

LABORATORIUM VOOR TOEGEPASTE GEOLOGIE EN HYDROGEOLOGIE

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RECONNAISSANCE DRILLING NEAR THE  
BETZ PLANT AT HERENTALS

A.I.B.

TGo 90/32

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NEAR THE BETZ PLANT  
AT HERENTALS**

**LTG**

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**A.I.B.**

Direction : Prof. Dr. W. DE BREUCK  
Report : Lic. I. BOLLE

Research nr. : TGO 90032

Date : September 28th, 1990

## **1. INTRODUCTION**

By order of A.I.B. the Laboratory of Applied Geology and Hydrogeology of the State University of Ghent carried out six reconnaissance drillings near the BETZ PLANT at Herentals.

The reconnaissance consisted of :

- drilling and sampling of six holes near an abandoned tank site
- equipment of the six boreholes as observation wells
- measurement of the groundwater level
- sampling of the groundwater.

The reconnaissance was performed on September 24th and 25th 1990. This report contains an overview of the field work.

## **2. SITE DESCRIPTION**

### **2.1. Location**

The BETZ PLANT is located at the industrial area of Herentals. The area is situated between the highway E313 Antwerp-Hasselt and the Albertcanal (fig. 1).

A tank containing "Solveso" was situated near the warehouse of the factory (fig. 2).

### **2.2. Physiography**

The site is located on a small ridge (about 12 m above sealevel\*). The ridge is oriented from west to east and is bordered to the north by the Albertcanal at about +10 and to the south by the "Zelse beek" at approximately +10 (fig. 3).

\* All levels in this report refer to the datum level of the National Geographic Institute (Second General Leveling = TAW)



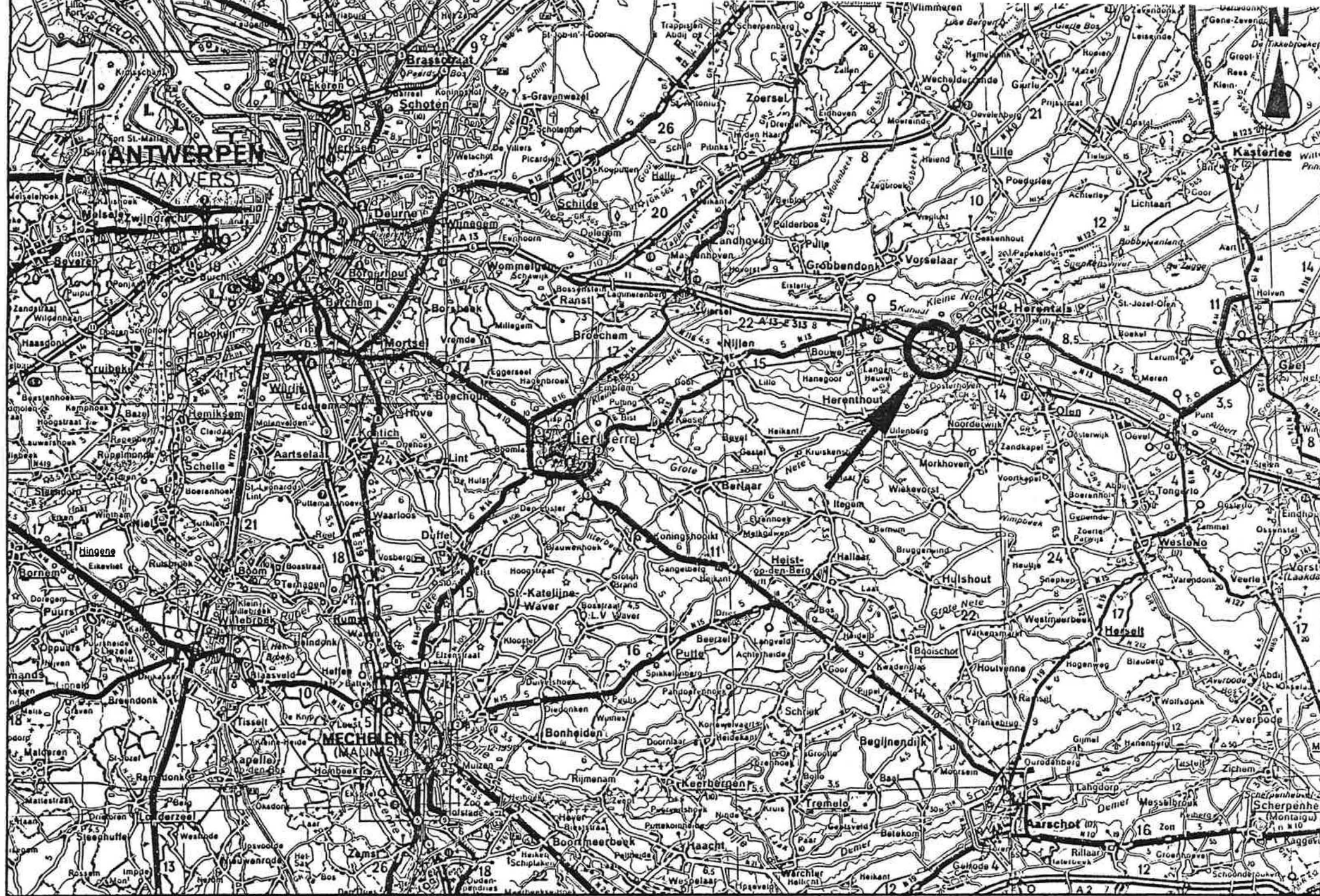


Fig.1 - Situation of the Herentals industrial area (Michelin,1990,1/200000)

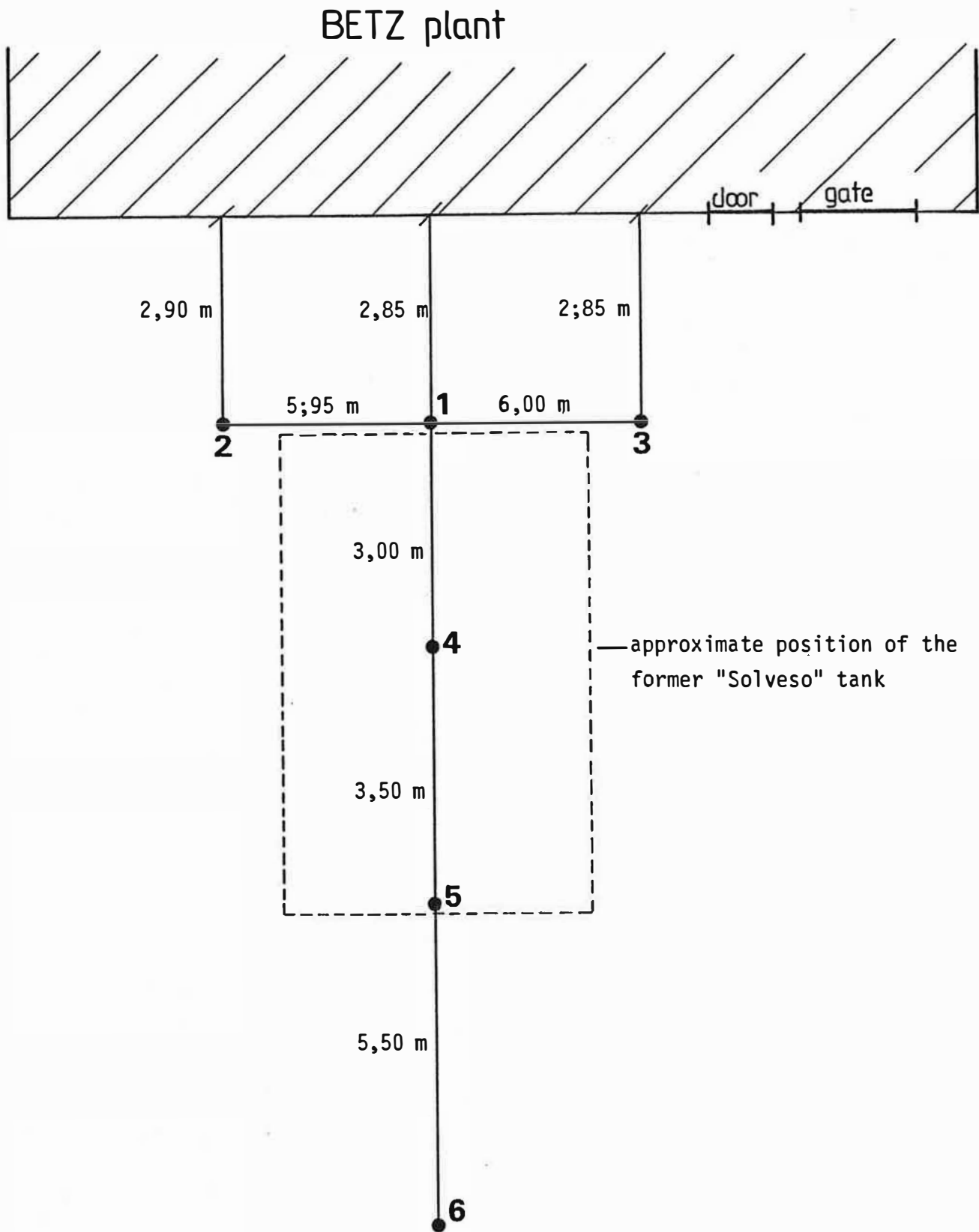


Fig.2 - Performed drillholes ( not to scale ) and position of the former "Solveso" tank.



