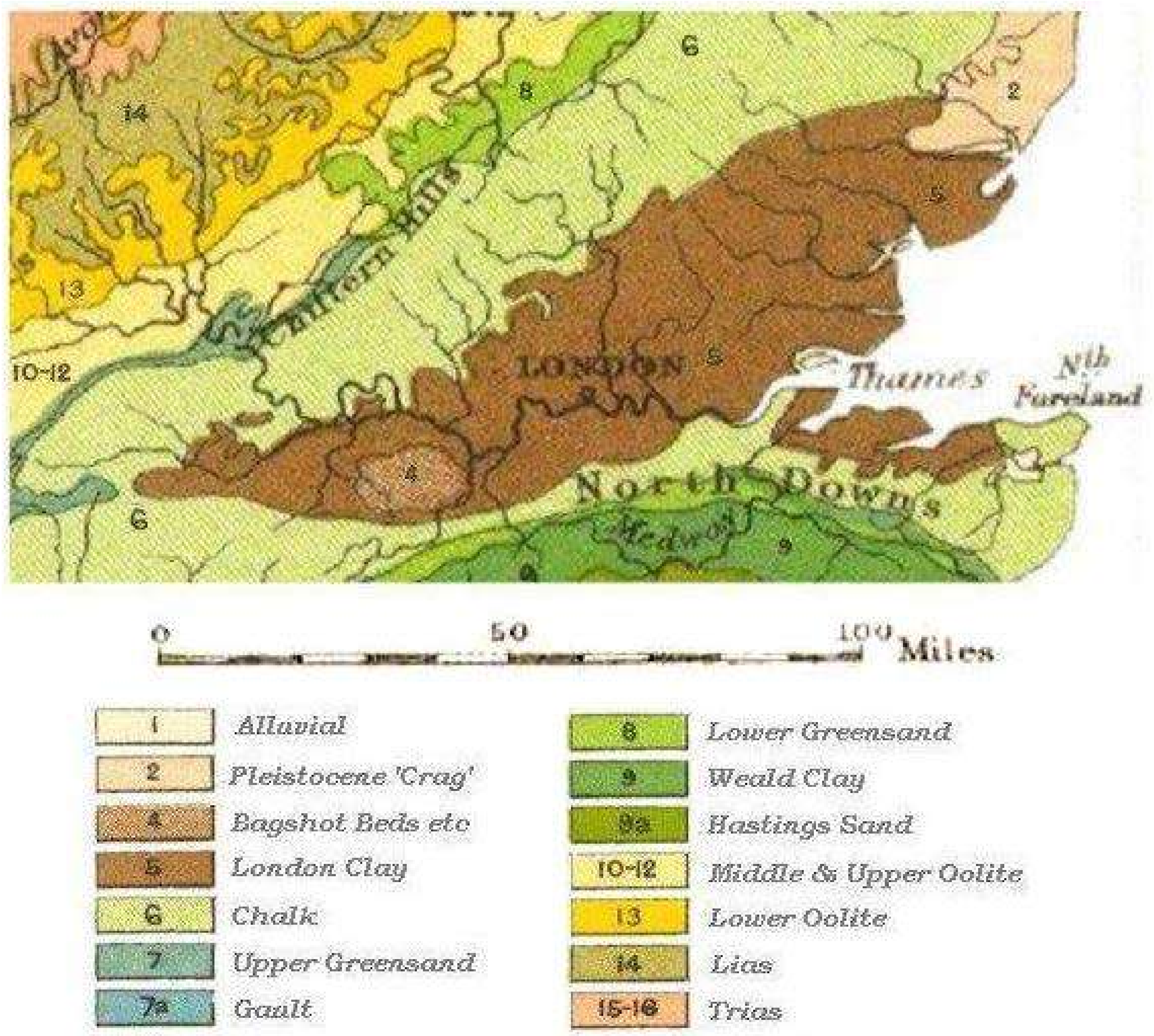
