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

August 2023
Issue 219

The Clay Research Group

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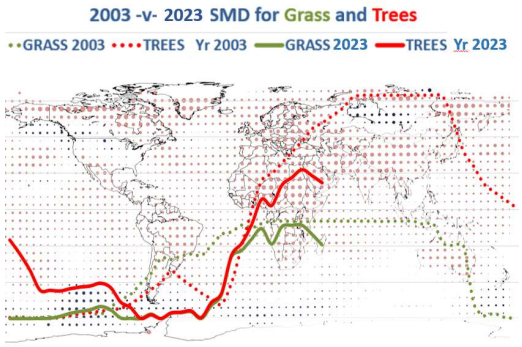
Issue 219, August 2023

Soil Moisture Deficit Update

The Soil Moisture Deficit readings in the last issue were incorrect and have been updated in the graph below.



SMD Data provided by the Met office. Tile 161, Medium Available Water Capacity with grass and tree cover

Contributions Welcome

We welcome articles and comments from readers. If you have a contribution, please Email us at: *clayresearchgroup@gmail.com*

THE CLAY RESEARCH GROUP
www.theclayresearchgroup.org
clayresearchgroup@gmail.com

District and Sector Risk

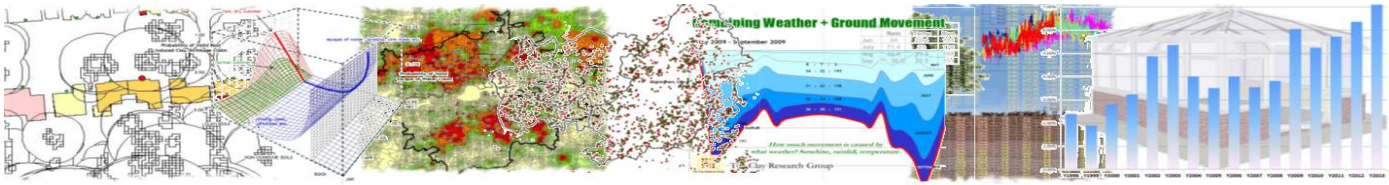
The London Borough of Barking and Dagenham is the topic of the 'Risk by District' series in this month's edition. The borough is situated north of the Thames and has superficial deposits of River Terrace with alluvium bordering the Thames overlying predominantly London clay.

The risk maps are built from a data sample covering four claim years, including one surge and three 'normal' years.

FORTHCOMING EVENTS

TDAG - Part B of 'Trees and the Underground' will take place on 19th July, 2pm. Free registration via Eventbrite: https://www.eventbrite.co.uk/e/trees-and-the-underground-part-b-tickets-592262572297?aff=oddtdtcreator. If you missed Part A, '*Trees and the underground – understanding the conditions, regulations and relationship with utilities*', it is now available on the TDAG website, https://www.tdag.org.uk/past-events.html

Subs Forum Training Day – 12th October, 2023.
https://www.subsidenceforum.org.uk/
To be held at Mythe Barn, Warwickshire.



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Climate Change Induced Ground Movement

Alessandro Rotta Loria, assistant professor of civil and environmental engineering at Northwestern's McCormick School of Engineering has carried out research into the link between global warming and ground movement. His team installed a wireless network of more than 150 temperature sensors above and below ground level across Chicago Loop and considers the implications of climate change but also postulates how the heat generated by buildings, underground services etc., might be captured for re-use.
https://www.sciencedaily.com/releases/2023/07/230711131050.htm

Loss of The Crooked House

Reports in the press describe the loss of The Crooked House shortly after its sale to a private buyer.

The 18th century public house leans more than the Tower of Pisa due to mining subsidence. The left-hand side was around 1.2mtrs lower than the right according to reports in the press.

Circumstances surrounding the loss are currently under investigation by the police and council.

Tree News

Contributions from Keiron Hart of Tamla Trees Ltd.

Protesters have called for the council to halt plans to cut down 35 trees at a popular beauty spot.
https://www.bbc.co.uk/news/uk-england-manchester-66079588

Less than half of the tree planting target in England has been met. *"Report finds government goal to plant 30,000 hectares of woodland by March 2025 unlikely to be achieved."*
https://www.theguardian.com/environment/2023/jul/19/half-annual-tree-planting-target-england-met-mp-report