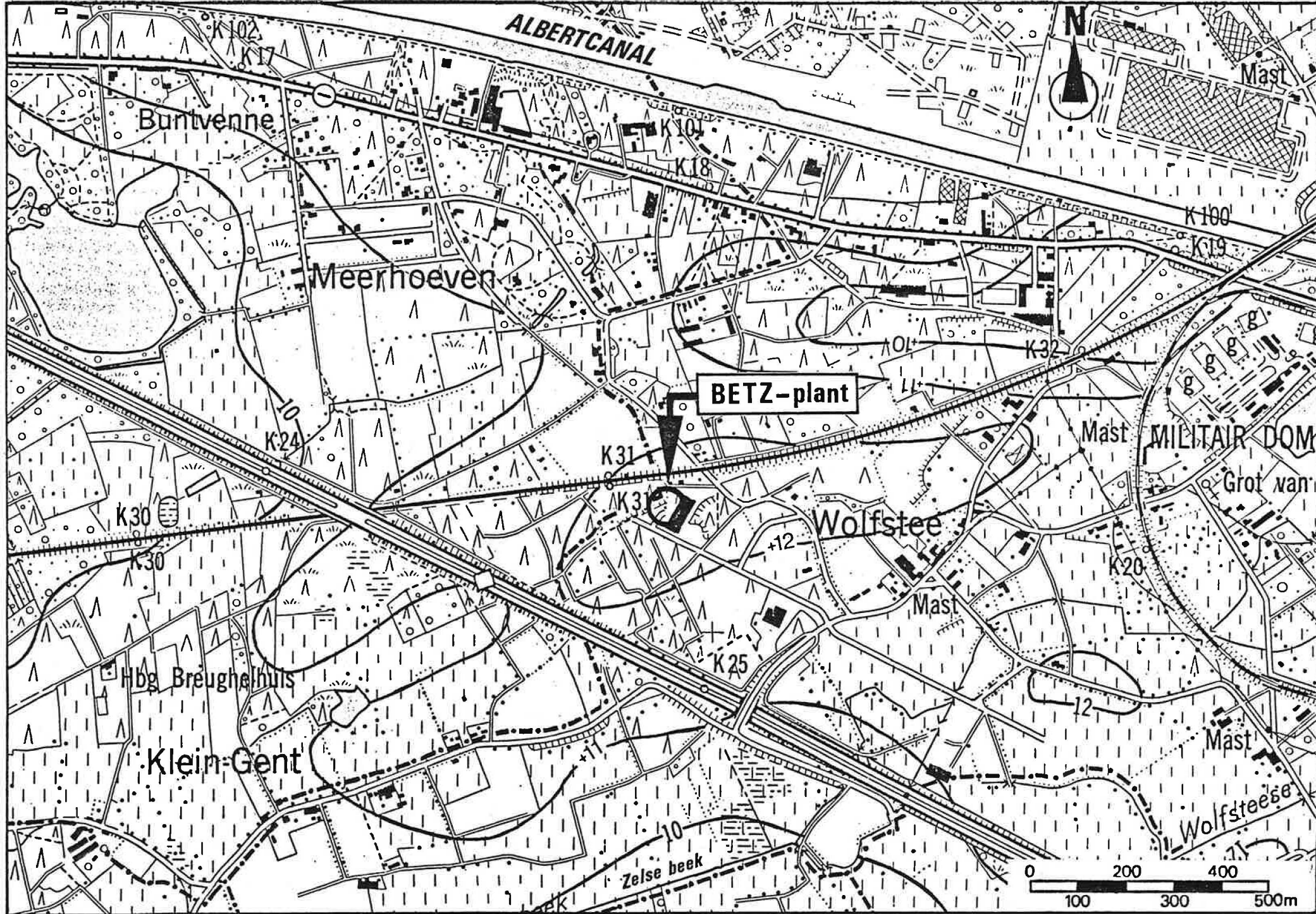


Fig.3 - Topographic map 16/7 Herentals (NGI). Contourline in terval 1 m.

### **3. SOILS**

The original soils in the area consisted mainly of dry sand. With the build-up of the industrial area the original ground-level was heightened mostly with sandy material.

### **4. GEOLOGY**

At a depth of approximately -65 the Boom clay (Oligocene) is occurring. This layer, which is more than 100 m thick, consists of a stiff clay. The Boom clay is covered by the Berchem Formation (Miocene), consisting of fine green clayey sand with shells and glauconite. The top of the Berchem Formation is at approximately -48.

On top of the Berchem Formation we find the Diest Formation, a green fine sometimes coarse sand with glauconite. The thickness of the Diest Formation is about 55 to 60 m.

The Diest Formation is covered by a thin layer of fine sand of Pleistocene age.

### **5. HYDROGEOLOGY**

The Pleistocene deposits together with the Diest and Berchem Formations form an unconfined aquifer; the Boom clay is acting as an impervious stratum of this unconfined aquifer.

The Diest Formation is an important aquifer in the Antwerp province. The "Provinciale en Intercommunale Drinkwatermaatschappij der Provincie Antwerpen" (PIDPA), a public water supply company extracts groundwater at several places in the Antwerp province from the Diest Formation.

## **6. DRILLING AND SAMPLING**

Six boreholes (fig. 2) were performed. The drilling was made by a hand-auger ( $\varnothing$  60 mm) in the insaturated zone. Beneath the water table drilling was made by the hand-rotary method with normal circulation of clean water. Representative formation samples were taken at a depth of approximately 3,0 m. The description of the lithology was made on the spot (appendix 1).

At the site 1 a strong smell of solveso was noticed. At the other sites (except no. 6) a more weaker smell was encountered. At site no. 6 no smell was noticed.

## **7. EQUIPMENT OF THE OBSERVATION WELLS**

The six boreholes were equiped as observation wells; the construction log is represented on fig. 4. To prevent contamination during the construction :

- no soil withdrawn from the borehole has been used as fill up
- no glue was used to join the PVC pipes.

After the equipment and before the groundwater sampling the observation wells have been developed during 20 to 35 minutes. While developing, the presence of foam in the pumped water from all the wells, except no. 6, was noticed.

## **8. LEVELING AND WATER-LEVEL MEASUREMENTS**

### **8.1. Leveling**

The top of each observation well was leveled. The threshold of the gate of the BETZ PLANT was used as a reference point (R +10). The results of the leveling are collected in table 1.

