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

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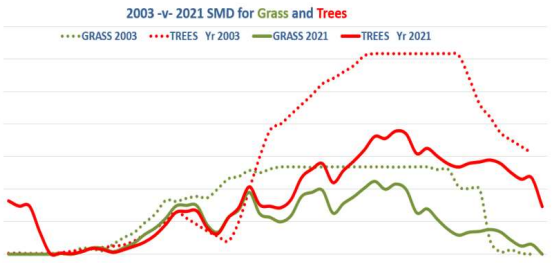
The Clay Research Group

CONTENTS

SMD Review - 2021



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

Soil Moisture Deficit data comparing tree and grass cover profiles for 2021 with 2003 - a surge year.

In next month's edition we will compare weather profiles for the two years to improve our understanding of the driving factors behind surge.

Contributions Welcome

We welcome articles and comments from readers. If you have a contribution, please Email us at:

clayresearchgroup@gmail.com

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Joint Mitigation Protocol

Following Andrea Plucknett's article in last month's edition we were wondering if anyone had any experience of how the Joint Mitigation Protocol was faring and whether the various parties involved in resolving council tree claims were following the recommended procedure? We welcome hearing from anyone with experience of the topic.

Tree Murderer Update

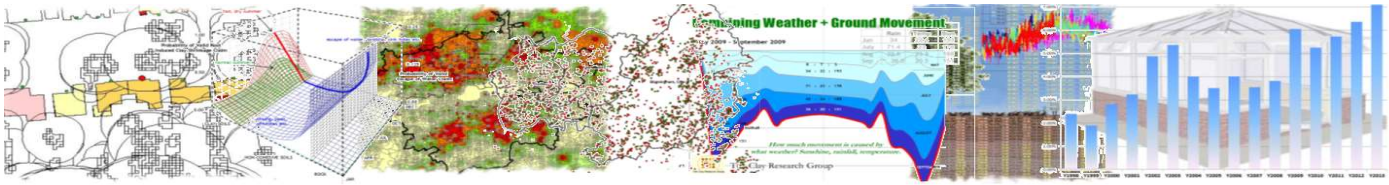
Update from the article in last month's edition reporting on the trial of an 'arrogant' homeowner (the judge's words) who killed a protected tree because it stood in the way of a lucrative property deal.

In 2016 the retired chartered accountant agreed to sell his large detached home near Poole Harbour to a developer who wanted to demolish it and build a block of luxury flats.

Robert Page, 71, formed an "irrational dislike" of the 65ft Monterey Pine and was "determined" to destroy it after he unsuccessfully applied five times to have it felled legally.

Page stood to make £100,000 from the deal but planning permission was refused, partly because of the public amenity value of the evergreen in his front garden which was protected by a tree preservation order (TPO).

Page has been ordered to pay a total of £80,000 – £50,000 for the amount his property has risen in value by the loss of the tree, £5,000 for loss to the public benefit and £25,000 court costs.



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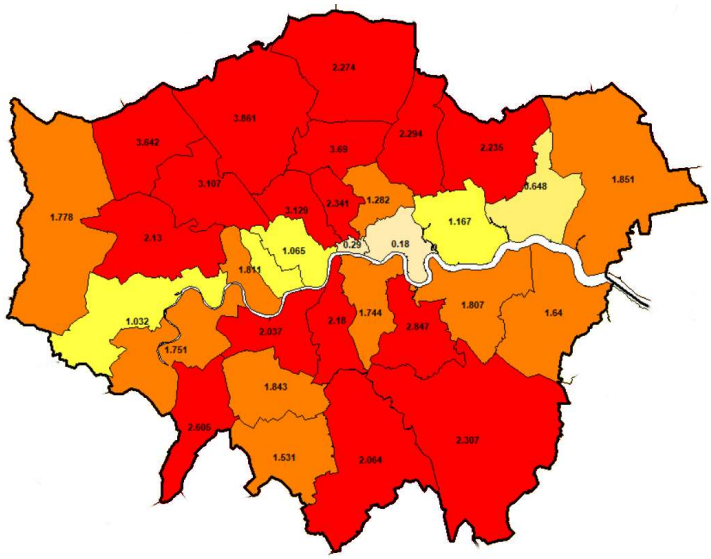
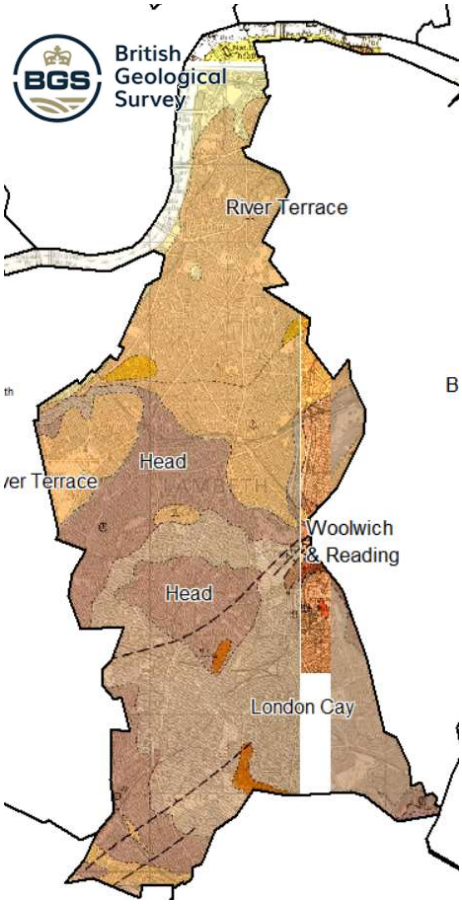
LAMBETH – Subsidence Risk Assessment

