

WERRIS CREEK COAL MINE

SOILS OF WERRIS CREEK FACT SHEET

SOILS SUMMARY

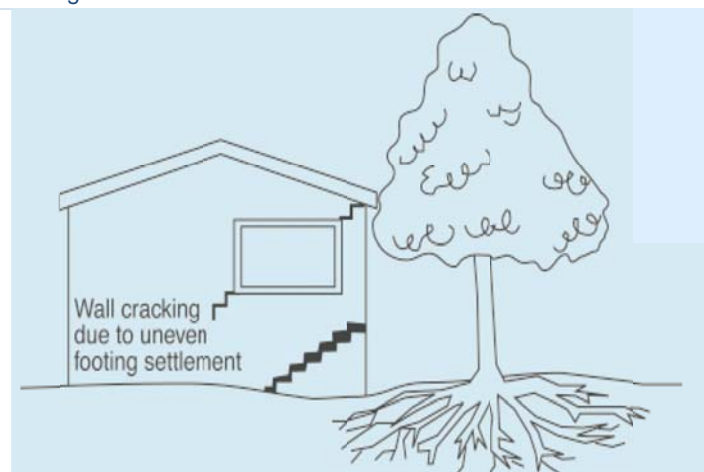
Expansive (or reactive) soil is any soil composed predominantly of clay, which undergoes appreciable volume change in response to variations in soil moisture content. Volume change occurs as soils swell upon wetting and soil shrinkage upon drying. Moisture changes may be induced by rainfall and evaporation, garden watering, leaking water pipes or tree roots.

Approximately 20% of Australia is affected by expansive soils with Newcastle and Adelaide most well-known. The soils of Werris Creek also are classified as expansive.

Building foundations constructed on expansive soils are frequently subjected to severe movement arising from non-uniform soil moisture changes, with consequent cracking and damage due to distortion.



Example of Shrinkage Cracks in Foundation



Example of soil shrinkage and damaged caused by trees close to houses (CSIRO, 2003)

CAUSES OF FOUNDATION MOVEMENT

- Immediate settlement under the weight of new building;
- Consolidation settlement from expulsion of moisture or soil lacks resistance to compressive or shear stresses;
- Erosion;
- Saturation;
- Seasonal swelling and shrinkage of soil;
- Shear failure due to removal of soil support or strength;
- Tree root growth.

The types of ground movement listed above usually occur unevenly throughout the buildings foundation soil (CSIRO, 2003 "Foundation Maintenance and Footing Performance: A Homeowner's Guide"). Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, gradually spreads to the interior. Swelling usually starts on the uphill or weather side of the house; while shrinkage begins on the side with the greatest heat from the sun (CSIRO, 2003).

WERRIS CREEK SOILS

The two most common soil landscapes within Werris Creek town are The Siphon and Dunover soil units comprising mostly of Red Chromosols and occasional Black Vertosols soil types (typically referred to as red and black soils). The soils have been derived from alluvium and colluvium material from the Permian volcanic geology of the Werrie Basalt and Warrigundi Intrusives. The Siphon soil landscape unit has a deeper profile along the lower (western) section of town compared to the Dunover unit along the eastern (ridge) section. Other less common soil units in the area is the Currabubula Creek and Terrible soil landscape of the alluvial and hill crests respectively; while the area to the west of the rail line is the Duffs Gully soil landscape unit. Soil chemistry typically has a low electrical conductivity (low salinity) and a neutral pH. The volcanic geology of the local area has resulted in the soils on the flatter slopes (particularly Duffs Gully) being highly fertile and excellent moisture storage characteristic.

FOUNDATION SOILS THAT ARE EXPANSIVE

Uneven or differential ground movement of founding soils under houses can cause large variation in stresses to occur across the structure. Founding soils that swell at the margins of the house can cause the dish effect where the external footings/piers are pushed higher than the internal footings. Shrinkage at the margins of a house will cause a doming effect. Differential movement of the foundation can occur due to excess watering of gardens or from trees close to the house absorbing moisture.

Australian Standard AS2870 (2011) "Residential slabs and footings" specifies the performance criteria and designs for footing systems for foundation conditions commonly found in Australia and has a particular emphasis placed on reactive clay sites. AS2870 can be used to estimate the potential ground movement based on the soil profile, site conditions and climate.



