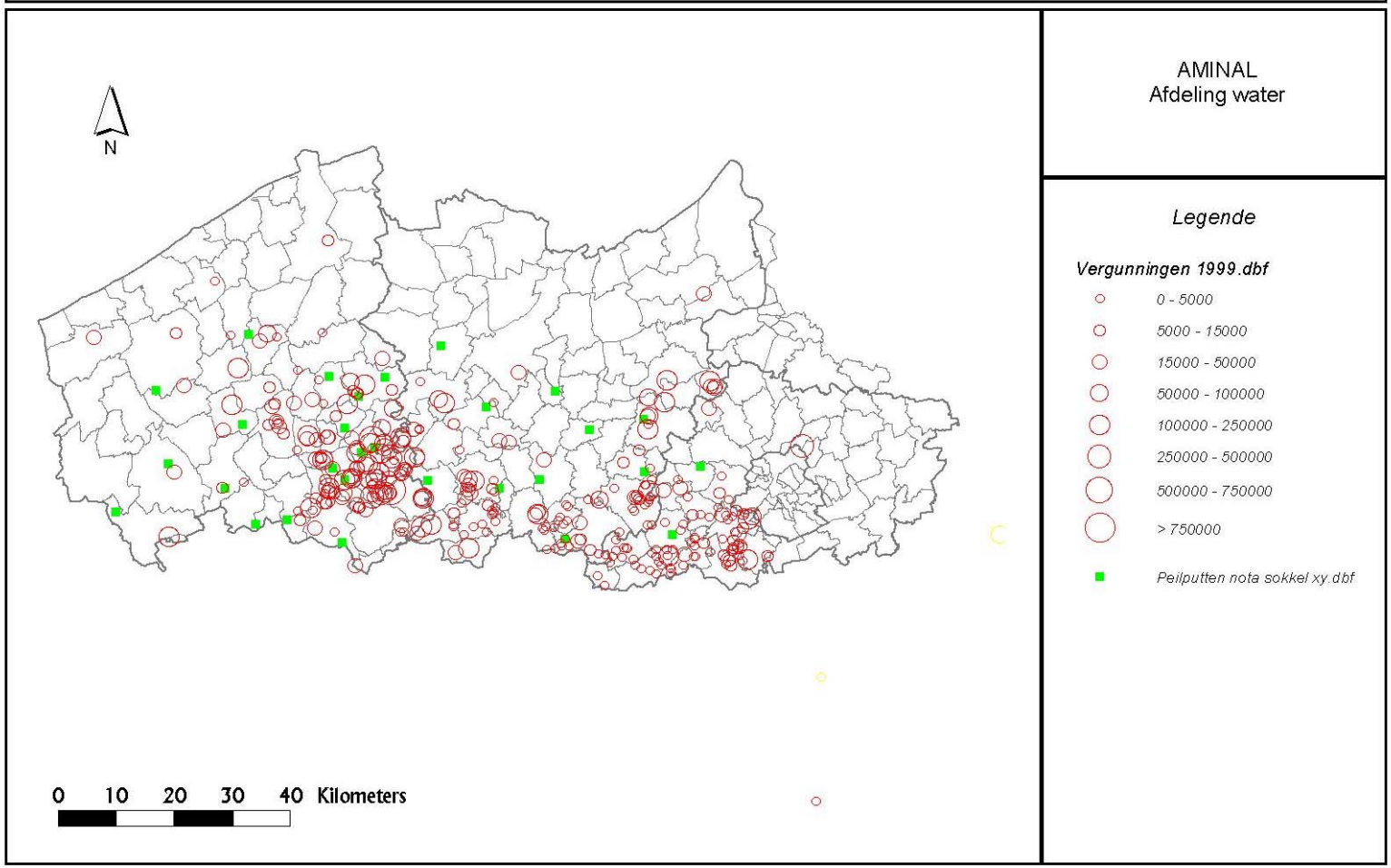
I. INTRODUCTION

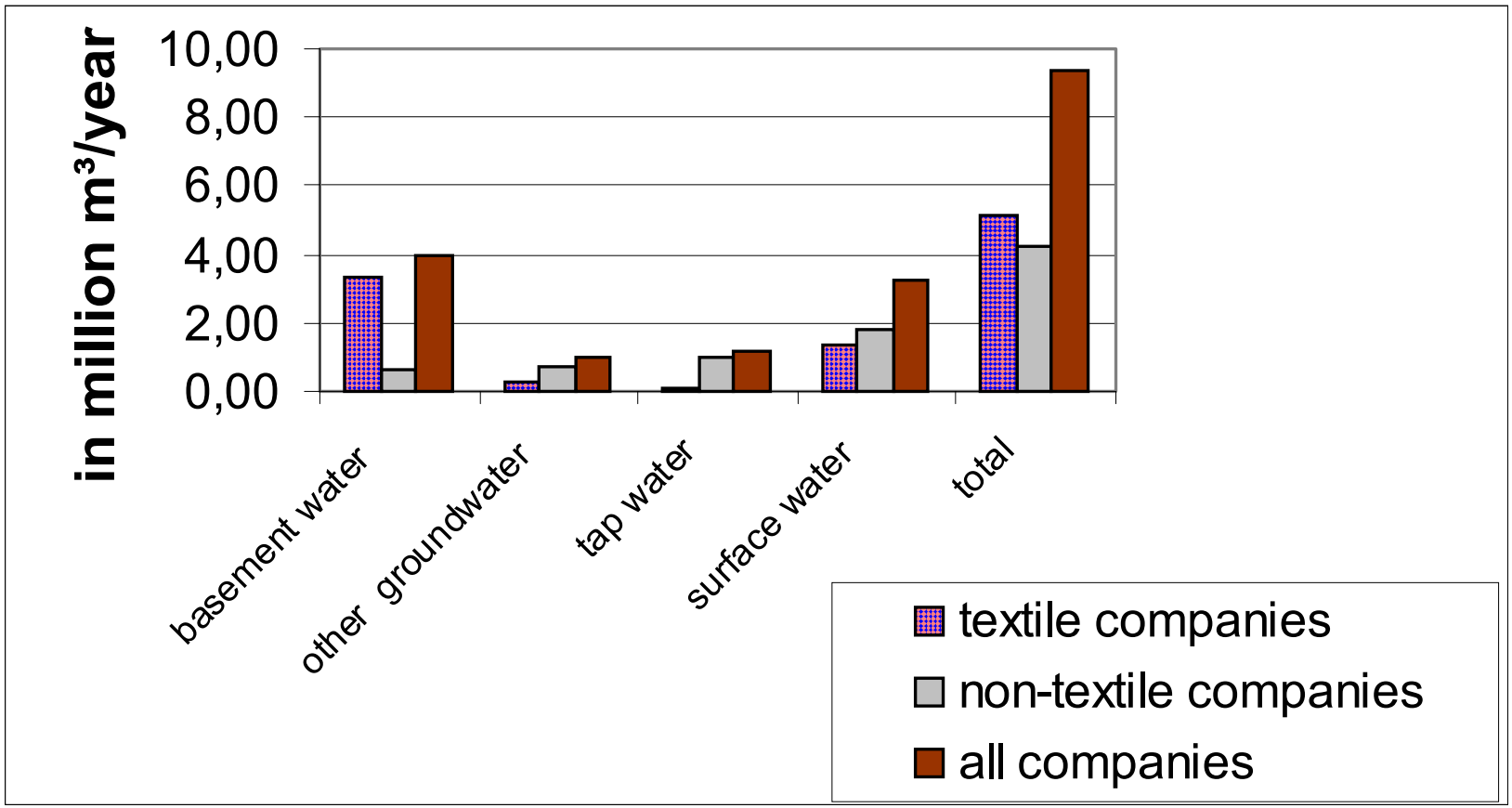
- 1. What is the problem?
- 2. What is our goal?
- 3. How was the study designed?
- 4. Where do we try this?
- 5. Who are our target groups?