Lambeth is a London borough situated immediately to the south of the Thames. It occupies an area of 26.8km^2 with a population of around 330,000.

The map, right, shows its location and below a map showing the risk by borough compared with the UK average.

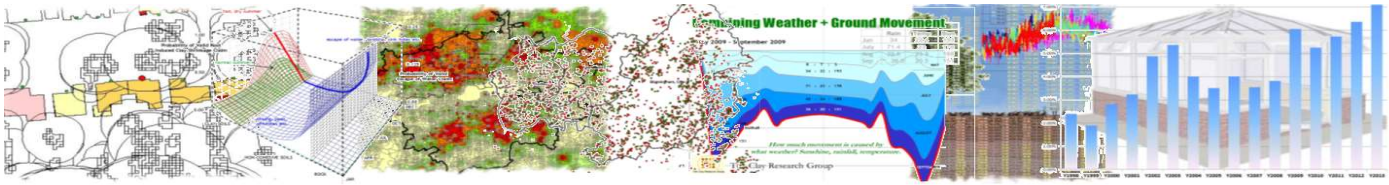
The subsidence claims frequency from the sample used suggests the borough is around twice as risky as the UK average and around the average for the London area (see map below), variable by year (normal or surge) and season.





Right, extract from the British Geological Survey 1:50,000 scale map revealing River Terrace to the north of the borough adjoining the Thames, and outcropping London clay to the south with areas of Head deposits.

The geology accounts for the 'by Season' variation in claim distribution on page 6 and the 'escape of water' risk map on page 7.



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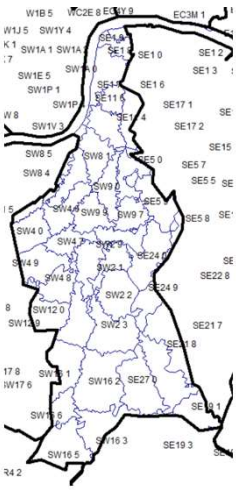
Subsidence Risk Analysis – LAMBETH



Postcode Sectors

Housing Distribution by Full Postcode

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

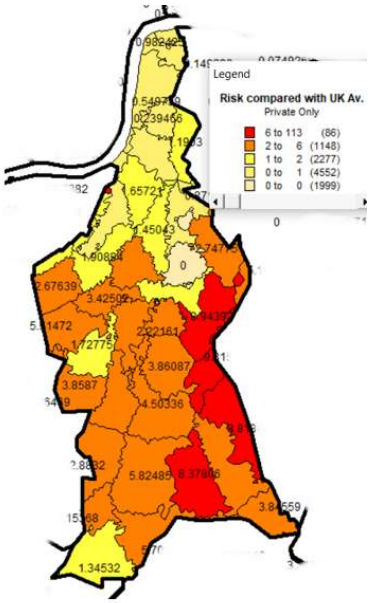
From the sample we have, sectors are rated for the risk of domestic subsidence compared with the UK average – see map, right.

Lambeth is in the top 25 of 413 districts in the UK from the sample analysed and is around 2.18x the risk of the UK average, or 0.56 on a normalised scale.

The distribution varies considerably across the borough as can be seen from the sector map.