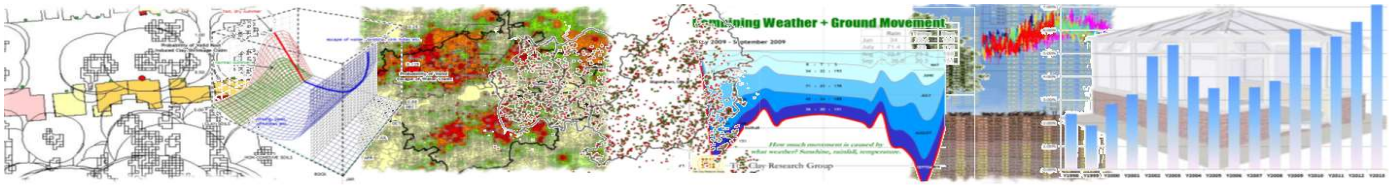
A ten-year plan to enhance and protect Somerset trees.
https://www.somerset.gov.uk/somerset-tree-strategy-takes-root/

"The boss of Astra Zeneca, Pascal Soriot, has pledged that the company is to invest £310m to plant 200 trees by 2030."
https://www.theguardian.com/environment/2023/jun/28/astrazeneca-pledges-to-plant-and-maintain-200m-trees-globally-by-2030

"A plaque recognising the actions of campaigners who fought to save threatened trees in Sheffield will be installed by the city council in 2024.
https://www.bbc.co.uk/news/uk-england-south-yorkshire-65976309

Trees Lost

An article in The Times reports that over half-a-million trees planted as part of highway works have died over the last 5 years. The number lost is around 30.4% of those planted to compensate for mature trees felled as part of highway projects. This figure, provided by National Highways, only takes account of 9 out of 38 projects undertaken, so the actual figure is far higher.



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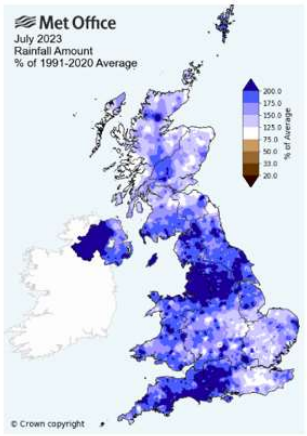
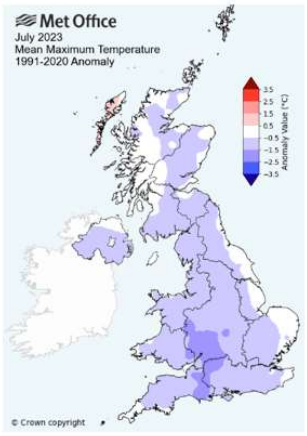
Surge Years

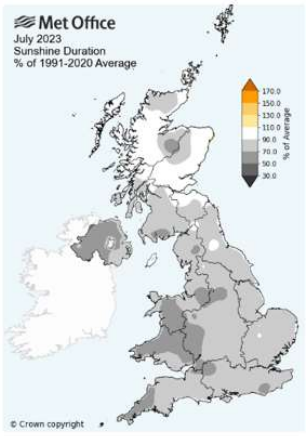
Surge years are defined as those receiving 30% more claims than preceding years. They are shown in the graph below with the 'y' axis plotting the difference. As subsidence was added to the policy in 1970, perhaps seeing 1976 at the head of the list isn't surprising as people became aware of the peril, even though claim numbers were relatively low at around 20,000. This compares with a count of 55,400 claims in 2003. The more recent surge years have claim counts of around 23,000 each.

Met Office July 2023 Update.
Anomaly Data, 1991 – 2020

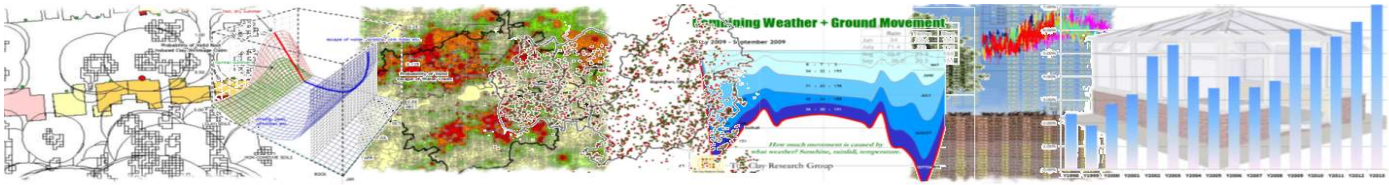
Anomaly maps from the Met Office web site reproduced below. Compared with averages for the period 1991 – 2020, July delivered increased rainfall, cooler temperatures and less sunshine across the UK. Based on the figures, we would not anticipate a subsidence surge this year.







https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-actual-and-anomaly-maps



