



A guide to preventing structural damage

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Home owners guide to planning landscaping and maintenance of foundations

Structural damage can result from movement in clay soils caused by varying moisture conditions around the perimeter of homes.

The majority of Queensland homes are situated on what are termed reactive clay soils. These soils are subject to expansion and contraction depending on seasonal weather and site conditions. Sandy sites and rocky terrain are usually not prone to this expansion and contraction.

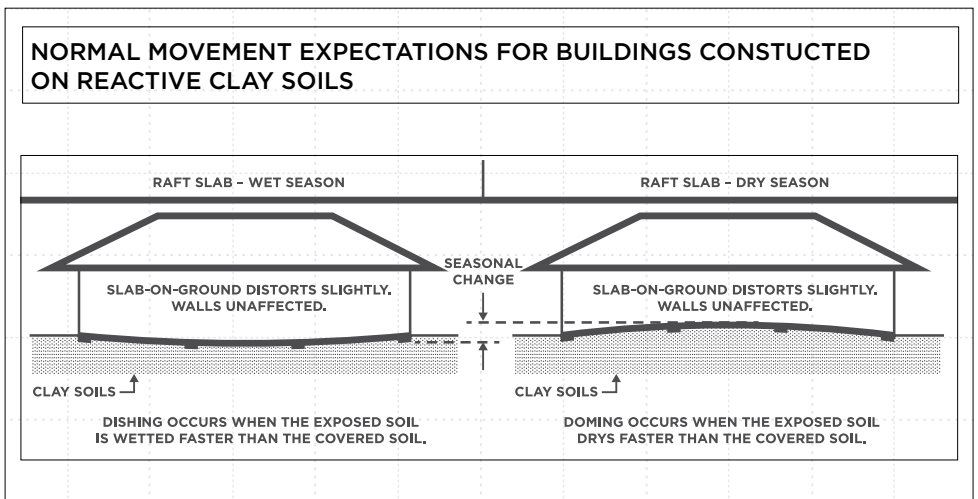
In Queensland, engineers design footings to the **Australian Standard AS2870 - 2011 Residential slabs and footings**. Footings correctly designed to this standard are intended to accommodate the expected movements caused by seasonal volume changes in the soil (swelling when wet and shrinking when dry)

- under **normal conditions**. The performance of footings under this standard requires **normal conditions** to be **maintained** around the house.

This guideline identifies **abnormal conditions** that should be avoided and/or corrected.

Dry seasons cause soils to dry out rapidly. Wet seasons cause soils to become wet quickly. This results in sudden extreme volume changes and movement in soil.

Abnormal conditions (other than seasonal changes), may include the effect of trees, poor surface drainage and/or leaking plumbing. If not allowed for in the engineer's design, these types of abnormal conditions may lead to movement and damage varying from minor to extreme.



How much can the soils under my house move?

The amount of movement that may occur depends on the site classification, which is defined under the **Australian Standard AS2870**.

The relevant classifications and expected movements under normal site conditions and seasonal influences are:

Site classification	Description of type of clay and reactivity	Expected range of movement
A	Mostly sand and rock with little or no ground movement from moisture changes.	0
S	Slightly reactive clays that do not present significant trouble. Very limited damage could be expected in the life of the building.	0 to 20mm
M	Moderately reactive clays that may cause minor movement and damage in the life of the building. Reasonable care is required in planning the site.	20 to 40mm
H (H1 & H2)	Highly reactive clays have potential to move more, and react to variable moisture change conditions. Some minor damage may occur in the life of the building under normal conditions. More significant damage may occur where site maintenance conditions are a problem e.g. influence of trees or leaking underground plumbing or poor drainage. Particular care is required in planning the site.	H1 40 to 60mm H2 60 to 75mm
E	Extremely reactive clays have the potential to react significantly to any variable moisture changes in the foundation clays and require significant attention to detail in planning the site works. Extreme movement and damage may occur if the site conditions and foundation maintenance requirements are not observed. Footing systems and site conditions on "E" sites require very detailed specification from an engineer.	>75mm (Note: Movements on E sites have been known to move up to and in excess of 100 to 150mm in SE Qld)

Is it normal to expect cracking to occur in brickwork, walls and ceilings?

Yes, damage in varying degrees can be expected in the life of the building depending on the relevant site classification.

