



# ROCK INVESTIGATION



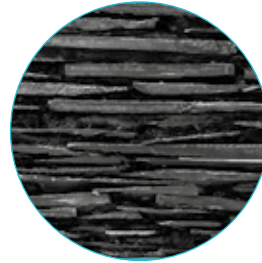
Tideway



CHALK



GRANITE



SLATE



LIMESTONE

Constructing the Thames Tideway Tunnel, London's new super sewer, requires geological understanding of the ground beneath the city. Geologists compare the properties of rocks, which inform the decisions about tunnelling processes.

- 1 Perform experiments on granite, chalk, slate and limestone pebbles. Compare the permeability, hardness, structure and appearance, recording results appropriately.
  - **Permeability:** Drip a droplet of water onto the rock. If it leaves a damp mark, the rock is permeable.
  - **Hardness:** Scratch each rock with a nail file. Which scratches the most easily? Which does not scratch at all?
  - **Colour and texture:** How do the rocks vary in appearance and structure?
- 2 The east section of the Thames Tideway Tunnel passes through a layer of chalk. Chalk contains lots of water. Why might this property of chalk be a problem for tunnel builders?



# CHALK AND CHEESE PIZZA



The Thames Tideway Tunnel is a new super sewer being built under London using tunnel boring machines. These machines work like a huge cheese graters, grinding through the layers of clay, sand and chalk beneath the city, as the tunnel gets deeper from west to east.

**1** Comparing these ground types is like comparing cheddar, mozzarella and feta cheese. Grate each cheese, and consider the qualities of their equivalent soil types from the table below. Which is the wettest? Which is crumbliest? Which grates the smoothest? Then, with a responsible adult, why not make a delicious pizza?

Tunnel Section	West	Central	East
Ground Material	Clay	Sand	Chalk
Equivalent Cheese	Cheddar	Feta	Mozzarella
Properties			

**2** Two types of tunnel boring machine are used to excavate the Thames Tideway Tunnel; earth pressure balance machines, and slurry shield machines. Whilst both can be used to excavate sand, earth pressure balance machines can be damaged by flint, an abrasive stone, found in chalk deposits. Conversely, slurry shield machines, which pump waste materials away as liquid, rather than using a conveyor, can be clogged by clay.

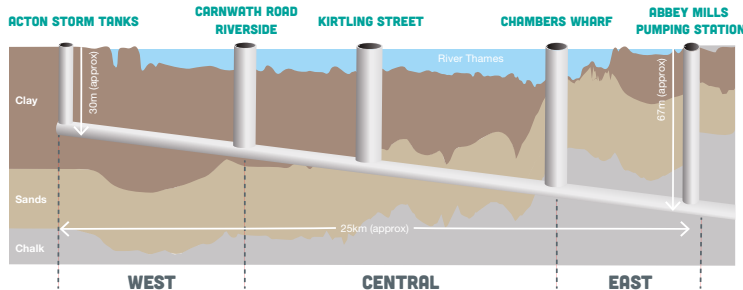


Fig. 5 This diagram shows how the Thames Tideway Tunnel will pass through layers of London's ground materials

Considering this information, which type of machine should be best for the west, central and east sections?

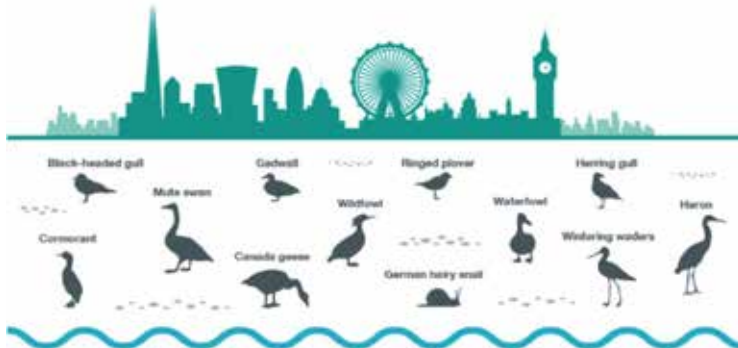


# THAMES TWITCHERS



The Thames and its waterways are an important habitat for many species of water birds. The Thames Tideway Tunnel aims to protect this ecosystem by reducing the amount of sewage pouring into the River Thames by tens of millions of tonnes every year.

With a parent or guardian, take a walk along the Thames Path and see how many of these birds you can spot. You may wish to split your route into sections, and record your data in a table, or record data at each Thames Tideway Tunnel drive site. Always take care when walking along waterway routes and do not leave the public footpath or enter the river or mudflats areas.



Bird Species	Number Counted in 10 minutes			
	Site 1	Site 2	Site 3	Site 4
Black-headed Gull				
Canada Geese				
Cormorant				
Gadwall				
Herring Gull				
Heron				
Mute Swan				
Ringed Plover				
Wintering Waders				



# CONCRETE JUNGLE



Tideway

The Thames Tideway Tunnel is a new super sewer being built under London to help clean up the Thames and meet the needs of London's growing population. Built of fibre reinforced concrete, its innovative design will allow its smooth sections to be precast and quickly constructed by machine.



National Theatre, Southbank, a performing arts venue designed by Denis Lasdun and completed in 1976.



Queen Elizabeth Hall, Southbank, designed by Bennett, Whittle, West and Horsefall and completed in 1967.



The Barbican Centre, Golden Lane, an arts centre and social housing development designed by Chamberlin, Powell and Bon and completed in 1982.



Waterloo Bridge, designed by Sir Giles Gilbert Scott and opened in 1942. Also called the 'Ladies Bridge' as it was partly built by a female workforce, during WWII.



Centre Point, New Oxford Street and a mixed use tower block designed by George Marsh and completed in 1966.

With a parent or guardian, take a walk along the Thames and see how many other concrete structures you can spot. Look out for these structures, along the Thames Path and on London's skyline. How do the colours and shapes of these buildings compare to brick or glass structures? Always take care when walking along waterway routes and do not leave the public footpath or enter the river or mudflat areas.