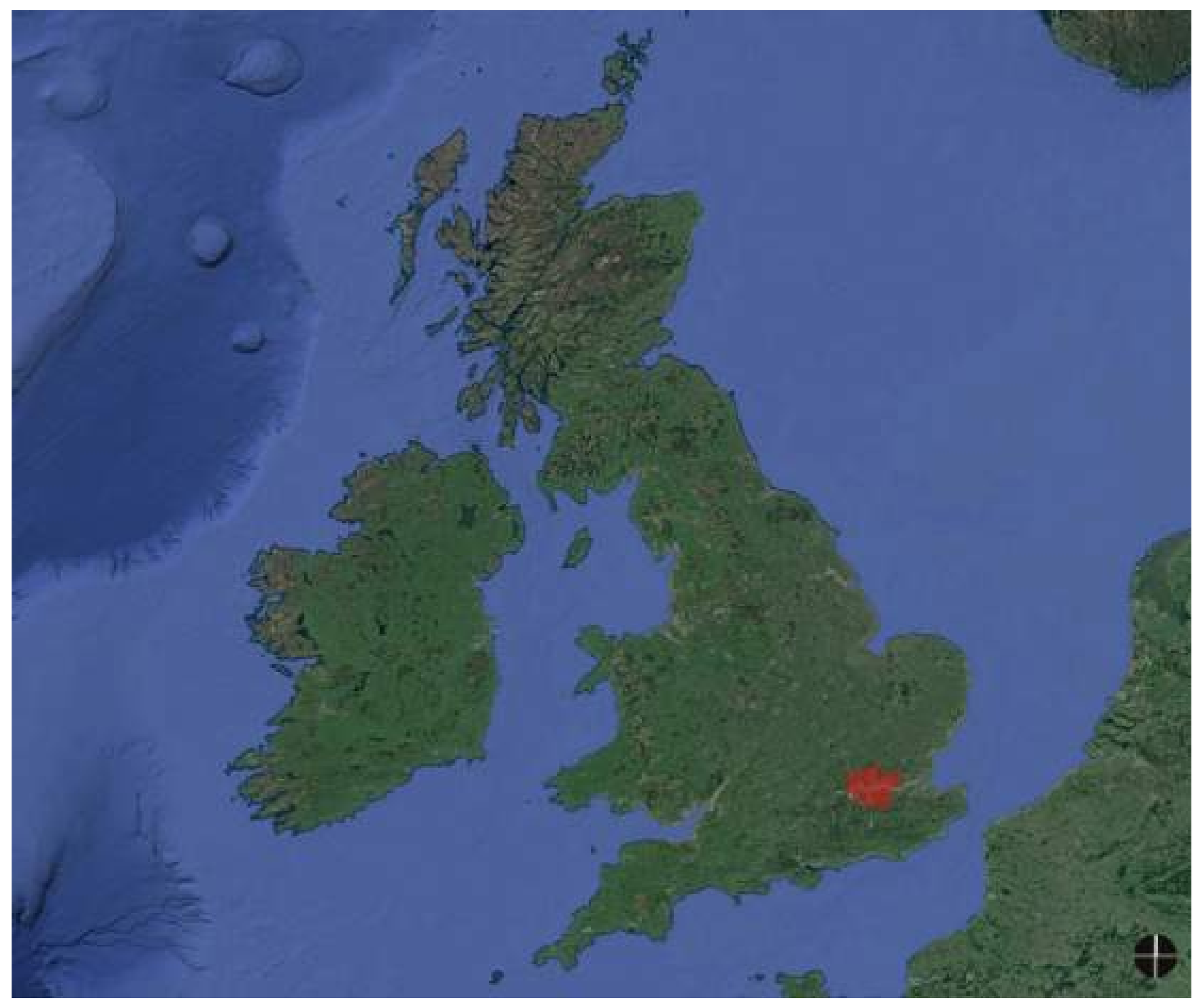
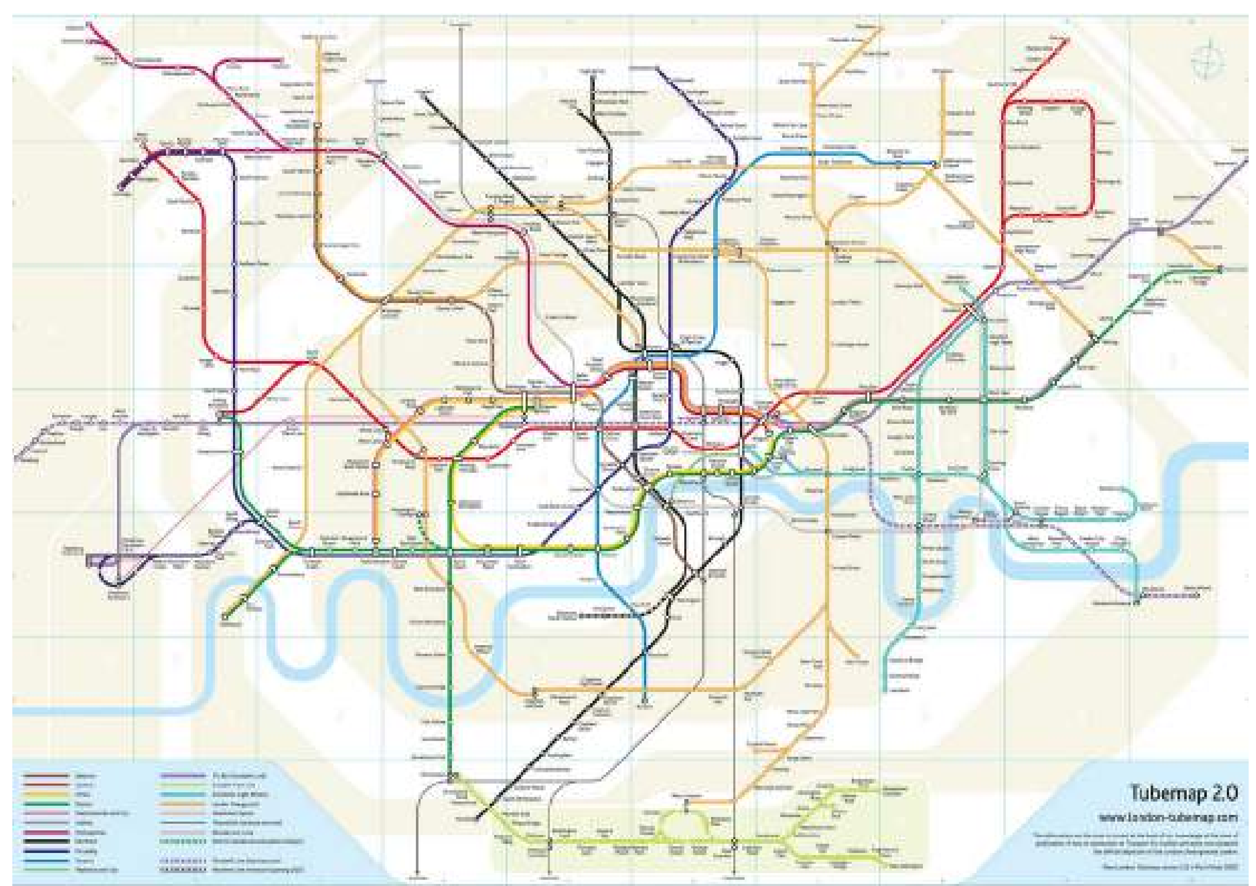
Geology and Topography of London



