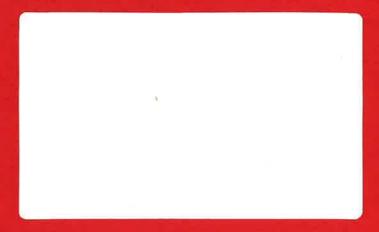
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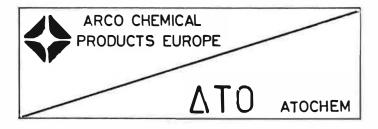
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ADDITIONAL HYDROGEOLOGICAL SURVEY
OF THE ARCO CHEMICAL
PRODUCTS EUROPE PLANT SITE
AT RIEME (BELGIUM)



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CONTENTS

| 1. | INTR | ODUCTION | 1 | | | | | | | |
|----|---------------|---------------------------------------------|-----|--|--|--|--|--|--|--|
| 2. | GEOLOGY | | | | | | | | | |
| 3. | DRILLING | | | | | | | | | |
| | 3.1. | General | 4 | | | | | | | |
| | 3.2. | Rotary drilling | 4 | | | | | | | |
| | 3.3. | Cable-tool drilling | 5 | | | | | | | |
| | 3.4. | Special cable-tool drilled holes | 9 | | | | | | | |
| | 3.5. | Cross section B-B' | 1 3 | | | | | | | |
| 4. | GROU | NDWATER FLOW | 14 | | | | | | | |
| | 4.1. | General | 1 4 | | | | | | | |
| | 4.2. | Water-level measurements | 14 | | | | | | | |
| | 4.3. | Head distribution in the KZ2 and the KZ1 | 14 | | | | | | | |
| ć | aquif | er | | | | | | | | |
| 5. | PUMPING TESTS | | | | | | | | | |
| | 5.1. | Conduction of the pumping tests | 18 | | | | | | | |
| | 5.2. | Interpretation by means of an inverse model | 20 | | | | | | | |
| | 5.3. | Results | 22 | | | | | | | |
| | 5.4. | Conclusions | 25 | | | | | | | |
| 6. | GROUI | NDWATER QUALITY | 27 | | | | | | | |
| | 6.1. | General | 27 | | | | | | | |
| | 6.2. | Sampling | 27 | | | | | | | |
| | | Analysis | 29 | | | | | | | |
| | | Discussion | 29 | | | | | | | |
| | 6.5. | Conclusions | 35 | | | | | | | |
| 7. | | EMATICAL MODEL | 49 | | | | | | | |
| | | General | 49 | | | | | | | |
| | 7.2. | Applied model | 49 | | | | | | | |
| | | Simulations in a horizontal plane | 50 | | | | | | | |
| | | Simulations in a vertical section | 63 | | | | | | | |
| | | Conclusions | 65 | | | | | | | |
| | | | 0.5 | | | | | | | |
| AP | PENDI | X 1 - Borehole records situation plans | | | | | | | | |

APPENDIX 2 - Geometric characteristics of the observation wells

1. INTRODUCTION

By its letter of June 15th 1987 ATOCHEM instructed the Laboratory of Applied Geology and Hydrogeology of the State University Ghent to carry out an additional hydrogeological investigation at the Rieme plant site. The test programme was outlined during a meeting held at O.V.A.M. and the State University Ghent.

The hydrogeological investigation was to include

- 1. Boreholes and lithological description
- 2. Sampling (ground and water)
- 3. Pumping tests
- 4. Mathematical modelling of groundwater flow and quality

The investigation started on June 30th 1987. The present report relates its actions and results. The following subjects are treated successively: geology, drilling, groundwater flow, pumping tests, groundwater quality, mathematical model.

2. GEOLOGY

A detailed description of the geology of the area was given in the 1986 report TGO 86/13(1) "Hydrogeological survey of the ARCO CHEMICAL PRODUCTS EUROPE plant site at Rieme (Belgium)" by the Laboratory of Applied Geology and Hydrogeology (Prof. Dr. W. De Breuck).

The regional geology is given in figure 1.

The subsoil of the northern part of the Province of East-Flanders is characterised by the presence of a thick complex of Tertiary formations monoclinally dipping in a northeastern direction, covered by Quaternary deposits.

The larger part of the Quaternary deposits have been laid down in periglacial conditions during the Pleistocene. Hydrogeologically they consist of a continuous sandy top layer (KZ2) on a semi-pervious silty layer (KL) resting upon a continuous sandy layer (KZ1).

The Tertiary substratum is formed by alternating pervious, semi-pervious and impervious layers. They are indicated on the geological section (fig. 3) as s3, Le-P, Yd (pervious), s2, s1, Plc (semi-pervious), and a3, a2, and al (impervious).

The layers to be considered under the Rieme plant are :

KZ2: unconfined aquifer, sandy

KL : confining layer, silty

KZ1: semi-confined aquifer, sandy

a3 : impervious substratum, clay

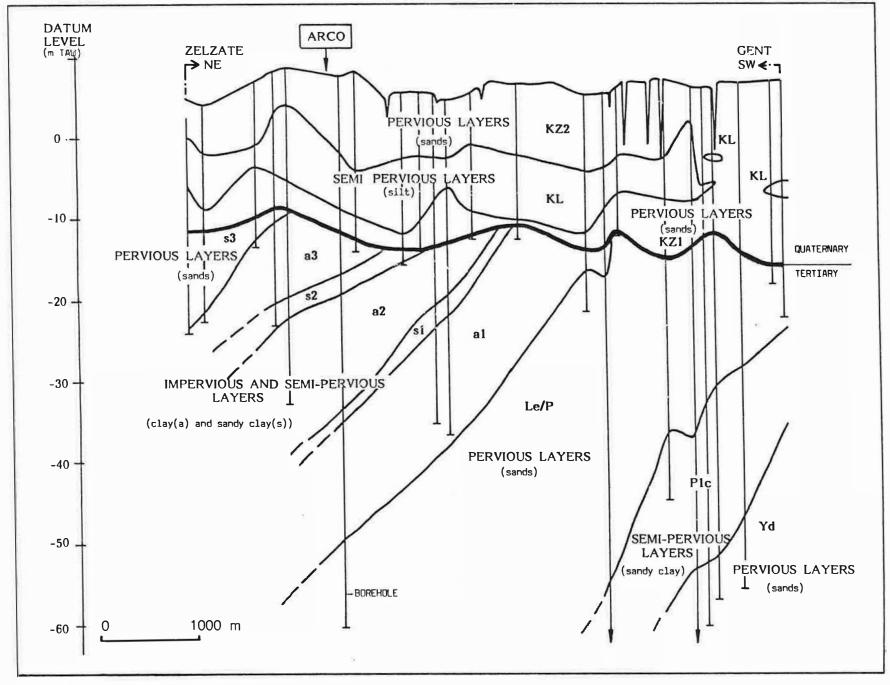


Fig. 1 - Geologic cross section Gent-Zelzate (DE BREUCK, VAN BURM & VAN CAMP, 1983)

3. DRILLING

3.1. General

According to the proposal several boreholes were made:

- seven rotary-drilled holes of variable depth for installation of screens to be used for the pumping tests
- eleven cable-tool drilled ("dry") holes to the bottom of the KZ2 layer
- three special cable-tool drilled holes to the bottom of the KZ1 layer.

The location of every borehole was determined as well as the elevation of the site and the reference points on the observation wells (appendices 1 and 2).

A general lay-out is given in map 1. On this map the formerly drilled holes are also indicated.

The borelogs are given in appendix 1.

3.2. Rotary drilling

In the northern part of the Rieme plant seven holes were rotary drilled (with normal circulation of clean water) to install

- two wells (4D2, 4D3) in KZ1
- three wells (4S1, 4S2, 4S3) in KZ2
- one well (4S4) near the water table (also in KZ2)
- one well (4S5) in KL

referring to the datum level of the National Geographical Institute (NGI)

The well 4S1 is pumping well in KZ2.

The arrangement is outlined in figure 2 and the construction is shown in the figures 3 and 4.

The wells (except 4S1) consist of a PVC riser pipe (DYKA PVC NBN T42-111 PN10 φ 63 mm) and a PVC screen (mostly 2 m) (VAN RYSWYCK - VEGHEL BV HOLLAND φ 63 mm NP10). The well-diameter of 4S1 is 125 mm.

The gravel pack around all the screens is made of coarse sand (0,7 - 1,25 mm). The clay seals at the level of the KL layer and above the gravel packs are made of DURANIT or COMPACTONITE clay pellets to prevent downward seepage along the borehole.

3.3. Cable-tool drilling

Eleven holes (1Sbis, 2Sbis, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S) have been made by augering and bailing (figure 5). The holes attained the top of the semi-pervious KL layer. They had a diameter of 168 mm. During the drilling no water was added to ensure uncontaminated sampling and accurate description. During the drilling and in between separate drillings the auger, the bailer and the casing were rinsed with clean water.

During the drilling of the holes 1Sbis and 2Sbis no samples were taken, since this was already done during the drilling of 1Dbis and 2D.

Samples retrieved from the other boreholes were described on the spot. This description included colour, grain size, silt and clay content, inclusions and odour (appendix 1). The description was made according to the classification used by the Laboratory of Applied Geology and Hydrogeology, which is

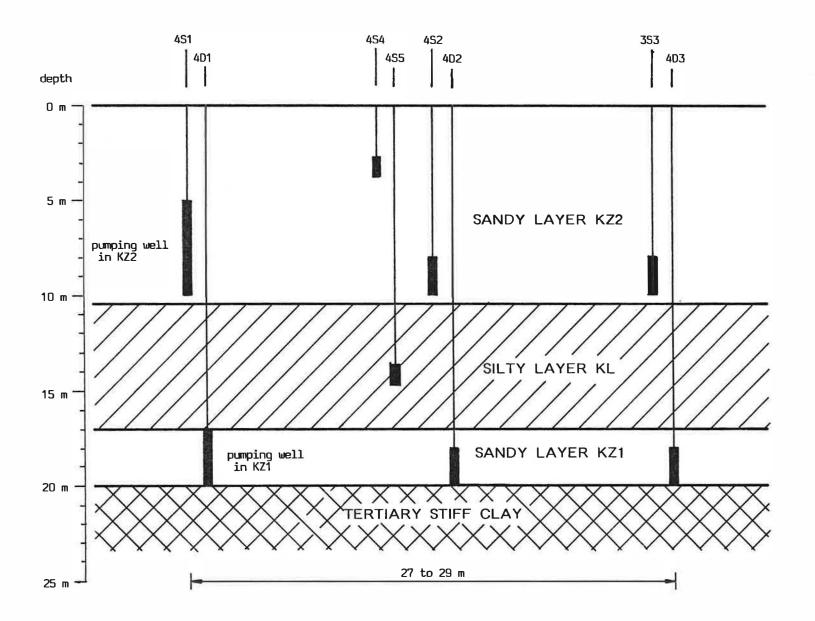


Fig. 2 - Wells for pumping tests.

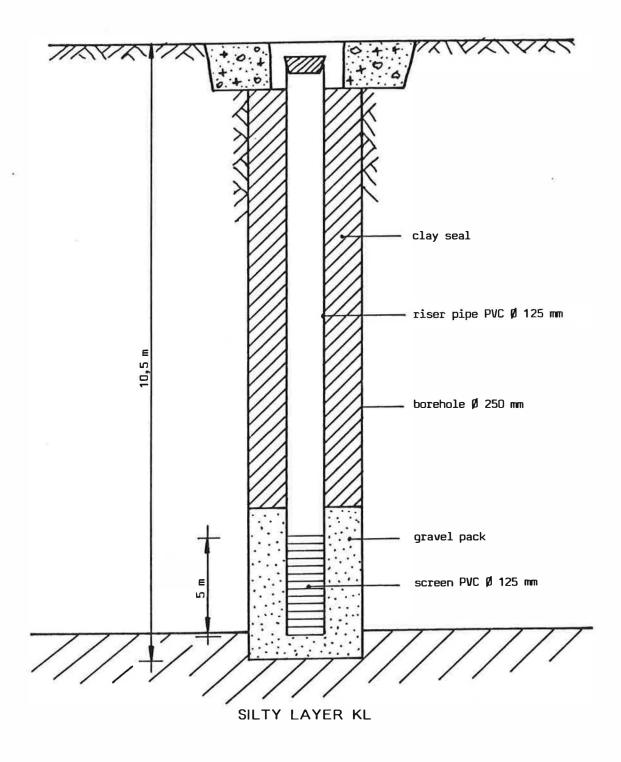


Fig. 3 - Well 4S1

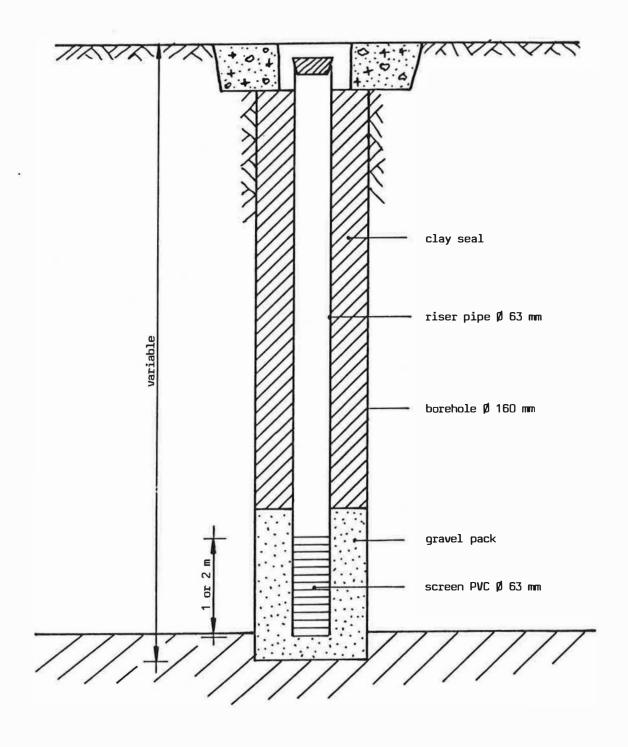


Fig. 4 - Wells 4S2, 4S3, 4S5, 4D2, 4D3

based upon the classification of the Department of Public Works.

Samples, taken every m, have been packed in 1L glass containers. The samples that were not analyzed are still stored at a temperature of 2 to 4 $^{\circ}\text{C}$.

In each borehole a 2 m PVC screen (ϕ 63 mm) was installed at the bottom of KZ2. The borehole completion is shown in figure 5.

3.4. Special cable-tool drilled holes

Three boreholes (1Dbis, 2D and 4D1) in the KZ1 layer are of a special construction (figures 6 and 7).

First, the holes were drilled with a large diameter (267 mm) into the upper part of the semi-pervious layer KL. Then a protective casing (PVC DYKA-RIOOL 200 x 3,90) was installed and pushed 0,5 to 1 m deeper into the KL layer. Around this casing, bentonite grouting was inserted. The proportion bentonite to cement was about 1/3.

After 1 day stabilisation of the bentonite + cement grout, drilling was continued with smaller diameter (168 mm) trough the inside of the protective casing until the bottom of the pervious layer KZl was reached. A screen of φ 63 mm (1Dbis, 2D) or a pumping well of φ 125 mm (4Dl) was installed. Around the screen a gravel pack was placed with a clay seal above it. Before the equipment of the pumping well 4Dl the hole was jetted with clean water to flush the hole and to allow a better screen development.

The installation of a protective casing enclosed in a bentonite-cement seal and filled with a clay seal prevents all

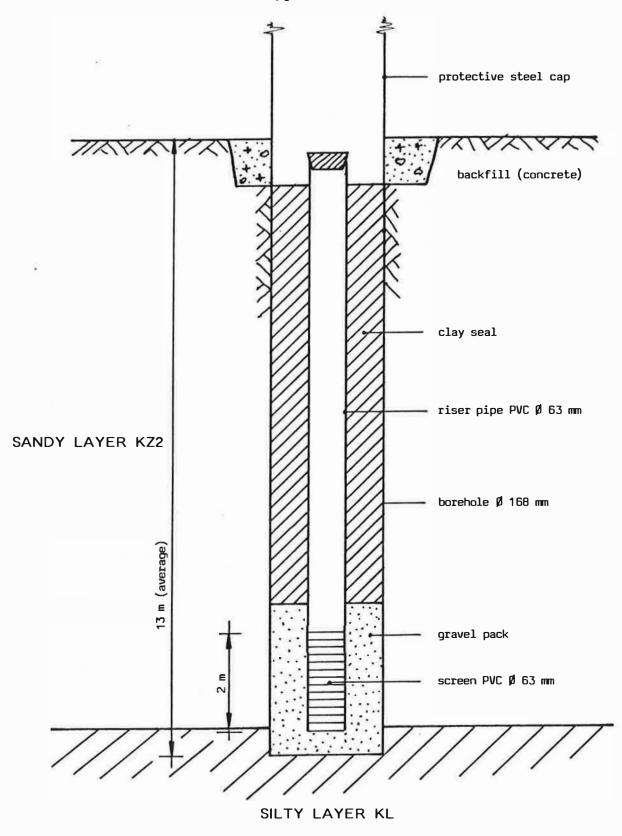


Fig. 5 - Wells $6S \rightarrow 14S$ and 2Sbis, 1Sbis

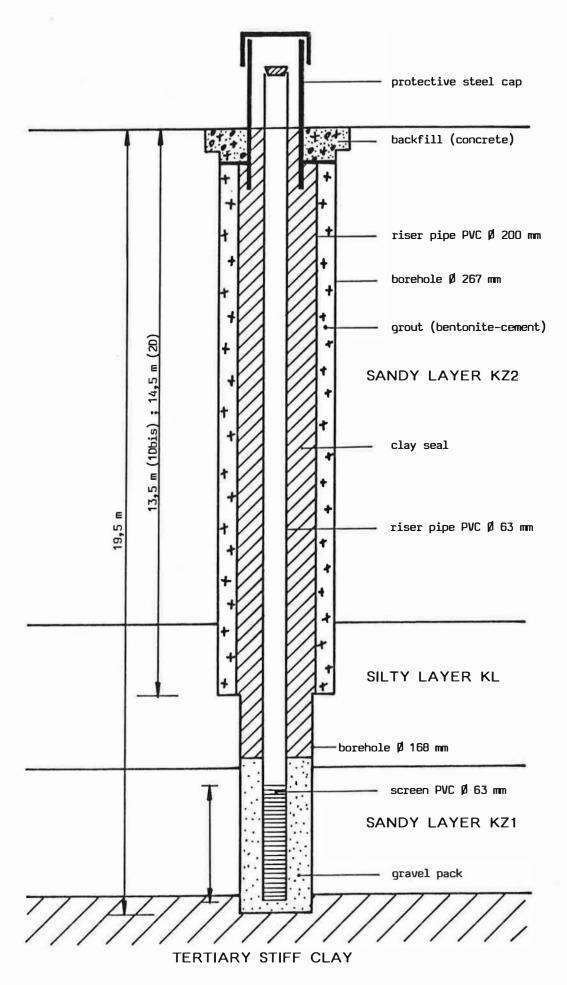


Fig. 6 - Wells 2D and 1Dbis

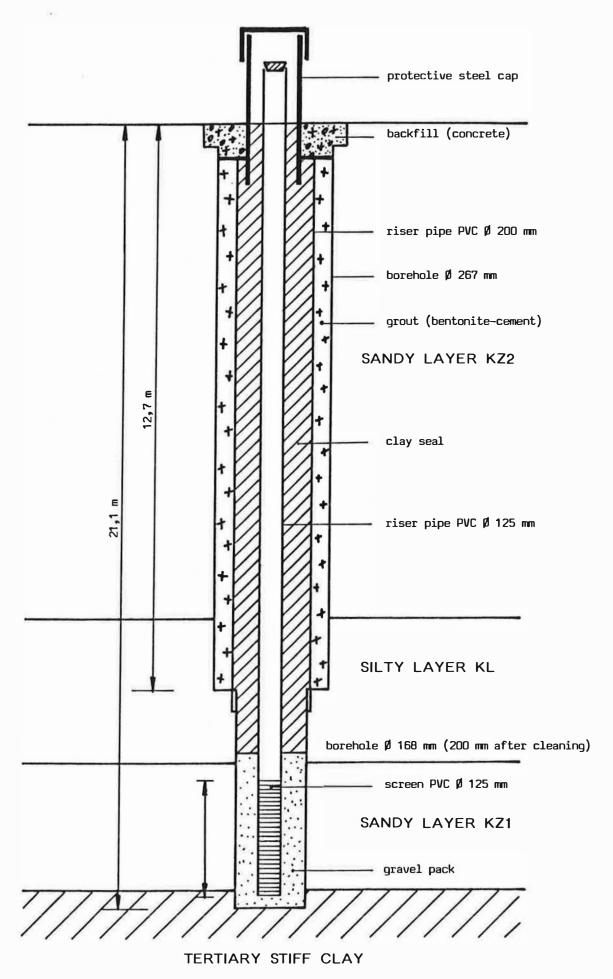


Fig. 7 - Well 4D1

contamination from the KZ2 to the KZ1 and vice versa during drilling and sampling.

3.5. Cross-section B-B'

Based upon the new borelogs a geological cross-section has been drawn. The layers have already been discussed in a previous report of the Laboratory of Applied Geology and Hydrogeology.

4. GROUNDWATER FLOW

4.1. General

The groundwater flow pattern is based on the water level measurements in the previous (1986) and recently (1987) drilled wells. A characterisation of these wells is given in appendix 2.

4.2. Water-level measurements

The water levels were measured on August 5th, 1987 (table 1).

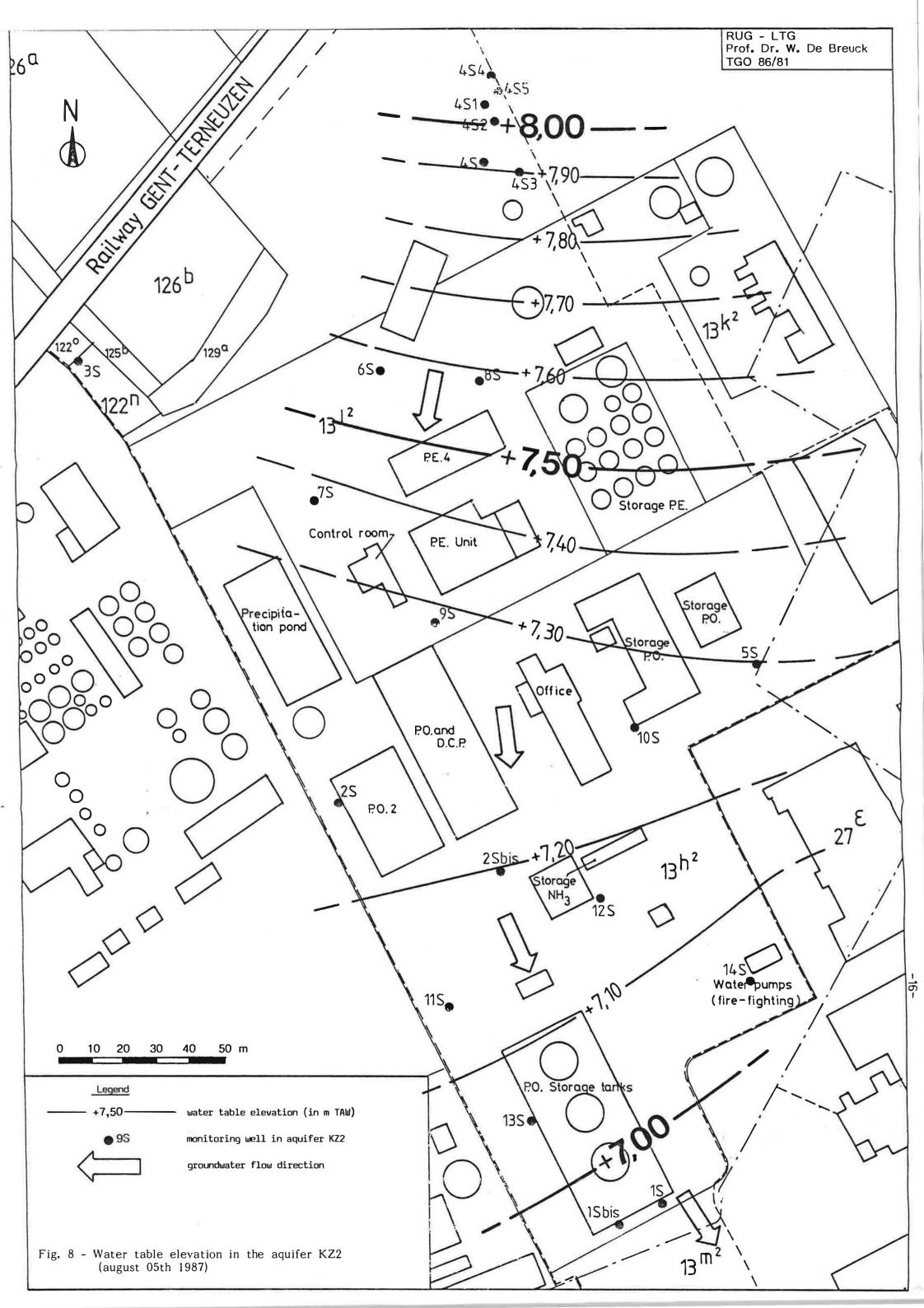
4.3. Head distribution in the KZ2 and the KZ1 aquifers

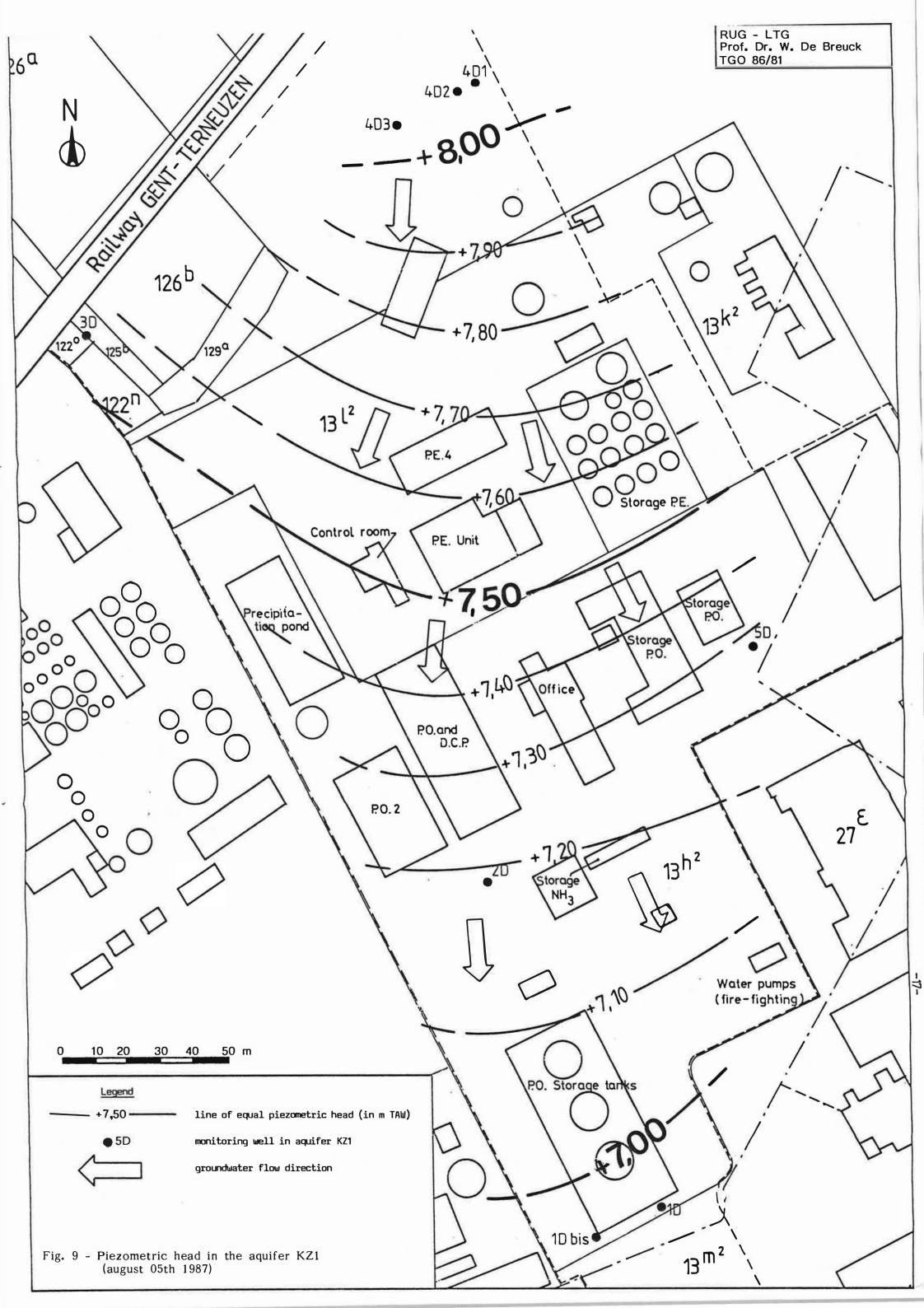
The figures 8 and 9 are showing the contours of the heads on August 5th, 1987. The flow direction in both aquifers is from north to south and southeast in the southern part of the area and from north to south and southwest in the northern part of the area. The heads are very similar to those of June 1986, but in the contours the bend to the southeast and the southwest is more pronounced. The groundwater flow follows the general pattern from the RHONE-POULENC CHEMIE gypsum pile towards the canal.

The head difference between KZ2 and KZ1 is small and attains a maximum in the northwestern part of the area, which is likely to be influenced by the drainage ditch around the RHONE-POULENC CHEMIE gypsum pile.

Table 1. Heads in the KZ2 and the KZ1 aquifers and in the KL semi-pervious layer on August 5th, 1987.

| Well nr. | Head |
|-------------|------------------------------|
| well mr. | (m versus datum NGI = m TAW) |
| KZ2 la | ver |
| KBZ Tu | YCI |
| 1S | + 6,972 |
| 1Sbis | + 6,931 |
| 2Sbis 3S | + 7,195 + 6,870 |
| 4S1 | + 8,059 |
| 452 | + 8,025 |
| 4S3 | + 7,930 |
| 454 | + 8,056 |
| 5S 6S | + 7,312 + 7,593 |
| 7S | + 7,393 |
| 8S | + 7,584 |
| 9S | + 7,266 |
| 10S | + 7,257 |
| 11S 12S | + 7,140 + 7,131 |
| 135 | + 7,067 |
| 14S | + 7,040 |
| KL lay | yer |
| 455 | + 8,079 |
| KZ1 la | ayer |
| 1D | + 6,946 |
| 1Dbis | + 6,956 |
| 2D | + 7,161 |
| 3D 4D1 | + 7,458 + 8,071 |
| 4D1 4D2 | + 8,082 |
| 4D3 | + 8,087 |
| 5D | + 7,296 |
| | |





5. PUMPING TESTS

5.1. Conduction of the pumping tests

The pumping tests were conducted to determine the hydraulic characteristics of the layers which are used on their turn to calculate the groundwater flow velocity and to elaborate the mathematical model which calculates the distribution of the pollution.

Two pumping tests were executed. The configuration of the pumping and observation wells is indicated on figures 2 and 10.

During the first pumping test, carried out on July 8-9, 1987, water was extracted from the pumping well 4D1 (layer KZ1) with a constant discharge rate of 188,34 m³/d. The drawdowns were measured automatically in all the other wells at regular time intervals, following a logarythmic scale. The measuring was done by means of pressure transducers VEGA type 137.01 which can registrate a maximum change of 4 m water pressure head and have an accuracy of 0,1 %. A packer was placed above the pressure transducer to eliminate water flow from the observated well into the groundwater reservoir. Time and pressure drop were registrated on magnetic tape with the use of a measuring- and registration unit MESS & SYSTEMS TECHNIK, logmaster MDL 1000.

During the second pumping test, on July 13-14, 1987, water was extracted with a constant discharge rate of $30,884 \text{ m}^3/\text{d}$ out of the pumping well 4S1 with the layer KZ2. The drawdowns were measured in the same way as in the first pumping test.

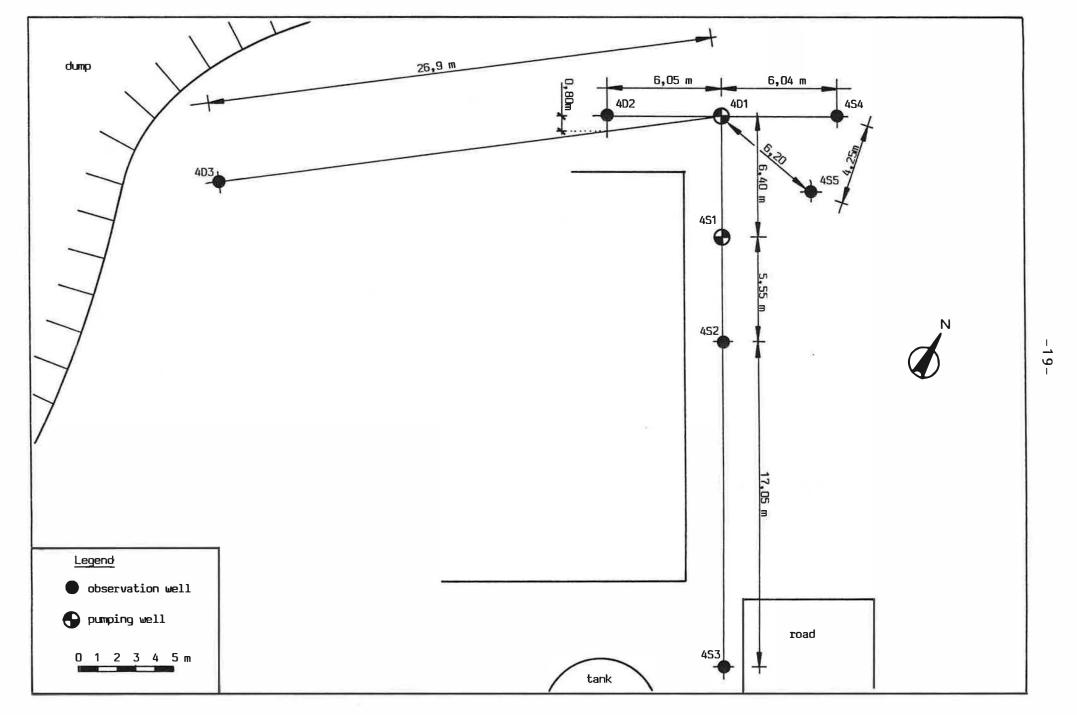


Fig. 10 - Location of wells for pumping tests.

5.2. Interpretation by means of an inverse model

By the application of an inverse model the hydraulic parameters are deduced from the observed drawdowns of the pumping tests. In this model the drawdowns are calculated by a finit-difference axial-symmetric model. By the minimization of the sum of the squares of the deviations between the calculated and the observed drawdowns one can deduce the values of the hydraulic parameters and their accuracies.

In the numerical model the groundwater reservoir is schematized in five different layers as shown in figure 11. The introduction of the thin layer 5 permits a treatment of the groundwater flow from the water table to the groundwater reservoir.

In the model each layer is subdivided in a number of coaxial rings. The axis of the rings coincides with the axis of the pumped well. The outer and inner boundary of two successive rings are formed by the same cylinder. The radii of the coaxial cylinders, that form the boundaries of the rings, increase logarythmically. The number of rings is chosen sufficiently large, so that there can occur no drawdown in all the layers at a corresponding large distance to the pumped well.

Every layer is characterized by a horizontal conductivity k and a specific elastic storage S'A. Between each two layers a hydraulic resistance c (this is the distance between the middle of the layers, divided by the vertical conductivity) has to be considered. By the introduction of firstly estimated values of these hydraulic parameters the drawdowns are calculated with the help of the numerical model which applies the law of Darcy and the continuity law. The calculated and the observed drawdowns are then compared. With the help of

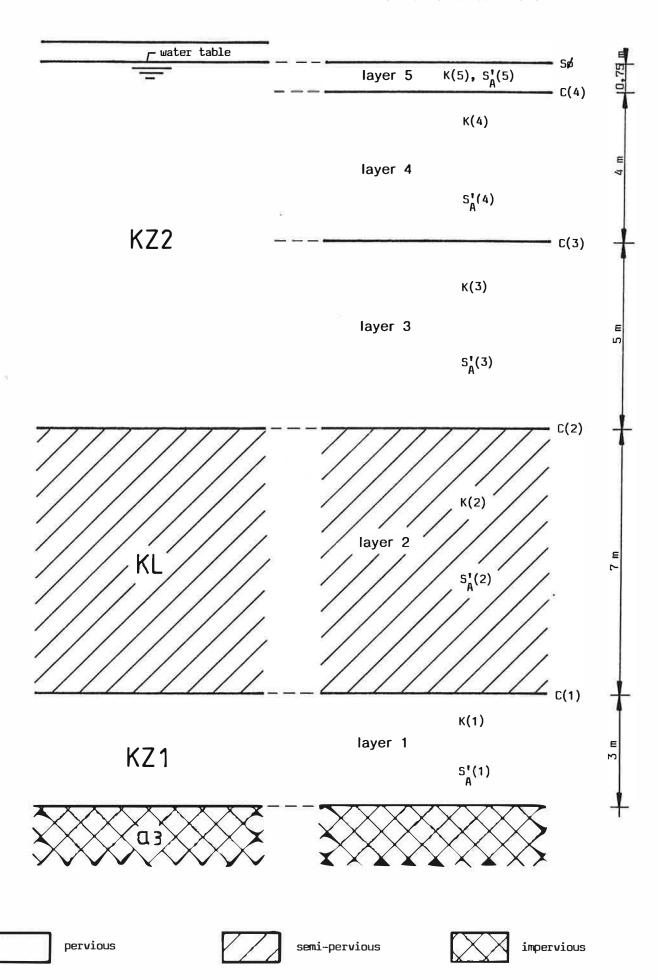


Fig. 11 - Schematization of the groundwater reservoir.

their differences and of the sensitivities of the drawdown to the hydraulic parameters, these paremeters are adjusted in such a way that the difference between observed and calculated drawdowns becomes smaller.

