

ha

HAWKESBURY



Landscape—rugged, rolling to very steep hills on Hawkesbury Sandstone. Local relief 40 – 200 m. Slopes >25%. Rock outcrop >50%. Narrow crests and ridges, narrow incised valleys, steep sideslopes with rocky benches, broken scarps and boulders. Mostly uncleared eucalypt open-woodland and tall open-forest.

Soils—shallow (<50 cm), discontinuous Lithosols/Siliceous Sands (Uc1.21) associated with rock outcrop; Earthy Sands (Uc5.11, Uc5.23), Yellow Earths (Gn2.24) and some Yellow Podzolic Soils (Dy4.11) on inside of benches and along joints and fractures; localised Yellow Podzolic Soils (Dy4.11, Dy5.21) and Red Podzolic Soils (Dr5.11, Dr5.21) associated with shale lenses; Siliceous Sands (Uc1.2) and secondary Yellow Earths (Gn2.41) along drainage lines.

Limitations—extreme soil erosion hazard, mass movement (rock fall) hazard, steep slopes, foundation hazard, rock outcrop, shallow, stony, highly permeable soils, low soil fertility.

LOCATION

Steep, rugged, Hawkesbury Sandstone slopes and ridges in the Macdonald Ranges and Watagan Mountains in the west of the mapped area. Includes portions of Dharug and Yengo National Parks and parts of the Watagan and Olney State Forests.

LANDSCAPE

Geology

Hawkesbury Sandstone—medium- to coarse-grained quartz sandstone with minor shale and laminite lenses. Sandstones are either massive or cross-bedded sheet facies with vertical or sub-vertical joint sets. The combination of bedding planes and widely spaced joints gives sandstone outcrops a distinctive blocky appearance. In the Watagan

Mountains physiographic unit, rock outcrop is less conspicuous and the sandstone appears to be more deeply weathered.

Topography

Rolling to very steep hills. Local relief varies from 40–200 m. Slope gradients range from 25–100%. Crests and ridges are convex and <300 m wide. Slopes are moderately inclined to precipitous. Rock outcrop occurs as horizontal benches and broken scarps up to 10 m high. Cliffs are often present. Boulders, cobbles and rock benches usually cover up to 50% of the ground surface. Valleys are narrow, steep and incised. In the Watagan Mountains the sandstone appears to be more deeply weathered and rock outcrops are less frequent giving the slope a smoother appearance. Numerous sandstone benches are often restricted to slopes with exposed westerly and northerly aspects.

Vegetation

Mostly uncleared open-woodland and open-forest with pockets of tall open-forest and closed-forest in sheltered areas.

On exposed crests and ridges there is usually a low open-woodland. Common tree species include yellow bloodwood (*Euclayptus eximia*), red bloodwood (*E. gummifera*), grey gum (*E. punctata*), sydney peppermint (*E. piperita*), narrow-leaved stringybark (*E. oblonga*), scribbly gum (*E. haemastoma*), dwarf apple (*Angophora hispida*) and old man banksia (*Banksia serrata*).

In the west of the mapped area, scribbly gum (*E. racemosa*) and narrow-leaved apple (*Angophora bakeri*) become increasingly common.

A shrub understorey is present and common families include *Banksia* spp., *Hakea* spp., native heath (*Epacris* spp.), spider flower (*Grevillea* spp.), tea-tree (*Leptospermum* spp.) and wattle (*Acacia* spp.).

On the more sheltered sideslopes an open-forest/open-woodland consisting of smooth-barked apple (*Angophora costata*) and sydney peppermint (*E. piperita*) occurs.

In Olney and Watagan State Forests some crests and upper slopes have often been planted to blackbutt (*E. pilularis*) and blue-leaved stringybark (*E. agglomerata*) plantations.

Land Use

Mostly rugged bushland managed as National Parks (Brisbane Water, Dharug, and Yengo National Parks). Small areas occur within State Forest (Olney and Watagan State Forest) and are logged for hardwoods, mainly blue-leaved stringybark and blackbutt. Some small areas of Crown Land occur.

Existing Erosion

Severe sheet erosion often occurs during storms and after the ground cover is destroyed by bushfires (Atkinson 1983). Minor gully and rill erosion occur along unpaved tracks and fire trails (e.g., Great Northern Road) especially those used regularly by 4WD vehicles.

Included Soil Landscapes

Small areas of GyMEA (**gy**) soil landscape occur on crests and Watagan (**wn**) soil landscape on lower slopes. In the Watagan Mountains small areas of Sydney Town (**st**) soil landscape occur on crests.

SOILS

Dominant Soil Materials

ha1—Loose coarse quartz sand. Sand to sandy loam with loose apedal single-grained structure and porous sandy fabric. It generally occurs as topsoil (A_1 horizon).

