



Hills Face Reserves Vegetation Management Framework

Address: 401 Greenhill Road, Tusmore SA 5065

Phone: 8366 4200

Email: burnside@burnside.sa.gov.au

Web: www.burnside.sa.gov.au

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Executive Summary

With the support of EBS Ecology, the City of Burnside (the Council) has developed a Hills Face Reserves Vegetation Management Framework. This Framework consists of the guiding principles and actions for managing bushfire fuel, biodiversity and weed species in over 130 ha of reserves and approximately 27 km of roadsides in the Adelaide Mount Lofty Ranges Hills Face Zone, within the Council. The Council has an active Conservation and Land Management Program, which manages the hills face reserves and roadsides through contractor works, a volunteer program, and collaborations with Trees for Life and Conservation Volunteers Australia.

This Framework includes the following components:

- Review of relevant Council policies, plans and studies;
- Compliance and legislative summary;
- Description of the hills face reserves natural assets, including pre-European, existing and desired vegetation structures, and significant flora and fauna species;
- Identification and discussion of the risks associated with vegetation management to the community, environment and economy, including weeds, bushfire, erosion, climate change, feral animals, habitat loss and physical injury to visitors and staff;
- Detail of the Council's vegetation management vision, principles and actions, including Bushfire Management Zones, responsible officers, approaches (e.g. slashing, woody weed control, weed spraying), and monitoring and reporting to be undertaken; and
- Summary of management issues, including reserve management access, fire hazards and weeds on private land, and illegal dumping.

This Framework should be used in conjunction with the Council's Operational Reserve Management Plans, developed for each of the hills face reserves.

The key desired vegetation management outcomes in the hills face reserves and roadsides include:

- Fuel within Bushfire Management Zones are managed per the CFS standard or better;
- Open indigenous tree canopies with few to no trees within 20 m of property boundaries, patchy tree canopies with gaps and open spaces, and trees within Asset Protection Zones having the bottom of their crowns trimmed at least to 2 m;
- Shrubs in widely-spaced groups with none within 10 m of property boundaries, sparse cover in Asset Protection Zones, and in clumps beyond Asset Protection Zones, but still consistent with a moderate or better overall fuel hazard rating;
- Ground covered with native grasses and wildflowers managed by slashing to prevent fuel accumulation;
- Patchy scrub, particularly away from Asset Protection Zones, that provide habitat for woodland bird species;

- A transition from weed dominated landscapes to native vegetation through weed control, facilitated natural regeneration and revegetation;
- Reserves that are resistant and resilient to the risks and impacts of erosion, runoff and sedimentation;
- A trail network that provides safe access for visitors, contractors, volunteers and Council staff, and separates the reserves into convenient management units; and
- Aesthetically pleasing and uplifting reserves that are accessible and where weeds are controlled, native flora and fauna thrive, and illegally dumped waste is eliminated or removed swiftly.

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1 INTRODUCTION

The Council has an active Conservation and Land Management Program, which manages the city's hills face reserves and roadsides through contractor works, a volunteer program, and collaborations with Trees for Life and Conservation Volunteers Australia.

The Council conducted a Bushfire Management Audit in early 2018 to assess the Council's existing bushfire prevention and response treatments. A key recommendation of that audit was that a formal vegetation management plan be developed for all of the Council's hills face reserves and road verges. At the time of the audit, the only formally endorsed vegetation management plan was the *Southern Hills Face Reserves Vegetation Management Plan* (SHFR VMP), which covered approximately 37 ha of southern hills face reserves and roadsides.

The audit prompted the development of this Hills Face Reserves Vegetation Management Framework 2019-2024 (hereafter "framework"), which consists of the guiding principles and actions for managing bushfire fuel, biodiversity and weed species in over 130 ha of reserves and approximately 27 km of roadsides in the Adelaide Mount Lofty Ranges (AMLR) Hills Face Zone (HILLS FACE ZONE).

1.1 Objectives

The objectives of the framework are to:

- Provide a high-level conceptual structure that, in conjunction with individual Operational Reserve Management Plans, Technical Notes and Geographic Information System (GIS) Resources, guides the Council's approach to the management of its hills face reserves and roadsides for bushfire risk, biodiversity protection and enhancement, weed control, and landscape aesthetics;
- Review relevant policies, management plans and studies;
- Provide a compliance and legislative summary;
- Provide background information on the hills face reserves;
- Describe the natural assets of the hills face reserves;
- Outline the risks associated with the hills face reserves;
- Outline the Council's vegetation management vision, principles and actions, which integrate bushfire risk, environmental, biodiversity, and weed management;
- Review and update vegetation and bushfire risk mapping;
- Outline management issues and how these will be addressed; and
- Facilitate efficient and effective use of resources.

1.2 Hills face reserves and roadsides

The Council's Conservation and Land Management Program manages 28 hills face reserves covering a total area of 132.3554 ha. These are summarised in Table 1 and shown in Figure 1 and Figure 2. The Council also manages within this program approximately 27 km of hillside zone roadside reserves and verges.

Table 1. Summary of the Council's hills face reserves.

Reserve name	Area (ha)
Auldana Drainage Reserve	0.9712
Auldana North Reserve	3.5644
Auldana South Reserve	6.4869
Brock Reserve (part)	0.8860
Chambers Gully Reserve	46.6877
Chimney Reserve	2.6825
Danthonia Reserve	7.7468
Dashwood Gully Reserve	2.1028
Gandy's Gully Reserve	1.1534
Gully Reserve	11.4843
Hayward Verge	0.8447
Hermitage Reserve	0.3240
Ifould Drainage Reserve	0.0986
Ifould Upper Reserve	0.5889
Lavers Reserve	0.8850
Magill Stone Mine Reserve	3.5422
McBeath Unmade Road Reserve	0.5657
Michael Perry Reserve (part)	0.4793
Mount Osmond Freeway Reserve	2.5340
Mount Osmond Unmade Road Reserves	8.3252
Old Bullock Track	8.5385
Queens Avenue Road Closure	0.1377
Themeda Reserve	9.3755
Waterfall Gully Reserve	3.3818
Wattle Park Reserve	2.7343
Wheal Gawler Mine Reserve	1.9365
Wyfield Reserve	2.1176
Zig Zag Reserve	2.1799
Total	132.3554

1.3 Accompanying documents

This framework should be used in conjunction with the Operational Reserve Management Plans for each of the reserves listed in Table 1, and the Council's internal GIS Resources and Technical Notes listed in Figure 3. This approach allows for adaptive management in the framework since these are dynamic operational documents and resources that will be updated throughout the lifetime of the framework based on the collection and analysis of data, and management outcomes.



Figure 1. The location and extent of the Council's northern hills face reserves.



Figure 2. The location and extent of the Council's southern hills face reserves.