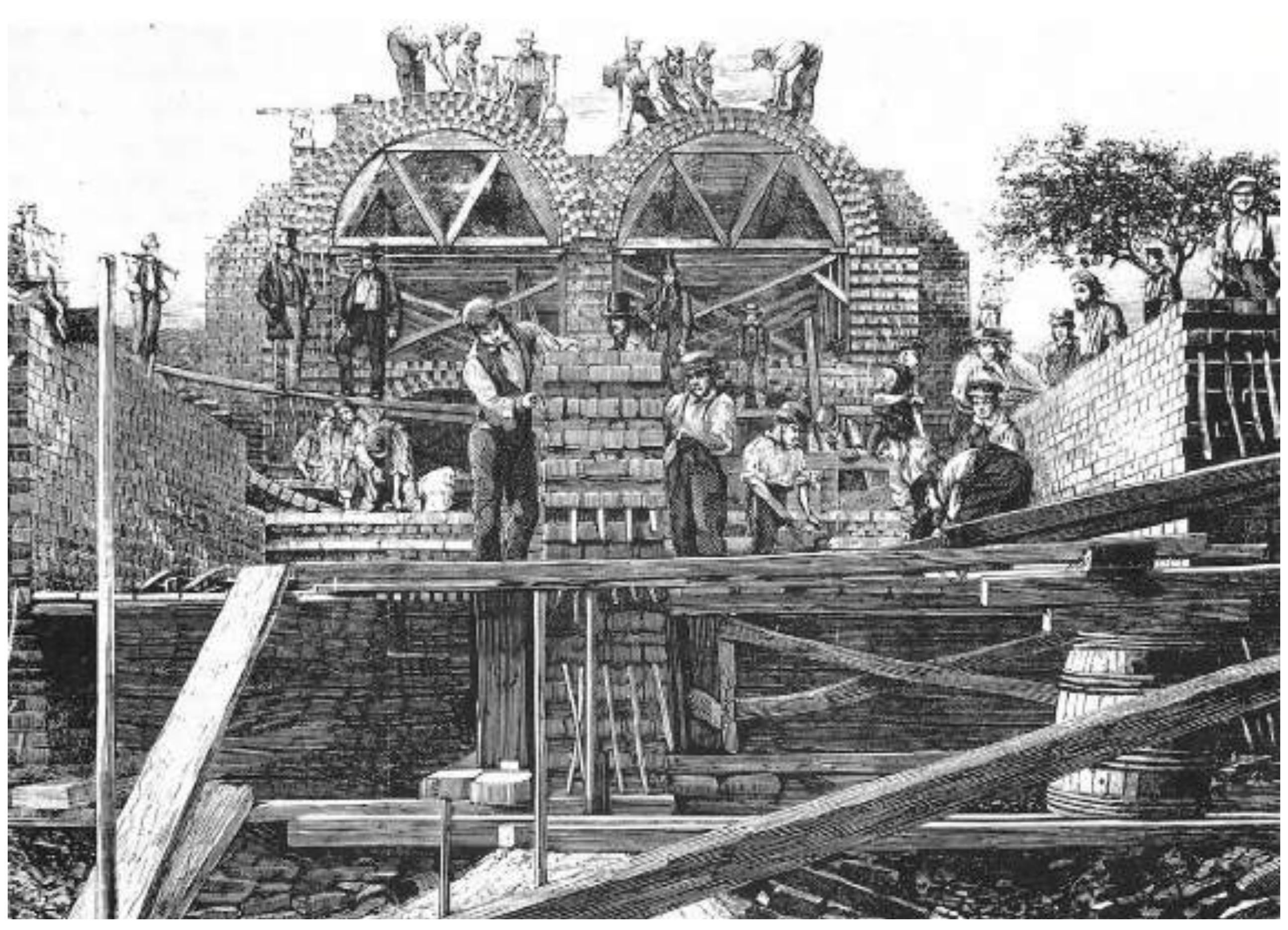


Looking at the complex geology of the city. At the surface one may see many different rock types/sands/gravels from glacial activity and deposits through wind and water.
The area that predated London was folded 15 to 20 million years ago into a shallow basin, a syncline made form a layer of chalk, which was filled with stratified rock. These rocks are surfacing today in the Chiltern Hills (North-West) and the North Downs (South-East edge of London Area). The chalk of the London Basin is covered by a thick layer of Cenozoic sediments, predominately London Clay. In some places the clay layer is 150m thick.
Clay is heavy, no good for agriculture but has two very useful characteristics that were detrimental to how the city was formulated.
Firstly, clay is easy to be tunnelled and secondly it is used to produce bricks. Large parts of London's infrastructure run through networks of tunnels dug into the London clay. Clay was an abundant material resource with large availability.
Both the subterranean and terrestrial settlements were formed from bricks made from London clay. Historically developers were given portions of the city to produce bricks. Once a job was finished, they had permission to build on site which formed the vernacular of rows and rows of Georgian multi-storey terrace houses.