Colour varies from brownish black (10YR 2/2) when abundant organic matter is present to dull yellow orange (10YR 7/2). Colour often becomes lighter with depth. The pH ranges from strongly acid (pH 4.0) to slightly acid (pH 6.0). Weakly weathered sandstone fragments may be present whilst charcoal fragments and roots are common. This material is commonly water repellent.

ha2—Earthy yellowish brown sandy clay loam. Clayey sand to sandy clay loam with apedal massive or occasionally weakly pedal structure and porous earthy fabric. It occurs as subsoil often in association with sandstone bedrock (B or C horizon).

Where peds are present, they are large sub-angular blocky and rough-faced. Ped sizes range from 30–60 mm. Common colours include yellow orange (10YR 7/8), bright yellowish brown (10YR 6/8, 10YR 6/6) and yellowish brown (10YR 5/6). The pH ranges from strongly acid (pH 4.0) to moderately acid (pH 6.0). Gravels, stones and ironstone plated sandstone fragments are common, but roots and charcoal fragments are rare.

ha3—Pale strongly pedal light clay. Fine sandy clay loam to medium clay with strongly pedal structure and rough-faced ped fabric. It occurs as subsoil on shale lenses within the Hawkesbury Sandstone (B or C horizon).

Structure is strongly pedal when dry and apedal when saturated. Peds range in size from 20–60 mm and are sub-angular blocky to angular blocky in shape. Colours are most often pale but can vary according to site drainage characteristics. Colour ranges from bright reddish brown (5YR 5/6) in well-drained areas to a light grey (10YR 8/1) in poorly drained areas. Red, orange and grey mottles are often present. The pH ranges from strongly acid (pH 4.0) to slightly acid (pH 6.0). Stratified ironstone gravels are

common, but roots and charcoal fragments are usually rare or absent.

Associated Soil Materials

Litter and decomposing organic debris. Surface litter consists of decomposing remnants of leaves and twigs, fungal and root mats, and quartz sand grains. Distribution depends on site productivity, fire regime, location of nearby species and surface wetness. Over 10 cm of decomposing organic debris often accumulates in debris dams and small fans on breaks of slope as well as in joint crevices of rock outcrops. There is usually a sharp boundary with the mineral soil.

White loose sand. This material is found on the surface and is composed of quartz sand grains found in recently deposited surface washes such as small debris dams and fans found on breaks of slope. This material is often mixed with litter and charcoal fragments.

Occurrence and Relationships

The soils are discontinuous with often >50% of the surface covered by sandstone rock outcrop. Soils in joint lines may be >100 cm deep.

Crests and ridges. Up to 20 cm of loose coarse quartz sand (**ha1**) overlies either bedrock [Lithosols (Uc1.21)] or <30 cm of earthy yellowish brown sandy clay loam subsoil (**ha2**) [Earthy Sands (Uc5.11, Uc5.23), Yellow Earths (Gn2.24, Gn2.31)]. Total soil depth is <50 cm. The boundary between soil materials is usually gradual. Texture often increases slowly with depth.

Sideslopes and benches. Soils are discontinuous. Sandstone outcrop and boulders may cover >50% of the ground surface. Usually 10–30 cm of **ha1** overlies bedrock [Lithosols and Siliceous Sands (Uc1.22)] on outsides of benches whilst 5–15 cm of **ha1** overlies <50 cm of **ha2** on higher sides of benches. Boundaries between soil materials are either gradual or clear, and total soil depth, although variable, is usually <70 cm. In some instances, especially along joint lines, soil depth may exceed 200 cm [Yellow Earths (Gn2.24) to clear Yellow Podzolic Soils (Dy 4.11)]. Often **ha2** is found along bedding planes in the sandstone.

Friable sandstone may occur as deep subsoil in poorly drained pockets and along joint lines. Minor lenses of shale are occasionally associated with higher sides of benches and have <30 cm of **ha1** which overlies <50 cm of strongly pedal clay subsoil (**ha3**). There is a clear to sharp boundary between soil materials. Total soil depth is usually <150 cm [Yellow Podzolic Soils (Dy4.11, Dy5.21) and occasional Red Podzolic Soils (Dr5.11, Dr5.21)].

Drainage lines. Drainage lines are either on exposed bedrock or have deposits of gravel or loose quartz sands (**ha1**) [Siliceous Sands (Uc1.2)] which occasionally overlie **ha2** [Yellow Earths (Gn2.41)]. Total soil depth is usually <100 cm.

In the Watagan Mountains rock benches are less numerous, and the soils are deeper and more continuous. On the crests 5–30 cm of **ha1** overlies <100 cm of **ha2** [Yellow Earths (Gn2.24, Gn2.41)]. The boundary between the soil materials is usually gradual and the total soil depth ranges from 30–150 cm. On the slopes <40 cm of **ha1** overlies 50–150 cm of **ha2** and the boundary between the materials is usually clear [Yellow Podzolic Soils (Dy4.61)] or occasionally gradual [Yellow Earths (Gn2.24)]. Total soil depth ranges from 30–200 cm.

