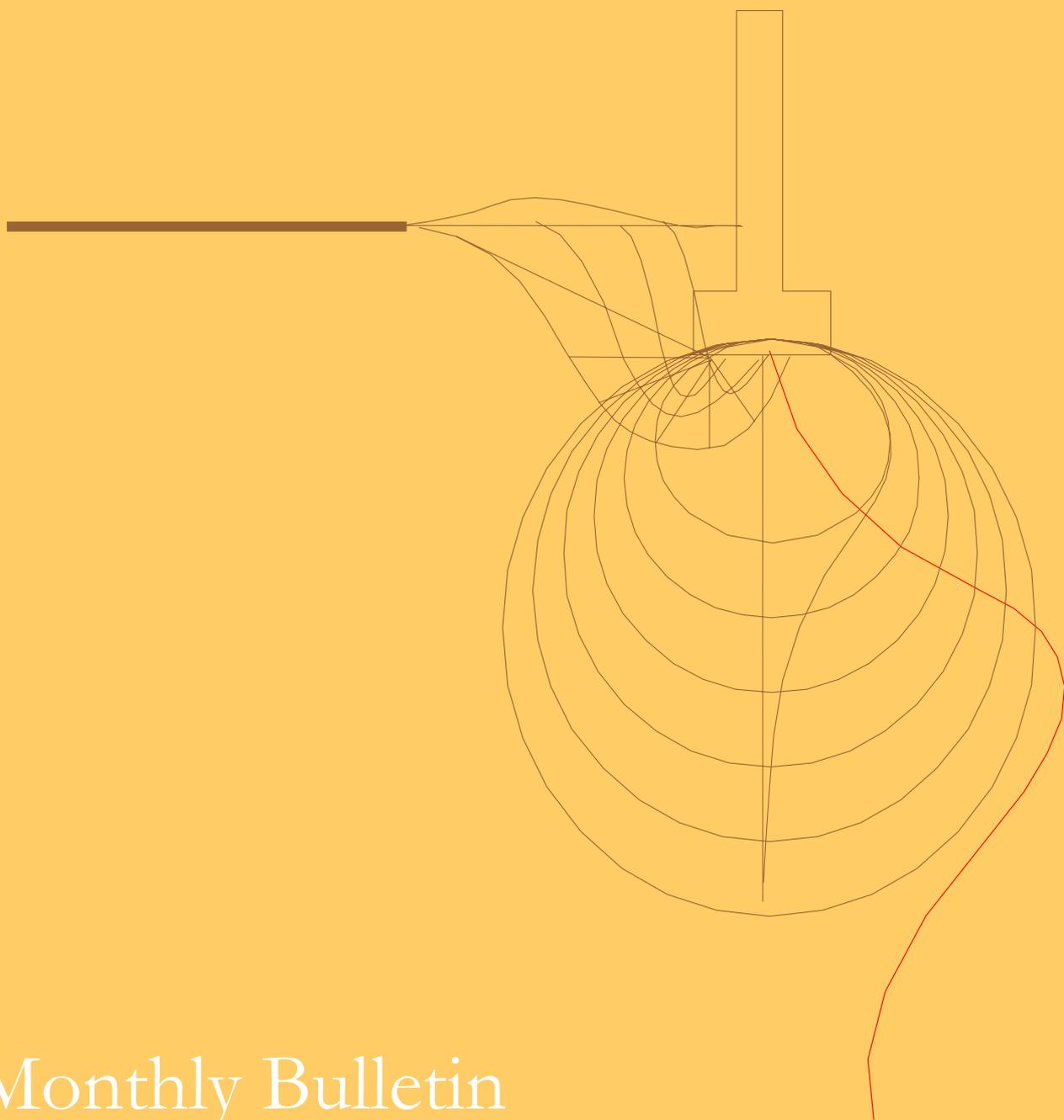


# The Clay Research Group



Monthly Bulletin

# Aldenham Data Update

September 2006.