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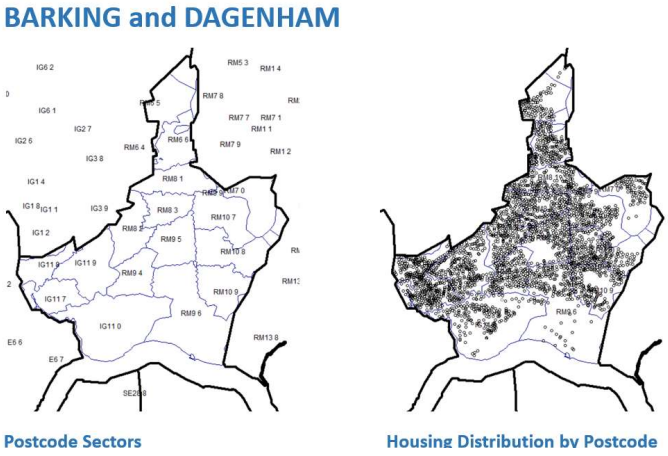
Subsidence Risk Analysis – BARKING and DAGENHAM

Barking and Dagenham is a borough in east London occupying an area of 36.09km^2 with a population of around 212,000.



Distribution of housing stock using full postcode as a proxy. Each sector covers around 2,000 houses on average across the UK and full postcodes include around 15 – 20 houses on average, although there are large variations.

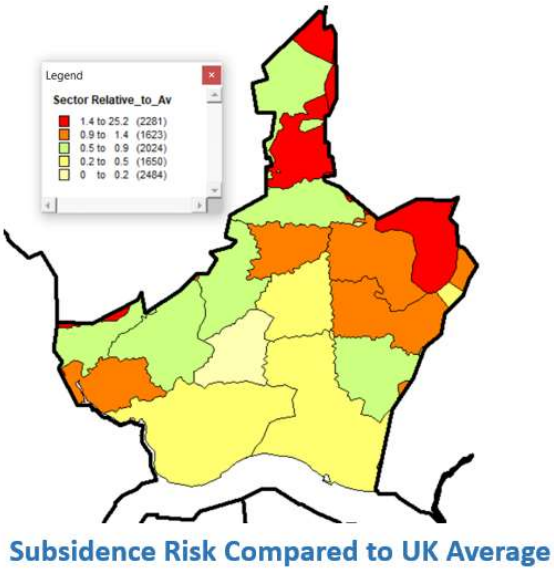
Sector and housing distribution across the district (left, using full postcode as a proxy) helps to clarify the significance of the risk maps on the following pages. Are there simply more claims in a sector because there are more houses?

Using a frequency calculation (number of claims divided by private housing population) the relative risk across the borough at postcode sector level is revealed, rather than a 'claim count' value.

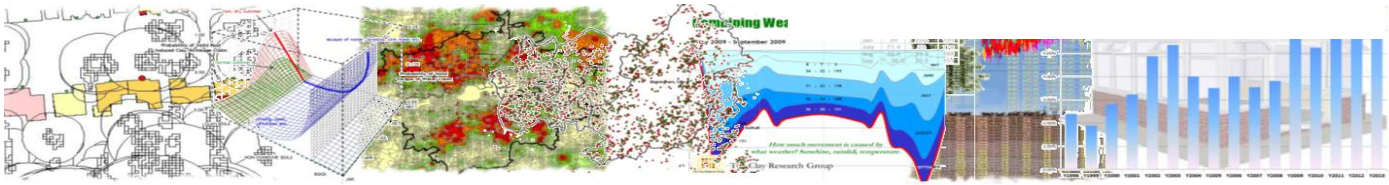
From the sample we hold, sectors are rated for the risk of domestic subsidence compared with the UK average – see map, right.

Barking and Dagenham is rated 284th out of 413 districts in the UK from the sample analysed and is around 0.648x the risk of the UK average, or 0.168 on a normalised 0 - 1 scale.

There is a varied risk across the borough as can be seen from the sector map, right, which reflects the varied geology with non-cohesive drift deposits overlying predominantly London clay.



Barking and Dagenham district is rated around 0.648 times the UK average risk for domestic subsidence claims from the sample analysed.



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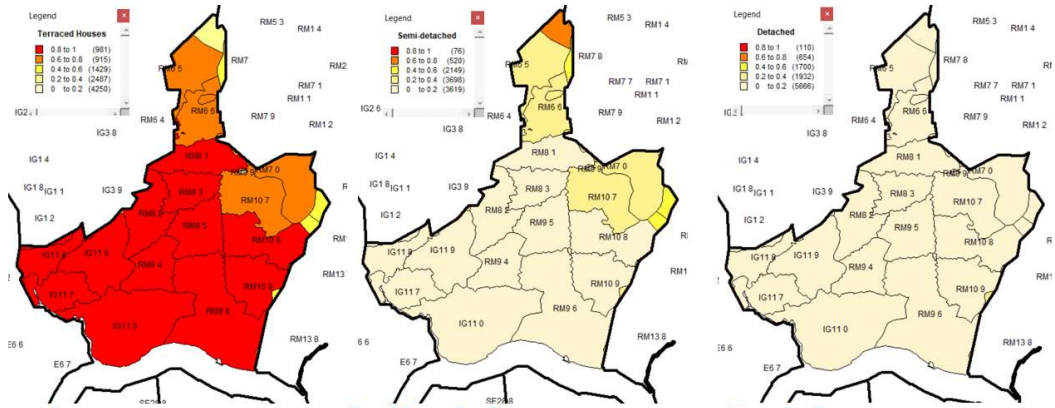
BARKING and DAGENHAM - Properties by Style and Ownership