"The London Stock Brick" is all over the capital.

Whickham Lane Brick Fields in Plumstedt 1901. The image shows the typical organisation of quarry and construction site sharing the same site and being operated simultaneously same to formulate the local vernacular of brick terraces. (Photograph – Gibbs A., 1901, Whickham Lane Brickfields, Availbale at: http://www.plumstead-stories.com/ (Accessed 21 January 2022)



That clay is good for tunnelling is evident when looking at the tube map. There are only few tunnels south of the Thames as there are only few clay deposits. The clay was an abundant material resource with large availability.



A sectional view of the tunnels from Wick Lane, near Old Ford (top), gives a good impression of the building techniques employed.
(Image - London Under London
A subterranean guide
Richard Trench and Ellis Hillman
John Murray (Publishers) Ltd,
London 1984, p.77

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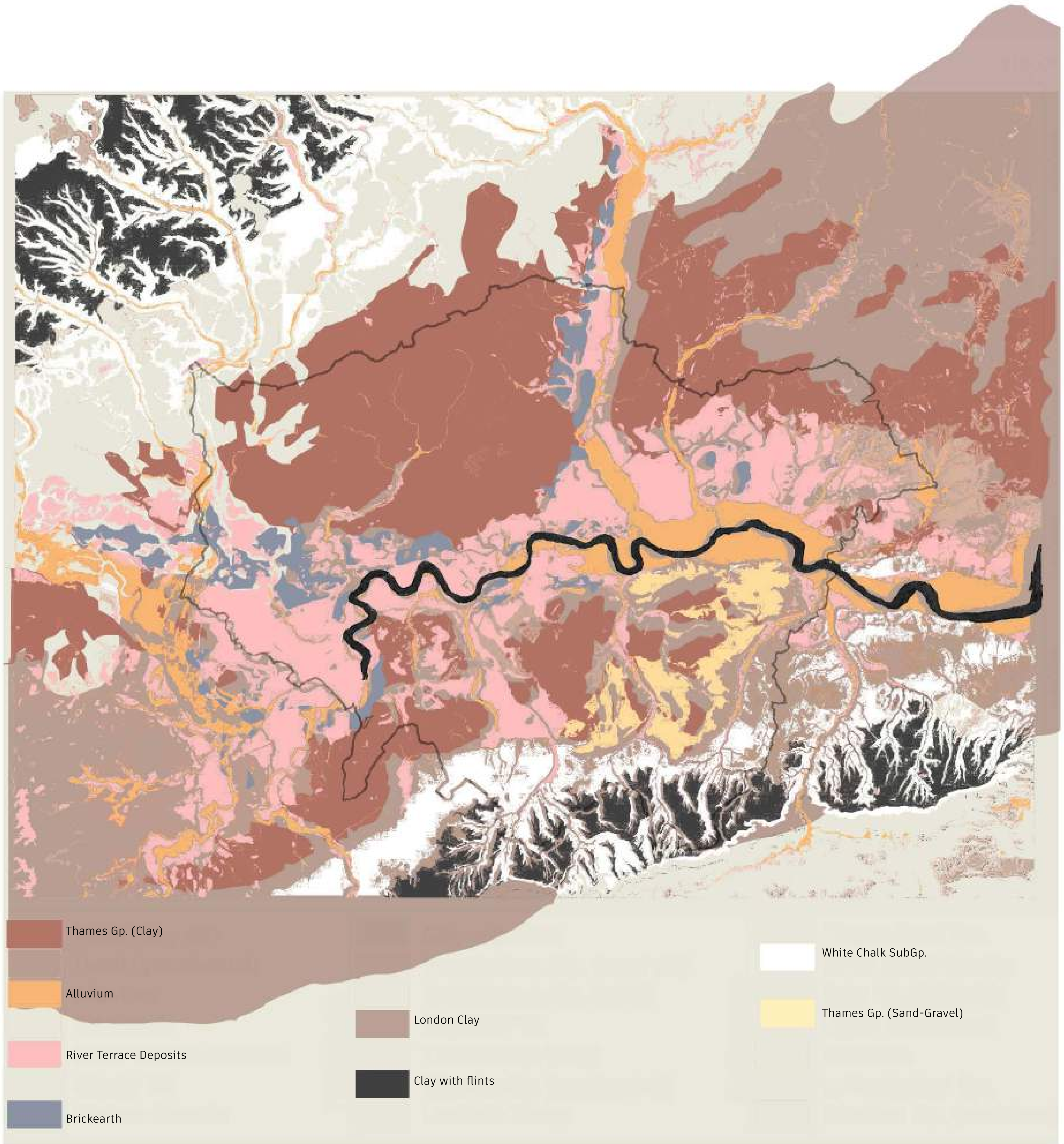
London's last traditional brick kiln Pottery Lane in Notting Hill (1), examples of solid wall London Stock Brick Architecture Georgian Terraces of Bedford Square (2), Sidney Square (3)