If cracking becomes apparent the site maintenance conditions should be checked as noted under "key points to consider..."

Corrective action should be carried out immediately and may include regrading surface drainage, moving gardens and trees or repairing leaks in water supply, stormwater and/or sewer drainage.

A sound plan for a reactive clay site is to provide a consistent moisture regime around the building by installing paths and patios against the house. Locate lawns up against paths & patios. Garden beds, the most heavily watered parts of a garden, should be kept well away from the house.

If gardens must be placed in close proximity to the house, they should be sealed with plastic and contain only a few small plants. Take care not to trap water against the building if using garden edging.

Caution: Care should also be taken if placing filling against the house. Always ensure weep holes are not covered and that existing Termite Management Systems are not compromised.

Key points to consider when planning landscaping to avoid structural damage.

- Plan type and location of gardens, paths, driveways, lawns, filling and retaining walls
- Take care in selection of trees and shrubs. Do not over plant next to the house
- Keep trees with high water demand well away from buildings in reactive clay areas.
- Avoid variable conditions around the house and maintain adequate moisture/watering. Do not **over** water and avoid the use of unregulated sprinkler systems.
- Locate ponds and water features away from the house.
- Direct surface water away from the house. Do not allow water to be trapped or pond near the house.
- Repair leaking pipes and taps.

Note: these issues should be considered as part of planning and maintaining the home. Aim to provide a consistent moisture regime around the house. This will minimise soil moisture variations that may cause movement and result in structural damage.

Common sense guidelines for landscaping and gardens

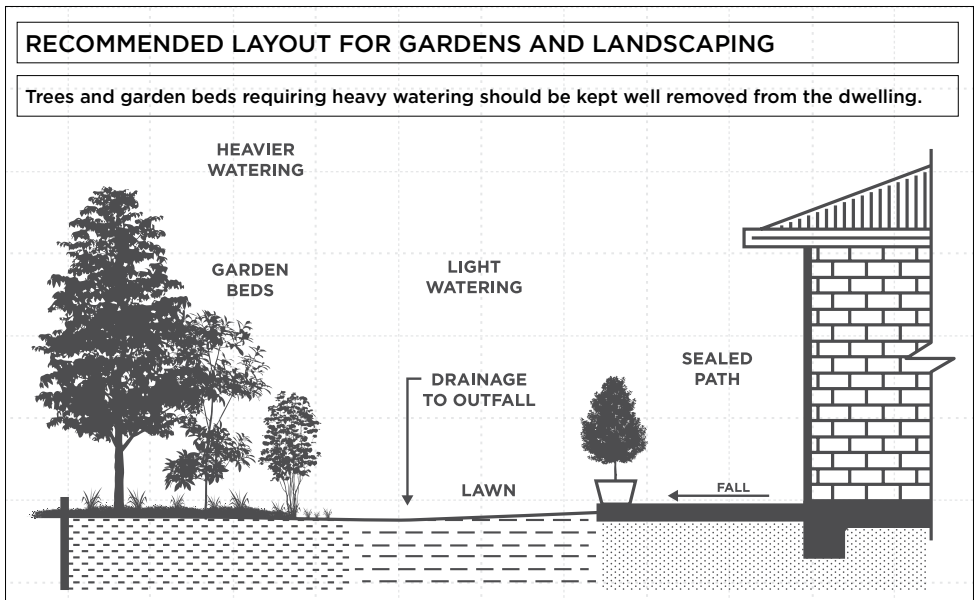
1. Gardens

Important: It is quite impractical to try to prevent gardening activities from increasing the moisture content around the foundations of your home. The only practical course is to keep such activities away from the immediate vicinity of the building and so minimise their effects.

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2. Paths, patios and driveways