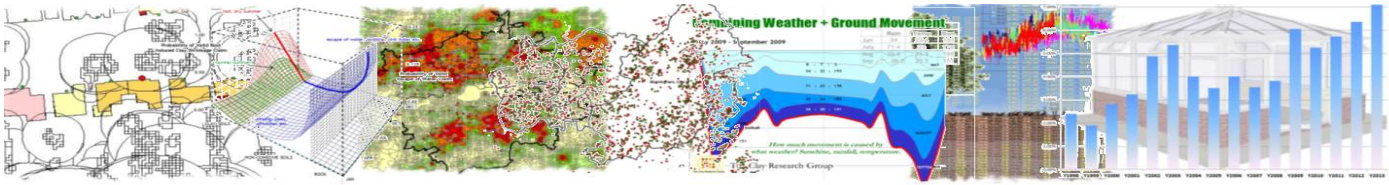
Housing distribution across the district (left, using full postcode as a proxy) helps to clarify the significance of the risk maps on the following pages. Are there simply more claims in a sector because there are more houses?

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.



Postcode Sector Risk

Risk compared with UK Average.
Lambeth is rated around 2.18 times the UK average risk for domestic subsidence claims from the sample analysed. Above, risk by sector.



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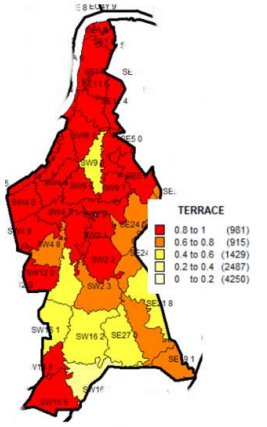
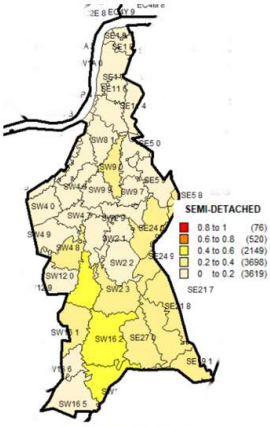
LAMBETH - Properties by Style and Ownership

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.

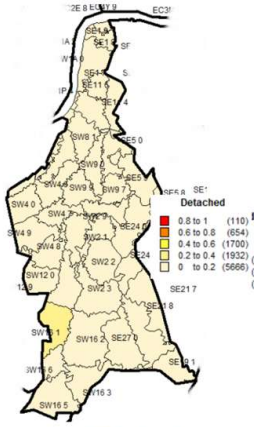
DISTRIBUTION BY HOUSE TYPE – LAMBETH



Terraced



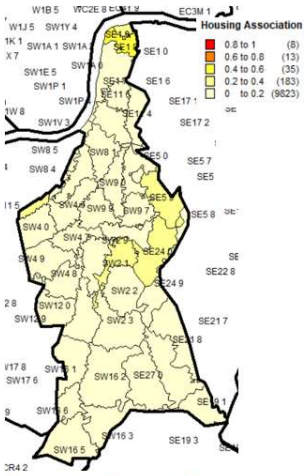
Semi-Detached



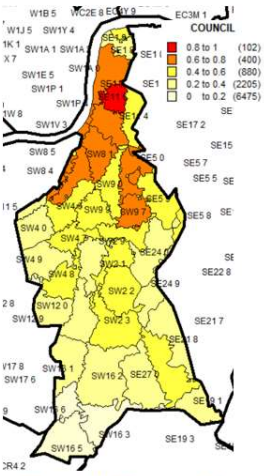
Detached

Distribution by ownership is shown below. Privately owned properties are prevalent to the south, situated on London clay. Council ownership is denser towards the north of the borough.