1. What is the problem?

Kaart 6 : Vergunde winningen in de Sokkel



1. What is the problem (bis)?



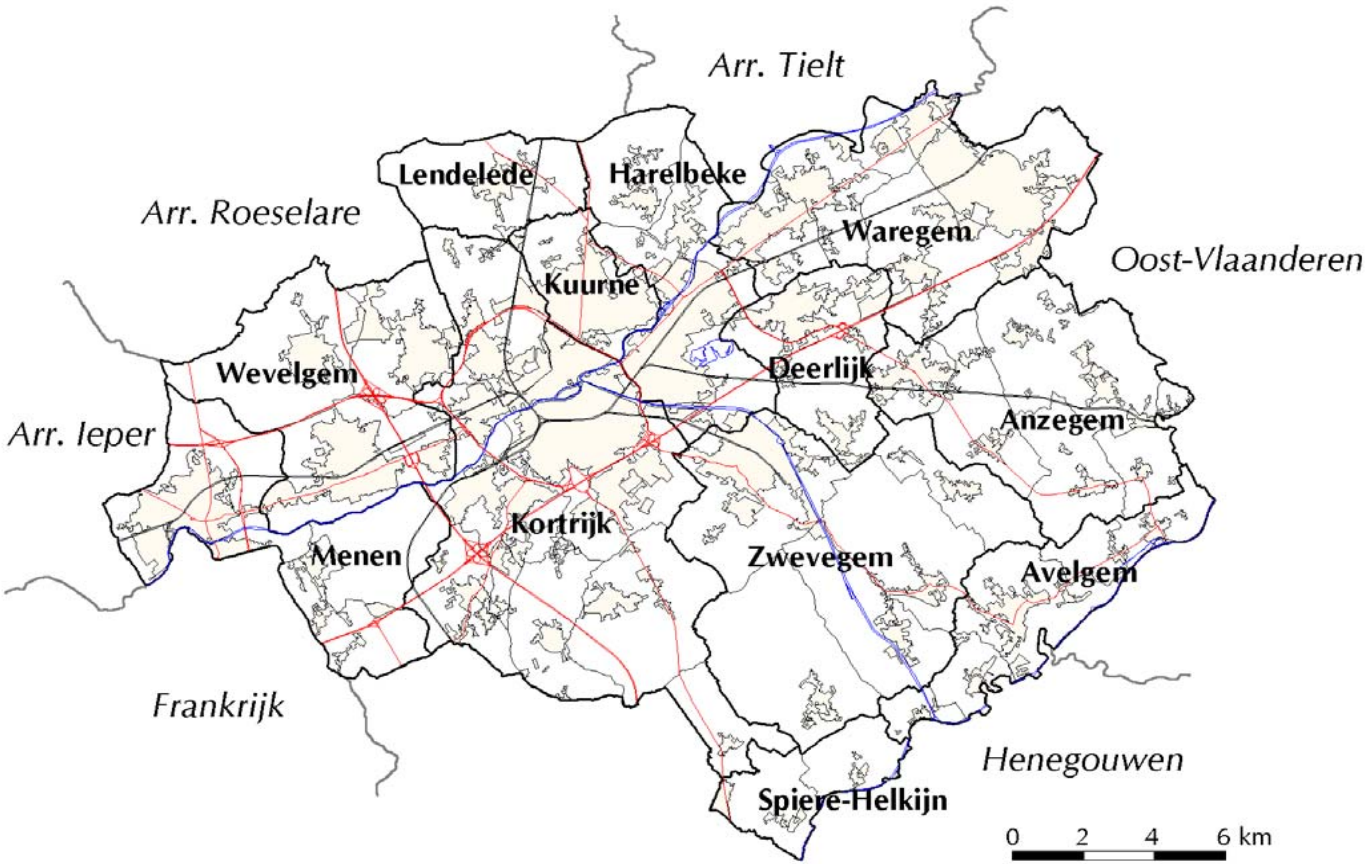
2. What is our goal?