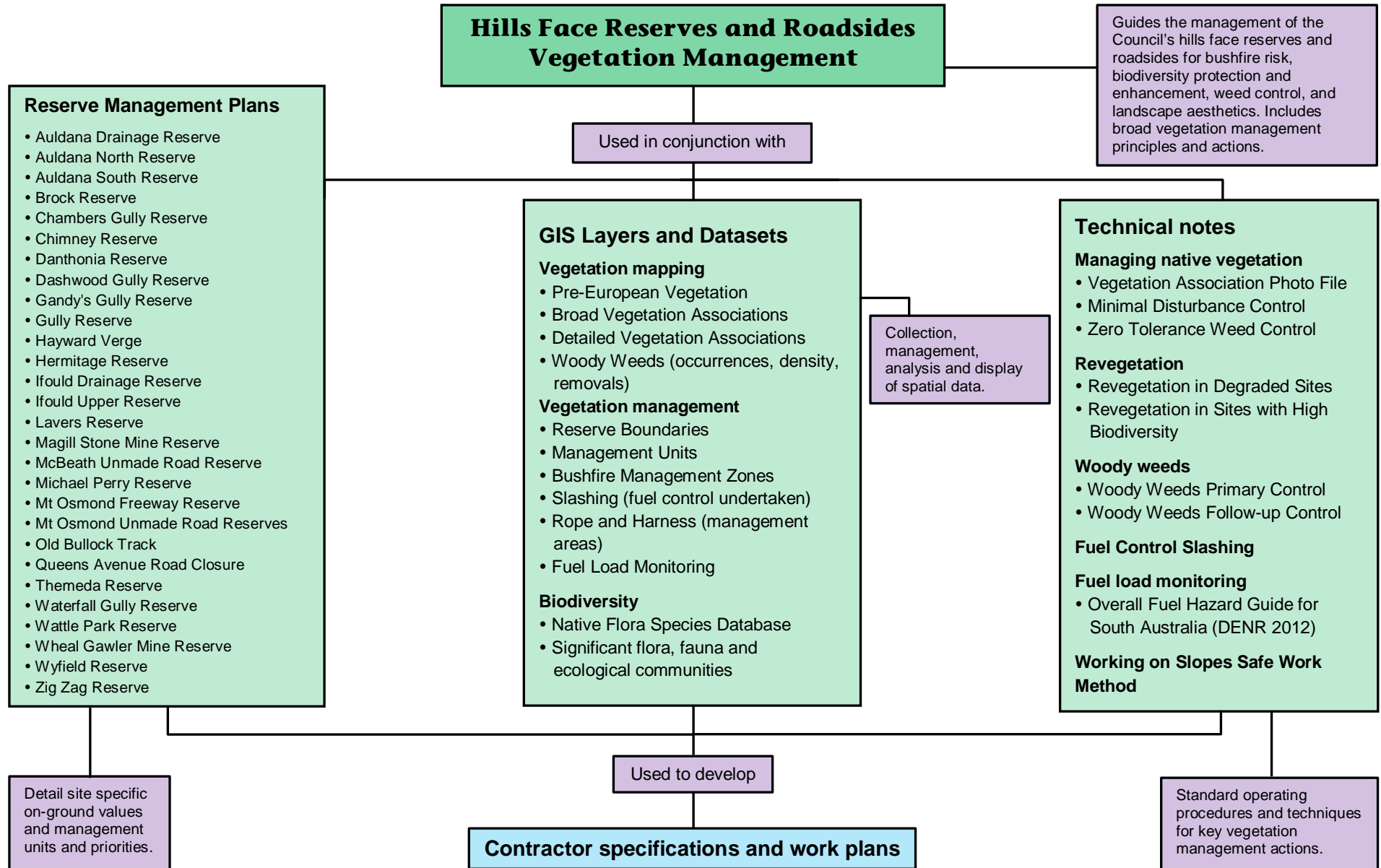


Figure 3. Hills face reserve and roadsides vegetation management framework.

1.4 Relevant policies, plans and studies

The policies, plans and studies relevant to this framework are summarised in Table 2.

Table 2. Summary of policies, plans and studies relevant to the management of the hills face reserves.

Policy / plan / report	Author	Year	Details
Hills Face Trails Review 2021	Council/Birdseye Studios	2021	This review assessed opportunities for the development and improvement of the hills face reserves trail network. A detailed overview of the trail network was provided to be used as the basis for the development of a trails strategy to determine the future direction of the trail network.
Burnside 2030 Strategic Community Plan	Council	2020	Priority Community – 1.1 Flexible, fit for purpose facilities and places. Priority Environment – 2.2 Canopy cover, greening and open space. Priority Environment – 2.4 Healthy habitats and biodiversity.
Bushfire Hazard Management Policy	Council	2020	This policy was first issued in May 2003 and last reviewed in September 2020, with the next review scheduled in July 2024. The policy outlines the distinct roles and responsibilities of the Council in regards to the management of bushfire hazard risk for its community and its assets.
Environmental Sustainability Strategy 2019-2023	Council	2019	Priority Healthy Habitats – Creating and maintaining healthy habitats and tree canopy for people and wildlife – Preserve and promote biodiversity, and the natural environment, including habitat for healthy wildlife populations.
Council – Bushfire Management Internal Audit	Galpins	2018	This audit assessed the Council's existing bushfire prevention and response treatments. Council staff were consulted and relevant documentation, including policies and procedures, was reviewed. A key recommendation was that a formal vegetation management plan is developed for all of the Council's hills face reserves and roadsides. At the time of the audit, the only formally endorsed vegetation management plan was the SHFR VMP (COB 2012), which covered approximately 37 ha of southern hills face reserves and road verges.
WHS Fire Danger Preparedness and Response Procedure	Council	2017	The procedure outlines the actions to be taken to prepare for, manage and recover from Fire Danger Days. The procedure identified and assessed all reasonably foreseeable hazards associated with Extreme and Catastrophic Fire Danger Days that could create emergencies.
Connected Communities Strategy 2017-2021	Council	2017	Priority Activation – Well used and valued community spaces and services which enable community development, learning, connection and wellbeing – Creation and activation of community spaces and the provision of both active and passive recreation opportunities.
Southern Hills Face Reserves Vegetation Management Plan 2012-2017	Council	2012	This vegetation management plan outlined vegetation management principles and actions for risk management, particularly bushfire and weeds, nature conservation, and the development of landscape aesthetics. The plan covered six southern hills faces reserves: (i) Themeda Reserve; (ii) Gully Reserve; (iii) Wheel Gawler Mine Reserve; (iv) Zig Zag Reserve (v) Chimney Reserve; and (vi) Danthonia Reserve. The plan also covered approximately 5 ha of roadside reserves and verges comprising Gill Terrace, Hayward Drive, the Old Bullock track, and Mount Osmond Road.
Independent Report on the Petition Submitted to Burnside Council for Tree Removal at Mt Osmond	Leading Emergency Services	2009	This report assessed bushfire risk on the upper slopes of the southern hills face reserves. A key recommendation was that a 100 m buffer downslope from dwellings is maintained at a low overall fuel hazard rating. The report stated that the standard Country Fire Service (CFS) recommendation of a low overall fuel hazard rating within a 20 m buffer upslope from dwellings should be maintained, with the balance of the

			reserves maintained at a rating of moderate or lower. Recommendations regarding bushfire risk management on private land were provided.
Council Hills Face Reserves Vegetation Management Plan	EBS	2008	This plan was prepared to provide a long-term vision for the management of vegetation within Council's hills face reserves following the Council's legislative land management responsibilities. The plan reviewed and updated vegetation mapping, and provided management actions to address bushfire risk, weeds and enhance biodiversity. The plan formed the basis for the SHFR VMP (see below) (Council 2012).
Mount Osmond Reserve Flora and Fauna Survey	M. Robertson	2001	This survey was commissioned to provide biological information for the preparation of a management plan for Mount Osmond Reserve. The survey report defined areas of the highest biodiversity conservation value in the reserve to assist in planning for active and passive recreation with no negative impacts on biodiversity.
Mount Osmond Road Vegetation Survey	A. Crompton	1997	This survey identified and mapped indigenous flora present within the Mount Osmond Road verges. The survey report provided recommendations for the conservation and enhancement of Mount Osmond Road roadside vegetation that were consistent with fire prevention and road safety objectives.
Mount Osmond Reserves Action Plan	A. Crompton	1996	This action plan detailed the management actions required to implement the recommendations in the <i>Burnside Hills Face Reserves – Management Plan Part 2</i> (see above) (Maguire 1995). The plan covered four Mount Osmond reserve groups: (i) Themeda Slopes Reserve; (ii) Gully, Southern and Wheel Watkins Reserves; (iii) Zig Zag and Chimney Reserves; and (iv) Danthonia Reserve. The plan incorporated vegetation mapping, including the identification and location of indigenous plant species, and provided general and site-specific work programmes and guideline recommendations.
Burnside Hills Face Reserves – Management Plan Part 2	M. Maguire	1995	This management plan outlined hazard and vegetation management strategies and actions for the hills face reserves at Mount Osmond, Chambers Gully, Wattle Park and Rosslyn Park. The key objective of the plan was to meet the Council's legislative land management responsibilities, focusing on bushfire risk reduction and pest plant control. The plan recommended a 10 m fuel hazard reduction buffer on boundaries of residential properties, incorporated the principle of replacing thick woody weed growth with an open indigenous woodland canopy, and provided reserve specific recommendations.
Burnside Hills Face Reserves – Management Plan Part 1: Feasibility Study	M. Maguire	1994	This study outlined the legal responsibilities of the Council regarding the hills face reserves at Mount Osmond, Chambers Gully, Wattle Park and Rosslyn Park. The study assessed particular physical and environmental characteristics of the reserves, mapped the vegetation and its significance, and, more specifically, analysed the bushfire risk posed by each reserve. The study also outlined and evaluated management options. The study was in direct response to concerns associated with the bushfire risk in the area and therefore bushfire management and assessment were priority components.