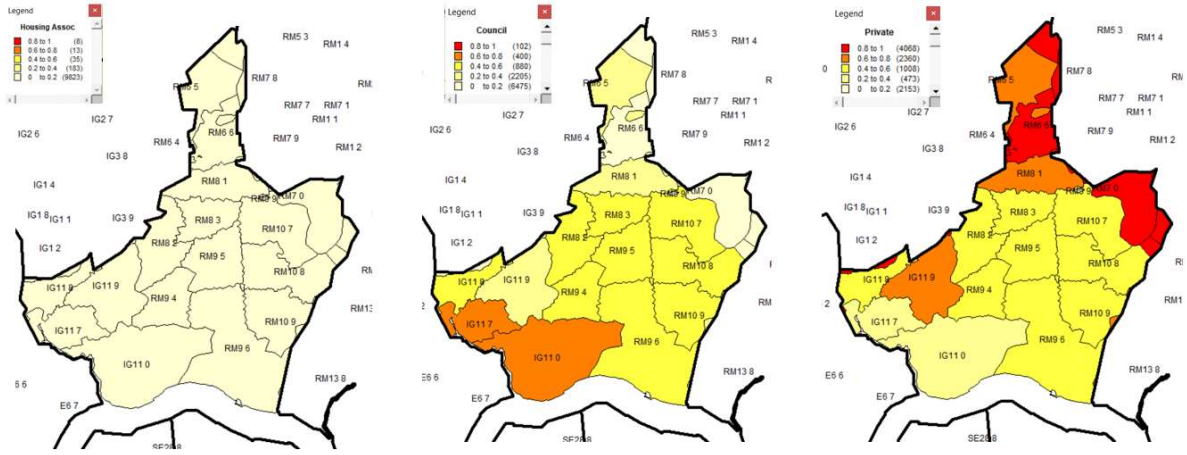
Below, the general distribution of properties by style of construction, distinguishing between terraced, semi-detached and detached. Unfortunately, the more useful data is missing at sector level – property age. Risk increases with age of property and the model can be further refined if this information is provided by the homeowner at the time of application.

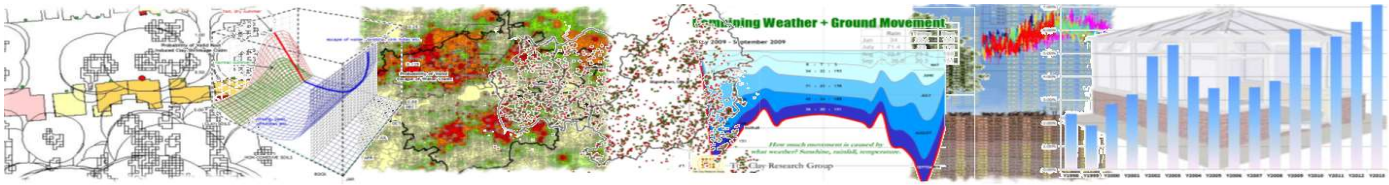
BARKING and DAGENHAM - Distribution by House Type



Distribution by ownership is shown below. Terraced properties are the dominant class with private ownership increasing to the north of the borough.

BARKING and DAGENHAM - Distribution by Ownership





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Subsidence Risk Analysis – BARKING and DAGENHAM

Below, extracts from the British Geological Survey low resolution 1:625,000 scale geological maps showing the solid and drift series. View at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html for more detail.