- Looking for alternative watersources
  - navigable rivercourses (Leie/Scheldt/canal Bossuit-Kortrijk)
  - Preliminary treated surface water
  - Effluent of waste water treatment plants (WWTP)
  - coordination of distribution
- ensure the future of textile and other waterdemanding industrial sectors
  - southern region of West Flanders
  - 12 municipalities

3. How was the study designed?

- First step: research for the demand of water
  → survey in the area (several industries)
- Second step: research for the supply of water
- third step: modalities for distribution
- Fourth step: determine trajectories taking into account the industrial zones
- Fifth step: suggestions for the policy and further research

4. Where do we try this?



5. Who are our target groups?

- Input from groundwater Data base
  - companies with permit for water abstraction from the hardrock basement aquifer
  - companies with permit for water abstraction from other aquifers >30.000 m^3/year

results

71 permits for groundwater abstraction
65 companies
Selection of 58 companies: 24 textile-/34 non-textile companies

5.1. Main groundwater users per aquifer

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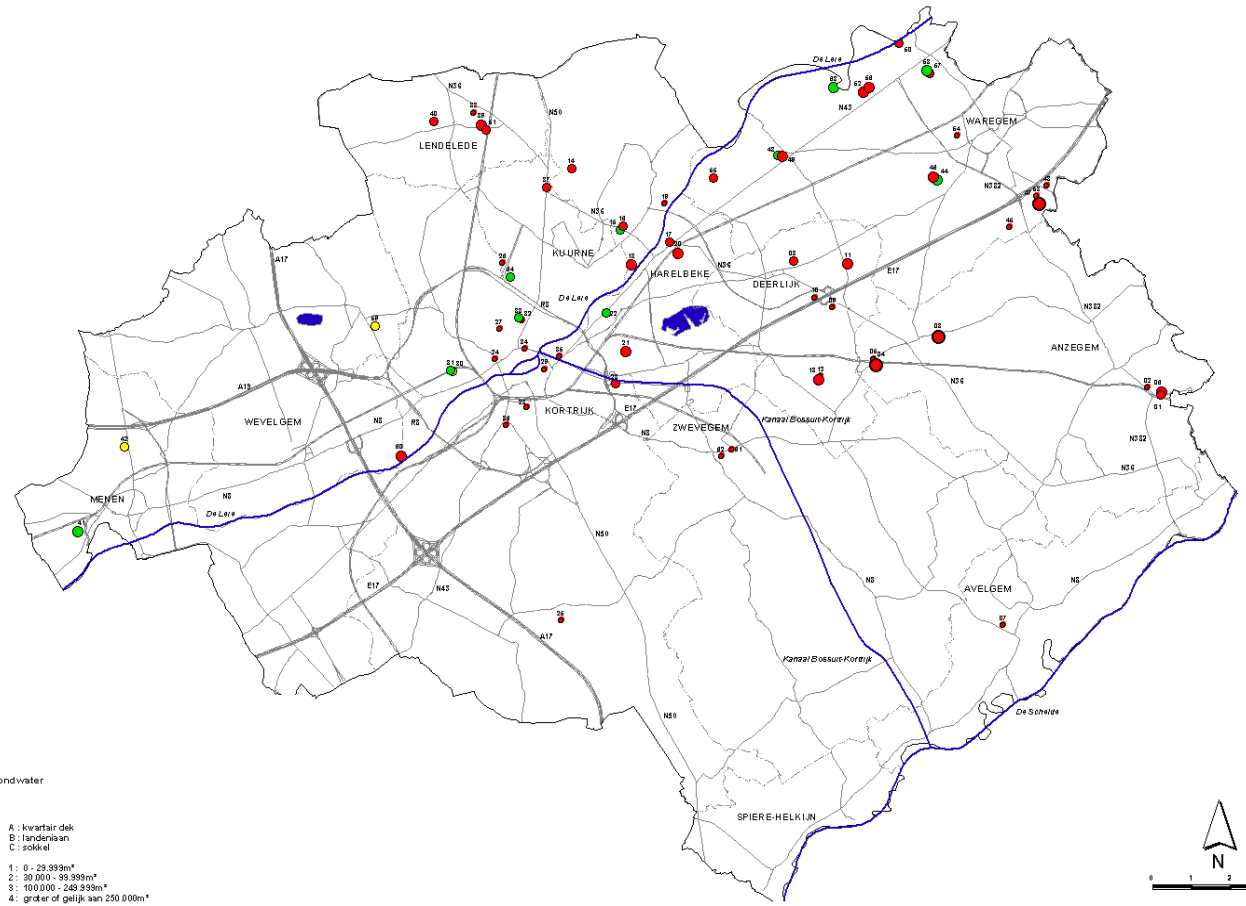
kaart 1.1. Ligging van de grote waterverbruikers van grondwater volgens watervoerende laag.



