FLUCTUATION PATTERNS OF THE PHREATIC SURFACE OF RAHEENMORE BOG

1. INTRODUCTION

The fluctuation pattern of phreatic groundwater levels in a raised bog is a main determining factor for the redox conditions and their changes over the year in the upper peat layer. Redox conditions, on their turn, strongly influence the process of mineralisation of organic matter and therefore the vegetation.

In this publication, fluctuations of the phreatic water table along two transects over Raheenmore bog are analysed and correlated with vegetation units as defined by Lara Kelly.

Raheenmore bog is a bog of 162 ha in County Offaly, Ireland. It lies in a deep basin and has a well developed dome shape (Cross, 1989).

Its location is shown in fig. 1.

Fig. 1. Situation of Raheenmore Bog

Peat cutting has occurred along almost the whole margin of Raheenmore Bog. It has ceased several years ago. The bog is surrounded by deep marginal drains.

2. TRANSECTS AND AVAILABLE DATA

2.1 Transects

There are two transects of piezometers and phreatic groundwater level observation tubes; the N-S and the E-W. Their positions are shown on the map of fig. 2. The N-S transect was installed in 1987, the E-W transect in 1989 at the beginning of the Irish-Dutch Raised Bog Study. Only the results of the phreatic tubes and piezometers with a screen depth of 1.20 m or less are discussed here, because they are expected to correlate with the vegetation pattern. The N-S transect is 1000 m long and contains phreatic tubes or shallow piezometers at 44 sites. The length of the E-W transect is 829 m and it contains phreatic tubes at 13 sites, including one in common with the N-S transect.

Fig. 2. Position of the transects on Raheenmore Bog

2.2 Ground water level observations

The tubes and piezometers of the N-S transect have been observed on a monthly basis from October 1987 through March 1989. Observations were resumed on a two-weekly basis in October 1989 and ended in March 1992. The the E-W transect was observed with the same frequency, starting in November 1989 and also ending in March 1992. After March 1992 only a few additional observations were taken on the E-W transect.

2.3 Levellings

Table 1 shows the dates on which the transects were levelled.

Table 1. Levelling dates of both transects

N-S transect	E-W transect
??-???-87	05-Dec-89
	15-Aug-90
29-Aug-90	29-Aug-90
22-Sep-90	13-Sep-90
12-Jan-91	13-Jan-91
14-May-91	25-Apr-91
30-Aug-91	09-Aug-91
20-Nov-91	20-Oct-91
	18-Aug-92

The large number of levellings was made to obtain information as to effects of seasonal fluctuations of the surface level of the bog on top-tube levels.

2.4 Selection of data.

2.4.1 Time period

In order to have full years with approximately equidistant intervals in time, the period of 21-Jan-90 through 13-Jan-92 was selected for analysis. Including fractions of years would produce series with biased frequency distributions of groundwater levels. The data of 1987-1989 have longer intervals between them and there is a gap of 6 months between the 1987-1989 and the 1989-1992 series.

2.4.2 Levelling data

The levellings of the top-tube levels appeared to be only partly reliable. Of the levellings of 1987 it was unclear which benchmark had been used. Later levellings gave large deviations in level (up to 0.30 - 0.50 m) at large distances from the benchmarks. This was partly due to the bog surface on which the levelling gear did not remain in position during the measurements and the available instrument which could not compensate for such changes. Another reason appeared to be faulty equipment (deviations of 1 cm in 100 m were found). In the winter of 1991 semi-automatic optical levelling gear became available and three additional benchmarks were installed on the bog by OPW.

Of the N-S transect the levelling data of 1987, 22-Sep-1990 and 12- Jan-1991 (tube nrs 325 and higher) were discarded because of the presence of too many obvious errors. Of the E-W transect the levelling data of 05-Dec-1989, 15-Aug-1990 and 29-Aug-1990 were discarded for the same reason. Levels for intermediate dates were interpolated linearly between the dates with accepted measurements. Levels outside the periods were assumed to be equal to those of the the first or last date, depending on whether they were before or after the period with measured and accepted data. Table 2 shows the remaining levelling dates.

Table 2. Remaining levelling dates after data checking.

N-S transect	E-W transect
29-Aug-90	
22-Sep-90	13-Sep-90
12-Jan-91 (nrs <325 only)	13-Jan-91
14-May-91	25-Apr-91
30-Aug-91	09-Aug-91
20-Nov-91	20-Oct-91
	18-Aug-92

The levels (top of tube) and standard deviations per tube in both transects are listed in Annex A. The fluctuations of the levels are relatively small. Most standard deviations of both transects are less than 2 cm. The standard deviations include effects of both surface level fluctuations and measurement errors. This means that surface level fluctuations on Raheenmore Bog have been small during the selected observation period.

2.4.3 Observation tubes

Of the phreatic tubes near the bog margin, a considerable part has not given data for a number of monitoring dates in relatively dry periods, because the groundwater level had fallen below the bottom of the tubes. Tubes with less than 80% of the maximum possible amount of data (41 out of 51) have been discarded in the analysis.

Missing data of the remaining tubes were estimated using simple linear regression on the nearest tube with (nearly) the same filter screen depth. Some corrections on data that were obviously erroneous were made in the same way. On 29 March 1990 the tubes on the N-S transect were not observed. On all tubes, these missing values were estimated by linear interpolation between the two adjacent dates in the series in order to maintain approximate equidistance in time of the data values.

The position in the transect, maximum possible and actual number of data values and filter screen depth are given in Annex B.

Table 3 shows the numbers of both accepted and measured data values of the phreatic tubes and shallow piezometers in the N-S transect that were used in the analysis and that had one or more estimated data values.

Table 3. Numbers of accepted and observed data (the latter in parentheses) for tubes with less than 51 accepted observed level values from 21-Jan-1990 through 13-Jan-1992

307GW	49 (50)	331GD	50 (51)	342GD	41 (41)
310GD	50 (51)	333A	50 (51)	342GW	50 (50)
313A	48 (48)	336GD	43 (44)	344A	45 (45)
313GW	49 (49)	336A	50 (51)	346A	50 (51)
320GD	47 (47)	339GD	41 (51)	346GW	49 (49)
325GD	50 (50)	341GD	43 (43)	348	48 (48)
326GD	49 (49)				

No corrections have been made on the data of the E-W transect. Therefore the numbers of accepted and measured data values of this transect are equal. Only two phreatic tubes had one missing value each. Numbers of missing data values can be derived from table B.1 in Annex B.

2.5 Surface levels

In theory, surface levels at the piezometer nests and single phreatic tubes can be obtained during the levelling of the tube tops. However, the bog surface is uneven with small low hummocks and shallow hollows in many places and it is soft, particularly in the central parts. "The" surface level therefore is a rather ill-defined quantity. The results of levellings of the surface show considerable variations, that cannot have been caused by seasonal vertical surface movements, but must be the result of different positions of the staff at different levellings. Therefore, all the data were converted to metres above sea level for most of the analysis work.

For ecological purposes, however, the position of the water levels with respect to the surface is important. For this reason, surface levels at all locations have been measured on 12 October 1992. At each site, the vertical distance from the phreatic tube (numbers with extension "GD" OR "GW" in the N-S transect and "A" in the E-W transect) to the ground level at the tube was measured. Where the tube was placed on a hummock, the difference in level with the surroundings was estimated visually and added to the measured level. Surface levels thus obtained reflect the levels in the hollows, rather than a mean of hummock and hollow levels.

With this method, seasonal fluctuations of the surface level are neglected. The alternative, however, is to use data of which most of the variation in time is due to the measurement technique used rather than to seasonal changes in the surface level.

Descriptions of all sites, including vegetation and local position with respect to slopes and other particulars are given in Annex C.

3. RESULTS

3.1 General remarks

In this chapter the following results will be discussed.

- Surface levels along the transects
- Phreatic levels and their temporal fluctuations in relation to surface levels
- Frequency distributions of observed phreatic levels

- Deterministic and stochastic components

3.2 Surface levels

The surface levels along the transects are shown in fig. 3 (E-W transect) and 4 (N-S transect). Fig. 3 also shows the tube numbers of the E-W transect in their position. Because the horizontal distances between piezometer sites in the N-S transect become very small near both end, the numbers in the N-S transect are shown at different scales in fig. 5.

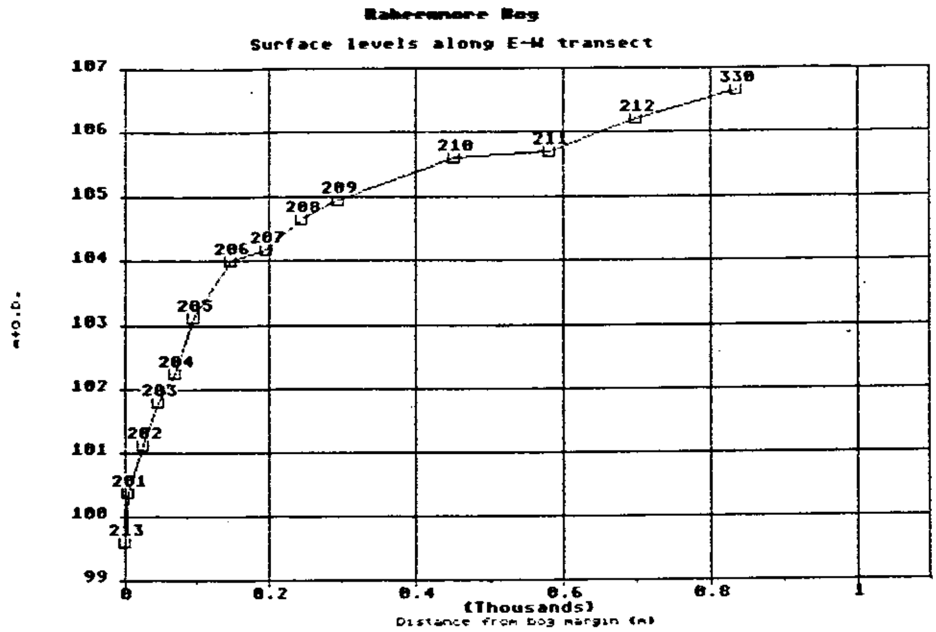


Fig. 3. Piezometer site numbers and surface elevations along the E-W transect.

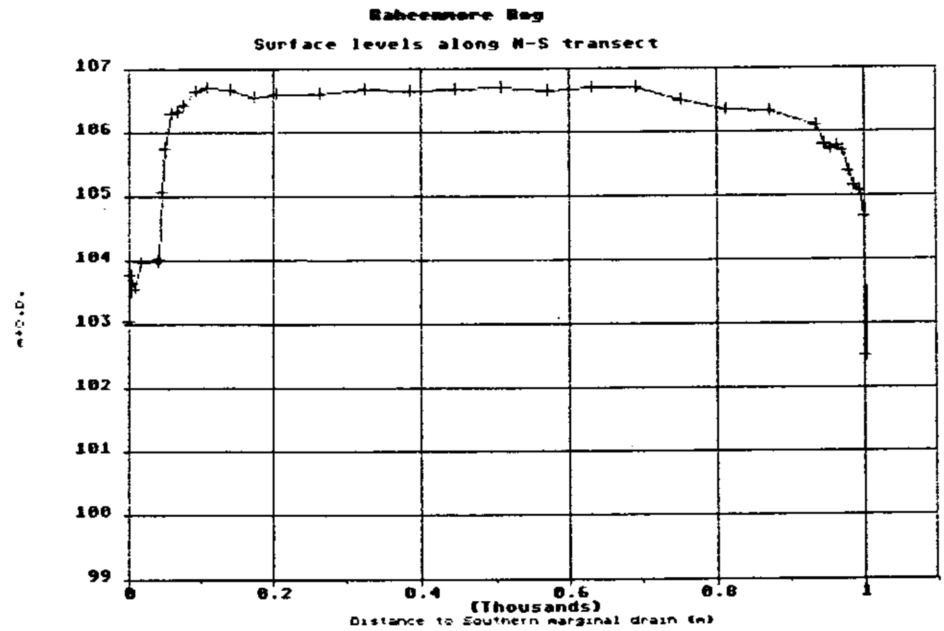
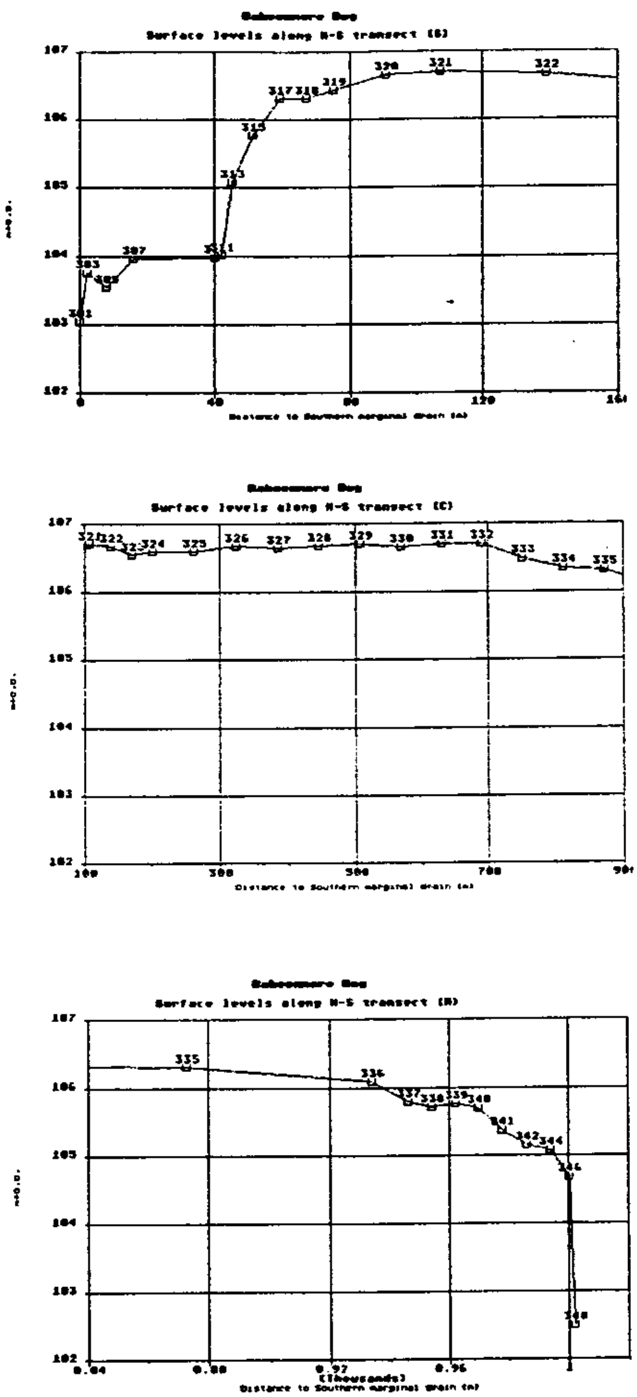


Fig. 4. Surface elevations along the N-S transect.



a.

b.

c.

