The Clay Research Group

RESEARCH AREAS

Climate Change ◆ Data Analysis ◆ Electrical Resistivity Tomography
Time Domain Reflectometry ◆ BioSciences ◆ Ground Movement
Soil Testing Techniques ◆ Telemetry ◆ Numerical Modelling
Ground Remediation Techniques ◆ Risk Analysis
Mapping ◆ Software Analysis Tools
Artificial Intelligence

December 2018
Edition 163

The Clay Research Group

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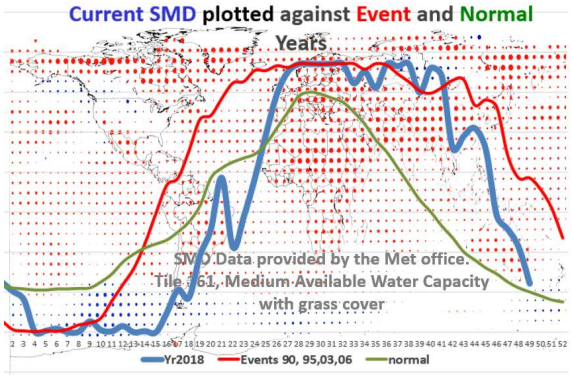
Issue 163, December, 2018

SMD Update

Fairly rapid rehydration following the dry summer, with the current SMD merging with the 'normal year' profile.



2018 Claims Update

The warm spell in the summer of 2018 has delivered a significant upturn in claim numbers. The ABI report just under 12,000 subsidence claims notified in 2017, and current estimates suggest that 2018 could deliver around 20 – 25,000.

The ABI report a record fourfold increase in subsidence claim numbers from the second to the third quarter of 2018, putting it into the surge category.

Hotspots

This edition explores how we might define a Hot Spot that would satisfy the courts and the various interested parties involved in Third Party, root induced clay shrinkage claims. One party representing a borough on clay soil asked why, if insurers have so much claims experience, don't they share their knowledge to help councils avoid claims in the first place?

Unfortunately, insurers don't have this level of expertise, which is where the foreseeability defence comes in. We may have modelled root zones in high risk areas, but that still doesn't tell us which trees will cause damage, where, or when.

Research into locations that do pose a particularly high risk would help local authority tree officers direct their efforts and resources better, and reduce insurers' spend.

Over the next few months we hope to plot the Brent data using a GIS and see if there is a method to determine hot spot locations.

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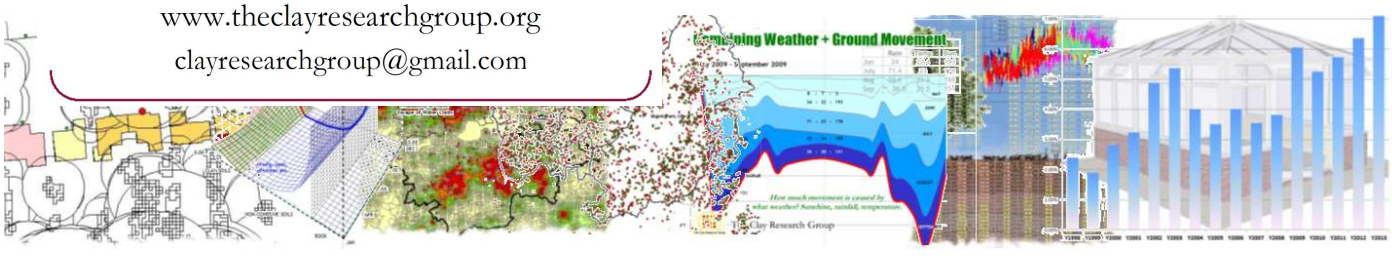

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Basildon Study

Basildon, Essex, is a fairly high-risk district and forms the subject of a review in this month's edition. The study follows the usual format, plotting risk at district and sector level, as well as using claims data at full postcode level to understand the relationship between geology, house type, ownership and cost.

DISTRICT PROBABILITY TABLE

	SUMMER			WINTER		
District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Wandsworth	0.628	0.134	0.238	0.08	0.37	0.55
Basildon	0.740	0.045	0.215	0.01	0.16	0.83
Basingstoke and Deane	0.506	0.192	0.302	0.16	0.43	0.401
Brent	0.760	0.026	0.214	0.01	0.16	0.83

Above, an extract from the probability table listing the likelihood of a claim being valid by season (also variable by sector - not shown).

Due to the fairly extensive presence of outcropping London clay in the borough, the probability that a claim will be valid in the summer is greater than 70%. In the winter, this drops considerably - an indicator that the clay sub-soil is encountered at shallow depth.

The article also considers some of the issues with Big Data and explores the benefits of mapping. Does seeing the location help our understanding of risk, compared with looking at lists of postcodes in a database?

Do we always know what we are looking at when we view data and maps? Count is one thing, and frequency another. Frequency of what exactly?

The article looks at an example that could be misleading even though the output is correct.

Why wasn't the Intervention Technique tested at Aldenham?

Once the patent was granted, the plan was to set up a test rig at the Aldenham site and take advantage of the existing levelling stations to determine the effectiveness of 'turning the tree off' using controlled rehydration.

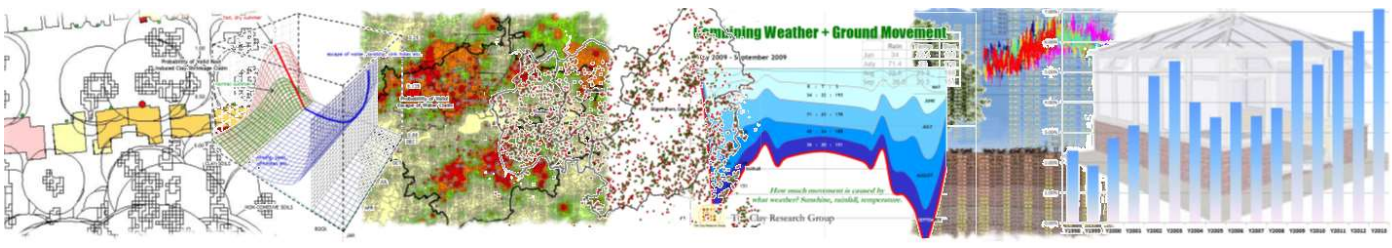
Why didn't we?