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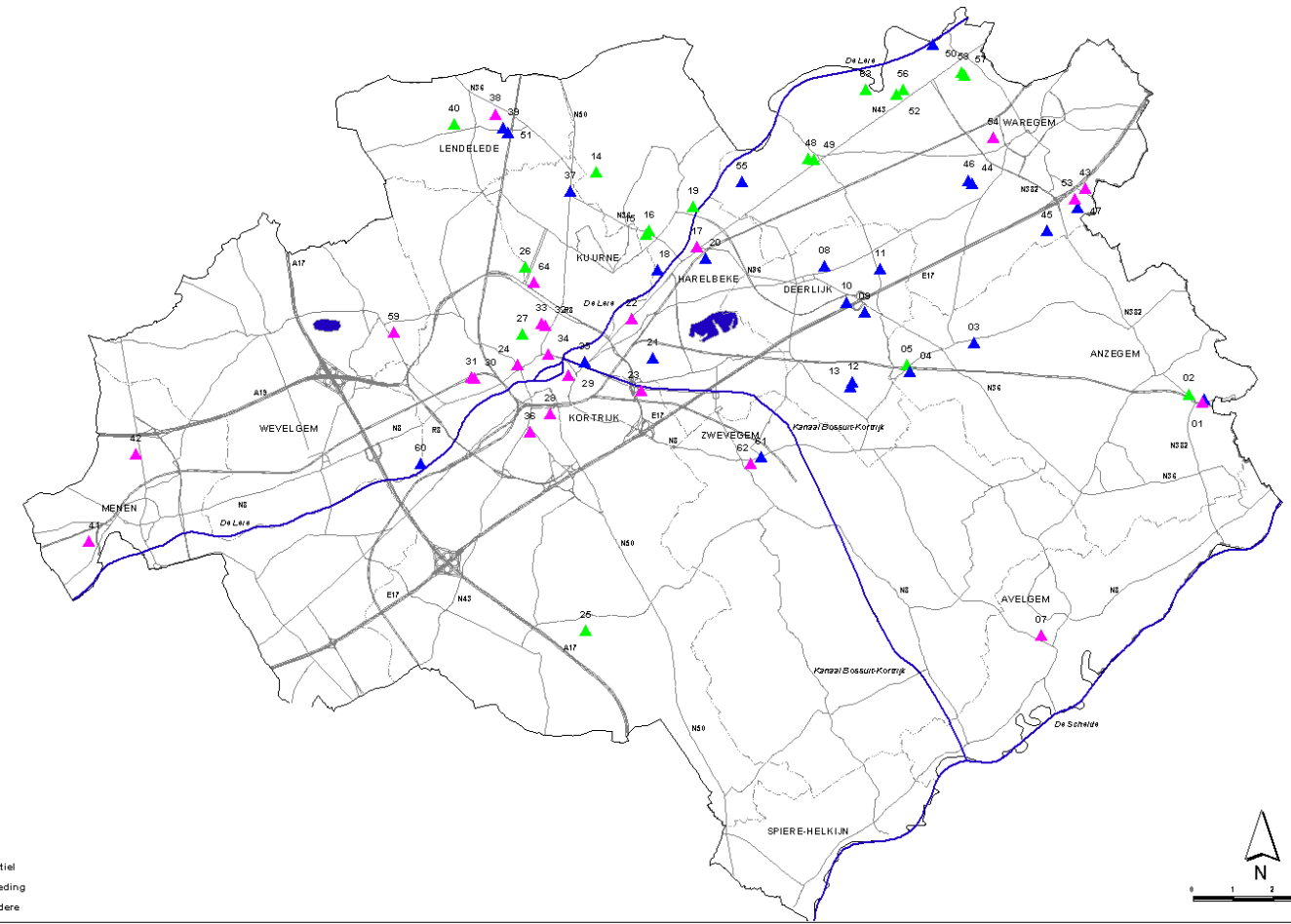
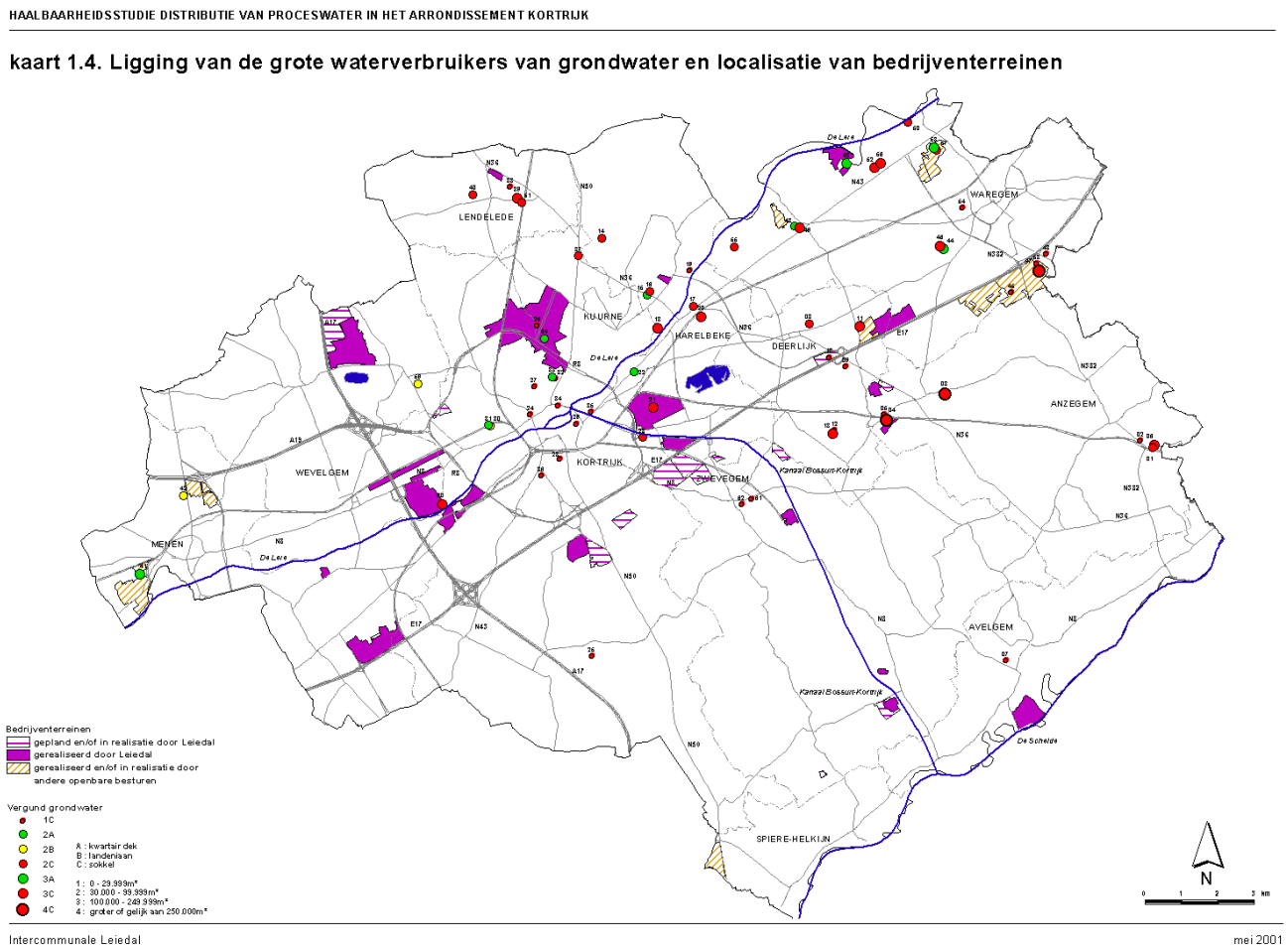
5.2. Main groundwater users per sector

kaart 1.2. Ligging van de grote waterverbruikers van grondwater volgens sector.



5.3. Main groundwater users and localisation of industrial zones



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II. Demand for water

- Survey
  - 58 companies asked (total groundwater use of 5.2 million m^3/year)
  - goal: what is the current and future demand of water in the area?
  - Response: 42 companies (4 million m^3/year groundwater
    - 18 textile companies
    - 24 non-textile companies

1. Current and future demand for water

- Current demand for water
  - total amount of groundwater (basement + other groundwater >30.000 m³/jaar): 5,2 million m³/year
    - 4,2 million basement water; 1 million other groundwater
- Future demand for water
  - Textile companies (18): 3 strong increase, 11 small increase
  - other companies (24): 3 strong increase, 10 small increase
  - No decrease in demand foreseen
  - limiting conditions: technology/price of water/permits/ taxes/production changes/recuperation/sustainable wateruse/consumer
- Hypothesis future demand: current permits + 25%