Fig. 5. Piezometer site numbers and surface elevations along the E-W transect
(a: Southern part, b: central part, c: Northern part)

Figs. 3 and 4 show very different shapes of the cross section. The N-S transect (fig. 4) is located on the central part of the bog, while the eastern part of the E-W transect lies in an area where subsidence is very likely to have occurred as a result of the presence of (now mostly infilled) drains. Sytsma and Veldhuizen (1992) presented data from which an approximate surface subsidence in the E-W transect could be estimated of

2.50 m at site 201, 2.70 m at 206, 1.50 m at 209 and less than 1 m at 210.

Surface levels at the eastern margin are about 3 m lower than those at the Northern and Southern margin. The transition from elevations between 106 and 107 m above O.D. in the centre of the bog to 102-103 m at the margin is relatively abrupt in the N-S transect and gradual in the E-W one.

The enlarged section of fig. 5a clearly shows the bog face, resulting from former turf cutting and the marginal slope in the South. The actual bog face is located between the points 311 and 313, 0.5 m N of 311. The other part of the slope is a steep marginal slope that probably is the result of subsidence rather than of cutting. From the data of Sytsma and Veldhuizen (1992) a surface subsidence at site 313 could be derived that indicated that in the undisturbed situation the surface level must have been almost equal to the level in the central part of the bog.

The part below the bog face is on partly cutover peat. The level at point 301 is the level of the top of a gauge in the marginal drain, not a real surface level.

The enlarged central section in fig. 5b shows only very small variations of the surface level that begins to fall slowly towards the Northern bog margin from site 332 on.

The enlarged section of fig. 5c shows that in the North the bog surface level does not drop very much until the edge; the distance between the sites 346 and 348 is only 2 m and 348 is in fact not a surface level but the top of a gauge in the marginal drain. Although the marginal drain level is lower than in the S, the marginal slope of the bog is much less steep here.

3.3 Phreatic levels and their temporal fluctuations.

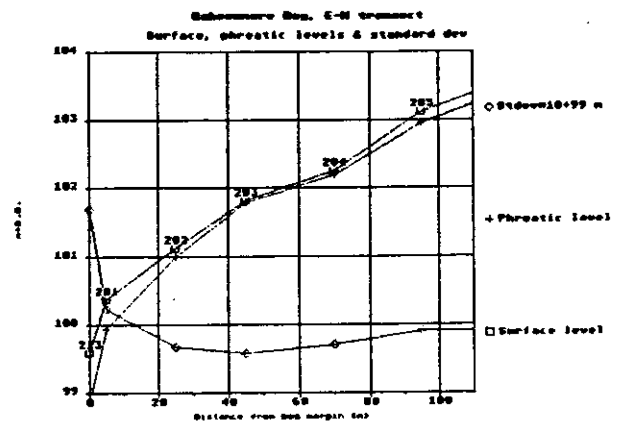
3.3.1 General remarks

The rate of fluctuation in time of phreatic or piezometric levels can be expressed conveniently in a single figure as the standard deviation around the mean of all observed values of each series. For comparison, the time series concerned should be of equal length and contain the same number of data, observed on (approximately) the same dates. To prevent biased distributions as much as possible, the series should cover one or more full years.

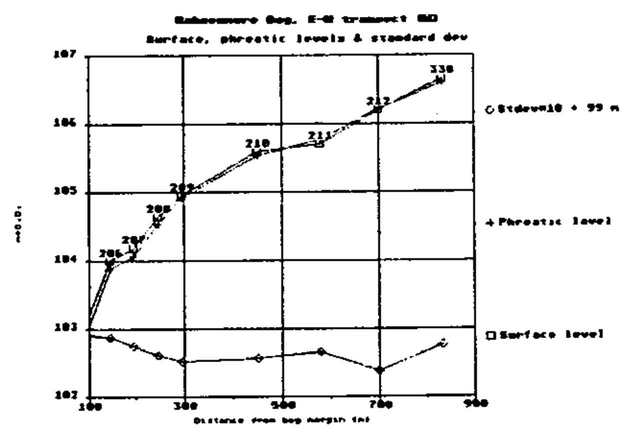
Because relationships between the slope of the bog surface, the mean depth of the phreatic surface below the bog surface and the rate of fluctuation of the phreatic surface may exist, all three are examined in this section.

3.3.2 The E-W transect

The data are shown in fig. 6 (E-W transect). Because of the short distances between the observation points in the transects near the bog margin, this part is shown at a larger horizontal scale than the part towards the centre of the bog. The standard deviations have been multiplied by 10 and the level represented by the ascissa of the graphs has been added to the result for visualisation in the same graph.



a.



b.

Fig. 6. Surface levels, phreatic levels and standard deviations of the phreatic levels along the E-W transect. a: Eastern (marginal) part; b: Western part.

The Easternmost observation tube in fig. 6a shows a very large fluctuation with a standard deviation of about 0.27 m. In fact this tube has been placed in the mineral soil, so it does not show fluctuations in the bog. The phreatic level already gets close to the surface at about 20 m from the margin and the standard deviation of the phreatic level is then down to about 0.07 m. Further along the transect there seems to be a strong correlation between depth of the phreatic surface and the rate of fluctuation.

Fig. 7 shows the depth of the phreatic surface versus the standard deviation around its mean.

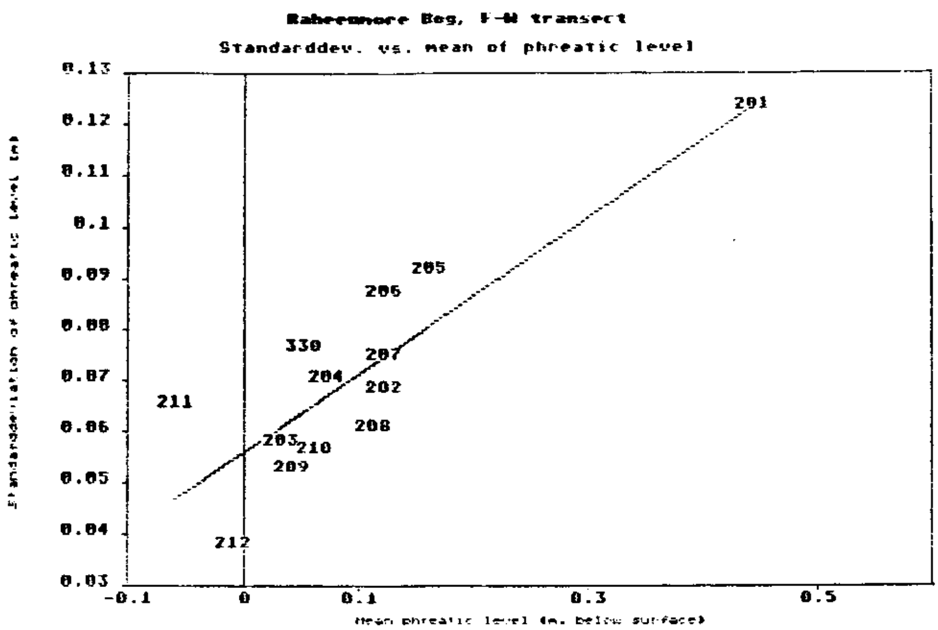


Fig. 7. Mean phreatic levels on the E-W transect versus their standard deviations.

The data are also given in table 4.

Table 4. E-W transect. Sites, their mean phreatic level in m below surface ("mean") and standard deviation of the phreatic level around the mean ("stdv") in m and the number of really observed data (n).

site	201	202	203	204	205	206	207	208	209	210	211	212	330
mean	.44	.12	.03	.07	.16	.12	.12	.11	.04	.06	-.06	-.01	.05
stdv	.123	.068	.058	.070	.091	.087	.074	.060	.052	.056	.065	.037	.076
n	51	51	52	52	52	52	52	52	52	52	52	52	51

There is a correlation between mean level below surface and standard deviation: the deeper the mean phreatic surface, the larger its fluctuation. This is clearly shown when linear regression is applied. (Table 5).

Table 5. Linear regression model of standard deviation (s in m) vs. depth of the phreatic level (d in m). E-W transect, sites 201 through 330. ANOVA for model s=0.056m-0.153d

		degrees of freedom	variance
data values		13	
sum of squares abt. mean	$5.47 \cdot 10^{-3}$	12	$4.56 \cdot 10^{-3}$
sum of squares of model	$4.01 \cdot 10^{-3}$	1	$4.01 \cdot 10^{-3}$
sum of squares residual	$1.46 \cdot 10^{-3}$	11	$1.33 \cdot 10^{-3}$
	$F(1,11)=30.1$, $Q(F\|1,11) << 0.001$		

This phenomenon is probably caused by three processes:

1. When the phreatic level is close to the surface, its rising is limited to a few cm above it, because the excess water will be removed quickly by surface runoff. This process limits the upward movement of the phreatic level. Where the acrotelm ("active layer" as described by Romanov (1961, 1968)) is well developed, the discharge may already be fast at water levels just below the surface as a result of the extremely high hydraulic conductivity in the upper cms. The fluctuation is then also limited by high storage coefficients. Veldkamp and Westein (1993) calculated mean storage coefficients of 35% in a well developed acrotelm from a lysimeter experiment on Raheenmore Bog.

2. Where deeper phreatic levels occur, the acrotelm with only slightly humified young peat is either not present anymore at all or severely damaged and thin (van 't Hullenaar and ten Kate, 1991). Instead, the top layer is rather strongly humified (humification degree 4 or more according to Von Post and Granlund's scale). In such material, average pore sizes are smaller and hence the storage coefficients are lower than in a functioning active layer. For situations with a less severely damaged acrotelm than along the bog margin, Veldkamp and Westein found a mean value of 26% in the lysimeter experiment already mentioned. The storage coefficients at the bog margin where the deepest phreatic levels and the most severely damaged active layer occur, probably are even considerably smaller.

3. Drainage in bogs generally causes a lowering and an increased rate of fluctuation of the phreatic level, resulting from easier discharge at relatively low phreatic levels. The bog area from site 201 through 208 where the deepest levels and largest fluctuations occur, is influenced by old grown in shallow drains; the very margin of the bog has a relatively intense natural drainage.

Nicholson et al. (1989) found an increase in peak flow and a quicker response of the discharge to rainfall after drainage in a small bog with 50 year old grown in drains in Scotland. This already indicates that the drainage must have had an increasing effect on the amplitude of fluctuations of the phreatic level. From the data presented in their paper, an increase of the standard deviation around the mean of the phreatic level from just over 0.07 m to about 0.09 m and a lowering of the mean level by about 0.07 m can be derived.

It is therefore very likely that both the mean phreatic level and its rate of fluctuation have been influenced in a considerable way by the old drains. The influence may have been larger than today, for two reasons:

1. The old drains have grown in and have partly been blocked as a result of this process
2. Assuming that the shape of original bog surface before the drains were cut must have resembled the shape of the N-S transect more than today, subsidence resulting from the drainage must have caused the surface to follow the dropped water levels to a large extent.

Surface slope may also have a certain effect on the size of the fluctuations of the phreatic level, since it influences the horizontal gradient of the phreatic level and thus the process of runoff. Fig. 8 shows a scatter diagram with regression line. The slope for each point was determined as follows:

$$S_n = \frac{H_{n-1} + H_{n+1}}{D_{n-1} + D_{n+1}}$$

where

S_n	Slope at n-th point in transect (-)
H_{n-1}, H_{n+1}	Altitude at n-1 th (n+1 th) point in transect (m)
D_{n-1}, D_{n+1}	Distance of n-1 th (n+1 th) point in transect to beginning of transect

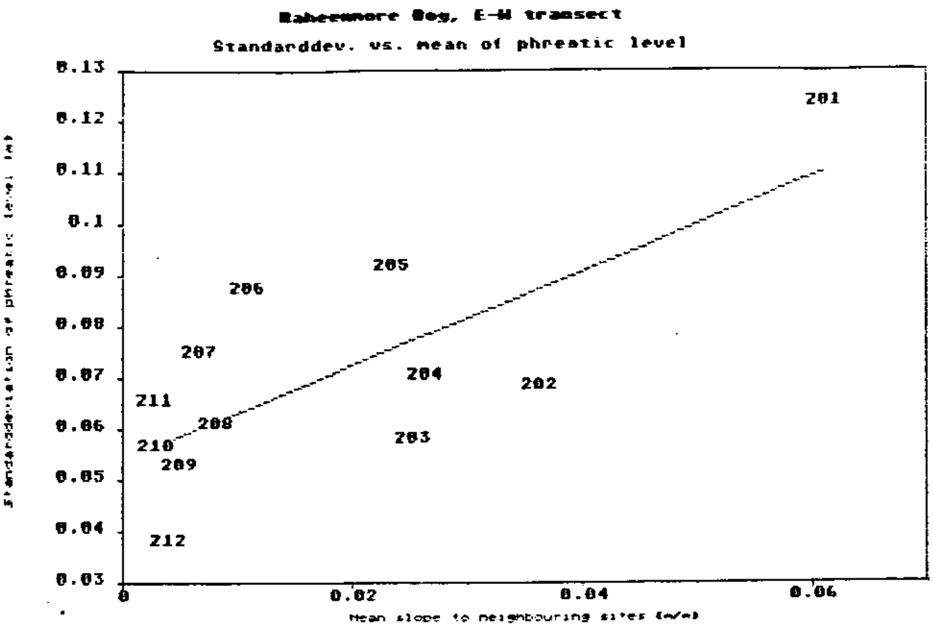


Fig. 8. Standard deviation of the phreatic level vs. surface slope with regression line

The ANOVA of the regression analysis is shown below in table 6.