2 COMPLIANCE AND LEGISLATIVE SUMMARY

2.1 Planning, Development and Infrastructure Act 2016 and Regs 2017

In 2021 the Burnside (City) Development Plan 2017 was replaced with the Planning, Development and Infrastructure Act 2016, related Regulations 2017 and the Planning and Design Code (Version 2022.2 – 3 Feb 2022).

This management framework encompasses several planning zones such as Conservation, Hills Face and Hills Neighbourhood. Within these zones, there are many desired and performance outcomes related to the minimisation of detrimental impacts on, and the conservation and enhancement of, the natural environment and natural ecological processes.

Specifically in each zone, the desired outcomes are –

- Conservation –
 - *The conservation and enhancement of the natural environment and natural ecological processes for their ability to reduce the effects of climate change, for their historic, scientific, landscape, habitat, biodiversity, carbon storage and cultural values and provision of opportunities for the public to experience these through low-impact recreational and tourism development.*
- Hills Face –
 - *To maintain the western slopes of the South Mount Lofty Ranges as an important natural asset of Greater Adelaide by limiting development to low-intensity agricultural activities and public and private open space. The natural character of the zone will be preserved, enhanced and re-established to:*
 - a. *provide a natural backdrop to the Adelaide Plain and a contrast to the urban area*
 - b. *preserve biodiversity and restore locally indigenous vegetation and fauna habitats close to metropolitan Adelaide*
 - c. *provide for passive recreation in an area of natural character close to the metropolitan area*
 - d. *provide a part of the buffer area between metropolitan districts and prevent the urban area extending into the western slopes of the Mount Lofty Ranges.*
- Hills Neighbourhood –
 - *Development provides a complementary transition to adjacent natural and rural landscapes. Low-density housing minimises disturbance to natural landforms and existing vegetation to mitigate the visible extent of buildings, earthworks and retaining walls.*

2.2 Local Government Act 1999

The *Local Government Act 1999* specifies the principle functions of a council relating to the management of vegetation to mitigate the threat of bushfire risk, protect and enhance biodiversity, control weeds and improve landscape aesthetics under the following section:

7—Functions of a council

The functions of a council include—

- (d) to take measures to protect its area from natural and other hazards and to mitigate the effect of such hazards;
- (e) to manage, develop, protect, restore, enhance and conserve the environment in an ecologically sustainable manner, and to improve amenity; and
- (f) to provide infrastructure for its community and for development within its area (including infrastructure that helps to protect any part of the local or broader community from any hazard or other event, or that assists in the management of any area).

2.3 Fire and Emergency Services Act 2005

The *Fire and Emergency Services Act 2005* (FES Act) provides for the continuation of a metropolitan fire and emergency service, country fire and emergency service and State emergency service, the prevention, control and suppression of fires and the handling of certain emergencies. The following section relates to the management of council land:

105G—Council land

- (1) A council that has the care, control or management of land—

- (a) in the country; or
- (b) in a designated urban bushfire risk area,

must take reasonable steps—

- (c) to prevent or inhibit the outbreak of fire on the land; and
- (d) to prevent or inhibit the spread of fire through the land; and
- (e) protect property on the land from fire; and
- (f) to minimise the threat to human life from a fire on the land.

Section 73A requires each of the nine South Australian Bushfire Management Committees (BMC) to prepare and maintain a Bushfire Management Area Plan (BMAP). The Council area falls under the AMLR BMAP, which assumes that all persons in the AMLR bushfire management area are responsible for the mitigation of the bushfire risk for themselves, their neighbours and their community, and therefore need to understand and partake in bushfire prevention and preparedness.

To ensure that the community is observing these bushfire prevention and management activities, the Council's Fire Prevention Officers within the AMLR bushfire management area are required by the FES Act to assess the extent of bushfire hazards within the council area, and provide advice to land holders and work with communities on bushfire prevention and preparedness. Where necessary, Fire Prevention Officers can enforce the provisions of the FES Act on private land.

2.4 Native Vegetation Act 1991

The *Native Vegetation Act 1991* (NV Act) regulates the clearance of native vegetation in South Australia to conserve, protect and enhance the native vegetation of the State, with particular focus on preventing further biodiversity loss and land and soil degradation, and the loss of critical habitat and quantity and quality of native vegetation in the State.

To allow for limited and sustainable clearance of native vegetation, Section 28 of the Act outlines a process for applications for consent to clear native vegetation. The Act also established the *Native Vegetation Regulations 2017*, which amongst other things, sets out exemptions to the Act that allows for clearance of native vegetation in certain circumstances.

Clearance of native vegetation is required for the management of vegetation in the hills face reserves, which, due to the circumstances, will most likely be exempt under the *Native Vegetation Regulations 2017*, as summarised in Table 3.

Table 3. Summary of the *Native Vegetation Regulations 2017* relevant to vegetation management in the hills face reserves and roadsides (adapted from NVC (2017)).

Regulation	Approval process	Description of activity
Schedule 1, 8(15) – Plant and animal control	Self-assessed by the proponent, notification to the Native Vegetation Council (NVC) is required before clearance	Allows for clearance of vegetation for the control of declared plants and animals under the <i>Natural Resources Management Act 2004</i> where it is not possible to undertake control without clearing native vegetation.
Schedule 1, 8(16) – Native vegetation causing natural resource management problems		Allows for clearance to manage native vegetation that is affecting the health of other native species and natural resources.
9(1)(17) – Fire prevention and control	CFS approval required	Allows for clearance of vegetation for fire prevention and control measures to be undertaken around dwellings (within 20 m; not large trees with circumference ≥ 2 m at 1 m from the ground) and fence lines (within 5 m).
9(2)(19) – Fire prevention and control (large trees)		Allows for clearance of large trees growing or situated within 20 m of a dwelling for fire prevention and control purposes.
9(2)(20) – Fuel reduction		Allows for clearance of vegetation to reduce the risk of combustible material on land as reasonably required for fire prevention and control. If prescribed burning is required approval must be sought (see Section 2.6).
9(2)(22) – Fire access tracks		Allows for clearance for the establishment or maintenance of a fire access track constructed for use by vehicles undertaking firefighting activities.
11(23) – Roadside or rail corridor vegetation management	Requires a management plan approved by the NVC	Allows for clearance of vegetation on road reserves or rail corridors for the personal safety of those entering or passing the land, or of property on the land; or for controlling pests on the land applicable to a roadside or rail corridor.

2.5 Landscape South Australia Act 2019

From July 1 2020, the Landscape South Australia Act 2019 replaced the Natural Resources Management Act 2004, as the key framework for managing the state's land, water, pest plants and animals, and biodiversity across the state. The Act is administered by eight new regional Landscape South Australia boards together with a new entity, Green Adelaide which is intended to bring an integrated approach to managing Adelaide's urban environment and which covers the entirety of City of Burnside. The Act defines landholder responsibilities for the notification, destruction and/or control of declared pest plants on private, council and roadside land. Pest plants declared under the Act are known to occur throughout the Council, including the hill face reserves.