By the repeatedly application of this method the sum of the squares of the deviation between the observed and the calculated values is minimized. Once the minimum value of this sum is reached, one obtains the values of the hydraulic parameters. From the sensitivities and the remaining deviations between calculated and measured drawdowns the accuracy of the obtained values of the hydraulic parameters is deduced.

5.3. Results

The observed drawdowns of the two pumping tests are shown in time-drawdown and distance-drawdown curves by means of crosses (figures 12 and 13). The calculated drawdowns corresponding to the deduced values of the hydraulic parameters are represented in the same figures by the curves.

The deduced values of the hydraulic parameters are given, together with their accuracy factor in table 2. By the multiplication or division of the deduced value of the parameters by the accuracy factor one obtains respectively the upper or the lower limits of the confidence range with a probability of 98 %. The actual values are within this range. The more the accuracy factor approaches a value of 1, the higher the accuracy of the corresponding value.

From this table one can conclude that the horizontal conductivities of the pumped layers, k(1) and k(3) and the hydraulic resistandes c(1) and c(3) are very accurately known. These values, which result in the most important conductivity properties of the aquifers, are followed in accuracy by all

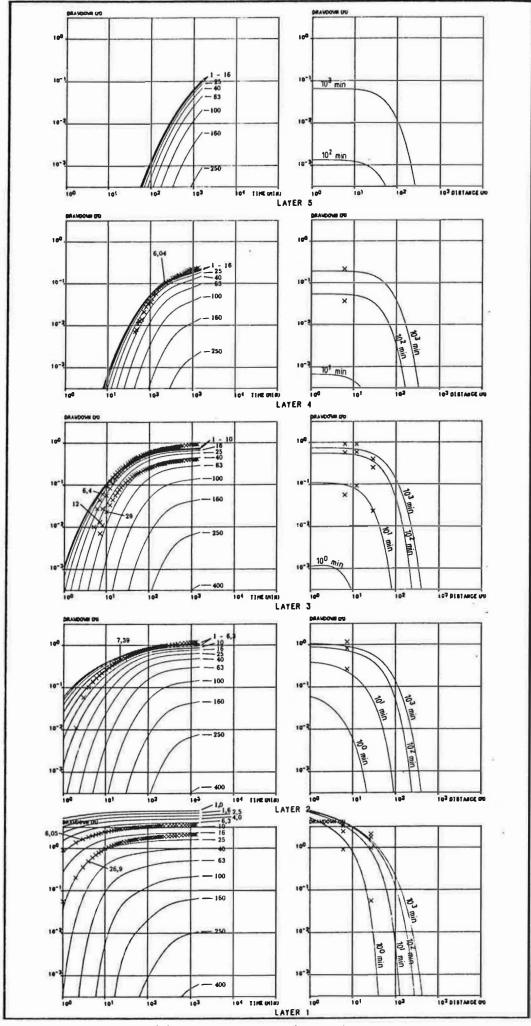


Fig. 12 - Observed (x) and calculated (curves) drawndowns during the pumping test in KZ1

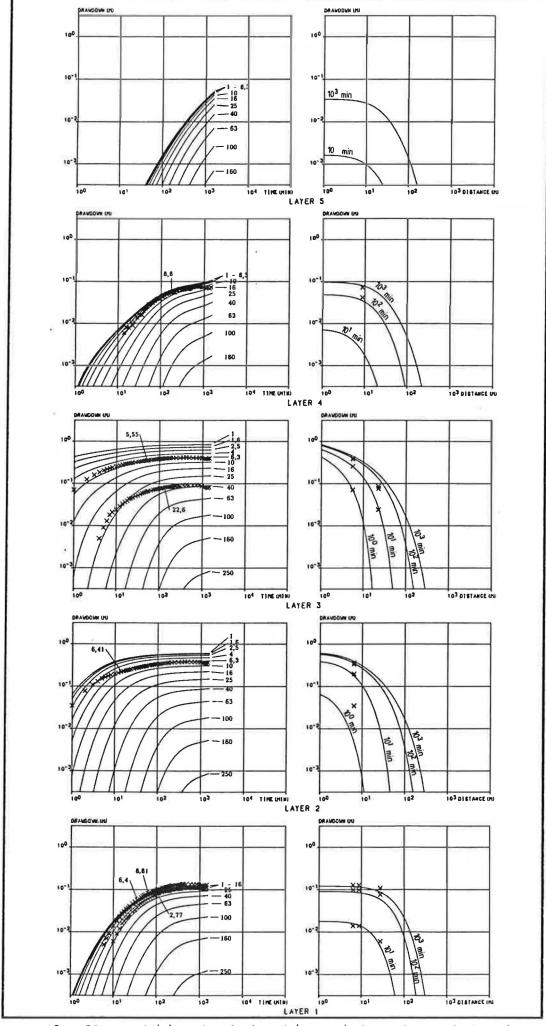


Fig. 13 - Observed (x) and calculated (curves) drawndowns during the pumping test in KZ2

the parameters who determine the elastic properties of the layers, namely $S'_{A}(3)$, $S'_{A}(1)$, $S'_{A}(2)$, $S'_{A}(4)$ and $S'_{A}(5)$. The accuracies of c(2) and c(4) are lower and those of the hydraulic conductivities of the two uppermost layers k(4) and k(5) and the storage coefficient near the water table S_{Φ} are very poor.

Table 2: Deduced values of the hydraulic parameters together with the factors which determine the upper and lower limit of the confidence band with a probability of 98 %.

| Hydraulic-parameter | Deduced volues | Accuracy Factor |
|---------------------|----------------|-----------------|
| k(1) | 5 m/d | 1,0568 |
| k(3) | 4,2 m/d | 1,0639 |
| c(1) | 71 d | 1,0659 |
| c(3) | 60 d | 1,0820 |
| S'A(3) | 1,4.10-4 m-1 | 1,1013 |
| S'A(1) | 4,1.10-5 m-1 | 1,1251 |
| S'A(2) | 6,2.10-5 m-1 | 1,1402 |
| S'A(4) and S'A(5) | 1,3.10-3 m-1 | 1,1520 |
| c(4) | 18 d | 1,1967 |
| c(2) | 4,9 d | 1,2190 |
| k(4) and k(5) | 1,25 m/d | 1,6998 |
| S _Φ | 0,064 | 1,9125 |

The deduced values for these three parameters can only be seen as an estimate. The horizontal conductivity of layer 2, k(2), does not influence enough the measured drawdowns so that its value can not be deduced from these measurements. The introduced value of 0,1 m/d is only a raw estimate.

5.4. Conclusion

The hydraulic properties of the lithostratigraphical units could be derived from the results of the pumping tests.

Layer KZ1 has at the pumping test site a rather small horizontal conductivity of 5m/d and a small specific elastic

storage of $4.1 * 10^{-5} m^{-1}$.

The layer KL has a vertical conductivity of 0,092 m/d (D(2)/(c(1)+c(2))) and a specific elastic storage of 6.2 * 10^{-5} m⁻¹. From the observed drawdown the horizontal conductivity of the layer KL can not be deduced .

The lower part of KZ2 has a horizontal conductivity of 4,2 m/d and a specific elastic storage of 1,4 * 10⁻⁵ m^{-1} . The upper part of KZ2 is less pervious. The horizontal conductivity is rawly deduced from the observed drawdowns. It has a value equal to 1,25 m/d. The vertical conductivity of the of part KZ2 is equal to 0,061 m/d upper (D(4)+D(5)/(c(3)+c(4)). The specific elastic storage of the upper part of KZ2 is rather large: $1.3 \times 10^{-3} \text{ m}^{-1}$. The storage coefficient near the watertable is estimated at 0,064.

6. GROUNDWATER QUALITY

6.1. General

The description of the water quality is based upon the new analyses.

The sampling of the groundwater was done by the Laboratory of Applied Geology and Hydrogeology, the analytical work by the Laboratory of Analytical and Agrochemistry and the Laboratory of Organic Chemistry of the Faculty of Agricultural Sciences, State University of Ghent. The analytical procedures are not discussed in this report.

6.2. Sampling

For the purpose of this study groundwater has been sampled from the previous and new observation wells. Samples were taken after purging minimum 10 well volumes. During flushing the resistivity, the temperature and the pH were monitored. In all cases samples were taken after stabilisation of those parameters.

In table 3 field measurements are given.

Table 3: Field measurements

| Nr new well | Specific conductance (µS/cm) | temperature (°C) | рН |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 1Sbis 1Dbis 2Sbis 2D 4S1 4D1 6S 7S 8S 9S 10S 11S 12S 13S 14S | 12.099 5.984 10.153 8.887 15.256 9.071 15.336 16.645 15.020 16.902 11.203 11.854 9.555 10.248 7.384 | 12,5 14,5 13,2 13,5 13,1 11,6 11,2 11,6 11,5 13,6 13,0 14,0 12,1 12,8 12,3 | 6,46 7,39 6,50 6,59 6,55 6,55 6,55 6,57 6,46 6,54 6,52 6,50 |
| Nr old well | Specific conductance (µS/cm) | temperature (°C) | рН |
| 1S 1D 3S 3D 5S 5D | 4.177 2.857 15.046 7.074 6.784 4,401 | 11,2 12,1 11,5 11,6 12,6 13,02 | 7,08 6,65 6,59 6,60 6,59 6,58 |

6.3. Analysis

The samples retrieved during the drilling were mixed ground/groundwater samples. All those taken from a depth of 6 m, and three samples taken from a depth of 11 m (2D, 4D1, 14S) were analysed for COD, 1,2-dichloropropane (1,2-DCPA) and bischloro-isopropylether (BCIE).

The groundwater samples from the observation wells with the screen at the bottom of the KZ2 aquifer, were analysed for COD, Zn, As, Ba, Se, Hg, Cl, SO₄, F, 1,2-DCPA and BCIE.

The groundwater samples from the deeper KZ1 aquifer were analysed for COD, 1,2-DCPA and BCIE.

The pH and the specific conductance of all samples were determined as well.

The results are shown in tables 4 and 5.

By GC-MS analysis on the groundwater samples 1Dbis, 1Sbis, 2Sbis, 2D, 14S and 10S other minor organic compounds were identified such as chloroform, trichloropropane and two chloropropane isomeres.

6.4. Discussion

The major part of the concentrations of the parameters were plotted on a map of the Rieme plant (figures 14 to 25). Where sufficient data were available, iso-concentration lines were drawn.

Table 4: Results of the analysis on the mixed ground/groundwater samples

| Nr Borehole | Depth (m) | рН | Specific | PARAMETER | | | | |
|-------------|-----------|------|----------------------|----------------|---------------|--------------|--|--|
| | | | conductance mS/cm | COD mg O2/1 | 1,2 DCPA mg/l | BCIE mg/l | | |
| 1Dbis | 6,5 | 7,60 | 4,91 | 33 | < 1 | < 1 | | |
| 2D | 6 | 5,95 | 9,08 | 5540 | 3620 | 205 | | |
| 4D1 | 6 | 6,32 | 15,08 | 45 | < 1 | < 1 | | |
| 6S | 6 | 6,30 | 23,40 | 265 | < 1 | < 1 | | |
| 7S | 6 | 7,15 | 16,10 | 310 | < 1 | < 1 | | |
| 88 | 6 | 6,44 | 15,90 | 320 | < 1 | < 1 | | |
| 98 | 6 | 6,48 | 13,40 | 66 | < 1 | < 1 | | |
| 108 | 6 | 6,66 | 4,36 | 123 | < 1 | < 5* | | |
| 118 | 6 | 7,20 | 4,21 | 156 | < 1 | 12 | | |
| 128 | 6 | 6,23 | 7,68 | 4100 | 753 | 234 | | |
| 138 | 6 | 7,43 | 1,81 | 74 | 35 | 64 | | |
| 148 | 6 | 7,20 | 2,82 | 90 | 57 | 5 | | |
| 2D | 11 | 6,30 | 10,91 | 845 | 2914 | 266 | | |
| 4D1 | 9 | 6,39 | 15,20 | 74 | < 1 | < 1 | | |
| 148 | 11 | 7,40 | 7,70 | 490 | 381 | 79 | | |

^{*} Detected but below limit of quantitative determination

Table 5 : Results of the analysis of the groundwater samples

| Nr. Piezo- meter | рН | Specific Conductance mS/cm | COD mgO2/1 | 1,2 DCPA | BCIE | Zn | As | Ba units a | Se 11 in mg/l | Нд | Cl | S04 | F4 |
|------------------------|----------|----------------------------------|---------------|----------|------|------|--------|---------------|------------------|---------|------|------|-------|
| Shallow | wells | KZ2 (11 m) | | | | | | | | | | | |
| 1Sbis | 6,29 | 12,20 | 270 | 650 | 143 | 0,06 | 0,108 | 220 | <0,025 | 0,0005 | 4281 | 2617 | <0,20 |
| 2Sbis | 6,37 | 10,47 | 1690 | 3094 | 263 | 0,33 | 0,271 | 199 | <0,025 | <0,0005 | 2096 | 4200 | <0,20 |
| 4S1 | 6,31 | 15,20 | 115 | < 1 | < 5* | 0,89 | <0,050 | 188 | <0,025 | 0,0009 | 5519 | 1862 | 2,63 |
| 6S | 6,31 | 15,62 | 33 | < 1 | < 5* | 0,13 | <0,050 | 218 | <0,025 | <0,0005 | 6103 | 1820 | <0,20 |
| 7 S | 6,41 | 17,08 | 82 | < 1 | < 5* | 0,19 | 0,065 | 210 | <0,025 | <0,0005 | 5316 | 3277 | <0,20 |
| 88 | 6,30 | 15,60 | 66 | 6 | < 5* | 0,84 | <0,050 | 221 | 0,065 | <0,0005 | 5908 | 1912 | <0,20 |
| 9S | 6,40 | 15,90 | 66 | < 1 | < 1 | 0,04 | 2,945 | 249 | <0,025 | <0,0005 | 3007 | 7357 | <0,20 |
| 10S | 6,45 | 11,18 | 82 | < 1 | < 5* | 0,21 | 0,345 | 195 | <0,025 | <0,0005 | 2344 | 4085 | <0,20 |
| 118 | 6,25 | 11,84 | 935 | 2481 | 337 | 0,21 | 0,212 | 192 | 0,028 | <0,0005 | 3538 | 3450 | <0,20 |
| 12S | 6,45 | 10,12 | 675 | 2834 | 343 | 0,09 | 0,340 | 186 | 0,104 | <0,0005 | 2132 | 4044 | <0,20 |
| 138 | 6,41 | 10,29 | 385 | 1173 | 240 | 0,84 | 0,108 | 180 | <0,025 | 0,0005 | 3246 | 2342 | <0,20 |
| 148 | 6,30 | 8,21 | 360 | 2757 | 160 | 0,07 | <0,050 | 171 | <0,025 | <0,0005 | 1079 | 4298 | <0,20 |
| Deep we | ells KZI | L | | | | | | | | | | | |
| 1Dbis | 7,09 | 6,05 | 197 | 167 | 35 | | | | | | | | |
| 2D | 6,38 | 9,01 | 820 | 3685 | 321 | | | | | | | | |
| 4D1 | 6,41 | 9,77 | 41 | < 1 | < 1 | | | | | | | | |

^{(*) =} detected but below limit for quantitative determination

6.4.1. Quality in the KZ2 aquifer

6.4.1.1. At 6 m depth

The results of the analyses of the ground/groundwater samples are shown in table 4. The conductance is very high in 6S (23.400 μ S/cm). Generally the higher values are in the north; they decrease towards the south.

The COD shows very high values at the site of the former P.O.-production plant. Figure 14 shows a plume with an initial concentration of at least 5500 mg O_2/l , decreasing over a short distance to 1000 mg O_2/l . The background for the area seems to be below 100 mg O_2/l , which suggests the presence of another but smaller pollution, directly north of the P.E.-unit, at the border of the local gypsum dump.

The iso-concentration lines of 1,2-DCPA run parallel to those of the first, highest COD-pollution plume (figure 15). They attain at least 3600 mg/l at the former P.O.-production unit and form a very similar plume that extends in a southeasterly direction to the well 14S.

BCIE is found in the same part of the area as 1,2-DCPA (figure 16). It also shows a plume with a maximum concentration of at least 300 mg/l, extending in a southeasterly direction.

6.4.1.2. At 11 m depth

The results of the analyses of the groundwater samples taken at the bottom of the KZ2 aquifer are shown in table 5. Results on the ground/groundwater samples are shown in table 4.

6.4.1.2.1. Groundwater samples

The pH of the groundwater samples is quite normal. The conductance, on the contrary, is extremely high (figure 17). In the northern part of the area, which is clearly influenced by water percolating trough the RPC gypsum pile a value of about seems to be average for the groundwater. Within this part there is a zone with a higher conductance around wells 7S and 9S. A front zone with values of 15.000 to 12.000 $\mu S/cm$ separates the northern from the southern part of the area. In the southern zone the conductance decreases from northwest to southeast, to a value of about 8200 $\mu S/cm$ in well 14S. The conductivities as measured in the field (table 2) are very similar to those measured in the laboratory.

The temperature of the groundwater (figure 18) is relatively high in wells 9S, 10S, 2Sbis and 11S. Higher temperatures may indicate pollution.

The COD of the groundwater samples is lower than those of the ground/groundwater samples (figure 19). The background value on the site seems to be below $100 \text{ mg } 0_2/1$. A pollution plume is formed, with a maximal concentration of at least $1690 \text{ mg} 0_2/1$ (2Sbis). The core of the plume coincides with the one at 6 m depth, but is spread over a larger area. From the high values downstream at the borders of the site, it may be concluded that the plume extends out of the area.

The spreading of the 1,2-DCPA concentration is very similar to the COD concentration (figure 20). Very high values, near the solubility limit, are reached in the same zone, with the same south-southeast extension across the borders of the area.

The BCIE concentration follows the same pattern, although less higher concentrations are attained (figure 21). Traces of BCIE have been found in the wells 4S1, 6S, 7S, 8S and 10S, which might indicate the presence of another pollution source

outside the former P.O.plant.

The distribution of the chloride content shows a pattern very similar to the one of the specific conductance (figure 22): from a maximum at the border of the local dump it decreases towards the southeast. The concentrations are mostly higher than the average concentration in the canal water. The drinking water standard (200 mg/l) is largely exceeded in every observation well.

The sulphate content (figure 23) also shows a pollution plume with a maximal concentration in the well 9S (7357 mg/l) and a tail in the downstream, south-southeasterly direction. The background of the incoming groundwater appears to be lower than 2000 mg/l.

The Zn concentration is high for groundwater, but does not exceed the Belgian standard for drinking water.

The F and Hg concentration are only exceptionally high in the well 4S1, where F exceeds the drinking water standard (1,5 mg/l).

The barium concentration is extremely high and shows a weak maximum at the border of the local gypsum dump in the wells 6S, 7S and 8S and in the wells 9S and 1Sbis.

High Se contents are encountered in the wells 8S and 12S. Belgian drinking water standards are exceeded for Se (0,01 mg/l).

Arsenicum shows a point source pollution pattern, with the highest concentration in the well 9S and a dispersion in the downgradient direction of the groundwater flow (figure 24). The drinking water standard (0,05 mg/l) is largely exceeded.

6.4.1.2.2. Mixed ground/groundwater samples.

The results of the analysis of the ground/groundwater samples are comparable to the values found for the groundwater of the same depth, except for the COD and the DCPA and BCIE concentrations in well 14S.

6.4.2. Groundwater quality in the KZ1 aquifer

The results are shown in table 5 and in figure 25. The conductance and the COD are high but lower than the one in the KZ2.

The concentrations of 1,2-DCPA and BCIE are extremely high in the well 2D and are still very high downstream in the well 1Dbis.

These facts demonstrate that the pollution has penetrated trough the KL and is moving downstream in the KZ1 aguifer.

6.5. Conclusions

Following samples were analyzed:

- twelve ground/groundwater samples at 6 m depth in KZ2
- three ground/groundwater samples and twelve groundwater samples at 11 m depth at the bottom of KZ2
- three groundwater samples at a depth of approximately 18 m in KZ1.

Based on the results of the analyses some maps with iso-concentration lines have been drawn (figures 14 to 25).

All groundwater in the area is contaminated. The pollution that originates from the plant site area itself consists of an extremely heavy organo-chemical pollution by 1,2-dichloro-propane (DCPA) and bischloroisopropylether (BCIE). These chemicals have leached into the ground at the site of the former P.O.-production plant. DCPA is found in concentrations up to the solubility limit.

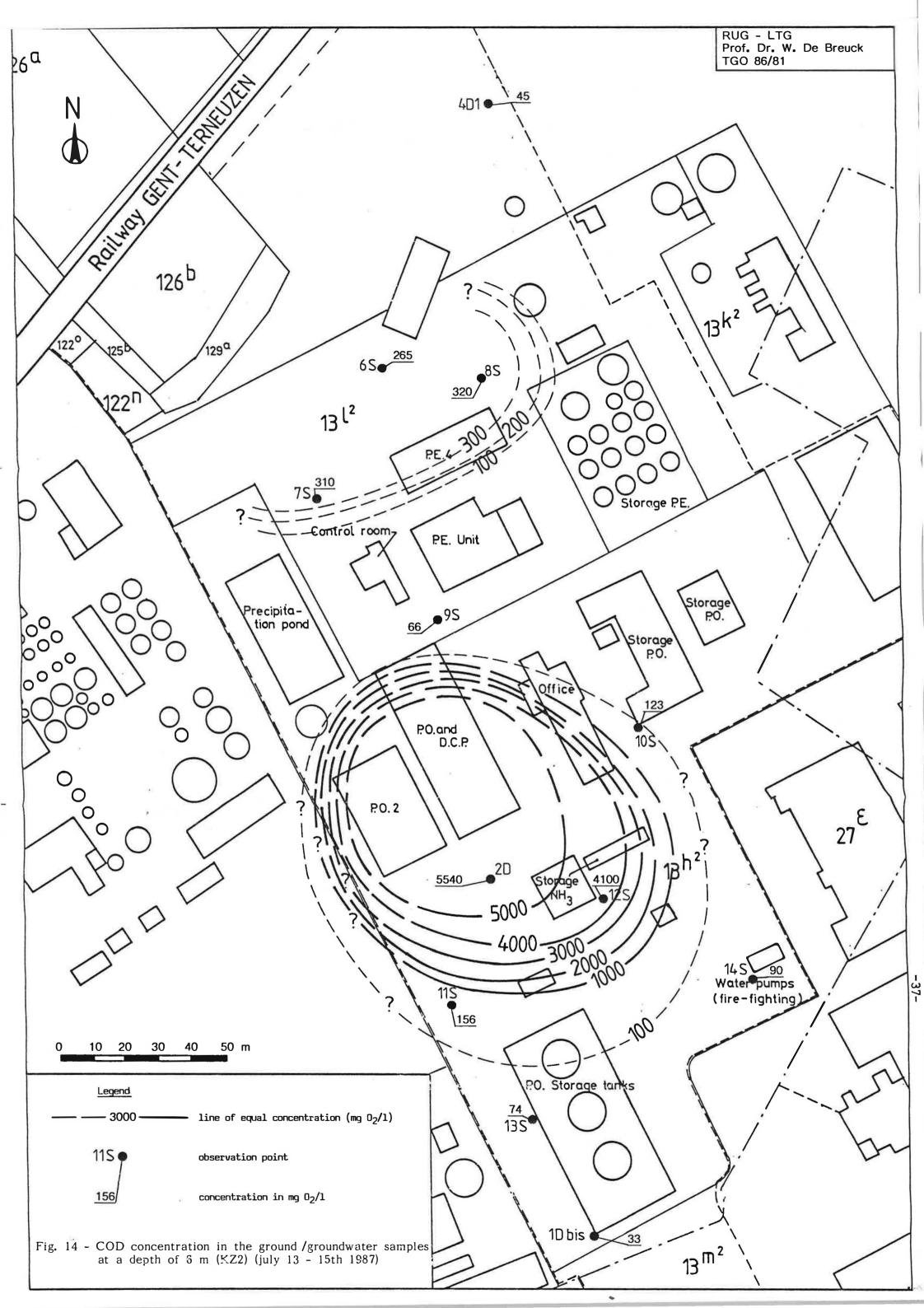
An important anorganic sulphate and arsenicum pollution probably originates in the area itself in the vicinity of the well 9S: concentrations of respectively 7357 and 2,95 mg/l are found. The high barium content of the groundwater may originate from the percolation out of the local dump.

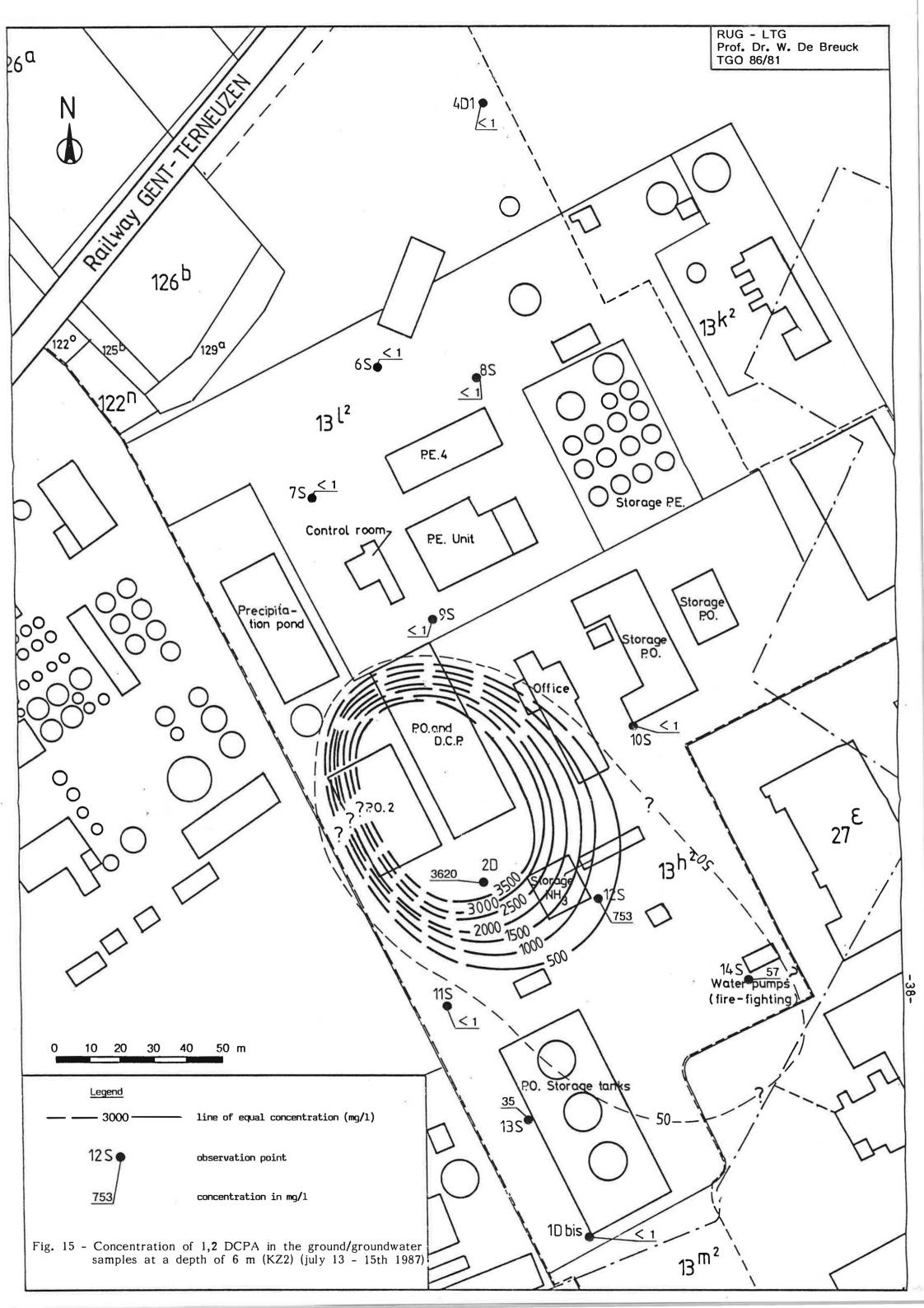
The present study does not allow to relate the high zinc,

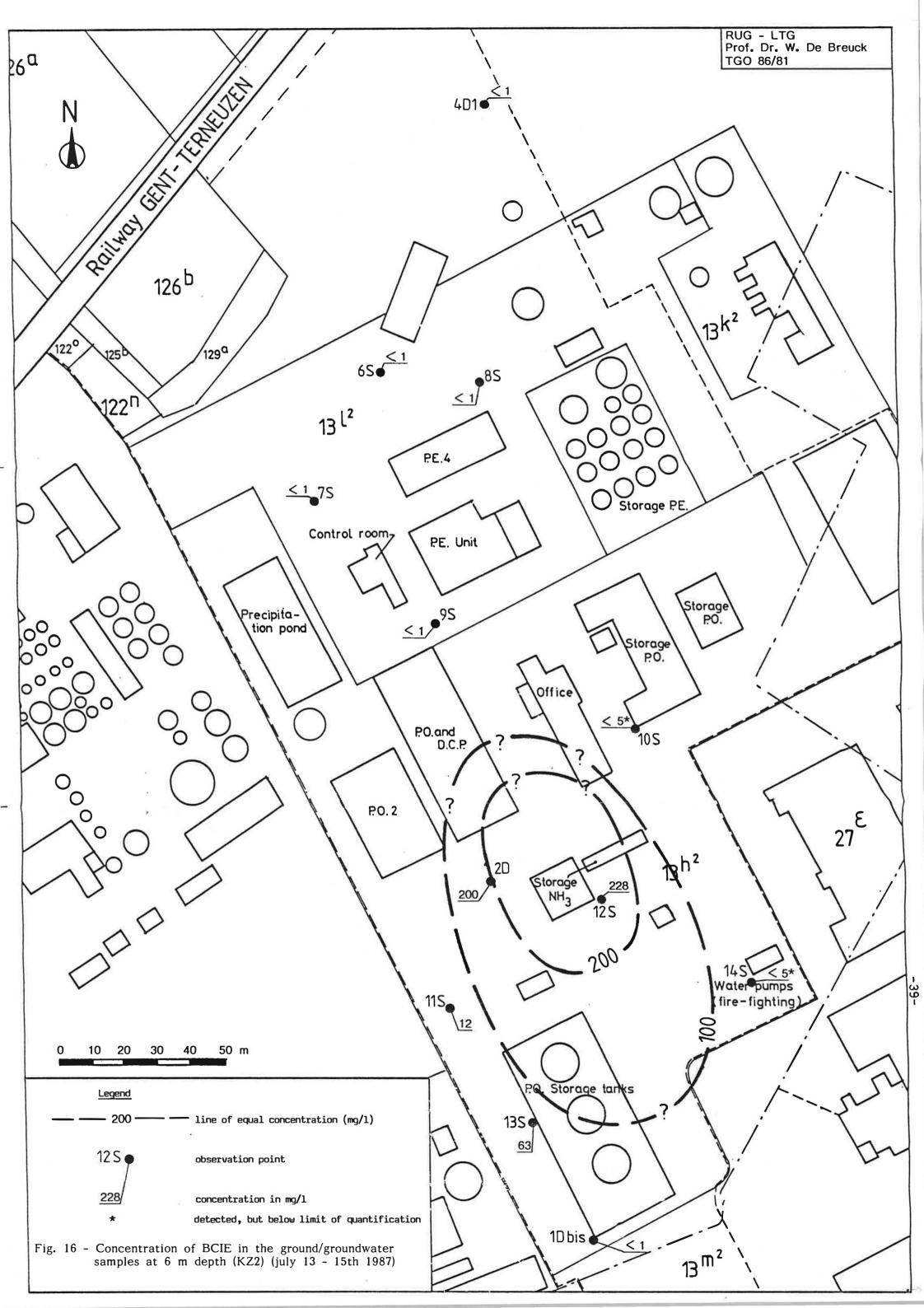
selenium, fluoride and chloride concentrations to any particular source in the area.

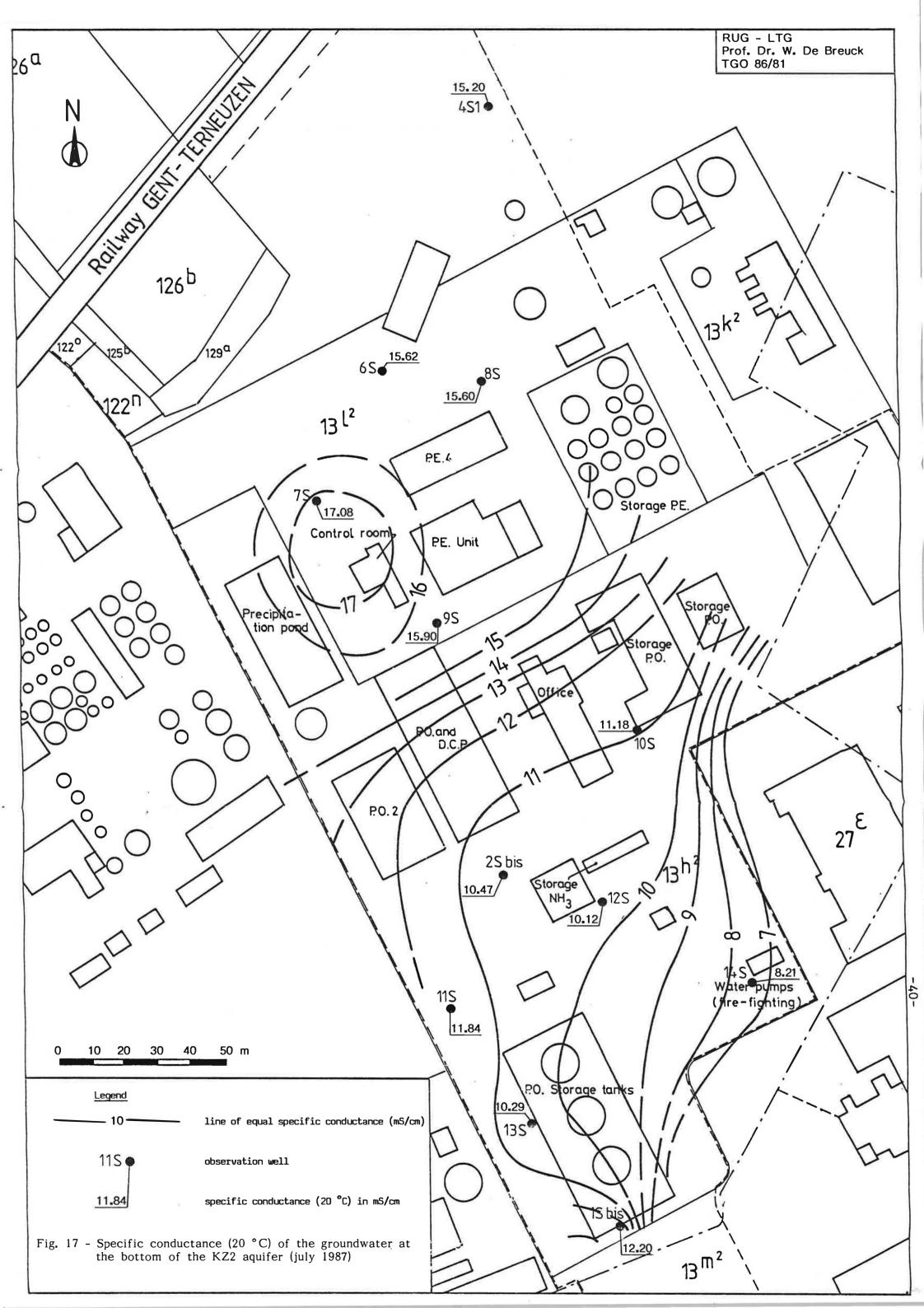
The organo-chemical as well as the inorganic pollution plumes migrate downstream in a southward direction and have already passed across the borders of the plant site area.