Table 6. Linear regression model of standard deviation (s in m) vs. surface slope S (m/m). E-W transect. ANOVA for model $s = 0.055\text{m} - 0.920\text{m} * S$

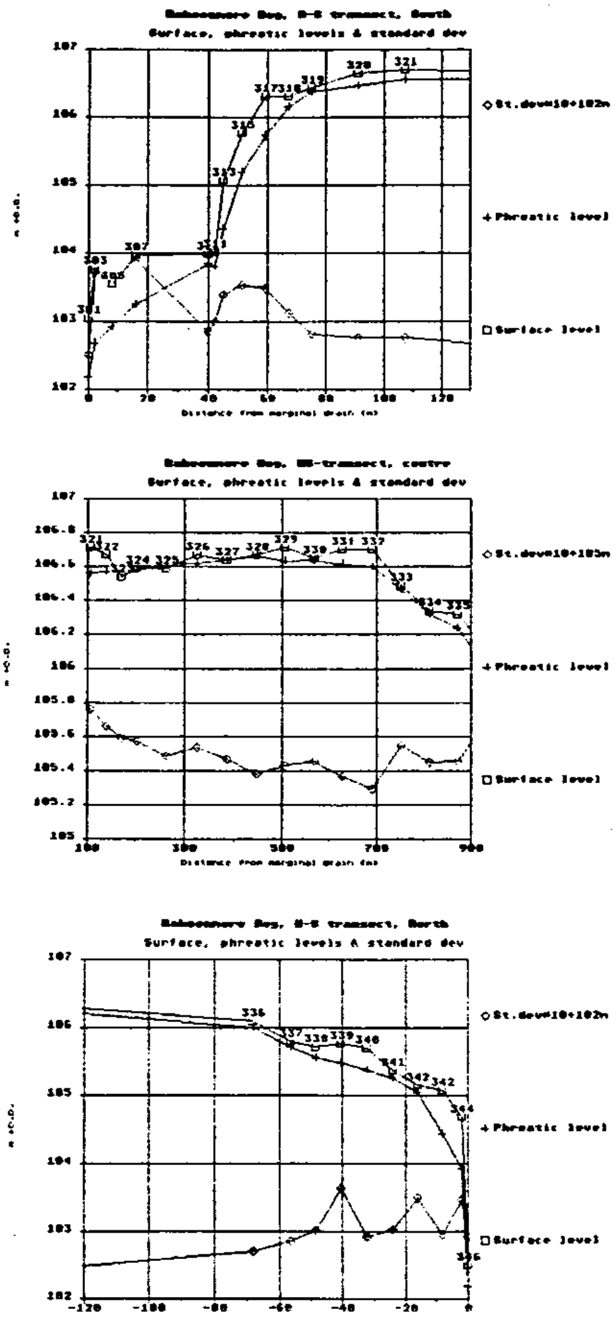
		degrees of freedom	variance
data values		12	
sum of squares abt. mean	$5.44 * 10^{-3}$	11	
sum of squares of model	$2.92 * 10^{-3}$	1	$2.92 * 10^{-3}$
sum of squares residual	$2.52 * 10^{-3}$	10	$2.52 * 10^{-4}$

$F|1,10 = 11.6$, $0.005 < Q(F|1,10) < 0.01$

Although the relationship found is not as convincing as the one for standard deviation vs. mean depth, the significance is rather high. However, since slope and mean depth of the phreatic levels are no fully independent quantities and the slope values for each site have in fact been averaged over the distance between the two neighbouring sites, the results in Table 6 should be used with some care.

3.3.3. The N-S transect

The data are represented graphically in fig. 9. The diagrams of the margins (9a and 9c) have a larger horizontal scale than the one of the central part (9b). The vertical scale of the latter is larger than that of the other two because of the relatively small vertical fluctuations. As in fig. 6, the standard deviations have been multiplied by 10 and a level has been added in order to make the bottom of the diagram the zero level of the standard deviation.



a.

b.

c.

Fig. 8. Surface levels, phreatic levels and standard deviations of the phreatic levels along the E-W transect. a: Southern margin; b: centre; c: Northern margin.

As in the E-W transect, the standard deviations increase towards the bog margins while the distance of the mean phreatic level to the bog surface tends to increase as well.
However, there are some differences:

- The transition from almost flat bog to the marginal slope is much more abrupt than on the E-W transect. This difference may be explained by the absence of drains near the margin on the bog itself at both the Northern and the Southern margin.

- Fig. 9a shows a marked drop in the fluctuation together with a relatively shallow phreatic level at the bottom of the bog face, which could be explained by the relationship between depth of the phreatic level and its rate of fluctuation.

- The slope of the mean phreatic level towards the marginal drain is considerably less steep than the one at the bog face and the marginal slope of the bog, indicating a larger hydraulic conductivity in the cutover part than in the margin of the uncut bog. This may be due to more shrinkage in the margin of the uncut bog (forming of a "secondary" marginal slope) than in the cutover part. Such effects have been described several times in literature on bogs. A good example from Schleswig-Holstein in Germany has been given recently by Aue (1991).

- The rate of fluctuation of the phreatic surface very gradually drops from 0.076 m at site 321 to 0.03 m at site 332, after which the proximity of the Northern bog margin begins to take effect. No good explanation for this phenomenon has yet been found.

- The tendency mentioned in the previous point does not go together with any clear change in the depth of the mean phreatic level as is shown in Table 8b. In fact, the rate of fluctuation on the flat part of the bog seems to be quite independent of the mean depth of the phreatic level. This can be explained by the large hydraulic conductivity of the acrotelm which is well developed on the flat part of the bog, which results in an averaging of level fluctuations over relatively large areas and little influence of surface level fluctuations on fluctuations of the phreatic surface.

- At the Northern margin the rate of fluctuation pf the phreatic level rises again while the mean drops below the surface again. The surface slope here is less pronounced than in the South. At site 344 the bog surface falls abruptly by about 1.50 to 2 metres. The irregularities in the rate of fluctuation are mainly due to phreatic tubes which seem to give wrong data at low levels, maybe as a result of a clogged filter screen.

Fig. 10 shows a scatter diagram and a regression line of standard deviations versus depth below the surface. The data are given in table 7.

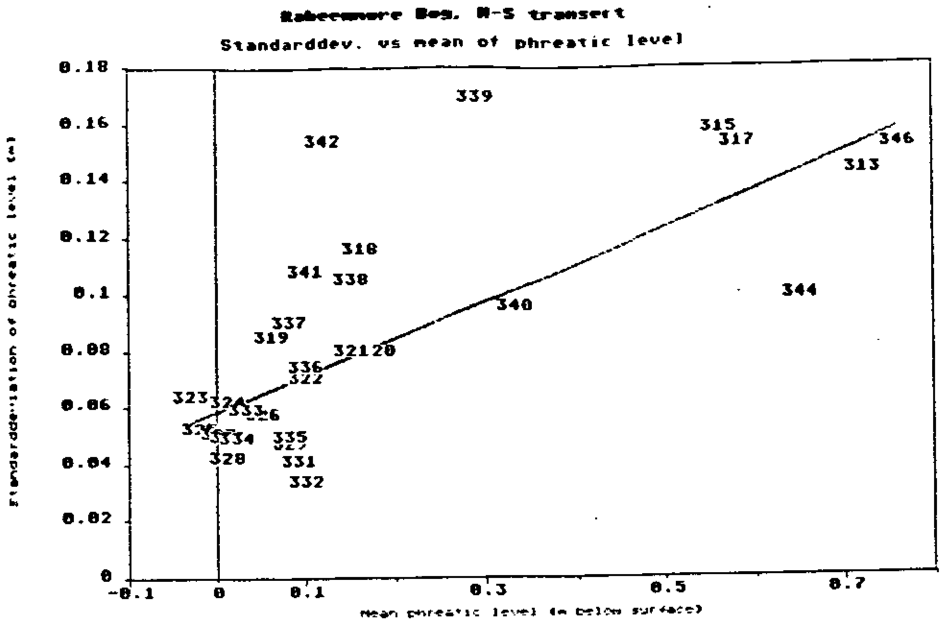


Fig. 10. Mean phreatic levels on the E-W transect versus their standard deviations.

Table 7. N-S transect. Sites, their mean phreatic level in m below surface ("mean") and standard deviation of the phreatic level around the mean ("stdv") in m and the number of really observed data (n).

Site	303	305	307	310	311	313	315	317	318	319	320	321
Mean	1.09	.63	.72	.14	.20	.72	.56	.58	.16	.06	.18	.15
stdv	.173	.161	.191	.085	.099	.138	.154	.149	.112	.081	.076	.076
n	51	51	51	51	51	49	51	51	51	51	47	51
Site	322	323	324	325	326	327	328	329	330	331	332	333
Mean	.10	-.03	.01	-.02	.05	-.00	.01	.08	.01	.09	.10	.03
stdv	.066	.059	.058	.049	.054	.047	.038	.043	.046	.037	.030	.055
n	51	51	51	50	49	51	51	51	51	51	41	51
Site	334	335	336	337	338	339	340	341	342	344	346	
Mean	.02	.08	.10	.08	.15	.29	.33	.10	.12	.65	.76	
Stdv	.045	.045	.070	.086	.101	.165	.091	.104	.149	.095	.147	
n	51	51	44	51	51	41	51	43	41	45	49	

Table 8a below gives an analysis of variance of the relationship between depth of the mean phreatic level and its rate of fluctuation (standard deviation around the mean). The data have been restricted to those in the uncut bog, which means that the analysis refers to sites 313 through 346. Table 8b gives the same for the central part of the bog.

Table 8a. Linear regression model of standard deviation (s in m) vs. depth of the phreatic level (d in m). N-S transect, sites 313 through 346. ANOVA for model $s = 0.058m - 0.129d$.

		degrees of freedom	variance
data values		30	
sum of squares abt. mean	0.0481	29	
sum of squares of model	0.0257	1	$2.57 \cdot 10^{-2}$
sum of squares residual	0.0224	28	$8.00 \cdot 10^{-4}$
	r=0.731		
	$F(\|1,28)=32.2$, $Q(F\|1,28) << 0.001$		

Table 8b. Linear regression model of standard deviation (s in m) vs. depth of the phreatic level (d in m). N-S transect, sites 321 through 332. ANOVA for model $s = 0.048m + 0.014d$.

		degrees of freedom	variance
data values		12	
sum of squares abt. mean	$1.92 \cdot 10^{-3}$	11	
sum of squares of model	$6.63 \cdot 10^{-5}$	1	$6.63 \cdot 10^{-5}$
sum of squares residual	$1.85 \cdot 10^{-3}$	10	$1.85 \cdot 10^{-4}$
	r=0.186		
	$F(\|1,10)=0.36$, $Q(F\|1,10)>0.5$		

The correlation between slope and rate of fluctuation shows more or less the same picture as in the E-W transect: less significant than the correlation between depth of the phreatic surface and rate of fluctuation, but nevertheless rather significant. The ANOVA is given in Table 9; a diagram is not given.

Table 9. Linear regression model of standard deviation (s in m) vs. surface slope S (m/m). N-S transect. ANOVA for model $s=0.073m-0.326m*S$

		degrees of freedom	variance
data values		30	
sum of squares abt. mean	0.0481	29	
sum of squares of model	0.0140	1	$1.40*10^{-2}$
sum of squares residual	0.0341	28	$1.22*10^{-3}$

$r=0.540$

$F|1,28 = 11.5$, $0.001<Q(F|1,28)<0.005$

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ANNEX A.

TOP TUBE LEVELS OF THE PHREATIC TUBES AND SHALLOW PIEZOMETERS OF THE TRANSECTS ON RAHEENMORE BOG.

TABLE A.1. E-W (=C-C') TRANSECT (m+O.D.). Standard deviations have been calculated over all dates for each tube and for the means of all levelling dates.

Date Tube nr.	13-09-90	13-01-91	25-04-91	09-08-91	20-10-91	18-08-92	stdev
201A	100.53	100.56	100.59	100.57	100.55	100.57	.019
202A	101.26	101.31	101.35	101.32	101.29	101.31	.027
203A	101.94	102.01	101.98	102.00	101.98	101.99	.022
204A	102.44	102.49	102.52	102.49	102.48	102.48	.024
205A	103.30	103.33	103.35	103.34	103.35	103.34	.017
206A	104.14	104.16	104.17	104.17	104.18	104.16	.013
207A	104.32	104.34	104.35	104.35	104.36	104.36	.014
208A	104.81	104.83	104.84	104.84	104.86	104.85	.016
209A	105.20	105.21	105.21	105.21	105.22	105.20	.007
210A	105.83	105.85	105.86	105.86	105.87	105.85	.014
211A	106.09	106.08	106.06	106.06	106.06	106.07	.011
212A	106.56	106.55	106.54	106.56	106.56	106.58	.012
Mean	103.868	103.893	103.900	103.895	103.895	103.895	.012

TABLE A.2. NS-Transect (m+O.D.)