2.6 Environment Protection Act 1993

Under clause 5, subclause (2)(a)(iii) of the *Environmental Protection (Air Quality) Policy 2016* (under the *Environment Protection Act 1993*), a person is not prevented from carrying out the following burning activities within a metropolitan council area or within a township in a non-metropolitan council area: (iii) burning of agriculture or forestry waste, burning off vegetation for fire prevention or control, or burning vegetation for any other purpose, outside a fire danger season, provided that: (A) the burning activity is carried out in accordance with a burning permit issued under clause 6; and (B) the person complies with any mandatory measures of a prescribed burning code of practice that apply in relation to the burning activity; and (C) the person has regard to any recommended measures of a prescribed burning code of practice that apply in relation to the burning activity. Fires must only be lit between 10:00 and 15:00 Monday to Saturday and residents must remain responsible for the fire and advise the CFS before igniting the fire.

Should the Council be required to undertake prescribed burning for bushfire risk reduction and/or ecological purposes in the hills face reserves and roadsides, when conditions are suitable outside of the bushfire danger season, permission will be sought as detailed above.

2.7 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the Act as Matters of National Environmental Significance (MNES). Two MNES are of relevance to the management of vegetation in the hills face reserves: (i) nationally threatened species and ecological communities; and (ii) migratory species. Threatened flora and fauna species and ecological communities listed under the EPBC Act are known to occur in the Council's hills face reserves (see Sections 4.2.1 and 4.3.1).

Any action that has will have, or is likely to have a significant impact on MNES requires referral under the EPBC Act. Substantial penalties apply for undertaking an action that has, will have or is likely to have a significant impact on a matter of national environmental significance without approval.

2.8 National Parks and Wildlife Act 1972

The *National Parks and Wildlife Act 1972* (NPW Act) protects native plants and animals in South Australia. It is an offence to take a native plant or protected animal without approval. Threatened plant and animal species are listed in Schedules 7 (Endangered species), 8 (Vulnerable species) and 9 (Rare species) of the Act. Threatened flora and fauna species listed under the NPW Act are known to occur in the Council's hills face reserves (see Sections 4.2.1 and 4.3.1).

3 BACKGROUND INFORMATION

3.1 Location

The hills face reserves are located on the western slopes of the AMLR HILLS FACE ZONE. The southern reserves form a steep band fringing the Council area, extending from the southern slopes of Mount Osmond north to Waterfall Gully Reserve, with reserves linked by a combination of fire and walking trails. From here the northern reserves are scattered within the residential matrix, extending north to the suburb of Auldana.

3.2 Surrounding land use

The surrounding land use is predominantly residential, with the majority (and largest) of assets listed in the CFS AMLR Bushfire Management Area Plan Risk Register being human settlements.

3.3 Cultural significance

The traditional owners of the land that now constitutes the hills face reserves are the Kurna people. The Kurna people had a sophisticated culture, with a complex language and deep knowledge of the environment. Although the main Kurna presence was in Tarndanyangga ("red kangaroo place"), which is the current Adelaide city centre, the Kurna people also resided in Burnside (Warburton 1981).

3.4 Grazing

For more than 100 years following European settlement, the HILLS FACE ZONE in the Council area was grazed, mostly by sheep. As the land was subdivided in the 1960s, sheep were gradually removed, with the last sheep removed from Chimney Reserve in the late 1990s. The cessation of grazing led to the rapid spread of woody weeds and an increase in grass growth. No flora studies exist as a baseline so the effect that cessation of grazing had on biodiversity remains unknown.

3.5 Climate

The local climate is Mediterranean with most rain falling in winter and spring. Summers are generally hot and dry although storms occasionally produce short periods of intense rain.

3.6 Topography and soils

Soils in the HILLS FACE ZONE reflect the bedrock from which they are derived. They are mostly shallow loams over weathered shale. Most of the sub-soils are slight to strongly alkaline. In the Stonyfell areas, there are areas of quartzite bedrock, which weathers slowly and develops shallow skeletal acid soils.

3.7 Interim Biogeographical Regionalisation of Australia (IBRA)

The IBRA is a landscape-based approach to classifying the land surface across a range of environmental attributes, which is used to assess and plan for the protection of biodiversity (DotE 2012). The land is

classified into bioregions, which are further divided into subregions, and then environmental associations. The hill face reserves are located within the Flinders Lofty Block IBRA Bioregion, Mount Lofty Ranges IBRA Subregion, and Mt Terrible IBRA Environmental Association, which are summarised in Table 4. Approximately 15% (46,342 ha) of the Mount Lofty Ranges IBRA subregion is mapped as remnant native vegetation, of which 27% (12,706 ha) is formally conserved and protected within reserves under the NPW Act, and private Heritage Agreements under the NV Act.

Table 4. Interim Biogeographical Regionalisation of Australia (IBRA) Bioregion, Subregion, and Environmental Association environmental landscape summary.

Flinders Lofty Block IBRA Bioregion	
Temperate to arid Proterozoic ranges, alluvial fans and plains, and some outcropping volcanics, with the semi-arid to arid north supporting Native Cypress, Black Oak and Mallee Open Woodlands, Eremophila and Acacia Shrublands, and Bluebush/Saltbush Chenopod Shrublands on shallow, well-drained loams and moderately-deep, well-drained red duplex soils. The increase in rainfall to the south corresponds with an increase in Low Open Woodlands of <i>Eucalyptus obliqua</i> and <i>E. baxteri</i> on deep lateritic soils, and <i>E. fasciculosa</i> and <i>E. cosmophylla</i> on shallower or sandy soils.	
Mount Lofty Ranges IBRA Subregion	
This subregion extends from north of the Fleurieu Peninsula to the Barossa Valley and is predominantly an undulating to low hilly upland with steeper marginal ranges and hills. The Barossa Valley is the lowest area in this subregion and represents a structural basin. The rest of the subregion consists of hilly uplands on sandstone and shale with northerly trending strike ridges and dissected lateritic tableland remnants. Low Open Woodland commonly dominated by <i>Eucalyptus obliqua</i> and <i>E. baxteri</i> is found in higher rainfall areas on deep, lateritic soils. Shallower or sandy soils support <i>E. fasciculosa</i> , <i>E. cosmophylla</i> and in the northern part of the region <i>E. goniocalyx</i> , <i>E. leucoxydon</i> dominates the woodlands on podsolised soils in the lower rainfall areas, <i>E. viminalis</i> ssp. <i>cygnetensis</i> dominate the wetter and cooler woodlands and <i>E. odorata</i> characterises drier sites. Eucalypts give way to <i>Allocasuarina verticillata</i> in the aridest woodlands and coastal situations on shallow rocky soils.	
Remnant vegetation	Approximately 15% (46,342 ha) of the subregion is mapped as remnant native vegetation, of which 27% (12,706 ha) is formally conserved.
Landform	Hills and valleys; alternating subparallel hilly ridges and valleys with a general N-S trend in the north. In the south, hilly dissected tableland.
Geology	Dissected lateralised surface in the south.
Soil	Hard setting loams with red clayey subsoils, highly calcareous loamy earth, hard setting loams with mottled yellow clayey subsoil, coherent sandy soils, cracking clays.
Vegetation	Eucalyptus Woodlands with a shrubby understorey.
Conservation significance	129 species of threatened fauna, 270 species of threatened flora. 4 wetlands of national significance.
Mt Terrible IBRA Environmental Association	
Remnant vegetation	Approximately 41% (7,889 ha) of the association is mapped as remnant native vegetation, of which 41% (3,206 ha) is formally conserved.
Landform	Ridges and hills with steep slopes on metasediments.
Geology	Metasediments and alluvium.
Soil	Hard pedal red duplex soils, reddish friable loams and black self-mulching cracking clays.
Vegetation	Woodland of SA Blue Gum, Swamp Gum and Peppermint Box, Open Forest of Messmate Stringybark and Brown Stringybark or Pink Gum and Woodland of River Red Gum.

Conservation significance	48 species of threatened fauna, 116 species of threatened flora. 0 wetlands of national significance.
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4 NATURAL ASSETS

4.1 Native vegetation

4.1.1 Pre-European vegetation

Before European settlement, the entire area that now comprises the city was covered in various woodlands and forests based on environmental factors such as soil, topography and rainfall. The land was managed by the Kurna people who utilised fire as a management tool to encourage grass growth and maintain an open landscape. The pre-European native vegetation associations that existed in the Council area are summarised in Table 5 and mapped in Figure 4 and the *Pre-European Vegetation* GIS Layer.