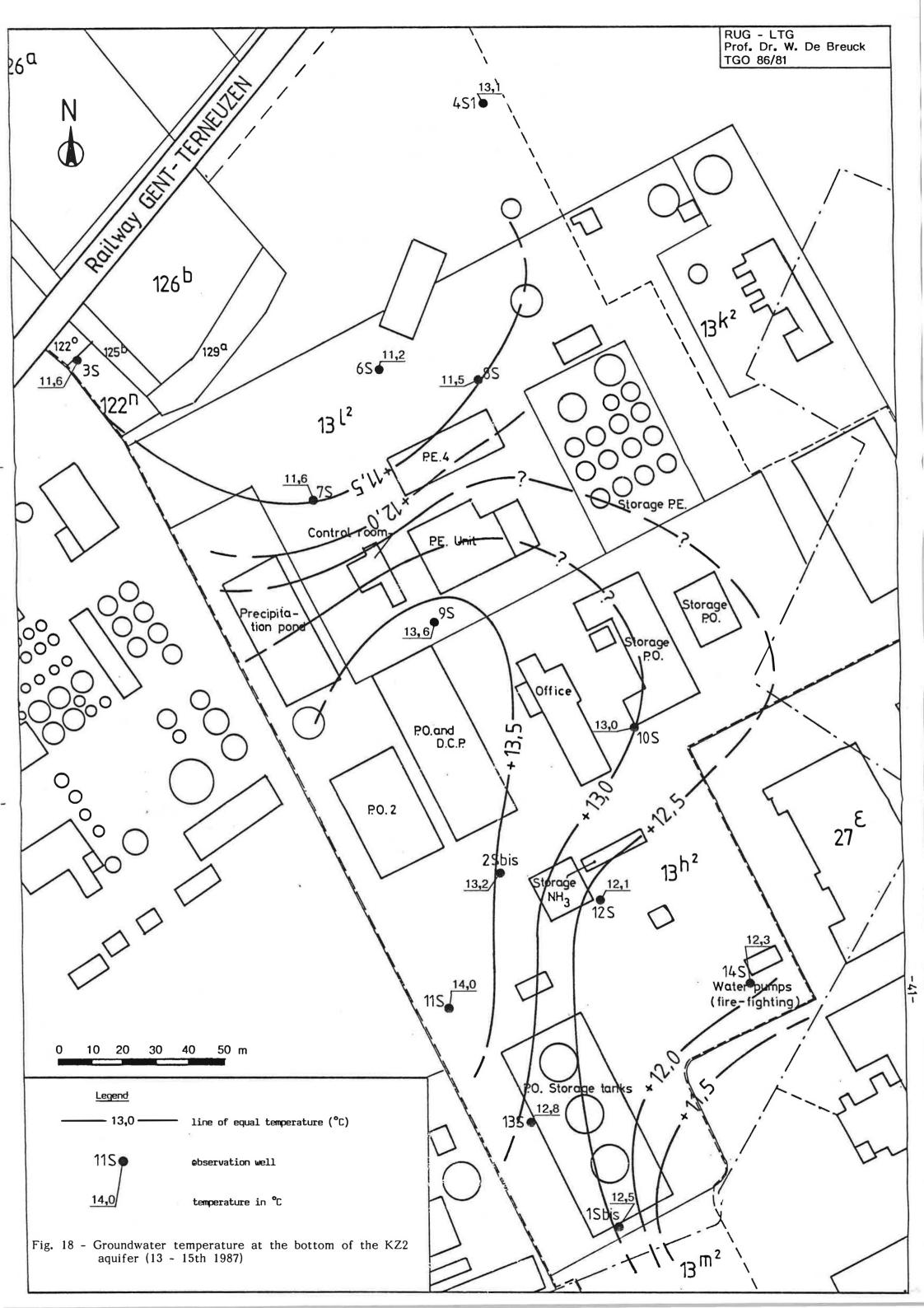
The organo-chemical pollution has also migrated downward through the KL into the KZ1 aquifer where the same high values and a similar pattern of spreading have been detected.

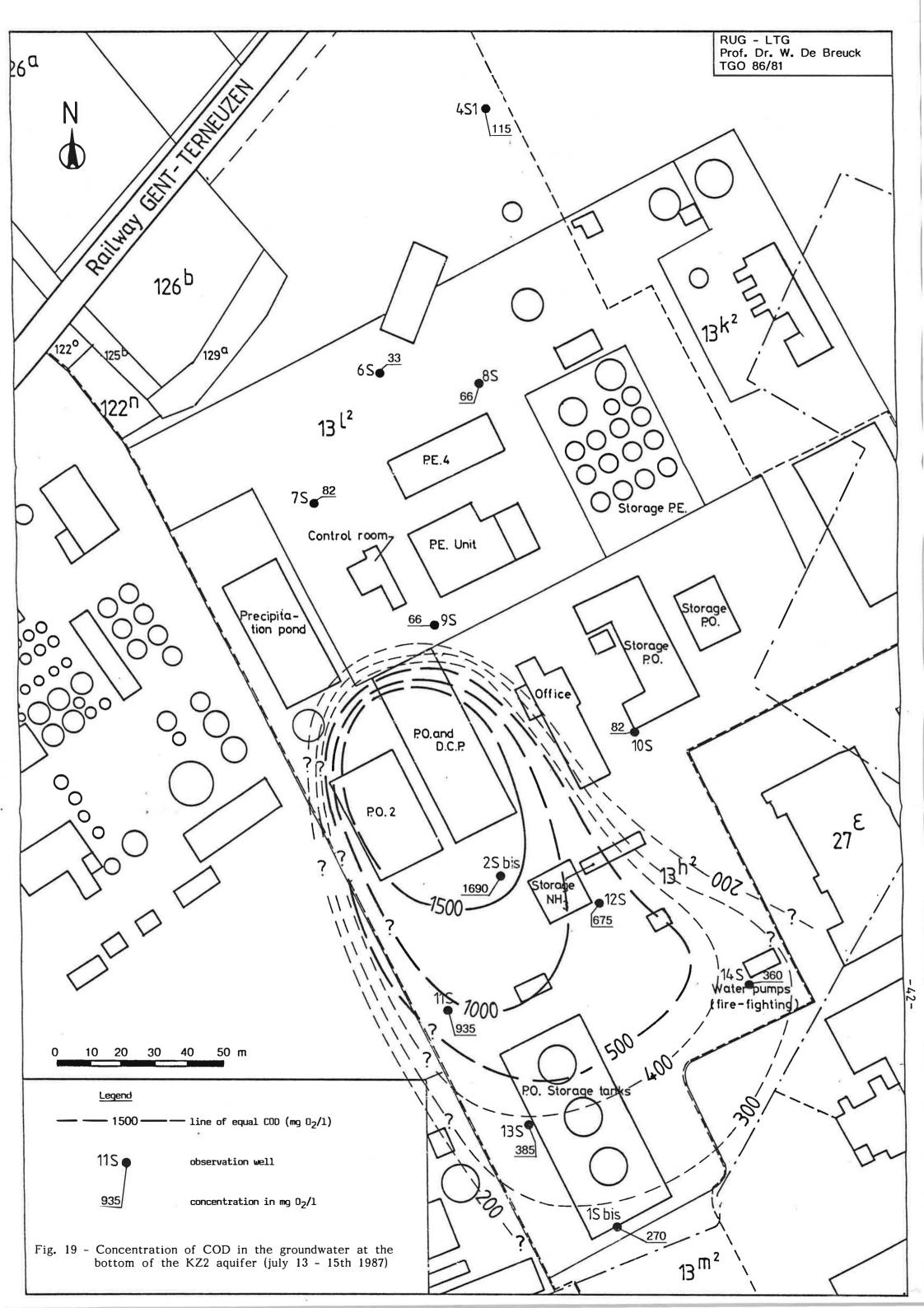


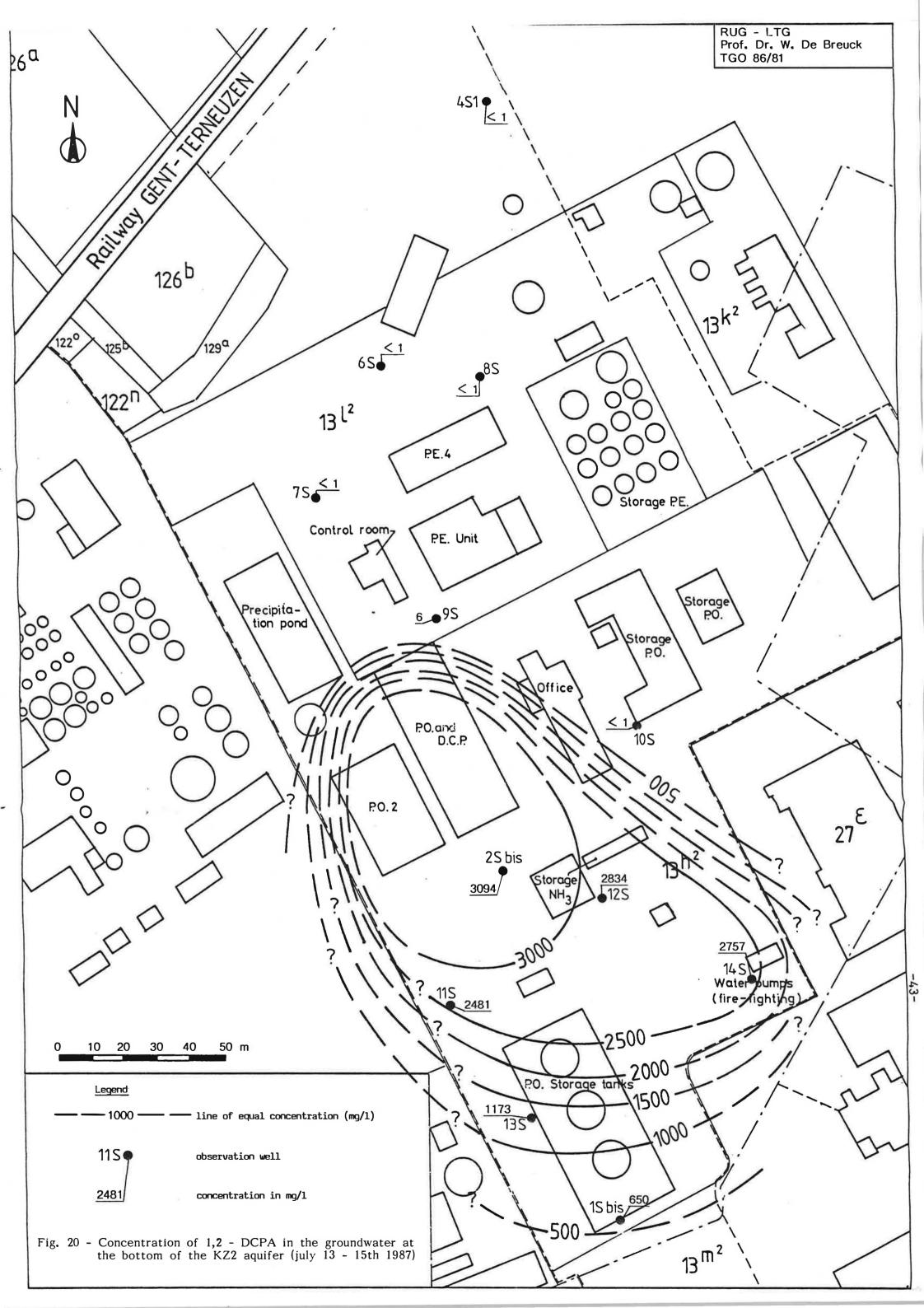


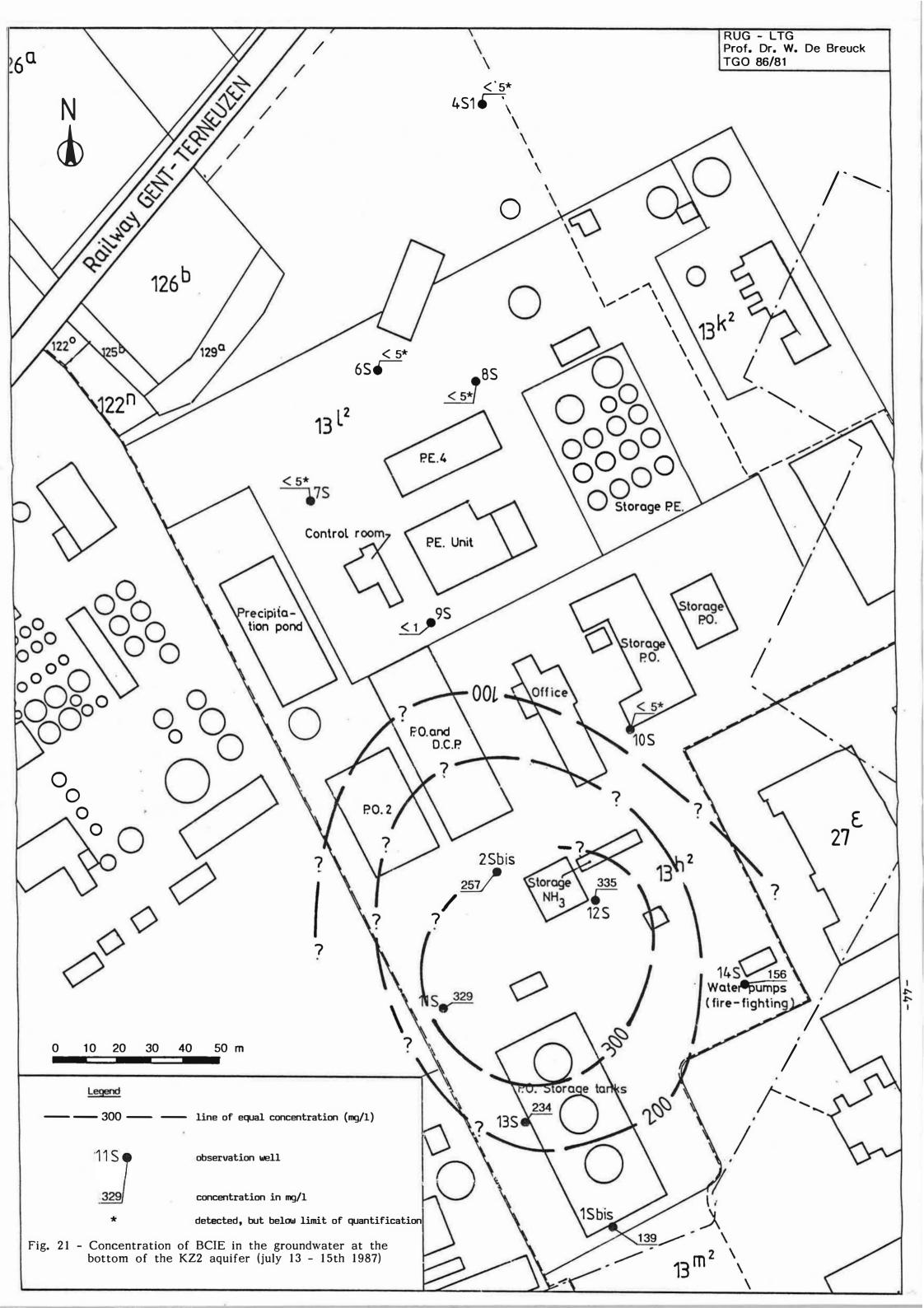


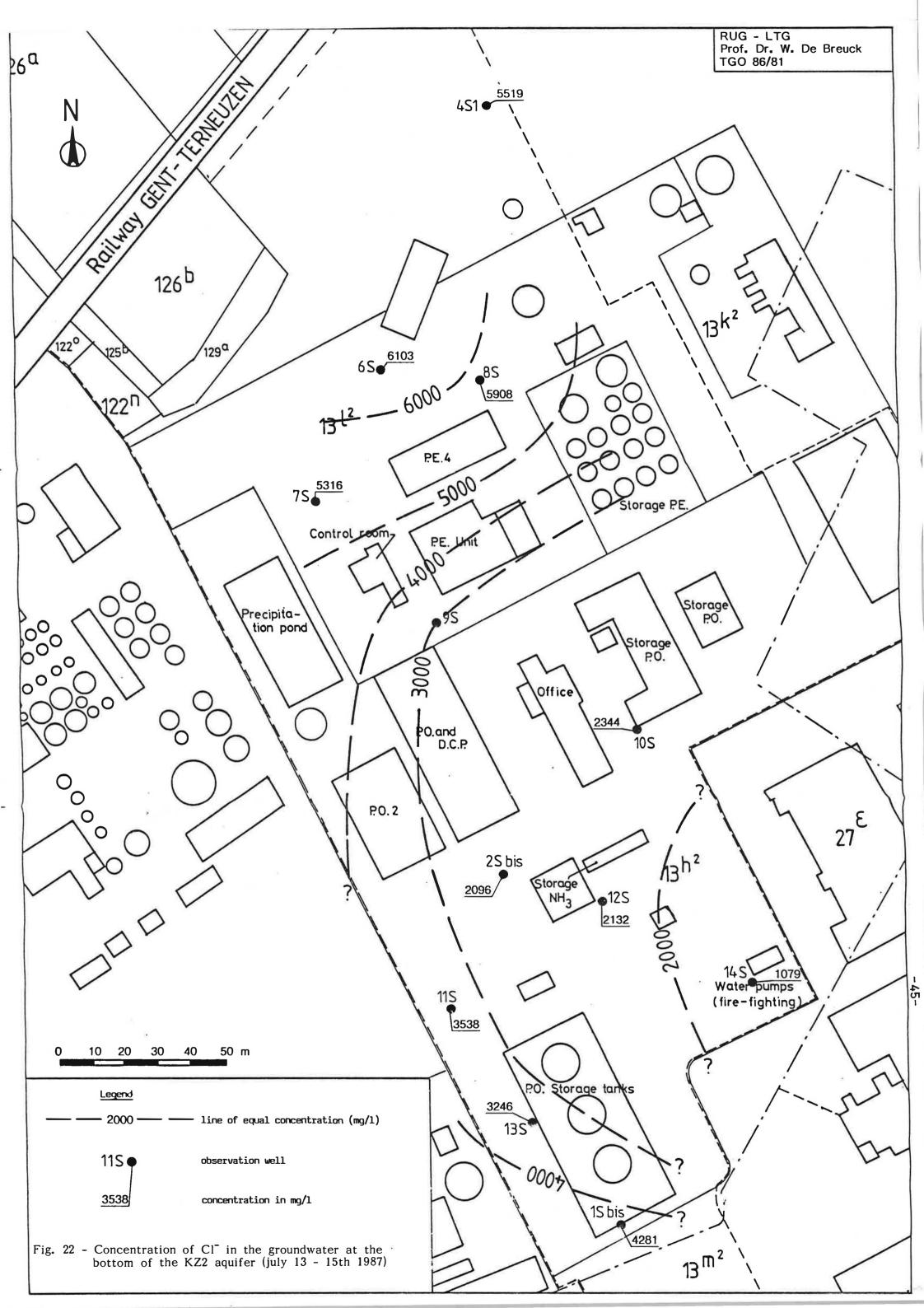


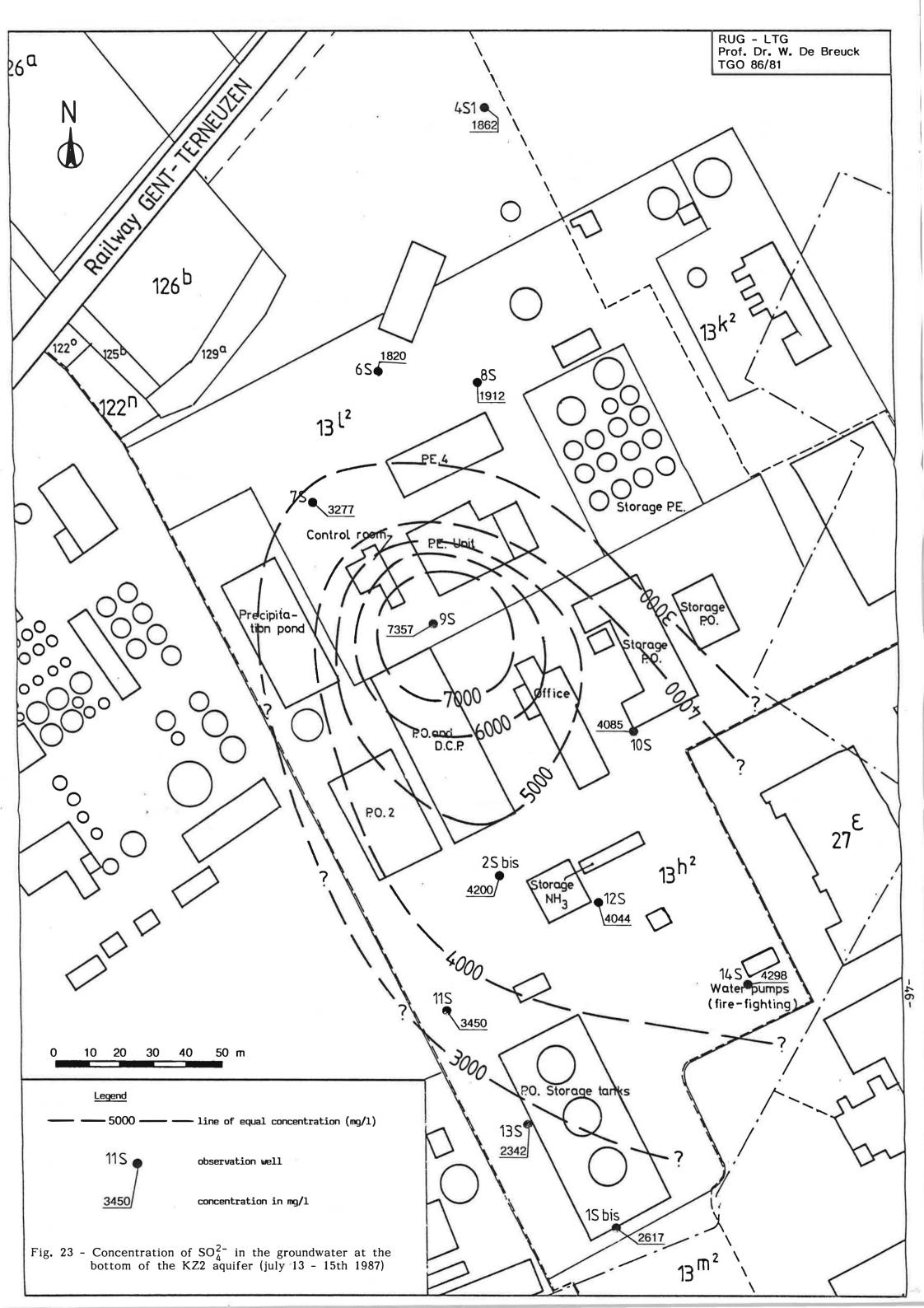


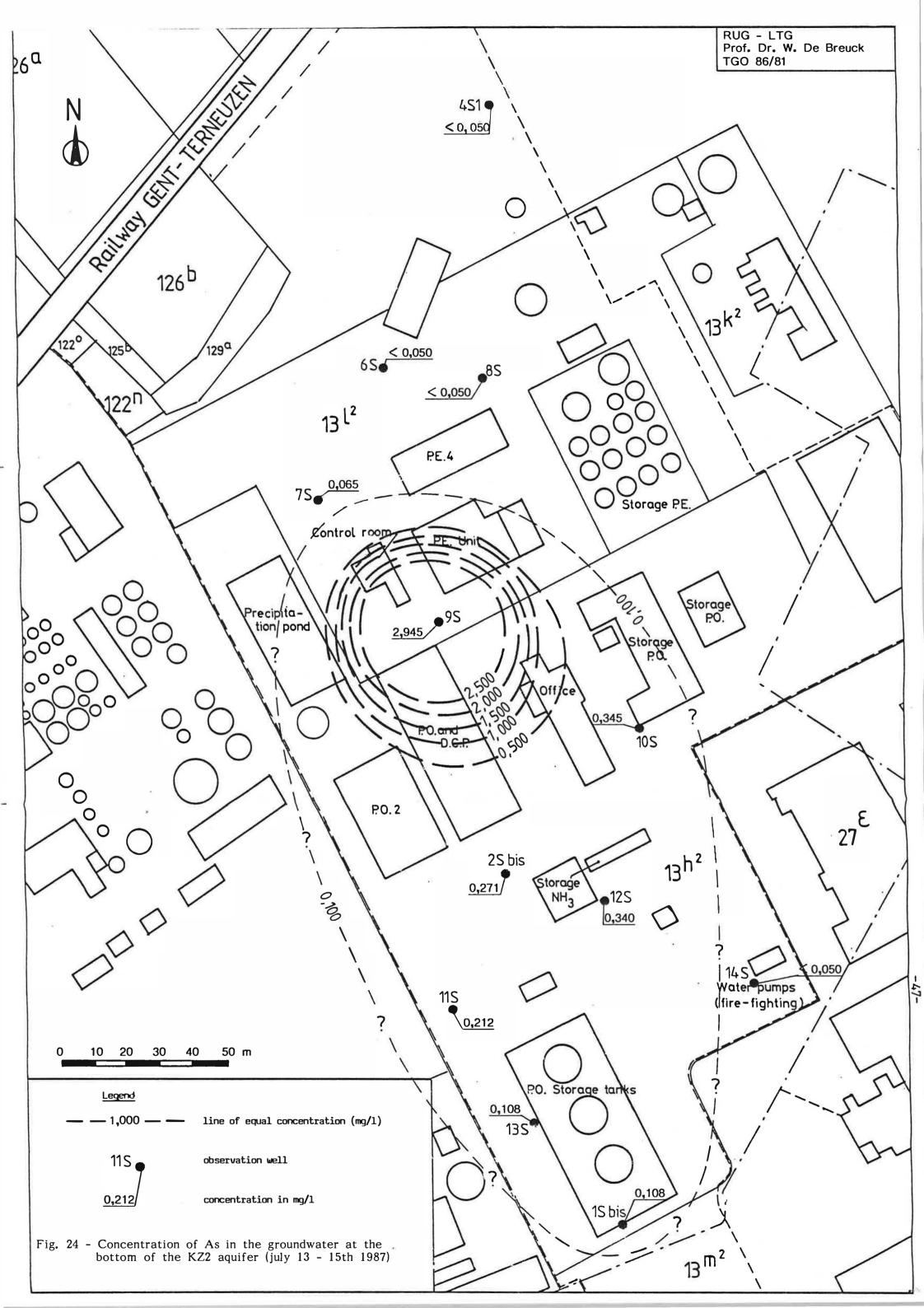


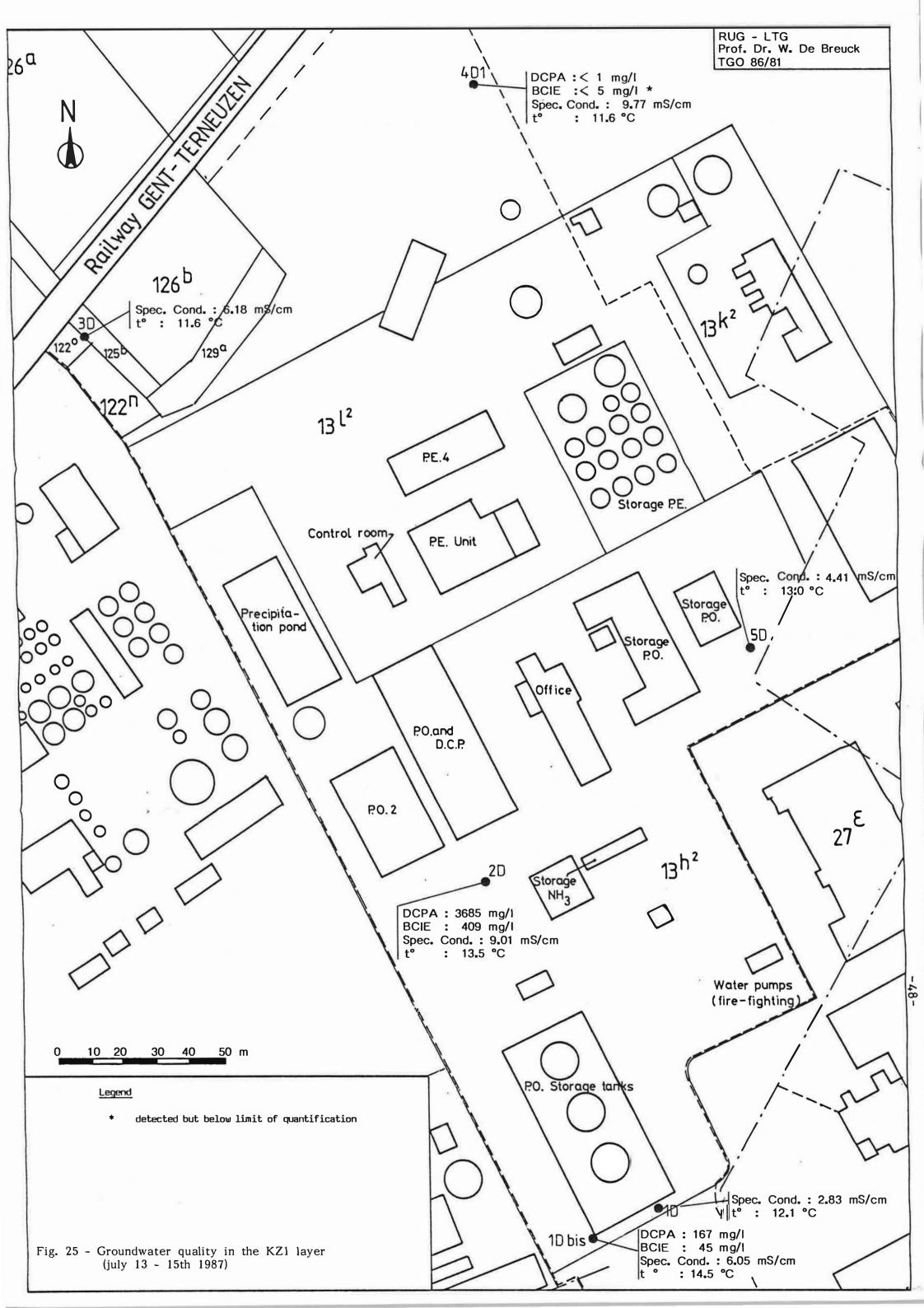












7. MATHEMATICAL MODEL

7.1. General

To obtain more information about the evolution of the ground-water quality and the occurence of contamination a mathematical model has been applied. The purpose of a mathematical model is to simulate the real hydrogeological situation. Herefore the area is subdivided in a grid of cells. In each cell the hydraulic parameters of the aquifer and the boundary conditions must be entered.

In this study two different options of one model are applied. The first simulates the groundwater flow in a horizontal plane. This implies that the properties of the aquifer remain the same over the whole thickness. This model calculates the areal average groundwater quality distribution, but gives no information over quality changes in depth.

With the second option of the model the groundwater flow in a vertical cross-section is simulated. Information is obtained about the contaminant distribution in the different layers.

Combining the results of the two models, an idea of the spatial distribution in the groundwater reservoir is obtained.

7.2. Applied model

The mathematical model of solute transport and dispersion in groundwater of KONIKOW & BREDEHOEFT has been applied. This model calculates the transient changes in concentration of a non-reactive solute in flowing groundwater. The computer program solves simultaneously two partial differential equa-

tions. One equation is the groundwater flow equation, which describes the head distribution in the aquifer. The second is the solute-transport equation, which describes the chemical concentrations in the system. A particle-tracking procedure is used to solve the solute-transport equation.

Each simulation is subdivided in a small number of time steps. Each time step corresponds with a period of 1,25 year. For every time step the piezometric head, the groundwater flow velocities and the chemical concentration are obtained. The output data are presented in the form of plots. On each plot the piezometric head during the time step is presented by lines of equal water level. The groundwater flow velocities are indicated by vectors. The concentrations are represented by lines of equal percentage of contamination. A saturated solution of the organic chemical DCPA is concidered as 100 %. Lines of 1 % , 5 % , 16 % , 50 % , 84 % , 95 % and 99 % contamination are plotted.

7.3. Simulations in a horizontal plane

7.3.1. Location-boundaries-input data

In the horizontal model the groundwater flow is simulated in a rectangular area of approx. 640 by 720 m, bordered to the west by the railway Gent-Terneuzen, and to the east by the canal Gent-Terneuzen (fig. 26).

The finite-difference grid is subdivided in 40 rows and 40 columns, corresponding with 1600 cells. Each cel measures about 15 by 20 m. The aquifer is bounded below by the semi-pervious layer KL. The model calculates the groundwater flow in the pervious layer KZ2.

The aquifer has a thickness of 12 m. The applied horizontal hydraulic conductivity is 1,25 m/d in the whole area, the longitudinal dispersivity 0,30 m, the ratio of transverse to longitudinal dispersivity 0,30.

The model has constant head boundaries in the north, south, west and east. The east boundary is the canal (level: +4,45), the values in the cells near the other boundaries are derived from piezometric level measurements.

The mean natural infiltration rate is 300 mm/year, which is the normal value for this area. In the cell representing the spill area an amount of 900 m³/year of polluted water is injected (approx. 3,2 tons DCPA). This value is a rough estimation. In some simulations an amount of 90 'm³/year/cel of polluted water was assumed to have leaked from a sewer (approx. 4,2 tons/year DCPA) (figure 27).

An overview of the different simulations in the horizontal plane is given in table 6.

7.3.2. Discussion of results

Six different simulations in the horizontal plane are given (see table 6).

In the first two simulations (figures 28 and 29) there is assumed that infiltration of polluted water occurs at only one place (spill area between the former P.O.-installation and the precipitation pond). In the corresponding cel 900 $\,\mathrm{m}^3/\mathrm{year}$ is injected. The injected water is considered as a saturated solution (100 %).

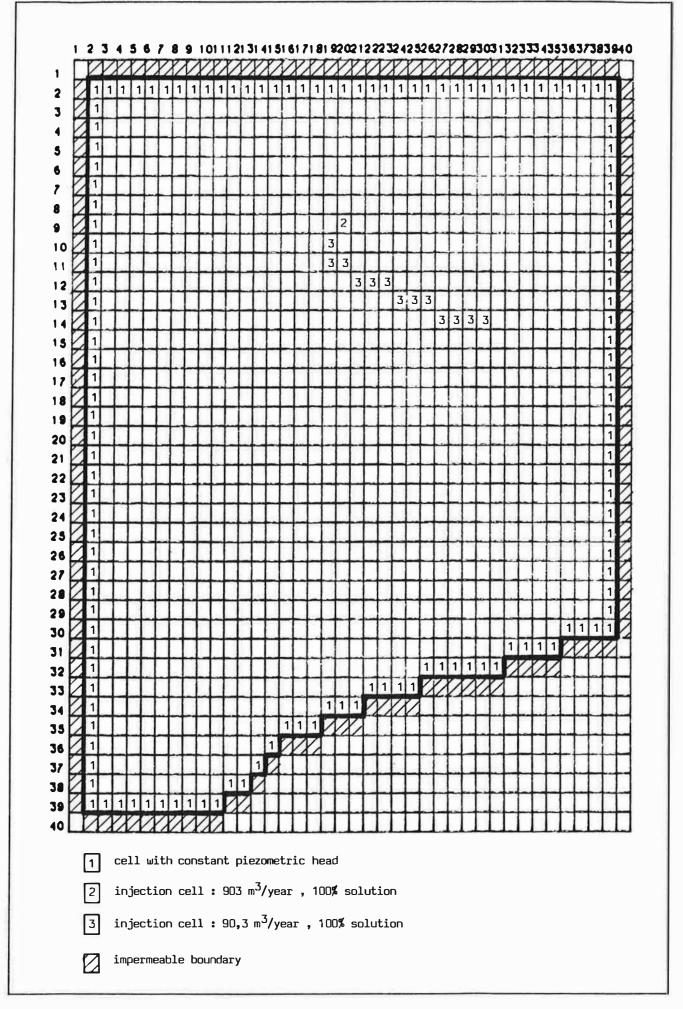


Fig. 27 - Boundary conditions (for the simulations in the horizontal plane)

-54-

Table 6: The different simulations in the horizontal plane

| | 1972-1979,5 | place of infiltration | 1979,5-1987 | place of infiltration | 1987-2002 | place of infiltration |
|---------------|------------------------------------------------|-----------------------|--------------------------------------------------|-----------------------|--------------------------------------------------|-----------------------|
| | | spill sewer area | | spill sewer area | 1 | spill sewer area |
| SIMULATION H1 | infiltration of saturated solution (100 %) | x | no further solution of organic compounds | | | |
| SIMULATION H2 | infiltration of oversaturated solution (>100%) | x | further solution of organic compounds | x | | |
| SIMULATION H3 | infiltration of saturated solution (100 %) | x x | no further solu- tion of organic compounds | | | |
| SIMULATION H4 | infiltration of oversaturated solution (>100%) | x x | further solution of organic compounds | x x | | |
| SIMULATION H5 | infiltration of oversaturated solution (>100%) | x x | further solution of organic compounds | x x | no further solu- tion of organic compounds | |
| SIMULATION H6 | infiltration of oversaturated solution (>100%) | x x | further solution of organic compounds | х х | further solution of organic compounds | x x |

In the first simulation (figure 28) the pollution source exists only during the period 1972-1979,5. After 1979,5 there is only natural infiltration (300 mm/year). In the second simulation (figure 29) the pollution source exists during the whole period, from 1972 until present. This can be explained by the assumption that the infiltrating solution in the first 7,5 years was oversaturated (> 100 %), so that an amount of non-dissolved organic halogens leaked into the aquifer, and the process of dissolving could continue years after the polluting infiltration.

In both cases the pollution front has moved approx. 200 m to the east, and the zone of contamination has a long, small form in the groundwater flow direction.

Fitting the results of the chemical analyses, an evolution like this seems unlikely. It can not explain the high values of organic compounds in boreholes 2Sbis, 12S and 14S. These high values can be explained by a leakage from a sewer (figure 27), which captured the effluent of the P.O.plant. This situation is calculated in simulations 3 and 4 (figures 30 and 31). In these simulations in each cell representing the sewer (see figure 27) 90 m³/year of saturated solution is injected. In simulation H3 the leakage ended in 1979, while in simulation H4, the dissolving of organic compounds continues due to the previous leakage of an oversaturated solution. In both cases the calculated pollution front has reached the canal. Unfortunately there are no observation points to confirm this. In simulation H3 the concentrations of the contamination zone become smaller, due to the effects of mixing and dispersion. The results of simulation H4 fit best with the observed concentrations. In the adjacent downstream part of the sewer, almost saturated water is found. This is confirmed by observation wells 2Sbis, 12S en 14S.