Top_tube levels N-S transect Raheenmore Bog (m+OD).
Levels of 29-Aug-90 have been corrected for error on 301 (points 301-330)
Data of 13-Jan-91 for points 325+ have been interpolated between 20-Nov-90 and 25-Apr-91
Some tubes were topped in November 1990. Where applicable, new levels have been calculated from the levelling data of 29-Aug-90. Standard deviations for each tube and the means per levelling date have been calculated over the dates of 20-Nov-1990 onwards.

		aft. top	aft. top	aft. top					
Date	29-08-90	01-11-90	06-11-90	20-11-90	13-01-91	25-04-91	09-08-91	20-11-91	stdv
Tube nr									
301S	103.05	103.05	103.05	103.05	103.04	103.05	103.04	103.03	0.007
303A	104.32	104.31	104.31	104.31	104.29	104.26	104.29	104.29	0.016
303GW	104.07	104.07	104.07	104.07	104.05	104.07	104.05	104.04	0.012
304GW	104.12	104.12	104.12	104.12	104.14	104.15	104.13	104.13	0.010
305A	104.06	104.06	104.06	104.06	104.03	104.05	104.03	104.03	0.013
305B	104.06	104.06	104.04	104.04	104.03	104.05	104.03	104.03	0.008
305GW	103.81	103.81	103.81	103.81	103.82	103.83	103.81	103.80	0.010
306GD	103.53	103.53	103.53	103.53	103.53	103.56	103.53	103.53	0.012
307GD	103.71	103.71	103.71	103.71	103.71	103.74	103.71	103.72	0.012
307A	104.10	104.11	104.11	104.11	104.11	104.14	104.11	104.11	0.012
307GW	103.81	103.82	103.82	103.82	103.82	103.85	103.82	103.82	0.012
308GD	103.82	103.82	103.82	103.82	103.80	103.82	103.79	103.81	0.012
309GD	103.95	103.95	103.95	103.95	103.94	103.96	103.93	103.96	0.012
310GD	104.04	104.05	104.05	104.05	104.02	104.05	103.99	104.04	0.023
310A	104.36	104.37	104.36	104.36	104.37	104.41	104.37	104.40	0.019
311GD	104.04	104.05	104.05	104.05	104.04	104.08	104.05	104.07	0.015
312GD	105.05	105.05	105.05	105.05	105.06	105.09	105.06	105.08	0.015
313GD	105.01	105.01	105.01	105.01	105.04	105.06	105.03	105.05	0.017
313A	105.44	105.43	105.43	105.43	105.43	105.43	105.43	105.45	0.008
313GW	105.24	105.24	105.24	105.24	105.24	105.24	105.23	105.25	0.006
314GW	105.44	105.44	105.44	105.44	105.48	105.50	105.46	105.49	0.022
315GD	105.55	105.55	105.55	105.55	105.59	105.62	105.56	105.60	0.026
315A	105.99	105.99	105.98	105.98	105.95	105.99	105.94	105.97	0.019
315GW	105.79	105.79	105.79	105.79	105.76	105.79	105.74	105.77	0.019
316GD	105.89	105.89	105.89	105.89	105.85	105.90	105.83	105.88	0.026
317GD	106.15	106.15	106.15	106.15	106.11	106.15	106.09	106.12	0.023
317A	106.53	106.53	106.52	106.52	106.47	106.53	106.46	106.49	0.027
317GW	106.28	106.28	106.28	106.28	106.27	106.31	106.25	106.28	0.019
318GD	106.35	106.35	106.35	106.35	106.35	106.39	106.34	106.37	0.018
319GD	106.56	106.56	106.56	106.56	106.52	106.56	106.53	106.54	0.016
320GD	106.71	106.71	106.71	106.71	106.67	106.71	106.68	106.70	0.016
321GD	106.74	106.74	106.74	106.74	106.69	106.75	106.72	106.74	0.021
321A	107.13	107.13	107.13	107.13	107.09	107.14	107.13	107.14	0.019
322GD	106.70	106.70	106.70	106.70	106.67	106.73	106.70	106.72	0.021
323GD	106.68	106.68	106.68	106.68	106.67	106.72	106.70	106.70	0.017
324GD	106.69	106.70	106.70	106.70	106.70	106.72	106.70	106.72	0.010
324A	106.89	106.90	106.90	106.90	106.88	106.91	106.90	106.91	0.011
325GD	106.71	106.71	106.71	106.71	106.72	106.72	106.70	106.71	0.007
326GD	106.71	106.71	106.71	106.71	106.71	106.71	106.69	106.72	0.010
327GD	106.79	106.79	106.79	106.79	106.78	106.78	106.77	106.79	0.007
327A	107.19	107.19	107.19	107.19	107.18	107.17	107.16	107.19	0.012
328GD	106.76	106.77	106.77	106.77	106.77	106.77	106.75	106.77	0.008
329GD	106.73	106.73	106.73	106.73	106.74	106.75	106.73	106.75	0.009
330GD	106.73	106.73	106.73	106.73	106.74	106.74	106.72	106.74	0.008
330A	107.13	107.13	107.12	107.12	107.11	107.11	107.09	107.11	0.010
331GD	106.79	106.79	106.79	106.79	106.81	106.82	106.78	106.81	0.015
332GD	106.75	106.75	106.75	106.75	106.73	106.72	106.69	106.72	0.019
333GD	106.58	106.58	106.58	106.58	106.58	106.58	106.57	106.59	0.006
333A	107.03	107.03	107.03	107.01	107.02	107.03	107.02	107.02	0.006

334GD	106.41	106.41	106.41	106.41	106.41	106.41	106.40	106.42	0.006
335GD	106.37	106.37	106.37	106.37	106.38	106.39	106.38	106.39	0.007
336GD	106.16	106.16	106.16	106.16	106.18	106.20	106.18	106.20	0.015
336A	106.60	106.60	106.60	106.60	106.60	106.60	106.60	106.62	0.008
337GD	105.91	105.91	105.91	105.91	105.94	105.96	105.95	105.97	0.021
338GD	105.75	105.75	105.75	105.75	105.75	105.76	105.75	105.77	0.008
339GD	105.79	105.80	105.80	105.80	105.80	105.81	105.80	105.82	0.008
340GD	105.53	105.53	105.53	105.53	105.52	105.50	105.49	105.50	0.015
340A	105.81	105.82	105.82	105.82	105.82	105.83	105.82	105.83	0.005
341GD	105.51	105.52	105.52	105.52	105.53	105.54	105.53	105.54	0.007
342GD	105.28	105.29	105.29	105.29	105.30	105.32	105.31	105.33	0.014
342A	105.67	105.67	105.67	105.67	105.68	105.69	105.69	105.70	0.010
342GW	105.42	105.42	105.42	105.42	105.43	105.44	105.44	105.44	0.008
343GD	105.17	105.17	105.17	105.17	105.18	105.19	105.18	105.20	0.010
344A	105.55	105.55	105.55	105.55	105.57	105.58	105.58	105.58	0.012
344GW	105.36	105.36	105.36	105.36	105.37	105.38	105.38	105.38	0.008
345GW	105.11	105.11	105.11	105.11	105.12	105.12	105.12	105.13	0.006
346A	105.01	105.01	105.01	105.01	105.02	105.02	105.03	105.03	0.007
346GW	104.82	104.82	104.82	104.82	104.82	104.82	104.83	104.84	0.008
348	103.12	103.12	103.12	103.12	103.14	103.15	103.15	103.15	0.012
349					102.49	102.49	102.50	102.50	0.005
	105.564	105.565	105.564	105.564	105.517	105.534	105.513	105.529	0.018

ANNEX B. NUMBERS OF LEVEL OBSERVATIONS DURING THE PERIOD 21-JAN-1990 THROUGH 13-JAN-1992. PHREATIC TUBES AND SHALLOW PIEZOMETERS

TABLE B.1. E-W TRANSECT. Maximum possible and actual number of data values. "phr" in screen depth column means phreatic tube (perforated over the full length below the bog surface). Filter screen of piezometer 213S is 0.15 m long, that of 330A 0.10 m.

Tube	Distance to bog margin (m)	maximum possible	Actual number % in ()	screen depth (m. below surf.)
213S	0	52	47 (90)	5.60
201A	5	52	51 (98)	phr
202A	25	52	51 (98)	phr
203A	45	52	52 (100)	phr
204A	70	52	52 (100)	phr
205A	95	52	52 (100)	phr
206A	145	52	52 (100)	phr
207A	195	52	52 (100)	phr
208A	245	52	52 (100)	phr
209A	295	52	52 (100)	phr
210A	451	52	52 (100)	phr
211A	579	52	52 (100)	phr
212A	699	52	52 (100)	phr
330GD	829	51	51 (100)	phr
330A	829	51	51 (100)	1.18

TABLE B.2. N-S TRANSECT. Maximum possible and actual number of data values. "phr" in screen depth column means phreatic tube (perforated over the full length below the bog surface). Filter screens of piezometers are 0.10 m long. Tubes numbered with extension "GD" consist of 50 mm drain pipes, others of 1" PVC tube.

Tube	Distance to bog margin (m)	maximum possible	Actual number % in ()	screen depth (m. below surf.)
301	0	51	49 (96)	gauge in marginal drain
303A	2	51	51 (96)	1.95
303GW	2	51	15 (29)	phr
304GW	4	51	26 (51)	phr
305A	8	51	36 (71)	1.20
305B	8	51	51 (100)	1.66
305GW	8	51	36 (71)	phr
306GD	12	51	25 (49)	phr
307GD	16	51	25 (49)	phr
307A	16	51	51 (100)	1.20
307GW	16	51	50 (98)	phr
308GD	24	51	31 (61)	phr
309GD	32	51	34 (67)	phr
310GD	40	51	51 (100)	phr
310A	40	51	51 (100)	1.18
311GD	42	51	51 (100)	phr
312GD	44	51	0 (0)	phr
313GD	45	51	0 (0)	phr
313A	45	51	48 (94)	1.20
313GW	45	51	49 (96)	phr
314GW	47	51	39 (76)	phr
315GD	51	51	29 (57)	phr
315A	51	51	51 (100)	1.18
315GW	51	51	51 (100)	phr
316GD	55	51	38 (75)	phr
317GD	59	51	38 (75)	phr
317A	59	51	51 (100)	1.18

317GW	59	51	51 (100)	phr
318GD	67	51	51 (100)	phr
319GD	75	51	51 (100)	phr
320GD	91	51	47 (92)	phr
321GD	107	51	51 (100)	phr
321A	107	51	51 (100)	1.20
322GD	139	51	51 (100)	phr
323GD	171	51	51 (100)	phr
324GD	202	51	51 (100)	phr
324A	202	51	51 (100)	1.20
325GD	263	51	50 (98)	phr
326GD	324	51	49 (96)	phr
327GD	385	51	51 (100)	phr
328GD	446	51	51 (100)	phr
329GD	507	51	51 (100)	phr
330GD	568	51	51 (100)	phr
330A	568	51	51 (100)	1.18
331GD	629	51	51 (100)	phr
332GD	690	51	51 (100)	phr
333GD	751	51	51 (100)	phr
333A	751	51	51 (100)	1.16
334GD	812	51	51 (100)	phr
335GD	873	51	51 (100)	phr
336GD	934	51	44 (86)	phr
336A	934	51	51 (100)	1.20
337GD	946	51	51 (100)	phr
338GD	954	51	51 (100)	phr
339GD	962	51	51 (100)	phr
340GD	970	51	51 (100)	phr
340A	970	51	51 (100)	1.20
341GD	978	51	43 (84)	phr
342GD	986	51	41 (80)	phr
342A	986	51	51 (100)	1.20
342GW	986	51	50 (98)	phr
343GD	990	51	37 (73)	phr
344A	994	51	45 (88)	1.20
344GW	994	51	29 (57)	phr
345GW	998	51	35 (70)	phr
346A	1000	51	51 (100)	phr
346GW	1000	51	49 (96)	phr
348	1002	51	48 (94)	gauge in marginal drain

ANNEX C.

DESCRIPTION OF THE TRANSECTS ON RAHEENMORE BOG MADE WITH LARA KELLY ON 12-OCT-1992.

C.1 Abbreviations used

Zone names are according to Lara's description. Both transects (E-W and N-S) were covered. Species are mentioned to give a general idea of the vegetation. Listings do not cover all species at a site. Names of species have been abbreviated according to the following table:

Ap	Andromeda polyfolia
Aup	Aulacomnium palustre
Clp	Cladonia potentosa
Clu	Cladonia uncialis
Cv	Calluna vulgaris
Dis	Dicranum scoparium
Ea	Eriophorum angustifolium
En	Empetrum nigrum
Et	Erica tetralix
Ev	Eriophorum vaginatum
Hju	Hypnum jutlandicum
Je	Juncus effusus
Leu	Leucobryum glaucum
Mc	Molinia caerulea
Mg	Myrica gale
Mt	Menyanthes trifoliata
No	Narthecium ossifragum
Pe	Potentilla erecta
Pls	Pleurozium schreberi
Ra	Rhynchospora alba
Sc	Scirpus caespitosus
Sca	Sphagnum capillifolium
Scu	Spagnum cuspidatum
Sfu	Sphagnum fuscum
Sma	Sphagnum magellanicum
Spa	Sphagnum papillosum
Spl	Sphagnum palustre
Sre	Sphagnum recurvum
Ssu	Sphagnum subnitens
Ste	Sphagnum tenellum
Ue	Ulex europaeus
Vm	Vaccinium myrtyllus
Vo	Vaccinium oxycoccus

C.2 E-W Transect

Piezometer(s) nr.	distance (m)	Surface (m below A or GD)	Description
201	0	0.18	Strongly disturbed bog margin. Surface uneven. Marginal deep drain at 3-4 m. Species: Mc, Je, Pteridium sp.
202	20	0.17	Near bottom of marginal bog slope to E. Surface rather even. Slightly disturbed Scirpus zone. Species: Sc, Ue, Cv, Hju
203	40	0.15	Narthecium hollow complex. Piezometer on a low hummock, ground level 0.05 m above surroundings. Gently sloping to E. Species: No, Cv, Ev, Ea, Ssu, Sca, Leu.
204	65	0.16	Narthecium hollow complex. Piezometers on a hummock, ground level 0.05-0.10 m above surroundings. At bottom of short slope to E. Species: No, Cv, Ev, Sma, Sca, Hju
205	90	0.18	Narthecium hollow complex. Piezometer on a low hummock, ground level 0.05 m above surroundings. On a short slope to E. Species: Cv, Ev, Ste, Ssu, Hju
206	140	0.16	Narthecium hollow complex. Piezometers on a very low hummock, ground level <0.05 m above surroundings. In a relatively flat area, near the transition to a slope to E (downward from piezometers). Species: Cv, No, Sc, Ev, Ea, Sca, some Hju.
207	190	0.16	Narthecium hollow complex. Piezometers on a very low hummock, <0.05 cm high. On a slope to E. Cv, No, Sca, Hju, Campylopus sp.
208	240	0.20	Narthecium hollow complex. Piezometer next to a low hummock, <0.05 m high. Very gently sloping to E (less than 207). Species: Et, No, Ea, Ev, Sma, Spa, Sca.
209	290	0.19	Eriophorum vaginatum zone. Piezometer on low hummock, ground level 0.05-0.07 m above surroundings. In flat area, near transition to gentle slope to E, downward from piezometer. Species: Cv, Ev, Ea, No, Sca, Sma, Ste.
210	446	0.21	Transition between Narthecium complex and Eriophorum vaginatum zone. Piezometer on hummock, ground level 0.05-0.10 m above surroundings. Flat area in central part of bog. Species: Cv, No, Ea (no Ev), Sc, Sma, Sca.