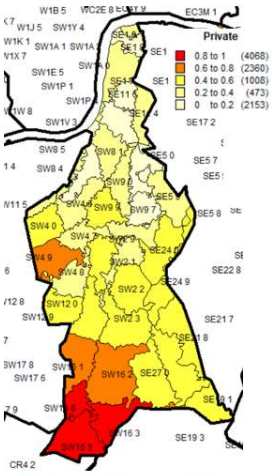
DISTRIBUTION BY OWNERSHIP – LAMBETH



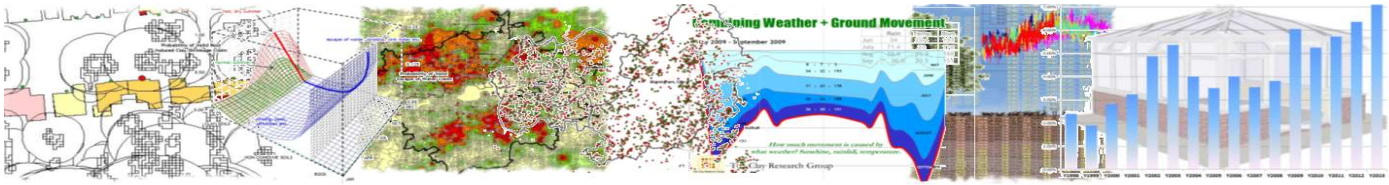
Housing Association



Council Ownership



Private Ownership



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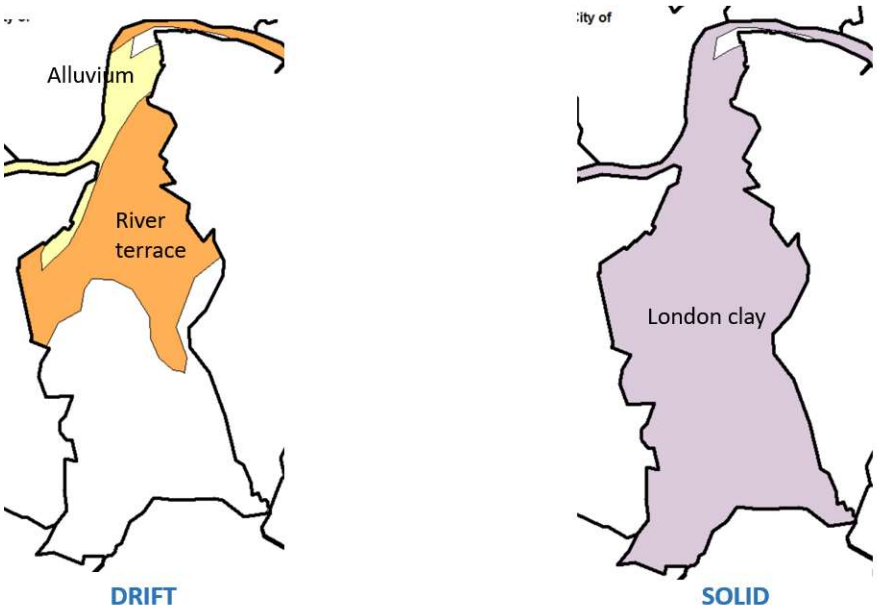
Subsidence Risk Analysis – LAMBETH

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.

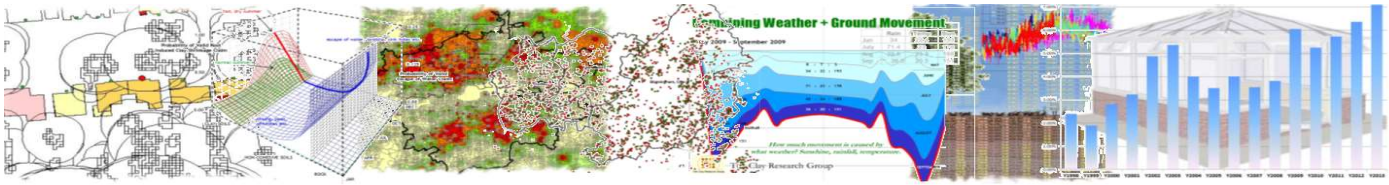
See page 12 for a seasonal analysis of the sample we hold which reveals that in the summer there is a greater than 70% probability of a claim being valid, and of the valid claims, there is a high probability (greater than 80% in the sample) that the cause will be clay shrinkage.

In the winter the situation reverses. The likelihood of a claim being declined is around 70% and if valid, there is greater than 80% probability the cause will be due to an escape of water. Maps at the foot of Page 8 shows the seasonal distribution.

1:625,000 scale British Geological Survey Maps



1:625,000 series British Geological Survey maps. Working at postcode sector level and referring to the 1:50,000 series maps (see sample on page 2) deliver far greater benefit when assessing risk. The geology suggests that subsidence associated root induced clay shrinkage is the dominant cause to the south of the borough (outcropping London clay) and escape of water (leaking drains and water services washing away non-cohesive soils) claims to the north.