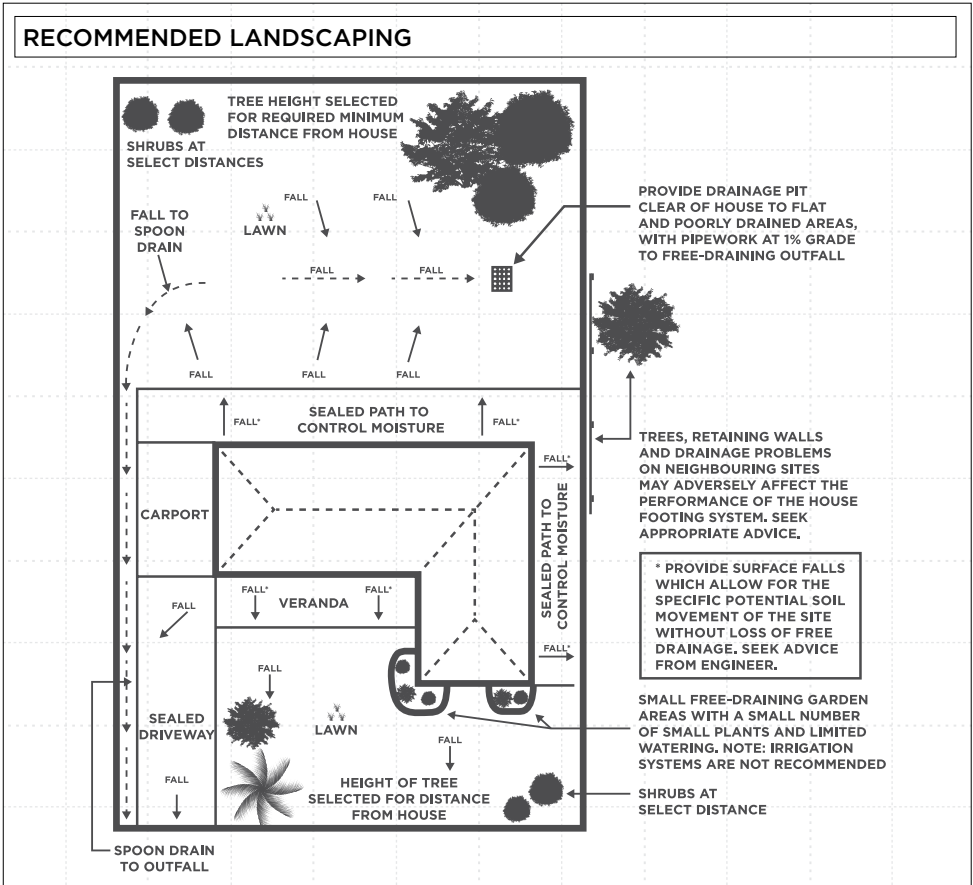
Paths should be laid hard against brickwork or footings with a fall away from the house to a stormwater discharge point.

Avoid placing large expanses of concrete on one side of the house and heavily watered garden beds on the other.

The water saturated clay in the gardens will expand and swell while the soil under the concrete may not move. Structural damage can result from this unco-ordinated movement.

Concrete pavements should be constructed in a way that will not impede surface water flowing away from the building or cause water to pond adjacent to the footings causing clay foundations to swell.

On “H” & “E” site classifications, particular detail is required to prevent pavement from moving away from the building. Movement in paths could cause stress on pipes and inspection openings and/or breakages in pipes. Resulting leakages may cause movement and damage as a result of clay soils under the house swelling.



3. Lawns

If placing lawn areas against the house, ensure that filling built up against the wall is graded away and will not allow ponding of water to occur. The filling should be impervious clay soil and not sandy loam.

REMEMBER: Do not cover weep holes.

4. Filling

Prior to preparing for gardens, lawns or filling as part of site works, care should be taken to ensure the sub-grade or ground level is graded or sloped away, especially when filling or top dressing with sandy loam. The sub-grade should consist of impervious natural site clay.

Where elevated floors exist ensure that the final finished ground level outside the house is not higher than the sub-floor area and that water cannot flow back under the house.

5. Excessive watering of gardens and lawns

The erection of a building also indirectly brings with it changes in the moisture content to the site. While it is normal to water gardens and lawns, excessive or over watering should be avoided. Consistent and adequate watering should be observed at all times.

The location of sprinkler systems next to houses should also be avoided on H and E sites.

Sprinkler systems should be as well controlled and maintained as practical, and only used in gardens and on lawns away from the building.