Simulations H5 and H6 (figures 32 and 33) give a probable

| <u>I</u> | LEGEND |
|----------|------------------------------------------------|
| 50 ——— | Line of equal percentage of saturated solution |
| 26,00 | Line of equal riezometric head (m TAW) |



Fig. 28 - Simulation H1 - situation after 15 years (1987) (one spill area during 1972 - 1979,5 only normal infiltration during 1979,5 - 1987)

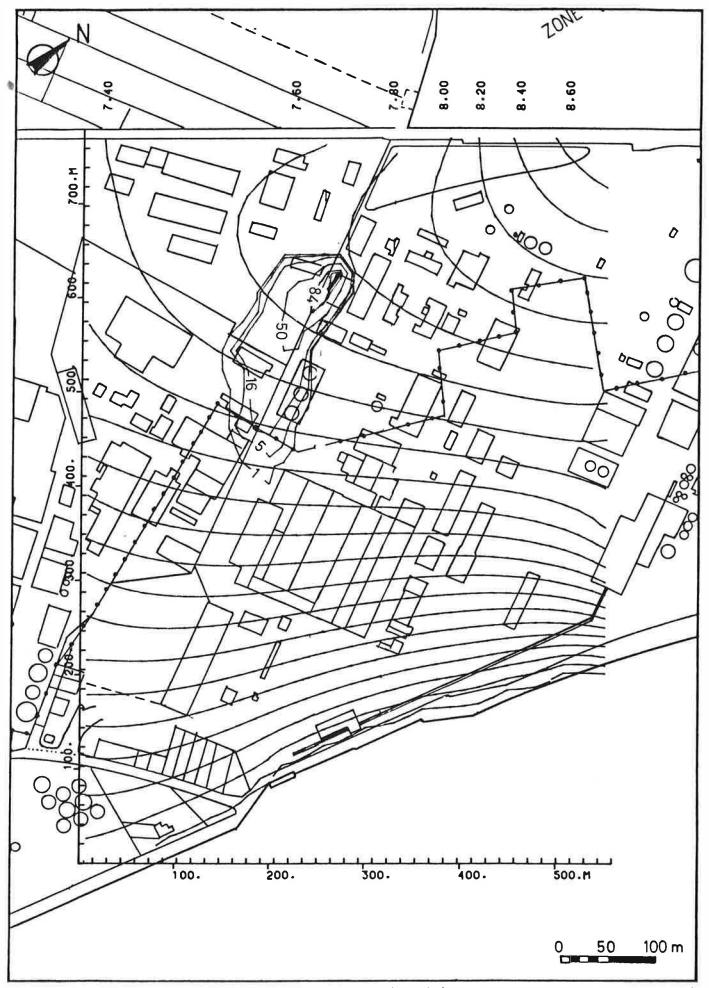


Fig. 29 - Simulation H2 - situation after 15 years (1987) (one spill area during 1972 - 1987)

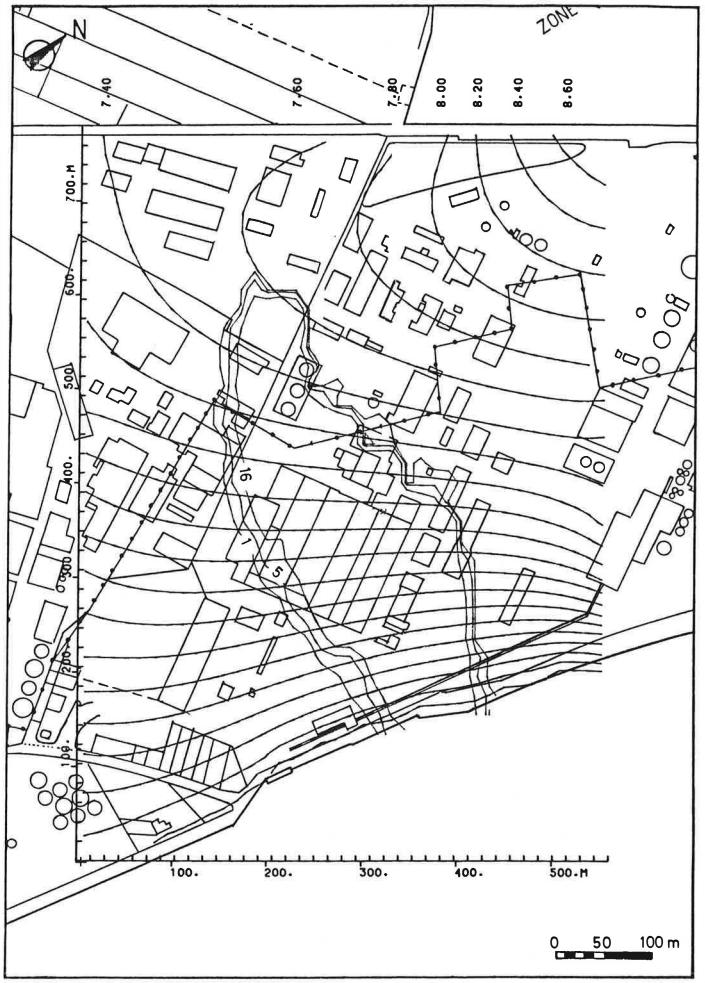


Fig. 30 - Simulation H3 - situation after 15 years (1987) (spill area + infiltrating sewer during 1972 - 1979,5 , only normal infiltration during 1979,5 - 1987)

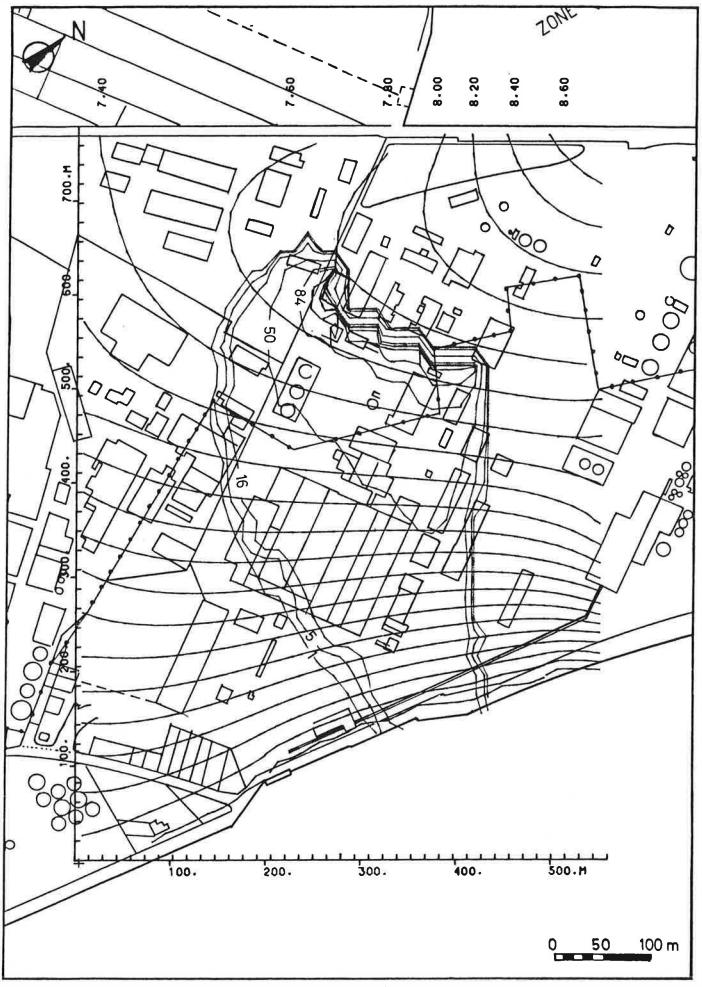


Fig. 31 - Simulation H4 - situation after 15 years (1987) (spill area + infiltrating sewer during 1972 - 1987)

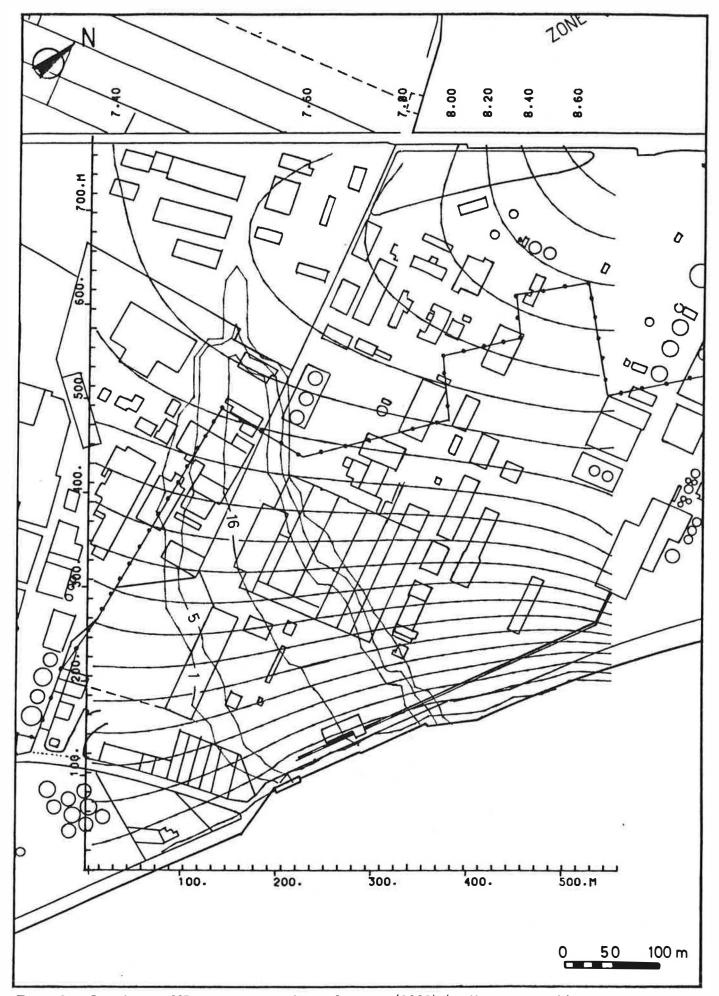


Fig. 32 - Simulation H5 - situation after 30 years (2002) (spill area + infiltrating sewer during 1972 - 1987, only normal infiltration during 1987 - 2002)

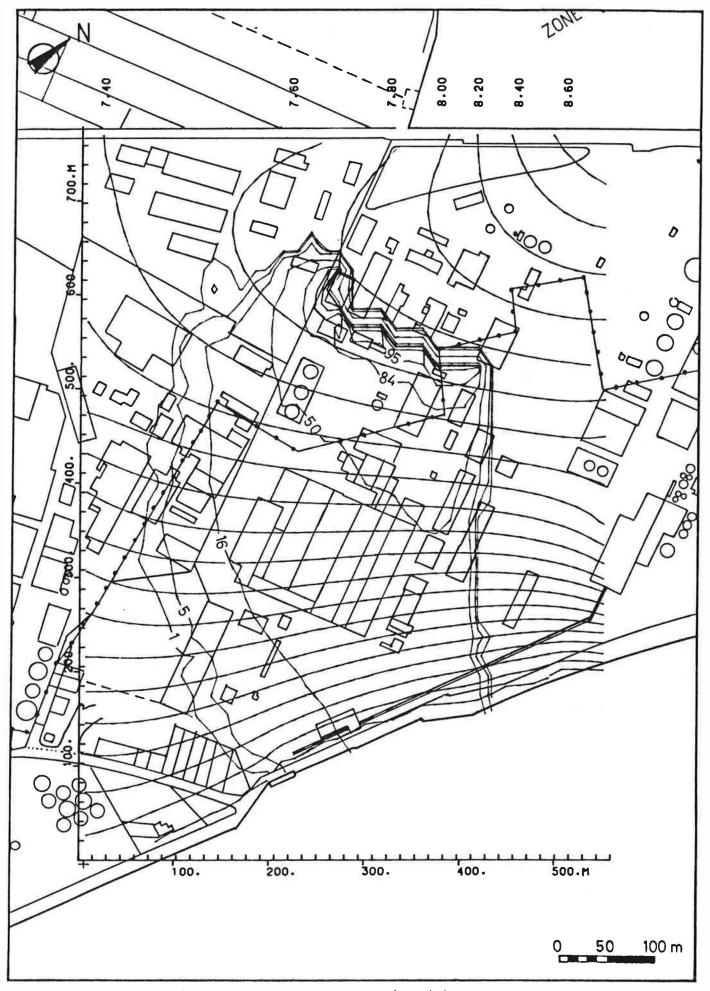


Fig. 33 - Simulation H6 - situation after 30 years (2002) (spill area + infiltrating sewer during 1987 - 2002)

evolution in the next future (1987 - 2002). The situation with a future continuous dissolution of pollutant shows a similar pattern as compared with the present, except for a further broad southerly extension.

7.4. Simulations in a vertical cross-section

7.4.1. Location-boundaries-input data

The groundwater flow and the evolution of the groundwater quality is simulated in a cross-section of approx. 1770 m length, along a straight line, beginning at the top of the gypsum pile, and ending in the canal Gent-Terneuzen (figure 26). A vertical model permits to evaluate the change in groundwater quality in different layers.

The finite difference grid is subdivided in 16 rows and 40 columns. Each cel is approx. 46,5 meters long and has a thickness of 3 meters. The aquifer is bounded below by the impermeable layer of the a3 clay. The different horizontal hydraulic conductivities are derived from the results of the pumping tests. The assumed longitudinal dispersivity is 0,30 m. The ratio of transversal to longitudinal dispersivity is 0,30.

The left boundary of the cross-section is the water-divide under the gypsum pile, the right boundary is a constant head boundary (sea canal : + 4.45). The natural infiltration rate is 300 mm/year. On the gypsum pile the infiltration rate is 1500 mm/year. In the cel corresponding with the spill area, the infiltration rate of polluted water is equal to the quantity of water injected in the horizontal model.

A schematisation of the input data is shown in figure 34.

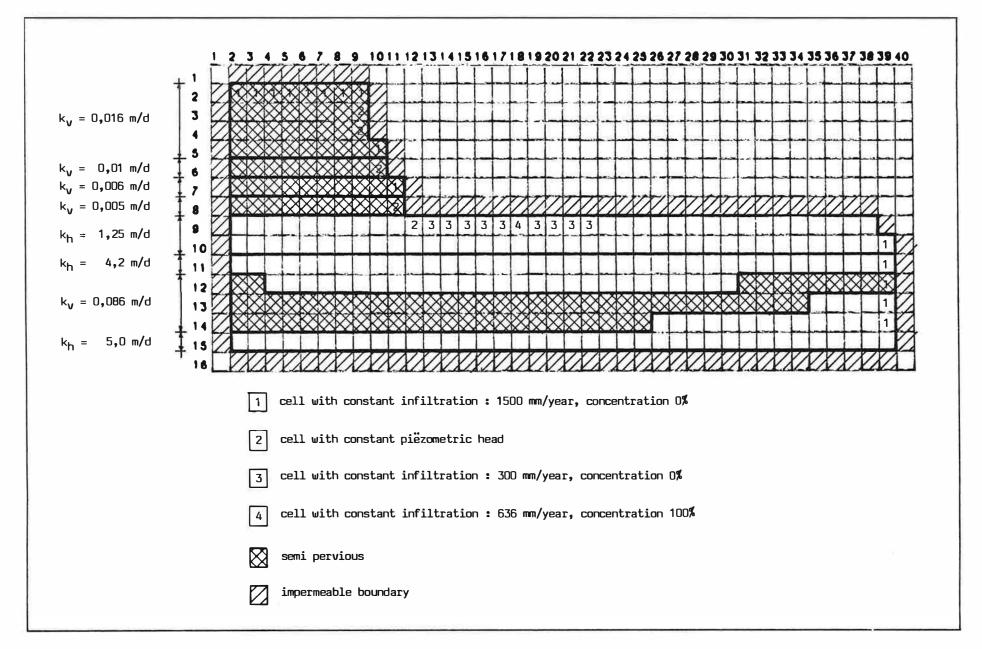


Fig. 34 - Boundary conditions and permeabilities (for the conditions in the vertical cross-section)

7.4.2. Discussion of results

It is assumed that in the period 1972-1979,5, the infiltrating solution was oversaturated. The next 7,5 years, dissolution continues and the pollution source remains. The calculated situation after 15 years (1987) is shown in the figures 35 and 36 (simulations V1 and V2).

The contamination moves downstream in the direction of the canal. The pollution front had advanced mostly in the lower part of the KZ2 layer, where the horizontal conductivity (4,2 m/d) is higher than in the upper part (1,25 m/d). The concentrations increase towards the bottom of the KZ2 layer. Concentrations of 10 - 20 % may be expected 250 m downstream the spill area, and within a range of 150 m the concentrations may exceed 50 % of a saturated solution. This is confirmed by the water analyses in wells 1Sbis, 13S and 11S. Lower concentrations may be found in the KZ1 aquifer (well 1Dbis), around the spill area the concentrations may be greater.

7.5. Conclusions

With the mathematical model the occurence of the contamination was calculated. Most likely the leakage of organic halogens took not only place around the P.O.-installation, but also along the sewer. The infiltrating polluted water was an oversaturated solution, so that the dissolution process could continue after 1979 in the aquifer. The pollution front moves downstream, where it has probably reached the canal. There are no observation wells to confirm this. In the south the pollution front moves more slowly. The evolution in the next future depends on the amount of non-dissolved organic halogens that is left in the aquifer, which is not known.

<u>LEGEND</u>

Line of equal percentage of saturated solution

Line of equal piëzometric head (m TAW)

Velocity vector

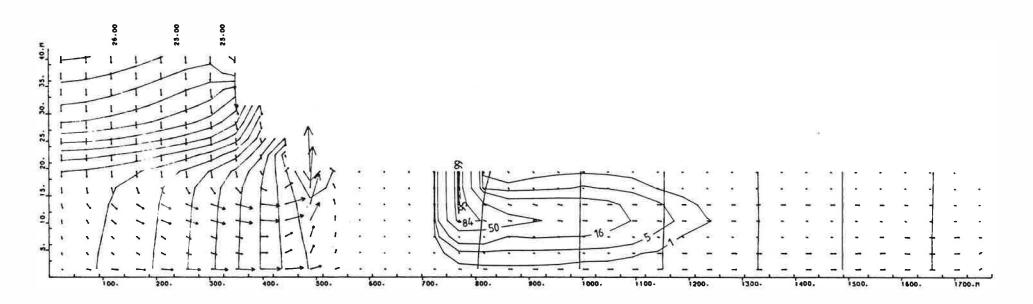


Fig. 35 - Simulation V1 - situation after 15 years (1987)

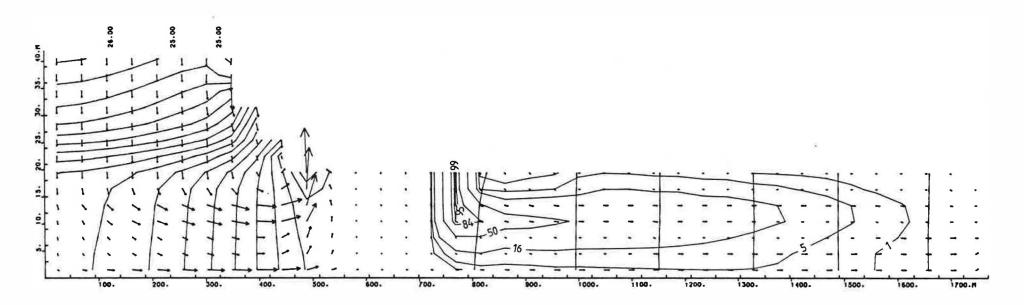


Fig. 36 - Simulation V2 - situation after 30 years (2002)

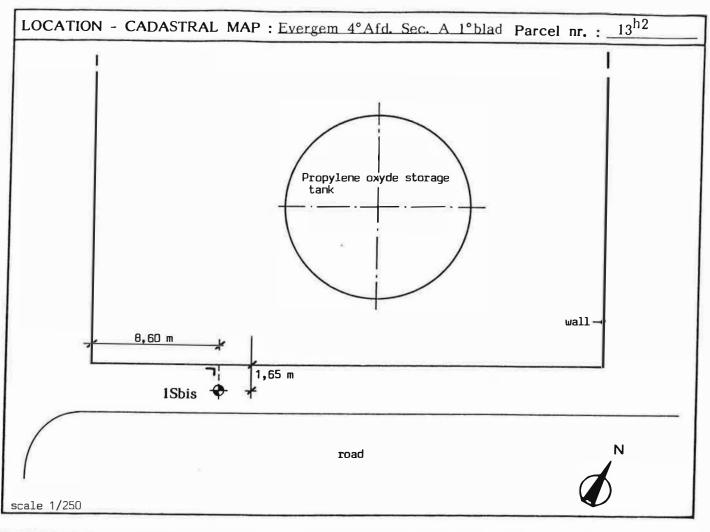
APPENDIX 1
BOREHOLE RECORDS
SITUATION PLANS

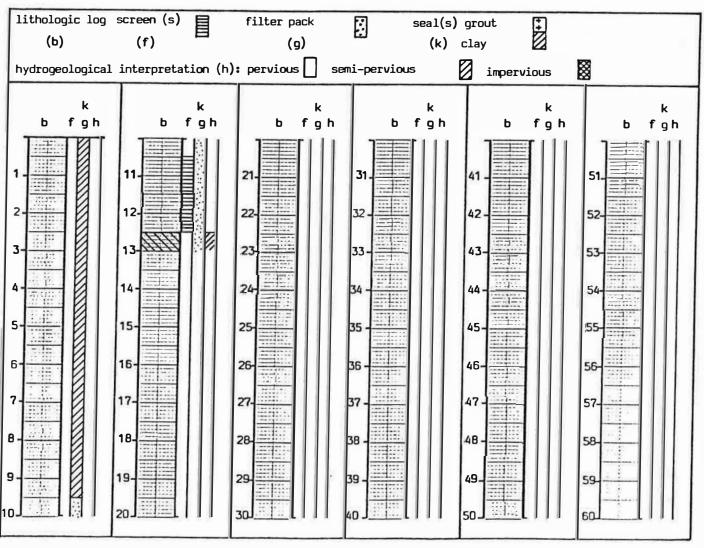
| Rijksuniversiteit Gent Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: Well nr.: 1S bis | | | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|------------------------------------|------------|----------|----------|-----------|------|--|--|
| RESEARCH: Additional hydrogeological Survey of the OWNER: ARCO-ATOCHEM | | | | | | | | | | |
| Arco Chemical Products Europe plant site at Rieme (Belgium) | | | | | | | | | | |
| - DATE:July 14th 1987 | | | | | | | | | | |
| - DRILLING CY.: Geolab | | | | | | | | | | |
| - DRILLING RIG Nordmeyer DRILLER: | | | | | | | | | | |
| - MAP N.G.I. Nr.: 14/5 GEOL/PFDOL, MAP Nr.: 40E | | | | | | | | | | |
| - MUNICIPALITY : _Evergem | | | | | | | | | | |
| $(LAMBERT-COORDINATES) \qquad ZMV* = \underline{\qquad} (m TAW)$ | | | | | | | | | | |
| (ZMV = ground level (measured); ZMV* = ground level (estimated)) | | | | | | | | | | |
| | Ø DEPTH (in m) | | | | | | | | | |
| DRILLING METHOD | (mm) | from | from - to from - to from - to from | | | | from - to | | | |
| Anger | 168 | | 2 | | | | | | | |
| Bailer | 135 | | 13 | | 1 | | | | | |
| Casing | 168 | 0 - | 12,5 | | | _ | | | | |
| | | | | | - | - | | - | | |
| | | | | | 1 | TION | (1) | | | |
| - DRILLING MUD : - BOREHOLE LOG(S) : | | | | | ONSUM | TION | (1): = | | | |
| | FB I |)FO | ZMP | ZMP* | GWDP | L | ST | Р | | |
| F1 10, | 5 12 | 2,5 | 8,791 | | | 1 | 10 | 2 | | |
| F2 F3 | | _ | | 1 | | | +- | | | |
| | | | | | - 1 | | | | | |
| NR = Number DFB = Depth to | ton of | SCTE | en (m) | | | | | | | |
| DFO = Depth to | | | | (m) | | | | | | |
| ZMP = Level me | | | | | | | | | | |
| ZMP* = Estimate GWDP = Groundwa | | | • | • | | | | | | |
| L = Type of | | | | | n phreat | ic | | | | |
| ST = Stratigrap | ohy (con | form | to leg | end LTG) | | | | | | |
| P = 1=Piezom | eter; 2= | Obse | rvation | well; 3=D | ugged w | ell; 4=l | umping | well | | |
| Several screens in or Characteristics - rise | r pipes | : _ø | 63 x 1 | 8 PN10 | | | | | | |
| - 9056 | eens | | | -111 | | | | | | |
| 301 | CIIS | | | | | | | | | |
| - con | nections | | | | | | | | | |
| - Bottom pipe (m): | ,05 | | | | | | | | | |
| - Screen slot openings | - type : | _ve | rtical | sawed slo | ts | | | | | |
| | | | | | | | | 1200 | | |
| - Centralizer(s) - place | (m):_ | - | | | | | | | | |
| - Filter-pack type and | charact | eristi | cs : _cc | parse sand | 0,7 - | 1,25 m | | | | |
| - volume (l.) : 9.5 - 13 m depth - Seals-type and characteristics : clay pellets Duranit | | | | | | | | | | |
| - volume (l.) : from 0 to 9.5 m depth | | | | | | | | | | |
| - Development - method : | | | | | | | | | | |
| - date - duration (h):inly 14th_1987; 15_min | | | | | | | | | | |
| - discharge (m ³ /h): ± 1 ; see also sampling | | | | | | | | | | |
| - Finishing : _steel cap | | | | | | | | | | |

| | LITHOLOGIC LOG - DATE : July 14th 1987 | | |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|
| C1- | Description of the cuttings | Depth | (m) |
| Sample nr. | Description of the cuttings | from | to |
| | Cable tool drilling with use of pure water | | |
| | cable cool drilling with use of pure water | - | |
| | Description of cuttings : see Drilling nr 1D bis | | |
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| mp <u>le</u> | Description of the cuttings | Depth | (m) |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|
| | Description of the cuttings | from | to |
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| Geological interpre | tation and remarks | |
|---------------------|--------------------|--|
| 0 - 12,50 | : KZ2 | |
| 0 - 12,50 12,50 | : KL | |
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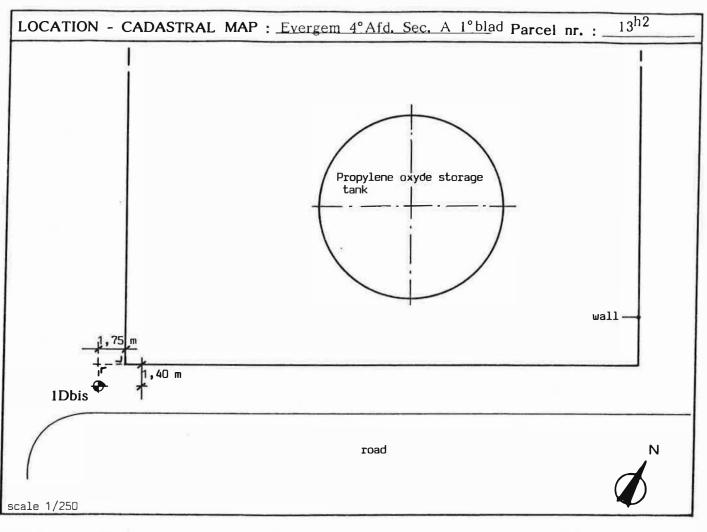


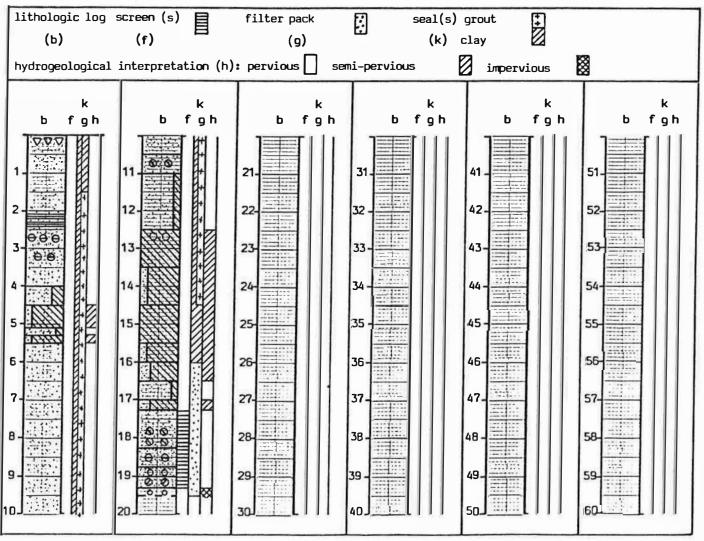
| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolo Prof. Dr. W. De Breuck | e Geologic gy and Hyd | e en H drogeo | ydrogeol logy | OUTE | search n O 86/81 | г. : | | Well 1 D h | = |
|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|------------------------|----------------------------|------|--------|---------------|-----------|
| RESEARCH: Addition Arco Che | mical Pı | coduc | - | Survey of ope plant | | OW | NER | • ARCC | O-ATOCHEM |
| at Rieme | (Belgi | ım) | 1 4007 | | | | | | |
| - DATE : July 6th 19 | olah | Ly /t | n 1987 | | | | | | |
| - DRILLING CY.: Ge - DRILLING RIG No: | DRILLING RIG Nordmeyer DRILLER: DESCRIPTION OF CUTTINGS BY: A. De Bruyn | | | | | | | | |
| - MAP N.G.I. Nr. :14 | /5 | DI | G | EOL./PEDC | L. MAP | Nr. | . 40 | Œ | |
| - MUNICIPALITY :Ev | ergem | | | | | | NIS | -CODE | E: 44019 |
| - X = Y | = | | | _ ZMV : | <u>8,434</u> | | | | _(m TAW) |
| (LAMBERT-COORDINA (ZMV = ground level (me | • | ZMV | * = gro | | = (estimate | | | | _(m TAW) |
| | Ø | | | | DEPTH (i | in m | 1) | | |
| DRILLING METHOD | (mm) | fron | n - to | from - to | from - | to | from | - to | from - to |
| Auger | 220 | - | - 5,5 | | | | | | |
| Bailer | 220 | | 5-14,0 | | | | | | |
| Casing | 267 | 0 | | | | | | | |
| Bailer | 135 | | 0-19,0 -19,0 | | | _ | | | |
| Casing | | | | | | | | | |
| DRILLING MUD :BOREHOLE LOG(S) | - | | | C | ONSUMI | PTIC |)N (I) | : | |
| screen nr. NR. D | FB I | OFO | ZMP | ZMP* | GWDP | | L | ST | P |
| | ,25 19 | ,25 | 9,011 | | | | 2 | 11 | 2 |
| F2 | | | | | | | | | |
| F3 | | | | | | | | | |
| DFB = Depth to DFO = Depth to ZMP = Level me ZMP* = Estimate GWDP = Groundword L = Type of ST = Stratigra | 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) | | | | | | | well | |
| - Several screens in or - Characteristics - rise | | | | | PVC NBN | T42 | 2-111 | | |
| - scr | eens | | | 8 mm VAN F NP10 | | | | | |
| - con | nections | | LUED JO | DINTS | | | | | |
| - Bottom pipe (m): | 0,05 | | | | | | | | |
| - Screen slot openings | - type : | vei | ctical | sawed slot | S | | | | |
| | - open | area | (%):_ | | | | | | |
| Centralizer(s) - placeFilter-pack type and | charact | - eristi | cs : _ c | coarse sand | 0,7 - | 1,25 | mm; | | |
| - Seals-type and charac | - volum cteristic | . · C | Lav pel | lets "comp | pactonit | e" | | | |
| volBorehole backfill matDevelopment - meth | ume (I.) erial : _ od : | : | ee samp | ling | from 10 | 6,0 | to 0 | m | |
| - date | - durat | ion (l | h) : | | | | | | |
| | arge (m | 3/h) | : | | | | | | |

| ple | Description of the cuttings | Depth | (m) |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|
| r• | Description of the eatenings | from | to |
| | Brown sand with stones and stone fragments | 0 | 0,3 |
| | Brown fine sand | 0,3 | 1,5 |
| | Greyish brown fine sand | 1,5 | 2,0 |
| | Greyish brown fine sand with thin layers of peat and | | |
| | plant fibres | 2,0 | 2,5 |
| | Greyish brown fine sand with many wood fragments | 2,5 | 3,5 |
| | Dark brown fine sand | 3.5 | 4.0 |
| | Grey silty fine sand | 4,0 | 4,5 |
| | Grey slightly sandy silt | 4,5 | 5,1 |
| | Grey slightly silty fine sand | 5,1 | 5,3 |
| | Grey slightly sandy silt | 5,3 | 5,5 |
| | Grey fine sand | 5,5 | 6,5 |
| | Greenish grey fine sand | 6,5 | 8,5 |
| | Grey fine sand | 8,5 | 9,5 |
| | Greenish grey fine sand with few fine shell fragments | 9,5 | 10,5 |
| | Grey fine sand with silt lumps | 10,5 | 11,0 |
| - | Grey slightly silty fine sand with very few fine shell | | |
| | fragments | 11,0 | 12,5 |
| | Grey silt | 12,5 | 12,6 |
| | Grey silt with few fine gravel | 12,6 | 13,5 |
| | Greenish grey slightly sandy silt with thin black layers and few fine gravel | | |
| | - Placement of protective casing (Ø 200 mm NP 7,5 VAN RYS- WYCK-VEGHEL BV HOLLAND Ø 200 x 5,1 Polva PVC 7,5 bar), pressed to a depth of 14,55 m. | | |
| | Inserting of bentonite-cement grout from 0 to 13,5 m around this casing | | |
| | | | |

| Sample nr. | Description of the cuttings | Depth | (m) |
|------------|-----------------------------------------------------------------------------------------------------------------------|-------|-------|
| 112,0 | Description of the cuttings | from | to |
| | July 7th 1987 | | |
| | Greenish grey slightly sandy silt | 13,5 | 14,5 |
| | | | |
| | Greenish grey silt | 14,5 | 15,5 |
| | Greenish grey slightly sandy silt | 15,5 | 16,0 |
| | Greyish green sandy silt | 16,0 | 16,5 |
| | Greyish green slightly silty fine sand | 16,5 | 17,0 |
| | Grey sandy silt | 17,0 | 17,25 |
| | Greyish green fine sand | 17,25 | 17,5 |
| | Greyish green fine sand with small silt lumps | 17,5 | 18,25 |
| | Greyish green fine sand with few fine wood fragments | 18,25 | 18,75 |
| | Greyish green fine sand with few fine gravel | 18,75 | 19,0 |
| | Greyish green fine sand with lumps of sandy clay | 19,0 | 19,3 |
| | Green stiff slightly sandy clay with few coarse and fine gravel | 19,3 | 19,5 |
| | During installation of the observation well, the inside of the protective casing has been filled up with clay pellets | | |
| | From 2 - 9 m : slight odour (same as 2D) 9 - 17,5 m : strong penetrating odour (2D) | | |
| | 17,5-19,5m : slight odour (2D) | | |
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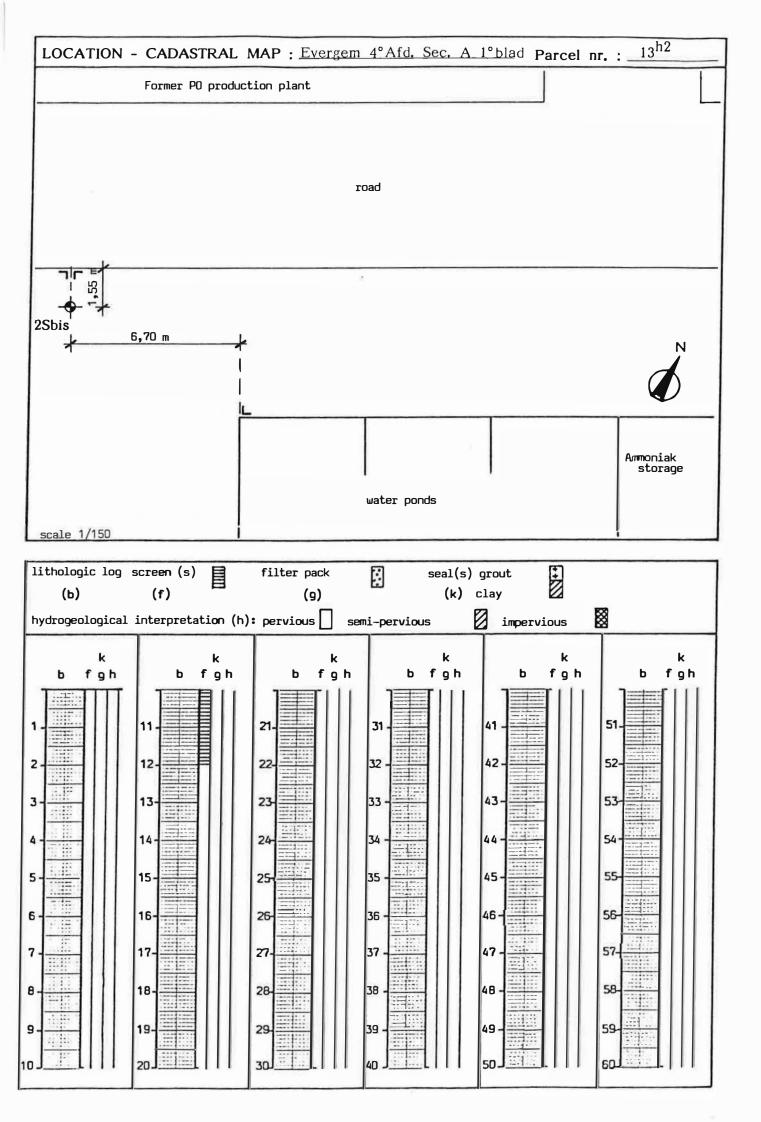
| 0 - 0,3 m | Fill (disturbed soil) |
|----------------|--------------------------------|
| 0,3 - 12,5 m | KZ2 (pervious layer) |
| 2,5 - 17,25 m | KL (semi pervious layer) |
| 7,25 - 19,25 m | KZ1 (pervious layer) |
| 9,25 - | a3 (Tertiary clay substratum) |
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| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolog Prof. Dr. W. De Breuck | Geologio y and Hy | e en Hydroge drogeology | prodre | esearch 1 | | Well nr.: 2S bis |
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| RESEARCH : Additional | l hydrodical Pro | geological oducts Eur | Survey of ope plant | | OWNER | : ARCO-ATOCHEM |
| - DATE: July 15th | | 11] | | ************************************** | | |
| - DRILLING CY. : Geol | ab | | | | | |
| - DRILLING CI. : See S | meyer | | DRIL | IFR: | | |
| - DESCRIPTION OF CUT | ITINGS | $BY : \underline{A}$ | De Bruyn | | | |
| - MAP N.G.I. Nr.: 14/5 | | | GEOL./PED | OL. MAI | | |
| - MUNICIPALITY : _Ever | cgem | | | | NI: | S-CODE: 44019 |
| - X = Y (LAMBERT-COORDINA | = | | ZMV | = 8,15 | 1 | (m TAW) |
| (ZMV = ground level (mea | TES) sured); | $ZMV^* = g$ | ZMV* round level | = (estimat | ed)) | (m TAW) |
| DRILLING METHOD | Ø | I | | DEPTH (| | |
| DIVIDENTAL MICHAEL | (mm) | from - to | from - to | o from - | to from | m - to from - to |
| Auger | 168 | 0 - 2 | | | | |
| Bailer | 135 | 2 - 12 | | | | |
| Casing | 168 | 0 - 12 | | | | |
| | | | | | 4-1 | |
| | | | | | | |
| - DRILLING MUD : - BOREHOLE LOG(S) : | | | | CONSUM | PTION (I |): |
| screen nr. NR. DI | FB I | OFO ZM | P ZMP* | GWDP | l L | ST P |
| F1 10 | 12 | | | UNDI | 1 1 | 10 2 |
| F2 10 | | 0,040 | | | | 10 2 |
| F3 | | | | | | |
| NR = Number DFB = Depth to DFO = Depth to ZMP = Level med ZMP* = Estimated GWDP = Groundwa L = Type of a ST = Stratigrap P = 1=Piezome | bottomasuring level of ter depinguifer: http://doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org/doi.org | of screen point (m ' of mark (n th below n the legan to legan | (m) TAW) TAW) TAW) Tark Tatic; 2 = no | - | | mping well |
| - Several screens in one - Characteristics - rise | | : _Ø 63 x | 1,8 PN10 | | | |
| - scre | ens | | | | | |
| | | _HOLLANI | NP10 | | | |
| - conn | ections | | | | | |
| - Bottom pipe (m):O | ,05 | | | | | |
| - Screen slot openings - | type: | | | | | |
| - | size (r | nm):_60 | x 0,3 | | | |
| - Centralizer(s) - place - Filter-pack type and c | (m):_ | = | | | | |
| | volume | e (l.) : _ | ,5 - 12 m | depth | | |
| - volu | me (l.) | :f | rom 0 to 9 | ,5 m dep | t.h | |
| Borehole backfill mateDevelopment - metho | erial : _ od :s | - see sampling | | | | |
| - date - | - durati | on (h) : | | | | |
| - discha | rge (m ³ | 3/h) : | | | 34.2 | |