211	574	0.21	Sphagnum magellanicum zone. Piezometer on hummock, ground level 0.15 above surroundings. Flat area in central part of bog. Species: Calluna vulgaris, Ev, Ea, Sma, Sca, some No.
212	694	0.23	Sphagnum magellanicum zone, looks slightly less wet than 211. Flat area in central part of bog. Piezometer on hummock, ground level 0.10-0.15 m above surroundings. Species: as at 211, plus Ra and some more Ea.
330	829	0.31	Sphagnum magellanicum zone. Flat area in central part of bog. Piezometer on hummock, ground level 0.15 m above surroundings. Species: Cv, Ea, Ra, Mc, No, Sma.

C.3 N-S transect

Piezometer(s) nr.	distance (m)	Surface (m below A or GD)	Description
301	0		Gauge in marginal drain.
303	2	0.52	As 304; 2 m from deep marginal drain. Species: Pe, Mc, Ue, Poa sp. Anthoxanthum odoratum
304	4	0.35	Ulex/Molinia community in cutaway area. Species: Rubus sp., Ue, Mc, Anthoxanthum odoratum, Brachythecium sp., Poa sp.
305	8	0.48	Ulex/Molinia community in cutaway area. Species: Mc tussock, Pe.
306	12	n.m.	Cutaway area as 307. Species: Mc. Pe, Spl, Anthoxanthum odoratum, Poa sp.
307	16	0.14	Cutaway area, Molinia/Potentilla community. Species: Et, Ev, Mc, Pe, Pls, Aup, Spl, Dis.
308	24	0.00	Partly cutover peat, Molinia/Potentilla community. Species: Mc, Cv, Pe, Ue, Dis, Pls, Hju.
309	32	0.04	Partly cutover peat, Molinia/Potentilla community. Uneven surface, looks slightly drier than 310. Species: Cv, Mc (abundant), Pe, Sca, Spl.
310	40	0.30	Partly cutover peat; enriched Molinia zone below face bank. Piezometer in a hollow, ground level 0.10-0.15 m below surroundings. Looks wetter than 311. Species: Mc, Ev, Ea, Et, Scu, Sma, Spa.
311	42	0.05	Partly cutover peat; enriched Molinia zone, just below Southern face bank. Fairly even surface. Species: Cv, No, Et, Ea, Hju, Sca.
312	44	0.05	Calluna zone, 1.5 m from face bank. Steep marginal slope, facing S. Species: Cv, Hju.
313	45	n.m.	Calluna zone on steep marginal slope, facing S, 2.5 m from face bank. Species: Cv only.
314	47	0.19	Calluna zone on steep marginal slope,facing S, even surface. Species: Cv, little Sc, Et, Hju.
315	51	0.21	Calluna zone on marginal slope, facing S. Even surface. Species: Cv, Ea, Sc, Leu, Hju.
316	55	0.04	Scirpus zone on marginal slope, facing S. Slightly uneven surface, no hummocks. Species: Cv, Sc, Et, Hju.

317	59	0.18	Calluna zone with Scirpus. Uneven surface without hummocks on marginal slope of bog, facing S. Species: Cv, Sc, Ea, Hju, Clp, Ssu.
318	67	0.05	Narthecium hollow complex on marginal slope, facing S. Even surface. Species: Cv, No, Sc, Ea, Hju, Sca, Spa, Ste.
319	75	0.00	Narthecium hollow complex on marginal slope of bog, facing S. Tube in side of hummock. Ground level 0.10-0.12 above surroundings. Species: Cv, Et, Ev, Sc, No (little), Hju, Sca, Spa.
320	91	0.03	Narthecium hollow complex at beginning of marginal slope, facing S. Tube on low "artificial" hummock, ground level <0.05 m above surroundings. Species: Cv, Et, Ra, No, Ea, Ev, Sc, Sca, Sma, Ste, Clp.
321	107	0.38	Narthecium hollow complex, in area very gently sloping towards S. Piezometer on "artificial" hummock, ground level 0.05 m above surroundings. Species: Cv, Et, Ea, Ev, No, Sc, Sma, Spa, Sca, Hju.
322	139	0.00	Narthecium hollow complex in almost flat area. Tube on low hummock, ground level 0.05 m above surroundings. Species: Cv, Et, Sc, Ra. Ea, Ev, Campylopus sp., Sca, Sma, Spa, Ssu, Hju.
323	171	0.06	Sphagnum magellanicum zone. Fairly flat bog area. Tube on hummock, ground level 0.10 m above surroundings. Species: Cv, Et, Ra, Ea, Ev, Hju, Sca, Sma, Spa.
324	202	0.12	Sphagnum magellanicum zone in flat central bog area; transitional to Narthecium hollow complex. Tube on Sma-hummock, ground level 0.20 m above surroundings. Species: Et, Ea, Ev, Ra, No, Sma, Spa, Sca (photographed)
325	263	0.05	Sphagnum magellanicum zone in flat central bog area. Tube on low hummock, ground level 0.05-0.10 m above surroundings. Species: Cv, Et, No, Ra, Ea, Ev, Hju, Sma, Spa.
326	324	0.05	Sphagnum magellanicum zone in flat central bog area. Tube next to low hummock, < 0.05 m high. Species: Cv, Ra, Ea, Ev, Et, Hju, Sca, Sma, Scu, Clp.
327	385	0.38	Sphagnum magellanicum zone in flat central bog area. Tube on high hummock, ground level 0.15-0.20 m above surroundings. Species:Cv, Ea, Ev, Vo, No, Sma, Sca, Hju.

328	446	0.03	Sphagnum magellanicum zone. Flat central bog area. Tube on hummock, ground level 0.05-0.10 m above surroundings. Species: Cv, Et, Ev, Ea, Sc, Sca, Spa, Sfu, Sma.
329	507	0.04	Sphagnum magellanicum zone. Flat central bog area. Tube next to low hummock of <0.05 m. Species: Cv, Ev, Ea, Et, No, Hju, Sma, Spa, Sca, Dis.
330	568	0.31	Sphagnum magellanicum zone. Flat area in central part of bog. Piezometer on hummock, ground level some 0.15 m above surroundings. Species: Cv, Ea, Ra, Mc, No, Sma.
331	629	0.04	Sphagnum magellanicum zone. Flat area in central part of bog. Tube on hummock, ground level 0.07 m above surroundings. Species: Cv, Ev, Ea, Sma, Spa, Hju, Pls.
332	690	0.00	Sphagnum magellanicum zone. Flat to very gently sloping to N. Tube on very low hummock, ground level approx. 0.02 m above surroundings. Species: Cv, Sc, Ev, Ea, Sma, Sca, Dis, Aup, Hju.
333	751	0.43	Sphagnum magellanicum zone. Very gently sloping to N, on edge to flat bog. Piezometers on hummock, ground level some 0.10 m above surroundings. Species: Sc, Cv, Ea, Ev, Ra, Sma, Sca, Aup, Hju.
334	812	0.03	Sphagnum magellanicum zone. Flat bog area. Tube on low hummock, ground level 0.05 m above surroundings. Species: Cv, Ea, Sc, Hju, Sca, Ste, Scu, No, Ra.
335	873	0.02	Transition from Sphagnum magellanicum zone to Narthecium hollow complex. Flat bog area. Tube on low hummock, ground level abt. 0.05 m above surroundings. Species: Cv, No, Ea, Ev, Sc, Ra, Hju, Sca, Ste, Scu, Ssu, Clp, Clu.
336	934	0.42	Narthecium hollow complex. At upper end of marginal slope. Tube on Calluna hummock, ground level 0.10 m above surroundings. Species: No, Cv, Sc, Ev, Ea, Ra, Hju, Sca, Scu.
337	946	0.06	On slope of large Calluna hummock in Narthecium hollow complex; 0.40 m from flat part, ground level 0.10-0.12 m above flat area. Area on marginal slope. Species: Cv, Ev, Ea, No, Sc, Hju, Sca, Ste.

338	954	0.03	Scirpus zone, transition to Narthecium hollow complex. Marginal slope of bog, facing N. Tube in uneven surface, ground level <0.05 m above lower parts. Species: No, Sc, Cv, Ev, Ea, Et, Sca, Ste, Hju.
339	962	0.05	Scirpus zone. Higher part in zone of marginal bog slope, facing N. Rather even surface. Species: Sc, Cv, Ev, Et, Leu (poor), Sca (poor), Hju.
340	970	0.33	Scirpus zone. Marginal slope of bog, facing N. Piezometer on hummock in lower area af bog, approx. 0.30 m below surroundings, ground level on hummock abt. 0.10 m above lower area. Species: Cv, Ev, Sc, No, Et, Hju, Sca, Clp.
341	978	0.05	Scirpus zone on marginal slope of bog, facing N. Tube on fairly large Calluna hummock, ground level 0.10-0.15 m above surroundings. Species: Cv, No, Ev, Sc, Clp, Hju, Sca, Ste.
342	986	0.44	Scirpus zone, near bog margin and erosion (?) channel. Tube on hummock, ground level 0.10 m above surroundings
343-346 (990-1000 m)			Strongly disturbed bog margin towards deep marginal drain. Bog surface >3m above neighbouring grassland area.
347	1002		Gauge (pipe) in marginal drain.

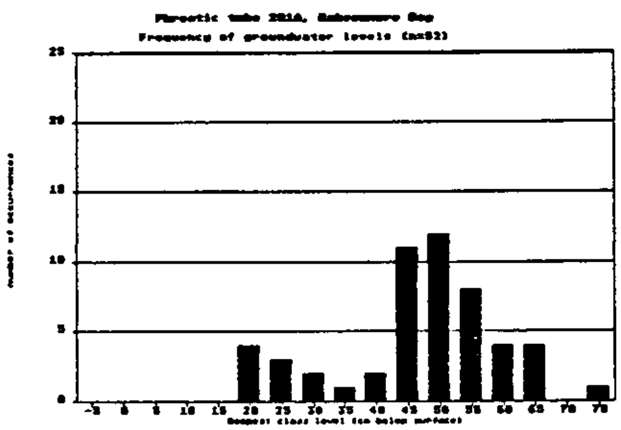
ANNEX D.

GROUNDWATER LEVEL FREQUENCY DISTRIBUTIONS AND VEGETATION ZONES.

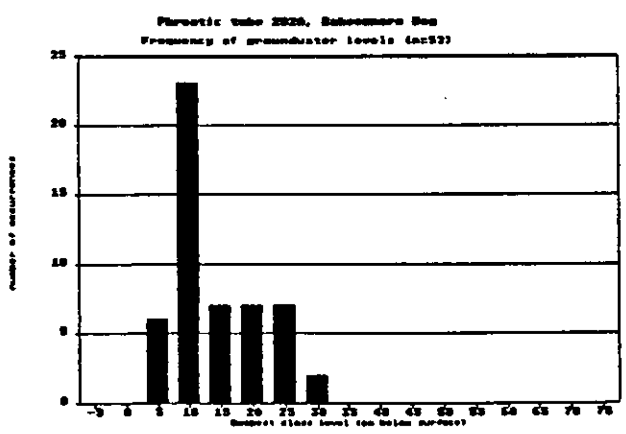
The diagrams in the annex show frequency distributions of groundwater levels. With the diagrams, the names of the vegetation zones as mentioned by Larissa Kelly are given.

The frequency classes are all 5 cm wide. The diagrams have been kept in the order they have along their transects.

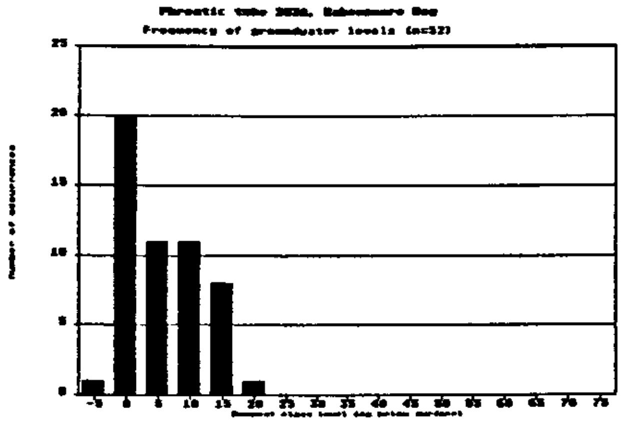
The data of the E-W transect are given first. They are followed by those of the N-S transect.



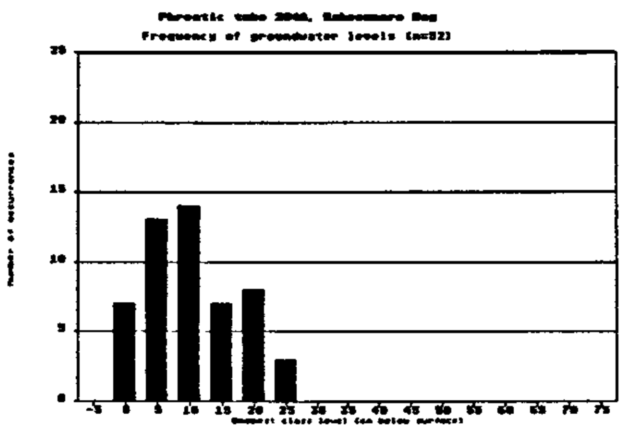
Phreatic tube 201A. Strongly disturbed bog margin.



