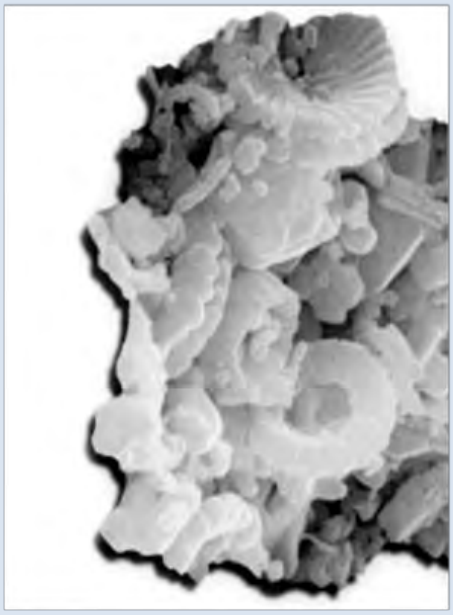
Chalk Links in the North Wessex Downs

"Chalk Links" Fact Sheets:

Geology groups across the region have produced a series of fact sheets explaining how the underlying chalk affects other characteristic features of this unique area including landscape, soils, land use, industry, hydrology & archaeology. Other fact sheets in this series can be downloaded from: www.northwessexdowns.org.uk

FACT SHEET: CHALK AND GROUNDWATER



A high resolution image of the tiny chalk particles and the spaces between them. A chalk well can yield more than 10 million litres of water per day, sufficient to provide the needs of about 70,000 people at 150 litres per person per day.

Mother Antony's Well, near Roundway in Wiltshire. Spring emerging at the base of the permeable Upper Greensand overlying the impermeable Gault Clay

What is chalk?

Much of the North Wessex Downs is underlain by Chalk. Chalk is a soft white limestone traversed by layers of flint. It consists of minute calcareous shells and shell fragments which are the remains of plankton which floated in clear, sub-tropical seas covering most of Britain during the Upper Cretaceous, between 95 and 65 million years ago.

Chalk is a highly porous rock. The microscopic spaces or pores between these particles can soak up enormous quantities of water. We can think of chalk as a giant sponge soaking up rainfall before it has a chance to run off into streams and rivers. Thus, over much of the upland Downs, there is no surface water in the form of ponds or streams.

Chalk and groundwater

Chalk is the most important aquifer (underground storage water system) in southern Britain. The total abstraction of groundwater in the UK, including that used by industry and agriculture, is some 2400 million cubic metres per year. Over 70% of the total public water supply in SE England is derived from groundwater.

Where is the water table?

Rainfall in this region averages around 700 to 800 mm per year. Much of this evaporates or is taken up by plants, but about 40% percolates down into the chalk moving slowly through a network of pores and fine cracks until it reaches a level known as the water table, below which the pores are saturated with water.

The water table varies in height throughout the year, falling during the summer and autumn months and recovering (due to recharge by rainfall) during the winter and spring months, with the largest seasonal variations observed away from the rivers. In a well at Rockley in Wiltshire, the water table varies annually from 2 to 18 metres below the surface.

NORTH WESSEX DOWNS AREA OF OUTSTANDING NATURAL BEAUTY

Big CHALK

Oxfordshire Geology Trust

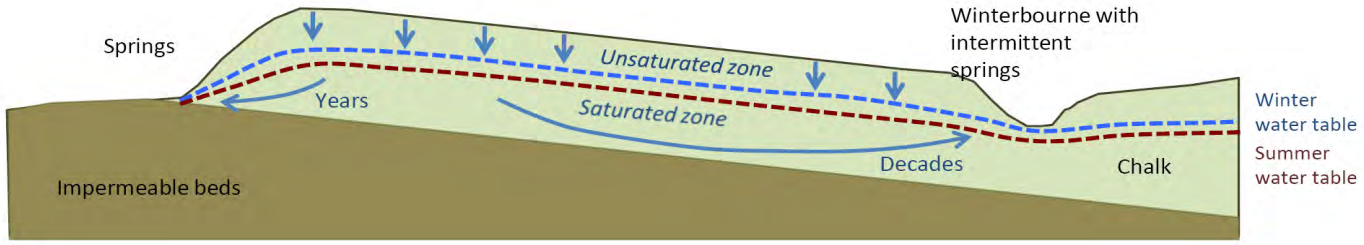
Chalk Links in the North Wessex Downs

The height of the water table

The water table is highest beneath the highest topography. This is true, for example, in the area of the chalk escarpment south of Swindon. Wells here need to be up to 50m deep to tap a water supply. At Barbary Castle Country Park it is 125m. At the base of the chalk escarpment and in the downland valleys, the water table reaches the surface. Here springs can emerge and streams can move over the chalk bedrock. Seasonal variations in the water table lead to intermittent flow of some streams, the so-called *winterbournes.*

The age of ground water

Water flows slowly through the tiny pores of the unsaturated chalk (rate of approx. 1 metre per year), but much faster through open fractures in the saturated rock. Fractures closer to the surface provide a pathway along which water may flow much more quickly (at rates between tens and thousands of metres per day). However, it may still take decades for the rainwater seeping into the chalk to reach a spring or stream.



Why do springs dry up?

The chalk of southern England is a huge underground reservoir, storing fresh water that can be pumped out to supply the needs of households and industry. If too much water is abstracted or there is insufficient rain, then the water table drops. This may cause springs and streams to dry up and means other wells in the area need to be deepened to reach water. Low winter rainfall in 2005-6 lowered the water table and led to drying up of the headwaters of the River Pang. If the water table rises too much, it can rise above the level of the valley floors and cause sustained groundwater flooding.

When streams dry up their biodiversity is threatened and any pollutants become more concentrated. For this reason it is important to maintain their flow and to regulate the abstraction of water. For example, the River Lambourn from its source to almost Great Shefford is a 'winterbourne' stream and only carries water at certain times of the year. In Lambourn the effects of this can be seen in Lynch Wood where during the spring months water can be seen emerging from springs. At other times the ponds are dry. A series of wells have been drilled around the upper stretches of the Pang and Lambourn valleys from which water can be pumped and piped further down the valley to supplement the flow of these streams in the drier seasons.

Diffuse ground water pollution

The pesticides and fertilisers (such as nitrates) applied to downland fields can find their way into the groundwater. Their concentration is reduced as they diffuse slowly through the microscopic chalk pores. However if they enter the fracture systems they may reach springs and streams faster and with less dilution. Efforts are being made to reduce the use of these pollutants, since their impact on the water supply will continue to be felt for decades.

For more information on chalk hydrology/hydrogeology, please visit:

British Geological Survey: http://www.bgs.ac.uk/research/groundwater/home.html

UK Groundwater Forum: http://www.groundwateruk.org/

About the Oxfordshire Geology Trust, please visit: http://www.oxfordshiregt.org