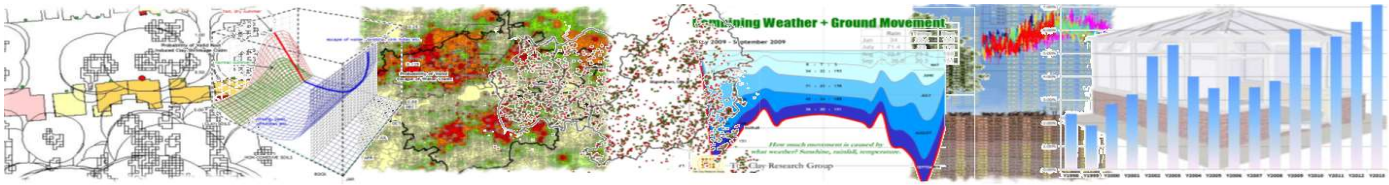
See page 9 for a seasonal analysis of the sample which reveals that, at district level, there is around a 60% probability of a claim being valid in the summer and, of the valid claims, there is around a 50% chance that the damage will have been caused by an escape of water – leaking drains etc., with clay shrinkage accounting for the remaining 50%. In the winter the likelihood of a claim being valid is around 70% - and if valid, there is an equal chance of the cause being an escape of water or clay shrinkage. This reflects the geology – variable depths of river terrace and alluvium overlying London clay.

Maps at the foot of the following page plot the seasonal distribution.

BARKING and DAGENHAM : BGS Geology – 1:625,000 scale

DRIFT DEPOSITS **SOLID GEOLOGY**

Above, extracts from the 1:625,000 series British Geological Survey maps. Working at postcode sector level and referring to the 1:50,000 series delivers far greater benefit when assessing risk.



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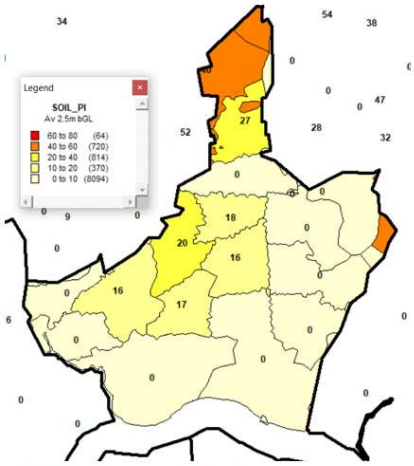
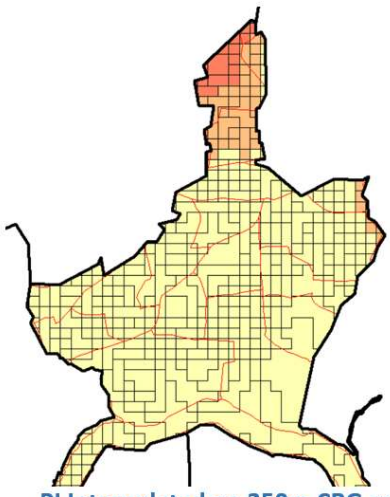
Liability by Geology and Season

Below, the average PI by postcode sector (left) derived from site investigations and interpolated to develop the CRG 250m grid (right). The higher the PI values, the darker red the CRG grid.

BARKING and DAGENHAM– Soil Plasticity Index



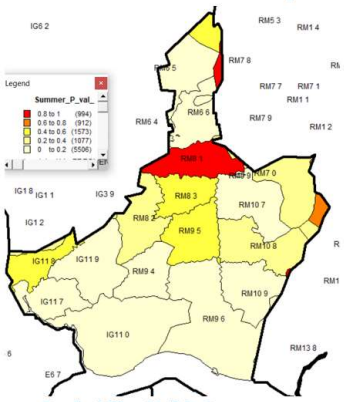
Soil PI Averaged by Sector



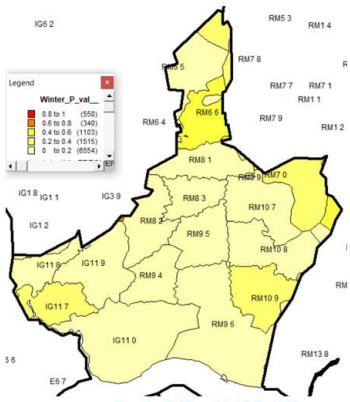
PI Interpolated on 250m CRG grid

Zero values for PI in some sectors may reflect the absence of site investigation data - not necessarily the absence of shrinkable clay. A single claim in an area with low population can raise the risk as a result of using frequency estimates.

BARKING and DAGENHAM – by season



Probability Valid, Summer

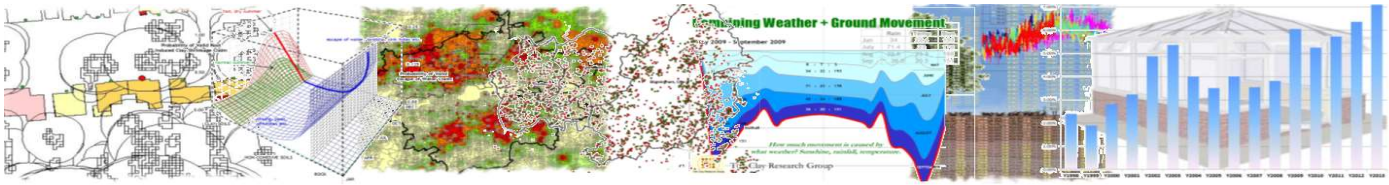


Probability Valid, Winter

The maps, left, show the seasonal difference from the sample used.