| ample | Description of the cuttings | Depth | Depth (m) | | | |
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| nr. | Beserver of the cuttings | from | to | | | |
| | Cable tool drilling with use of pure water | | | | | |
| | | | | | | |
| | Description of cuttings : see Drilling nr 2D bis | | | | | |
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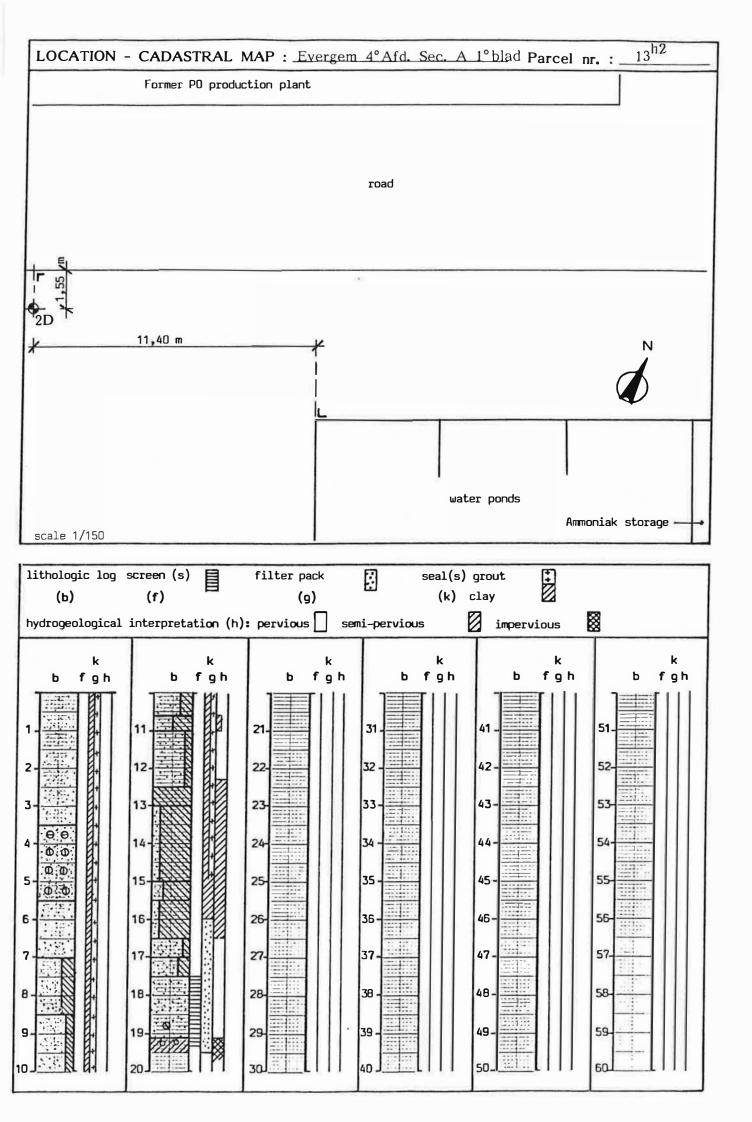


| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolog Prof. Dr. W. De Breuck | Geologie y and Hyd | e en Hydrogeo drogeology | TOUTE | search n 60 86/81 | r, : | Well nr. 2 D | : | |
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| | nical Pi | coducts Eu | l Sur v ey of cope plant | | OWNER | : ARCO-ATO | OCHEM | |
| at Rieme | | | | | | | | |
| - DATE : July 02 nd 19 | 987 - Ji | ıly 03 rd | 1987 | | | | | |
| DRILLING CY. : Geolab | | | | | | | | |
| DRILLING RIG Nordmeyer DRILLER: DESCRIPTION OF CUTTINGS BY: _A. De Bruyn | | | | | | | | |
| | | | | | | 100 | | |
| - MAP N.G.I. Nr. : 14/5 | 2 | | JEOL./PEDO | OL. MAP | Nr. : _4 | OE | | |
| MUNICIPALITY : _EverX = Y(LAMBERT-COORDINA | cgem | | | | NIS | -CODE: | | |
| - X = Y | = | | ZMV | = 8,12 | 24 | (п | TAW) | |
| | | | | | | (m | TAW) | |
| (ZMV = ground level (mea | sured); | ZMV* = gr | ound level | (estimate | d)) | | | |
| | | | (*) | | | | | |
| DDU LING METHOD | Ø | | I | DEPTH (i | nm) | | | |
| DRILLING METHOD | (mm) | from - to | from - to | from - | to from | - to fro | m - to | |
| | | | Troin to | 1110111 | to mon | 10 110 | 111 - 10 | |
| _Auger | 220 | 0 - 2 | | | | | | |
| Bailer | 220 | 2 -14,5 | | | | | | |
| Casing | 250 | 0 -14,5 | | | | | | |
| Bailer | 135 | 14,5-19,5 | | | | | | |
| Casing | 168 | 0 -19,0 | | † | | | | |
| | | | 1 | | | 1 | | |
| - DRILLING MUD : - BOREHOLE LOG(S) : | | | | CONSUMF | PTION (1) | : | | |
| screen nr. NR. D | FB I | OFO ZMF | P ZMP* | GWDP | L | ST | P | |
| F1 | | | -1 | l CWB1 | | 01 | | |
| | 5 10 | 9.5 8.7 | 11 | | 2 | 11 | 2 | |
| F2 | | | | | | | | |
| F3 | | | | | | | | |
| NR = Number | | V | | | | | | |
| | | (-) | | | | | | |
| | | | | | | | 10.0 | |
| DFO = Depth to | | | | | | | | |
| ZMP = Level me | _ | • | | | | | 1.0 | |
| ZMP* = Estimated | | - | • | | | | 1 | |
| GWDP = Groundwa | | | | | _ | | 1.1 | |
| L = Type of a | | | | on phreat | ic | | 1.1 | |
| ST = Stratigrap | | | • | | | | . 11 | |
| P = 1=Piezom | eter; 2= | Observatio | n well; 3=D | ugged we | ell; 4=Pui | mping wel | 1 | |
| | | _ | | | | | | |
| - Several screens in on | e boreh | ole: 🌠 🗷 | 0 | 40 | | | | |
| - Characteristics - rise | r pipes | : PVC Ø 6 | 3 mm x 1,8 | PN IO D | YKA PVC | | | |
| | - Characteristics - riser pipes : PVC Ø 63 mm x 1,8 PN 10 DYKA PVC NBN T42-111 | | | | | | | |
| - screens : PVC Ø 63 NP 10 VAN RYSWYCK-VEGHEL BV | | | | | | | | |
| - scre | eens | PVC Ø 6 | 3 NP 10 VA | | | BV | | |
| | | PVC Ø 6 | 3 NP 10 VA | N RYSWYC | K-VEGHEL | BV | | |
| | | PVC Ø 6 | 3 NP 10 VA | N RYSWYC | K-VEGHEL | | | |
| | nections | PVC Ø 6 HOLLANI GLUED 3 | 3 NP 10 VA | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m): | nections | PVC Ø 6 HOLLANI GLUED 3 | 03 NP 10 VA 0 COINTS | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m): - Screen slot openings | ,05 | PVC Ø 6 HOLLAND GLUED 5 | OINTS Sawed slo | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m): - Screen slot openings | ,05 - type : | : PVC Ø 6 HOLLAND : GLUED 3 vertical mmm): 60 | Sawed slo | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m): - Screen slot openings | ,05 - type : - size (| : PVC Ø 6 HOLLAND : GLUED 3 vertical mmm): 60 area (%): | Sawed slo | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m): - Screen slot openings - Centralizer(s) - place | ,05 - type : - size (- open : | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): 60 area (%): 17,0; 19 | sawed slo | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m):0 - Screen slot openings - Centralizer(s) - place - Filter-pack type and | ,05 - type : - size (- open : (m) : _ | PVC Ø 6 HOLLAND GLUED 3 vertical mm): 60 area (%): 17,0; 19 | sawed slo x 0,3 | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m):0 - Screen slot openings - Centralizer(s) - place - Filter-pack type and | ,05 - type : - size (- open : (m) : _ | PVC Ø 6 HOLLAND GLUED 3 vertical mm): 60 area (%): 17,0; 19 | sawed slo x 0,3 | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m):0 - Screen slot openings - Centralizer(s) - place - Filter-pack type and | ,05 - type : - size (- open : (m) : _ | PVC Ø 6 HOLLAND GLUED 3 vertical mm): 60 area (%): 17,0; 19 | sawed slo x 0,3 | N RYSWYC | K-VEGHEL | | | |
| - con - Bottom pipe (m): Screen slot openings - Centralizer(s) - place - Filter-pack type and - Seals-type and character | - type : - size (- open : - character- volumeteristics | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): 60 area (%): 17,0;19 eristics: 6 e (l.): s: Clay pe | sawed slo x 0,3 | N RYSWYC ts 0,7 - 1 16,0 to nit | ,25 mm 19,5 m | | | |
| - con - Bottom pipe (m): Screen slot openings - Centralizer(s) - place - Filter-pack type and - Seals-type and characteristic control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control | - type : - size (- open : - characte - volume teristics ume (1.) erial : | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): 60 area (%): 17,0;19 eristics: 6 e (l.): 6 s: Clay pe | sawed slo x 0,3 | ts 0,7 - 1 16,0 to | ,25 mm 19,5 m | | | |
| - con - Bottom pipe (m): Screen slot openings - Centralizer(s) - place - Filter-pack type and - Seals-type and characteristic control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control | - type : - size (- open : - characte - volume teristics ume (1.) erial : | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): 60 area (%): 17,0;19 eristics: 6 e (l.): 6 s: Clay pe | sawed slo x 0,3 | ts 0,7 - 1 16,0 to | ,25 mm 19,5 m | | | |
| - con - Bottom pipe (m): Screen slot openings - Centralizer(s) - place - Filter-pack type and - Seals-type and charace - vol - Borehole backfill mat - Development - meth | - type: - size (- open (m): _ characteristicume (l.) erial: _ sod: _ s | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): 60 area (%): 17,0;19 eristics: 6 e (l.): 6 clay pe | sawed slo x 0,3 | N RYSWYC ts 0,7 - 1 16,0 to nit | ,25 mm 19,5 m | | | |
| - con - Bottom pipe (m): Screen slot openings - Centralizer(s) - place - Filter-pack type and - Seals-type and charace - vol - Borehole backfill mat - Development - meth - date | - type: - size (- open (m): _ charact - volume tteristic: ume (l.) erial: _ od: durat | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): 60 area (%): 17,0; 19 eristics: 6 e (l.): 6 c Clay pe ee sampling ion (h): | sawed slo x 0,3 | ts 0,7 - 1 16,0 to | ,25 mm 19,5 m | | | |
| - con - Bottom pipe (m): Screen slot openings - Centralizer(s) - place - Filter-pack type and - Seals-type and charace - vol - Borehole backfill mat - Development - meth - date | - type : - size (- open : - charact - volume :teristic: ume (1.) erial : od :s - durat arge (m | PVC Ø 6 HOLLAND GLUED 3 vertical mmm): _60 area (%): 17,0 ; 19 eristics: _6 e (l.) : _ s: _Clay pe : ee samplin ion (h): _ 3/h): _ | sawed slo x 0,3 coarse sand from llets Dura | ts 0,7 - 1 16,0 to | ,25 mm 19,5 m | | | |

| Description of the cuttings Dark brown fine sand Idem Brown fine sand | Depth from | (m) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 0.0 | |
| Idem Brown fine sand | | 1,0 |
| Tacin Dionn Time Sand | 1,0 | 2,5 |
| Greyish brown fine sand | 2,5 | 3,0 |
| Brown fine sand | 3,0 | 3,5 |
| Greenish grey fine sand with wood fragments | 3,5 | 4,0 |
| Greenish grey fine sand with small sandstone fragments | 4,0 | 5,5 |
| Greenish grey fine sand | 5,5 | 6,0 |
| Greenish grey fine sand | 6,0 | 7,0 |
| Greenish grey silty fine sand with very few fine shell fragments | 7,0 | 8,5 |
| Greenish grey slightly silty fine sand with very few fine shell fragments | 8,5 | 9,0 |
| Idem | 9,0 | 10,0 |
| Greenish grey silty fine sand with very few fine shell fragments | 10,0 | 10,6 |
| Greenish grey sandy silt and silty sand | 10,6 | 11,0 |
| Greenish grey slightly silty fine sand with very few fine shell fragments | 11,0 | 12,0 |
| Idem | 12.0 | 12,5 |
| Grey silt | 12,5 | 13,0 |
| Grey slightly sandy silt with black spots | 13,0 | 13,5 |
| Grey slightly sandy silt | 13,5 | 14,5 |
| Placement of protective casing to a depth of 15,0 m, pressed into the silt layer KL the last half a meter (PVC VAN RYSWYCK EN VEGHEL BV HOLLAND Ø 200 mm x 5,9 | | |
| Polva PVC 7,5 bar) | | |
| Placement of bentonite grout around the protective casing, from 14,5 to 0 m | | |
| | | |
| | Greenish grey fine sand with wood fragments Greenish grey fine sand Greenish grey fine sand Greenish grey fine sand Greenish grey silty fine sand with very few fine shell fragments Greenish grey slightly silty fine sand with very few fine shell fragments Idem Greenish grey silty fine sand with very few fine shell fragments Greenish grey silty fine sand with very few fine shell fragments Greenish grey sandy silt and silty sand Greenish grey slightly silty fine sand with very few fine shell fragments Idem Grey silt Grey slightly sandy silt with black spots Grey slightly sandy silt Placement of protective casing to a depth of 15,0 m, pressed into the silt layer KL the last half a meter (PVC VAN RYSWYCK EN VEGHEL BV HOLLAND Ø 200 mm x 5,9 Polva PVC 7,5 bar) | Greenish grey fine sand with wood fragments Greenish grey fine sand with small sandstone fragments Greenish grey fine sand Greenish grey fine sand Greenish grey fine sand Greenish grey silty fine sand with very few fine shell fragments Greenish grey slightly silty fine sand with very few fine shell fragments Greenish grey slightly silty fine sand with very few fine shell fragments Greenish grey silty fine sand with very few fine shell fragments Greenish grey silty fine sand with very few fine shell fragments Greenish grey sandy silt and silty sand 10,6 Greenish grey slightly silty fine sand with very few fine shell fragments 11,0 Grey slightly sandy silt with black spots 12,5 Grey slightly sandy silt with black spots 13,0 Grey slightly sandy silt 13,5 Placement of protective casing to a depth of 15,0 m, pressed into the silt layer KL the last half a meter (PVC VAN RYSWYCK EN VEGHEL BV HOLLAND Ø 200 mm x 5,9 Polva PVC 7,5 bar) Placement of bentonite grout around the protective casing, |

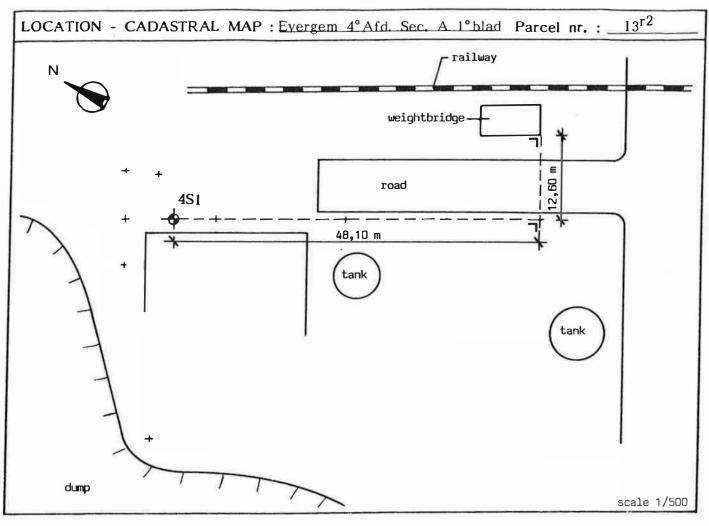
| Sample | Description of the cuttings | Depth (m) | | |
|--------|------------------------------------------------------------------------------------------------------------------|-----------|------|--|
| 114 | Description of the cuttings | from | to | |
| | Drilling continued on July 3rd 1987 | - | | |
| M15 | Greenish grey slightly sandy silt | 14,5 | 15,0 | |
| | Greenish grey sandy silt with black spots | 15,0 | 15,5 | |
| M16 | Greenish grey slightly sandy silt with fine black inter- layers | 15,5 | 16,5 | |
| M17 | Greenish grey slightly silty sand | 16,5 | 17,0 | |
| м18 | Greenish grey silty sand | 17,0 | 18,5 | |
| | Greenish grey fine sand | | | |
| M19 | Greenish grey fine sand with few small silt lumps | 18,5 | 19,1 | |
| | Greyish green sandy stiff clay with few gravel and shell fragments | 19,1 | 19,4 | |
| | Greyish green sandy stiff clay | 19,4 | 19,5 | |
| | During installation of observation well the inside of the protective casing has been filled up with clay pellets | | | |
| | from 1,5 - 6,5 m slight odour | | | |
| | 6,5 - 12,5 m strong penetrating odour 12,5 - 13,5 m slight odour | | | |
| | 13,5 - 19,5 m strong penetrating odeur | | | |
| | During the drilling, from 1,5 to 19,5 m : all the same, | <u> </u> | | |
| | solvent like odour, which is referred to in the other drillings as "odour 2D" | | | |
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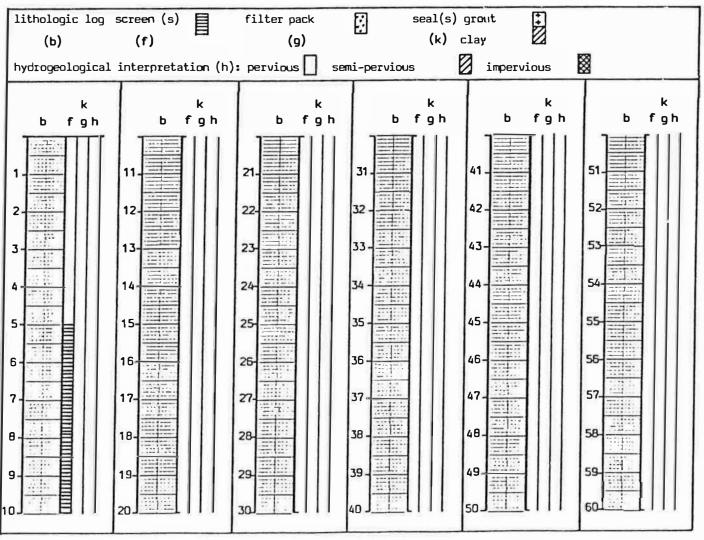
| Geological in | nterpreta | tion | and | remarks |
|---------------|------------------------|------|-----|---------|
| 0 | - 12,25 | m : | KZ2 | |
| 12,25 | - 17 , 5 | m : | KL | |
| 17,5 | - 19,1 | m : | KZ1 | • |
| 19,1 | | | | |
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| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolog | Geologie | en H | ydrogeol | ogre | Research nr.: Well nr.: TGO 86/81 4S1 | | | | |
|-----------------------------------------------------------------------------------------------|-----------------------|---------------|-------------------|-----------------------|---------------------------------------|------|----------|-----------|---------|
| Prof. Dr. W. De Breuck | | | | | | | | | |
| RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site | | | | | | | | | |
| at Rieme (Belgium) | | | | | | | | | |
| - DATE: July 3rd 1987 | | | | | | | | | |
| - DRILLING CY.: Geolab DRILLER: | | | | | | | | | |
| - DESCRIPTION OF CUTTINGS BY: no description - MAP N.G.I. Nr.: 14/2 GEOL./PEDOL. MAP Nr.: 25E | | | | | | | | | |
| - KILKII IDALIIV · Fizor | COM | | | | | | NIIC | CODE | 44019 |
| - X = Y (LAMBERT-COORDINA | = | | | ZMV | 8, 798 | | 1415 | ——— (| m TAW) |
| (LAMBERT-COORDINA | TES) | 7141 | • | ZMV* | = | 111 | | (| m TAW) |
| (ZMV = ground level (mea | isurea); | ZMV | → = gro | ound level | (estimate | ((D: | | | |
| DRILLING METHOD Ø DEPTH (in m) | | | | | | | | | |
| BRIEBING METHOD | (mm) | fron | n - to | from - to | from - | to | from | ı - to fr | om - to |
| rotary | 160 | 0 | - 10 | | | | | | |
| | | | | | 1 | | <u> </u> | | |
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| | | | | | | | | | |
| - DRILLING MUD : | pure wa | ter | | C | CONSUME | PTIC |)N (I) | : | _ |
| - BOREHOLE LOG(S) | : | | | | | | | | |
| | | | ZMP | ZMP* | GWDP | | L | ST | Р |
| F1 5, | 0 10 | ,0 | 9,394 | | | 1 | | 10 | 2 |
| F3 | | - | - | | | - | | | |
| | | | | | | | | | |
| NR = Number DFB = Depth to | top of | scre | en (m) | | | | | | |
| DFO = Depth to | bottom | of s | screen | | | | | | |
| ZMP = Level me ZMP* = Estimated | | | | | | | | | |
| GWDP = Groundwa | ater dep | th be | elow ma | ark . | | | | | |
| L = Type of ST = Stratigran | aquifer | : 1 = | phreat | tic; 2 = no | n phreat | ic | | | |
| ST = Stratigray P = 1=Piezom | ony (con leter: 2= | i orm Obse | to leg rvation | ena LIG) well: 3=D | ugged we | ell: | 4≃Pu: | mping we | ell |
| | | | | | -00 | | | Paris | l l |
| Several screens in orCharacteristics - rise | | | | | st KL10 | | | | |
| | | _K. | IWA 611 | 0/87-11 | | | | | |
| - scr | eens | : _P | /C Ø 12 | 25 x 4,8 W | IKA | | | | |
| - con | nections | : GI | | INTS | | | | | |
| - Bottom pipe (m): _0 | ,10 | | | | | | | | |
| - Screen slot openings | - type : | Ve | ertical | sawed slo | ots | | | | |
| | - size (| mm) | : 60 x | 0,4 | | | | | |
| - Centralizer(s) - place | - open : : (m) : | area 10,(| $(\%): _$ | 5,0 | | | | | |
| - Filter-pack type and | characte | eristi | cs: _c | coarse sand | 0,7/1, | 25 | | | |
| - Seals-type and charac | cteristic | s : 0 | Clay pe | llets comp | pactonite | e | | | |
| - vol | ume (l.) | : _ | | | from 0 | to | 6 m | | |
| Borehole backfill matDevelopment - meth | erial:_ | see r | oumpina | test | | | | | |
| · · · · · · · · · · · · · · · · · · · | | | | | | | | | |
| - disch | arge (m | 3/h) | : | | | | | | |
| - Finishing : steel ca | Ρ | | | | | | - | | |

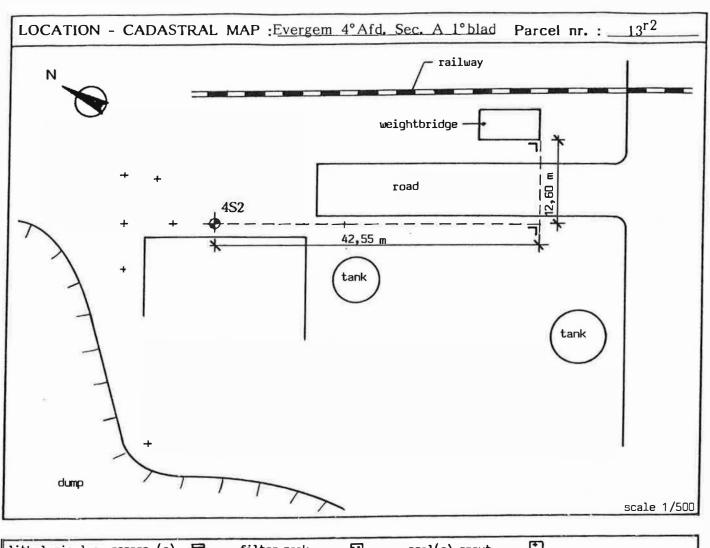
| | LITHOLOGIC LOG - DATE : | | | | | | | |
|--------|-----------------------------|-------|--------|--|--|--|--|--|
| Sample | Description of the cuttings | Depth | (m) | | | | | |
| nr. | | from | to | | | | | |
| | See description 4D1 | | - | | | | | |
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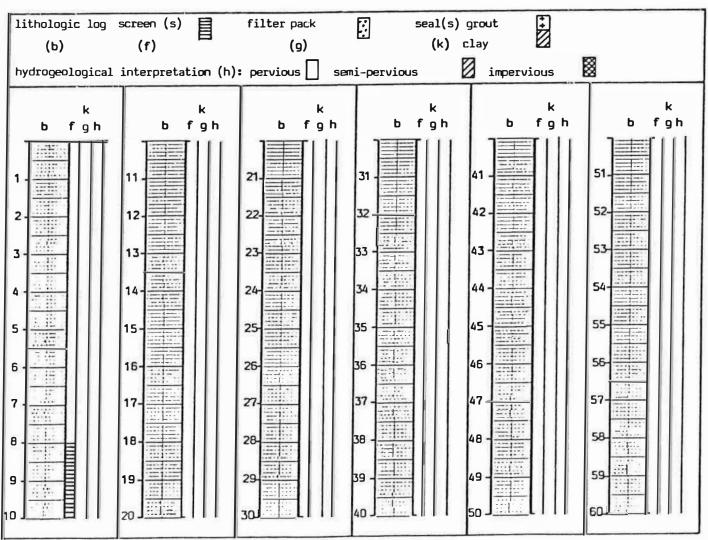




| Rijksuniversiteit Gent Laboratorium voor Toegepasto Laboratory of Applied Geolog Prof. Dr. W. De Breuck | e Geologio gy and Hyd | e en H drogeo | lydrogeol ology | ogie | search n | | Well 4s2 | | |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|------------|--------------|--------|-------------|-----------|--|
| RESEARCH: Additional hydrogeological Survey of the OWNER: ARCO-ATOCHEM | | | | | | | | | |
| Arco Chemical Products Europe plant site | | | | | | | | | |
| at Rieme (Belgium) | | | | | | | | | |
| | - DATE: July 3rd 1987 | | | | | | | | |
| - DRILLING CI.: _Geo | - DRILLING CY.: Geolab DRILLER: | | | | | | | | |
| - DRILLING CI.: Geolab - DRILLING RIG Geolab - DESCRIPTION OF CUTTINGS BY: - MAP N.G.I. Nr.: 14/2 GEOL./PEDOL. MAP Nr.: 25E | | | | | | | | | |
| - MAP N.G.I. Nr. : | rgem | | G | EOL./PEDO | DL. MAP | Nr.:_ | S-CODE | 44019 | |
| - MUNICIPALITY : _Eve - X = Y | = | | | _ ZMV | 8,655 | 5 141 | | (m TAW) | |
| (LAMBERT-COORDINA | ATES) | | | ZMV* | | | | (m TAW) | |
| (ZMV = ground level (mea | asured); | ZMV | * = gro | ound level | (estimate | (D: | | | |
| Ø DEPTH (in m) | | | | | | | | | |
| DRILLING METHOD | (mm) | fron | n - to | from - to | from - | to fro | m - to | from - to | |
| rotary | 160 | 0 | - 10 | | | | | | |
| | | | | | | | | | |
| | | - | | | _ | | | | |
| | | - | | | | | | | |
| DDILLING MUD. | L | | | | CONCLINA | TION (| 1) | | |
| - DRILLING MUD : - BOREHOLE LOG(S) | | | | | ONSUM | TION (| 1): | | |
| | | OFO | | | GWDP | L | ST | P | |
| P4 | | 0,0 | 9,200 | ZIVII · | GWDF | 1 | 10 | 2 | |
| F2 | ,0 10 | ,0 | 9,200 | | | - | 1 10 | | |
| F3 | | | | | | | | | |
| DFO = Depth to ZMP = Level me ZMP* = Estimate GWDP = Groundwa L = Type of ST = Stratigra | 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) | | | | | | | | |
| - Several screens in or | ne boreh | ole : | XXX/no | | | | | | |
| - Characteristics - rise | | : _P | VC Ø 63 | mm DYKA | | | | | |
| - COP | eens | | | | | | | | |
| - 301 | cens | 75.00 | | | | | | | |
| - con | nections | :_G | LUED JO | DINTS | | | | | |
| - Bottom pipe (m): | 0,05 | | | | | | | | |
| - Screen slot openings | - type | ve | rtical | | | | | | |
| | - size (| mm) | 60 > | . 0,3 | | | | | |
| - Centralizer(s) - place | | | | | | | | | |
| - Filter-pack type and | charact | eristi | ics : _cc | arse sand | 0,7/1,2 | 5 | | | |
| - Seals-type and charac | cteristic | s : _ | Clay pe | llets com | pactonit | e | | | |
| - vol - Borehole backfill mat - Development - meth | erial: | | | | | | | | |
| | | | | | | | | | |
| | arge (m | $^{3}/h)$ | : | | | | | | |

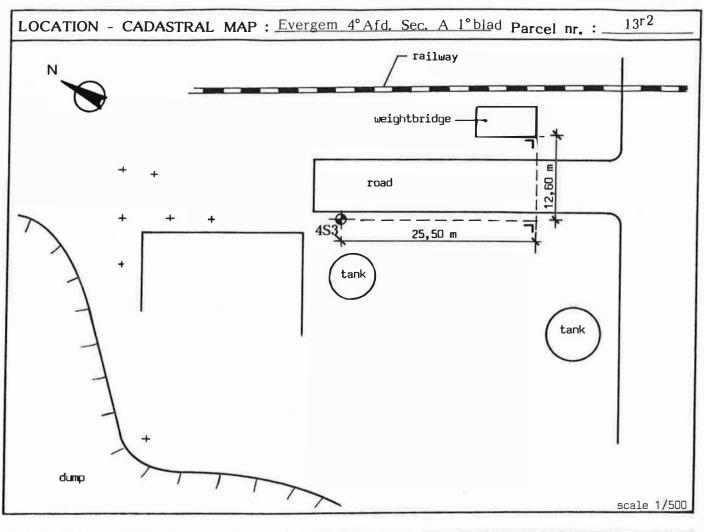
| Sample nr. See description 4D1 | Depth (m) from to |
|---------------------------------|-------------------|
| See description 4D1 | |
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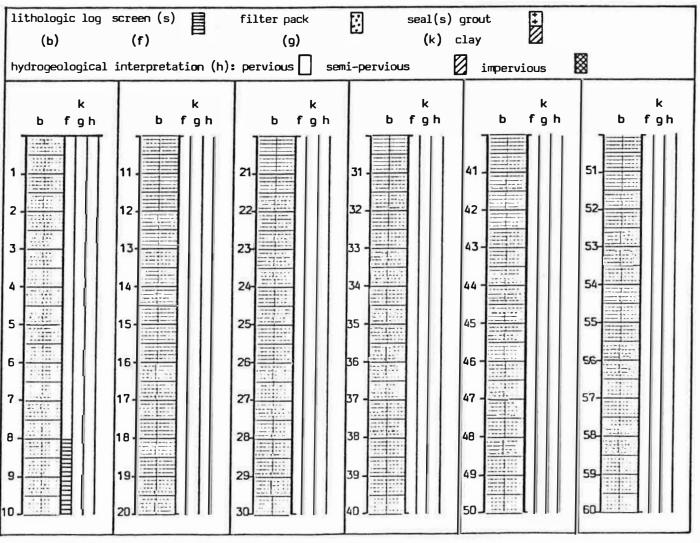




| Rijksuniversiteit Gent Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: TGO 86/81 Well nr.: 4S3 | | | | | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|
| RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site OWNER: ARCO-ATOCHEM | | | | | | | | |
| at Rieme (Belgium) - DATE:Inly 3rd 1987 - DRILLING CY.: _Geolab | | | | | | | | |
| - DESCRIPTION OF CUTTINGS BY: - MAP N.G.I. Nr.: 14/2 GEOL./PEDOL. MAP Nr.: - MUNICIPALITY: Evergem NIS-CODE: - X = Y = ZMV =8,468 (m TAW) | | | | | | | | |
| - X = Y = ZMV =8,468 (m TAW) (LAMBERT-COORDINATES) ZMV* = (m TAW) (ZMV = ground level (measured); ZMV* = ground level (estimated)) | | | | | | | | |
| DRILLING METHOD DEPTH (in m) | | | | | | | | |
| (mm) from - to | | | | | | | |
| NOTECT 100 0 10 | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| - DRILLING MUD :pure water CONSUMPTION (I) : - BOREHOLE LOG(S) : | | | | | | | | |
| screen nr. NR. DFB DFO ZMP ZMP* GWDP L ST P | | | | | | | | |
| F1 8,0 10,0 9,165 1 10 2 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 DYKA PVC NBN T42-111 PN10 | | | | | | | | |
| - screens : PVC Ø 63 mm VAN RYSWYCK-VEGHEL BV HOLLAND NP10 | | | | | | | | |
| - connections : GLUED JOINTS | | | | | | | | |
| - Bottom pipe (m): | | | | | | | | |
| - Screen slot openings - type :vertical sawed slots | | | | | | | | |
| - open area (%): - Centralizer(s) - place (m): _10.0 and 5.0 m - Filter-pack type and characteristics: _ coarse_sand 0.7/1.25 - volume (l.): from 10 to 7 m | | | | | | | | |
| - Volume (I.): Trom to to 7 m - Seals-type and characteristics: Clay pellets "compactonite" - volume (I.): from 0 to 7 m - Borehole backfill material: | | | | | | | | |
| - Development - method : | | | | | | | | |
| - date - duration (h) : | | | | | | | | |
| - Finishing: | | | | | | | | |