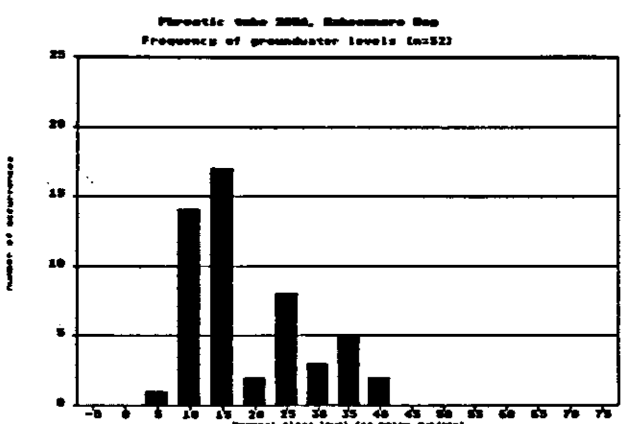
Phreatic tube 202A. Slightly disturbed Scirpus caespitosus zone



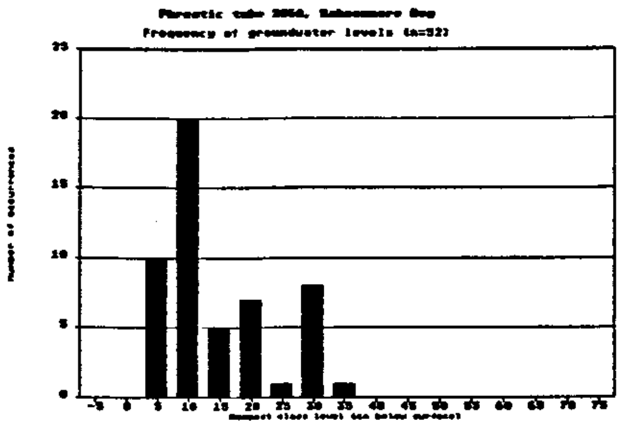
Phreatic tube 203A. Narthecium hollow complex



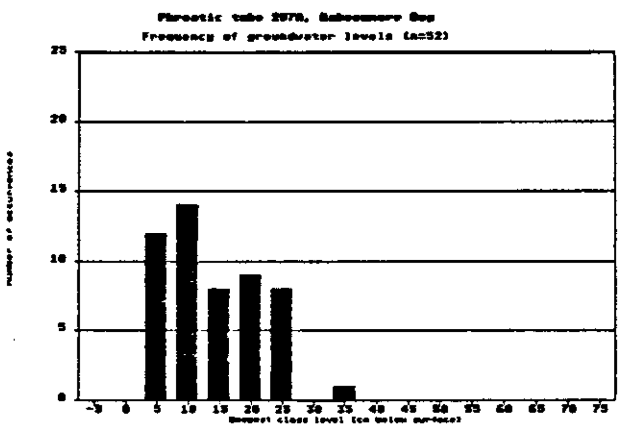
Phreatic tube 204A. Narthecium hollow complex



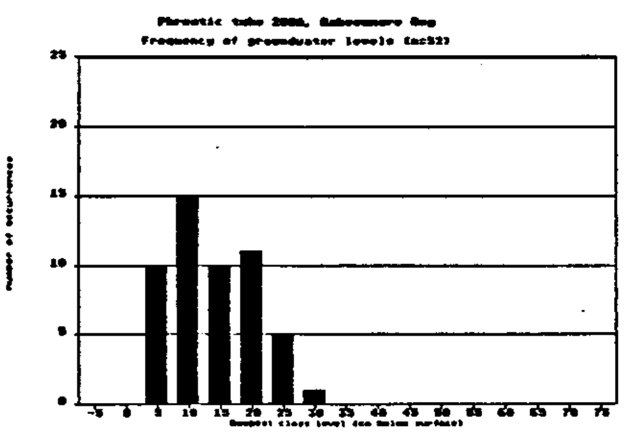
Phreatic tube 205A. Narthecium hollow complex



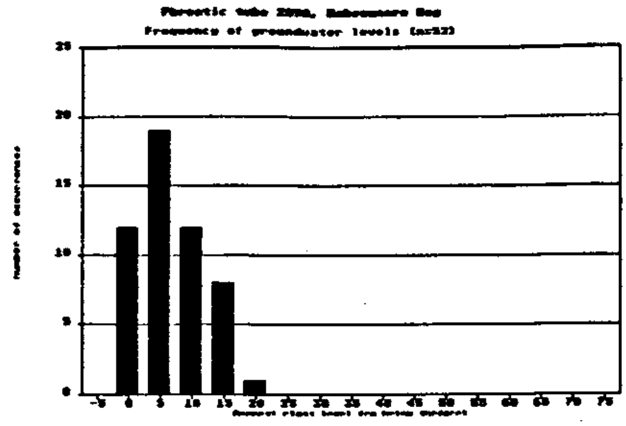
Phreatic tube 206A. Narthecium hollow complex



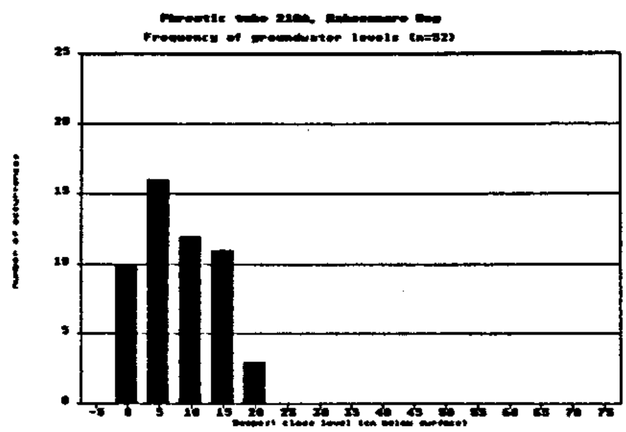
Phreatic tube 207A. Narthecium hollow complex



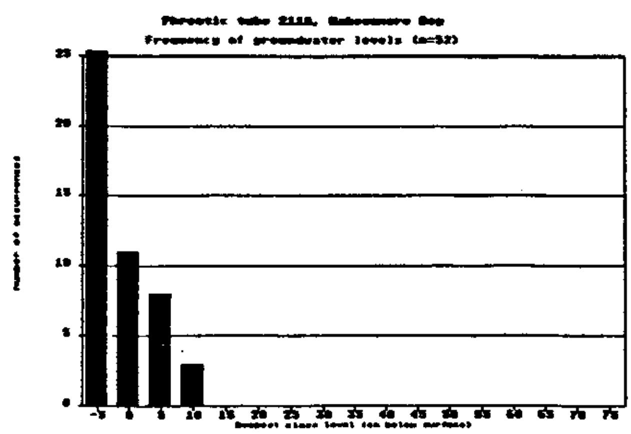
Phreatic tube 208A. Narthecium hollow complex



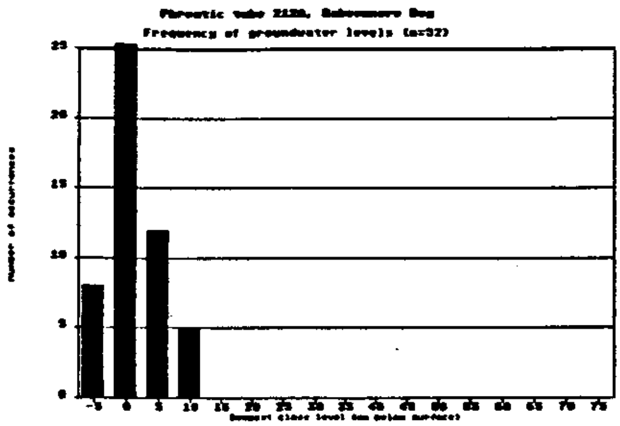
Phreatic tube 209A. Eriophorum vaginatum zone.



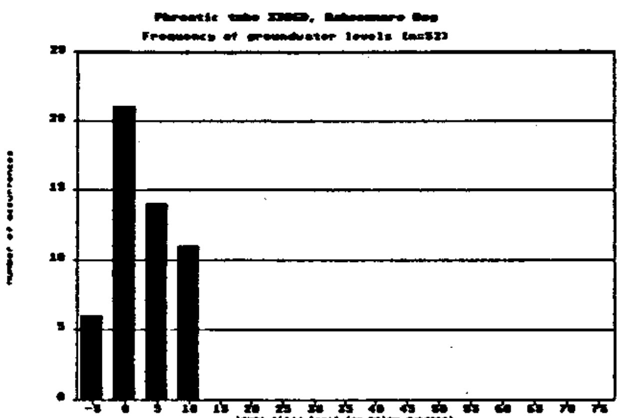
Phreatic tube 210A. Transition between Narthecium hollow complex and Eriophorum vaginatum zone.



Phreatic tube 211A. Sphagnum magellanicum zone.

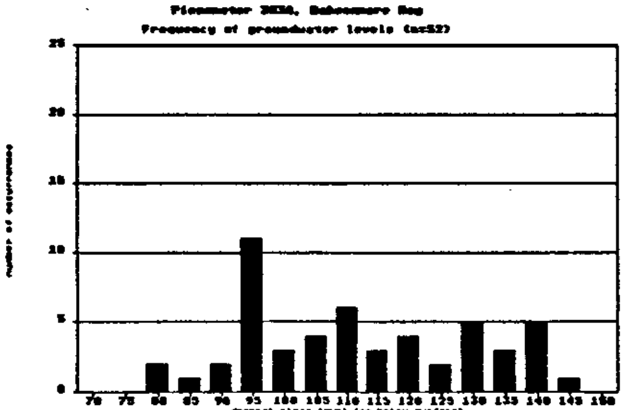


Phreatic tube 212A. Sphagnum magellanicum zone.

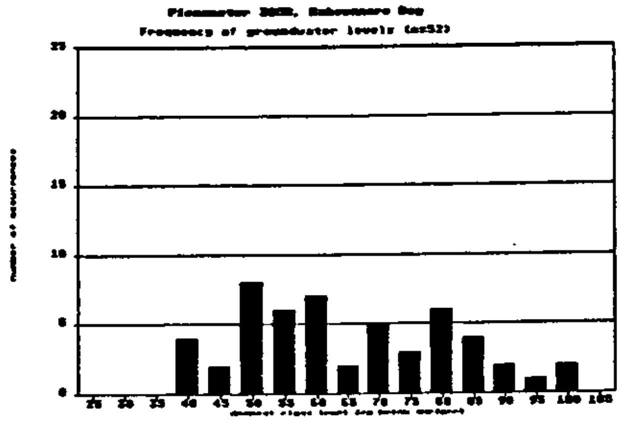


Phreatic tube 330GD. Sphagnum magellanicum zone

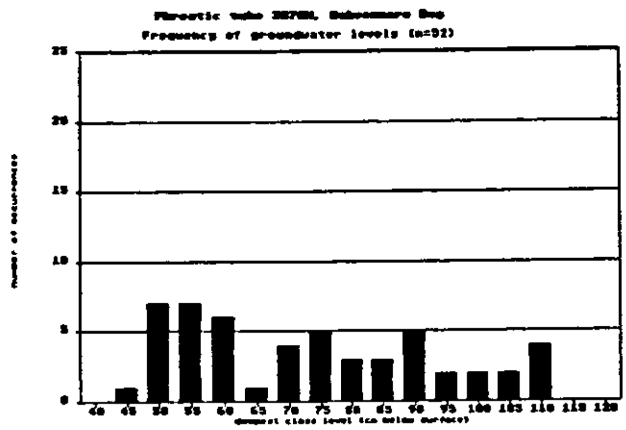
Cutover part on Southern margin of Raheenmore Bog (303-311)



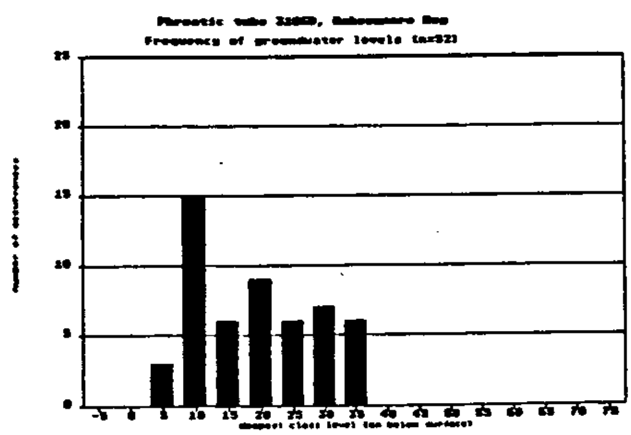
Piezometer 303A. Strongly disturbed, near marginal drain



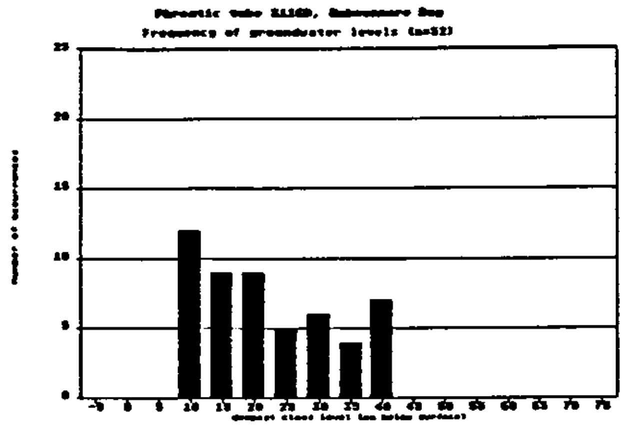
Piezometer 305B. Ulex/Molinia community in cutaway area.



Phreatic tube 307GW. Molinia-Potentilla community

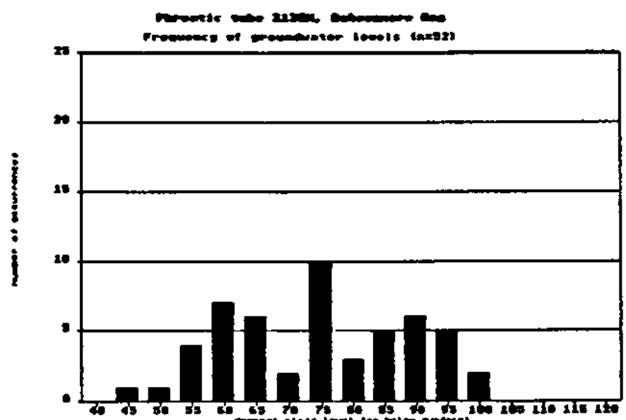


Phreatic tube 310GD. Enriched Molinia zone on partly cotover peat below face bank.