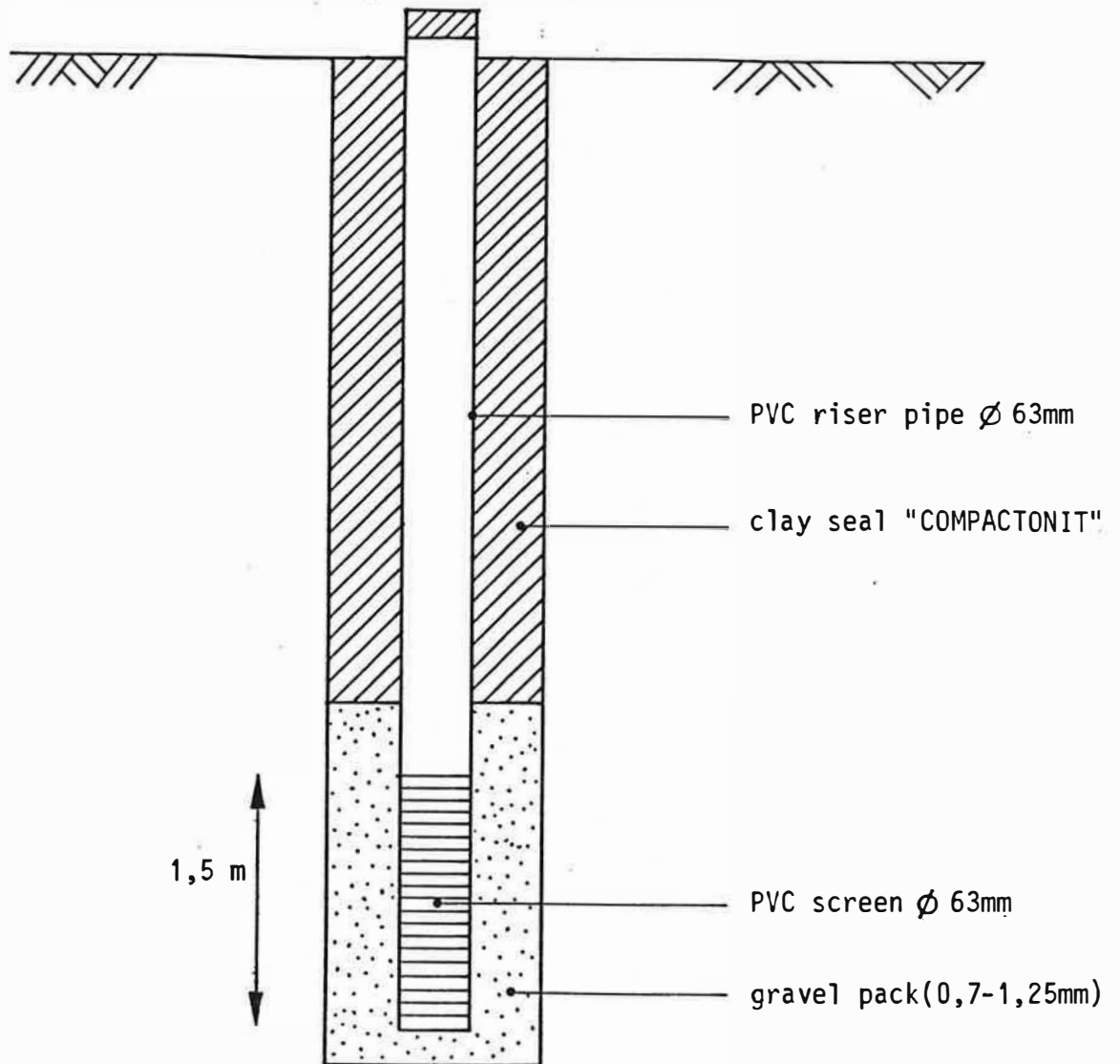


Fig.4 - Construction log of an observation well.

Table 1 - Levels of the observation wells

Well number	Relative level
1	R +9,839
2	R +9,613
3	R +9,711
4	R +9,646
5	R +9,328
6	R +9,708

## 8.2. Groundwater level measurement

On September 25th 1990 the groundwater level in all the observation wells was measured. The results are given in table 2.

Table 2 - Groundwatermeasurements

Well number	Relative level
1	R +5,553
2	R +5,543
3	R +5,546
4	R +5,556
5	R +5,563
6	R +5,558

## 9. GENERAL GROUNDWATER FLOW

Due to the short distance between the observation wells no direction of the groundwater flow can be determined from the groundwatermeasurements listed in table 2.

From the topographic map at scale 1:10.000 (fig. 3) however, one can determine approximately the general groundwater flow direction in the unconfined aquifer. This however supposes the absence of

any anthropogenic influence such as i.e. groundwater extraction or infiltration in the close vicinity of the BETZ PLANT.

The general groundwater flow will probably be directed towards the W and NW. More precision concerning the direction and the gradient requires at least two supplementary observation wells at a larger distance.

#### **10. GROUNDWATER SAMPLING**

After development of the observation wells groundwater samples were taken on September 25th 1990. Before taking the samples the well volume was pumped several times. The sampling was performed with a hand teflon bailer.

#### **11. SAMPLE ANALYSIS**

The formation samples and the groundwater samples will be analysed by A.I.B.

September 28th, 1990.



**APPENDIX 1**

**DRILLING LOGS OF THE OBSERVATION WELLS**

RESEARCH : Reconnaissance drilling near the BETZ PLANT OWNER : A.I.B.  
 at Herentals

- DATE : 24 September 1990
  - DRILLING CY. : RUG - LTGH
  - DRILLING RIG : by hand DRILLER : RB
  - DESCRIPTION OF CUTTINGS BY : IB
  - MAP N.G.I. Nr. : 16/7 GEOL./PEDOL. MAP Nr. : 45W
  - MUNICIPALITY : Herentals NIS-CODE : \_\_\_\_\_
  - X = \_\_\_\_\_ Y = \_\_\_\_\_ ZMV = \_\_\_\_\_ (m TAW)
  - (LAMBERT-COORDINATES) ZMV\* = +14,5 (m TAW)
- (ZMV = ground level (measured); ZMV\* = ground level (estimated))

DRILLING METHOD	Ø (mm)	DEPTH (in m)				
		from - to	from - to	from - to	from - to	from - to
Hand auger	60	0,0 - 3,3				
Hand-rotary	95	3,3 - 6,0				

- DRILLING MUD : - CONSUMPTION (l) : -
- BOREHOLE LOG(S) : -

screen nr.	NR.	DFB	DFO	ZMP	ZMP*	GWDP	L	ST	P
F1		4,5	6,0		+14,5	4,286	1		1
F2									
F3									

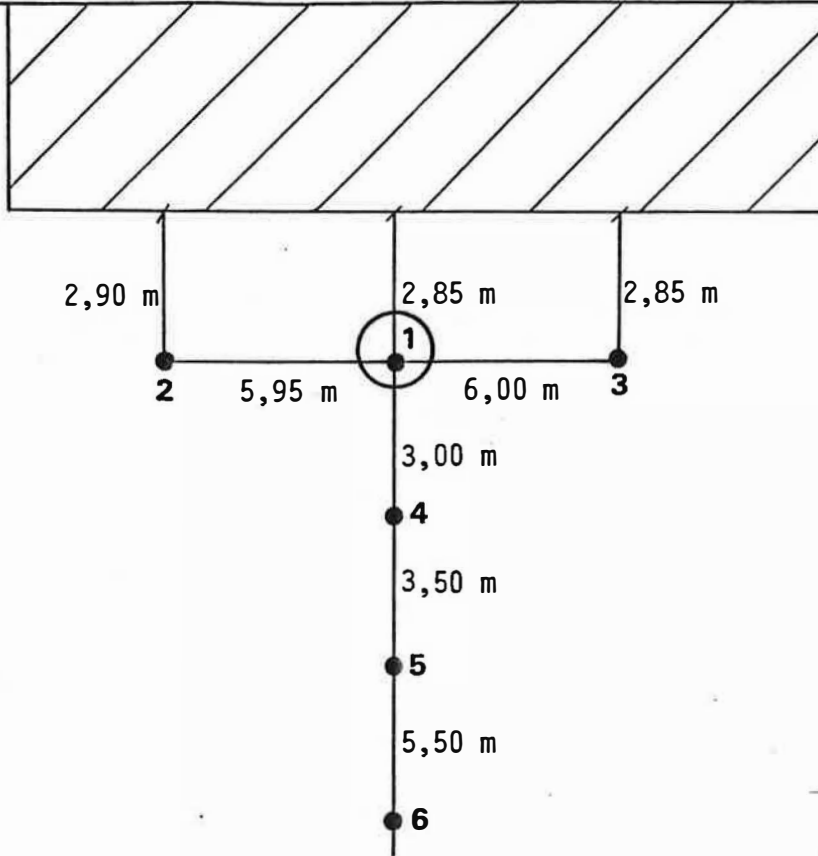
- NR = Number
- DFB = Depth to top of screen (m)
- DFO = Depth to bottom of screen (m)
- ZMP = Level measuring point (m TAW)
- ZMP\* = Estimated level of mark (m TAW)
- GWDP = Groundwater depth below mark
- L = Type of aquifer : 1 = phreatic; 2 = non phreatic
- ST = Stratigraphy (conform to legend LTG)
- P = 1=Piezometer; 2=Observation well; 3=Dugged well; 4=Pumping well

- Several screens in one borehole : yes/no
- Characteristics - riser pipes : PVC Ø 63 mm
- screens : PVC Ø 63 mm
- connections : no glue was used
- Bottom pipe (m) : -
- Screen slot openings - type : Horizontal slots
- size (mm) : 0,3
- open area (%) : -
- Centralizer(s) - place (m) : -
- Filter-pack type and characteristics : gravel (0,7 - 1,25 mm)
- volume (l.) : 11
- Seals-type and characteristics : clay pellets "compactonit"
- volume (l.) : 8
- Borehole backfill material : -
- Development - method : peristaltic pump
- date - duration (h) : 25/09/90 25'
- discharge (m<sup>3</sup>/h) : 0,8
- Finishing : PVC plug and covered with ground



LOCATION - CADASTRAL MAP : \_\_\_\_\_

Parcel nr. : \_\_\_\_\_



lithologic log screen (s) (b) (f)



filter pack (g)