The problem was, the London clay series in the vicinity is underlain by chalk, and there was a problem at Aldenham many years ago when the pool suffered damage as a result of undermining of the deeper layers by erosion.

Clearly, a rehydration system, however competent, would not be suitable given the geology.

Just to refresh, the Intervention Technique relies on rehydrating a section of the root zone to prompt the production of abscisic acid, the drought hormone to trigger partial closure of the stomata and reduce moisture uptake.

Instead of testing at Aldenham, the technique has been used on over 100 claims with no reports of failure. Several properties have been monitored and whilst we have recorded the usual seasonal pattern of movement, none of the claims have been re-opened.



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Hot Spots – can we define their location?

The Berent judgement (2012) looked at the issue of foreseeability and came up with the idea of 'hot spots'. Could the local authority have reasonably foreseen a problem?

Are 'hot spots' linked to tree species, height and distance? How do we find out where these hot spots are? How many claims, how close together, represent a 'hot spot'? Is it the case of asking every borough for details of claims under the Freedom of Information Act, and mapping them using a GIS to see if a pattern emerges?

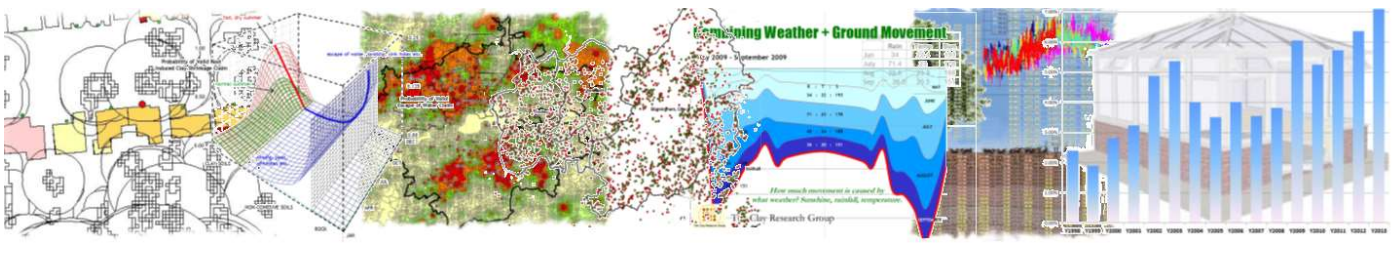
Some time ago, our colleague Ian Brett-Pitt did just this and obtained information relating to claims for tree root damage from Brent council. The list contained 2313 records covering the period from the middle of November 1993 to the end of November, 2012. The data contains claims from the event years 1995, 2003 and 2006.

Our study, spread over the next few months, looks at their distribution across the borough, and seeks to determine if a 'hot spot' can be identified. The outcome will hopefully be useful to all parties. Council tree officers will be able to direct their spend to reduce the risk of future liabilities; engineers will hopefully have a better idea of the challenges faced by the tree officers.

It also raises the question of what can reasonably be done to reduce the incidence of claims in these hot spots. Should all of the trees be removed? Is pruning an acceptable alternative? Indirectly, it also touches on the threat posed by global warming. Root induced clay shrinkage claims increase in warmer, drier weather.

In next month's edition we include examples from various streets across the borough to illustrate the problem faced by the LTOs in the hope of bringing the parties together.

Above, the location of the borough in north west London. Brent is rated in the top ten districts in terms of subsidence risk from the sample we hold. The study looks at risk by postcode, plotting claims notified to the borough and insurers' experience, together with some data from the 2006 LiDAR survey. It is a snapshot in a changing world, with trees felled and new planted since the survey, perhaps of a different species, and account hasn't been taken of changing weather patterns, with the risk of root induced clay shrinkage having diminished over recent years – at least, prior to the current year.



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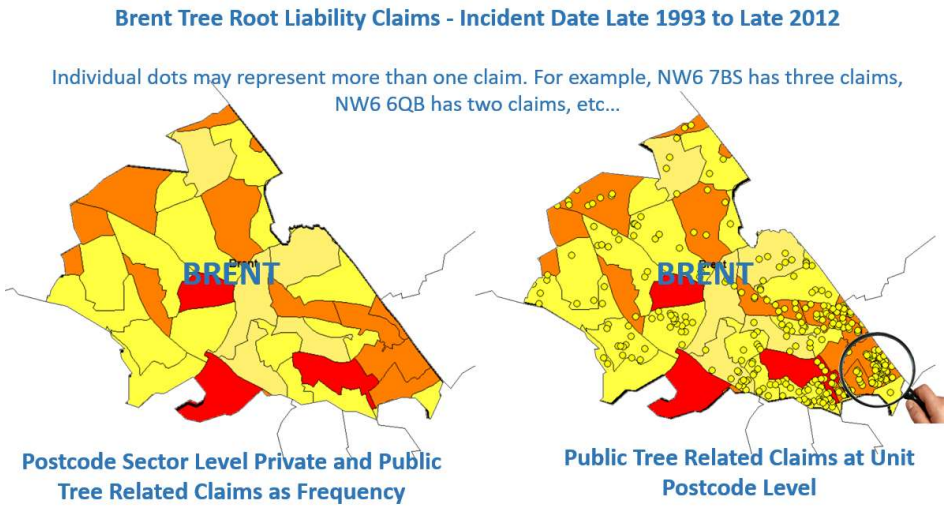
London Borough of Brent – Locating the 'Hot Spot'

First, the geology. Brent is predominantly underlain by outcropping, highly shrinkable, London clay with a narrow band of alluvial soil and pockets of gravel. Site investigations from claims suggest it has fairly even properties across the borough with a Plasticity Index of around 45% - 50%.

We could find no geological feature that would account for a variable claim distribution.