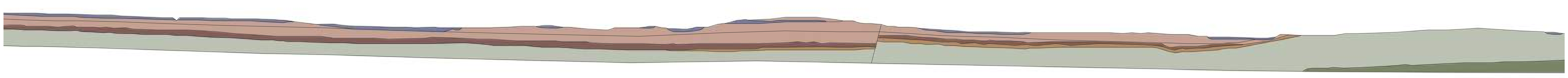
Foundation properties of soil types

Stiff fissured clays such as London Clay have a relatively high bearing capacity below their softened weathered surface. Also, since they are over consolidated clays, they have a moderate low compressibility. They are highly plastic clays and heavy structures founded on them show slow settlement over a long period of years. Stiff-fissured clays show marked volume changes with varying moisture content. Thus, foundations need to be taken down to a depth where they will be little to no appreciable movement resulting from swelling and shrinkage of the clay in alternating wet and dry seasons. For the same reason it is necessary to avoid accumulation of water at the bottom of excavations in order to avoid swelling and softening of the soil. Fissuring in these soils can cause wide a wide variation in shear strength determined by laboratory tests on samples taken by drive tubes, due to random distribution of fissures and their partial opening during sampling. It is difficult to access the results when assessing bearing capacity. The fissured structure of these clays causes difficulties, mainly unpredictable, in the stability of slopes of excavations, the stability of the walls of unlined holes sunk by mechanical boring methods for deep pier or piles and in the design of timbering or sheet piling to excavations.