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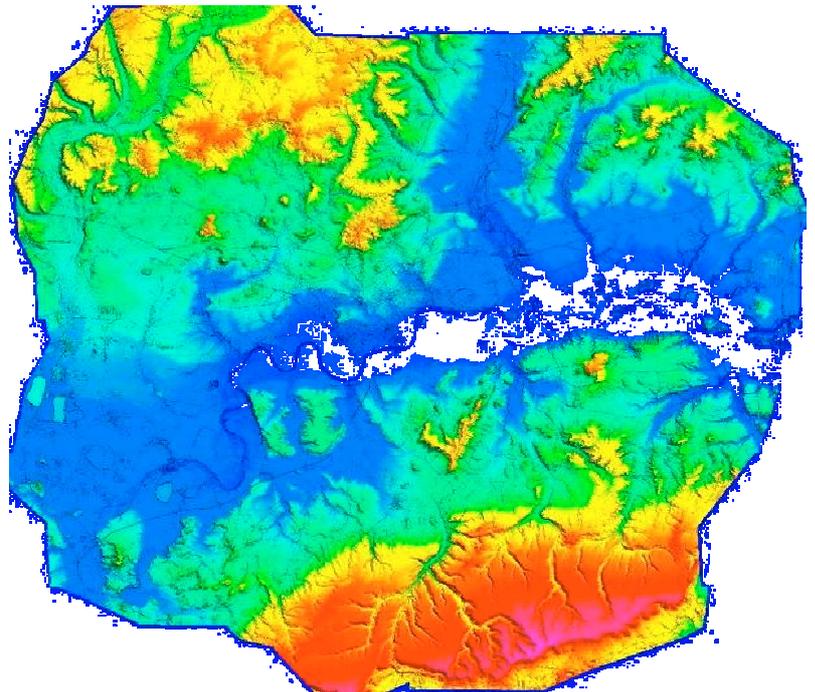
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## Ground Terrain Models

The LiDAR ground terrain model of London (see below) has provided a useful insight into its geology and provenance.



Using contouring we can build an entire geology in the visual spectrum. Height data is represented by different colours, with blue being the base line (the Thames), through green, yellow and red as the height increase.

Red (bottom right) is the outcropping chalk and the yellow to the North West are the glacial deposits at their extremity. The green represents the sedimentary deposits - the London clay series in this case.

In the chalk we see the flows and can estimate the location of the clay-with-flints superficial geology. The lighter blue represents the river terrace passing downwards to the alluvial soils and at its darkest, the Thames and its tributaries.

This is a powerful by-product of the ground terrain model and plotting the claims onto the image provides some interesting information, as we will see next month.

## Feedback

Jon Heuch suggested caution when looking at tree data as every tree is unique. He wondered if the data review we printed in the last edition sounded the death knell for too many trees.

In particular he disliked the grouping of trees under the headings 'broadleaf' and 'deciduous' as far too broad a brush. To conclude he wondered about our criticism in respect of the H/D value, which he thought had some value but agreed it was complicated because many trees had been pollarded and/or cut back which would change their moisture uptake and the root distribution of course.

Many thanks for this. All feedback is appreciated.

Prof. Powrie thought the project was gathering steam and 'coming together nicely', which just about sums up our view.

Thanks also for the kind comments and support from several readers.

## Methane

In Nature this month (17<sup>th</sup> August, 2006) we see an article entitled "the Methane Mystery" which outlines the findings of several researchers suggesting vegetation is a significant source of methane.

The article says "If true, the findings could account for a substantial fraction of the methane entering the atmosphere - potentially throwing off calculations of how much industry contributes".

Some researchers estimate that vegetation could produce 40% of the total emissions.

How plants produce methane remains a mystery however. There is no defined process that would account for it.

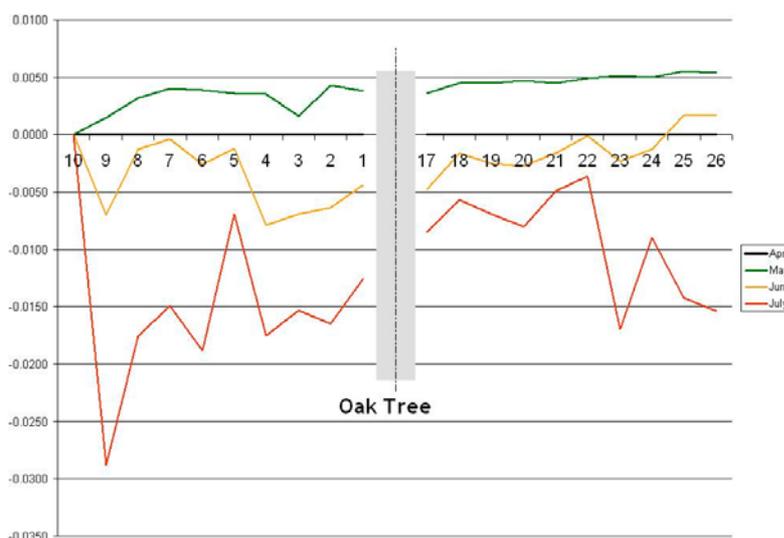
## Levelling Data - Oak

It is no surprise given the recent dry weather to see significant ground movement taking place. Below we have plotted the level data either side of the Aldenham Oak for the period April to July, 2006.