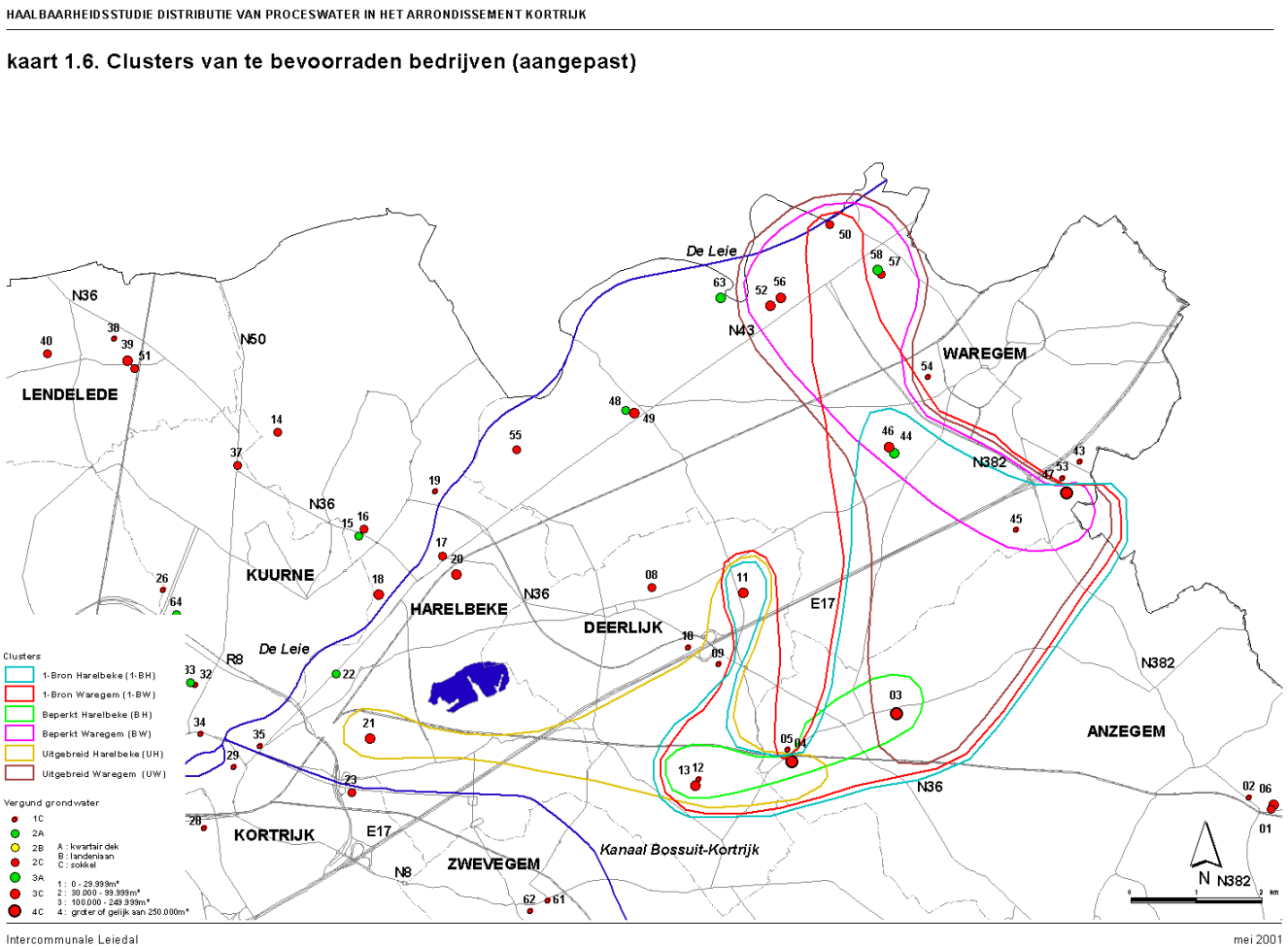
2. How do the companies react on the alternatives?

- 35% of the companies are positive for a changeover to other water
- especially recuparation water and tapwater are seen as likely candidates (not rainwater or surfacewater)
- on short notice: tapwater and freatic groundwater
- on long term: changeover to surfacewater, rain water and purified water for reuse
- if an alternative distribution system is installed, almost 90% is interested

3. What are the qualitative needs?

- Textile companies
  - high quality demands, especially in refinement
  - proceswater needs to be soft, low Fe content, clear and neutral pH
  - if quality is constant, a small anomaly is achievable
  - Conclusion: to strive to a good basic quality to satisfy the needs. For processes needing a better quality, a purification on company level needs to be installed
- food industry
  - most of the time, for most processes, drinking water quality is obligatory

4. How can the companies be clustered?



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5. How much water do the “clusters” need?

Cluster	flow
BW (Beperkt Waregem) (flow dependent on quality)	340 m³/hr of 220 m³/hr
	6,850 m³/d of 4,270 m³/d
	1,650,000 m³/y of 1,000,000 m³/u
UW (Uitgebreid Waregem) (flow dependent on quality)	560 m³/hr of 430 m³/hr
	11,227 m³/d of 8,650 m³/d
	2,590,000 m³/y of 1,965,000 m³/y
BH (Beperkt Harelbeke)	390 m³/hr
	7,650 m³/d
	1,580,000 m³/y
UH (Uitgebreid Harelbeke)	240 m³/hr
	4,800 m³/d
	950,000 m³/y
1-BW (1-Bron Waregem)	640 m³/hr
	12,800 m³/d
	2,750,000 m³/y
1-bron (1-Bron Harelbeke)	620 m³/hr
	12,500 m³/d
	2,700,000 m³/y

III. Supply of water

- Investigated in this study:
  - navigable watercourses (retribution to be payed):
    - Leie, Scheldt (high flow, quality variable)
    - canal Bossuit-Kortrijk (good quality, also used by VMW)
  - effluentwater WWTP (Waregem and Harelbeke) (low flow; upgrading of certain substances)
  - pretreated water from the canal Bossuit-Kortrijk
- not investigated in this study:
  - tapwater
  - water from unnavigable watercourses
  - reuse of water on companylevel
  - etc.