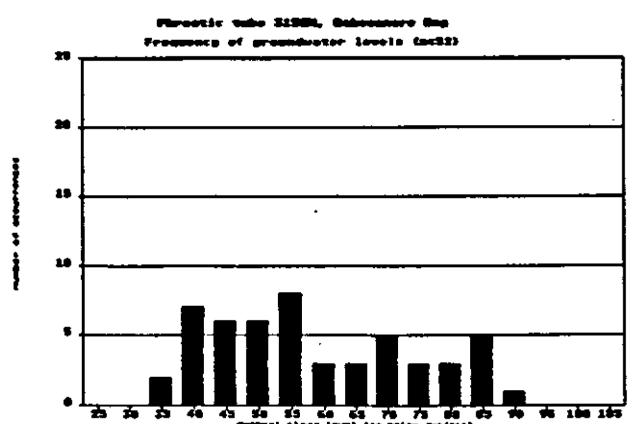


Phreatic tube 311GD. Enriched Molinia zone on partly cutover peat just below face bank.

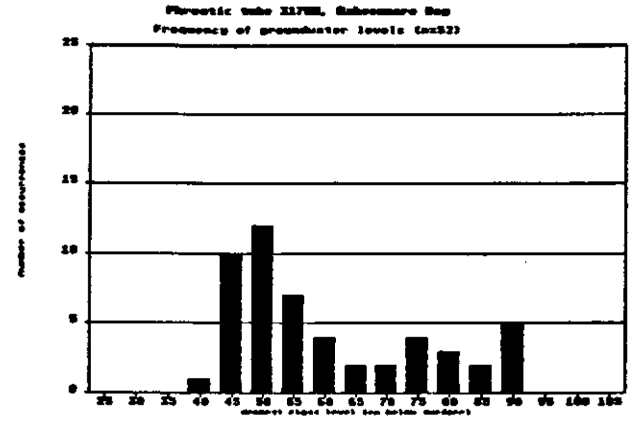
Uncut bog surface; from Southern to Northern margin



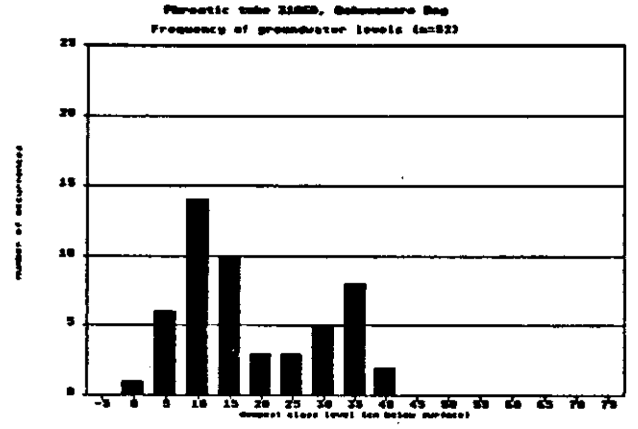
Phreatic tube 313GW. Calluna zone.



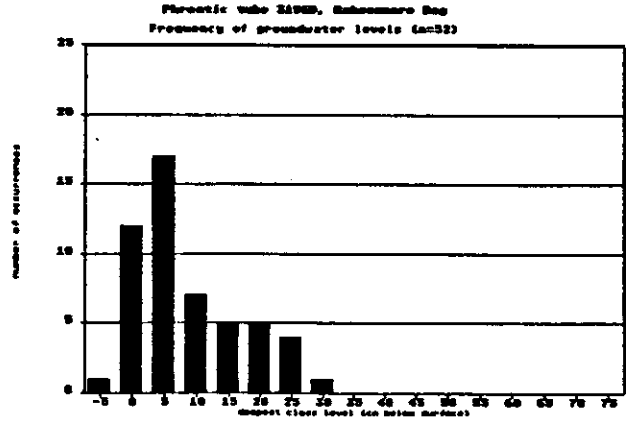
Phreatic tube 315GW. Calluna zone.



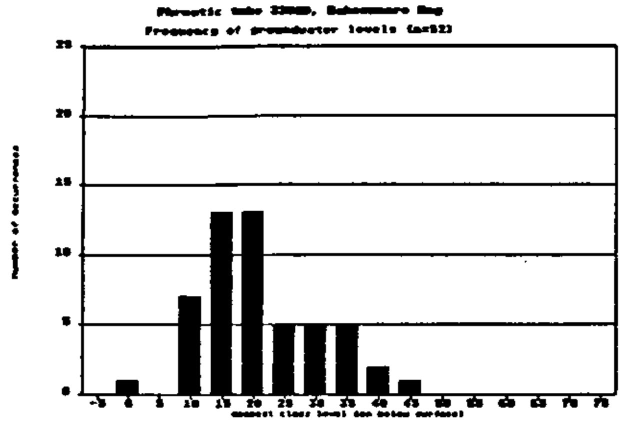
Phreatic tube 317GW. Calluna zone with Scirpus caespitosus.



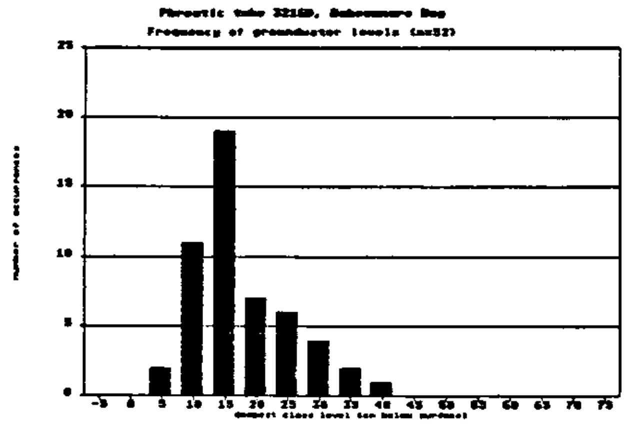
Phreatic tube 318GD. Narthecium hollow complex.



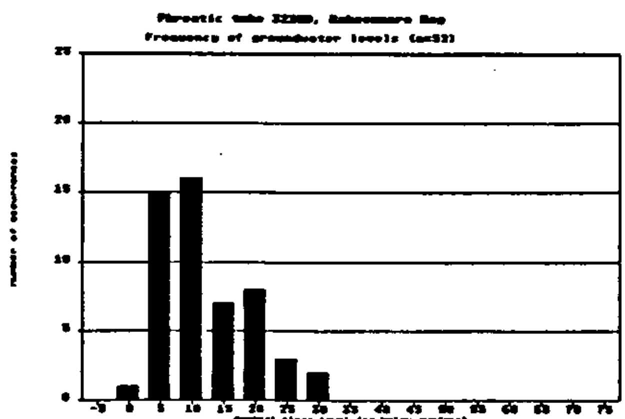
Phreatic tube 319GD. Narthecium hollow complex.



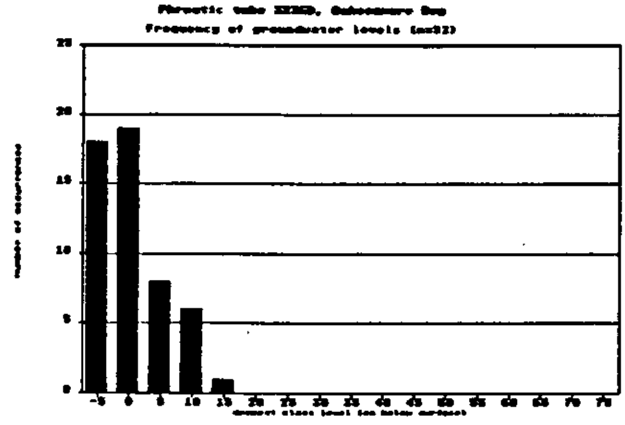
Phreatic tube 320GD. Narthecium hollow complex.



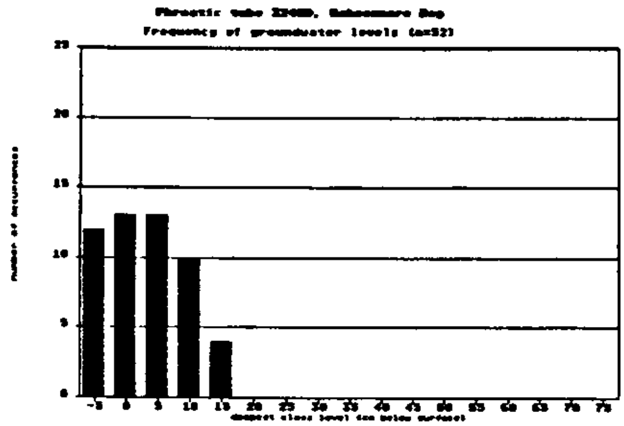
Phreatic tube 321GD. Narthecium hollow complex.



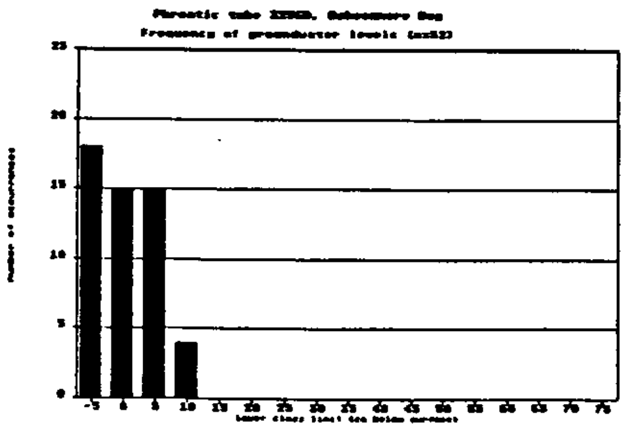
Phreatic tube 322GD. Narthecium hollow complex



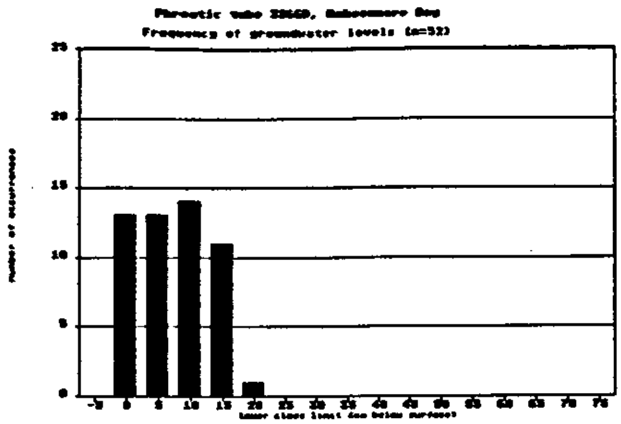
Phreatic tube 323GD. Sphagnum magellanicum zone



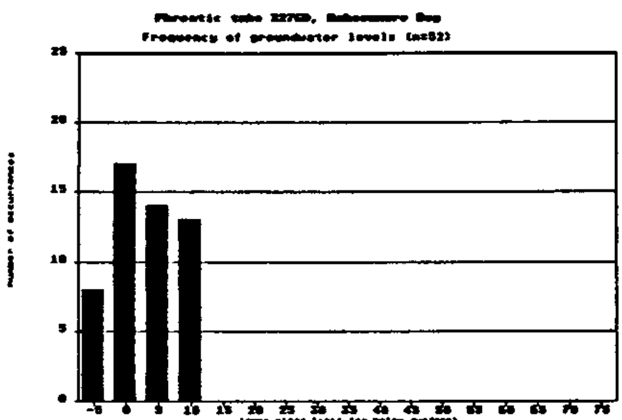
Phreatic tube 324GD. Sphagnum magellanicum zone; transitional to Narthecium hollow complex



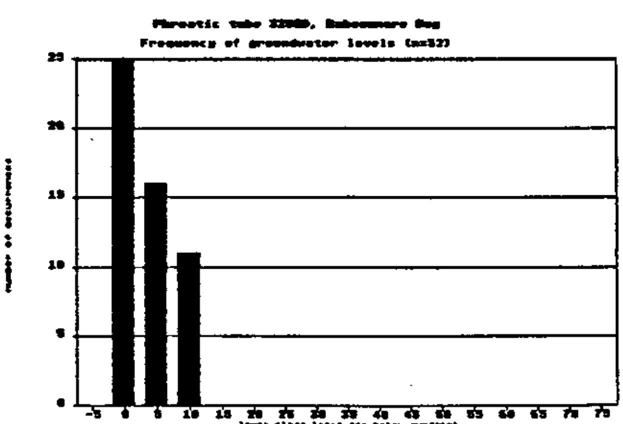
Phreatic tube 325GD. Sphagnum magellanicum zone.



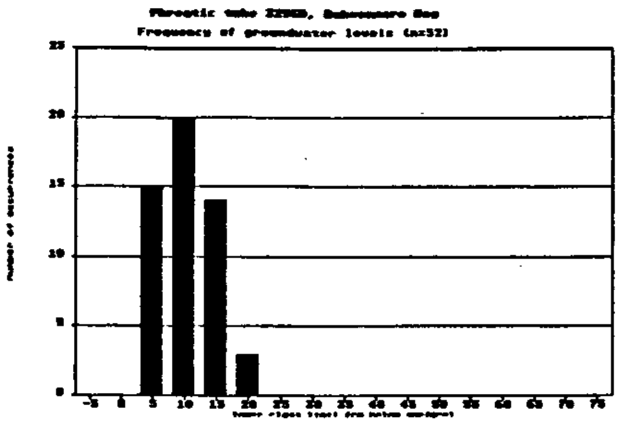
Phreatic tube 326. Sphagnum magellanicum zone.