Table 5. Pre-European vegetation associations within the Council (adapted from Council (2008)).

Pre-European Association	Description
Manna Gum (<i>Eucalyptus viminalis</i> ssp. <i>viminalis</i>) Woodland	<ul style="list-style-type: none"> Occurs on south-facing slopes and wetter areas in the HILLS FACE ZONE. Herbaceous/grassy understorey.
Mallee Box (<i>E. porosa</i>) Woodland	<ul style="list-style-type: none"> Occurs on hill slope country with alkaline subsoils. Herbaceous/grassy understorey.
River Red Gum (<i>E. camaldulensis</i>) / SA Blue Gum (<i>E. leucoxylon</i> ssp. <i>leucoxylon</i>) Open Forest	<ul style="list-style-type: none"> Mainly associated with the Torrens catchment. A mix of River Red Gum and SA Blue Gum determined by distance from water. Occurs on alluvial soils. Grassy/herbaceous understorey.
SA Blue Gum Woodland	<ul style="list-style-type: none"> Occurred on well-drained hill tops and gentle slopes across the HILLS FACE ZONE. Grassy understorey generally with heathy character on lower nutrient soils.
Grey Box (<i>E. microcarpa</i>) Grassy Woodland	<ul style="list-style-type: none"> Mainly associated with the Patawalonga catchment. Dominated by Grey Box with associated SA Blue Gum and Native Pine (<i>Callitris gracilis</i>). Shrubby/grassy/herbaceous understorey on plains, with some healthy character in the HILLS FACE ZONE. Occurs on higher nutrient soils, often clays of alluvial origin.
Riparian Vegetation	<ul style="list-style-type: none"> Vegetation on watercourses. Composition depends on the water regime.
Brown Stringybark (<i>E. baxteri</i>) Heathland	<ul style="list-style-type: none"> Occurs on well-drained, usually sandy or gravelly soils of relatively low fertility.
River Red Gum Woodland of Hill Country	<ul style="list-style-type: none"> Associated with hill slope areas with perched water tables in Chambers Gully. Grassy/herbaceous understorey.
Sheoak (<i>Allocasuarina</i> spp.) Woodland	<ul style="list-style-type: none"> Occurs on steep, particularly north and west, slopes throughout the HILLS FACE ZONE. Herbaceous/grassy understorey.
Native Pine (<i>Callitris gracilis</i>) Woodland	<ul style="list-style-type: none"> Small areas are scattered throughout the district. Herbaceous or semi-sclerophyllous understorey.
Bogs and Reedbeds	<ul style="list-style-type: none"> Areas with permanently wet soil. The best remaining example is Waterfall Gully Reserve.
SA Blue Gum / Manna Gum / River Red Gum Complex	<ul style="list-style-type: none"> Typically occurs on hill slope areas on clay loam soils. Loose agglomeration of various overstorey species. Grassy/herbaceous understorey.

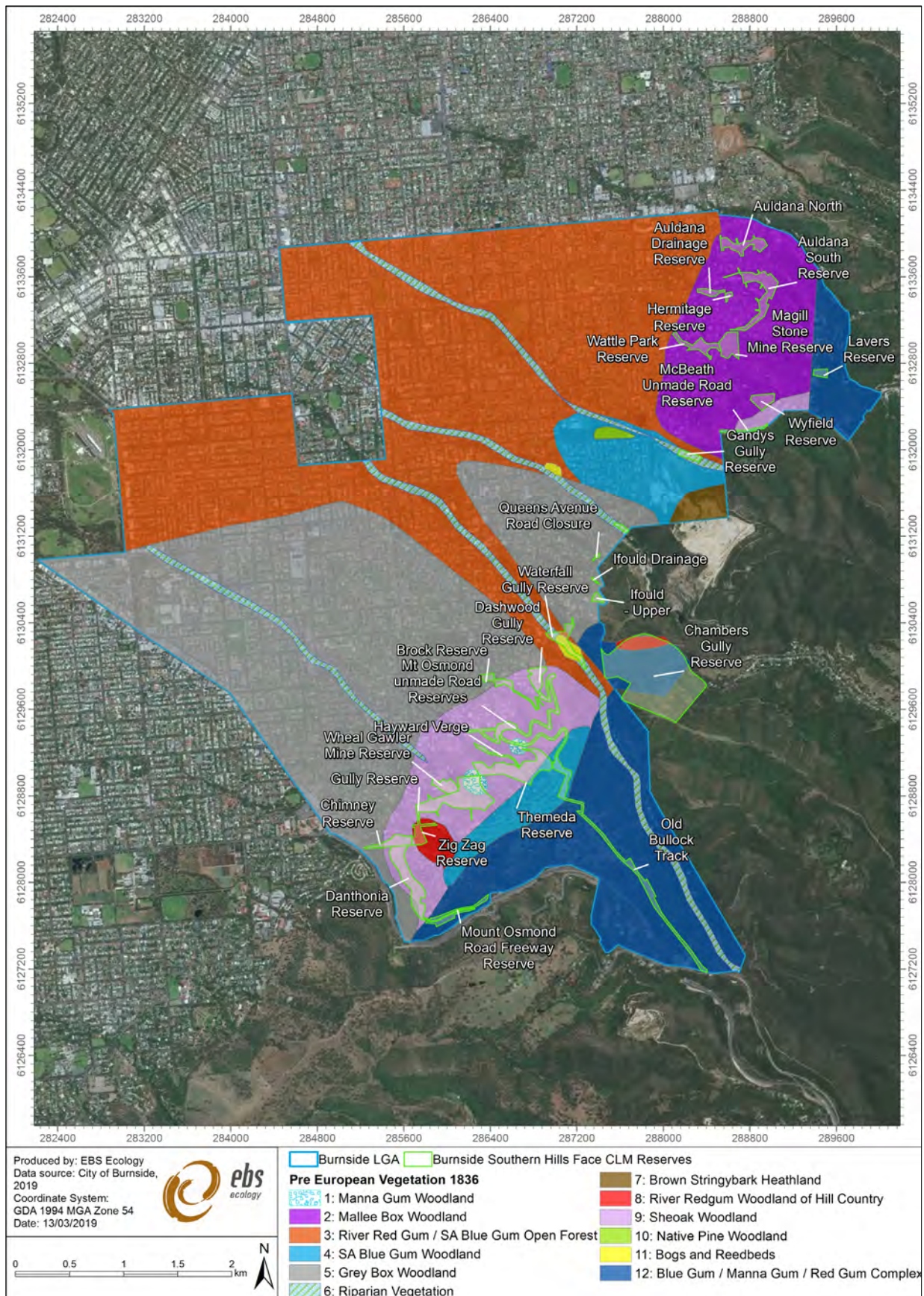


Figure 4. Pre-European vegetation associations mapped within the Council.

4.1.2 Existing vegetation

The existing vegetation in the hills face reserves and roadsides mostly consists of *Eucalyptus* spp. (Gums), *Acacia pycnantha* (Golden Wattle) and *Allocasuarina verticillata* (Drooping Sheoak) Woodlands, with large areas of Native Grassland including *Austrostipa* spp. (Spear-grasses), *Enneapogon nigricans* (Black-head Grass), *Rytidosperma* spp. (Wallaby-grasses) and *Themeda triandra* (Kangaroo Grass).

Certain areas remain dominated by *Pinus halepensis* (Aleppo Pine) Woodland and low thickets of woody weed species such as *Olea europaea* (Olive) and *Rubus fruticosus* (Blackberry) (see Section 5.1). Understoreys vary from native grasses and herbaceous weeds such as *Scabiosa atropurpurea* (Pincushion) to herbaceous and woody weeds, with all areas, including those in the best condition, containing large infestations of annual weed grasses and forbs (see Section 5.2).