Alluvial clays are geologically recent materials formed by the deposition of silty and clayey material in river valleys, estuaries, and on the bed of the sea. They are "normally consolidated," i.e. they have consolidated under their own weight and have not been subjected in their geological history to an over consolidation load as in the case of glacial till and stiff-fissured clays. Since they are normally consolidated, they show a progressive increase in shear strength with increasing depth ranging from very soft near the ground surface to firm or stiff at depth. Atmospheric drying and the effects of vegetation produce a stiff surface crust of alluvial clays. The thickness of this crust is generally 1 – 1.2m in Great Britain, but it is likely to be much greater and liable to vary erratically in thickness in arid climates. Some regions show several layers of desiccation separated by soft, normally consolidated clayey layers. Moderately high bearing pressures, with little or no accompanying settlement, can be adopted for narrow foundations in the surface crust which do not transmit stresses to the underlying soft and highly compressible deposits. In the case of wide or deep foundations it is necessary to adopt very low bearing pressures, or to use a special type known as the buoyancy raft, or to support the structure on piles driven through the soft and firm alluvial clays to a satisfactory bearing stratum.
Alluvial clays, especially marine clays, are "sensitive" to disturbance, i.e. if they are disturbed in sampling or in construction operations, they show a marked loss in shear strength. The sensitivity can range from 2 or 3 in the case of estuarine clays of the Thames.
Excavations below the dried-out crust require support by timbering or sheet piling; open excavations require to be cut back to shallow slopes to avoid massive rotational slips. Excavations in soft clays exceeding a certain depth-width ratio are subject to failure by heaving of the bottom or appreciable inward yielding of the side supports. As In the case of stiff-fissured clays, precautions must be taken against the effects on foundations of seasonal swelling and shrinkage and the drying action of the roots of vegetation.
Alluvial clays are frequently varved or laminated clays interbedded with layers of peat, sand, and silt as in the Fens of East Anglia, and in major river deltas.

Silts occur as glacial or alluvial deposits, or as windblown deposits. Examples of the latter are the "brickearth" of south-eastern England. Glacial and alluvial silts are generally water bearing and soft in consistency. They are among the most troublesome soils in excavation work, since they are readily susceptible to slumping and "boiling." Being retentive of water they cannot readily be dewatered by conventional ground-water lowering systems. Silts are liable to frost heave.

Brickearths are generally firm to stiff and do not normally present any difficult problems in foundation work.