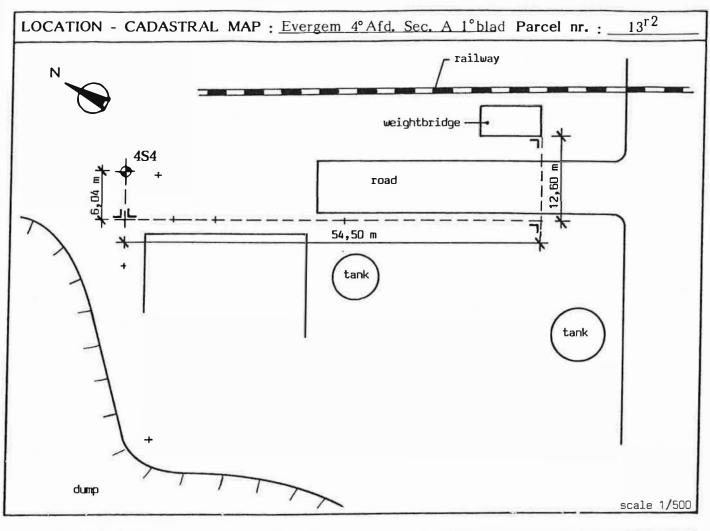
| | LITHOLOGIC LOG - DATE : | | | | | | | |
|--------|-----------------------------|---------------|-----|--|--|--|--|--|
| Sample | Description of the cuttings | Depth from | (m) | | | | | |
| 74. | Grand and April 1991 | 110111 | to | | | | | |
| | See description 4D1 | | | | | | | |
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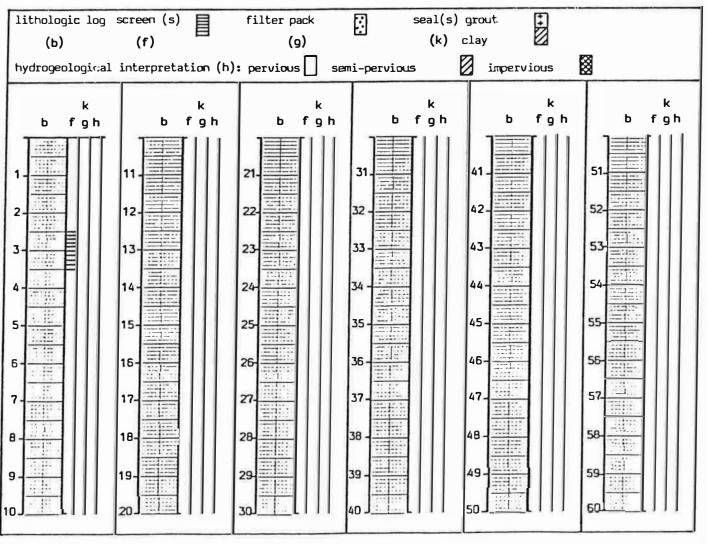




| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolog | e Geologie | e en H | ydrogeolo | ogre | search n | г. ; | | |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|-------------|----------|----------|----------|----------|
| Prof. Dr. W. De Breuck | | | | | | | | |
| RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site OWNER: ARCO-ATOCHEM | | | | | | | | |
| at Rieme (Belgium) | | | | | | | | |
| - DATE : July 4th 1987 | | | | | | | | |
| - DRILLING CY. : Geol | ab | | | DDILL | ED . | | | |
| - DRILLING RIG Geol - DESCRIPTION OF CU | TTINGS | BY | : | DRILL | EK: | | | |
| - MAP N.G.I. Nr. : 14/ | Z rgom | | GI | EOL./PEDO | DL. MAP | Nr.: | 25E | • 44010 |
| - MUNICIPALITY : _Eve - X =Y | = | | | _ ZMV | 8,75 | 50 | S-CODE | (m TAW) |
| (LAMBER I - COORDINA | (1ES) | | | ZMV* : | - | | | (m TAW) |
| (ZMV = ground level (mea | asured); | ZMV | → = gro | und level | estimate | ((D: | | |
| DRILLING METHOD | Ø | | | Ι | DEPTH (i | n m) | | |
| DRILLING METHOD | (mm) | fron | n - to | from - to | from - | to from | n - to f | rom - to |
| rotary | 160 | 0 - | 3,5 | | | | | |
| | | _ | | | - | _ | | |
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| - DRILLING MUD : | | | | | CONSUME | PTION (I |): | |
| - BOREHOLE LOG(S) | - | | | | | | | |
| | FB I | OFO | ZMP | ZMP* | GWDP | L | ST | P |
| F1 2 | ,5 | 3,5 | 9,046 | | | 11 | 10 | 2 |
| | | | | - | | | | |
| DFO = Depth to ZMP = Level me ZMP* = Estimate GWDP = Groundwa L = Type of ST = Stratigra | 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 | | | | | | | |
| - Several screens in or | ne boreh | ole : | xes/no | | | | | |
| - Characteristics - rise | er pipes | : PV PN | | mm DYKA P | VC NBN T | 42-111 | | - |
| - scr | eens | : PV | C Ø 63 | mm VAN RY | SWYCK-VE | GHEL BV | | |
| - con | nections | - 00 | LLAND N UED JOI | P10 NTS | | | | |
| - Bottom pipe (m): | 0,05 | - | | | | | | |
| - Screen slot openings | - type | ver | tical s | awed slot | | | | |
| opon60 | - size (| mm) | : 60 x | 0,3 | | | | |
| - Centralizer(s) - place | - open : (m) : | area - | (%):_ | | | | | |
| Filter-pack type andSeals-type and character | - volum | e (l.) | : Clay pe | llets com | from 1 | to 3,5 m | n | |
| volBorehole backfill matDevelopment - meth | ume (l.) erial : _ od : | : _ | | | from O | to 1 m | | |
| - date | - durat | ion (| h) : | | | | | |
| - disch | | | | | | | | |

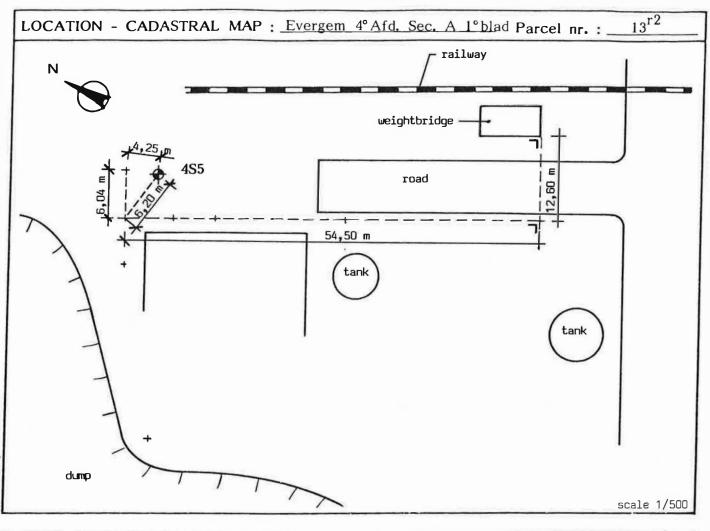
| | LITHOLOGIC LOG - DATE : | | |
|---------------|-----------------------------|-------|-----|
| Samole | Description of the cuttings | Depth | (m) |
| Sample nr. | Bescription of the cuttings | from | to |
| | See description 4D1 | | |
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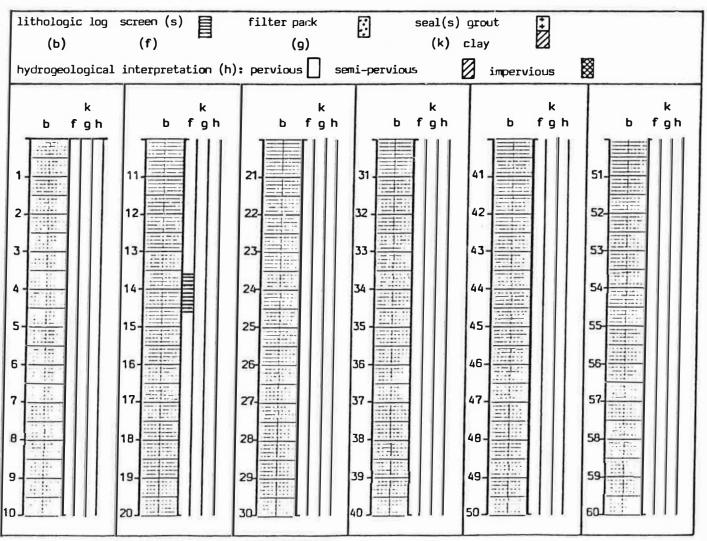




| Prof. Dr | rium ory of • W• | teit Gent voor Toege Applied (De Breuck | Geolog | y and | d Ĥyc | lrogeo. | logy | TG(| search ni 0 86/81 | r. : | | Well 4S | |
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| | | at R | | | Igiu | ım) | | | | | | | |
| | | July 4tl | | olab | | | | | | | _ | | |
| - DRIL | LIN | G CY. : | | | | - | | DRILL | CD . | | | | |
| - DESC | DID, | G RIG TION OF | CII | TTIN | ıcs | BY · | - | _ DRILL | ER : | | | | |
| - MAP | N ₋ G | I. Nr. | 14/ | 2 | 100 | .,, | G | EOL./PEDC | L. MAP | Nr. | : | 25E | |
| - MUNI | ICIP | ALITY: | Eve | rger | m | | | | | | NIS | -CODE | 44019 |
| - X = | | | Y | = , | | | | _ ZMV : | 8,78 | 4 | | | (m TAW) |
| (LAM | BER | T-COOR | DINA | TES | 3) | | | ZMV* = | | | | | (m TAW) |
| (ZMV = | gro | und level | (mea | sure | ed); | ZMV ² | * = gro | und level (| | | | | |
| | | | | | | | - 4 | | | | | | |
| DDU | T T TA | IC METI | IOD | Ø |) | | | | DEPTH (i | n m |) | | |
| DKI | LLIN | IG METH | עטו | (m | m) | fron | 1 - to | from - to | from - | to | from | - to | from - to |
| rota | rv | | - | 160 | | - | - 14,6 | | | | | | |
| 1000 | LL y | | | 100 | | Ť | 14,0 | | | \neg | | | |
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| | | | | 1-2-7-1 | | | | | | | | | |
| | | NG MUD OLE LOC | | | | | | C | ONSUMF | PTIO | N (I) | :- | |
| screen | 70.0 | NR. | D | FB | Ī | OFO | ZMP | ZMP* | GWDP | | L | ST | I P |
| F1 | 1 | | 13, | _ | | 4,6 | 9,234 | - | O W.D. | | 2 | 9 | 2 |
| F2 | - | | 13, | $\stackrel{\circ}{-}$ | | 4,0 | 7,234 | - | | - | | | |
| | - | | | - | | | | | | _ | | | |
| F3 | | | | | | | | | | | _ | | |
| NR | | = Num | | | | | | | | | | | |
| DF | | = Dept | | | | | | | | | | | |
| I DE | \cap | - Don | th ta | L - 4 | | | | | | | | | |
| DFO | | • | | | | | creen | | | | | | 1 |
| ZMI | P | = Leve | el me | asur | ring | point | t (m T/ | AW) | | | | | |
| ZMI ZMI | P P* | = Leve = Esti | el me mate | easur d lev | ring vel | point of m | t (m T/ ark (m | AW) TAW) | | | | | |
| ZMI ZMI GW | P P* | = Leve = Estin = Grou | el me mate indwa | easur d lev ater | ring vel dep | point of m th be | t (m T/ ark (m elow ma | AW) TAW) ark | | ia | | | |
| ZMI ZMI GWI L | P P* | = Leve = Estin = Grou = Type | el me mate indwa e of | easur d lev ater aqui | ring vel dep fer | point of m th be : 1 = | t (m T/ ark (m elow ma phreat | AW) TAW) ark .ic; 2 = no | n phreat | ic | | | , |
| ZMI ZMI GWI L ST | P P* | = Leve = Estin = Grou = Type = Stra | el me mate indwa e of a tigraj | easur d lev ater aqui: phy | ring vel dep fer (con | point of m th be th 1 = | t (m T/ ark (m elow ma phreat to leg | AW) TAW) ark cic; 2 = no end LTG) | • | | 4=Pm | mning | well |
| ZMI ZMI GWI L | P P* | = Leve = Estin = Grou = Type = Stra | el me mate indwa e of a tigraj | easur d lev ater aqui: phy | ring vel dep fer (con | point of m th be th 1 = | t (m T/ ark (m elow ma phreat to leg | AW) TAW) ark .ic; 2 = no | • | | 4=Pui | mping | well |
| ZMI ZMI GWI L ST P | P P* DP | = Leve = Estin = Grou = Type = Stra = 1=Pi | el memated indware of stigrape ezom | easur d levater aqui phy eter ne be | ring vel dep fer (con ; 2= | point of m th be th be of th be of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contrac | t (m T/ ark (m elow ma phreat to leg rvation | AW) TAW) ark cic; 2 = no end LTG) well; 3=D | ugged w | ell; | | | well |
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| ZMI ZMI GW L ST P - Seve - Cha - Bott - Scree - Filte - Seal - Bore - Deve | PP+ P+ DP eral eral aract tom een s etrali er-pa ehole elop | = Leve = Estin = Grou = Type = Stran = 1=Pi screens eristics | in or rise or con in grand in and in | easurd level additional designation of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control | ring vel dep fer (con ; 2= oreh ipes cions ze (con) : _ ract clum istic e (l.) il : _ urat e (m | point of m th be : 1 = Iform Obse lole: PY H(G::GI mm) area eristi le (l.) s: ion (l.) s: ion (l.) | t (m T/ark (m elow mark (m elow | TAW) TAW) ark cic; 2 = no end LTG) well; 3=D mm DYKA I mm VAN RY NP10 INTS sawed slot 0,3 carse sand | resugged we represent the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of the representation of | ell; T42- EGHE 25 3 to e to | 111 L BV | 5 m | |

| | LITHOLOGIC LOG - DATE : | | |
|--------|-----------------------------------------------|---------------|-----|
| Sample | Description of the cuttings | Depth from | (m) |
| | Description has been made during drilling 4D1 | 110 | 10 |
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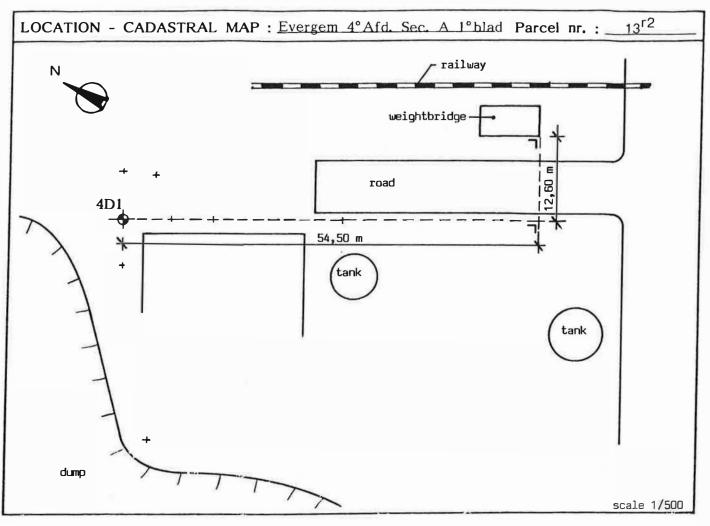


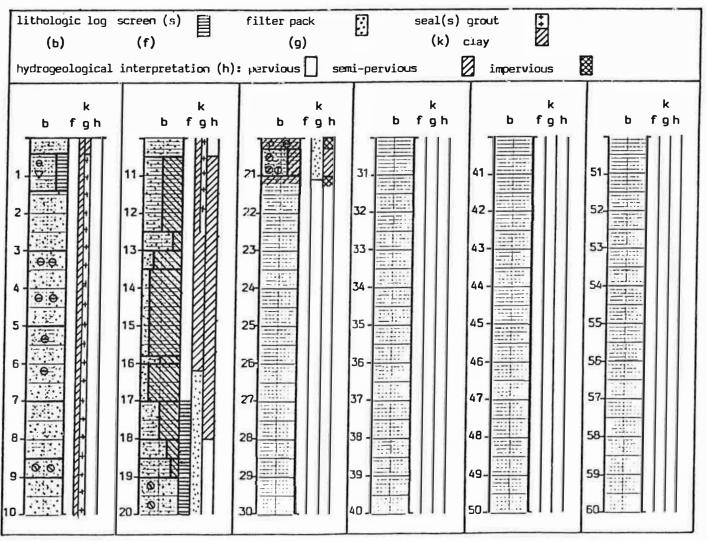
| Rijksuniversiteit Gent Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: Well nr.: TGO 86/81 4D1 | | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------|--------------------------|----------------------------|---------|-----------|---------|--|
| RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site at Rieme (Belgium) OWNER: ARCO-ATOCHEM | | | | | | | | | |
| - DATE: June 30, 198 - DRILLING CY.: Geol - DRILLING RIG Nord - DESCRIPTION OF CUT - MAP N.G.I. Nr.: 14/2 | 37 - Jul ab Imeyer TTINGS | y 01 BY: | E. Va | DRILL | A. De Br | uyn | 25E | | |
| - MUNICIPALITY: _Ever - X =Y (LAMBERT-COORDINA (ZMV = ground level (mea | gem = TES) | | | ZMV = ZMV* = und level (| = _8,801 = (estimate | NIS | S-CODE: | m TAW) | |
| DRILLING METHOD | Ø | | | Ι | DEPTH (i | nm) | | | |
| DRILLING METHOD | (mm) | fron | 1 - to | from - to | from - | to from | n - to fr | om - to | |
| Auger | 250 | | 1,5 | | <u> </u> | | | | |
| Auger Bailer | 220 | | - 2,5 -12,0 | | - | | | | |
| Casing | 267 | | -11,6 | | | _ | | | |
| Bailer | 135 | | -21,1 | | | | | | |
| Casing - BOREHOLE LOG(S): | 168 | | -21,2 | | | , , | | | |
| screen nr. NR. D | FB I |)FO | ZMP | ZMP* | GWDP | L | ST | Р | |
| F1 17, | 0 20 | ,0 | 9,391 | | | 2 | 11 | 2 | |
| F2 | | | | | | | | | |
| F3 | | | | | | L | | | |
| DFB = Depth to DFO = Depth to ZMP = Level me ZMP* = Estimated GWDP = Groundwa L = Type of a ST = Stratigrap | 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) | | | | | | | | |
| - Several screens in on - Characteristics - rise | r pipes | : _PV | WA 619 | PLAST Ø 13 0 / 87-11 | | | | | |
| - scre | eens | : _PV | C Ø 12 | 5 x 4,8 | | | | | |
| | | _ | | D SCREWED | JOINTS | | | | |
| - Bottom pipe (m): 0 | | | | | | | | | |
| | - size (| mm) | 60 | x 0,4 | | | | | |
| Centralizer(s) - placeFilter-pack type and | (m):_ charact - volum | 17, eristi | 0 ; 20 cs : co | arse sand | 0,7/1,2 | 5 | | | |
| - Seals-type and charac | teristic | s : <u>_</u> C | lay pe | llets Dura | nit | | | | |
| Borehole backfill matDevelopment - meth | erial : | - | | | | | | | |
| - disch | arge (m | 3/h) | : | | | | | | |
| - Finishing:steel cap | | | | | | | | | |

| | LITHOLOGIC LOG 4D1 - DATE: June 30th 1987 | | | |
|--------|--------------------------------------------------------------------------------------------------------------------|-------|------|--|
| Sample | Description of the cuttings | Depth | (m) | |
| nr. | | from | to | |
| | Greyish brown fine sand | 0,0 | 0,4 | |
| | Black humic fine sand | 0,4 | 0,5 | |
| | | | | |
| М1 | Black humic fine sand with wood and stone fragments | 0,5 | 1,4 | |
| M2 | Brown fine sand | 1,4 | 2,0 | |
| мз | Idem | 2,0 | 3,0 | |
| | | | | |
| M4 | Greyish brown fine sand with peat fragments | 3,0 | 4,5 | |
| _м5 | Idem, with wood fragments | 4,5 | 5,0 | |
| M6 | Grey to greenish grey fine sand with peat and wood fragments | 5,0 | 6,0 | |
| | cze, co greenzen gre, rine cana wron peac and week craymonte | | | |
| м7 | Idem | 6,0 | 7,0 | |
| м8 | Grey fine sand with very few peat fragments | 7.0 | 8,0 | |
| HO | | | | |
| | Grey fine sand | 8,0 | 8,5 | |
| м9 | Idem, with grey sandy silt lumps | 8,5 | 9,0 | |
| | | | | |
| M10 | Grey fine sand | 9,0 | 10,5 | |
| M11 | Grey very silty fine sand to sandy silt | 10,5 | 11,0 | |
| M12 | Idem, with very few fine shell fragments | 11,0 | 12,0 | |
| | Installation of protective casing to a depth of 12,65 m. | | | |
| | Around this casing bentonite-cement grout was inserted | | | |
| | from 12,1 to 0,5 m depth From 0,5 to 0 m clay pellets have been used to fill up around the protective casing which | | | |
| | is made of PVC (Ø 200 mm DYKA-RIOOL 200 x 3,90 86-33) | | | |
| | Drilling continued on July 1st 1987 | | | |
| 1 | Diffing continued on bury 1st 1987 | | | |
| м13 | Grey slightly silty fine sand | 12,0 | 13,0 | |
| | | | | |
| | Grey sandy silt | 13.0 | 13,5 | |
| M14 | Grey slightly sandy silt | 13,5 | 14,0 | |
| M1 E | Tdom | 14.0 | 15.0 | |
| M15 | Idem | 14,0 | 15,8 | |
| M1 6 | Grey very sandy silt | 15,8 | 16,0 | |
| | | | | |
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| Sample nr. | Description of the stations | Depth | (m) |
|---------------|----------------------------------------------------------------------------------------------------------------|-------|--------------------|
| | Description of the cuttings | from | to |
| | Grey slightly sandy silt | 16,0 | -16,5 - |
| м17 | Idem, with very few fine wood fragments | 16,5 | 17,0 |
| | Grey very silty fine sand with very few fine wood fragments | 17,0 | 17,5 |
| м18 | Idem, with very few fine shell fragments | 17,5 | 18,0 |
| | Grey silty fine sand with few fine shell fragments | 18,0 | 18,5 |
| M19 | Grey slightly silty fine sand with few fine shell and wood fragments | 18,5 | 19,0 |
| M20 | Grey sand with few silt lumps | 19.0 | 20.0 |
| | Greyish green and brown stiff clay with shell fragments, few wood fragments and few fine gravel | 20,0 | 20,3 |
| | Grey clayey fine sand with few clay lumps | 20,3 | 20,5 |
| M21 | Idem, with sandstone fragments and pyrite | 20,5 | 21,0 |
| | Grey stiff clay with pyritisized sandstone fragments | 21.0 | 21,1 |
| | After cable tool drilling, cleaning of the borehole with pure water, from 12,6 to 21,0 m (Ø 160 mm). Inside of | | |
| | protective casing has been filled up with clay pellets. | | |
| | Odour: 0,5 - 1 m: strong; different from 2D | | |
| | 7,5 - 14 m : same, but slight odour; different from 2D | | |
| | During jetting : ammonia odour | | |
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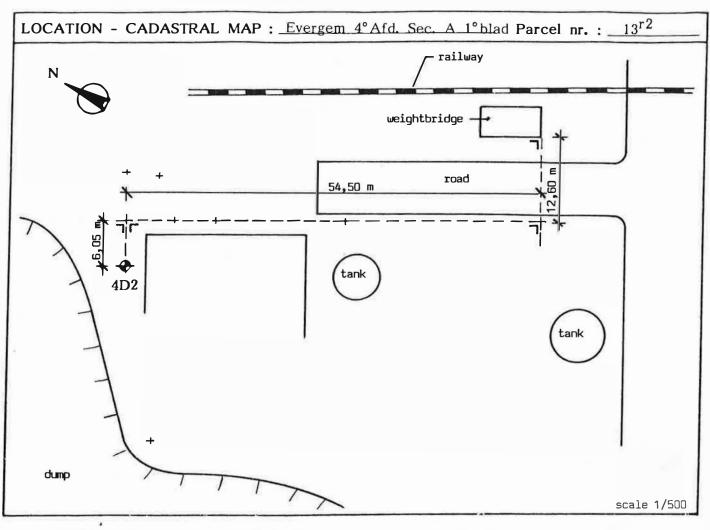
| 0 - 10,5 m | KZ2 | |
|---------------|-----|--|
| 10,5 - 17,0 m | KL | |
| 17,0 - 20,0 m | KZ1 | |
| 20,0 | _a3 | |
| | | |
| | | |

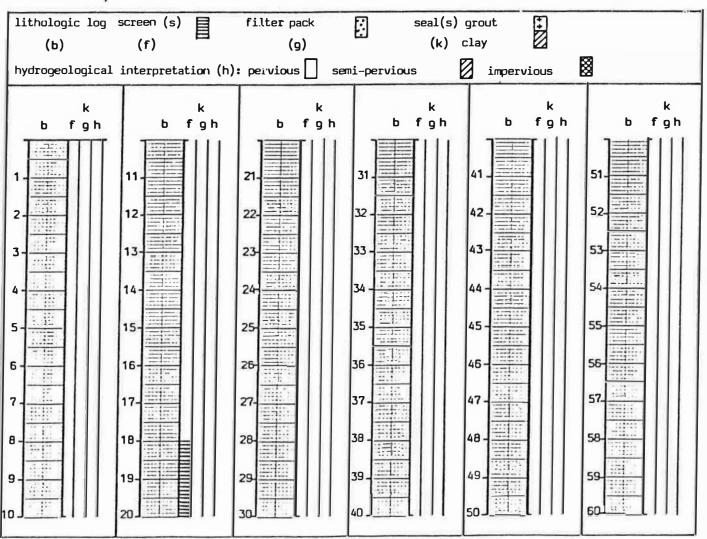




| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolog Prof. Dr. W. De Breuck | : Geologie gy and Hyd | en H | ydrogeol logy | nate | search n 30 86/81 | r. : | | Well 4D | | : |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------|------------------|---------------------|-----------------------------|------|---------------------|------------|---------|--------|
| RESEARCH: Additional hydrogeological Survey of the OWNER: ARCO-ATOCHEM | | | | | | | | | | |
| Arco Chemical Products Europe plant site | | | | | | | | | | |
| at Rieme (Belgium) | | | | | | | | | | |
| | - DATE : July 1st , 1987 | | | | | | | | | |
| - DRILLING CY. : Geo | olah | | | DRILI | FR · | - | | | | |
| - DESCRIPTION OF CU | TTINGS | BY: | : | | | | | | | |
| - MAP N.G.I. Nr. : _ 14 | /2 | | G | EOL./PEDO | DL. MAP | Nr. | : _2 | 5E | | |
| - MUNICIPALITY :EVE | ergem_ | | | 7MV | 8 935 | | NIS | -CODI | Ε;_ | 44019 |
| - MUNICIPALITY : | | | | | | | | | | |
| (ZMV = ground level (mea | asured); | ZMV | * = gro | und level | (estimate | ed)) | | | _(,,, | 17111 |
| | | | | | | | | | | |
| DRILLING METHOD | Ø | | | | DEPTH (i | | | | | |
| BIGEBING METHOD | (mm) | fron | n – to | from - to from - to | | to | from - to from - to | | | m - to |
| ROTARY | 160 | 0 - | 20 | | | | | | | |
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| L | L | | | | | | | | | |
| - DRILLING MUD : | pure wa | ter | | C | ONSUM | PTIC | ON (1) | : | | - |
| - BOREHOLE LOG(S) : | | | | | | | | | | |
| screen nr. NR. D | FB I | OFO | ZMP | ZMP* | GWDP | | L | ST | | P |
| F1 18, | 0 20 | ,0 | 9,627 | | | | 2 | 11 | | 2 |
| F2 | | | | | | | | | × 4 | |
| F3 | | | | | | | | | | |
| NR ' = Number | | | | | | | | | | |
| DFB = Depth to DFO = Depth to | | | | / \ | | | | | | |
| ZMP = Level me | | | | | | | | | | |
| ZMP* = Estimated | | • | - | • | | | | | | |
| GWDP = Groundwa | | | | | | | | | | |
| $\begin{array}{ccc} L & = \text{Type of } c \\ \end{array}$ | | | | | n phreat | ic | | | | |
| ST = Stratigrap P = 1=Piezom | ohy (con | form Obse | to leg | end LTG) | ugged pr | ~11• | 4_D | | w. a 11 | |
| | eter, Z= | Obse | rvation | well; 3=D | ugged w | en, | 4=Pu | mping | weii | |
| Several screens in onCharacteristics - rise | | | | | PVC NP10 | NBI | 1 T42 | -11 | | |
| - scre | eens | : _P(| vc ø 63 | mm VAN R | YSWYCK-V | EGHI | EL BV | | | |
| | | | | PN10 | | | | | | |
| - connections : GLUED JOINTS | | | | | | | | | | |
| - Bottom pipe (m): _0 | .05 | | | | | | | | | |
| - Screen slot openings | | | | | | | | | | |
| | | | | x 0,3 | | | | | | |
| - Centralizer(s) - place | - open | 20.0 | and 10 | .0 | | | | 100 | | |
| - Centralizer(s) - place (m): 20,0 and 10,0 - Filter-pack type and characteristics: coarse sand 0,7/1,25 - volume (l.): from 17 to 20 m | | | | | | | | | | |
| - Seals-type and characteristics : Clay pellets compactonite/duranite | | | | | | | | | | |
| - volume (l.) : from 0 to 17 m | | | | | | | | | | |
| - Development - method : | | | | | | | | | | |
| - date - duration (h): | | | | | | | | | | |
| - disch | arge (m | 3/h) | : | | | | | | | |
| - Finishing: | | | | | | | | | | |

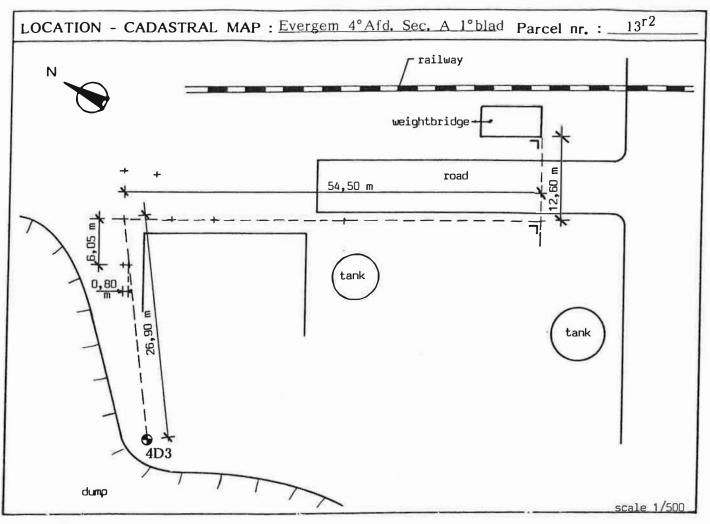
| Sample | Description of the cuttings | Depth | (m) |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| nr. | | from | to |
| | Description has been made during drilling 4D1 | | |
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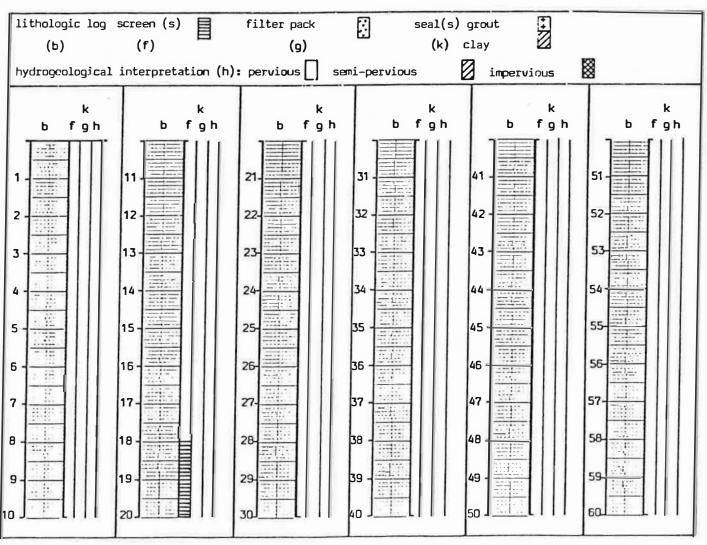




| Rijksuniversiteit Gent Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: TGO 86/81 4D3 | | | | | | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|
| RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site OWNER: ARCO-ATOCHEM | | | | | | | | | |
| at Rieme (Belgium) | | | | | | | | | |
| - DATE : July 2nd, 1987 | | | | | | | | | |
| - DRILLING CY. : Geolab | | | | | | | | | |
| - DRILLING RIG Geolab DRILLER : | | | | | | | | | |
| - MAP N.G.I. Nr. : 14/2 GEOL./PEDOL. MAP Nr. : 25E | | | | | | | | | |
| - MINICIPALITY · Evergem NIS-CODE · 44019 | | | | | | | | | |
| - MUNICIPALITY : <u>Evergem</u> NIS-CODE : <u>44019</u> - X = Y = ZMV = <u>9,192</u> (m TAW) | | | | | | | | | |
| (LAMBERT-COORDINATES) ZMV* = (m TAW) | | | | | | | | | |
| (ZMV = ground level (measured); ZMV* = ground level (estimated)) | | | | | | | | | |
| · · | | | | | | | | | |
| Ø DEPTH (in m) | | | | | | | | | |
| DRILLING METHOD (mm) from - to from - to from - to from - to | | | | | | | | | |
| | | | | | | | | | |
| Jetting 160 0 - 20,0 | | | | | | | | | |
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| - DRILLING MUD : _pure_water CONSUMPTION (I) : | | | | | | | | | |
| - BOREHOLE LOG(S): | | | | | | | | | |
| L I ND I DED I DEOL ZMD I ZMD+ I CWDD I I L CT I D | | | | | | | | | |
| Screen nr. NR. DFB DFO ZMP ZMP* GWDP L ST P | | | | | | | | | |
| F1 18,0 20,0 9,217 2 11 2 | | | | | | | | | |
| 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 | | | | | | | | | |
| = 1=Plezometer; 2=Observation wen; 3=Dugged wen; 4=Fumping wen | | | | | | | | | |
| - Several screens in one borehole: yes/no - Characteristics - riser pipes: DYKA PVC Ø 63 mm NBN T42-111 PN10 | | | | | | | | | |
| | | | | | | | | | |
| - screens : _VAN_RYSWYCK-VEGHEL_BV_HOLLAND_PVC Ø 63 mm | | | | | | | | | |
| _NP_10 | | | | | | | | | |
| - connections : GLHED JOINTS | | | | | | | | | |
| - Bottom pipe (m):20,05 | | | | | | | | | |
| - Screen slot openings - type : vertical sawed slots | | | | | | | | | |
| - size (mm): _60 x 0,3 | | | | | | | | | |
| - open area (%): | | | | | | | | | |
| - Centralizer(s) - place (m): 20 m and 10 m | | | | | | | | | |
| - Filter-pack type and characteristics:coarse_sand_0,7/1,25 | | | | | | | | | |
| - volume (l.) : from 20 to 17 m - Seals-type and characteristics : Clay pellets Duranit | | | | | | | | | |
| - volume (l.) : from 0 to 17 m | | | | | | | | | |
| - Borehole backfill material: | | | | | | | | | |
| - Development - method : | | | | | | | | | |
| - date - duration (h): | | | | | | | | | |
| - discharge (m ³ /h): | | | | | | | | | |
| - Finishing : | | | | | | | | | |

| | LITHOLOGIC LOG - DATE : | | |
|---------------|------------------------------|-------|-----|
| Sample nr. | Description of the cuttings | Depth | (m) |
| TU. | Description on Brillian AD1 | from | to |
| | Description see drilling 4D1 | | |
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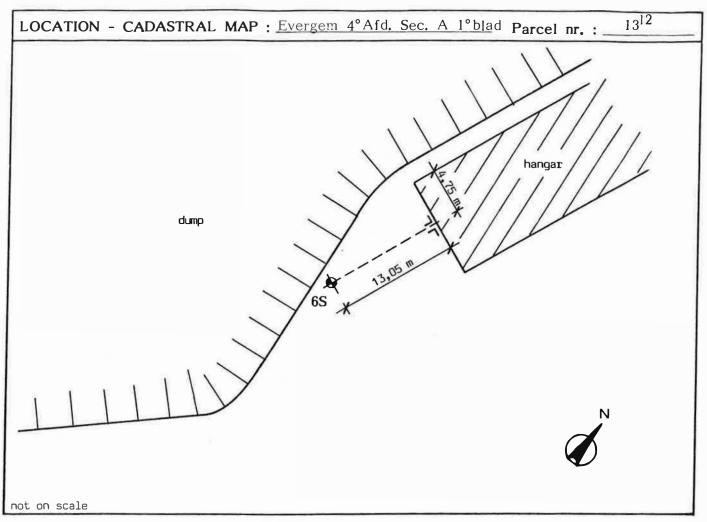
| Rijksumiversiteit Gent Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: Well nr.: TGO 86/81 65 | | | | | | | | | | | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------|----------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------|-----------------------------------------|------------------------------|--|--|--|--|--|--|--|--|
| RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site at Rieme (Belgium) | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| - DATE :July 9th | 1907 | | | | | | | | | | | | | | | | |
| - DRILLING CY. : | Geolab | | | | | | | | | | | | | | | | |
| - DRILLING RIG 🔛 | Nordme | yer | D1/ | | DRILL | ER: | | | | | | | | | | | |
| - DESCRIPTION OF C | | | | | Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Contro | | | | | | | | | | | | |
| - MAP N.G.I. Nr. : _ | | | | | | | | | | | | | | | | | |
| - MUNICIPALITY : | | | | | | | NIS | | | | | | | | | | |
| - X = | Y = | | | | _ ZMV | 8,86 | 9 | | (m TAW) | | | | | | | | |
| (LAMBERT-COORDI | | | | | | | | | (m TAW) | | | | | | | | |
| (ZMV = ground level (n | neasure | М)• 2 | 7.MV | k = grc | | | | | (| | | | | | | | |
| (2M) - Ground level (II | i cusui c | , . | 3.171 7 | - 6.0 | · · | (cotimate | ٠,٠, | | | | | | | | | | |
| | TØ | 7 | | | | DEPTH (i | n m) | | | | | | | | | | |
| DRILLING METHO | | | | | | | | | | | | | | | | | |
| DRIEDING METHO | [(m | m) | from | 1 - to | from - to | from - | to from | 1 - to f | rom - to | | | | | | | | |
| Dugged | | | 0 | - 0.7 | | | | | | | | | | | | | |
| | - | - | | | | | | | | | | | | | | | |
| Auger | | 68 | | 2,0 | | - | | | | | | | | | | | |
| Auger | 17 | 25 | 2,0- | - 5,0 | | | | | | | | | | | | | |
| Bailer | 1. | 3.5 | 5.0 | -14,3 | | | | | | | | | | | | | |
| Casing | | 58 | | -14,1 | | | | | | | | | | | | | |
| | - | | | | | | | | | | | | | | | | |
| - DRILLING MUD : - BOREHOLE LOG(S | | | | | C | CONSUMF | PTION (I) | : | | | | | | | | | |
| screen nr. NR. | DFB | D | FO | ZMP | ZMP* | GWDP | L | I ST | I P | | | | | | | | |
| F1 | | | | | 1 | | | i | i i | | | | | | | | |
| | 12.0 | 14 | 4.0 | 9,398 | 3 | | 1 | 10 | 2 | | | | | | | | |
| F2 | | | | | | | | | | | | | | | | | |
| F3 | | | | | | | | | | | | | | | | | |
| ND N | | | | | | | | *************************************** | | | | | | | | | |
| NR = Number | | | | | | | | | | | | | | | | | |
| DFB = Depth | | | | | | | | | | | | | | | | | |
| DFO = Depth | | | | | | | | | | | | | | | | | |
| ZMP = Level | measur | ing | point | : (m T | AW) | | | | | | | | | | | | |
| ZMP* = Estima | ated lev | vel c | of m | ark (m | TAW) | | | | | | | | | | | | |
| GWDP = Ground | | | | | | | | | | | | | | | | | |
| L = Type of | of aqui | fer · | 1 = | phrea | tic; $2 = no$ | n nhreat | ic | | | | | | | | | | |
| | | | | | end LTG) | n pincut | 10 | | | | | | | | | | |
| | | | | | well; 3=D | uggod w | oll: 4-Pu | mning u | _{vol1} | | | | | | | | |
| = 1=F1e2 | ometer | , Z= | Obse | i vation | well, J=D | ugged w | en, 4-1 u | mping w | /eii | | | | | | | | |
| C1 :- | h | L | -1 | | | | | | | | | | | | | | |
| Several screens inCharacteristics - r | one b | oreno | oie: | 3/99\$/IIC |) מיכ העצא פי | UC NEN T | 42 - 111 | | | | | | | | | | |
| - Characteristics - i | riser pi | pes | PN1 | I IIIII E | VC DIKA I | VC IVDIV 1 | 42 111 | | | | | | | | | | |
| | | | | | NIO HAN DW | THUOM ND | CUDI DU | | | | | | | | | | |
| - s | screens | | | | VC VAN RYS | SWYCK-VE | GHEL BV | | | | | | | | | | |
| | | | _ | LLAND N | | | | | | | | | | | | | |
| - (| connect | ions | GLU | JED JOI | NTS | | | | | | | | | | | | |
| - Bottom pipe (m) : | 0,05 | | _ | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| - Screen slot openin | gs - ty | pe: | ver | tical | sawed Slot | S | | | | | | | | | | | |
| | - si | ze (ı | mm) | : 60 x | 0,3 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| - Centralizer(s) - pla | ace (m) | ١. | - | | | | | | | | | | | | | | |
| - Filter-pack type as | nd chai | racte | rieti | ce · CC | arse sand | 0,7/1,2 | 5 | | | | | | | | | | |
| | - vc | olum | e (1.) | : | | from 14 | ,25 - 11 | m | | | | | | | | | |
| - Seals-type and cha | FOOTOF | ctics | (| Clay pe | llets | | | | | | | | | | | | |
| could type and cha | voluma | (1.1 | | | | from 0 | - 11 m | | | | | | | | | | |
| | | | | | | | | | - volume (l.): from 0 - 11 m | | | | | | | | |
| - borenote backfill f | - Borehole backfill material: | | | | | | | | | | | | | | | | |
| | - 4 l 1 | - Development - method : see sampling | | | | | | | | | | | | | | | |
| - date - duration (h): | | | | | | | | | | | | | | | | | |
| - discharge (m ³ /h) : | | | | | | | | | | | | | | | | | |
| - di | ate - d | urati | ion (| h) : | | | | | | | | | | | | | |
| - di | ate - d scharge | urati e (m | ion (1 3/h) | h) : | | | | | | | | | | | | | |
| - di - Finishing :steel | ate - d scharge | urati e (m | ion (1 3/h) | h) : | | | | | | | | | | | | | |