A total of 19 broad vegetation associations exist in the hills face reserves and roadsides. These are summarised in Table 6 and mapped in Figure 5 and the *Broad Vegetation Associations* GIS Layer. Aleppo Pine Woodlands have been included in native vegetation mapping since (i) they provide amenity value; (ii) the Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*) (State Vulnerable) utilises Aleppo Pine seed for food (species discussed in Section 4.3.1); and (iii) their management differs to that of other woody weed species in that some areas may be retained based on the first two points.

The 19 broad vegetation associations in the hills face reserves and roadsides are characterised further into a total of 72 detailed vegetation associations. These are summarised and mapped in the operational Reserve Management Plans developed for each of the reserves listed in Table 1, and mapped in the *Detailed Vegetation Associations* GIS Layer.

4.1.3 Threatened Ecological Communities

There are three Threatened Ecological Communities (TECs) listed in the *Provisional List of Threatened Ecosystems of South Australia* (DEH in progress) that occur within the hills face reserves (see the *Vegetation Associations Photofile* for images):

1. *Eucalyptus microcarpa* Grassy Low Woodland on foothills and slopes of Southern Mount Lofty Ranges (Vulnerable). Only a few degraded examples of this TEC remain within reserves of the hills south of Adelaide. This TEC has been heavily modified by urban spread and the associated invasions of exotics. There are four small remnant patches of this TEC in the hills face reserves, with larger patches in Danthonia Reserve and Gully Reserve (Table 6). All patches are in very poor condition due to the weed dominance in the understorey. The patches are unlikely to qualify as the EPBC Act listed TEC, Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grassland of South-Eastern Australia since two patches are less than 0.5 ha and the cover and number of perennial native species in the mid and ground layers of all patches are too low (TSSC 2010);
2. *Allocasuarina verticillata* Grassy Low Woodland on clay loams of low hills (Vulnerable). This TEC was formerly extensive before the clearance. Although some patches with good understorey remain, this TEC is poorly conserved and has mostly been highly modified by clearance, grazing and invasion of exotics. Only small patches degraded by weed invasion exist in Chambers Gully

Reserve, Danthonia Reserve, Gully Reserve, Hayward Verge, Wheel Gawler Mine Reserve and Wyfield Reserve.

3. *Themeda triandra* +/- *Danthonia* [*Rytidosperma*] spp. Tussock Grassland on heavy fertile soils of plains and hill slopes (Endangered). This TEC has been highly modified by grazing and weed invasion, with few examples remaining in reserves. Only small patches exist in the Council's hills face reserves, with a stronghold in Themeda Reserve. Although some of these patches are in moderate condition, most are poor with a high incidence of weed invasion.

Table 6. Broad vegetation associations within the hills face reserves.

Vegetation association	Reserves	Area (ha) ¹
<i>Acacia pycnantha</i> Woodland	Auldana South Reserve	0.2833
	Magill Stone Mine Reserve	0.4037
	Subtotal	0.6871
<i>Allocasuarina verticillata</i> Woodland	Chambers Gully Reserve	6.5911
	Danthonia Reserve	0.4975
	Gully Reserve	0.6926
	Hayward Verge	0.3214
	Wheel Gawler Mine Reserve	0.9609
	Wyfield Reserve	0.1216
	Subtotal	9.1850
<i>Corymbia maculata</i> / <i>C. citriodora</i> Woodland ²	Gully Reserve	0.7906
	Subtotal	0.7906
<i>Dodonaea viscosa</i> Shrubland	Chambers Gully Reserve	5.0076
	Subtotal	5.0076
<i>Eucalyptus camaldulensis</i> Woodland	Auldana Drainage Reserve	0.4126
	Auldana North Reserve	0.9763
	Danthonia Reserve	1.3795
	Gandy's Gully Reserve	1.1534
	Hayward Verge	0.4003
	Mount Osmond Unmade Road Reserves	4.2339
	Waterfall Gully Reserve	0.5959
	Wattle Park Reserve	0.1805
	Subtotal	9.3325
<i>Eucalyptus camaldulensis</i> / <i>E. leucoxyton</i> Woodland	Chambers Gully Reserve	32.8079
	Chimney Reserve	2.6825
	Dashwood Gully Reserve	1.1523
	Magill Stone Mine Reserve	0.3296
	Waterfall Gully Reserve	0.3836
	Wheel Gawler Mine Reserve	0.5012
	Zig Zag Reserve	1.0874
	Subtotal	44.6161
<i>Eucalyptus camaldulensis</i> / <i>E. leucoxyton</i> / <i>E. microcarpa</i> Woodland	Wattle Park Reserve	0.6329
	Subtotal	0.6329
<i>Eucalyptus camaldulensis</i> / <i>E. leucoxyton</i> / <i>E. porosa</i> Woodland	Auldana Drainage Reserve	0.5586
	Subtotal	0.5586
<i>Eucalyptus cladocalyx</i> Woodland ²	Gully Reserve	0.8254
	Wheel Gawler Mine Reserve	0.3301
	Subtotal	1.1555

<i>Eucalyptus fasciculosa</i> Woodland ³	McBeath Unmade Road Reserve	0.0861
	Subtotal	0.0861
<i>Eucalyptus goniocalyx</i> Woodland	Hayward Verge	0.0305
	Subtotal	0.0305
<i>Eucalyptus leucoxylon</i> Woodland	Auldana North Reserve	1.2924
	Auldana South Reserve	5.0295
	Brock Reserve	0.1807
	Danthonia Reserve	5.0318
	Gully Reserve	5.0820
	Ifould Upper Reserve	0.5889
	Lavers Reserve	0.8850
	McBeath Unmade Road Reserve	0.4796
	Michael Perry Reserve	0.4793
	Mount Osmond Road Freeway Reserve	2.5340
	Mount Osmond Unmade Road Reserves	1.6334
	Old Bullock Track	8.5385
	Themeda Reserve	8.9326
	Waterfall Gully Reserve	0.1256
	Wheal Gawler Mine Reserve	0.0758
Subtotal	40.8890	
<i>Eucalyptus leucoxylon</i> / <i>E. porosa</i> Woodland	Auldana South Reserve	0.1297
	Subtotal	0.1297
<i>Eucalyptus microcarpa</i> Woodland	Danthonia Reserve	0.8379
	Gully Reserve	1.4094
	Ifould Drainage Reserve	0.0986
	Queens Avenue Road Closure	0.1377
	Subtotal	2.4837
<i>Eucalyptus porosa</i> Woodland	Auldana North Reserve	0.3928
	Magill Stone Mine Reserve	1.8583
	Wyfield Reserve	1.9509
	Subtotal	4.2020
<i>Eucalyptus viminalis</i> Woodland	Themeda Reserve	0.4429
	Subtotal	0.4429
Exotic Grassland	Auldana South Reserve	0.9161
	Subtotal	0.9161
Exotic / Amenity Vegetation	Auldana North Reserve	0.0989
	Auldana South Reserve	0.0506
	Brock Reserve	0.0568
	Chambers Gully Reserve	0.7227
	Dashwood Gully Reserve	0.4009
	Gully Reserve	0.2942
	Hermitage Reserve	0.1298
	Magill Stone Mine Reserve	0.8393
	Mt Osmond unmade Road Reserves	2.4579
	Waterfall Gully Reserve	0.7741
	Wattle Park Reserve	0.8948
	Wyfield Reserve	0.0451
	Zig Zag Reserve	0.5810
Subtotal	7.3462	

Native Grassland	Auldana North Reserve	0.8039
	Auldana South Reserve	0.0777
	Gully Reserve	1.1041
	Hayward Verge	0.0925
	Magill Stone Mine Reserve	0.1113
	Wattle Park Reserve	0.7153
	Zig Zag Reserve	0.0628
	Subtotal	3.2785
<i>Phragmites australis</i> Wetland	Waterfall Gully Reserve	0.5456
	Subtotal	0.5456
<i>Pinus halepensis</i> Woodland ²	Brock Reserve	0.6485
	Chambers Gully Reserve	1.5584
	Dashwood Gully Reserve	0.5497
	Gully Reserve	1.2860
	Hermitage Reserve	0.1942
	Waterfall Gully Reserve	0.9570
	Wheal Gawler Mine Reserve	0.0686
	Zig Zag Reserve	0.4486
Subtotal	5.7110	
Total		132.3554

¹ **Subtotal/total areas calculated before rounding to four decimal places.**

² Dominated by exotic flora species.

