



Landscape—gently undulating rises to steep low hills on deeply weathered basaltic breccia. Local relief to 70 m, slopes range from 3% to 65%. Diatremes (volcanic necks) and shallow intrusions often located in sandstone valley floors. Mostly cleared, tall open-forest (wet sclerophyll forests) and weed infested closed-forest (rainforest).

Soils—deep (150–300 cm) Yellow Podzolic Soils (Dy4.11) on upper and midslopes; Yellow-Brown Earths (Gn2.41) and Red Podzolic Soils (Dr4.11) on sandstone colluvium; Yellow Podzolic Soils (Dy2.21) on volcanic breccia; deep (>200 cm) Structured Loams (Um6.21) in drainage lines. Associated soils include Prairie Soils (Gn3.91, Gn4.31), deep Krasnozems (Gn3.11) and Chocolate Soils (Db1.11, Db4.11).

Limitations—highly plastic, low wet-strength, highly reactive subsoil, occasional steep slopes with an extreme soil erosion hazard and localised mass movement hazard.

LOCATION

Located on diatremes and other intrusions scattered throughout the Sydney area. Largest occurrences include diatremes at Hornsby, Oxford Falls, Muogamarra Nature Reserve and Lugarno.

LANDSCAPE

Geology

Jurassic volcanic breccia, remaining from explosive volcanoes. Includes varying amounts of sedimentary breccia, olivine basaltic breccia, metamorphosed sandstone country rock and some volcanic tuffs (Herbert, 1983).

Topography

Where diatremes are surrounded by Hawkesbury Sandstones, volcanic topography is distinguished by gently inclined valley floors surrounded by steep, colluvial sideslopes. Local relief is up to 80 m and slope gradients range from 3–65%. The Hornsby diatreme is a typical example.

Where shales surround diatremes, topography is difficult to distinguish from surrounding landforms, which are gently inclined plateau surfaces. Local relief is <20 m and slopes are <10%. Dundas Valley is a typical example.

Vegetation

Mostly cleared, tall open-forest (wet sclerophyll forest) on side slopes to closed-forest (depauperate rainforest) on valley floors.

Tall wet sclerophyll forests are dominated by Sydney blue gum *Eucalyptus saligna*. Other tree species include white mahogany *E. acmenoides*, blackbutt *E. pilularis* and forest oak *Allocasuarina torulosa*. The understorey contains bracken fern *Pteridium esculentum*, and tree ferns *Dicksonia antarctica* and *Cyathea australis*.

Common rainforest species include sassafras *Doryphora sassafras*, coachwood *Ceratopetalum apetalum* and black wattle *Callicoma serratifolia*. In some locations, cabbage tree palm *Livistona australis* and bangalow palm *Archontophoenix cunninghamiana* indicate the presence of volcanic soils.

Weeds such as blackberry *Rubus vulgaris*, privet *Ligustrum* spp. and *Pittosporum undulatum* are common in areas that have been disturbed.

Land use

Quarrying for blue metal is the most intensive land use. Rubbish disposal sites, parks and playing fields are also common. Some urban development has occurred at Hornsby. Small areas are grazed.

Existing Erosion

Most areas have minor sheet erosion. Rill erosion occurs on steep, exposed batters. Severe sheet erosion as well as rill erosion occurs on unpaved roads on steep sideslopes.

SOILS

Dominant Soil Materials

ho1—Black, organic sandy loam. This is loose, organic rich, apedal single-grained sandy loam with porous sandy fabric. It generally occurs as topsoil (A1 horizon). Colour ranges from black (10YR 1.7/1) to brownish-black (10YR 2/2). Large amounts of organic material are present. The pH ranges from strongly acid (pH 4.5) to moderately acid (pH 5.5). Coarse quartz sand grains are derived from Hawkesbury Sandstone. Gravel and boulders consisting of strongly weathered sandstone and metamorphosed sandstone are common. Roots are also common and charcoal fragments are often present.

ho2—Hardsetting, dark brown sandy clay loam. This is a dark brown, light sandy clay loam to fine sandy clay loam that has a hardsetting surface condition and apedal massive to weakly pedal structure. This material occurs as an A2 horizon. Peds, when present, are porous and rough faced, 20–50 mm in size and have a sub-angular blocky shape. Abundant root and faunal pores are usually present. Coarse quartz sand grains are commonly found throughout this material. Colour

ranges from dark brown (7.5YR 3/3) to black (10YR 1.7/1). The pH ranges from strongly acid (pH 4.5) to slightly acid (pH 6.5). Sandstone and metamorphosed sandstone fragments, roots and charcoal fragments are often present.