1. Where are the alternatives to be found?

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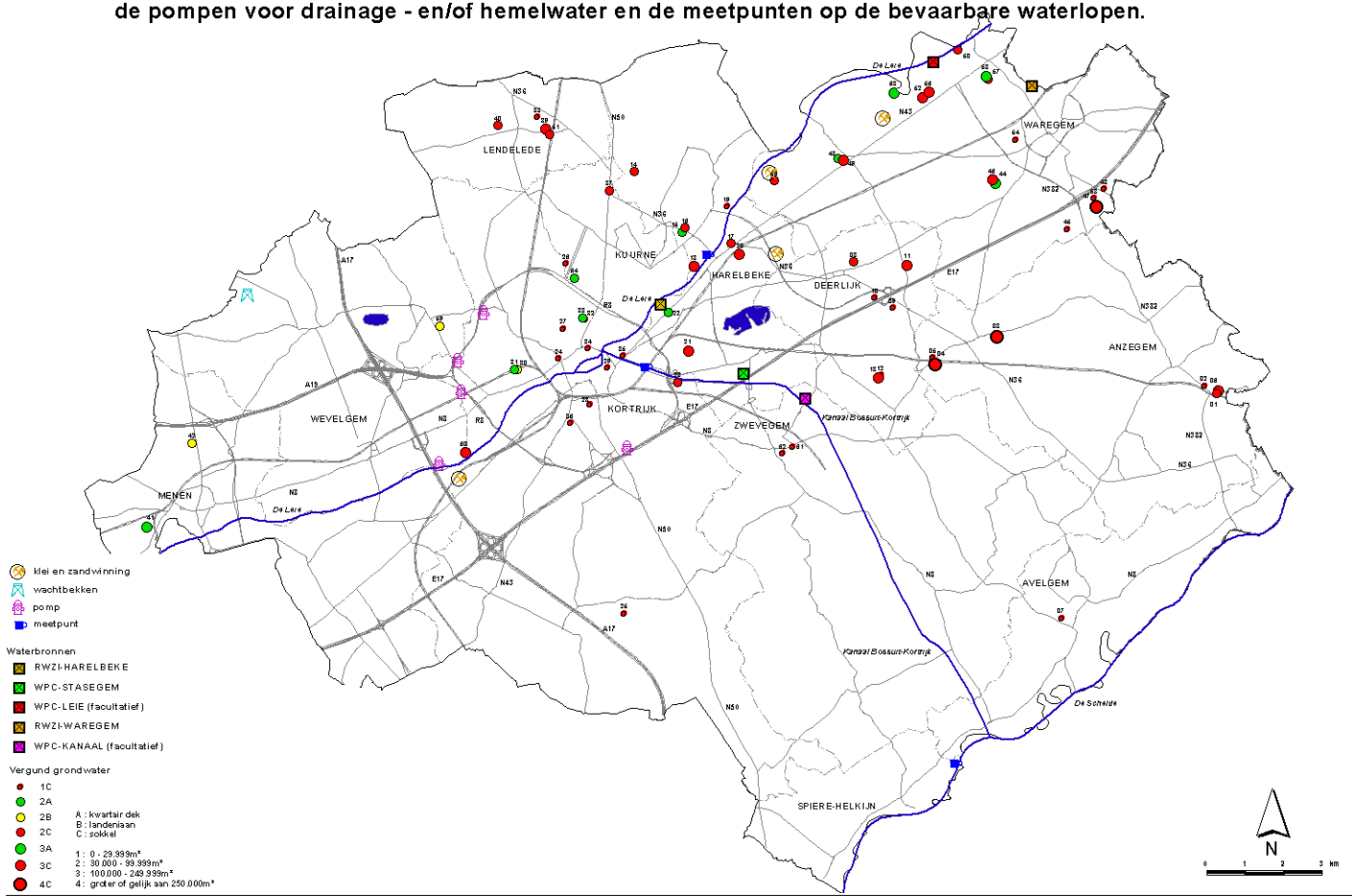
kaart 2.1. Ligging van de RWZI's, de WPC'c, de klei- en zandwinningen, het wachtbekken, de pompen voor drainage - en/of hemelwater en de meetpunten op de bevaarbare waterlopen.



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2. What treatment do we foresee?

- Classical solutions versus membrane technology?
- Quality of the distributed water on site:
  - the quality needed?
  - basic quality and further purification on site?
- Basic quality is source dependent (surface water - effluent water)
- Treatment of "raw water" to top quality
  - Leie : Membrane filtratieon and reverse osmosis
  - Canal Bossuit-Kortrijk : oxidation + sandfiltration + nanofiltration + chlorination
- Treatment of "raw water" to basic quality
  - Leie : aeration + membrane filtration
  - Canal Bossuit-Kortrijk : aeration + sand filtration

3. What is the cost of the treatment?

- Modalities investment costs
  - flow dependent (15 à 25 million m^3/y)
  - building debit 30 years, rest 15 years
  - membrane replacement every 3 years
  - interest rate 5,565%
- Modalities exploitation costs
  - inclusive costs for personnel, maintenance, energy, lab, chemicals, retribution, sludge
  - exclusive costs for taxes on concentrate and pollution of surface water

4. What is the cost of the treatment (bis)?

Tracé	Basic quality	cost (EUR/m³)	Top quality	cost (EUR/m³)
BW	Leie	0.35 à 0.40	Leie	0.52 à 0.57
	WWTP	Purchase price Aquafin	WWTP	0.37 à 0.42
UW	Leie	0.30 à 0.35	Leie	0.50 à 0.54
	WWTP	Purchase price Aquafin	WWTP	0.37 à 0.42
1-BW	Leie	0.27 à 0.32	/	
	WWTP	Purchase price Aquafin		
BH	Canal	0.20 à 0.25	Canal	0.35 à 0.40
	Pretreatd canal water	Purchase price VMW	/	
UH	Pretreated canal water	Purchase price VMW	Pretreated canal water	0.32 à 0.37
1-BH	Canal	0.12 à 0.17	/	
	Pretreated canal water	Purchase price VMW		

5. What is the cost of the distribution?

- Technical aspects (e.g. as short as possible)
- Use of public domain (permits? Retribution?)
- Juridical aspects (private domain)
- Planological or urban development planning aspects
- Juridical aspects (nature conservation)
- EIA in certain areas necessary?