³ Planted Pink Gum.

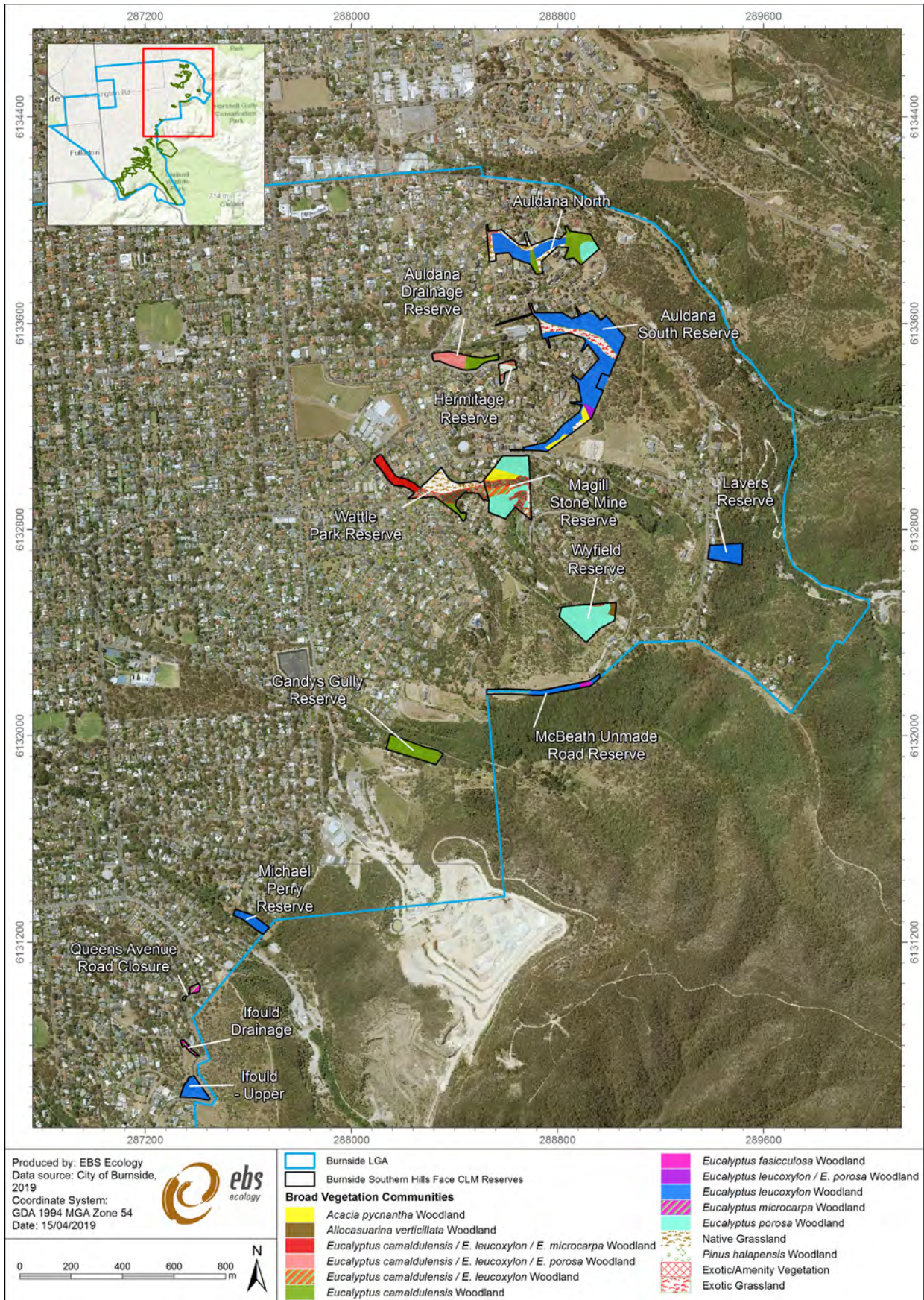


Figure 5. Broad vegetation associations mapped within the northern hills face reserves.

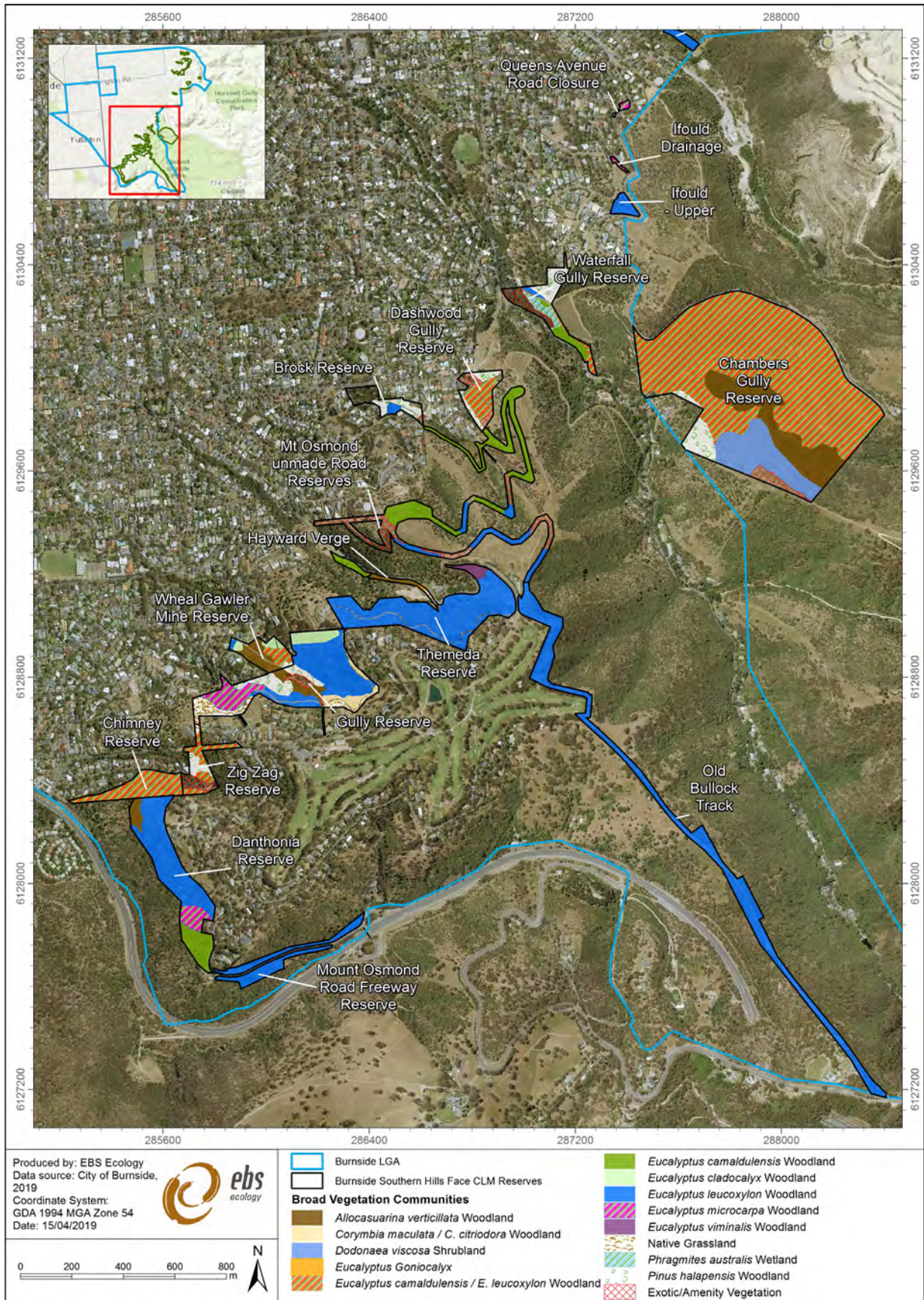


Figure 6. Broad vegetation associations mapped within the southern hills face reserves.