6. Site drainage and sloping sites

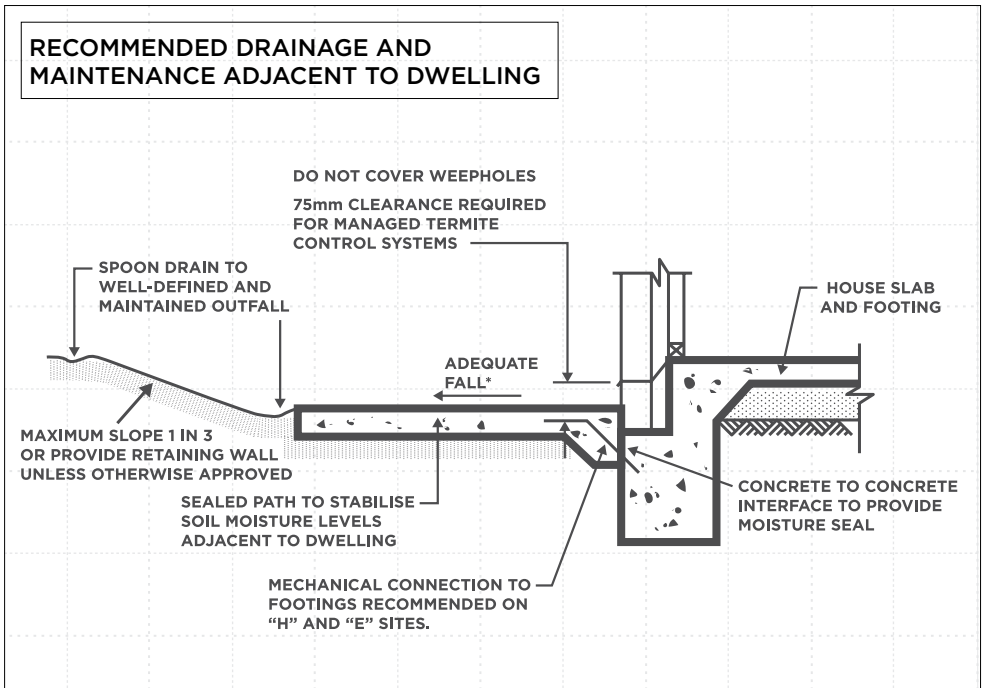
Design for site conditions, location of retaining walls, paths, swimming pools, future structures or proposed extensions etc. should all be considered when preparing the site for correct surface water flow.

If the ground slopes towards the house, paths with spoon drains should be provided.

It is also important to place drains uphill of the footings so as to direct water around the house and away from the footings. A stormwater and roof water drainage management plan should be considered and take into account water flowing from adjoining properties.

Seek advice from an engineer

1. To ascertain surface falls which allow for the specific potential soil movement of the site without loss of free drainage
2. To provide correct mechanical connection of perimeter paths of footings



7. Trees and shrubs

The roots of trees and shrubs can affect footings by removing moisture from clay soils immediately underneath the building causing subsidence as the clays shrink.

In its search for water, a tree root system can spread a lateral distance equal to the height of the tree. If in rows or grouped with other trees the roots may spread up to twice the height of the tree.

Care should be taken when selecting trees and, as a guide, the trees listed should not be planted within the distance of their mature height from the house depending on the site classification and whether they are to be planted in a line or in a group.

Height of Tree(h)

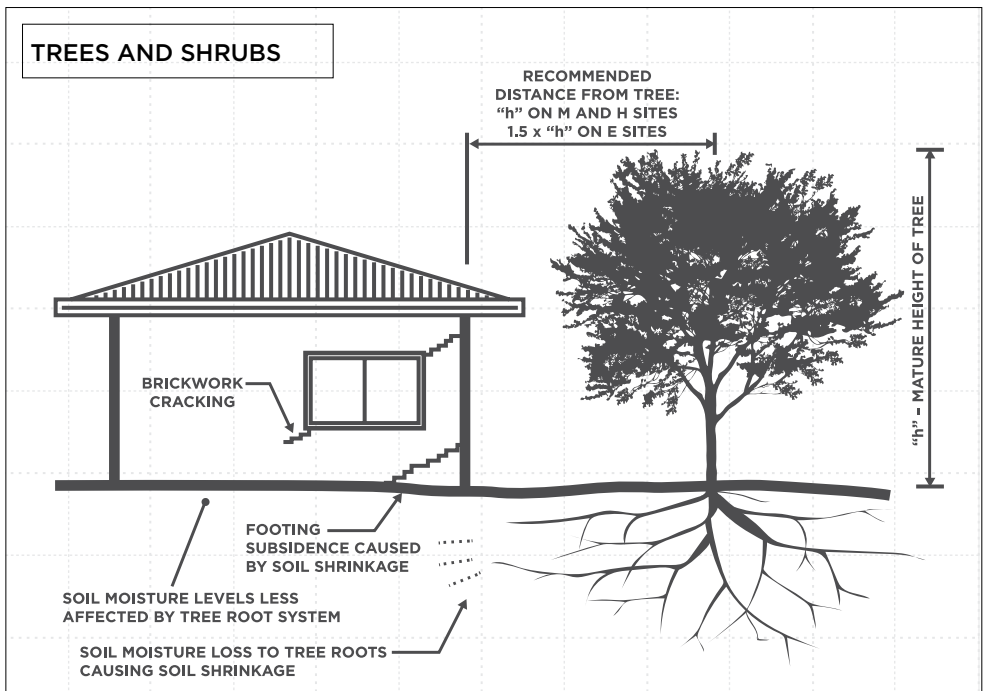
Distance from house (d)