The base line (black) represents the initial readings, taken in April. The ground recovered (green line) in May, and more towards Station 26 - the most Westerly station.

In June (orange line) we saw the onset of moisture loss and associated clay shrinkage shortly after the tree came into leaf.

July saw a significant change with the ground subsiding more towards the outer stations with Station 9 (to the North East) moving most.



This isn't the traditional view of how ground moves. We would usually expect to see most movement taking place close to the tree, reducing towards the periphery of the root zone.

Our initial thought - and subject to what the ERT data reveals - is that the readings are reflecting the presence of a persistent moisture deficiency as we know from the earlier site investigations and soils analysis. The clay is already dry and the roots are no doubt exploring the avenues of least resistance.

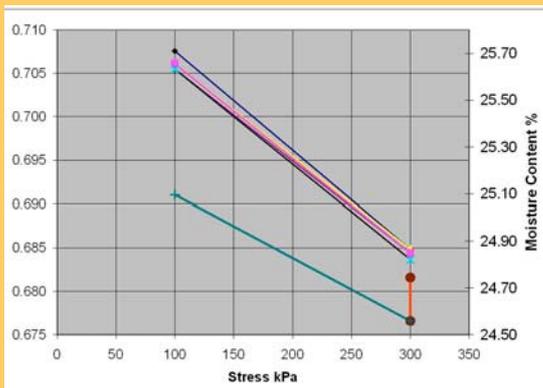
The level data would almost certainly have shown a different pattern of movement had the soils been fully rehydrated in the winter. For the station layout, see Page 5.

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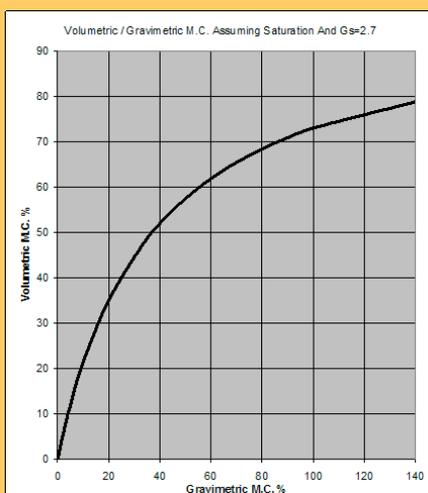
## Soil Treatment Notes

MatLab are carrying out shrink swell tests using the oedometer and a variety of treatments prior to application on site at Aldenham.



This graph plots the void ratio in relation to both moisture contents and stress.

Repeated cycles enable us to model what would happen over a period of several years in a matter of weeks.



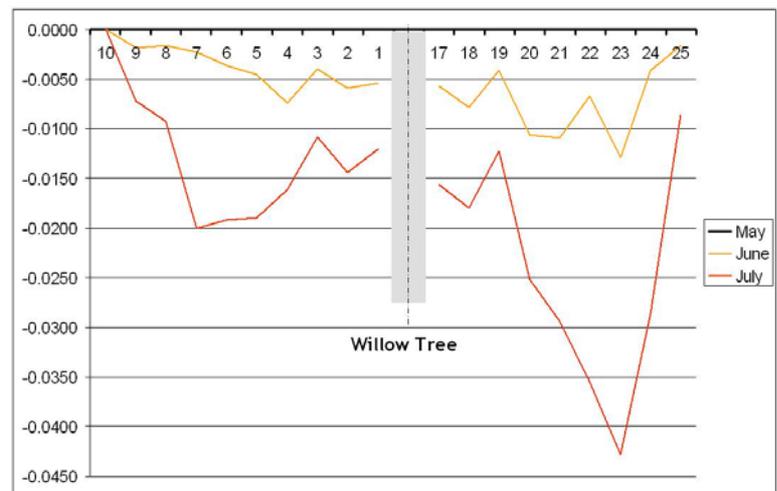
Clive Bennett (MatLab) has kindly plotted the relationship between the volumetric and gravimetric measure of moisture content.