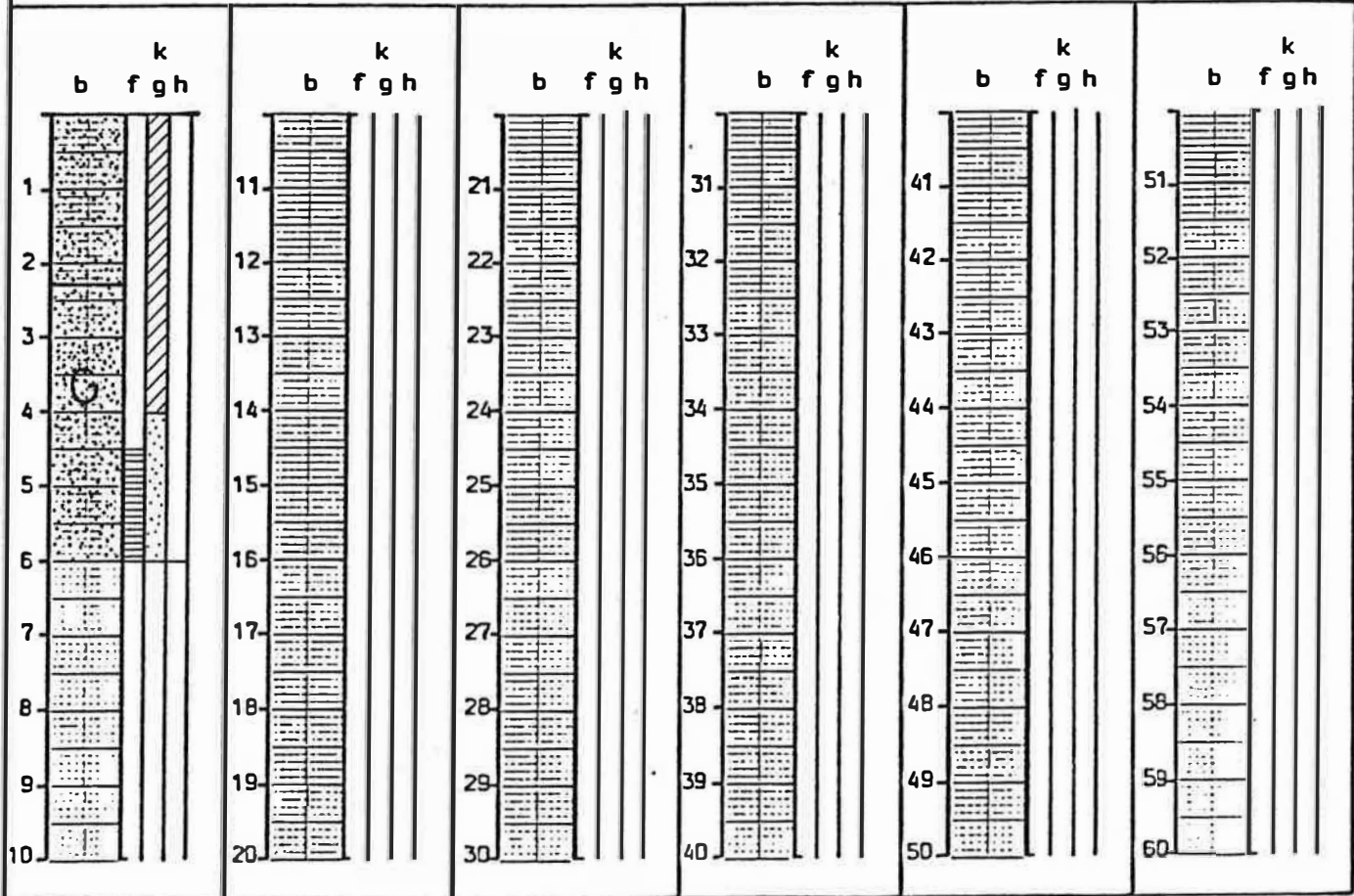
seal(s) grout (k) clay



hydrogeological interpretation (h): pervious

semi-pervious

impervious



RESEARCH : Reconnaissance drilling near the BETZ PLANT OWNER : A.I.B.  
 at Herentals

- DATE : 25 September 1990
  - DRILLING CY. : RUG - LTGH
  - DRILLING RIG : by hand DRILLER : RB
  - DESCRIPTION OF CUTTINGS BY : IB
  - MAP N.G.I. Nr. : 16/7 GEOL./PEDOL. MAP Nr. : 45W
  - MUNICIPALITY : Herentals NIS-CODE : \_\_\_\_\_
  - X = \_\_\_\_\_ Y = \_\_\_\_\_ ZMV = \_\_\_\_\_ (m TAW)
  - (LAMBERT-COORDINATES) ZMV\* = +14,5 (m TAW)
- (ZMV = ground level (measured); ZMV\* = ground level (estimated))

DRILLING METHOD	Ø (mm)	DEPTH (in m)				
		from - to	from - to	from - to	from - to	from - to
Hand auger	60	0,0 - 3,2				
Hand-rotary	95	3,2 - 6,0				

- DRILLING MUD : \_\_\_\_\_ CONSUMPTION (l) : \_\_\_\_\_
- BOREHOLE LOG(S) : \_\_\_\_\_

screen nr.	NR.	DFB	DFO	ZMP	ZMP*	GWDP	L	ST	P
F1		4,5	6,0		+14,5	4,070	1		1
F2									
F3									

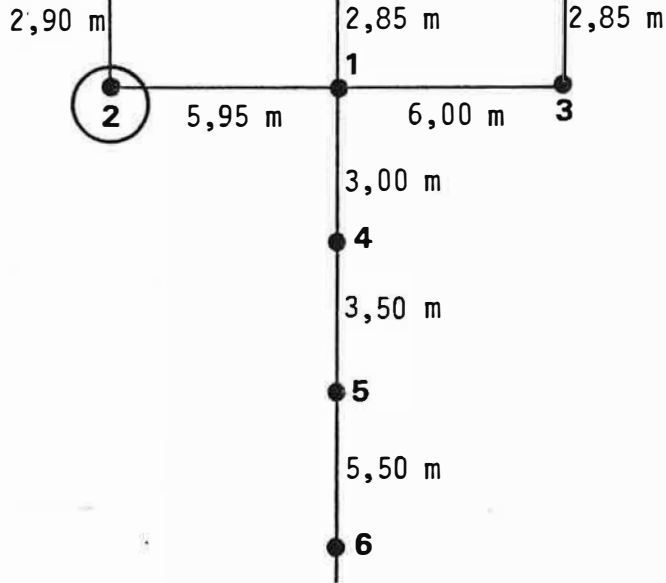
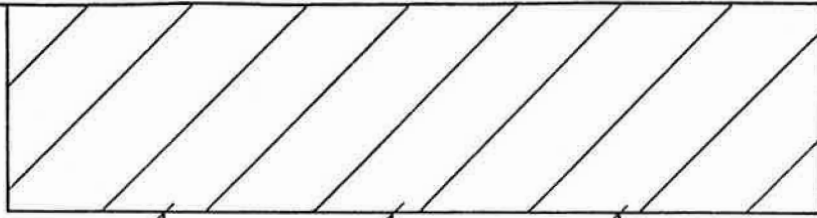
- NR = Number
- DFB = Depth to top of screen (m)
- DFO = Depth to bottom of screen (m)
- ZMP = Level measuring point (m TAW)
- ZMP\* = Estimated level of mark (m TAW)
- GWDP = Groundwater depth below mark
- L = Type of aquifer : 1 = phreatic; 2 = non phreatic
- ST = Stratigraphy (conform to legend LTG)
- P = 1=Piezometer; 2=Observation well; 3=Dugged well; 4=Pumping well

- Several screens in one borehole : yes/no
- Characteristics - riser pipes : PVC Ø 63 mm
- screens : PVC Ø 63 mm
- connections : no glue was used
- Bottom pipe (m) : \_\_\_\_\_
- Screen slot openings - type : Horizontal slots
  - size (mm) : 0,3
  - open area (%) : \_\_\_\_\_
- Centralizer(s) - place (m) : \_\_\_\_\_
- Filter-pack type and characteristics : gravel (0,7 - 1,25 mm)
  - volume (l.) : 11
- Seals-type and characteristics : clay pellets "compactonit"
  - volume (l.) : 8
- Borehole backfill material : \_\_\_\_\_
- Development - method : peristaltic pump
  - date - duration (h) : 25/09/90 35'
  - discharge (m<sup>3</sup>/h) : 0,5
- Finishing : PVC plug and covered with ground



LOCATION - CADASTRAL MAP : \_\_\_\_\_

Parcel nr. : \_\_\_\_\_



lithologic log screen (s)

filter pack

seal(s) grout

(b)

