2.4 Geology

Refer to Figure 2.5.

The geology of the area is typical of Sydney and is dominated by sandstone. In assessing the geology of the area five soil units have been identified in accordance with Soil Landscapes of Sydney (Chapman and Murphy, 1989). These are Luddenham, Hawkesbury, Glenorie, Gymea and the Lucas Heights soil landscapes. These landscapes have distinct landforms and soil characteristics which may influence the landscape design response for the motorway.

Luddenham

The Luddenham Soil Landscape characterises the corridor west of Windsor Road. This landscape is underlain by the Wianamatta Shale Group and is composed of Ashfield and Bringelly shale formations, between which Minchinbury sandstone is interlaid.

This soil is of low to moderate fertility and is highly erodible.

Glenorie

Glenorie Soil Landscape occurs as minor incursions at the western end of the corridor and on the Hornsby Plateau. Soil is underlain by the Wianamatta Group composed of the Ashfield shale and Bringelly shale formations. Ashfield shales are characterised by laminates of dark grey shale and Bringelly shale consisting of a shale calcerous claystone and lithic quartz sandstone.

Soils are of low to moderate fertility, with high available water capacity, and are acidic. The soils are of moderate erodibility.

Hawkesbury

Hawkesbury Soil Landscape is located between Windsor Road and Pennant Hills Road where it occurs in association with Blue Gum and Darling Mills Creeks, as depicted in Photo 2.11. The unit is characterised by steep rugged sandstone slopes and ridges of Hawkesbury sandstone which is a medium to coarse grained quartz sandstone with minor shale laminate lenses. A second area adjoins the Gymea landscape where the motorway follows the Devlins Creek Valley.

Fertility of soils in this landscape is very low, strongly to extremely acidic, with low to very low nutrient availability. These soils are typically shallow and stony.

Gymea

The Gymea Soil Landscape occurs in steeper terrain west of Terrys Creek and is evident by increased valleys. The steeper terrain is highlighted by the Norfolk Road Tunnel as depicted in Photo 2.12 and reveals the character of this rock. It marks the edge of the Hornsby Plateau. The geology is Hawkesbury sandstone which is a medium to coarse grained quartz sandstone with minor shale laminate lenses. The geology is similar to the Lambert and Hawkesbury Soil Landscapes.

Soils within this area are shallow stony, moderately acidic and highly permeable, with very low nutrient levels. The soil is subject to high erosion risk when exposed.

Lucas Heights

The Lucas Heights landscape is typified by the Mittagong formation which is characterised by interbedded shale, laminate and fine to medium grain quartz sandstone. A small incursion occurs towards the western end at Barclay Road. Soils here are generally of low fertility and nutrient availability, hard setting and stony. The subsoils are occasionally sodic and impermeable. When exposed they are of moderate erodibility. This landscape is located predominantly at the eastern end of the corridor, between Terrys Creek and Delhi Road where the motorway runs along a relatively flat ridge.