## The Aldenham Willow

On Page 2 we plotted the level data for the Oak, and below we see a similar view of the ground adjoining the willow tree.

Again, the data doesn't fit the traditional view of how roots take up moisture and we need to gather readings over a longer period to establish exactly what is happening.

We have estimates of the swell that might occur on rehydration from our soils investigations from May, so it may be possible to add the estimates of swell to the level data to carry out some crude modelling but at the moment we are gathering data from as many sources as possible before drawing any conclusions.



We have recorded quite large 'dips' at one end of the root zone for both trees, which appears unusual. Both appear on the extremes of the east facing lines.

For the Oak, the most extreme station is 9, adjoining the deep datum. For the Willow, the most easterly station is 25.

Both share a gradual (if irregular) slope across the root plate. Maximum movement for the Oak is just under 30mm and for the Willow, slightly less than 40mm.

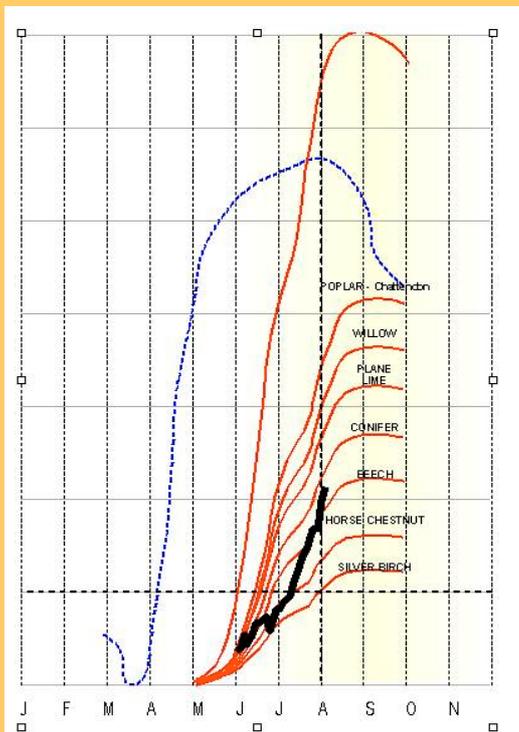
Far too early to draw any conclusions and we have a vast amount of data to combine and interpret. We hope to have some outline conclusions in the late summer of 2007.

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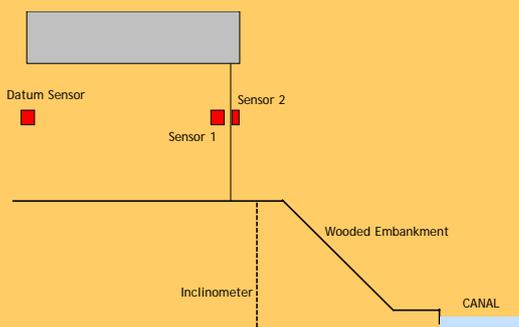
## TELEMETRY

Below we have superimposed the data from Sensor 2 of the electrolevel installation from our live claim onto the characteristic signatures of root induced clay shrinkage to see if there is any correlation. See the picture below. The incoming data is shown as a bold black line, plotted against the underlying template.



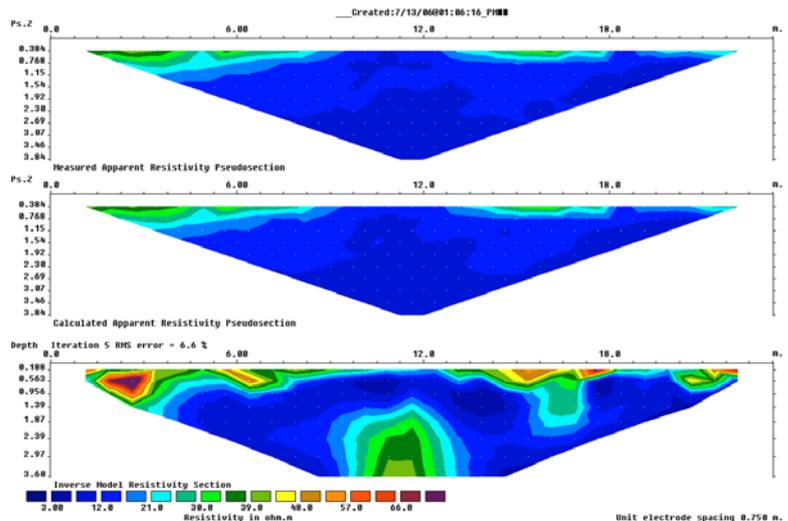
The sensor is measuring clockwise rotation. In October/November we are expecting the direction to change as the ground rehydrates.