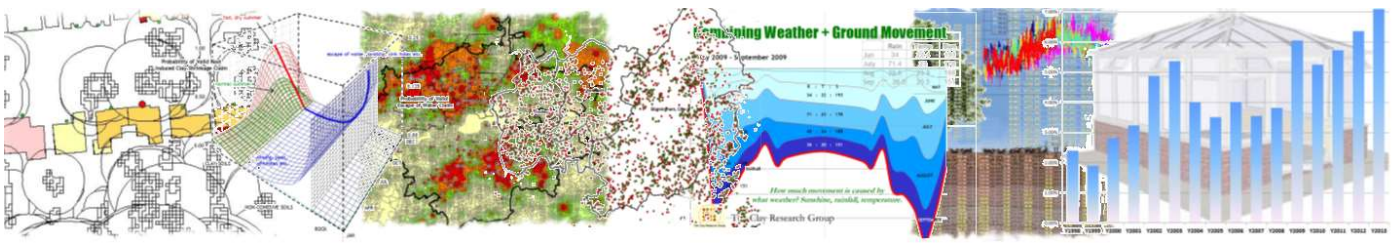
Next, the link between trees, properties and claims. Finding there are more claims in a location doesn't define a hot spot. It could be there are simply more properties. Our study uses frequency data – the number of claims divided by the number of houses in the location.



Insurers' view of the risk of subsidence at postcode sector level, including all claims received – not just public tree related claims.

The central issue is, what constitutes a hot spot in terms of resolution? Is the postcode sector map above useful? If one or two streets in a sector (sector format is "NW6 9") are particularly high risk, is it sensible to target a sector containing around 2,000 houses?

This study works at a higher resolution, looking at risk at street level using the full postcode – "NW6 7TT" for example - which typically contains around 15 or so houses – on average across the UK. More in next month's edition.



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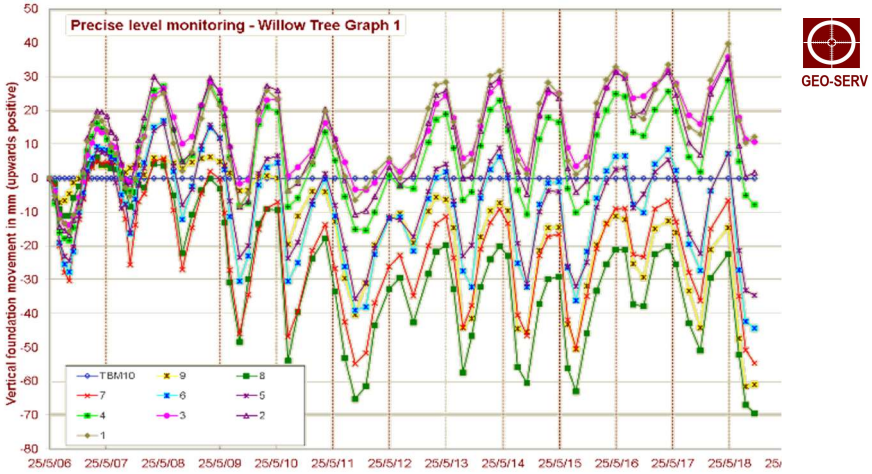
Aldenham Willow – Precise Levels Update

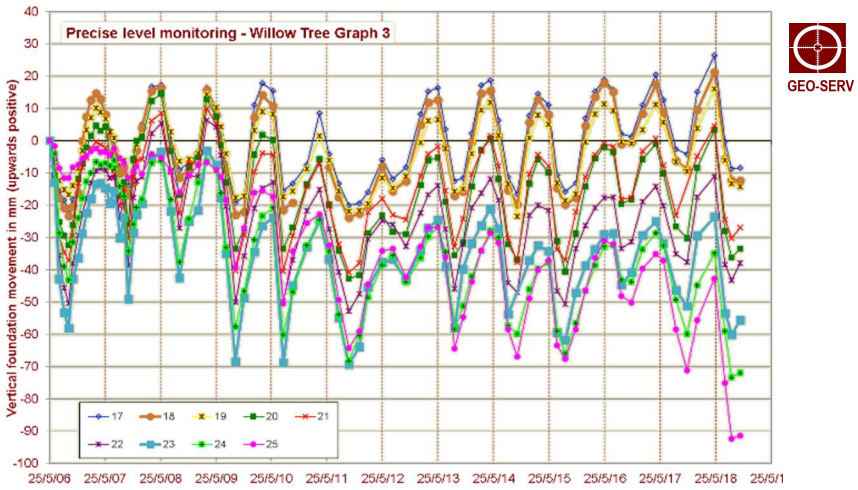
GeoServ Limited, funded by Crawford & Co., have supplied the following updates to the precise levels at the site of the Aldenham willow following the recent dry summer.

The influence of the recent spell of dry weather is evident at stations 6, 8 & 9 (top graph) and 24 & 25 (bottom graph), where record values have been reached since readings commenced in 2006.

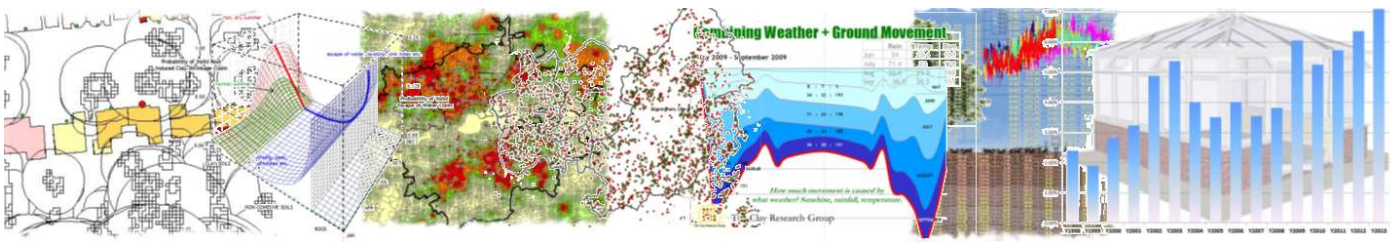
There is also evidence of a persistent deficit at many locations.