Combining the risk maps by season and reviewing the table on page 9 is perhaps the most useful way of assessing the potential liability, likely cause and geology using the values listed.

The 'claim by cause' distribution and the risk posed by the soil types is illustrated at the foot of the following page. A high frequency risk can be the product of just a few claims in an area with a low housing density of course and claim count should be used to identify such anomalies.



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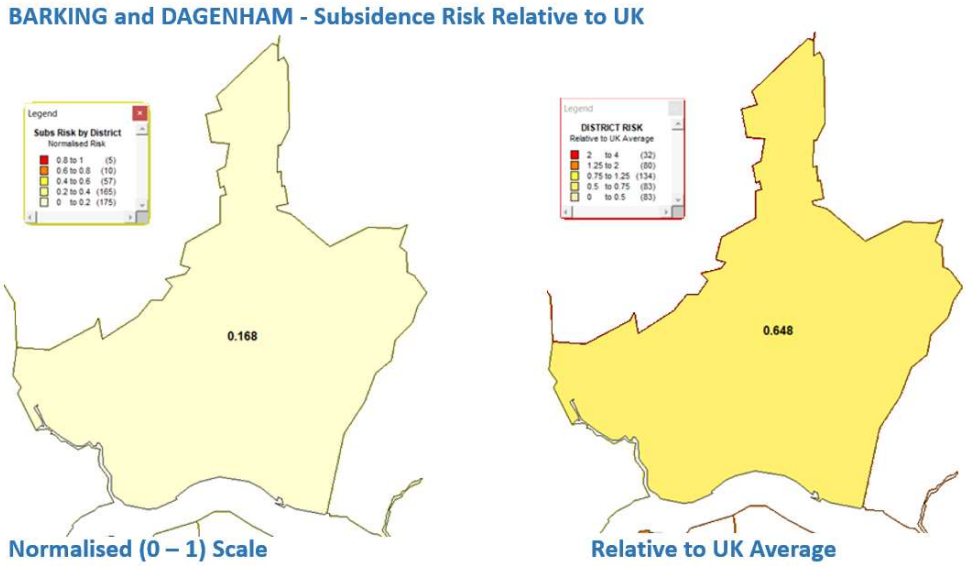
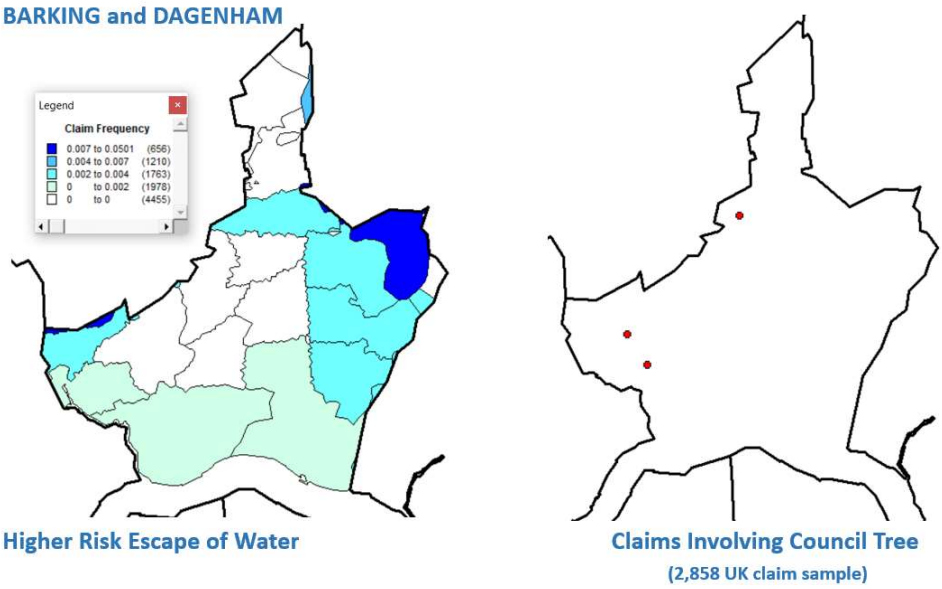
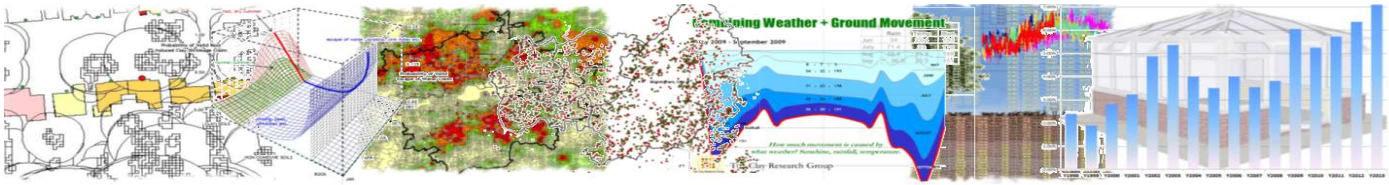
District Risk -v- UK Average. EoW and Council Tree Risk.