Below is a picture of the sensor location - on the wall adjoining the embankment.



## JULY IMAGES - LINE 1 - OAK

Glenda and Nigel have to process the data from 3 arrays on two trees, producing 3 images for each. These are the readings for July. The top image shows the measured pseudosection, beneath it is the calculated pseudosection and at the bottom, the inversion to reveal moisture change.



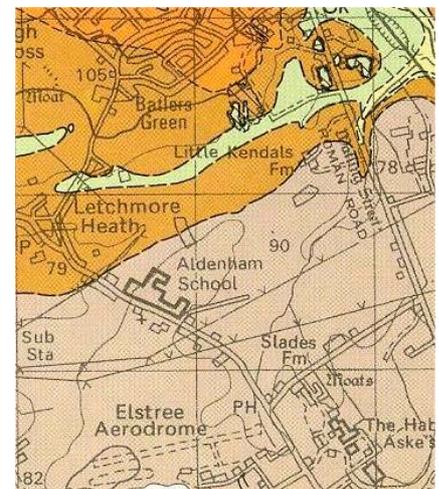
The legend shows values in the range 3.0 through to 66.0 - wet to very dry.

The processing of ER values is complex, needless to say, and this is very much a 'work in progress' as the team from Keele make several passes through their data to build various images.

## GEOLOGY

The British Geological Survey map shows the school to be situated on outcropping London clay.

To the North West are the Lambeth Group which no doubt contribute towards the sands and gravels we have encountered.



# Aldenham Data Update

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## Monitoring

One of our main objectives at Aldenham is to have an ongoing record of movement, soil moisture content and weather at a known site so that we can make meaningful comparisons over a period of several years.

We hope to compare the current years values against a backdrop of historic information - from the same site.

It is difficult - if not impossible - to make any sort of objective assessment without a stable context.

The school has been closed for the summer holiday, although work has been continuing on the project as you can see and we are waiting to receive the live feed from the weather station.

More news as it breaks.

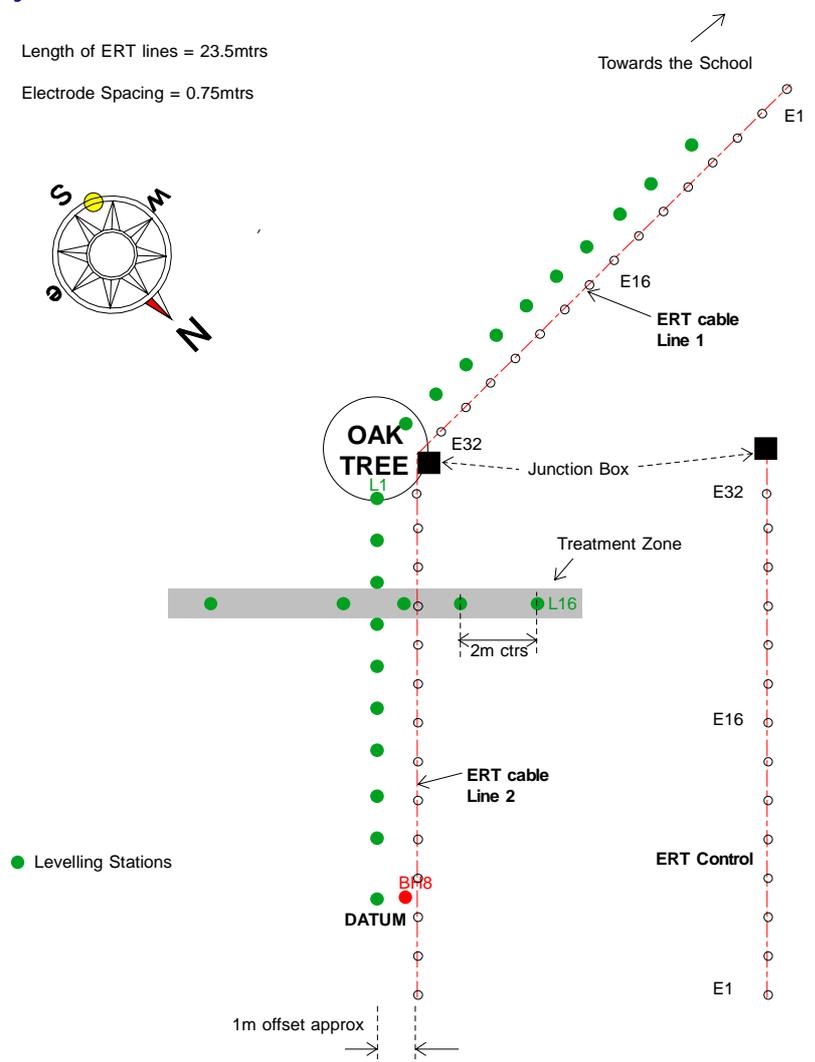
Aldenham should become our 'early warning station' in years to come, where we look for patterns to compare with earlier event years, and detect trends earlier.