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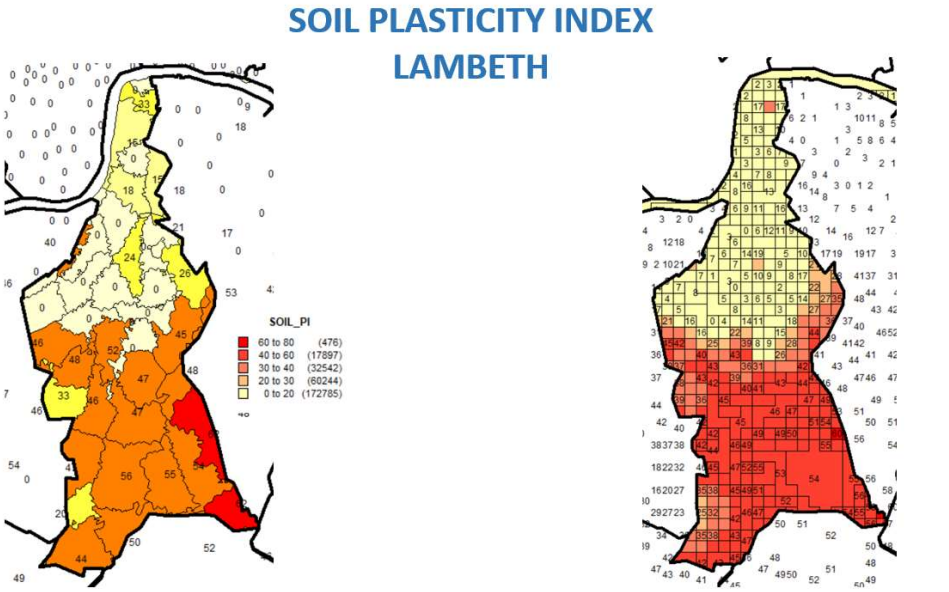
Liability by Geology and Season

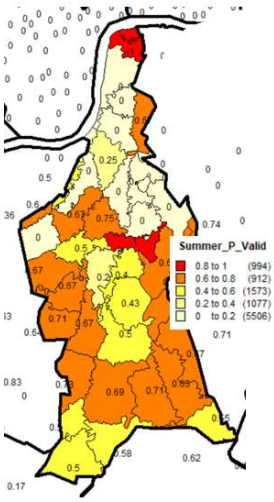
Below, the average PI by postcode sector (left) derived from site investigations and interpolated to develop the CRG 250m grid (right). The distribution of a shrinkable clay in the CRG model resembles the BGS maps on the previous page. The higher the PI values, the darker red the CRG grid.



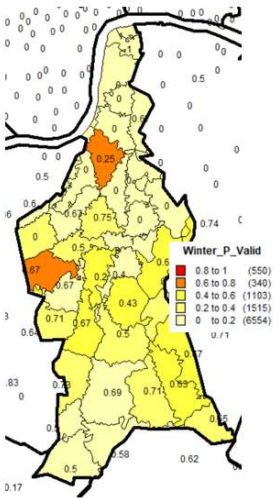
Soil PI Averaged by Sector

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.



Probability Valid, Summer

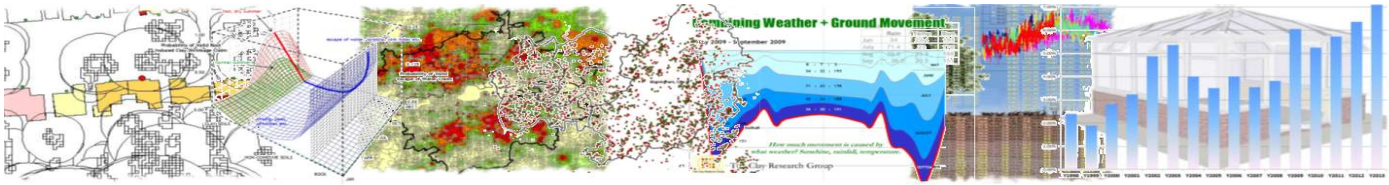


Probability Valid, Winter

Mapping the risk by season (table at foot of page 10) is perhaps the most useful way of assessing the likely cause, potential liability and geology using the values listed.

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

The probability of a claim being valid increases in the summer months for properties on outcropping clay soils and decreases in the winter.