Below, left, mapping the frequency of escape of water claims confirms the presence of non-cohesive soils bordering the Thames - deposits of River Terrace and alluvium, sands and gravels etc. As we would expect, the 50,000 scale BGS map provides a more detailed picture. The CRG 1:250 grid reflects claims experience.

Below right, map plotting claims where damage has been attributable to vegetation in the ownership of the local authority from a sample of around 2,858 UK claims. Although the superficial geology is largely non-cohesive, claims suggest shallow deposits in these locations.





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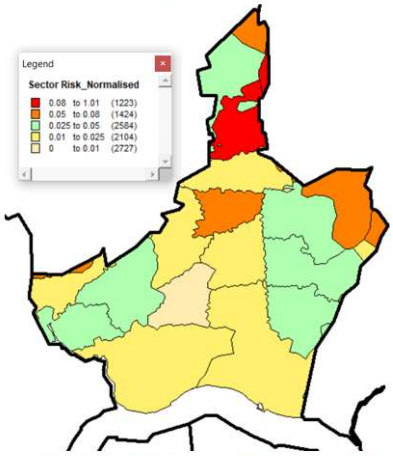
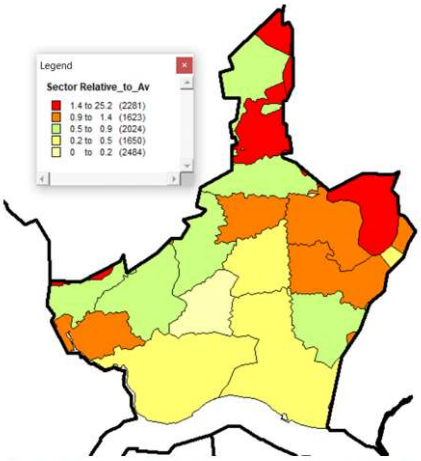
BARKING and DAGENHAM - Frequencies & Probabilities

Below, mapping the risk of subsidence by ownership. Claims frequency including council and housing association properties delivers a misleading value of risk as they tend to self-insure. The following show the normalised risk taking account of the private housing population.

Normalised Risk by Sector – BARKING and DAGENHAM



Normalised Subsidence Risk – scale 0 – 1



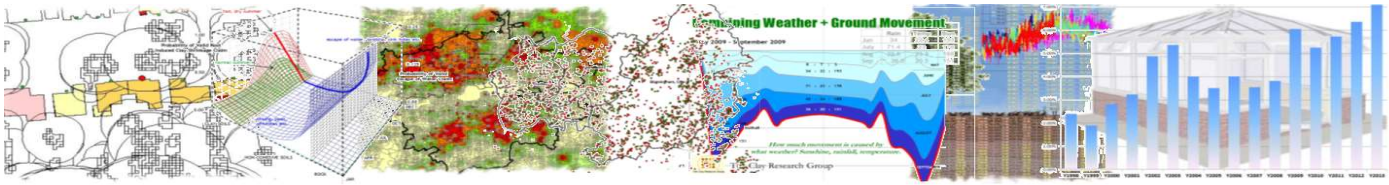
Subsidence Risk Compared to UK Average

On a general note, a reversal of rates for valid-v-declined by season is a characteristic of the underlying geology. For clay soils, the probability of a claim being declined in the summer is usually low, and in the winter, it is high.

Valid claims in the summer are likely to be due to clay shrinkage, and in the winter, escape of water. For non-cohesive soils, sands, gravels etc., the numbers tend to be fairly steady throughout the year.

Liability by Season - BARKING and DAGENHAM

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Barking and Dagenham	0.300	0.300	0.401	0.35	0.35	0.302



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Aggregate Subsidence Claim Spend by Postcode Sector and Household in Surge & Normal Years

The maps below show the aggregated claim cost from the sample per postcode sector for both normal (top) and surge (bottom) years. The figures will vary by the insurer's exposure, claim sample and distribution of course.