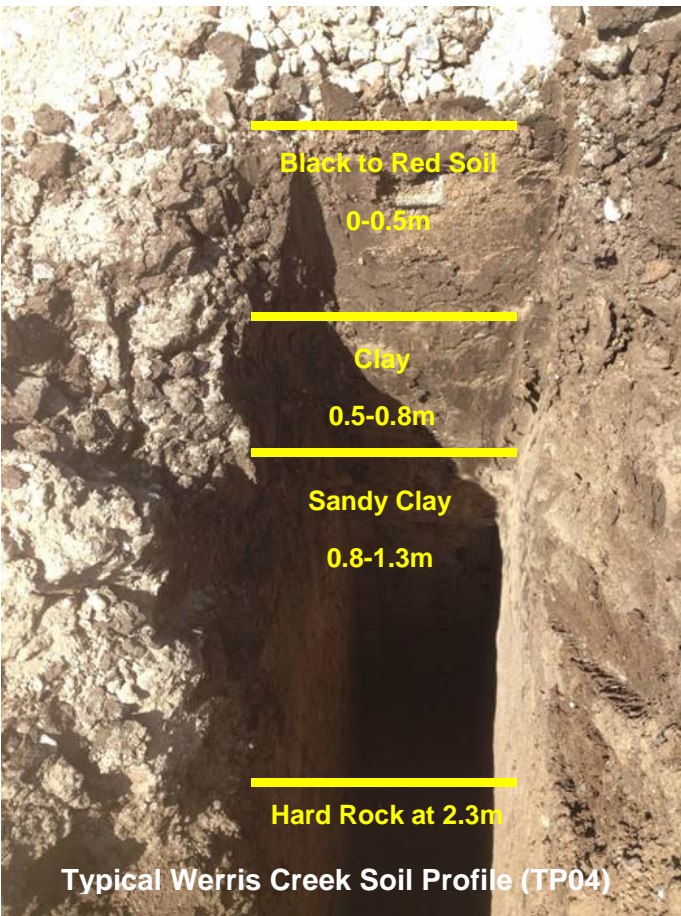
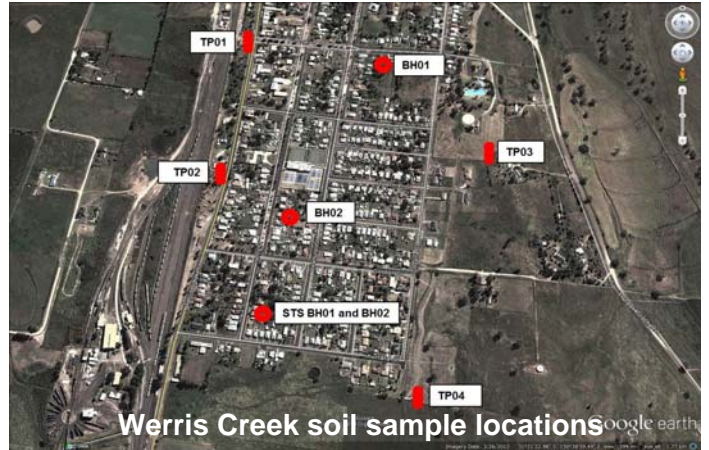
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METHODOLOGY FOR MEASURING EXPANSIVE SOILS

Seven locations within Werris Creek were selected for soil investigations representative of flat and steeper areas of town with four test pits and four hand auger holes dug. A total of ten undisturbed soil samples at likely footing depths were collected and analysed at an accredited laboratory. Shrink swell soil test measures the expansive potential of clay soils to provide a guide on how to engineer footings in expansive soils. Expansion is measured in millimeters of vertical ground movement.

Classification of Expansive Soils (from AS2870)		
Slightly Reactive Clay Soil	S	0-20mm
Moderately Reactive Clay Soil	M	20-40mm
Highly Reactive Clay Soil	H1	40-60mm
Very High Reactive Clay Soil	H2	60-75mm
Extremely Reactive Clay Soil	E	>75mm



SOIL TEST RESULTS

The laboratory test results for the clay soils of Werris Creek indicate they are highly reactive. The site investigations reveal the thickness of the clay layers are highly variable and range from 0.5m to 1.5m in thickness. Taking into consideration the clay soils present and depth to rock, the assessment of the seven different locations around Werris Creek indicate that the average soil foundation of houses in town have a classification of M to H2 (medium to very highly reactive). Based on the test results, you would expect soil movement underneath Werris Creek houses in the order of 17mm to 73mm.

Location	Soil Movement	AS2870 Classification
STS BH02	53 to 73mm	H1 to H2
TP01	-	M
TP02	25 to 33mm	M
TP03	22 to 30mm	M
TP04	53 to 69mm	H1 to H2
BH01	17 to 22mm	S to M
BH02	17 to 22mm	S to M

FOUNDATION MAINTENANCE

The publication "Foundation Maintenance and Footing Performance: A Homeowner's Guide" (CSIRO, 2003) outlines how to prevent or cure foundation movement by:

- Replace or repair plumbing;
- Improve drainage away from foundations;
- Install paving or apron around house perimeter;
- Subfloor ventilation to prevent condensation;
- Minimise garden beds adjacent to house; and
- Sever tree roots heading under the house or remove the whole tree.