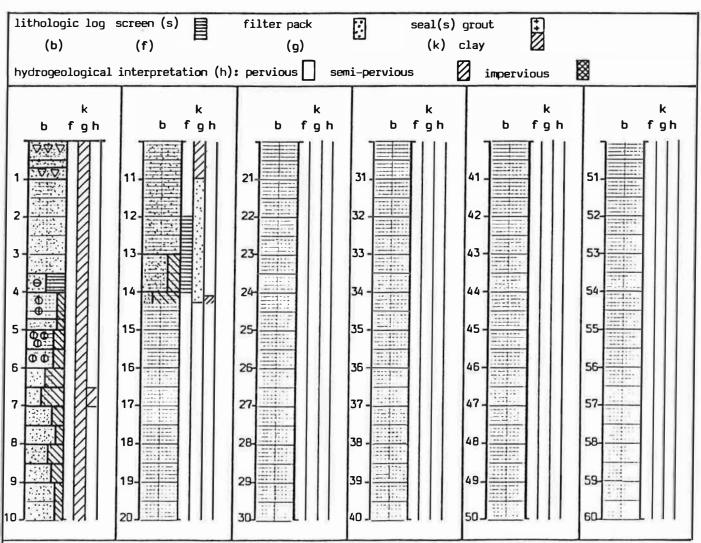
| Sample | Description of the cuttings | Depth | (m) |
|--------|-----------------------------------------------------------------|-------|------|
| nr. | | from | to |
| | Brown sand with stones and store fragments | 0,0 | 0,7 |
| M1 | Brown fine sand with gypsum and stones | 0,7 | 1,0 |
| | Brownish black fine sand | 1,0 | 1,3 |
| | Dark brown fine sand | 1,3 | 1,5 |
| M2 | Brown sand | 1,5 | 2,0 |
| м3 | Brown to greyish brown fine sand | 2,0 | 3,0 |
| | Grey fine sand | 3,0 | 3,5 |
| M4 | Brown fine sand with very much peat and wood fragments | 3,5 | 4,0 |
| | Greyish brown slightly silty fine sand with sandstone fragments | 4,0 | 4,7 |
| M5 | Idem, without sandstone fragments | 4,7 | 5,0 |
| м6 | Grey silty fine sand with sandstore fragments | 5,0 | 6,0 |
| | Grey very silty fine sand to sandy silt | 6,0 | 6,5 |
| м7 | Grey sandy silt | 6,5 | 7,0 |
| | Grey silty fine sand | 7,0 | 7,5 |
| M8 | Grey slightly silty fine sand | 7.5 | 8.0 |
| м9 | Grey silty fine sand | 8,0 | 9,0 |
| M10 | Grey slightly silty fine sand | 9,0 | 10,0 |
| M11 | Grey fine sand with very few fine shell fragments | 10,0 | 11.0 |
| M12 | Idem | 11.0 | 12,0 |
| 413 | Idem | 12,0 | 13,5 |
| 114 | Grey silty fine sand with very few fine shell fragments | 13,5 | 14,1 |
| | Grey sandy silt | 14,1 | 14,3 |
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| Sample nr. | Description of the cuttings | Depth | (m) |
|---------------|-------------------------------------------------------------|-------|-----|
| 112.0 | Description of the cuttings | from | to |
| | Odour : from 1,5 to 3,0 m, same odour as during drilling 4D | | |
| | | | |
| | from 3,0 to at least 7,0 m slight odour (2D) | | |
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| Geological interpretation | on and remarks |
|---------------------------|----------------|
| 0,0 - 1,0 m | Disturbed soil |
| 1,0 - 14,1 m | KZ2 |
| 14,1 | KL: |
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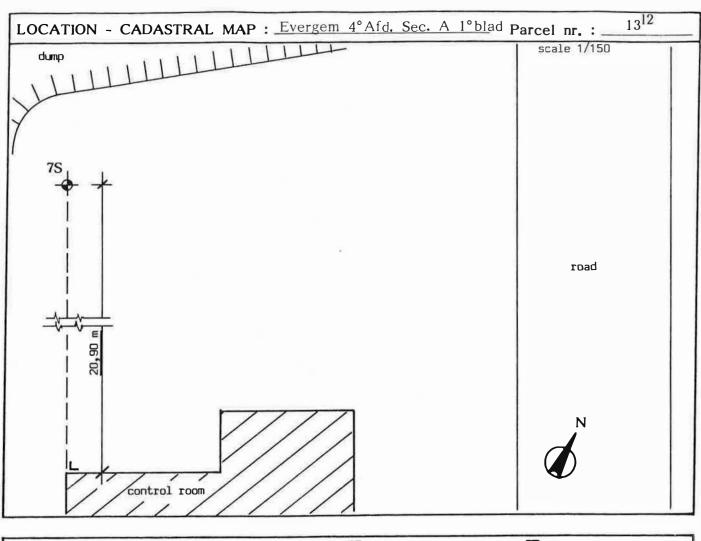


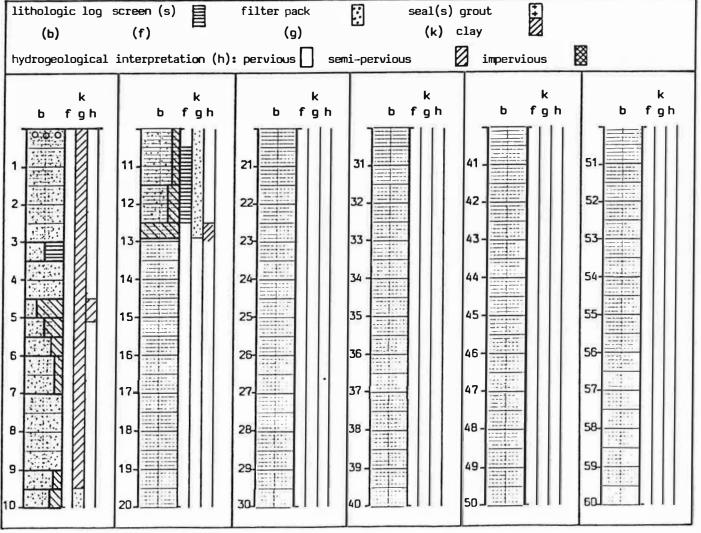
| La La | Rijksuniversiteit Gent Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: TGO 86/81 7S | | | | | | | | | | | | | | | |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|-------------|---------------|---------------|-----------------|------------|----------|----|---------|----------|--------|------|----------|--------|
| R | RESEARCH: Additional hydrogeological Survey of the Arco Chemical Products Europe plant site (Dalaine) | | | | | | | | | | | | | | | |
| - | at Rieme (Belgium) - DATE:July 08, 1987 - DRILLING CY.: _Geolab - DRILLING RIGNordmeyer DRILLER: - DESCRIPTION OF CUTTINGS BY:A. De Bruyn | | | | | | | | | | | | | | | |
| - - | - MAP N.G.I. Nr. : $_14/2$ GEOL./PEDOL. MAP Nr. : $_25E$ - MUNICIPALITY : $_Evergem$ NIS-CODE : 44019 - X = $_$ Y = $_$ ZMV = $_8,479$ (m TAW) (LAMBERT-COORDINATES) ZMV* = $_$ (m TAW) (ZMV = ground level (measured); ZMV* = ground level (estimated)) | | | | | | | | | | | | | | | |
| | DDILLI | IC METI | IOD | Q |) | | | | | DI | EPTH (i | n n | 1) | | | 40.00 |
| | DRILLIN | NG METH | עטו | (m | m) | fron | n – to | fr | om - to | 5 | from - | to | from | - to | fro | m - to |
| | Auger | | | 16 | 5 | 0 | - 2,0 | | | | | | | | | |
| | Auger | | | 12 | 5 | 2,0 | - 6,0 | | | 4 | | | | | | |
| - | Bailer | | | 13 | 5 | 6.0 | -12.9 | | | 4 | | | | | _ | |
| | Casing | | | 16 | 8 | 0 | -13,2 | _ | | 4 | | | | | _ | |
| | - DRILLI - BOREH | | | | | | | _ | | CC | ONSUMF | PTIC | N (1) | : | _ | |
| ſ | | | | | | \FQ | 7.4D | _ | 71 (D+ | _ | CIVIDID | _ | | OTT | _ | |
| ļ | screen nr. | NR. | | FB | | OFO | | - | ZMP* | I | GWDP | | L | ST | + | P |
| ŀ | F2 | | 10, | 5 | 1 | 2,5 | 9,001 | 1 | | l | | <u> </u> | 1 | 10 | + | 2 |
| ŀ | F3 | | | | - | | <u> </u> | + | - | ╁ | | - | | | \dashv | |
| | 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 - Charact | | | | | | | | m "Vipl | ех | (bereg | enir | ng" Pi | N10 | | |
| | | - | - scre | ens | | | -/2 | - | | | | | | | | |
| | | - | - con | nect | ions | : GI | LUED JO | INI | rs | | | _ | | | | |
| - | Bottom | pipe (m) | : _ | 0,05 | | | | | | _ | | | | | | |
| - | - Screen | slot open | | - si | ze (1 | mm) | : _60 | x_(| 0,3 | | | | | | _ | |
| | Centrali Filter-pa | | place and | (m) chai | : <u>1</u> | 0,5 eristi | and 12 cs:_c | ,5 oar | rse sano | d_ | 0,7/1, | 25 | | | | |
| | Seals-ty | | harac - vol | teri ume | stics (l.) | s : _ | Clay p | <u>ell</u> | lets cor | gn | from 9 | e 5 t | 0,0 |) m | | |
| | Borehole Develop | ment - | meth | od: | se | e sa | mpling | | | | | | - | | | |
| | | | | | | | | | | | | | | | | |
| - | Finishing | | | | | | | | | | | | | | | |

| (m) to 0,2 0,5 |
|-------------------------|
| 0,2 |
| 0,5 |
| 1,0 |
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| 3,0 |
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| 4,5 |
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| 7,0 |
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| 12,5 |
| 12,9 |
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| Sample nr. | Description of the suttings | Depth (m) |
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| '''' | Description of the cuttings | from to |
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| ological int | erpretation and remarks | |
| | | |
| 0 0 - | 0.2 m · disturbed soil | |

| Geological interpre | etation and remarks | |
|---------------------|---------------------|--|
| 0,0 - 0,2 | m : disturbed soil | |
| 0,2 - 12,5 | | |
| 12,5 - | : KL | |
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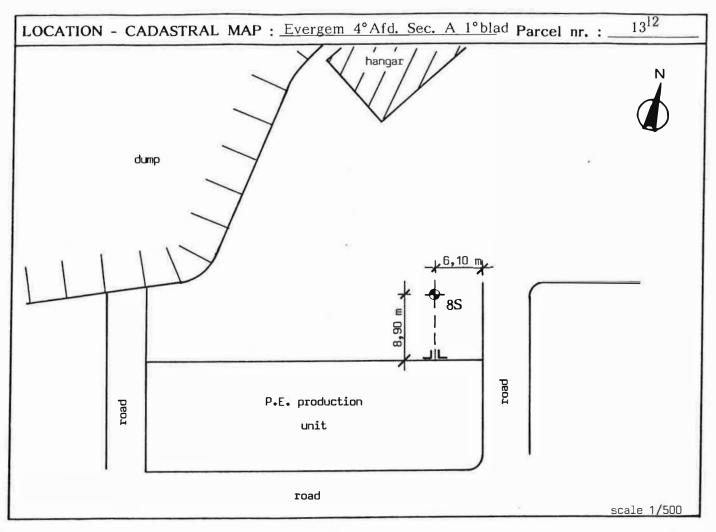


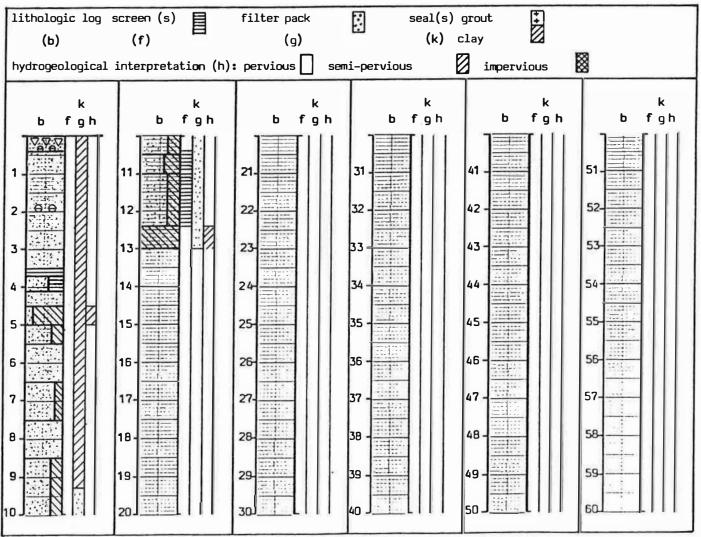
| Rijksuniversiteit Gent | Coologia | | vdzace). | Re | search n | r. : | Well nr | . : | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------|---------------------------------------------------|----------------------------------------------|----------|-----------|--------------|------------------|--|--|
| Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology Prof. Dr. W. De Breuck Research nr.: TGO 86/81 8S | | | | | | | | | | |
| l . | RESEARCH: Additional hydrogeological Survey of the OWNER: ARCO-ATOCHEM | | | | | | | | | |
| Arco Chemical Products Europe plant site | | | | | | | | | | |
| at Rieme (Belgium) | | | | | | | | | | |
| - DATE:July 08, - DRILLING CY.: _Geo | | | | 17-25 | | | | | | |
| - DRILLING RIG Nor | dmeyer | | | _ DRILL | ER : | | | | | |
| - DESCRIPTION OF CU | TTINGS | BY | A. De | Bruyn | | | | | | |
| - MAP N.G.I. Nr. : 14/ | 2 | | GI | EOL./PEDO | DL. MAP | Nr. : | 25E | 44010 | | |
| - MUNICIPALITY : _Eve - X = Y (LAMBERT-COORDINA | rgem | | | 7141 | 8 387 | NIS | S-CODE: | 44019 | | |
| (LAMBERT-COORDINA | TES) | | | _ ZIVIV 7MV* | = 0,001 | | (1 | m IAW) m TAW) | | |
| (ZMV = ground level (mea | | | | | | | | 17100 | | |
| DRILLING METHOD | Ø | | | | DEPTH (i | | | | | |
| | (mm) | _ | n – to | from - to | from - | to from | ı - to fr | om - to | | |
| Auger | 168 | | - 2,0 | | - | | | | | |
| Auger Bailer | 125 135 | | 9-8,0 0-13,0 | | - | | | | | |
| | | _ | | | | | | | | |
| Casing | 168 | 0 | -13,0 | | - | | | | | |
| - DRILLING MUD : | | ! | | | CONSUME | PTION (I) | : = | | | |
| - BOREHOLE LOG(S) | | 250 | 7140 | 1 714D+ | CWDD | | Lot | | | |
| | | OFO | | | GWDP | L | ST | P | | |
| F1 10 | ,4 1 1 | 2,4 | 8,914 | | | 1 | 10 | 2 | | |
| F3 | | | | | | | | | | |
| NR = Number DFB = Depth to DFO = Depth to ZMP = Level me ZMP* = Estimatee GWDP = Groundwa L = Type of ST = Stratigrap P = 1=Piezom | bottom easuring d level ater dep aquifer bhy (con | of s point of m th be 1 = form | screen t (m TA ark (m elow ma phreat to lege | AW) TAW) ark ic; 2 = no end LTG) | - | | mping we | ell | | |
| - Several screens in or - Characteristics - rise - scre | er pipes | : _P | vc ø 63 | mm_DYKA mm_VAN_R | | | | | | |
| 301 | | | | PN10 | | | | | | |
| - con | nections | | | INTS | | | | | | |
| - Bottom pipe (m): | 0,05 | | | | | | | | | |
| - Screen slot openings | - type : | _ve | rtical | sawed slo | | | | | | |
| | - size (| mm) | : _60 x | 0,3 | | 12 | | | | |
| | | | | D1 | | | | | | |
| - Centralizer(s) - place | (m):_ | | | 2800 5-17 | 0.7/1.2 | 5 | ; | | | |
| - Filter-pack type and | - volum | eristi e (i) | cs : _co | arse sand | from 12 | .4 to 9 | 3 m | | | |
| - Seals-type and charac | | | | | | | | | | |
| - vol | ume (l.) | : _ | | | from 9, | 3 to 0 m | | | | |
| - Borehole backfill mat | erial : | - | | | | | | | | |
| - Development - meth | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| - Finishing : _steel_ca | P | | | | | | | | | |

| | LITHOLOGIC LOG 8S - DATE: July 08, 1987 | | |
|------------|------------------------------------------------------------------|-------|------|
| Sample | Description of the cuttings | Depth | (m) |
| nr. | Province Colors 1 111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | from | to |
| | Brown fine sand with stones and stome fragments | 0,0 | 0,4 |
| | Dark brown fine sand with very much peat and wood fragments | 0,4 | 0,5 |
| М1 | Dark brown fine sand | 0,5 | 1,0 |
| | Greenish grey fine sand | 1,0 | 1,5 |
| | Light Brown fine sand | 1.5 | 1,7 |
| M2 | Greenish grey fine sand | 1,7 | 1,0 |
| | Brown fine sand with black spots and humic material | 1,9 | 2,0 |
| м3 | Brown fine sand | 2.0 | 3.5 |
| | Brown humic material and peat | 3,5 | 3,7 |
| M4 | Brown fine sand with much peat | 3,7 | 4,1 |
| | Grey fine sand | 4,1 | 4,5 |
| м5 | Grey slightly sandy silt | 4,5 | 5,0 |
| | Grey silty sand | 5,0 | 5,5 |
| M 6 | Grey fine sand | 5,5 | 6,5 |
| м7 | Grey slightly silty fine sand | 6,5 | 7,0 |
| | Idem, with very few fine shell fragments | 7,0 | 7,5 |
| M8 | Grey fine sand with very few fine shell fragments | 7,5 | 8,0 |
| | Grey fine sand | 8,0 | 8,5 |
| м9 | Grey silty fine sand | 8,5 | 9,5 |
| M10 | Grey silty fine sand with very few fine shell and wood fragments | 9,5 | 10,5 |
| M11 | Grey very silty fine sand, idem | 10,5 | 11,0 |
| M12 | Grey silty fine sand, idem | 11,0 | 12,4 |
| | Grey silty fine sand with silt lumps | 12,4 | 12,5 |
| | Grey silt with few fine gravel and very few fine shell fragments | 12,5 | 13,0 |
| | | | |
| | | | |

| Sample nr. | Description of the outtings | Depth (m) | | | |
|---------------|-------------------------------------------------------------|-----------|----|--|--|
| ,,, | Description of the cuttings | from | to | | |
| | Odour : - from 0,4 to 0,5 m : strong odour of rotten | | | | |
| | material | | | | |
| | | | | | |
| | - from 1,0 to 4,1 m : slight odour, different of | | | | |
| | odour at 2D | | | | |
| | | | | | |
| | - from 10,5 to 12,5 : slight odour, same as at 2D | | | | |
| | 110 10,5 to 12,5. Slight odoul, Same as at 2D | | | | |
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| Geological interpret | tation and remarks |
|---------------------------|---------------------------|
| 0 - 0,5 m 0,5 - 12,4 m | : Disturbed soil : KZ2 |
| 12,4 - | : KL |
| | |



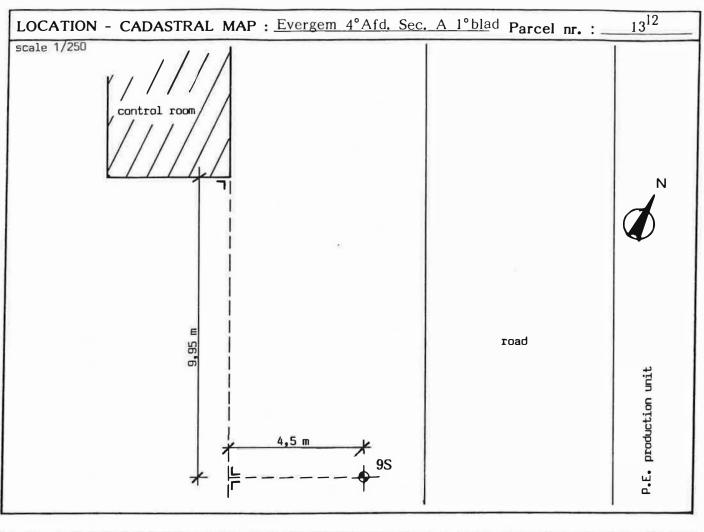


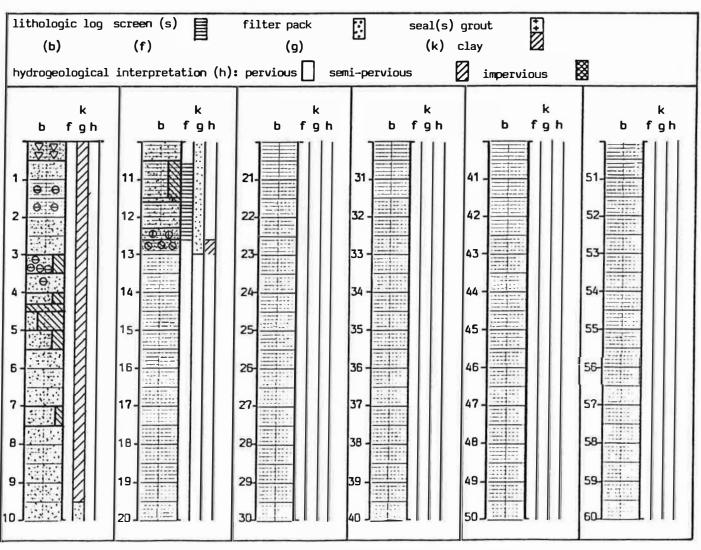
| Rijksuniversiteit Gent Laboratorium voor Toegepast Laboratory of Applied Geolo Prof. Dr. W. De Breuck | | | | ogie | search n 86/81 | r. : | Well 98 | |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------|-------------------------------------|-----------------------------------|--------------------|--------|---------------------|-----------|
| RESEARCH : Additiona Arco Chem at Rieme | ical Pr | oduct | | Survey of pe plant s | | OWNE | R : ARCC |)-ATOCHEM |
| - DATE: _July 15th, 1987 - DRILLING CY.: _Geolab - DRILLING RIGNordmeyerDRILLER: | | | | | | | | |
| | Ø | Г | | 1) | DEPTH (i | | | |
| DRILLING METHOD | (mm) | fron | n - to | from - to | from - | to fro | om - to | from - to |
| Dugged | 400 | 0- | | | | | | |
| Auger | 168 | 1- | 2 | | | | | |
| Bailer | 135 | | 3.0 | | | _ | | |
| Casing | 168 | 0-1 | 2,5 | | - | | | |
| - DRILLING MUD : - BOREHOLE LOG(S) | | | | | ONSUMI | PTION | (1): | |
| screen nr. NR. I | FB I | OFO | ZMP | ZMP* | GWDP | L | ST | P |
| F1 10 | ,6 1 | 2,6 | 8,78 | 1 | | 1 | 10 | 2 |
| F2 F3 | | | | | | | | |
| ST = Stratigra | bottom easuring d level ater dep aquifer phy (con | of s point of m th be 1 = | screen t (m Ta ark (m elow m to leg | AW) TAW) ark tic; 2 = no | • | | ² umping | well |
| | еепѕ | : P\ | VC Ø 63 OLLAND | mm VAN RY PN10 | | | BV | |
| - coi | nections | GI | LUED JO | DINTS | | | | |
| - Bottom pipe (m): _ | | - | | | | | | |
| - Screen slot openings | - type - size (| mm) | : 60 | sawed slot | S | | | |
| - Centralizer(s) - place - Filter-pack type and | e (m):_ charact | eristi | cs : _C | coarse sand | 1 0,7/1, from 9 | | | |
| Cools type and abore | cteristic lume (l.) terial : | s : _ | lay pa | illets bura | from 0 | - 9,5 | m | |
| _ | | | | | | | | |
| - disc - Finishing : steel ca | narge (m | ³ /h) | : | | | | | |

| Sami- | Description of the cutting | Depth | (m) |
|---------------|--------------------------------------------------------------------------|-------|-------|
| Sample nr. | Description of the cuttings | from | to |
| | Brown sand with stones and stone fragments, brick fragments | | |
| | and porcelane | 0,0 | 0,5 |
| M1 | Duran Sina and | 1 0 5 | 1 1 0 |
| MI | Brown fine sand | 0,5 | 1,0 |
| м2 | Brown fine sand with wood fragments | 1,0 | 2,5 |
| м3 | Grey fine sand | 2,5 | 3,0 |
| | Greyish brown silty fine sand with wood fragments | 3,0 | 3,3 |
| | Peat and greyish brown silty fine sand with very much wood | | |
| | fragments | 3,3 | 3,5 |
| M4 | Grey fine sand with few wood fragments and very few fine shell fragments | 3,5 | 4,0 |
| | | | |
| | Idem, but silty | 4,0 | 4,3 |
| | Grey silt | 4.3 | 4,5 |
| M 5 | Grey sandy silt | 4,5 | 5,0 |
| | Grey silty fine sand | 5,0 | 5,5 |
| м6 | Grey fine sand with very few fine shell fragments | 5,5 | 6,0 |
| м7 | Idem | 6,0 | 7,0 |
| | Grey slightly silty fine sand with very few fine shell | | |
| | fragments | 7,0 | 7,5 |
| м8 | Grey fine sand with very few fine shell fragments | 7,5 | 8,5 |
| M 9 | Idem | 8,5 | 9,5 |
| | | | |
| M10 | Grev fine sand | 9.5 | 10.5 |
| M11 | Grey silty fine sand | 10,5 | 11,5 |
| | Grey slightly silty fine sand | 11,5 | 11,6 |
| | Grey fine sand with few fine shell fragments | 11,6 | 12,3 |
| | Idem, with sandstone fragments | 12,3 | 12.6 |
| | Grey fine sand with many silt lumps | 12,6 | 13,0 |
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| Sample nr. | Description of the survivor | Depth (m) | | | |
|---------------|---------------------------------------------------------|-----------|----|--|--|
| | Description of the cuttings | from | to | | |
| | Odour : - from 0,5 - 5,0 m : very strong odour, same as | | | | |
| | at 2D | | | | |
| | - from 5,0 - 13,0 m : same strong odour | | | | |
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| Geological interpretation and remarks |
|---------------------------------------|
| 0 - 0,5 m : disturbed soil |
| 0,5 - 12,6 m : KZ2 |
| 12.6 - · KI. |
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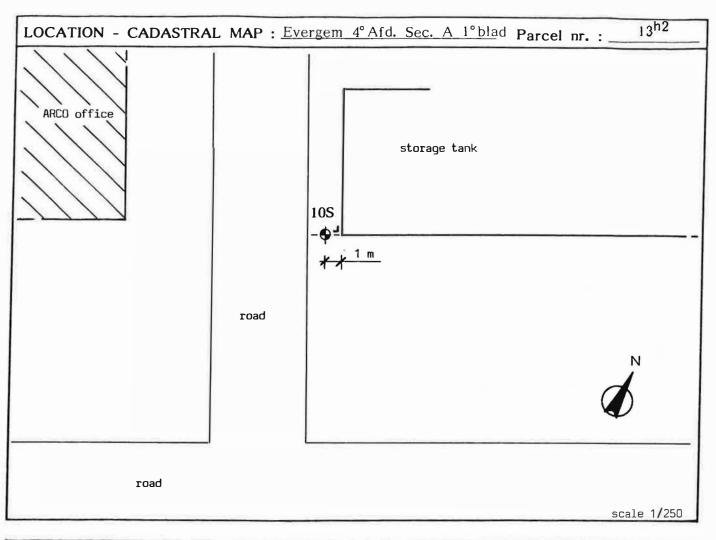


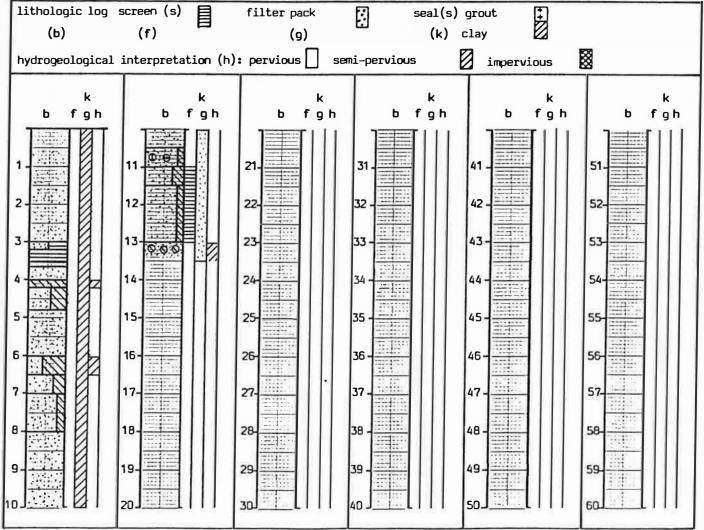
| Rijksuniversiteit Gent Laboratorium voor Toegepaste Laboratory of Applied Geolog Prof. Dr. W. De Breuck | Geologie | e en Hydrogeol drogeology | roare | search n | nr. : | Well 10s | |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------|------------------------------------|--------------------|--------------|-------------|-----------|
| RESEARCH : Additiona | nical Pr | oducts Euro | | | OWNE | CR : ARCC | O-ATOCHEM |
| - DATE: July 9th 19 - DRILLING CY.: Geo - DRILLING RIG Nor - DESCRIPTION OF CU - MAP N.G.I. Nr.: 14/ | 987 - Ju lab dmeyer | BY: A. De | DRILLI | | | | |
| - MUNICIPALITY:Eve - X = Y (LAMBERT-COORDINA (ZMV = ground level (means) | rgem = TES) | | ZMV = ZMV* = | 8,21 | .7 N | NIS-CODI | E: 44019 |
| | Ø | | D | DEPTH (| in m) | | 1 |
| DRILLING METHOD | (mm) | from - to | from - to | from - | to fr | om - to | from - to |
| Auger Auger | 168 125 | 0 - 2.0 2,0- 7,0 | | | | | |
| Bailer | 135 | 7.0-13.5 | | | | | |
| Casing | 168 | 0 -13.0 | | - | | | |
| - DRILLING MUD : | | L | C | <u> </u> ONSUMI | PTION | (1) : | |
| - BOREHOLE LOG(S) | | OFO ZMP | ZMP* | GWDP | l L | I ST | I P |
| F1 11 | ,0 13 | 3,0 8,827 | , | | 1 | 10 | |
| F2 | | | | | | | 1 |
| ZMP = Level me ZMP* = Estimate GWDP = Groundwa L = Type of | bottom casuring d level cater dep aquifer ohy (con | of screen point (m T of mark (m th below m : 1 = phrea form to leg | AW) TAW) ark tic; 2 = norgend LTG) | - - | | Pumping | well |
| - Several screens in or - Characteristics - rise | e boreh er pipes | ole : yes/no : PVC Ø 63 | O mm DYKA P | VC NP10 | NBN T | 42-111 | |
| | | HOLLAND | | | | | |
| - con | | | | | | | |
| - Screen slot openings | - type : | vertical | sawed slo | ts | | | |
| - Centralizer(s) - place - Filter-pack type and | - open (m):_characte | area (%) : _ - eristics : ° | oarse sand | 1,25/0 | ,7 | 1/- | |
| - Seals-type and charac | cteristics ume (l.) erial : _ | s: <u>Clay p</u> | ellets com | pactonit from 0 | te - 10 m | n | |
| - date | - durat arge (m | ion (h) : 3/h) : | | | | | |

| Sample | Sample Description of the cuttings | | | | | |
|--------|-----------------------------------------------------------------------|---------------|------|--|--|--|
| UL. | Description of the cuttings | Depth from | (m) | | | |
| | Dark brown fine sand with stones | 0 | 0,1 | | | |
| M1 | Brown fine sand | 0,1 | 1,0 | | | |
| M2 | Greenish brown fine sand | 1,0 | 2,0 | | | |
| мз | Brown fine sand | 2.0 | 3,0 | | | |
| | Brown fine sand with much humic material | 3,0 | 3,2 | | | |
| | Brownish black peat | 3,2 | 3,6 | | | |
| M4 | Grey fine sand | 3,6 | 4,0 | | | |
| | Grey silt | 4,0 | 4,2 | | | |
| | Grey very silty fine sand | 4,2 | 4,8 | | | |
| М5 | Grey fine sand | 4,8 | 5.0 | | | |
| м6 | Idem, with very few fine shell fragments | 5,0 | 6,0 | | | |
| | Grey sandy silt | 6,0 | 6,5 | | | |
| м7 | Grey silty fine sand | 6,5 | 7,0 | | | |
| м8 | Grey slightly silty fine sand | 7,0 | 8,0 | | | |
| | Drilling continued on July 10th, 1987 | | | | | |
| м9 | Grey fine sand with very few fine shell fragments | 8,0 | 9,0 | | | |
| M10 | Idem | 9,0 | 10,5 | | | |
| | Idem, with lumps of silty sand | 10,5 | 10,6 | | | |
| M11 | Grey slightly silty fine sand with few fine sandstore | | | | | |
| | fragments and very few fine wood fragments | 10,6 | 11.0 | | | |
| M12 | Grey silty fine sand, idem | 11,0 | 11,5 | | | |
| | Grey slightly silty fine sand, idem | 11,5 | 12,5 | | | |
| M13 | Idem | 12,5 | 13,0 | | | |
| | Grey fine sand with many silt lumps and very few fine shell fragments | 13,0 | 13,5 | | | |
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| Sample nr. | Description of the outtings | Depth (m) | | | |
|---------------|----------------------------------------------------------|-----------|----|--|--|
| | Description of the cuttings | from | to | | |
| | Odour : - from 1 to 8 m very strong odour, same as at 2D | | | | |
| | - from 8 to at least 12 m, same but slight odour | | | | |
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| | Because of repeated strongly uprising of sand in the | | | | |
| | casing, two buckets of pure water had to be poured in | | | | |
| | the borehole, at a drilling depth of 7,0 m | | | | |
| | the interiore, at a diffilling depth of 7,0 m | | | | |
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| Geological | al interpretation and remarks | |
|------------|-------------------------------|--|
| | - 0,1 : disturbed soil | |
| 0,1 | 1 - 13,0 : KZ2 | |
| 13,0 | 0 : KL | |
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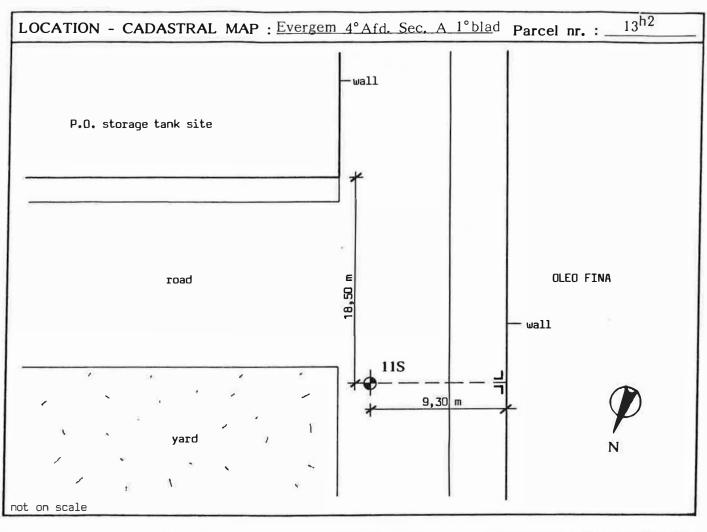