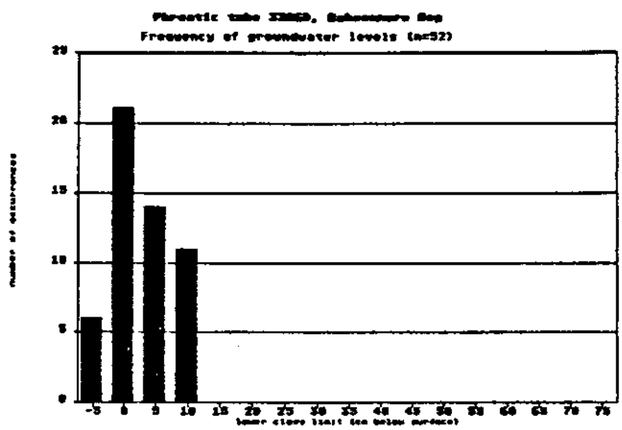
Phreatic tube 327. Sphagnum magellanicum zone



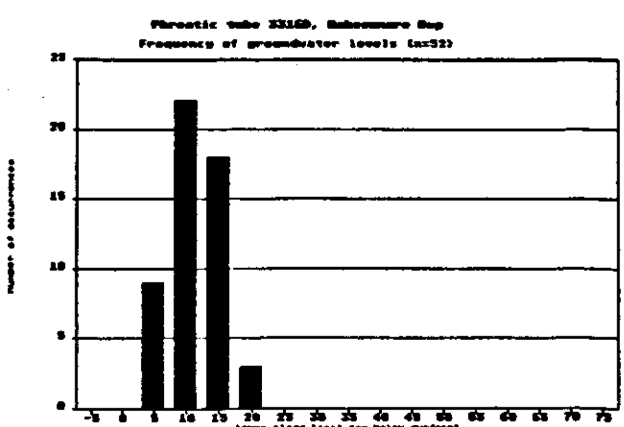
Phreatic tube 328. Sphagnum magellanicum zone



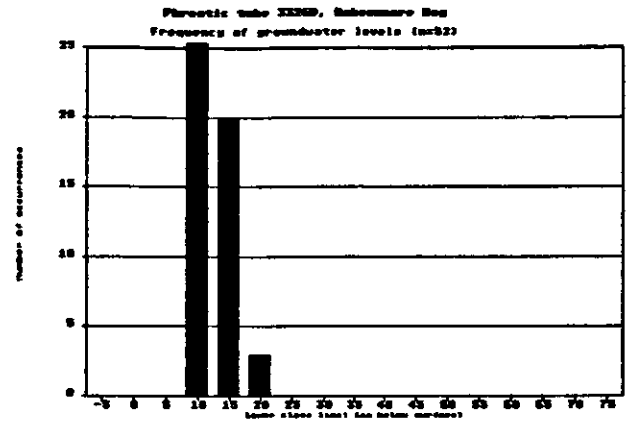
Phreatic tube 329. Sphagnum magellanicum zone.



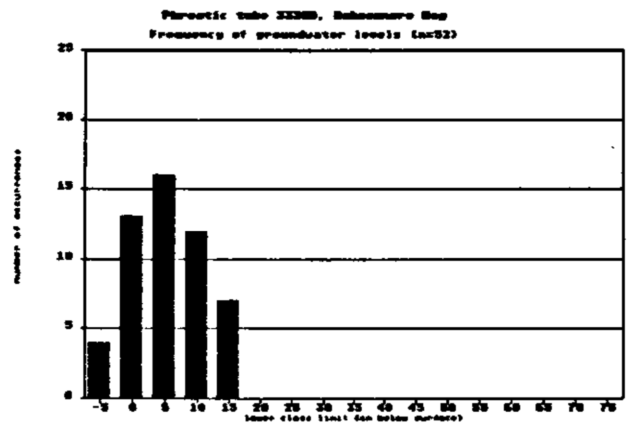
Phreatic tube 330. Sphagnum magellanicum zone.



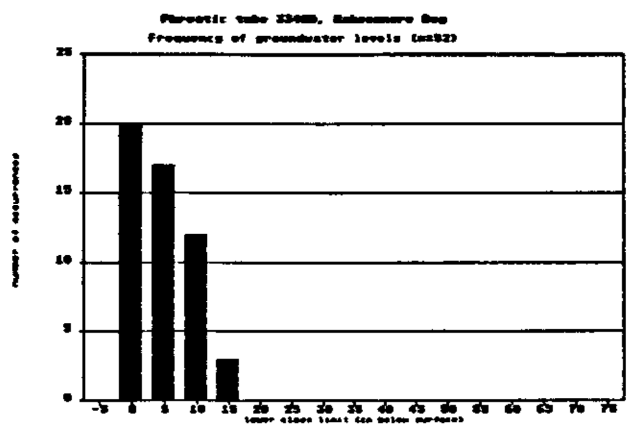
Phreatic tube 331GD. Sphagnum magellanicum zone.



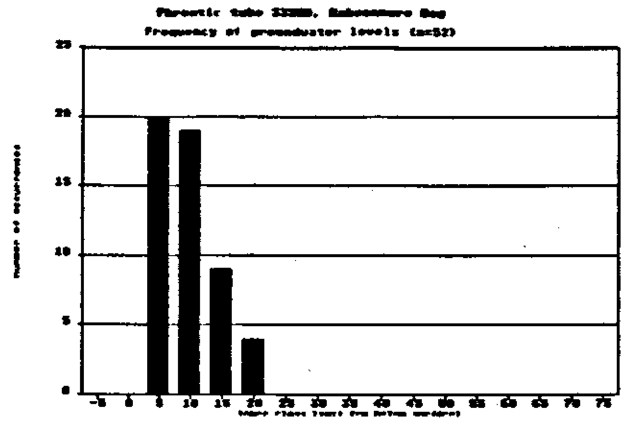
Phreatic tube 332GD. Sphagnum magellanicum zone



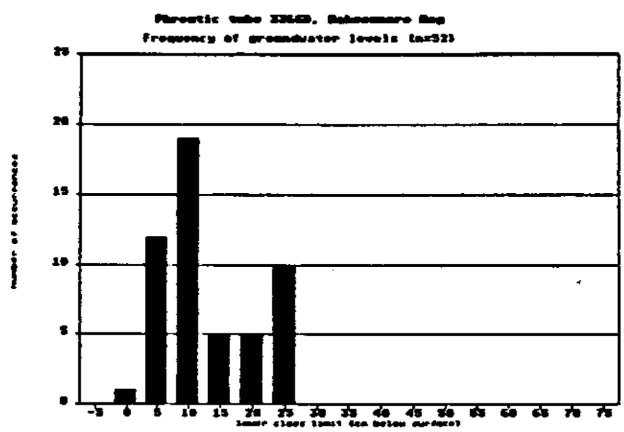
Phreatic tube 333GD. Sphagnum magellanicum zone



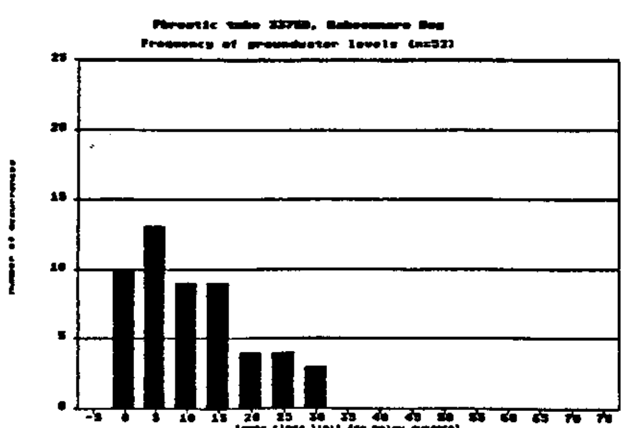
Phreatic tube 334GD. Sphagnum magellanicum zone.



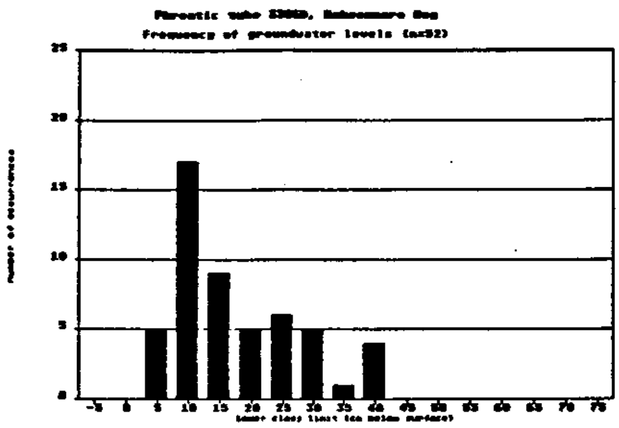
Phreatic tube 335GD. Transition from Sphagnum magellanicum zone to Narthecium hollow complex.



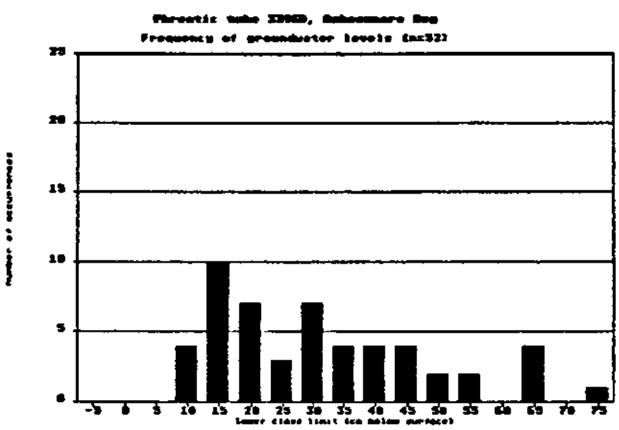
Phreatic tube 336GD. Narthecium hollow complex



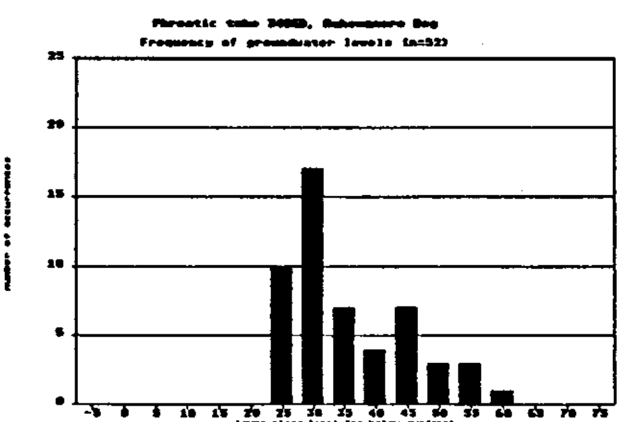
Phreatic tube 337GD. Narthecium hollow complex.



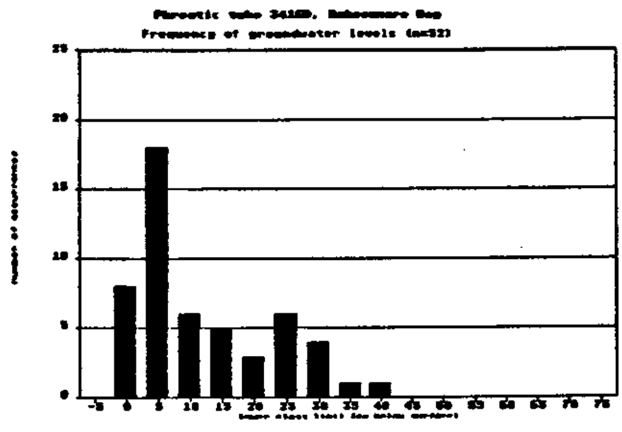
Phreatic tube 338GD. Scirpus caespitosus zone, transitional to Narthecium hollow complex.



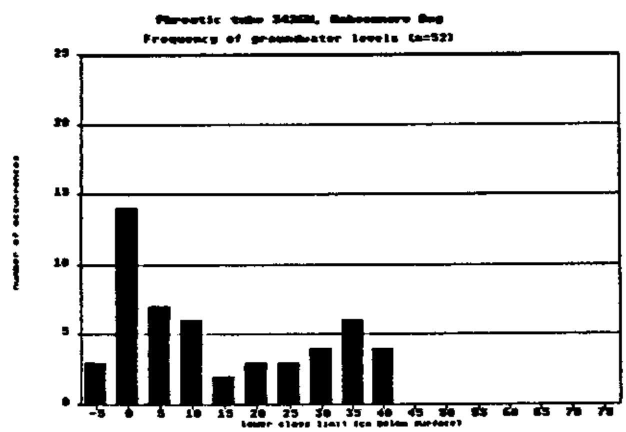
Phreatic tube 339GD. Scirpus caespitosus zone.



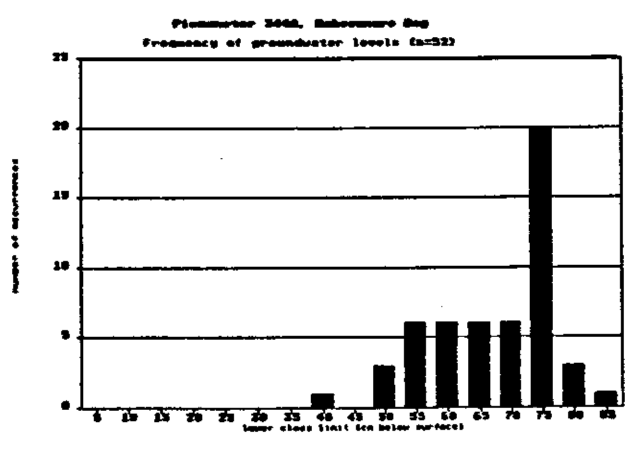
Phreatic tube 340GD. Scirpus caespitosus zone.



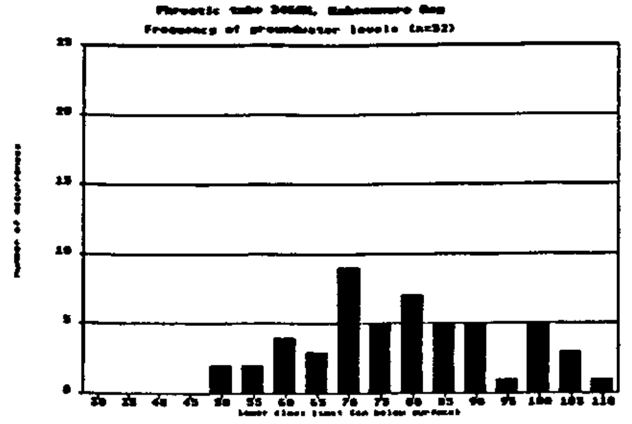
Phreatic tube 341GD. Scirpus caespitosus zone.



Phreatic tube 342GW. Scirpus caespitosus zone near bog margin.



Piezometer 344A. Strongly disturbed bog margin.



Phreatic tube 346GW. Strongly disturbed bog margin.

ERRATUM

Due to a misinterpretation of piezometer test data by a previous group of students, the hydraulic conductivities used in the assessment of the downward seepage in 4.5 are incorrect. The results, presented in 4.5 are therefore also incorrect. Since the misinterpretation was discovered after this report was finished, the authors cannot be blamed for this.

The water balance as derived from discharge data in Chapter 5 remains unaffected.

Sake van der Schaaf

1993.04.14