(f)

(g)

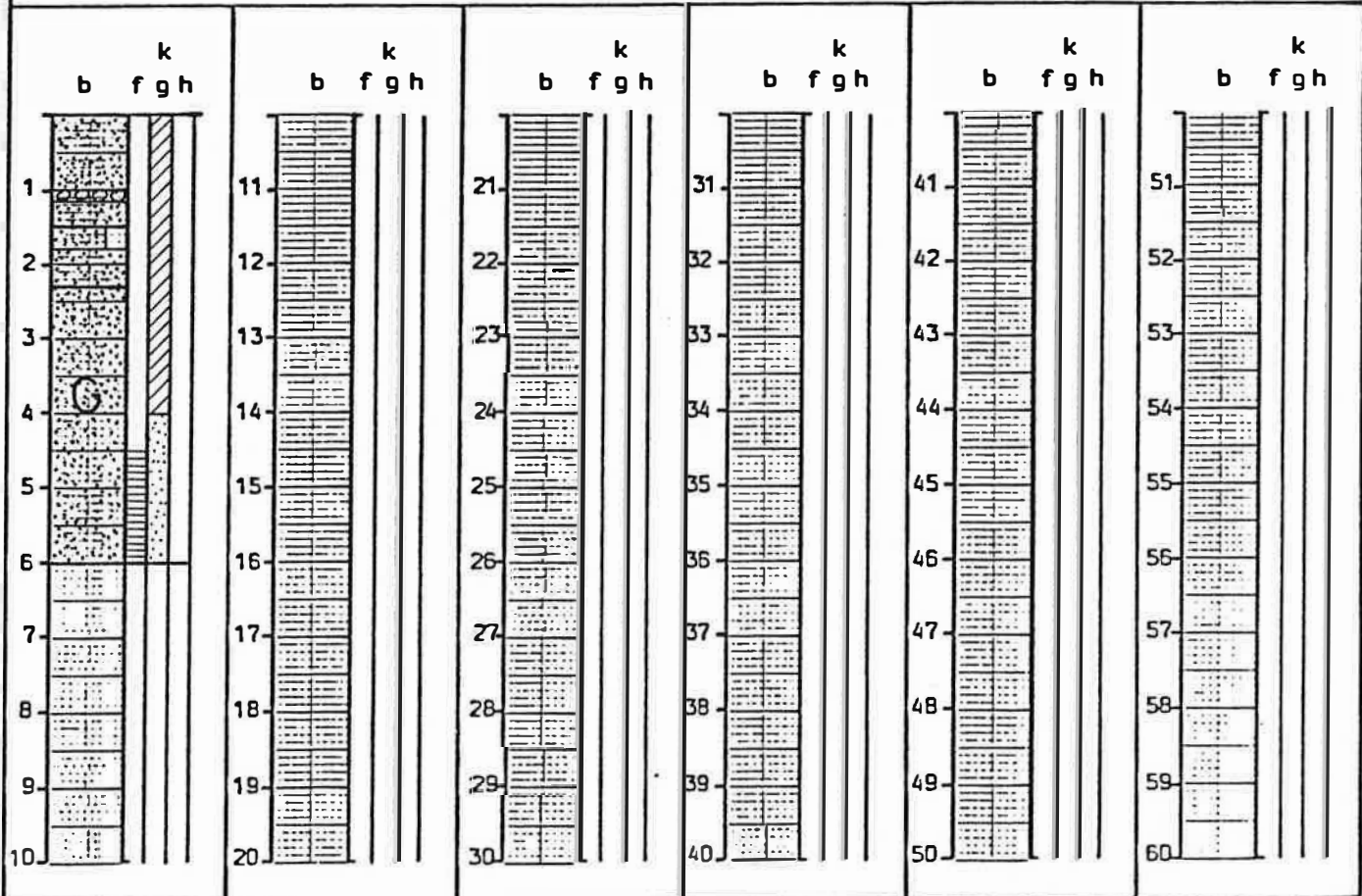
(k) clay

hydrogeological interpretation (h):

pervious

semi-pervious

impervious





RESEARCH : Reconnaissance drilling near the BETZ PLANT at Herentals  
 OWNER : A.I.B.

- DATE : 24 September 1990
  - DRILLING CY. : RUG - LTGH
  - DRILLING RIG : by hand DRILLER : RB
  - DESCRIPTION OF CUTTINGS BY : IB
  - MAP N.G.I. Nr. : 16/7 GEOL./PEDOL. MAP Nr. : 45W
  - MUNICIPALITY : Herentals NIS-CODE : \_\_\_\_\_
  - X = \_\_\_\_\_ Y = \_\_\_\_\_ ZMV = \_\_\_\_\_ (m TAW)
  - (LAMBERT-COORDINATES) ZMV\* = +14,5 (m TAW)
- (ZMV = ground level (measured); ZMV\* = ground level (estimated))

DRILLING METHOD	Ø (mm)	DEPTH (in m)				
		from - to	from - to	from - to	from - to	from - to
Hand auger	60	0,0 - 3,1				
Hand-rotary	95	3,1 - 6,0				

- DRILLING MUD : \_\_\_\_\_ CONSUMPTION (l) : \_\_\_\_\_
- BOREHOLE LOG(S) : \_\_\_\_\_

screen nr.	NR.	DFB	DFO	ZMP	ZMP*	GWDP	L	ST	P
F1		4,5	6,0		+14,5	4,165	1		1
F2									
F3									

- NR = Number
- DFB = Depth to top of screen (m)
- DFO = Depth to bottom of screen (m)
- ZMP = Level measuring point (m TAW)
- ZMP\* = Estimated level of mark (m TAW)
- GWDP = Groundwater depth below mark
- L = Type of aquifer : 1 = phreatic; 2 = non phreatic
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- P = 1=Piezometer; 2=Observation well; 3=Dugged well; 4=Pumping well

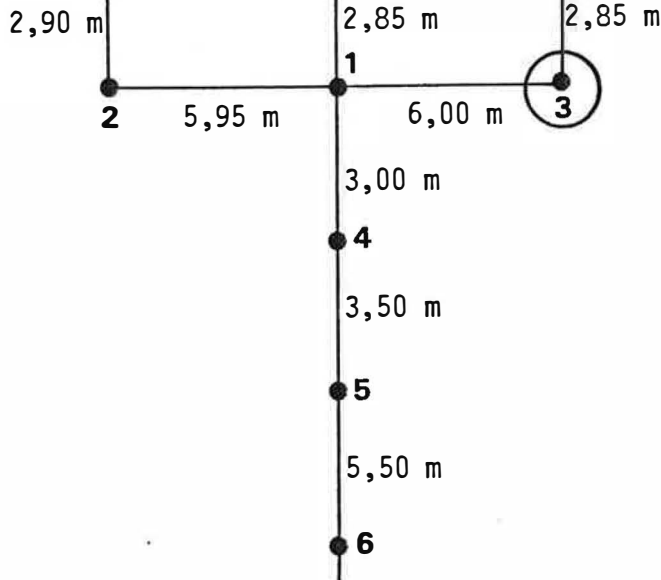
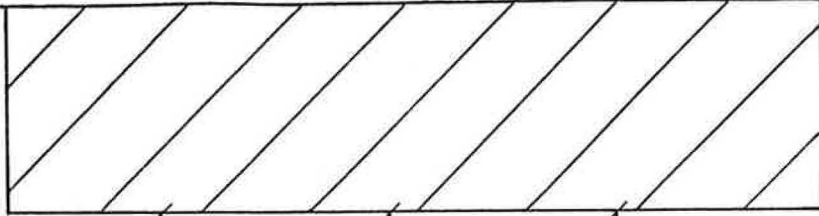
- Several screens in one borehole : yes/no
- Characteristics - riser pipes : PVC Ø 63 mm
- screens : PVC Ø 63 mm
- connections : no glue was used
- Bottom pipe (m) : \_\_\_\_\_
- Screen slot openings - type : Horizontal slots
- size (mm) : 0,3
- open area (%) : \_\_\_\_\_
- Centralizer(s) - place (m) : \_\_\_\_\_
- Filter-pack type and characteristics : gravel (0,7 - 1,25 mm)
- volume (l.) : 11
- Seals-type and characteristics : clay pellets "compactonit"
- volume (l.) : 8
- Borehole backfill material : \_\_\_\_\_
- Development - method : peristaltic pump
- date - duration (h) : 25/09/90 25'
- discharge (m<sup>3</sup>/h) : 0,5
- Finishing : PVC plug and covered with ground





LOCATION - CADASTRAL MAP : \_\_\_\_\_

Parcel nr. : \_\_\_\_\_



lithologic log screen (s)

filter pack

seal(s) grout

(b)

(f)