LIMITATIONS TO DEVELOPMENT

Landscape Limitations

Mass movement hazard
Rock fall hazard
Steep slopes
Extreme erosion hazard
Rock outcrop
Shallow soils
Foundation Hazard

Soil Limitations

- ha1** High permeability
Low available water-holding capacity
Stoniness
Very low fertility
Very strongly acid
Very high aluminium toxicity
High erodibility
- ha2** Low available water-holding capacity
Stoniness
Very low fertility
Very strongly acid
Very high potential aluminium toxicity
High erodibility
Hardsetting surface
Sodicity
- ha3** Low wet bearing strength (localised)
Low permeability
Very low fertility
Very strongly acid
High potential aluminium toxicity

Fertility

Fertility of the soil materials is very low. Soil materials are very shallow and stony, are very strongly acid with very low phosphorus and nutrient status and have a high potential aluminium toxicity. **ha1** and **ha2** have low available water-holding capacities and CECs. **ha2** is sodic. The general soil fertility is very low.

Erodibility

	K factor	Non-concentrated flows	Concentrated flows	Wind
ha1	0.023	moderate	high	low
ha2	0.016	low	high	low
ha3	0.032	moderate	moderate	low

Erosion Hazard

	Non-concentrated flows	Concentrated flows	Wind
grazing	extreme	extreme	slight
cultivation	extreme	extreme	slight
urban	extreme	extreme	slight

Foundation Hazard

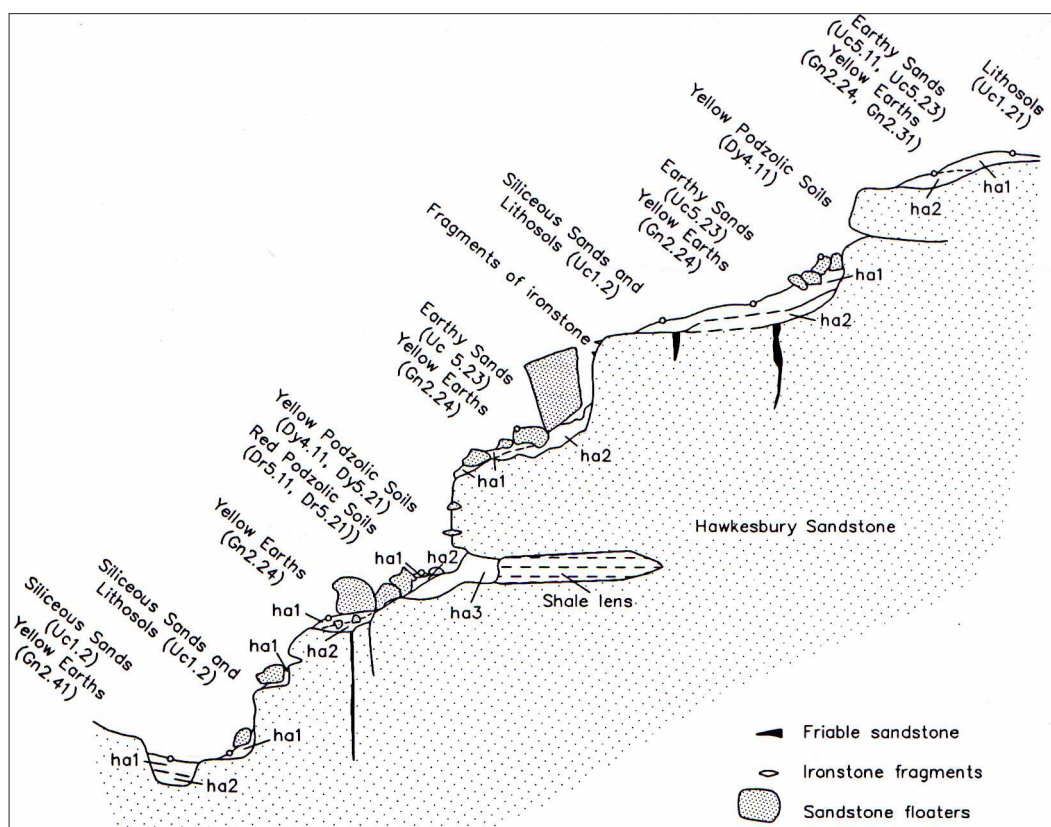
Steep slopes and mass movement hazard (rock fall) give this landscape a high foundation hazard. Soils are discontinuous and subsoil, when present (excluding Watagan Mountains physiographic region), is <20 cm deep. Total soil depth is generally <50 cm.

Urban Capability

High to severe limitations for urban development.

Rural Capability

High to severe limitations for cultivation and grazing.



■ Schematic cross-section of the Hawkesbury soil landscape illustrating the occurrence and relationship of the dominant soil materials.