ho3—Strongly pedal, brown light clay. This is brown, sub-plastic, light clay with strongly pedal structure and dense, smooth-ped fabric. This material occurs as subsoil over volcanic breccia (B horizon). Peds range in size from 2–20 mm, they are smooth-faced and granular to sub-angular blocky in shape. Common colours include dull reddish-brown (5YR 5/4), light reddish-brown (5YR 5/8), and bright brown (7.5YR 5/6). This material is often sub-plastic and is moderately sticky when moist. The pH ranges from moderately acid (pH 5.5) to slightly acid (pH 6.5). Rock and charcoal fragments are usually absent, and roots are rarely present.

ho4—Earthy, brown sandy loam. This is a sandy loam to a light sandy clay loam with apedal massive structure and porous earthy fabric. It generally occurs as subsoil over sandstone colluvium (B horizon). Colour varies from bright yellowish-brown (10YR 7/6) to dull yellowish-brown (10YR 4/3). The pH ranges from strongly acid (pH 4.5) to slightly acid (pH 6.0). Strongly weathered sandstone and metamorphosed sandstone fragments range from few to common. Roots are often abundant, whilst charcoal fragments are rarely present.

ho5—Earthy, reddish-brown, sandy clay. This is reddish brown, sandy clay to light clay with apedal massive or weakly pedal structure and earthy, slightly porous, fabric. It occurs as subsoil on sandstone colluvium (B-C horizon). Sand grains are often present throughout this material. Peds, when present, are commonly rough-faced and porous. They range in size from 5–20 mm and are usually sub-angular blocky in shape. Colour is commonly a bright reddish-brown (5YR 5/6). The pH ranges from strongly acid (pH 4.5) to moderately acid (pH 5.0). Sandstone boulders, cobbles and rock fragments are common whilst charcoal fragments and roots are rare.

ho6—Weathered volcanic breccia clay. This is a light to medium clay with highly pedal structure and rough-faced ped fabric that is the weathering product of volcanic breccia parent material. Peds are commonly rough-faced, prismatic and angular blocky in shape and range in size from 10–50 mm. They readily break down to smaller 2–10 mm polyhedral peds. Clusters of smooth-ped faces also occur. Colour ranges from bright reddish-brown (5YR 5/6) to light brownish grey (7.5YR 7/1). Dark red, orange or yellow mottles are commonly present. The pH ranges from strongly acid (pH 4.5) to moderately acid (pH 5.5). Strongly weathered, angular, breccia rock fragments are common. Roots and charcoal fragments rarely present.

Associated Soil Materials

Humus layer. Decomposing organic matter occurs as a surface layer (O horizon) and may be over 10 cm thick.

Dark brown, pedal clay loam. Dark brown or black, stony, strongly pedal, fine sandy clay loam to clay loam with abundant root and faunal pores and coarse sand grains is occasionally present. This material occurs as topsoil on mid and lower slopes. It is believed to be a mixture of **ho1** and subsoils of volcanic origin.

Pallid clay. White to pale grey light to heavy plastic clay with dense fabric and strong sub-angular blocky structure when dry. Occurs as subsoil in weathered dykes.

Occurrence and Relationships

Most information on soil relationships has been obtained from the Hornsby diatrema, with supplementary profiles having been described at other diatremes (Paton, 1978).

Soils are complex and highly variable. Soils identified at other diatremes include Krasnozems (Gn4.11) at Dundas Valley and Oxford Falls and Prairie Soils (Um6.11), Brown Podzolic Soils and Chocolate Soils (Db1.11) at Lugarno.

Steep sideslopes. Generally, 20–40 cm of black, organic sandy loam (**ho1**) overlies 60–200 cm of strongly pedal, brown light clay (**ho3**). Sandstone boulders and cobbles are common. Total soil depth is 150–300 cm. The boundary between soil materials is sharp [Yellow Podzolic Soils (Dy4.11)].

Steep footslopes below steep sideslopes. Generally, 20–60 cm of **ho1** overlies up to 50 cm of earthy, brown sandy loam (**ho4**) and more than 200 cm of earthy, yellowish brown, sandy clay (**ho5**). At depth **ho5** is thought to overlie **ho3** and weathered volcanic breccia clay (**ho6**). Total soil depth is at least 300 cm. Boundaries between soil materials are gradual to sharp [Yellow Brown Earths (Gn2.41), Red Podzolic Soils (Dr4.11)].

Undulating footslopes. Up to 30 cm of **ho1** overlies 20–40 cm of hardsetting, brown clay loam (**ho2**), up to 200 cm of **ho3** and over 50 cm of **ho6**. Total soil depth is 300 cm. Boundaries between **ho1**, **ho3** and **ho4** are clear whilst the boundary between **ho4** and **ho6** is gradual and irregular [Yellow Podzolic Soils (Dy2.21)].

LIMITATIONS TO DEVELOPMENT

Urban Capability

Low to moderate capability for urban development with localised very steep areas not capable of development.

Rural Capability

Generally capable of sustaining grazing. Localised areas on valley floors are capable of regular cultivation whilst steep lands are not capable of cultivation or grazing.