(g)



(k) clay



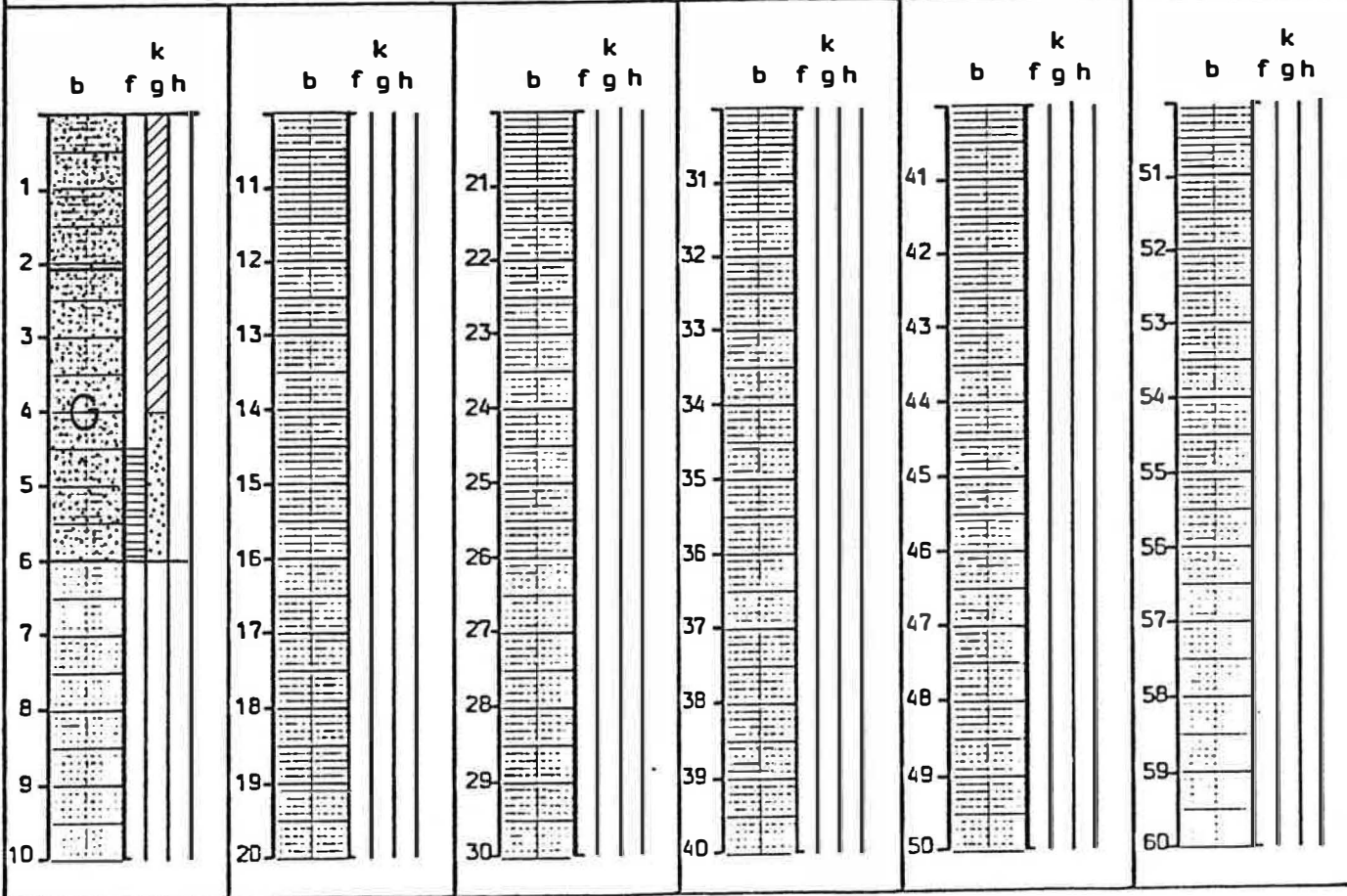
hydrogeological interpretation (h):

pervious

semi-pervious



impervious



RESEARCH : Reconnaissance drilling near the BETZ PLANT OWNER : A.I.B.  
 at Herentals

- DATE : 24 September 1990
  - DRILLING CY. : RUG - LTGH
  - DRILLING RIG by hand DRILLER : RB
  - DESCRIPTION OF CUTTINGS BY : IB
  - MAP N.G.I. Nr. : 16/7 GEOL./PEDOL. MAP Nr. : 45W
  - MUNICIPALITY : Herentals NIS-CODE : \_\_\_\_\_
  - X = \_\_\_\_\_ Y = \_\_\_\_\_ ZMV = \_\_\_\_\_ (m TAW)  
 (LAMBERT-COORDINATES) ZMV\* = +14,5 (m TAW)
- (ZMV = ground level (measured); ZMV\* = ground level (estimated))

DRILLING METHOD	Ø (mm)	DEPTH (in m)				
		from - to	from - to	from - to	from - to	from - to
Hand auger	60	0.0 - 3.1				
Hand-rotary	95	3,1 - 6,0				

- DRILLING MUD : \_\_\_\_\_ CONSUMPTION (l) : \_\_\_\_\_
- BOREHOLE LOG(S) : \_\_\_\_\_

screen nr.	NR.	DFB	DFO	ZMP	ZMP*	GWDP	L	ST	P
F1		4,5	6,0		+14,5	4,090	1		1
F2									
F3									

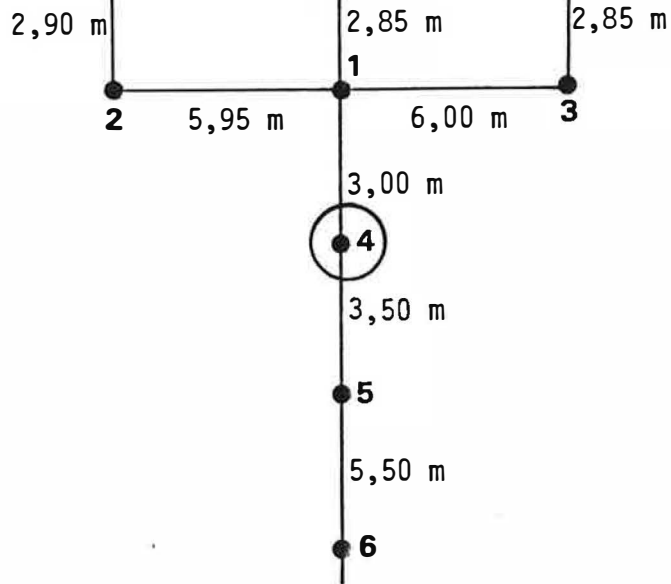
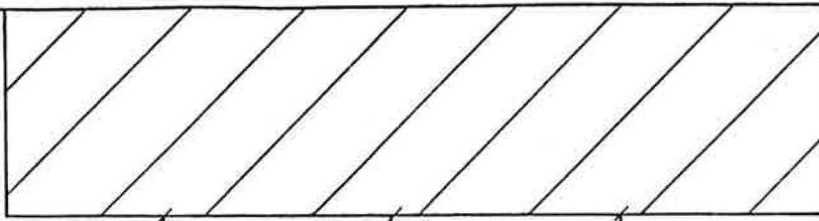
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- ST = Stratigraphy (conform to legend LTG)
- P = 1=Piezometer; 2=Observation well; 3=Dugged well; 4=Pumping well

- Several screens in one borehole : yes/no
- Characteristics - riser pipes : PVC Ø 63 mm
- screens : PVC Ø 63 mm
- connections : no glue was used
- Bottom pipe (m) : \_\_\_\_\_
- Screen slot openings - type : Horizontal slots
- size (mm) : 0,3
- open area (%) : \_\_\_\_\_
- Centralizer(s) - place (m) : \_\_\_\_\_
- Filter-pack type and characteristics : gravel (0,7 - 1,25 mm)
- volume (l.) : 11
- Seals-type and characteristics : clay pellets "compactonit"
- volume (l.) : 8
- Borehole backfill material : \_\_\_\_\_
- Development - method : peristaltic pump
- date - duration (h) : 25/09/90 20'
- discharge (m<sup>3</sup>/h) : 0,1
- Finishing : PVC plug and covered with ground