Photo 2.10 Shale seam in sandstone dominated geology

Photo 2.11 Sandstone is exposed in the motorway cuttings

Photo 2.12 Tunnel portal area reveals the local geology

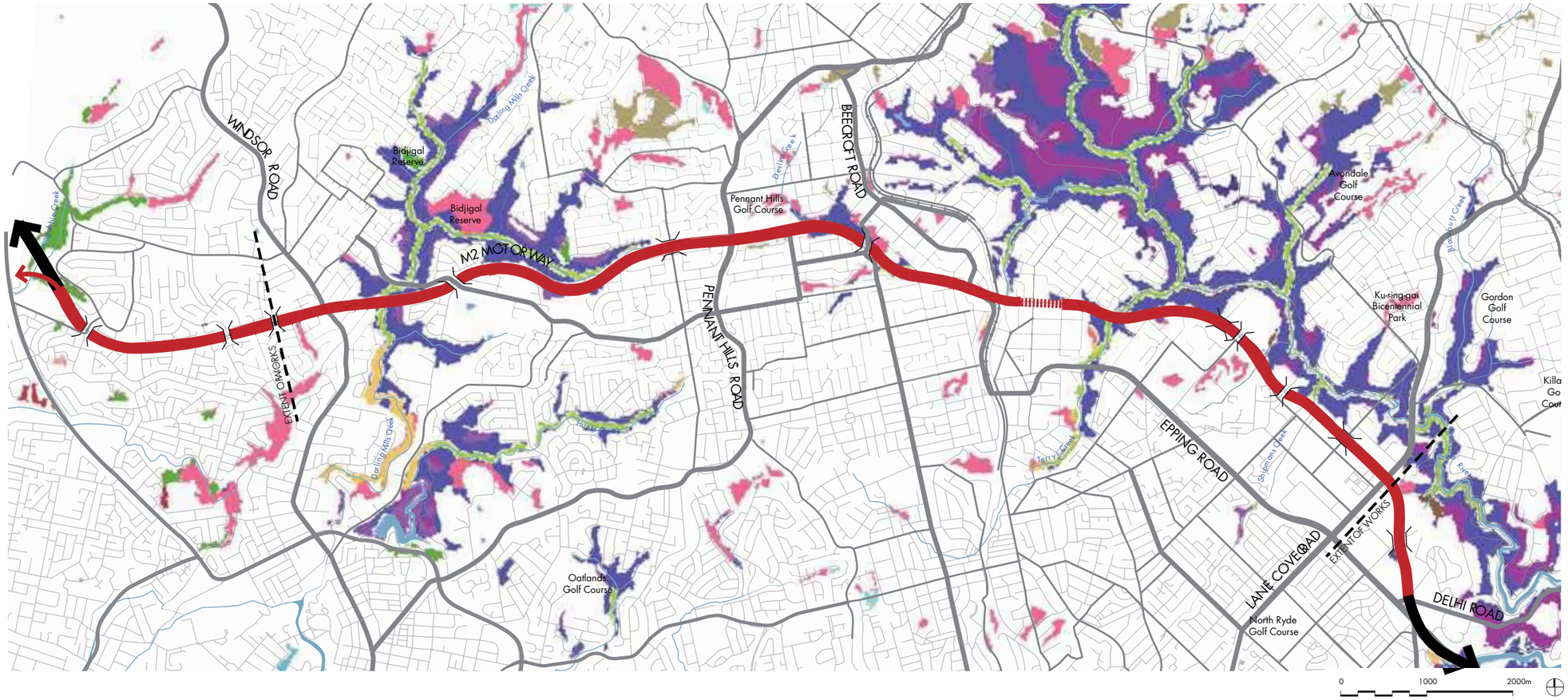

Figure 2.6 Vegetation

2.5 Vegetation

Refer to Figure 2.6.

The vegetation of the M2 Motorway corridor is a mix of revegetation works, undertaken as part of the original development, stands of remnant vegetation and weeds.

The natural vegetation of the region is preserved in National Park or Reserves along with isolated remnant stands within the urban fabric of the adjoining residential areas. These provide the basis for determining the likely communities to be used in revegetation works associated with the upgrade.

Tozer et al 2006, has mapped the communities adjoining the corridor as part of a study on Native Vegetation of Southeast NSW which identifies a number of key communities along the route. These communities are limited in that they are predominantly associated with the valleys where vegetation has been preserved. Despite this they appear to provide a good indication of likely communities and associations which would have once occurred along the alignment.

1. Hinterland Sandstone Gully Forest is a tall open forest in which *Eucalyptus pilularis* (Blackbutt), *Angophora costata* (Smooth barked apple) and in some locations *Syncarpia gummifera* (Turpentine) are dominant. Refer Photos 2.13 to 2.15. Under the canopy a moderately dense sub canopy of *Allocasuarina littoralis, A. torulosa, Banksia serrata, Ceratapetalum gummiferum*, and *Elaeocarpus reticulatus* occurs. The understorey is sparse to moderately dense with *Acacia linifolia, Dondonea triquetra, Grevillea linearifolia, Leptospermum trinervium* and *Pultanea flexilis*. The ground layer includes *Dianella caerulea, Entolasia stricta, Lomandra longifolia, Microlaena stipodes*, and *Pratia purpurascens*.

   This community occurs within gullies on Hawkesbury Sandstone with enriched soils as a result of the influence of the Wiannamatta group of shales within the sandstone bedrock. It is the dominant community within the corridor and adjacent to it.