From pit to wall

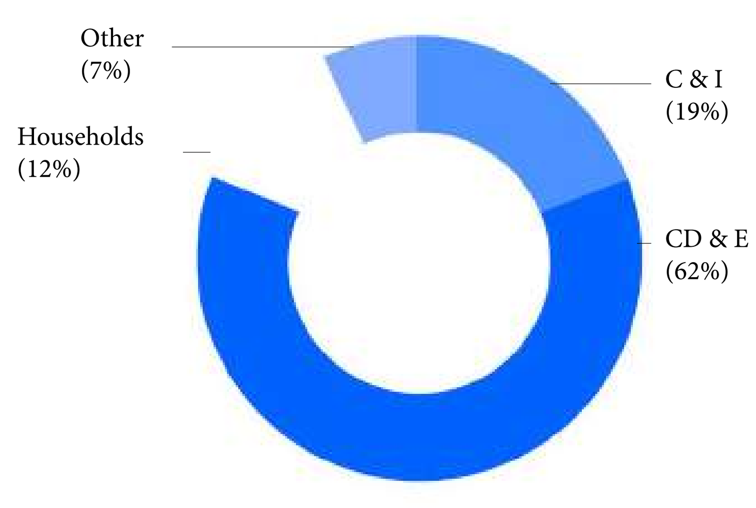




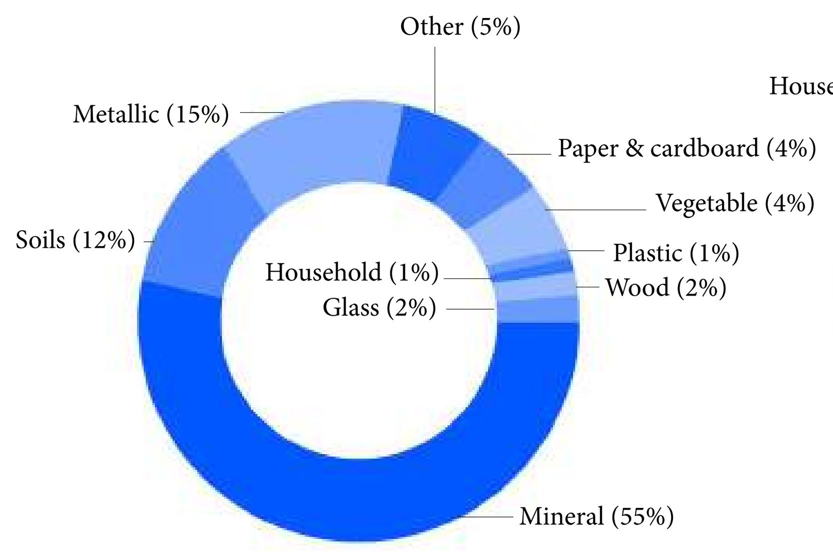




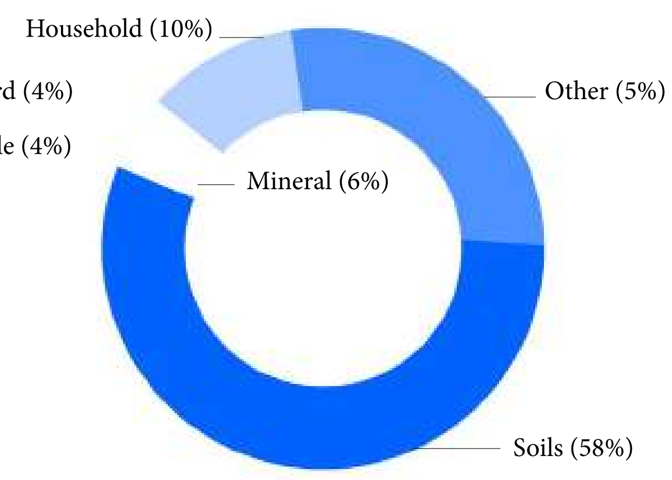
Nowadays, this practice has largely dissolved in London through global material sourcing, which precedes other construction materials (concrete, composite materials, steel) being introduced. It is only done in small quantities around London such as Kent and Sussex and the Chiltern Hills.
Clay now has become a by-product of the construction industry, particularly of civil engineering practices excavating vast amounts of soil for building foundations, basements and tunnels.
Whilst some of the extracted clay is recycled, mostly for backfilling purposes, the large majority is sent to Landfill.



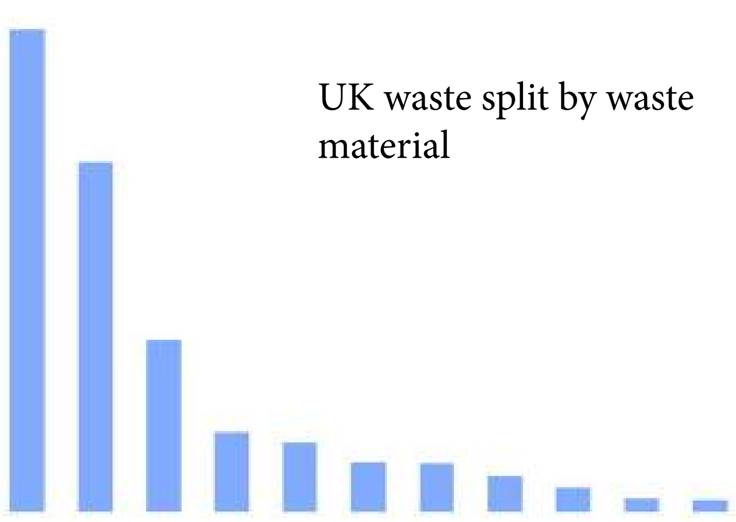
UK waste split by source



Waste recycling and other recovery



Landfill



UK waste split by waste material

City scale engineering projects such as Crossrail, Thames tideway super sewer, or basement excavations e.g. in Marylebone square are extracting vast volumes of London Clay. Crossrail alone displacing 6 million tonnes.