Stations 1 – 10



Stations 17 - 25



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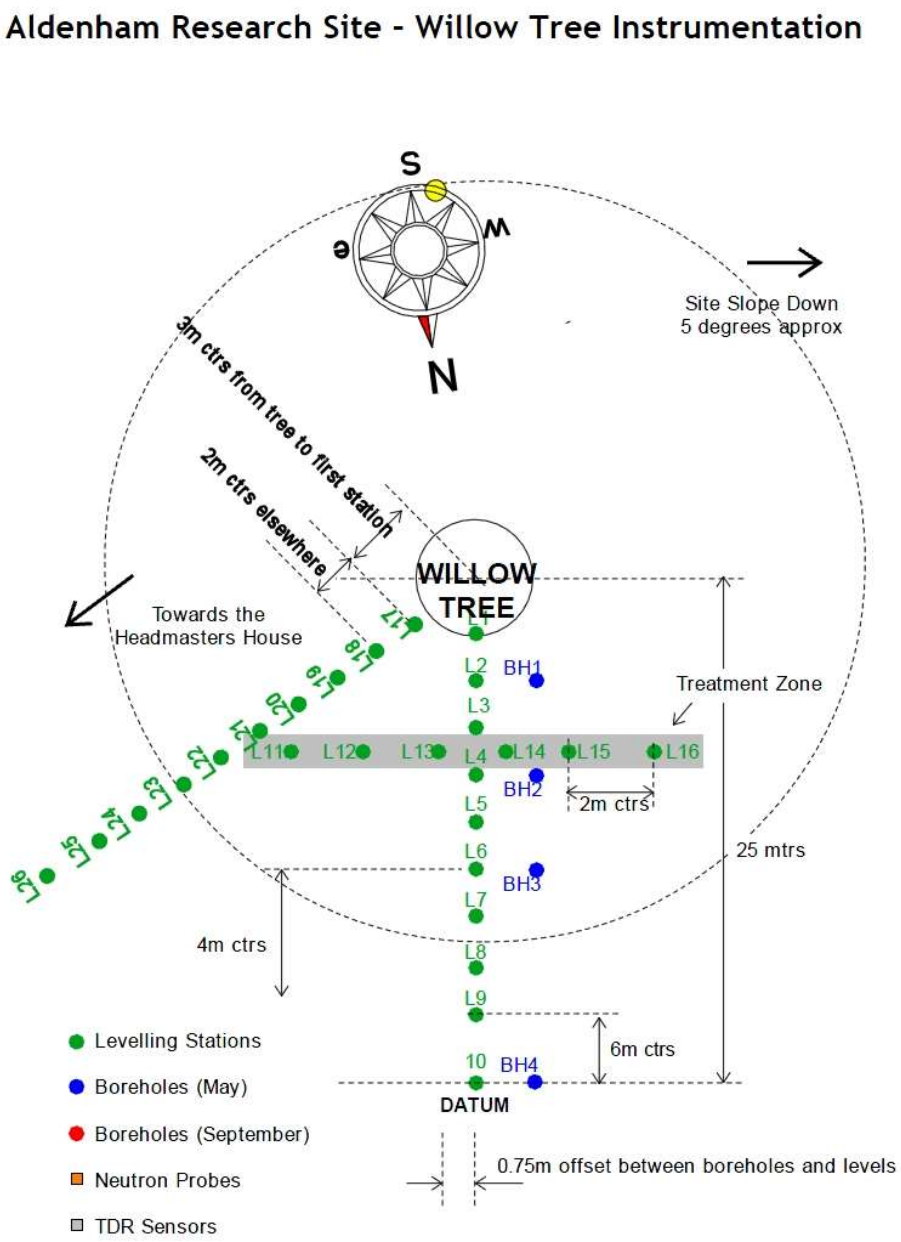
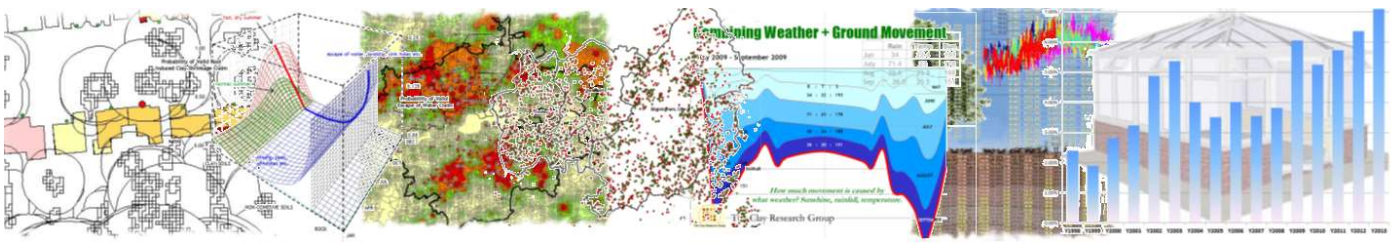


The location of maximum subsidence occurs at the root periphery in both arrays – or at least, stations furthest away from the tree. The exact extent of the roots in both locations has not been established. There has been some recovery at most stations nearest to the tree, although the exact amount of movement is difficult to establish without knowing the moisture deficit when levelling commenced. Maximum recovery (39.6mm) has been recorded at station 1.