We are pleased to report that the weather data is in the capable hands of the geography group at the school. They are honorary members of the CRG!

We anticipate the site will go live when the school return from their summer holidays.

## OAK TREE ERT IMAGING ARRAY

The image on Page 4 was taken from the Oak, Line 1. Below we see the cabling arrangement. Each cable is 23.5mtrs long, and runs in parallel with the levelling stations (19mtrs in length, from the trunk of the tree), and about 1m away. The control lines - set as far away as possible - are numbered in a similar way.



Station E1 for each of the runs is set at the cable extremity, and E32 is closest to the tree in both cases. The junction boxes are shown in black.

Readings are taken from pins set into the ground (the entire assembly is below ground) at 0.75mtrs ctrs.

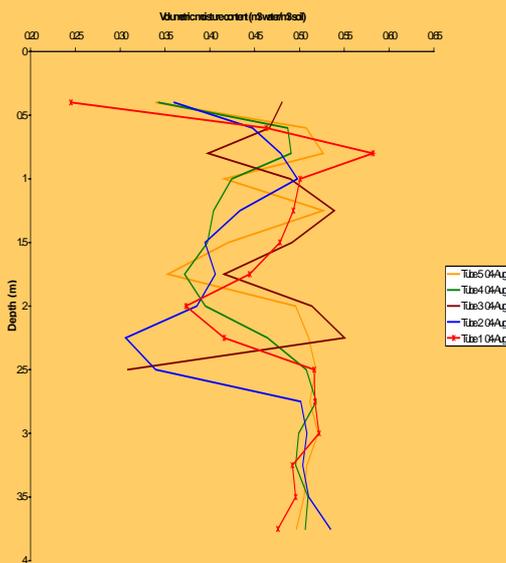
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## Neutron Probe Data

The first set of readings from the 5 tubes we have in place reveal irregular moisture profiles down to about 3mtrs, where the values start to converge at a volumetric moisture content of around 50% of the soil mass.

Joel Smethurst explains "a typically saturated clay would have a volumetric moisture content of around 45 - 50% and a desiccated clay would typically be around 25 - 35%".



Although early days, the data agrees with the oedometer results in terms of the depth of desiccation.

It is interesting to see that academics generally use volumetric measures of moisture, whereas laboratories that investigate subsidence traditionally use a gravimetric measure.