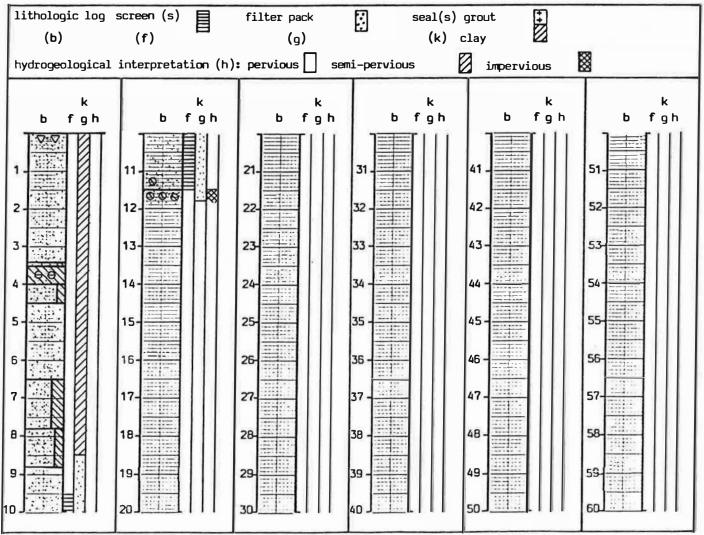
| Lab Lab | oratorium oratory of | iteit Gent voor Toege f Applied (De Breuck | | | | | | ogie | | search n 0 86/81 | | | 1: | 1S | |
|------------|-------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------|----------------------------------------------|----------------------------------------|--------------------------------|---------------------------------------------|------------------------|-----------------|---------------------|------------|--------|--------|------|--------|
| RE | SEARCH | | | nical | l Pr | oduc | ogical ts Euro | | | | OW | NER | : ARC | ra-c | COCHEM |
| <u>-</u> Г | DATE: | July 1 | | | | | | | | | | | | | |
| - г | DRILLING | G CY. : | Geol | ab | | | | | | | | | | | |
| I _ Г | - DRILLING CY.: Geolab - DRILLING RIG Nordmeyer DRILLER: DRILLER: DRILLER: DRILLER: | | | | | | | | | | | | | | |
| - I | DESCRIP | TION OF | CU | ITIN | GS | BY: | A. I | De Br | uyn (DEDO | T MAD | | _ 4 | lOE | | |
| - y | MAP N.C | G.I. Nr. : ALITY : | FUET | cem | | | G | EUL. | PEDU | L. MAP | Nr. | NIIC | CODI | c . | 44019 |
| | | ALIII . | Y | _ | | | | 7 | MV - | 8,197 | | 1419 | -CODI | ί., | TAW) |
| | | T-COOR | | | | | | Z | MV* = | | | | | — (п | TAW) |
| (ZN | AV = gro | ound level | (mea | sure | d); | ZMV ² | * = gro | | | | | | | | |
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| | | IC METI | IOD | Ø | | | | | D | EPTH (i | nπ | 1) | | | |
| - 1 | DRILLIN | NG METH | עטו | (m | m) | fron | 1 - to | fron | n - to | from - | to | fron | 1 - to | fro | m - to |
| Ė | Auger | | | 12 | | 0 | - 2,0 | | | 1 | | | | | |
| r | Bailer | | | 13. | | | -11,8 | - 33 | | | | | | | |
| - | Casing | | | 16 | | | -11,5 | | | | | | | | |
| ı | | | | | | | | | | | | | | | |
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| _ | DDILLI | NC MUD | | | | | | | | ONICLIM | TIC | NI /1\ | | | |
| | | NG MUD OLE LO | | | | | | | | ONSUMI | 110 |)N (1) | • | | |
| ſ. | screen nr | NR. | D | FB | I | FO | ZMP | ZI | MP* | GWDP | | L | ST | | Р |
| Ė | F1 | | 9, | 5 | 11 | ,5 | 8,675 | Ť | | | | 1 | 10 | | 2 |
| Ė | F2 | | , i | | | , | | İ | | | | | | Ì | |
| F | F3 | | | | | | | — | | | | | i | T | |
| | NR DFB DFO ZMP ZMP* GWDP L ST | = Leve = Estin = Grou = Type = Stra | th to th to el me matec undwa e of a | bot asur d lev ater aquit ohy | tom ing vel dep fer : (con | of s point of m th be 1 = form | screen t (m T/ ark (m elow ma phreat to leg | AW) TAW ark tic; 2 end | ! = no: LTG) | n phreat ugged w | | 4=Pu | mping | wel | 1 |
| | Saveral | screens | in or | o b | roh | ، ماه | vec/no | | | | | | | | |
| _ | Charact | teristics | - rise | r ni | nes Des | PV | $C \neq 63$ | mm I | YKA N | BN T42-1 | 11 | | | | |
| | Charac. | | 1100 | , p. | PCC | NP | 10 | | | | | | | | |
| | | - | - scre | eens | | | | | | | | | | | |
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| | | - | - con | nect | ions | | | | | | | | | | |
| - | Bottom | pipe (m) | : | 0,0 | 5 | | | | | | | | | | |
| | Saraan | slot open | inge | +1/ | 20 | 170 | rtical | Sawe | | | | | | | |
| _ | Screen | siot open | iiiigs | – цу – сі | ρε . 70 (| mm) | • 60 | x 0.3 | 310 | | | | | | |
| | | | | | | | | | | | | | | | |
| _ | Centrali | izer(s) - | nlace | (m) | • | _ | | | | | | | | | |
| - | Filter-p | ack type | and | chai | act | eristi | cs : co | oarse | sand | 0,7/1,2 | 25_ | | | | |
| | | | | - VC | dum | e (1) | • | | | from 8 | , 5 t | 0 11 | .8 m | | _ |
| - | Seals-ty | pe and c | harac | cteri | stic | s:_ | Clay pe | ellet | s Dur | anit | L - | 0 [| ~ | | |
| | D! ' | | | | | | | | | | | | | | - |
| - | Develor | e backfill ment - | mat | eria | 1: | - S | amplin | | | | | | | | |
| _ | Develop | ment - | meth | ou : | | | | | | | | | | | |
| | | - | date | - d | urat | ion (| h) : | | | | | | | | |
| | Finishin | g: ste | | | | | | | | | | | | | |
| _ | 1 1111211111 | 6 · | CI CO | Ψ | 120,247 | | | | | | | | | | |

| Sample | Description of the cuttings | Depth | (m) |
|--------|-----------------------------------------------------------------|-------|------|
| nr. | | from | to |
| | Brown fine sand with few stones and store fragments | 0 | 0,3 |
| | Brown fine sand | 0,3 | 0,8 |
| м1 | Grey fine sand | 0,8 | 1,5 |
| M2 | Idem | 1,5 | 2,5 |
| м3 | Idem | 2,5 | 3,5 |
| | Dark grey slightly silty fine sand | 3,5 | 3,6 |
| M4 | Dark grey very silty fine sand with wood fragments | 3,6 | 4,0 |
| IA14 | | | |
| | Grey slightly silty fine sand | 4,0 | 4,5 |
| м5 | Grey fine sand | 4,5 | 5,5 |
| м6 | Idem, with very few fine shell fragments | 5,5 | 6,5 |
| м7 | Grey silty sand | 6,5 | 7,8 |
| м8 | Grey, slightly silty fine sand | 7,8 | 8,5 |
| | Idem, with very few fine shell fragments | 8,5 | 8,8 |
| м10 | Grey fine sand with very few fine shell fragments | 8,8 | 10,0 |
| | Idem | 10,0 | 10,5 |
| M1.1 | Idem | 10,5 | 11,0 |
| M11 | | 11,0 | 11,5 |
| | Idem, with fine silt lumps | 11,0 | 11,5 |
| | Grey fine sand with many silt lumps | 11,5 | 11,8 |
| | Odour : from 1,0 to 2,5 : slight odour, different from odour 2D | | |
| | from 3,5 to 11,5 : slight odour same odour as at 2D | | |
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| ample nr. | Description of the cuttings | Depth (m) | | | |
|--------------|------------------------------------------|-----------|----|--|--|
| | Description of the cuttings | from | to | | |
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| eological interpre | tation and remarks | | |
|--------------------|--------------------|------|-----|
| 0 - 0,3 | : disturbed soil | | |
| 0,3 - 11,5 | :_KZ2 | | |
| 11,5 - | : KL | | |
| 11,5 | . 101 | *** | *** |
| 1- m - 1 m | | | |
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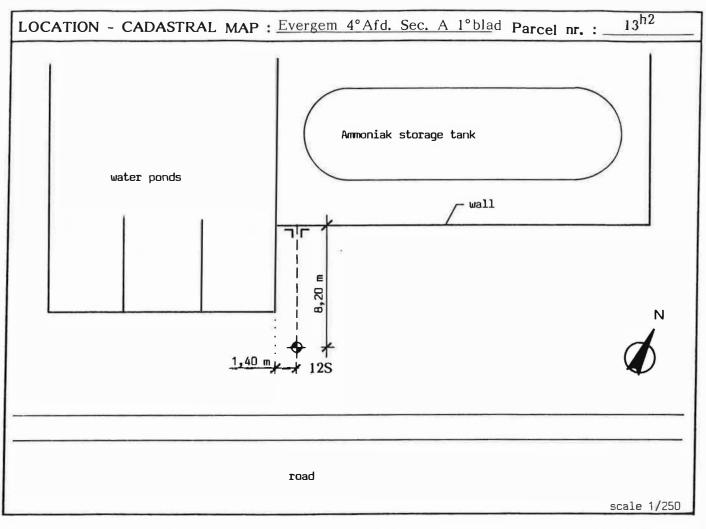


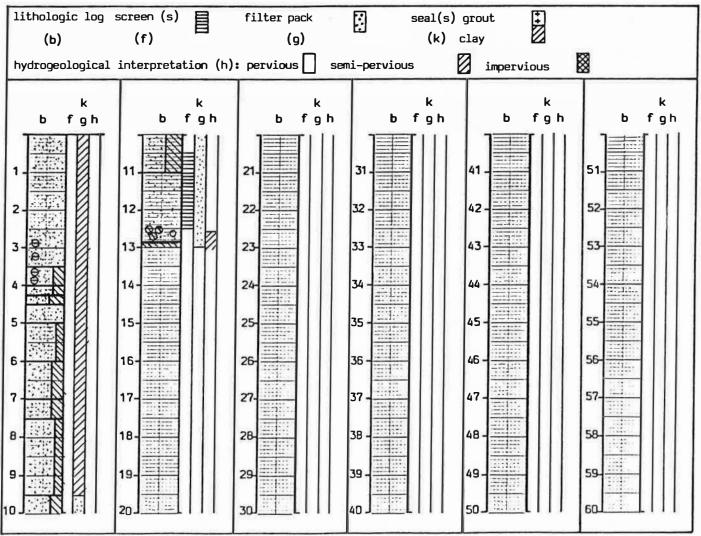
| Rijksunivers Laboratorium Laboratory o Prof. Dr. W. | voor Toego f Applied (| epaste Geolog | Geologi y and Hy | e en Hy drogeo | ydrogeolo logy | 0016 | esearch ni 50 86/81 | | 1 2S | |
|----------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------|------------------------------------------------------|------------------------------|---------------------------------------------|--------------------------------|------------------------|----------|-----------|---------|
| RESEARCH | Arco | Chem | | roduc | | Survey of ope plant | the site | OWNER | . ARCO-AT | POCHEM |
| - DATE : DRILLIN - DRILLIN - DESCRIP - MAP N.C - MUNICIP - X =(LAMBER (ZMV = gro | July 13 G CY.: G RIG TION OF G.I. Nr.: ALITY: | Geol Norc CUI 14/5 Evero Y DINA | 1987 Lab Imeyer TTINGS gem = TES) | BY: | _AD | DRILI Bruyn EOL./PEDO ZMV ZMV* | DL. MAP = _8,321 | Nr. : 40 |)E | |
| DDILL II | NC METI | IOD | Ø | | | | DEPTH (i | n m) | | |
| DRILLI | NG METH | HOD | (mm) | _ | n - to | from - to | from - | to from | - to fr | om - to |
| Auger Bailer | | | 168 135 | | 13,0 | | - | | | |
| Casing | | | 168 | - | 13,3 | | | | | |
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| - DRILLI | NG MUD | : _ | | L | | | CONSUMF | TION (I) | : | |
| - BOREH | | | | | | | | | | |
| screen nr | NR. | | - | DFO | | | GWDP | L | ST | Р |
| F1 F2 | | 10, | 5 | 12,5 | 8,931 | | | 1 | 10 | 2 |
| F3 | | | | | | | | | | |
| NR DFB DFO ZMP ZMP* GWDP L ST | = Dep = Leve = Estin = Grou = Type = Stra | th to th to el me matec undwa e of a | asuring d level ater dep aquifer ohy (co | point of m of m oth be : 1 = | screen t (m T/ ark (m elow ma phream to leg | AW) TAW) | | | mping we | ell |
| - Several - Charac | screens teristics | in on - rise | e bore | P | VC Ø 63 | mm DYKA | PVC_NBN | T42-111 | | |
| | | | eens nection | : _P | OLLAND LUED JO | nm VAN F NP10 DINTS | | | - | |
| - Bottom | pipe (m) | : | 0,05 | | | | | - | | |
| - Screen | slot oper | | - size | (mm) | : _60 x | sawed s] | ots | | | |
| CentralFilter-p | izer(s) - ack type | place and | (m): | - teristi | ics : _ c | coarse sar f | nd 0,7/1, | 25 | | _ |
| - Seals-ty | pe and c | harac | cteristic | :s : | Clay r | <u>ellets co</u> | mpactoni | te | | |
| - Borehol - Develop | e backfill ment - | l mat meth | erial : | ee s | ampling | L | | | | |
| | - | disch | arge (n | tion (13/h) | : | | | | | |
| - Finishin | g : steel | . cap | | | | | | | | |

| | Description of the cutting. | Depth | (m) |
|---------------|-----------------------------------------------------------------------------------------------------------------|-------|------|
| Sample nr. | Description of the cuttings | from | to |
| | Dark brown fine sand | 0 | 0,4 |
| | Reddish brown fine sand | 0,4 | 0,5 |
| M1 | Brown fine sand | 0,5 | 1,5 |
| M2 | Idem | 1,5 | 2,8 |
| мЗ | Brown fine sand with few wood fragments | 2,8 | 3,5 |
| M4 | Dark brown silty fine sand with few peat fragments | 3,5 | 4,0 |
| | Grey silty fine sand | 4.0 | 4.3 |
| | Grey very silty fine sand | 4,3 | 4,5 |
| М5 | Grey fine sand with very few fine shell fragments | 4,5 | 5,0 |
| м6 | Grey slightly silty fine sand, idem | 5,0 | 6,0 |
| м7 | Grey silty fine sand, idem | 6,0 | 7,5 |
| м8 | Grey slightly silty fine sand with very few fine shell fragments | 7.5 | 8.0 |
| м9 | Idem | 8,0 | 0,5 |
| M10 | Grey silty fine sand, idem | 9,5 | 10,0 |
| M11 | Grey very silty fine sand, idem | 10,0 | 11.0 |
| | Grey fine sand with very few fine shell fragments | 11,0 | 12,4 |
| | Idem, with silt lumps en few fine gravel | 12,1 | 12,9 |
| | Greenish grey silt | 12,9 | 13.0 |
| | Odour : from 2,8 to 11 m : strong to very strong odour (2D) from 11 m to at least 12,4 m : same, slighter odour | | |
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| Sample nr. | Description of the cuttings | Depth (m) | | | | |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|--|--|--|
| | Description of the cuttings | from to | | | | |
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| Geological interpre | etation and remarks |
|---------------------|---------------------|
| 0 - 12,4 | : KZ2 |
| 12,4 | : KL |
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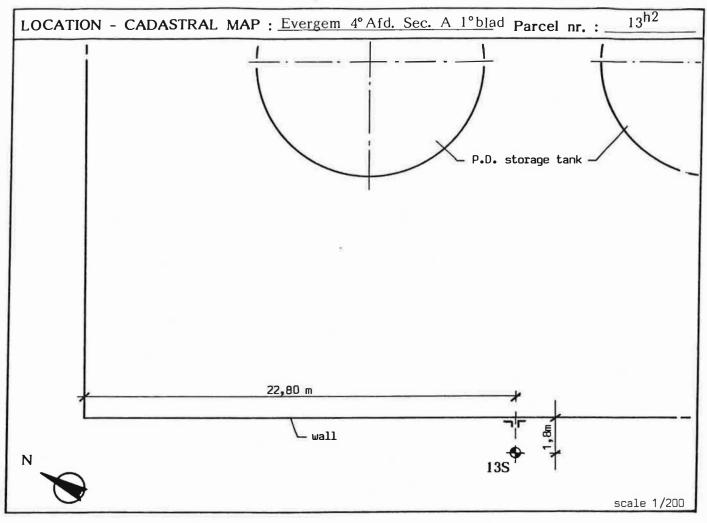


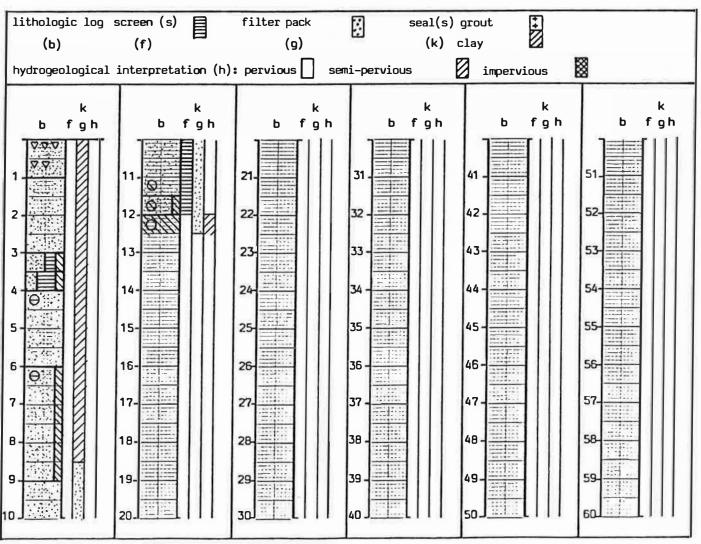
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|---------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------|---------------------------------------|---------------------------------------------|--------------------------------------|---------------------------------|------------------------------------------|--------------------------|-----------------------|-------|---------|-------|-----------------|
| RES | EARC | Arc | | emic | al F | rodu | _ | l Survey o rope plant | | OWNE | R: AR | CO-A | rochem |
| - DF - DF - DE - M/ - M(- X | RILLIN RILLIN ESCRIF AP N.O UNICIP = AMBEF | July 13 IG CY.: IG RIG PTION OF G.I. Nr.: PALITY: | Geo Nor CU' 14, Ever Y | 1987 clab cdme TTIN /2 cgem =TES | yer NGS | BY : | A. De | EOL./PEDO | OL. MAP =8,53 = | Nr. : | NIS-COI | DE : | 44019 n TAW) |
| Г | | | | I Q |) | ı . | | | DEPTH (i | in m) | | | |
| D | RILLI | NG METI | HOD | _ | m) | fron | 1 - to | from - to | _ | | om - t | o fro | om - to |
| Aı | ıger | | | 168 | 3 | | - 2 | | | | | | |
| | ailer asing | | | 135 | | 2 - | 12,5 | | - | + | | +- | |
| | asing | | | 100 |) | | 12,3 | | | | | + | |
| | | | | | | | | | | | | | |
| | | ING MUD | | | | | | | CONSUMI | PTION | (1) : | | |
| SC | reen nr | NR. | D | FB | I | OFO | ZMP | ZMP* | GWDP | L | S | T | P |
| | F1 | | 10 | ,0 | 12 | ,0 | 9,122 | | | 1 | 10 | 0 | 2 |
| | F2 F3 | | | | | | | | | | _ | | |
| I I I I I I I I I I I I I I I I I I I | NR OFB OFO ZMP ZMP* GWDP Z | = Leve = Esti = Groot = Type = Stra | th to th to el me matec undwa e of a | bot asur d lev ater aqui ohy | tom ing vel dep der (con | of s point of ma th be 1 = form | creen (m T/ ark (m elow ma phreat to leg | AW) TAW) | • | | Pumpin | g we | 11 |
| | | | | r pi | pes | PV NP PV | C Ø 63 10 C Ø 63 | mm DYKA I mm VAN RY | YSWYCK-V | EGHEL | BV | | |
| | | - | - con | nect | ions | : GL | UED_JO | INTS | | | | | |
| - B | ottom | pipe (m) | : | 0,0 | 5 | | | | | | | | |
| - S | creen | slot open | | - si | ze (| mm) | tical : 60 x | sawed slot 0,3 | .s | | | | |
| | | | place and | (m) chai | ر: ا act | 0,0 eristi | and 12 | .0 parse sand | 0,7/1, | 25 | | | *** |
| - B | orehole | e backfill | harac - vol mat | teri ume eria | stic: (l.) l:_ | s: <u>C</u> | lay pe | llets comp | from 0 | to 8, | 5 m | | |
| - D | evelop | - | date | - d | urat | ion (l | n) : | | | | | | |
| - F | inishin | | | | | | | | | | | | |

| Description of the cuttings | Depth | (m) |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | from | to |
| Stones, stone fragments and gravel | 0 | 0,2 |
| Dark brown fine sand | 0,2 | 1,0 |
| Brown fine sand | 1,0 | 1,5 |
| Grey fine sand | 1,5 | 2,5 |
| Brownish grey fine sand | 2,5 | 3,0 |
| Greyish brown slightly silty fine sand with peat | 3,0 | 3,5 |
| Idem, with very much peat and wood fragments | 3,5 | 4,0 |
| Grey fine sand with few wood fragments | 4.0 | 4.5 |
| Grey fine sand | 4,5 | 5,5 |
| Idem | 5,5 | 6.0 |
| Grey slightly silty fine sand with few fine wood fragments | 6,0 | 7,0 |
| Grey slightly silty fine sand | 7,0 | 8.0 |
| Idem | 8,0 | 9,0 |
| Grey fine sand | 9,0 | 9,5 |
| Idem, with very few fine shell fragments | 9,5 | 10,5 |
| Idem | 10,5 | 11,0 |
| Grey fine sand with very few fine shell fragments and few fine silt lumps | 11,0 | 11,5 |
| Grey slightly silty fine sand, idem | 11,5 | 12,0 |
| Grey silt with few fine gravel | 12,0 | 12,5 |
| Odour : from 6,5 to 8,0 m : slight odour, same as at 2D from 8,0 to 12,5 m : same strong odour | | |
| | | |
| | Dark brown fine sand Brown fine sand Grey fine sand Brownish grey fine sand Greyish brown slightly silty fine sand with peat Idem, with very much peat and wood fragments Grey fine sand with few wood fragments Grey fine sand Idem Grey slightly silty fine sand with few fine wood fragments Grey slightly silty fine sand Idem Grey fine sand Idem Grey fine sand Grey fine sand Grey fine sand Grey fine sand Grey fine sand Grey fine sand with very few fine shell fragments Idem Grey fine sand with very few fine shell fragments and few fine silt lumps Grey slightly silty fine sand, idem Grey slightly silty fine sand, idem Grey silt with few fine gravel | Dark brown fine sand 0,2 Brown fine sand 1,0 Grey fine sand 1,5 Brownish grey fine sand 2,5 Greyish brown slightly silty fine sand with peat 3,0 Idem, with very much peat and wood fragments 3,5 Grey fine sand 4,6 Grey fine sand 4,5 Grey fine sand 4,5 Grey slightly silty fine sand with few fine wood fragments 6,0 Grey slightly silty fine sand with few fine wood fragments 6,0 Grey fine sand 9,0 Idem 8,0 Grey fine sand 9,0 Idem, with very few fine shell fragments 9,5 Idem 10,5 Grey fine sand with very few fine shell fragments and few fine silt lumps 11,0 Grey slightly silty fine sand, idem 11,5 Grey slightly silty fine gravel 12,0 Odour: from 6,5 to 8,0 m: slight odour, same as at 2D |

| ample nr. | Description of the outtings | | Depth (m) | | | | |
|--------------|-----------------------------|------|-----------|--|--|--|--|
| | Description of the cuttings | from | to | | | | |
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| Geological | interpret | tation ar | nd remarks | | | |
|------------|-----------|-----------|------------|--|--|--|
| 0 | - 1,0 1 | m : dist | urbed soil | | | |
| 1,0 | - 12,0 ı | m : KZ2 | | | | |
| 12,0 | - | : KT. | | | | |
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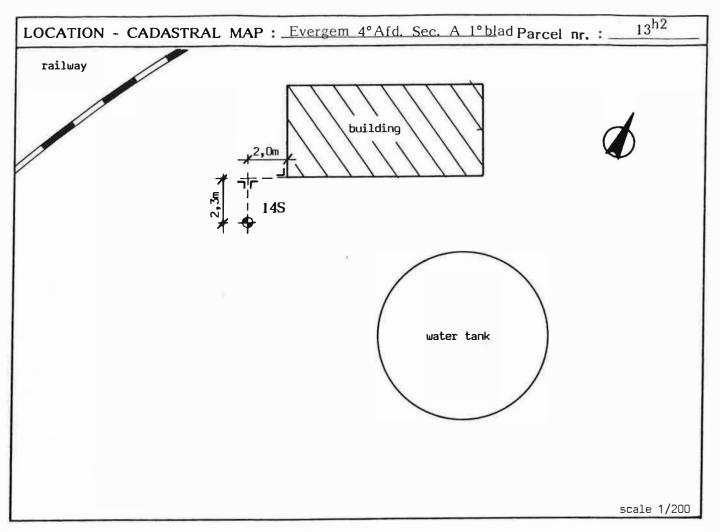


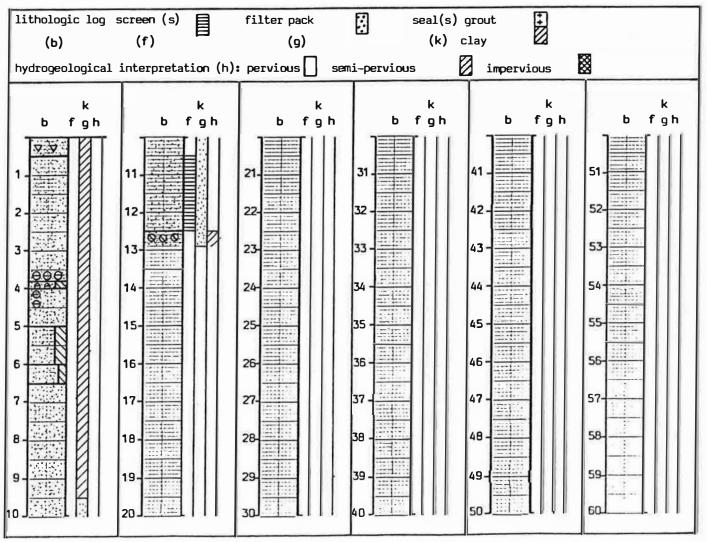
| Rijksuniversiteit Gent Laboratorium veer Jacoppaste Conlogio on Hydrogeologia Research nr.: Well nr.: |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Laboratorium voor Toegepaste Geologie en Hydrogeologie Laboratory of Applied Geology and Hydrogeology TGO 86/81 14S Prof. Dr. W. De Breuck |
| RESEARCH: Additional hydrogeological Survey of the OWNER: ARCO-ATOCHEM |
| Arco Chemical Products Europe plant site |
| at Rieme (Belgium) - DATE:July 10th, 1987 |
| - DRILLING CY.: _Geolab |
| - DRILLING RIG Nordmeyer DRILLER: |
| - DESCRIPTION OF CUTTINGS BY : A. De Bruyn |
| - MAP N.G.I. Nr.: 14/5 GEOL./PEDOL. MAP Nr.: 40E - MUNICIPALITY: Evergen NIS-CODE: 44019 |
| - MUNICIPALITY : |
| (LAMBERT-COORDINATES) ZMV* =(m TAW) |
| (ZMV = ground level (measured); ZMV* = ground level (estimated)) |
| Ø DEPTH (in m) |
| DRILLING METHOD (mm) from - to from - to from - to from - to |
| Auger 168 0 - 2,0 |
| Bailer 135 2 - 13,0 |
| Casing 168 0 - 12.8 |
| Casing 100 0 - 12.0 |
| |
| - DRILLING MUD : CONSUMPTION (I) : |
| |
| Screen nr. NR. DFB DFO ZMP ZMP* GWDP L ST P F1 10,5 12,5 8,830 1 10 2 |
| 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 DYKA PVC NBN T42-111 |
| PN10 |
| - screens : PVC Ø 63 mm VAN RYSWYCK-VEGHEL BV |
| HOLLAND NP10 - connections: GLUED JOINTS |
| - Bottom pipe (m) : |
| - Screen slot openings - type : vertical sawed slots |
| - size (mm) : 60 x 0,3 |
| - open area (%): |
| - Centralizer(s) - place (m): Filter-pack type and characteristics:coarse sand 0,7/1,25 volume (l.) : from 9,5 to 13,0 m |
| - Volume (I.): |
| - Borehole backfill material: - Development - method:see sampling |
| - date - duration (h) : |
| - discharge (m ³ /h): |

| Sample | Description of the cuttings | Depth | (m) |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| nr. | | from | to |
| | Brown fine sand with stones and store fragments and brick | | |
| | fragments | 0 | 0,! |
| N/1 | Brown fine sand | 0,5 | 1,5 |
| M1 | Brown Time Sand | 1 0,3 | 1 |
| M2 | Idem | 1,5 | 2,0 |
| | | | |
| м3 | Idem | 2,0 | 3,0 |
| | | 2 0 | 2 0 |
| | Greyish brown fine sand | 3,0 | 3,5 |
| | Dark brown silty fine sand with many wood fragments | 3,5 | 3,8 |
| | The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s | | |
| M4 | Dark brown silty fine sand with wood fragments | 3,8 | 4,0 |
| | | 1 1 0 | 4 5 |
| | Greyish brown fine sand with few wood fragments | 4,0 | 4,5 |
| м5 | Greyish brown fine sand | 4,5 | 5,0 |
| | | | |
| м6 | Greyish brown silty fine sand | 5,0 | 6,0 |
| | | | |
| | Grey slightly silty fine sand | 6,0 | 6,5 |
| м7 | Grey fine sand | 6,5 | 7,5 |
| | | | |
| м8 | Idem | 7,5 | 8,0 |
| | | | |
| м9 | Grey fine sand with very few fine shell fragments | 8,0 | 9,0 |
| | | | 1 40 0 |
| M10 | Idem | 9,0 | 10,0 |
| M11 | Idem | 10,0 | 11,0 |
| | | | İ |
| M12 | Idem | 11,0 | 12,5 |
| | | | |
| | Idem, with silt lumps | 12,5 | 12,9 |
| | | | |
| | Odour : from 4,0 to 12,9 m : slight odour 2D | | |
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| ample nr. | Description of the cuttings | Depth (m) |
|--------------|-----------------------------|-----------|
| | Description of the cuttings | from to |
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| ological int | erpretation and remarks | |

| Geological interpretation and remarks | | | | | | | | |
|---------------------------------------|--|--|--|--|--|--|--|--|
| 0 - 0,5 m : disturbed soil | | | | | | | | |
| 0,5 - 12,5 m : KZ2 | | | | | | | | |
| 12.5 : KL | | | | | | | | |
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APPENDIX 2 GEOMETRIC CHARACTERISTICS OF THE OBSERVATION WELLS

| borehole nr. | screen nr. | | | Ground | 1 | Screen | | length | Ø |
|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| | | х | У | elevation (m TAW) | measuring point | depth (m) TOP - BASIS | level (m TAW) TOP - BASIS | (m) | (mm) |
| | | FORMERLY DR | ILLED ARCO V | ELLS | | | | | |
| 1S 1D 2S 3S 3D 4S 5S | 1 S 1 D 2 S 3 S 3 D 4 S 5 S 5 D | SEE MAP 1 | | +8,2 +8,2 +8,2 +8,7 +8,7 +8,7 +8,2 +8,2 | +8,907 +8,816 +8,900 +9,360 +9,348 +9,337 +8,909 +8,918 | 7,0 - 9,0 17,5 - 19,5 7,0 - 9,0 8,5 - 10,5 18,0 - 20,0 7,5 - 9,5 8,4 - 10,4 16,5 - 18,5 | +1,2/-0,8 -9,3/-11,3 +1,2/-0,8 +0,2/-1,8 -9,3/-11,3 +1,2/-0,8 -0,2/-2,2 -8,3/-10,3 | 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 | 63 63 63 63 63 63 63 |
| 1Sbis 1Dbis 2Sbis 2D 4S1 4S2 4S3 4S4 4S5 4D1 4D2 4D3 6S 7S 8S 9S 10S 11S 12S 13S 14S | 1Sbis 1Dbis 2Sbis 2D 4S1 4S2 4S3 4S4 4S5 4D1 4D2 4D3 6S 7S 8S 9S 10S 11S 12S 13S 14S | SEE MAP 1 | ED OBSERVATI | ON WELLS +8,3 +8,4 +8,2 +8,1 +8,8 +8,5 +8,8 +8,8 +8,9 +9,2 +9,4 +9,0 +8,9 +8,8 +8,9 +9,1 +8,8 | +8,791 +9,011 +8,640 +8,711 +9,394 +9,200 +9,165 +9,046 +9,234 +9,391 +9,626 +9,217 +9,231 +8,822 +8,821 +8,541 +8,701 +8,465 +8,757 +8,904 +8,653 | 10,5 - 12,5 17,3 - 19,3 10,0 - 12,0 17,5 - 19,5 5,0 - 10,0 8,0 - 10,0 8,0 - 10,0 2,5 - 3,5 13,6 - 14,6 17,0 - 20,0 18,0 - 20,0 18,0 - 20,0 12,0 - 14,0 10,5 - 12,5 10,4 - 12,4 10,6 - 12,6 11,0 - 13,0 9,5 - 11,5 10,5 - 12,5 10,0 - 12,0 10,5 - 12,5 | -2,1/-4,1 -9,0/-11,0 -1,8/-3,8 -9,4/-11,4 +3,8/-1,2 +0,7/-1,3 +0,5/-1,5 +6,3/+5,3 -4,8/-5,8 -8,2/-11,2 -9,1/-11,1 -8,8/-10,8 -2,6/-4,6 -1,5/-3,5 -1,5/-3,5 -1,8/-3,8 -2,2/-4,2 -0,8/-2,8 -1,6/-3,6 -0,9/-2,9 -1,7/-2,7 | 2,0 2,0 2,0 2,0 5,0 2,0 1,0 1,0 3,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2,0 2 | 63 63 63 125 63 63 63 63 63 63 63 63 63 63 63 63 |