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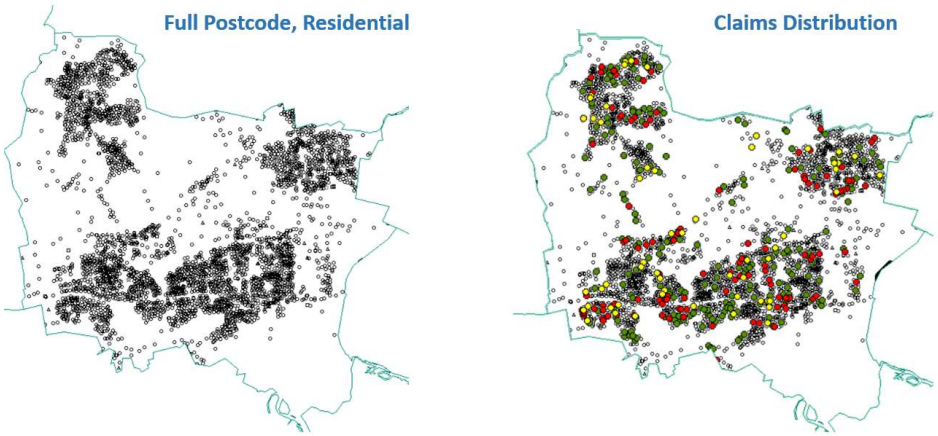
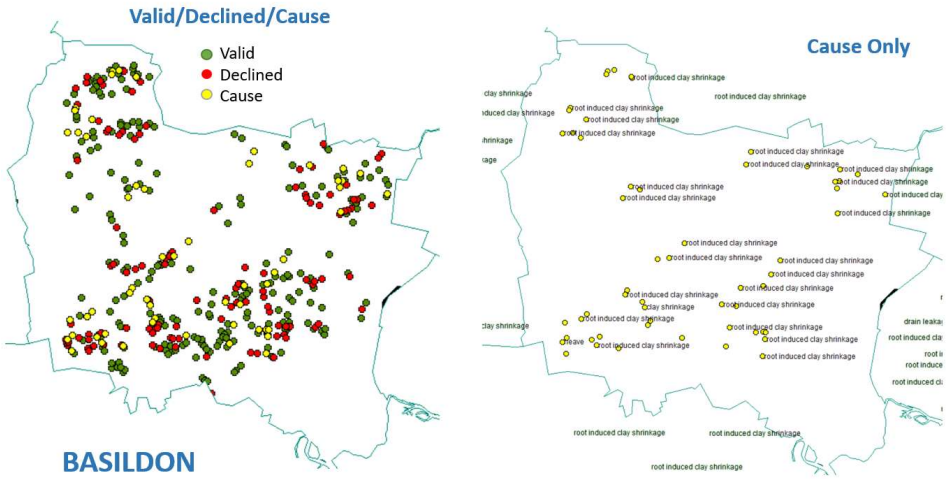
Basildon, Essex – Distributions and Data

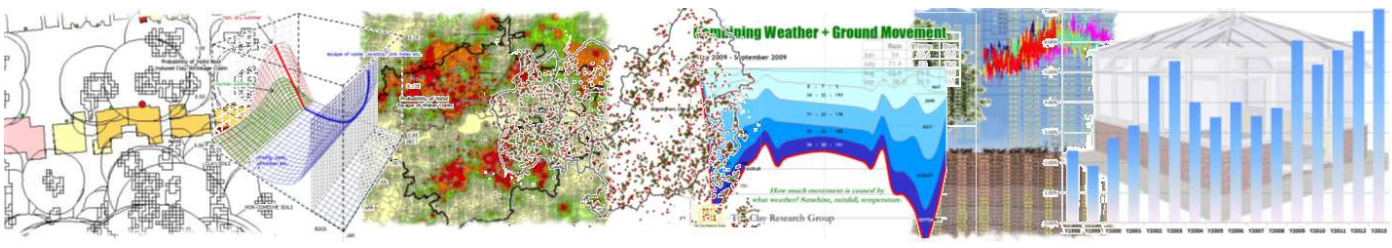
According to the Wikipedia entry, Basildon district has an area of 110km^2, and a population of around 184,000. We estimate that it falls around 30th on the risk table of UK districts. The following maps will naturally be biased for the claim sample we hold.



Left, a map of Basildon postcodes (format "SS14 3DG"), which puts the claim distribution (right) into perspective. Are there areas of particularly high or low risk, and if so, what are the drivers?



Left, the claim distribution by valid and declined, together with cause where available from the underlying data.



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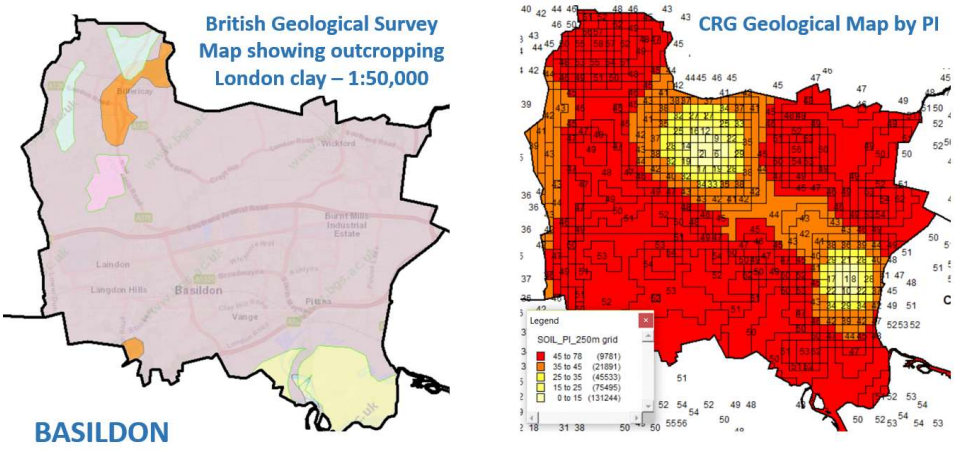
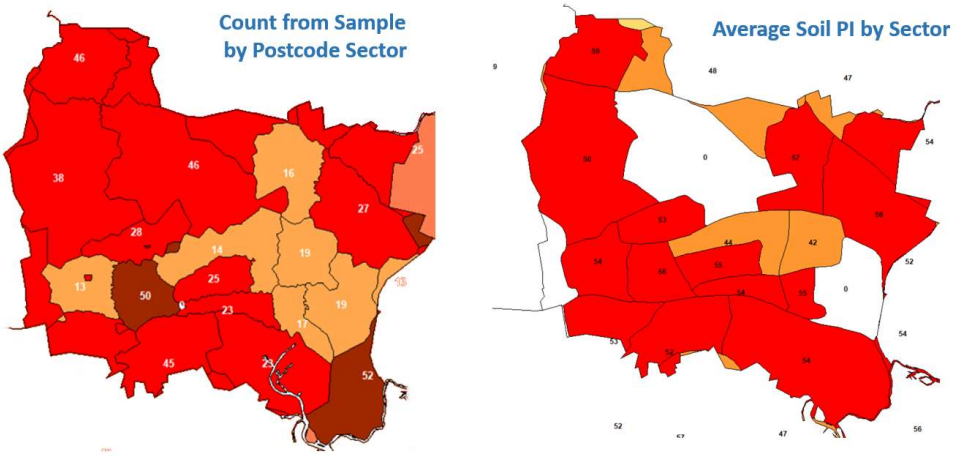
Basildon Study – Geology and Count

