



Source: Soil and Land Resources of the Hawkesbury-Nepean Catchment *interactive DVD*

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 (dry sclerophyll forest) and tall open-forest (wet sclerophyll 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 and Red Podzolic Soils (Dy4.11, Dy5.21, Dy5.11, Dr5.21) associated with shale lenses; Siliceous Sands (Uc1.2) and secondary Yellow Earths (Gn2.41) along drainage lines.

Limitations—extreme soil erosion hazard, steep slopes, rock outcrop, shallow, stony, highly permeable soil, low soil fertility.

LOCATION

Steep, rugged Hawkesbury Sandstone slopes and ridges of the Macdonald Ranges, Hornsby Plateau and Hawkesbury Valleys. Examples occur in Muogamarra Nature Reserve, Brisbane Water National Park and Ku-ring-gai Chase National Park. Within the metropolitan area, examples are found adjacent to Port Jackson, Georges River, Cowan Creek, Deep Creek and the upper reaches of the Lane Cove River.

LANDSCAPE

Geology

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

Topography

Rolling to very steep hills. Local relief varies from 40–200 m. Slope gradients range from 25–70%. Crests and ridges are convex and narrow, at >300 m wide. Slopes are moderately inclined to precipitous. Rock outcrop occurs as horizontal benches and broken scarps up to 10 m high. Boulders and cobbles cover up to 50% of the ground surface. Valleys are narrow and incised.

Vegetation

Mostly uncleared open-woodland (dry sclerophyll) with pockets of tall open-forest (wet sclerophyll) and closed-forest (rainforest).

On exposed crests and ridges there is usually a low open-woodland containing red bloodwood *Eucalyptus gummifera*, narrow-leaved stringybark *E. oblonga*, scribbly gum *E. haemostoma*, brown stringybark *E. capitellata* and old man banksia *Banksia serrata*. On the more sheltered sideslopes, a dry sclerophyll open-forest containing black ash *E. sieberi*, sydney peppermint *E. piperita*, smooth-barked apple *Angophora costata* and black sheoak *Allocasuarina littoralis* predominate. The understorey is dominated by shrub species of the families Epacridaceae, Myrtaceae, Fabaceae and Proteaceae.

Within sheltered gullies, wet sclerophyll closed-forests of blackbutt *Eucalyptus pilularis*, Sydney blue gum *E. saligna*, water gum *Tristania laurina* and occasionally coachwood *Ceratopetalum apetalum* occur. Black wattle *Callicoma serratifolia*, native myrtle *Backhousia myrtifolia* and bracken *Pteridium esculentum* form a closed scrubby understorey. Many sheltered valley floors are overrun with weeds (garden escapes washed in with sediment). Weed species include small and large-leaved privets *Ligustrum spp.*, lantana *Lantana camara*, morning glory *Ipomoea indica* and wandering jew *Tradescantia albiflora*.

Landuse

Mostly national parks (Ku-ring-gai Chase and Brisbane Water) and nature reserve (Muogamarra), which are used for education and recreation. Small areas under private ownership. Maroota State Forest occurs in the far north-west. Population pressures, scenic views and bushland settings have contributed to the urbanisation of this landscape.

Existing Erosion

Severe sheet erosion often occurs during storms and after ground cover is destroyed by bushfires (Atkinson, 1984). Minor gully erosion occurs along unpaved tracks and fire trails, especially those used regularly by four wheel drive vehicles, motorcycles and horses.

Associated Soil Landscapes

Small areas of Faulconbridge (**fb**) soil landscape occur on some crests, whilst Lambert (**la**) and Oxford Falls (**of**) occur on some sideslopes and Deep Creek (**dc**) is found in some valley floors.

SOILS

Dominant Soil Materials

ha1—Loose, coarse quartz sand. This is a sand to sandy loam with loose, apedal single-grained structure and porous sandy fabric. It generally occurs as topsoil (A1 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. This is a clayey sand to sandy clay loam with apedal massive or occasionally weakly pedal structure and a distinctly porous, earthy fabric. It generally 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 mm to 60 mm. Common colours include yellow orange (10YR 7/8), bright yellowish-brown (10YR 6/8, 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. This is fine sandy clay loam to medium clay with strongly-pedal structure and rough-faced ped fabric. It commonly occurs as subsoil derived from shale lenses within the Hawkesbury Sandstone (B or C horizons).

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

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), Yellow Earths (Gn2.24, Gn2.31)]. Total soil depth is <50 cm. The boundary between soil materials is usually gradational. Texture often increases slowly with depth.

Sideslopes and benches. Soils are discontinuous. Sandstone outcrop and boulders may cover over 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 up to 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 2 m [Yellow Earths (Gn2.24) to clear Yellow Podzolic Soils (Dy 4.11)]. Often **ha2** is found along bedding planes in the sandstone.

Friable sandstone (**la6**) may occur as deep subsoil in poorly drained pockets and along joint lines.

Minor lenses of shale are occasionally **ha3** associated with higher sides of benches and have up to 30 cm of **ha1** which overlies up to 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.

Associated Soils. Occasional shale crests that occur in the unit have approximately 30 cm of a brown hardsetting loam or clay loam topsoil overlying up to 100 cm of a pedal red or brown clay subsoil [Yellow Podzolic Soils (Dy3.21) and Red Podzolic Soils (Dr3.21)].

LIMITATIONS TO DEVELOPMENT

Urban Capability

Generally not capable of urban development.