2. Sandstone Riparian Scrub is found in narrow bands along creeklines within sandstone gullies. Dominant canopy species include *Ceratapetulum apetalum, Tristania laurina*, and *Callicoma serrata*. The understorey is composed largely of ferns including *Adiantum aethiopicum, Blechnum ambiguum*, and *Sticherus flabellatus*. *Lomandra longifolia* is also a common element of the understorey.

   This community occurs along all creeks within the corridor with the most intact occurrences at Darling Mills Creek and Terrys Creek.

3. Sydney Turpentine Ironbark Forest is a listed community under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. It is an open-forest of mixed and varying canopy species composition, in which *Syncarpia glomulifera* (Turpentine) and *Eucalyptus crebra* and/or *E. fibrosa* (ironbarks) are dominant. Other tree species include *Corymbia gummifera, E. saligna , E. punctata , E. cypellocarpa*, and *E. deanei*. Low tree and shrub species include *Acacia parramattensis, Breynia oblongifolia, Dodonaea triquetra, Leucopogon juniperinus, Notelaea longifolia, Ozothamnus diosmifolius, Pittosporum revolutum, P. undulatum, Polyscias sambucifolia* and *Maytenus silvestris*. Ground layer species include *Adiantum aethiopicum, Austrostipa pubescens, Dianella caerulea, Dichondra repens, Entolasia stricta, Lomandra longifolia, Poa affinis, Pseuderanthemum variable* and *Themeda australis*. Climbers include *Eustrephus latifolius, Glycine clandestina* and *Pandorea pandorana* (DEWHA 2009). Its distribution within the corridor has been questioned with similarities drawn between it and the Hinterland Gully Forest, however, it is considered it would have been the dominant community west of Windsor Road where a transition to shale derived soils becomes stronger.

4. Blue Gum High Forest is listed community under the Threatened Species Conservation Act, 1995; and Environmental Protection and Biodiversity Conservation Act, 1999. It is a moist tall open forest community which would have once occurred along sections of the corridor. Today it is limited to a narrow band between the M2 and Pennant Hills Golf Course. Dominant species include *Eucalyptus pilularis, E. saligna, E. paniculata, Angophora costata*, and *Syncarpia glomulifera*. It will not be impacted as part of the works.

5. Coastal Sandstone Ridgetop Woodland is an open dry sclerophyll community which occurs on the shallow sandy soils of the ridge tops and exposed slopes. This community is interpreted as likely to have occurred east of Terrys Creek. Dominant canopy species include *Angophora bakeri, A. costata, Corymbia gummifera, Eucalyptus haemastoma* and *E. piperita*. The understorey frequently includes *Banksia spinulosa, Isopogon anemonifolius, Leptospermum trinervuium, Dillwynia retorta, Eriostemon australis*. Some of the likely shrub species are illustrated in Photo 2.16 to 2.19.

   The existing revegetation works have had mixed success. While canopy trees are beginning to emerge above the noise walls, the understorey is heavily infested with weeds.

The landscapes success has been limited by a number of factors:

1) Topsoil depths - this has been an issue particularly in cuttings where exposed rock and subgrades are left exposed with no provision for achieving a vegetative cover.
2) Space - the narrow corridor has meant that landscape spaces have been limited to narrow strips which have poor microclimate due to reflected heat from tarmac and adjoining walls and soil preparation has been limited by access.
3) Weed infestation – due to adjoining suburban influences and the disturbance created by the initial construction works and the linear nature of the corridor, the area has suffered significant weed infestations.

Weed species including small leaf privet, lantana and cestrum to name just a few. All are listed on the noxious weed register and require control activities to be implemented. In addition to these weeds, numerous woody weeds are also evident. Control of weed species will be an important consideration in undertaking the new works as the level of infestation present could rapidly affect any new works adjacent.

In moving forward, the upgrade works need to consider the viability of the landscape works within confined zones, the ability to access and maintain the landscape and the role the landscape can play in both improving the character of the corridor by unifying its appearance and relating it back to its natural context.

Photo 2.13 Hinterland Sandstone Gully Forest adjoining Kirkham Street

Photo 2.14 Angophora costata and Syncarpia glomulifera

Photo 2.15 Eucalyptus pilularis and Syncarpia glomulifera

Photo 2.16 Sandstone ridgetop woodland

Photo 2.17 Leptospermum laevigatum

Photo 2.18 Banksia spinulosa

Photo 2.19 Grevillea speciosa