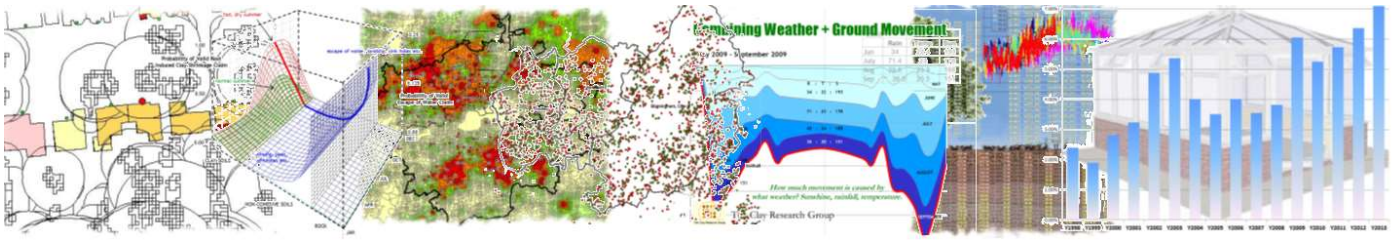
Our claim sample covers a 5-year period, four of which delivered around 30,000 claims annually, and one surge year with 50,000 claims. The district would be rated as being safer if the calculation covered wetter years (say 2012 – 2017) with fewer clay related notifications.



Two geological maps of the area. Left, the British Geological Survey 1:625,000 scale map showing outcropping London clay, and right, the Clay Research Group data mapped on a 250m grid, showing average PI by tile.



Above left, a count of claims from the sample we hold, and right, averaged PI, all by postcode sector.



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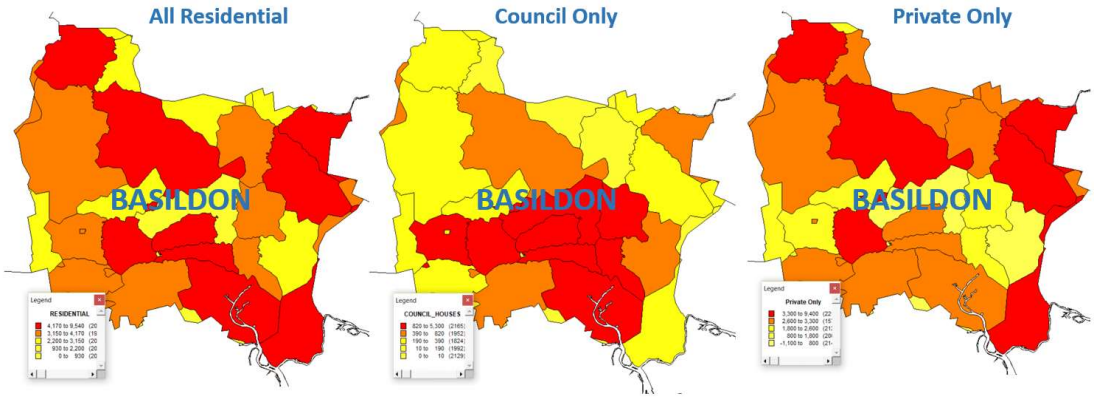
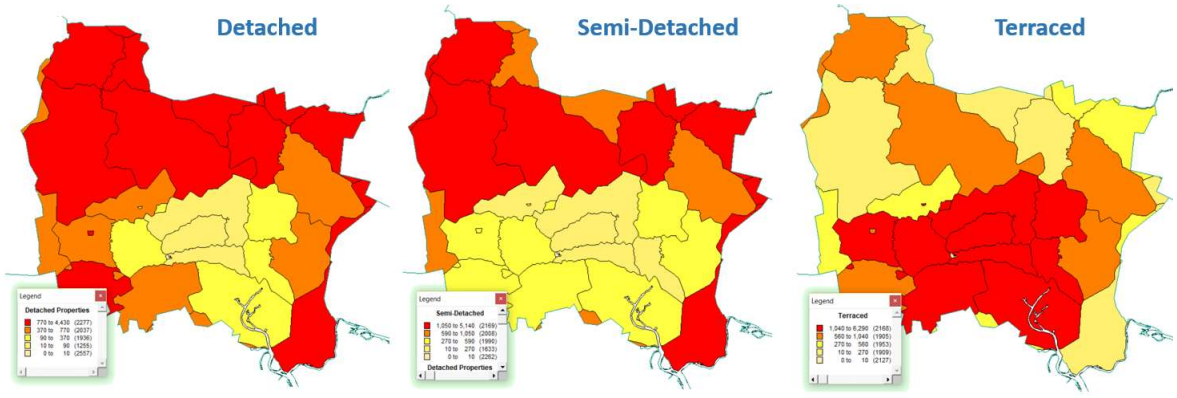
Basildon - Breakdown by Postcode Sector

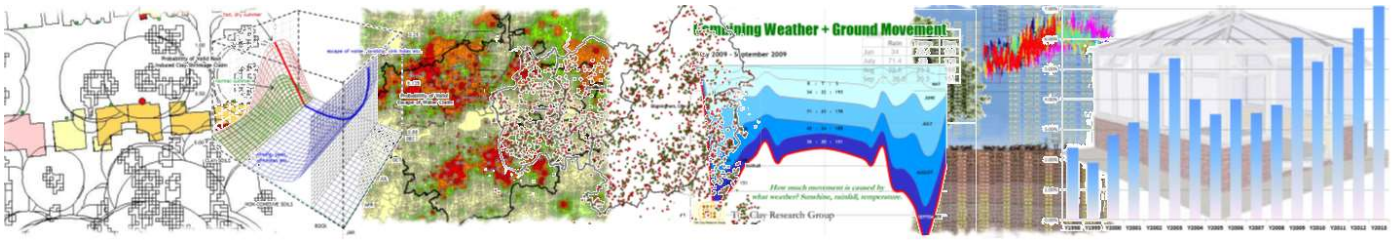
When considering risk, the options are to review a table of postcodes in a database, or to visualise the data using mapping software. Mapping allows the user to see where the risk lies, but also, and perhaps as important, the relationship with other elements. The obvious correlation is the geology of course, but what do the following offer to refine our understanding?