$d = 1 h$ for class **H** and **M** sites.

$d = 1.5 h$ for class **E** sites.

$d = 2 h$ for rows or groups of trees.

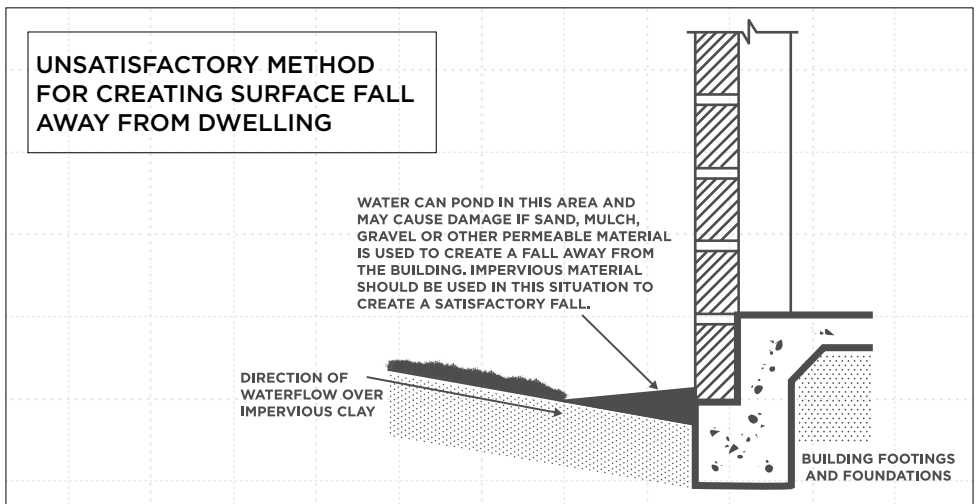
10 to 20 metres	20 to 30 metres	30 to 60 metres
Acacias	But-But	Blue Gum
Ash	Cedars	Cypress
Athel Tree	English Oak	English Elm
Candlebark	Lemon Gum	Figs
Manna Gum	Palms	Karri
Pepper tree	Planes	Pines
Willows	Sheoaks	Poplars
Yate	Silky Oak	River Gum
Yellow Gum	Spotted Gum	Sugar
	Casuarina	



Summary of owner responsibilities for houses under warranty

1. Maintain the site drainage at all times.
2. Do not alter the site drainage provided by the builder. Any changes to the site drainage should ensure that water will be directed away from the building and not pond adjacent to the footing and slab system. Care should also be taken to avoid directing water flow to adjoining properties.
3. Where possible on reactive clay sites (Type M,H,E Classifications), avoid placing gardens or installing garden edging, gravel pavements etc next to the building. This may cause water retention and/or promote a greater variation in moisture conditions around the building.
4. Installation of sprinkler systems next to dwellings on highly and extremely reactive sites (Type H & E Classifications) should be avoided. Adequate and consistent watering only is recommended. Over watering should be avoided.
5. Do not plant trees within a distance from a building that equates to their mature height. Always plant in accordance with the requirements for the relevant site classification.
6. Regularly check and maintain plumbing, drainage and stormwater systems by immediately carrying out repairs to leakages or breakages when observed (usually displayed by seepage and/or greener lawns etc.), or when minor damage or cracking exceeding 3-5mm appears in walls or ceilings.

By observing these requirements, movement and damage which may be expected in the life of the building can be minimised and maintained within normal performance requirements.



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