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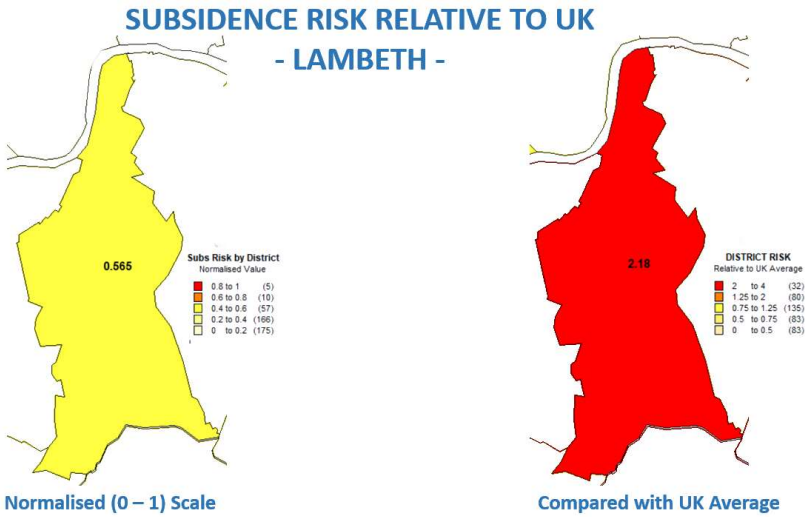
District Risk -v- UK Average. EoW and Council Tree Risk.

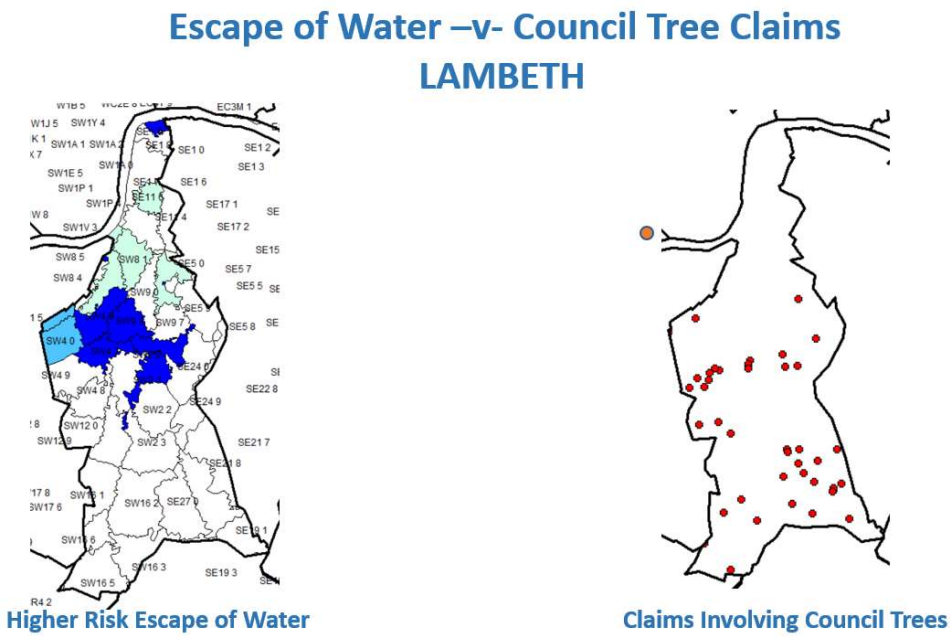


Normalised (0 – 1) Scale

Compared with UK Average

Below, left, mapping the frequency of escape of water claims reflects the presence of sands and gravels. The absence of shading often indicates a low frequency rather than the absence of claims.

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. Tree locations correspond with the presence of London clay.

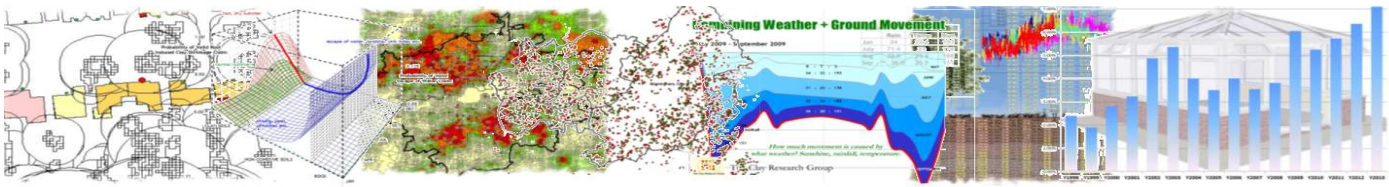


Higher Risk Escape of Water

(17,852 claim sample)

Claims Involving Council Trees

(2,858 claim sample)