Is ownership an indicator? The maps above suggest that it is, taking into account the likelihood of the properties being insured, which of course is fundamental to understanding insured subsidence risk and exposure.



Is there a link to style of property? Does attachment to another building increase stiffness and reduce risk, or does it make a property more vulnerable?



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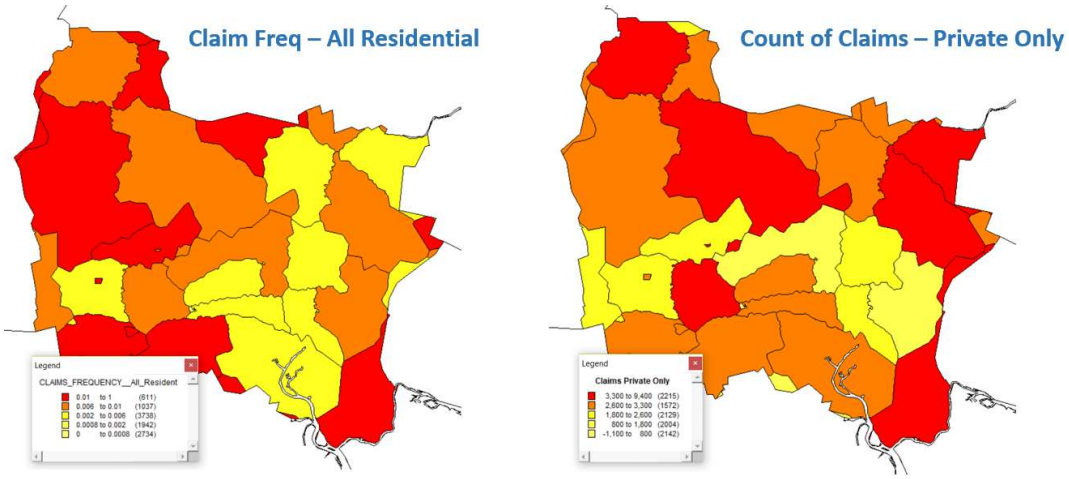
Basildon Risk Assessment

Sometimes the output confuses rather than clarifies, as revealed by the maps below. When the maps plot different data, or use different means of analysis (frequency or count for example), comparing outcomes can be misleading.

Left, the claims frequency for all residential properties, both social and private. Right, a different outcome using the same claims data, but comparing with private houses only. These maps deliver differing outcomes using the same claim data.

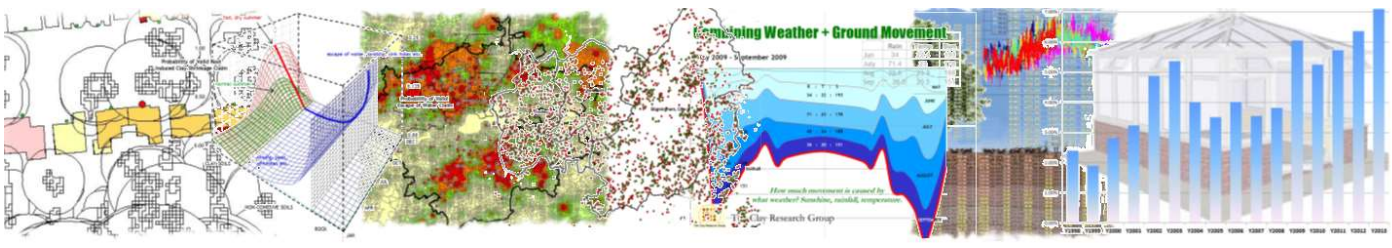


Other maps might plot claim spend, sometimes (but rarely) by season, or compare differing years as described before, some warmer and drier than others.

As mentioned previously, Basildon ranks higher in the risk table following a hot, dry summer than it will using data from mild, cooler and wetter years.

It is also the case that risk maps cover the UK, and seeing districts in isolation doesn't always appear to make sense, even when the underlying data is accurate.

As we see on maps in this newsletter, the rank order in the legend varies considerably. This can depend on the numbers involved, or directed to reveal a particular issue. We try to categorise using quintiles but distributions mean this isn't always possible if the purpose of the shading is to distinguish between specific areas.



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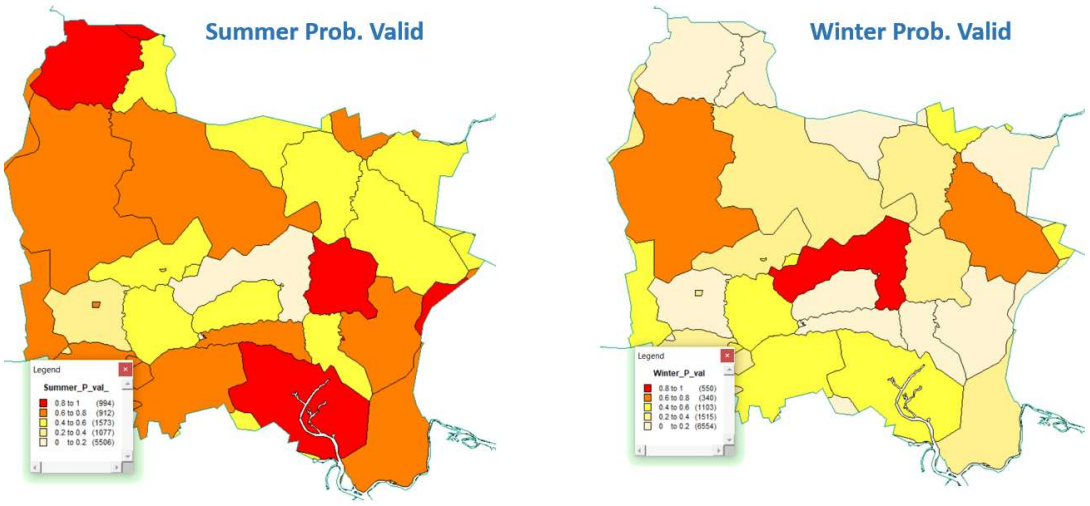
Basildon – by Count, Season, Frequency, Year, District, Sector or Postcode?