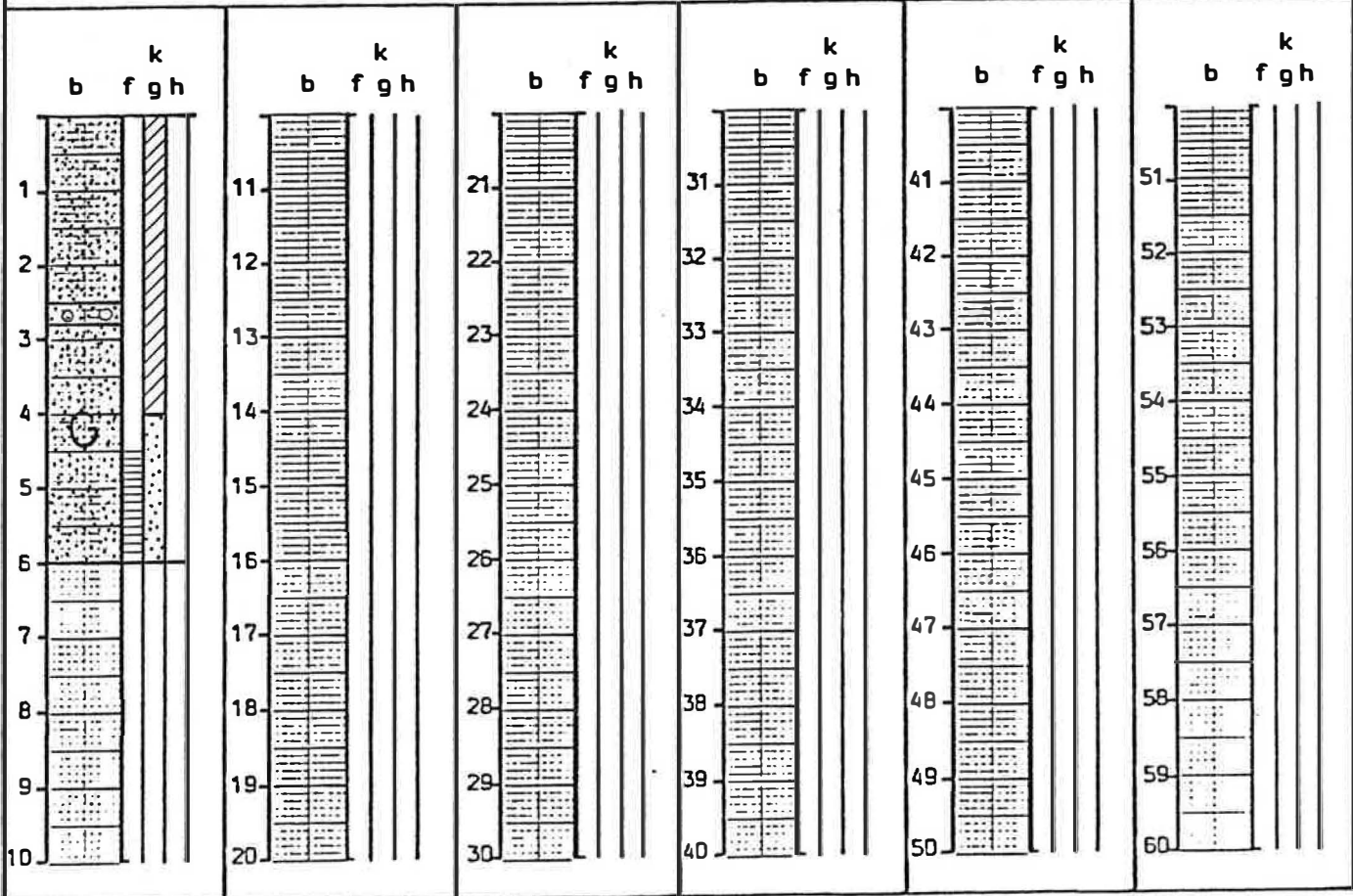
LOCATION - CADASTRAL MAP : \_\_\_\_\_

Parcel nr. : \_\_\_\_\_



lithologic log screen (s) filter pack seal(s) grout   
 (b) (f) (g) (k) clay

hydrogeological interpretation (h): pervious semi-pervious impervious



RESEARCH : Reconnaissance drilling near the BETZ PLANT OWNER : A.I.B.  
 at Herentals

- DATE : 24 September 1990
  - DRILLING CY. : RUG - LTGH
  - DRILLING RIG : by hand DRILLER : RB
  - DESCRIPTION OF CUTTINGS BY : IB
  - MAP N.G.I. Nr. : 16/7 GEOL./PEDOL. MAP Nr. : 45W
  - MUNICIPALITY : Herentals NIS-CODE : \_\_\_\_\_
  - X = \_\_\_\_\_ Y = \_\_\_\_\_ ZMV = \_\_\_\_\_ (m TAW)  
 (LAMBERT-COORDINATES) ZMV\* = +14,5 (m TAW)
- (ZMV = ground level (measured); ZMV\* = ground level (estimated))

DRILLING METHOD	Ø (mm)	DEPTH (in m)				
		from - to	from - to	from - to	from - to	from - to
Hand auger	60	0,0 - 3,1				
Hand-rotary	95	3,1 - 6,0				

- DRILLING MUD : \_\_\_\_\_ CONSUMPTION (l) : \_\_\_\_\_
- BOREHOLE LOG(S) : \_\_\_\_\_

screen nr.	NR.	DFB	DFO	ZMP	ZMP*	GWDP	L	ST	P
F1		4,5	6,0		+14,5	3,765	1		1
F2									
F3									

- NR = Number
- DFB = Depth to top of screen (m)
- DFO = Depth to bottom of screen (m)
- ZMP = Level measuring point (m TAW)
- ZMP\* = Estimated level of mark (m TAW)
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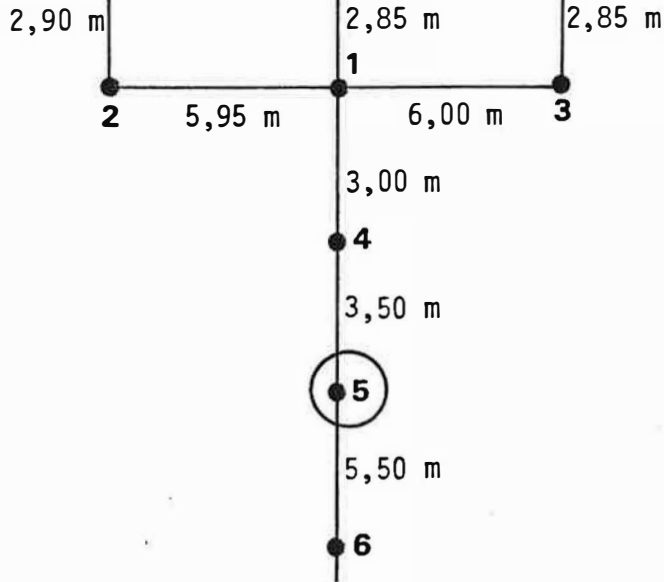
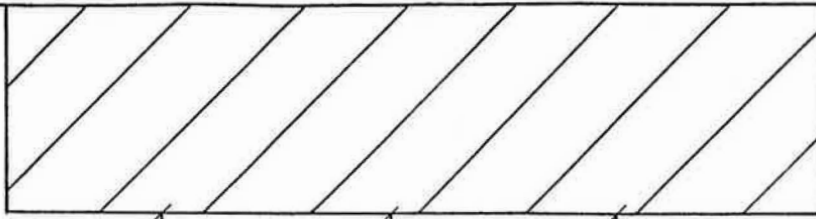
- Several screens in one borehole : yes/no
- Characteristics - riser pipes : PVC Ø 63 mm
- screens : PVC Ø 63 mm
- connections : no glue was used
- Bottom pipe (m) : \_\_\_\_\_
- Screen slot openings - type : Horizontal slots
- size (mm) : 0,3
- open area (%) : \_\_\_\_\_
- Centralizer(s) - place (m) : \_\_\_\_\_
- Filter-pack type and characteristics : gravel (0,7 - 1,25 mm)
- volume (l.) : 11
- Seals-type and characteristics : clay pellets "compactonit"
- volume (l.) : 8
- Borehole backfill material : \_\_\_\_\_
- Development - method : peristaltic pump
- date - duration (h) : 25/09/90 20'
- discharge (m<sup>3</sup>/h) : 0,4
- Finishing : PVC plug and covered with ground





LOCATION - CADASTRAL MAP : \_\_\_\_\_

Parcel nr. : \_\_\_\_\_



lithologic log screen (s)

filter pack

seal(s) grout

(b)

(f)