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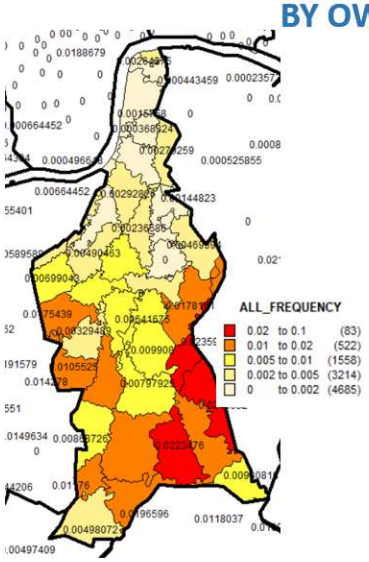
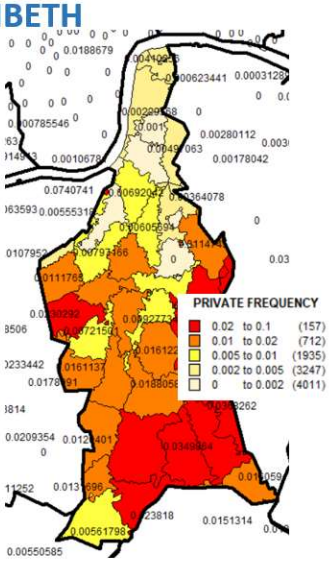
LAMBETH - Frequencies & Probabilities

Mapping claims frequency against the total housing stock by ownership, (left council and housing association combined and right, private ownership only), reveals the importance of understanding properties at risk by portfolio. There are several sectors in the 'private only' map with an increased risk.

POSTCODE SECTOR SUBSIDENCE RISK (FREQUENCY)
BY OWNERSHIP – LAMBETH



Combined Public and Private Frequency

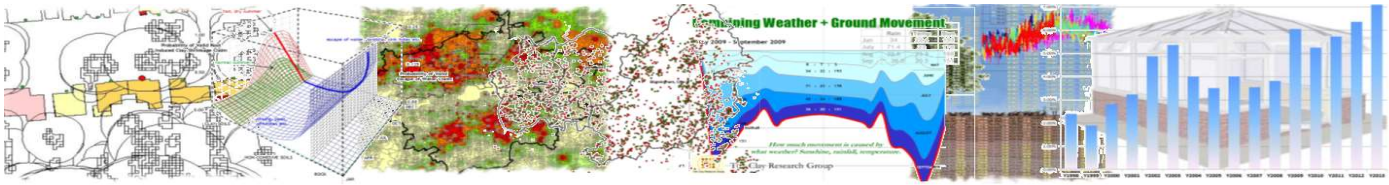


Private Only

On a general note, the 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 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 lower throughout the year, with an increase in the winter months.

Liability by Season - LAMBETH

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Lambeth	0.661	0.107	0.233	0.04	0.27	0.69



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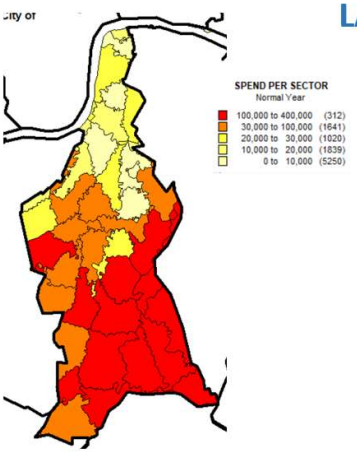
Aggregate Subsidence Claim Spend by Postcode Sector and Household in Surge & Normal Years

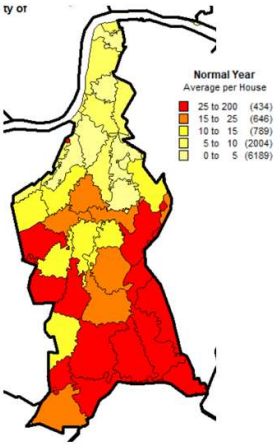
The maps below show the aggregated claim cost from the sample per postcode sector for both normal (top) and surge (bottom) years. The figures will vary by the insurer's exposure, claim sample and distribution.

NORMAL YEAR SPEND – UK SAMPLE £200m

LAMBETH



Spend by Sector

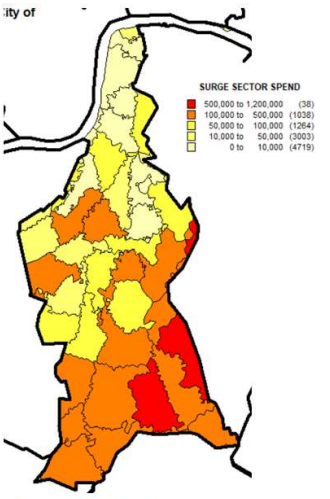


Spend Averaged over Housing Population

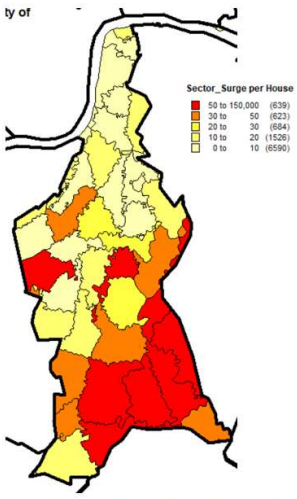
It will also be a function of the distribution of vegetation and age and style of construction of the housing stock. The images to the left in both examples (above and below) represent gross sector spend and those to the right, sector spend averaged across housing population to derive a notional premium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