Understanding the seasonal component of risk is far easier when we have a map showing the various elements. Due to the presence of outcropping London clay, the likelihood of a claim being valid increases significantly in the summer months which, for our purposes, runs from the middle of July to the middle of November (taking account of late notifications).

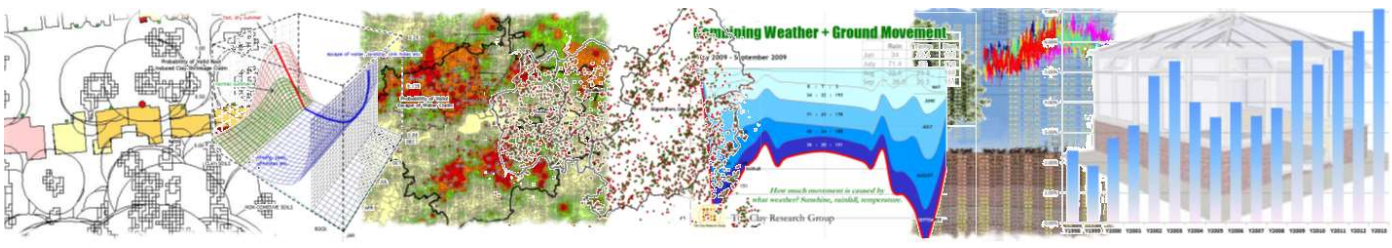


An example of potential ambiguity resulting from differing methods of analysis lies in the "Winter Prob. Valid" map, above right. In the centre lies a red shaded sector which suggests a high probability of a claim being valid if notified in the winter, expressed as frequency.

For the seasonal probability estimates, the frequency is based on valid claims/claims notified, rather than claims/ housing population. See following page for 'claims/houses' figure. In this instance, there was only one claim notified in the red sector, and it was valid. Sample numbers provide a confidence level. The more data available, the higher the confidence in the output.

To confuse matters further, on page 6 the 'count of claims' map shows 14 claim notifications in the subject sector, which includes the summer valid/declined data.

The British Geological Survey 1:50,000 scale map also shows small areas of head deposits in the postcode, comprising a mixture of clay, silt sand and gravel. In short, it may be the case that any claim notified in the winter, in this sector, has a high probability of being valid, but fortunately the chances of a claim being notified at all are small.



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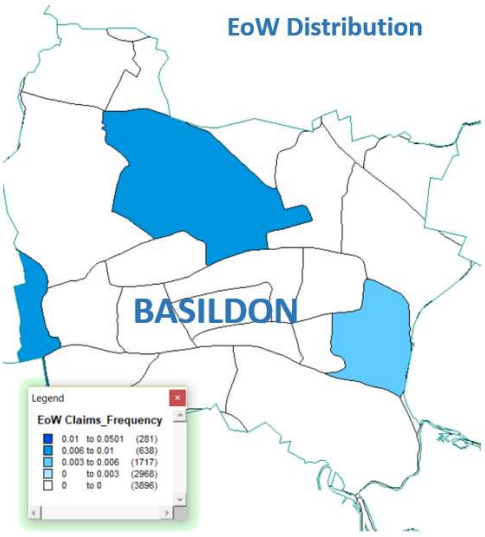
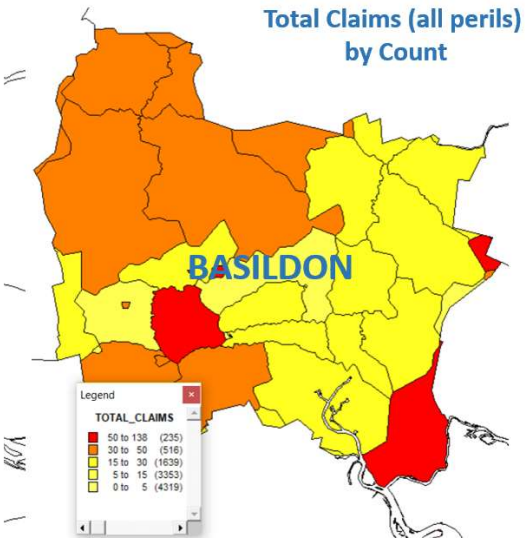
Below, left, distribution of escape of water (EoW) claims by frequency. There are usually fewer EoW claims on outcropping London clay due to its mineralogy, which favours an equilibrium condition, unless of course the soil is dried as a result of root action. The most common cause of EoW claims would be leaking drains softening topsoil or eroding a sand or gravel deposit, combined with shallow foundations.





Above, right, a postcode sector map showing the distribution by count of claim.

The maps revealing risk can seem confusing. Some plot frequency using ‘claims/houses’, others, ‘claims in a particular category/claims notified’ and then we have ‘sector by spend’, or a simple ‘count of claim’. Others may have a ‘count of claim by peril’ or by year, or season.

Finally, the weather skews the results whichever method is used. As we have said before, the data sample reflect four years, each with around 30,000 notifications, and one surge year with 50,000 claims. These figures represent claims notified, of which a variable number will be valid.

In a wetter year, around 20% of claims notified might be valid. In a surge year, that figure increases to something like 80%. And then we have insurer bias introduced by location and distribution and advertising channels. In short, the maps are general guides indicating what can be achieved.