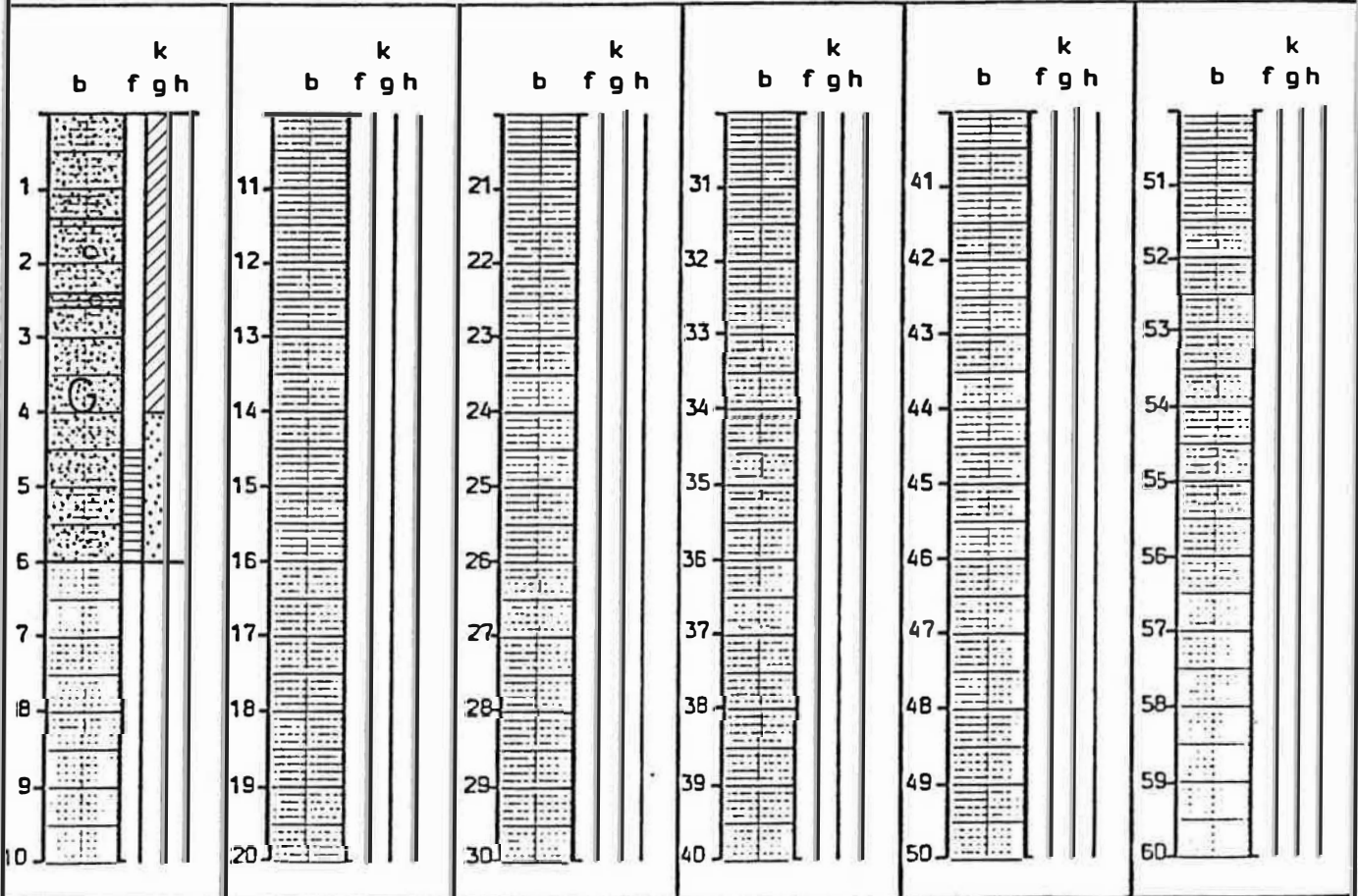
(g)

(k) clay

hydrogeological interpretation (h): pervious

semi-pervious

impervious





RESEARCH : Reconnaissance drilling near the BETZ PLANT OWNER : A.I.B.  
 at Herentals

- DATE : 24 September 1990
  - DRILLING CY. : RUG - LTGH
  - DRILLING RIG : by hand DRILLER : RB
  - DESCRIPTION OF CUTTINGS BY : IB
  - MAP N.G.I. Nr. : 16/7 GEOL./PEDOL. MAP Nr. : 45W
  - MUNICIPALITY : Herentals NIS-CODE : \_\_\_\_\_
  - X = \_\_\_\_\_ Y = \_\_\_\_\_ ZMV = \_\_\_\_\_ (m TAW)  
 (LAMBERT-COORDINATES) ZMV\* = +14,5 (m TAW)
- (ZMV = ground level (measured); ZMV\* = ground level (estimated))

DRILLING METHOD	Ø (mm)	DEPTH (in m)				
		from - to	from - to	from - to	from - to	from - to
Hand auger	60	0,0 - 3,1				
Hand-rotary	95	3,1 - 6,0				

- DRILLING MUD : \_\_\_\_\_ CONSUMPTION (l) : \_\_\_\_\_
- BOREHOLE LOG(S) : \_\_\_\_\_

screen nr.	NR.	DFB	DFO	ZMP	ZMP*	GWDP	L	ST	P
F1		4,5	6,0		+14,5	4,150	1		1
F2									
F3									

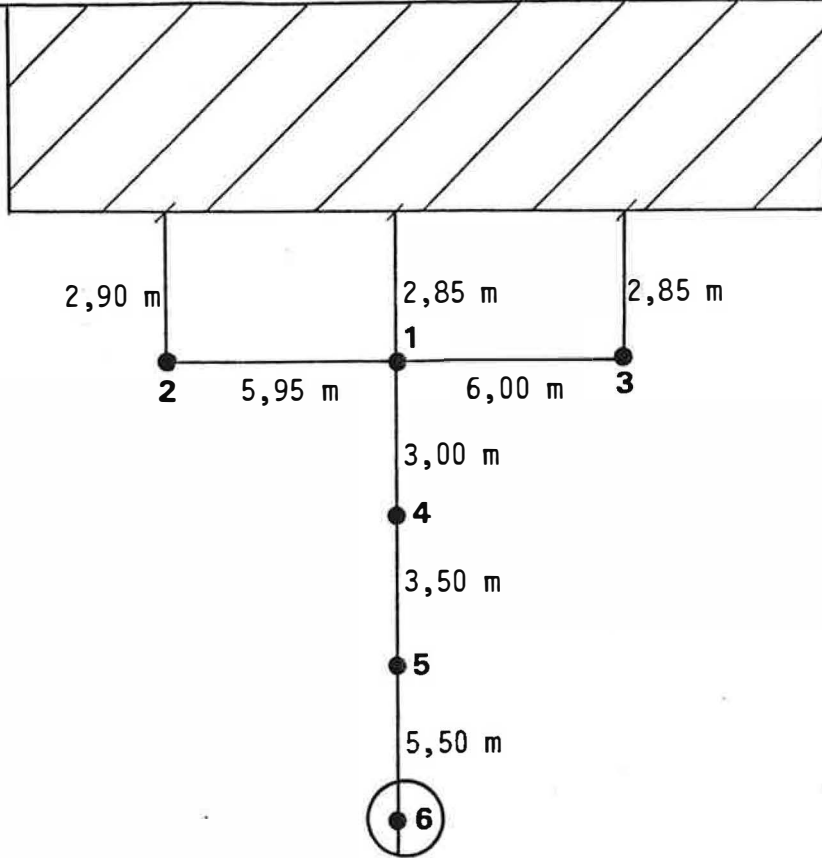
- NR = Number
- DFB = Depth to top of screen (m)
- DFO = Depth to bottom of screen (m)
- ZMP = Level measuring point (m TAW)
- ZMP\* = Estimated level of mark (m TAW)
- GWDP = Groundwater depth below mark
- L = Type of aquifer : 1 = phreatic; 2 = non phreatic
- ST = Stratigraphy (conform to legend LTG)
- P = 1=Piezometer; 2=Observation well; 3=Dugged well; 4=Pumping well

- Several screens in one borehole : yes/no
- Characteristics - riser pipes : PVC Ø 63 mm
- screens : PVC Ø 63 mm
- connections : no glue was used
- Bottom pipe (m) : \_\_\_\_\_
- Screen slot openings - type : Horizontal slots
- size (mm) : 0,3
- open area (%) : \_\_\_\_\_
- Centralizer(s) - place (m) : \_\_\_\_\_
- Filter-pack type and characteristics : gravel (0,7 - 1,25 mm)
- volume (l.) : 11
- Seals-type and characteristics : clay pellets "compactonit"
- volume (l.) : 8
- Borehole backfill material : \_\_\_\_\_
- Development - method : peristaltic pump
- date - duration (h) : 25/09/90 25'
- discharge (m<sup>3</sup>/h) : 1
- Finishing : PVC plug and covered with ground



LOCATION - CADASTRAL MAP : \_\_\_\_\_

Parcel nr. : \_\_\_\_\_



lithologic log screen (s)

filter pack

seal(s) grout

(b)

(f)

(g)

(k) clay

hydrogeological interpretation (h): pervious

semi-pervious

impervious