- Possible trajectories were on site investigated
- Matrix for the calculation of costs was made
- modalities for costs for investment and exploitation

6. Possible trajectories:

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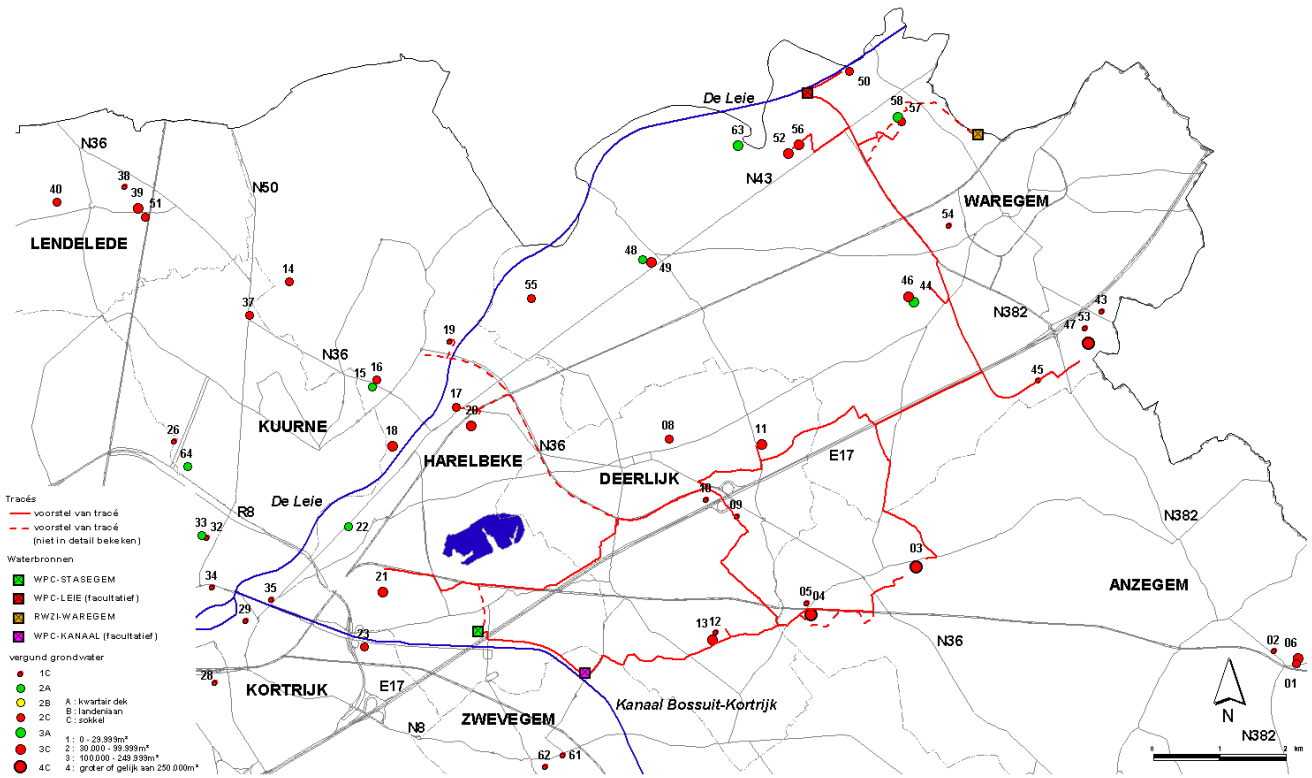
kaart 4.1. Voorstel van tracés.



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7. Distribution costs per trajectory

Trajectory	Waterflow to non-food companies	cost (EUR/m³)	Waterflow to all companies	Cost (EUR/m³)
BW	Leie	0.22 à 0.27	Leie	0.15 à 0.20
	WWTP	0.22 à 0.27	WWTP	0.15 à 0.20
UW	Leie	0.17 à 0.22	Leie	0.12 à 0.17
	WWTP	0.17 à 0.22	WWTP	0.12 à 0.17
1-BW	Leie	0.15 à 0.20	/	
	WWTP	0.15 à 0.20		
BH	Canal	0.15 à 0.20	Canal	0.15 à 0.20
	Pretreated canal water	0.15 à 0.20	/	
UH	Pretreated canal water	0.22 à 0.27	Pretreated canal water	0.22 à 0.27
1-BH	Canal	0.15 à 0.20	/	
	Pretreated canal water	0.15 à 0.20		

8. Total cost of distribution of treated water

- Treatment costs
- Distribution costs
- Overhead costs (logistics; insurance; preliminary flotation)
- Assumptions
  - Price pretreated canal water : 5 BEF/m^3
  - Price effluentwater : 1 BEF/m^3
  - Optimalisation sandfiltration WWTP: 2 BEF/m^3

9. Total cost of distribution of treated water (bis)

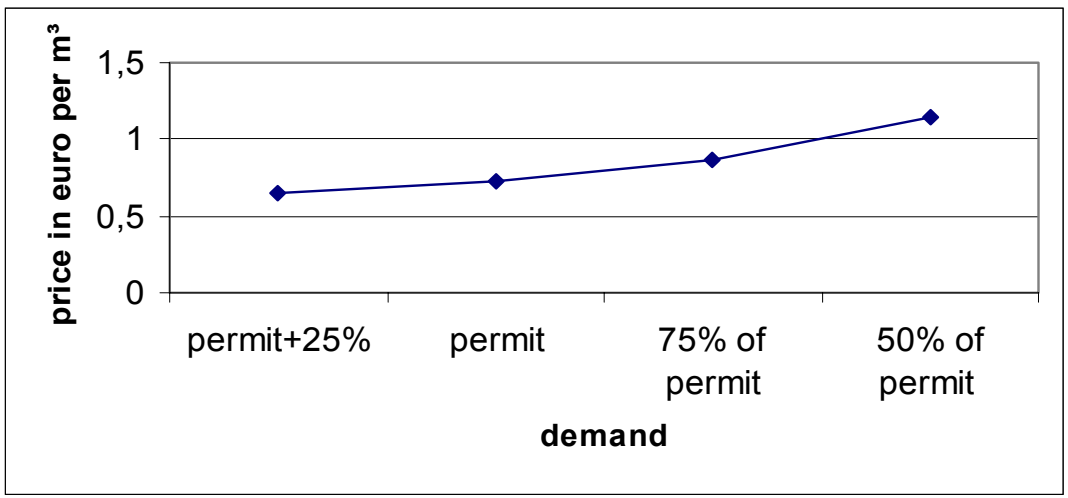
Trajectory	Basic quality non food companies	Cost (EUR/m³)	Top quality (All companies)	cost (EUR/m³)
BW	Leie	0.62 à 0.72	Leie	0.69 à 0.79
	WWTP + optimalisation sandfilter + price (Aquafin)	0.35 à 0.40	WWTP + price (Aquafin)	0.57 à 0.67
UW	Leie	0.47 à 0.57	Leie	0.64 à 0.74
	WWTP + optimalisation sandfilter + price (Aquafin)	0.25 à 0.30	WWTP + price (Aquafin)	0.55 à 0.64
1-BW	Leie	0.42 à 0.51	/	
	WWTP + optimalisation sandfilter + price (Aquafin)	0.22 à 0.27		
BH	canal	0.37 à 0.47	canal	0.52 à 0.62
	Pretreated canal water + price (VMW)	0.30 à 0.35	/	
UH	Pretreated canal water + price (VMW)	0.37 à 0.47	Pretreated canal water + price (VMW)	0.72 à 0.82
1-BH	canal	0.30 à 0.40	/	
	Pretreated canal water + price (VMW)	0.27 à 0.32		

10. Total cost of distribution of treated water (tris)

Relation price and demand

Price : partly fixed costs, partly variable costs
Fixed costs independent from demand

Possible evolution of price?