Landscape Limitations

Mass movement hazard (localised)

Steep slopes (localised)

Erosion hazard (localised)

Highly reactive soils

Soil Limitations.

ho1 Strongly acid
High aluminium toxicity

ho2 Low wet strength
Hardsetting surface

ho3 Low wet strength
High shrink-swell
Poor fertiliser response

ho4 Low available water capacity
Hardsetting
Very low soil fertility

ho5 Low wet strength
Low available water capacity (localised)
Very low fertility

Strongly acid
High aluminium toxicity

ho6 Low wet strength
High shrink-swell
Stoniness
Low available water capacity (localised)
Very low fertility
High aluminium toxicity

Fertility

The general fertility is low to moderate. Topsoils (**ho1**, **ho2**) have low to moderate nutrient status and CECs and often have high organic matter content (**ho1**). However, the subsoils (**ho3–ho6**) generally have low to moderate available water capacities, low to very low organic matter content and very low nutrient status. **ho3** will respond poorly to phosphate fertiliser.

Erodibility

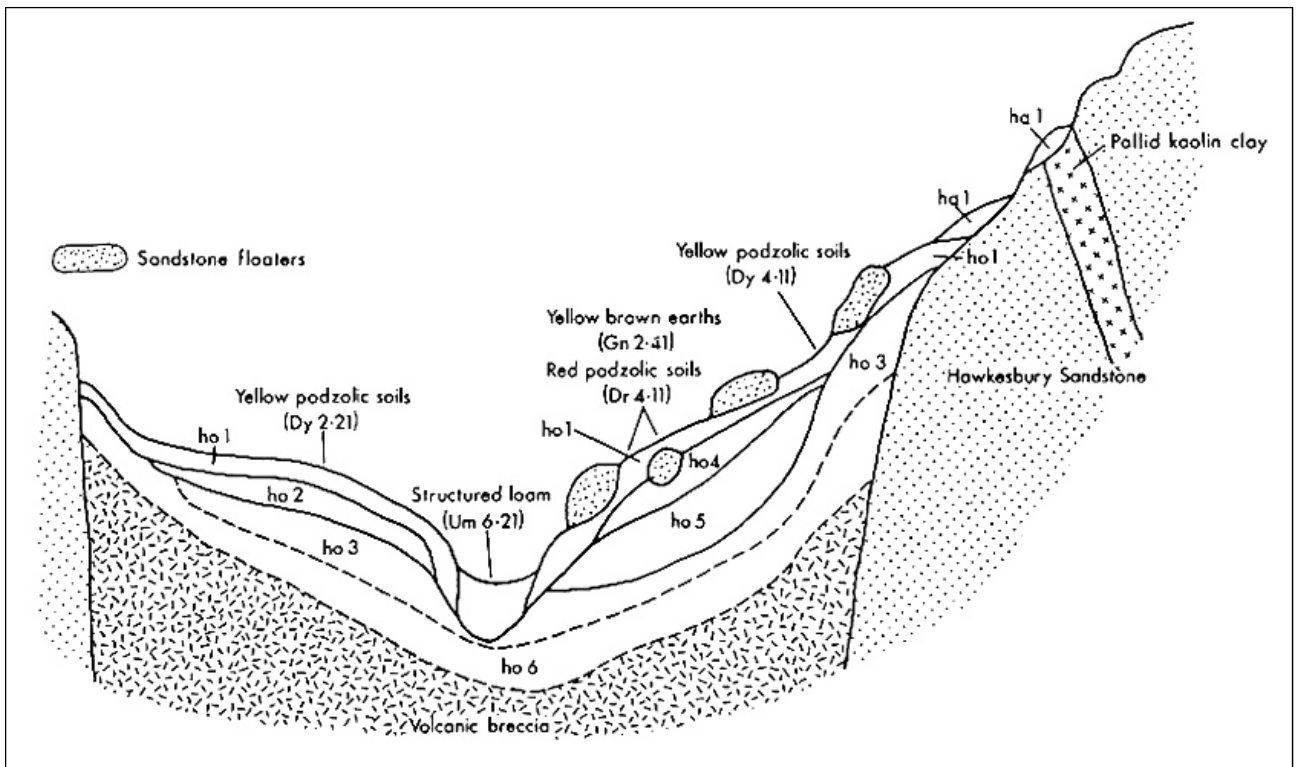
The soil erodibility for all soil materials is low. The topsoils and the subsoils consist of relatively stable soil aggregates.

Erosion Hazard

The erosion hazard for non-concentrated flows varies from moderate on the gently undulating surfaces to extreme on the steep sideslopes. Calculated soil loss during the first twelve months of development ranges up to 154 t/ha for both topsoil and exposed subsoil. Soil erosion hazard for concentrated flows ranges from low to extreme depending on slope and soil materials affected.

Surface Movement Potential

Soils are locally highly reactive as they consist of deep expansive clays in a landscape with large trees.



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