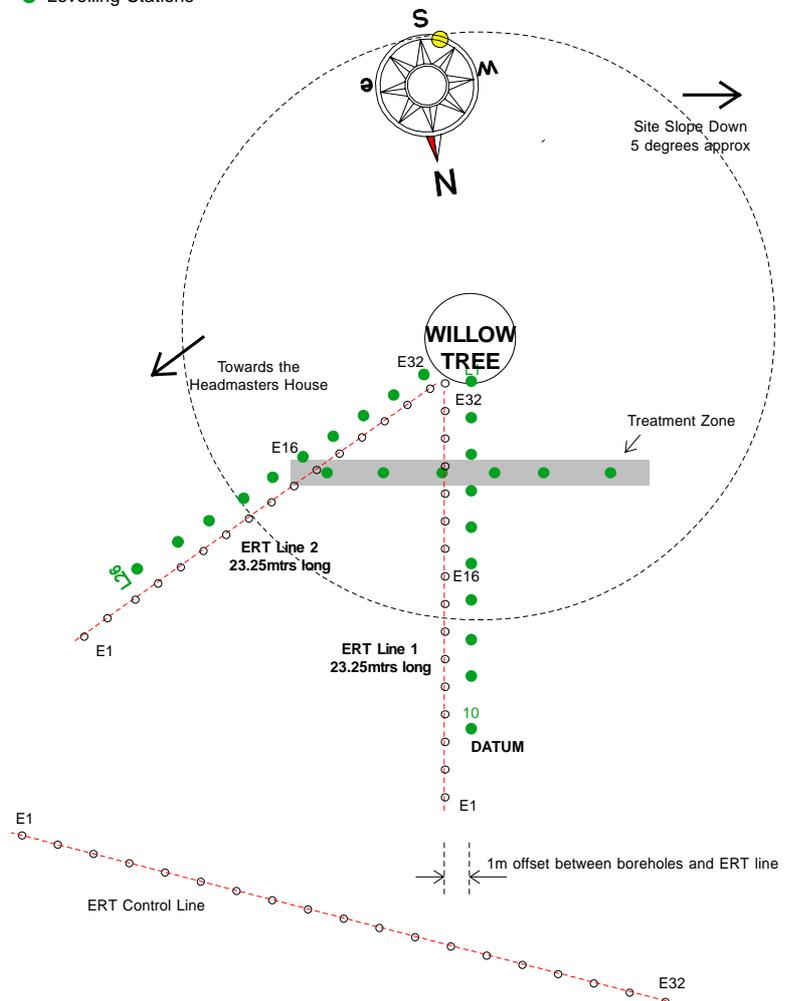
The probe measures a sphere of soil about the size of a football as the probe is lowered down the tube, with readings taken at around 0.25m ctrs.

## WILLOW TREE ERT IMAGING LAYOUT

Due to the nature of the site (i.e. the need to avoid other vegetation) we have an inverted 'v' arrangement, with the control running across from side to side at the northern end of the root zone.

1m (approx) offset between boreholes and ERT line

● Levelling Stations



As before, station E1 for each of the runs is set at the cable extremity, and E32 is closest to the tree.

As with the oak, the readings are taken from pins set into the ground (the entire assembly is below ground) at 0.75mtrs ctrs.

# Aldenham Data Update

## The Neutron Probe Installation

September 2006.

### Orientation

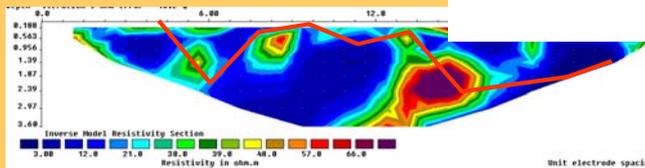
We have seen (Pages 2 & 3) that most movement has been recorded to the Easterly facing side of the site for both the oak and willow, which we are sure is just a coincidence.

Of course, we can't rule out the effect of the dreaded grass cutting device which has damaged some of the covers to the level stations, and the picture may become clearer as we assemble the various datasets.

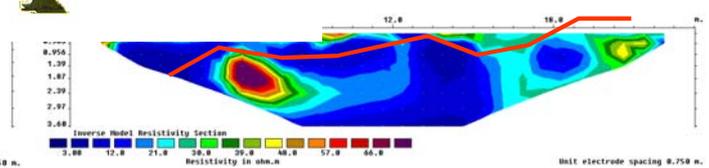
### Correlations

The objective of much of our research is correlating ground movement with the data we receive from the ERT, neutron probe, TDR sensors, soil analysis and so forth.

It isn't always easy to detect patterns and the first step is to plot all of the data to scale. Here we see the Oak tree, and the ER array, with the level data superimposed.



Unit electrode spacing 0.750 m.



Unit electrode spacing 0.750 m.

### GLENDA

An amazing coincidence we know, but Glenda has notified her Building Insurers because she has a problem at home. Yes, it may be subsidence. WE are waiting to hear the outcome.

This follows a month behind the Editor doing the same just when he was trying to sell his home.

Is the CRG jinxed? Does anyone else have a claim? At least we can rely on a prompt and efficient response from our respective insurers and their agents - can't we?

As well as receiving a copy of the data we acquire, subscribers will also receive a 'moving image' in Power Point, illustrating our findings in a visual format.

The movie will show the resistivity image changing by month and how the ground moves in response to moisture flow. Soil profiles will appear in the month they were sampled, alongside the information from the sensors and probes.

This is a first as far as we are aware, which should explain our findings in an easy to understand way. The background will be the data from the weather station, recording rainfall and temperature etc.