SPEND in SURGE – UK SAMPLE £419m

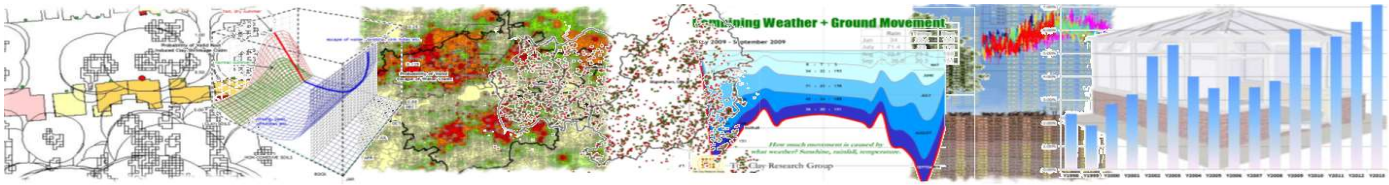
LAMBETH



Spend by Sector



Spend Averaged over Housing Population



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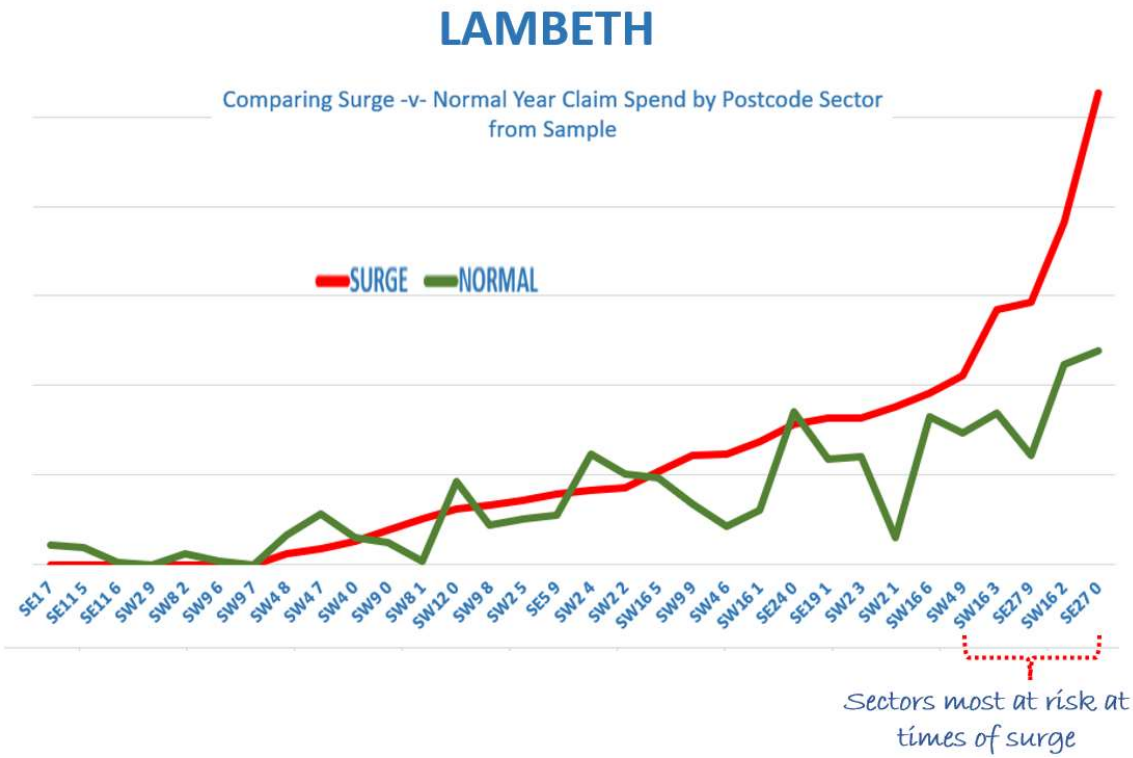

The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

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 is based on losses for surge of just over £400m, and for normal years, £200m.