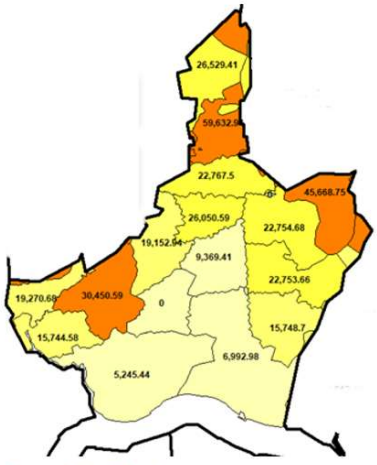
NORMAL YEAR SPEND - BARKING and DAGENHAM

Spend by Sector

Spend Averaged over Housing Population

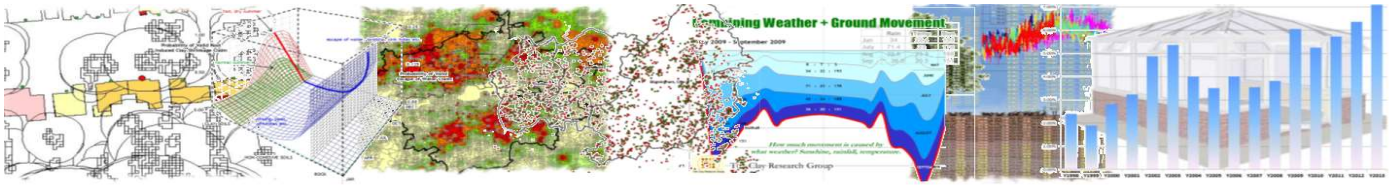
It will also be a function of the distribution of vegetation and age and style of construction of the housing stock. The images to the left in both examples (above and below) represent gross sector spend and those to the right, sector spend averaged across housing population to derive a notional premium per house for the subsidence peril. The figures can be distorted by a small number of high value claims.

SURGE YEAR SPEND – BARKING and DAGENHAM



Spend by Sector

Spend Averaged over Housing Population



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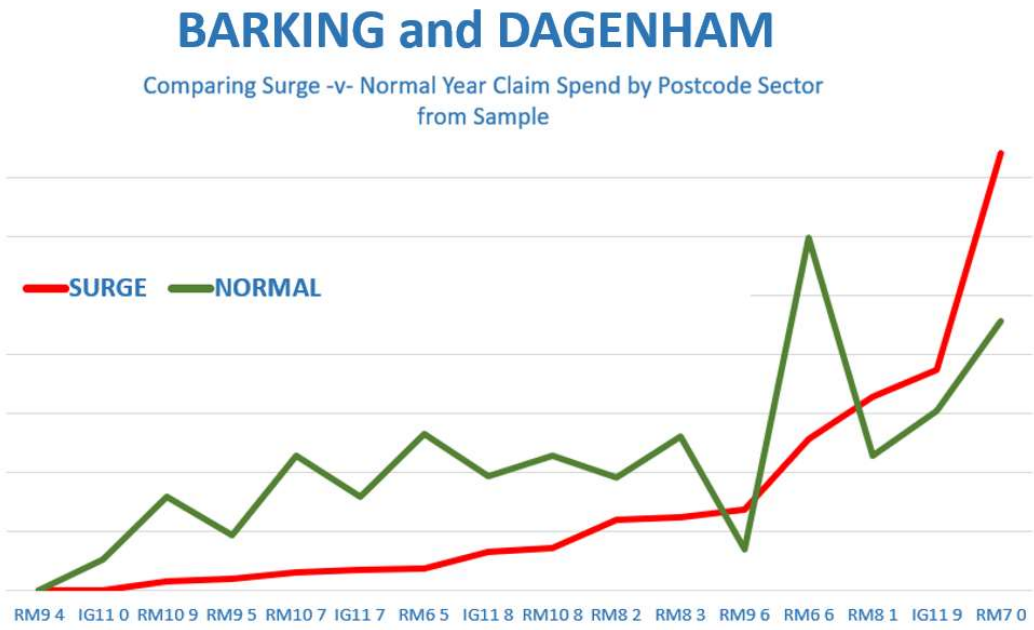

The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

It is of course the case that a single expensive claim (a sinkhole for example) can distort the outcome using the above approach. With sufficient data it would be possible to build a street level model.

In making an assessment of risk, housing distribution and count by postcode sector play a significant role. One sector may appear to be a higher risk than another based on frequency, whereas basing the assessment on count may deliver a different outcome. This can also skew the assessment of risk related to the geology, making what appears to be a high-risk series less or more of a threat than it actually is.

The models comparing the cost of surge and normal years are based on losses for surge of just over £400m, and for normal years, £200m.