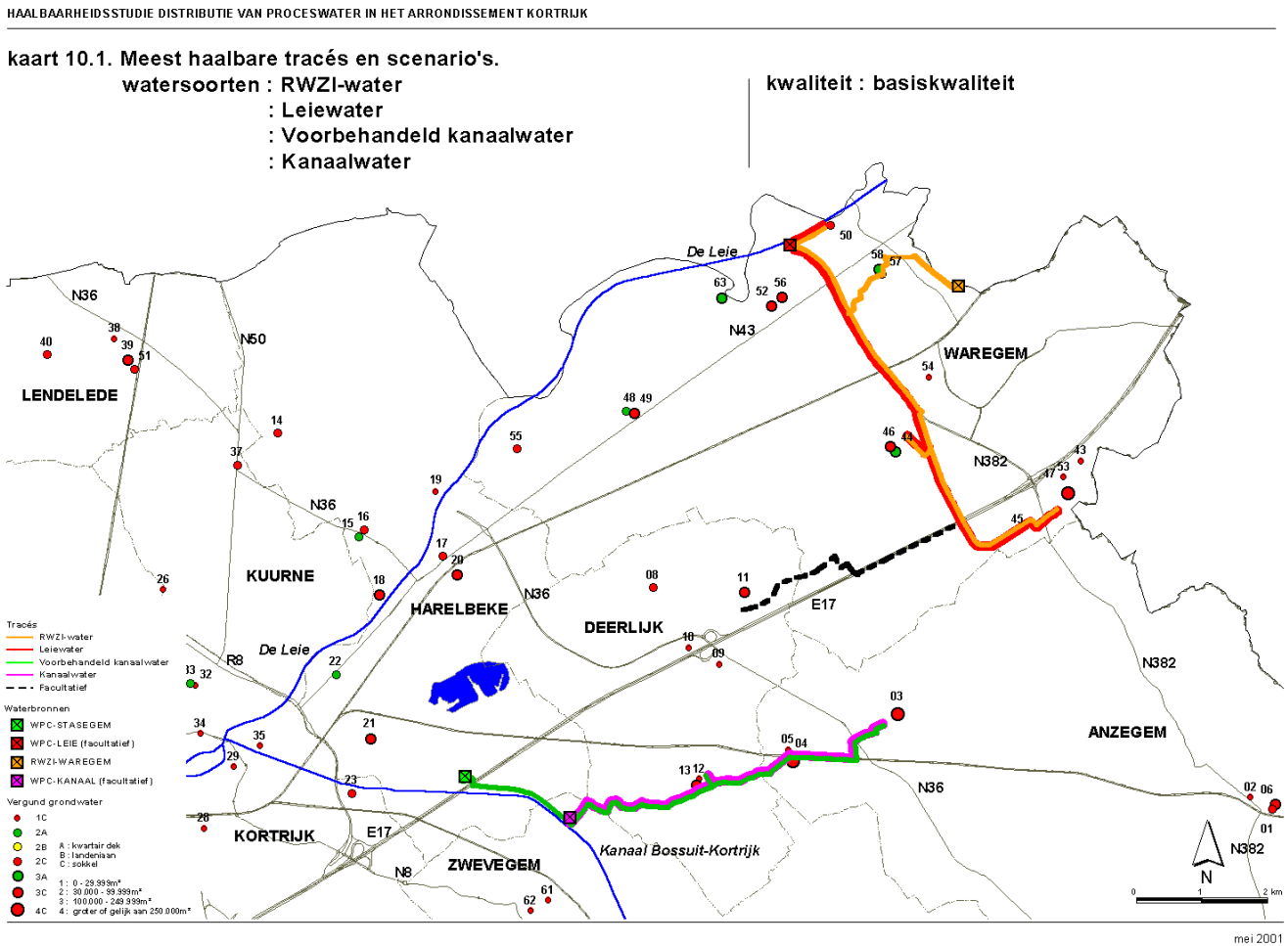
IV. Evaluation

- Management structure?
  - Companies themselves (or via cooperative partnership)
  - Service company (public or private)
  - PPP: public-private participation
- Subsidies?
  - To the companies
  - Structural support
- Criteria of evaluation
  - operational safety
  - Price
  - Sustainability
- Looking for optimum

1. Results of evaluation of criteria

	BW Leie	BW WWTP	UW Leie	UW WWTP	1-BW Leie	1-BW WWTP	BH CANAL	BH. Pretreated canal	UH Pretreated canal	1-BH Canal	1-BH Pretreated canal
Price	----	+	---	+++	--	++++	-	++	-	+	+++
Operational safety											
Quality (current)	--	-	--	-	--	-	+	++	++	+	++
Quantity (current)	++	+	++	+	+	--	+	+	+	--	--
Sustainability											
Long term solution											
Quality (future)	+	+	+	+	+	+	-	-	-	--	--
Quantity (future)	++	+	++	+	+	--	+	+	+	--	--
Localisation companies	+	+	+	+	++	++	+	+	++	++	++
Closing of waterchain	-	+	-	+	-	+	-	-	-	-	-

2. Most feasible trajectory:



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V. Recommendations

- Increase taxes on hardrock basement water
- research needed on
  - quality watersources
  - possibilities of concentrate
  - use of other watersources
  - juridical aspects (use; subsidies;…)
  - economical aspects (PPP?)
  - planological aspects
  - technological aspects
- Negotiations with drinking water companies
- wateraudits of companies necessary
- Type of study further in detail and on other locations