Rural Capability

Not capable of being cultivated or being grazed.

Landscape Limitations

Mass movement hazard

Rockfall hazard

Steep slopes

Severe erosion hazard

Rock outcrop

Shallow soils

Soil Limitations

ha1 High permeability
 Low available water capacity
 Stoniness
 High organic matter
 Low fertility
 Extremely acid
 Very high aluminium toxicity

ha2 Low available water capacity
 Stoniness
 Very low fertility
 Strongly acid
 Very high aluminium toxicity
 Low available water capacity
 Low wet strength (localised)

Low permeability (localised)
Very low fertility
Strongly acid
High aluminium toxicity

Fertility

General fertility is very low. The soils of this unit are extremely to strongly acid with a low to very low nutrient status. The soils are severely deficient in nitrogen and phosphorus and they have very low CEC. They are also shallow and stony with low available water capacities and high aluminium toxicity.

Erodibility

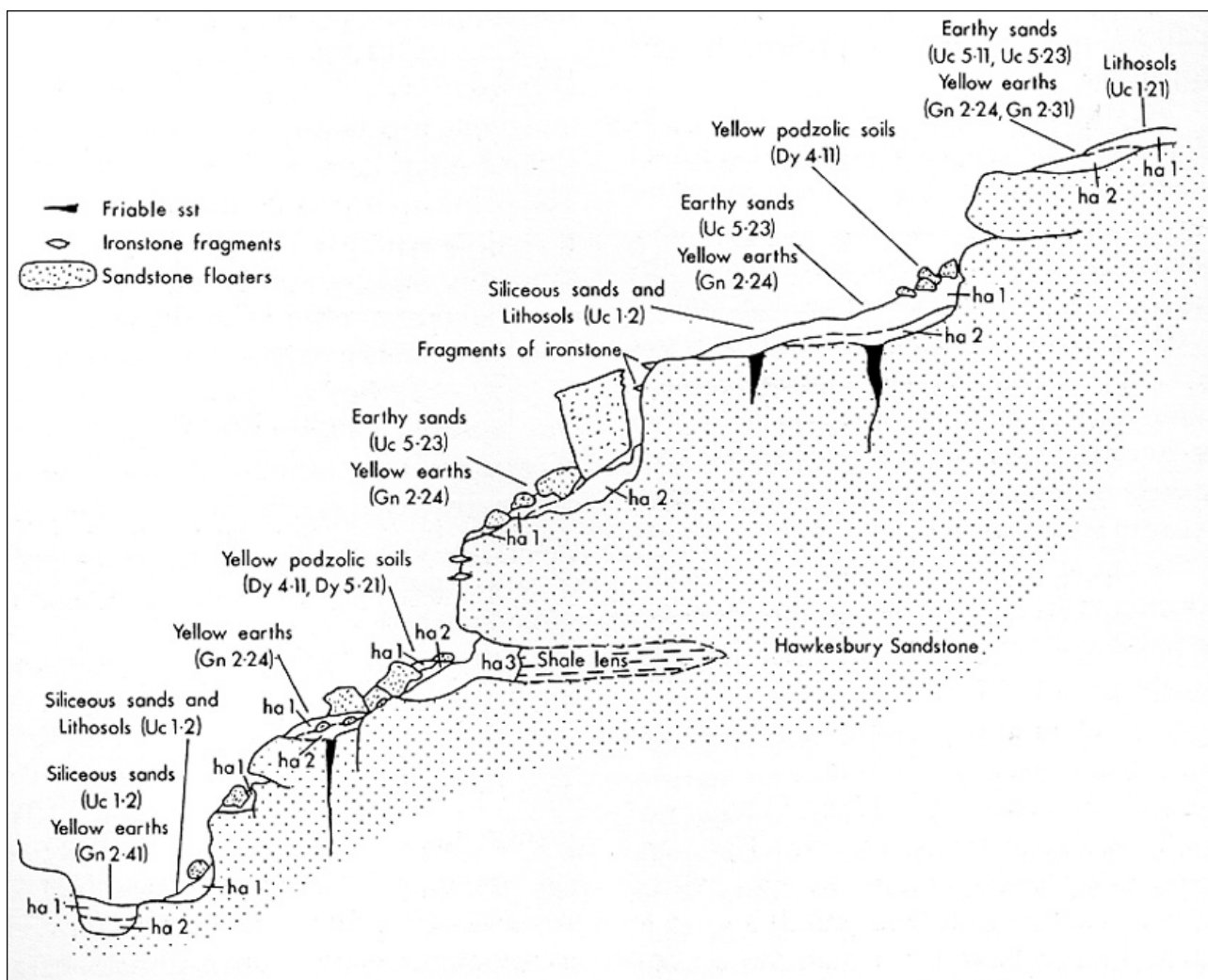
The topsoil **ha1** has low erodibility. It consists of highly permeable, loose, coarse sands and organic matter. **ha1** is highly susceptible to concentrated flow erosion, especially when the organic matter is removed by hot bushfires. **ha2** and **ha3** have moderate erodibility. They have low organic matter contents and weak fabrics.

Erosion Hazard

Erosion hazard for non-concentrated flows is generally very high and ranges from moderate to extreme. The calculated soil loss for the first twelve months of urban development ranges up to 109 t/ha for topsoil and 394 t/ha for subsoil. The soil erosion hazard for concentrated flows is extreme.

Surface Movement Potential

The shallow sandy soils are stable to slightly reactive.



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