4.2 Flora species

To date, 306 native flora species have been recorded within the hills face reserves and roadsides, including 21 trees, 20 large shrubs (>1 m), 31 small shrubs (<1 m), 150 understorey, 34 grass, 32 sedge/rush, three aquatic, 11 fern and four aerial parasite species. All flora species, including the reserves and management units they have been recorded in, are listed in an internal database. The database will be updated as new species are observed or there are more recent or range-extending flora species observations. Site-specific flora species are detailed further in the Operational Reserve Management Plans.

4.2.1 Significant flora

Threatened flora species listed as Rare under the NPW Act that are known to occur in the hills face reserves include:

- *Blechnum watsii* (Hard Water-fern);
- *Bothriochloa macra* (Red-leg Grass);
- *Dianella longifolia* var. *grandis* (Pale Flax-lily);
- *Eucalyptus fasciculosa* (Pink Gum) (planted in McBeath Unmade Road Reserve);
- *Eucalyptus viminalis* ssp. *viminalis* (Manna Gum);
- *Haloragis brownii* (Swamp Raspwort); and
- *Hypolepis rugosula* (Ruddy Ground-fern).

4.3 Fauna

The hills face reserves provide habitat for several native fauna species, with approximately 20 mammals, 40 reptiles and 130 bird species that are known to occur, or likely to or potentially occur based on their current distribution and habitat requirements (circa 2015). A Biological Database of South Australia data extract using NatureMaps identified 101 birds, nine mammals, seven reptiles and four frog species records within the Council's HILLS FACE ZONE (DEW 2019).

4.3.1.1 Significant fauna

Threatened fauna species that could potentially occur in the hills face reserves include:

- *Calyptorhynchus funereus* (Yellow-tailed Black Cockatoo) (State Vulnerable);
- *Corcorax melanorhamphos* (White-winged Chough) (State Rare);
- *Egernia cunninghamii* (Cunningham's Skink) (State Endangered);
- *Isoodon obesulus* ssp. *obesulus* (Southern Brown Bandicoot) (Nationally Endangered; State Vulnerable);
- *Pteropus poliocephalus* (Grey-headed Flying-fox) (Nationally Vulnerable; State Rare); and
- *Trichosurus vulpecula* (Common Brushtail Possum) (State Rare).

The Yellow-tailed Black Cockatoo is known to occur in areas of Aleppo Pine in the hills face reserves where it utilises the seed for food. This species is heavily reliant on Aleppo Pine for food as a result of the clearance of their native food sources.

White-winged Choughs are found in open forests and woodlands. They tend to prefer the wetter areas, with lots of leaf litter, for feeding, and available mud for nest building. They forage through leaf litter and their diet includes termites, beetles, worms, insects, grain, and snails. White-winged Choughs build a deep, cup-shaped nest of grasses held together with mud or sometimes manure in a tree fork.

The Cunningham's Skink occurs in higher rainfall woodlands and forests that feature rock outcrops with large crevices. In South Australia, the species is disjunct from the extant population in other states, being restricted to the AMLR. Within the AMLR, the species' relative area of occupancy is classified as 'Extremely Restricted' (DEH 2008).

The Grey-headed Flying-fox has a roosting colony of around 10,000 individuals in Botanic Park, which was first recorded in 2010. Urban environments such as botanic parks and city parklands are regularly utilised by Grey-headed Flying Foxes due to the diversity of non-indigenous food plants that offer suitable food resources year-round, which allows colonies to remain sedentary. Grey-headed Flying Foxes forage over a wide area, with individuals capable of travelling 40 km between their roost and feeding sites in a night (Eby and Law 2008). Grey-headed Flying Foxes consume fleshy fruits and blossoms, and within the Botanic Park area have been observed feeding on the fruits of the Morton Bay Fig (*Ficus macrophylla*) and the blossoms of Eucalypts (*Eucalyptus spp.*) (Van Weenen *pers. comm.*). Potential food tree species are present within the hills face reserves and roadsides, which include non-indigenous trees and the River Red Gum, which is a known food source (Eby and Law 2008).

The habitat in the majority of hills face reserves is not considered to be optimal for the Southern Brown Bandicoot, which prefers areas of dense ground and shrub cover (Haby and Long 2005). The species may occur in Chambers Gully Reserve, where it is known from nearby records (ALA 2019).

The Common Brushtail Possum is a nocturnal, arboreal mammal that is abundant within temperate areas over much of Australia, especially within metropolitan areas (Strahan 1995). In South Australia, the species is most abundant in the Mount Lofty Ranges, as well as the Adelaide plains and Kangaroo Island (ALA 2019). The species is typically found in open eucalypt forest and woodland areas where it usually dens above ground in tree hollows.

5 WEEDS

A weed is any plant that requires some form of action to reduce its effect on the environment, economy, human health and amenity. Weeds are among the most serious threats to Australia's natural environment and primary production industries since they displace native species, contribute significantly to land degradation and reduce farm and forest productivity. Weeds typically produce large numbers of seeds, which assists their spread, and are often excellent at surviving and reproducing in disturbed environments. A weed can be an exotic species or a native species that colonises and persists in an ecosystem in which it did not previously exist.

As with much of the AMLR, weeds are prolific within the hills face reserves and roadsides, and previous Management Plans have documented the extent to which woody weeds (including non-indigenous Australian species) have dominated the landscape. Extensive effort has been and continues to be placed into removing or controlling woody weeds in the hills face reserves and roadsides, as well as slashing understorey herbaceous and grassy weeds to reduce bushfire fuel levels and benefit native species.

Weeds in the hills face reserves and roadsides are managed based on their invasiveness, impact on biodiversity, potential distribution, bushfire risk and feasibility of containment. Weeds that are a significant threat to agriculture, the natural environment and public health and safety are Declared under the NRM Act and landowners have a legal responsibility to control their movement and destroy or control infestations.

Woody, herbaceous and grassy weeds are discussed separately below (Sections 5.1 and 5.2).

5.1 Woody weeds

The control of woody weeds has been successful in many areas of the hills face reserves and roadsides, with follow up maintenance ongoing to minimise recruitment. However, large infestations remain (Figure 7 and Figure 8). The main woody weed species that are extensively targeted in the hills face reserves and roadsides include:

- *Chrysanthemoides monilifera* (Boneseed);
- *Crataegus monogyna* (Hawthorn);
- *Fraxinus angustifolia* ssp. *angustifolia* (Desert Ash);
- *Olea europaea* (Olive);
- *Pinus halepensis* (Aleppo Pine);
- *Rhamnus alaternus* (Buckthorn);
- *Rubus fruticosus* (Blackberry).

Olive and Hawthorn are the most widespread and dense woody weeds in the hills face reserves (Figure 7 and Figure 8). Aleppo Pine is carefully managed since this species is an important food source for Yellow-tailed Black Cockatoos (State Vulnerable) (see Section 4.3.1), which are highly valued by residents and visitors.

The distribution of these woody weeds, among others, in the hills face reserves are mapped in Figure 7 and Figure 8, and the *Woody Weeds* GIS Layer.

The Council's vegetation management vision, principles and actions relating to woody weed management in the hills face reserves and roadsides are outlined in Section 7.

5.2 Herbaceous and grassy weeds

Past management has found that herbaceous and grassy weeds have proliferated in disturbed areas, including following woody weed removal. Not only has this led to high bushfire fuel loads, but it has also led to competition with remnant native grass and low growing species, reducing their recruitment, and an overall reduction in biodiversity. Management of herbaceous and grassy weeds has in the past been of lower priority during large scale woody weed control operations due to their low overall density and the fact that woody weeds contribute significantly to higher bushfire fuel loads. However, with the transition from woody weeds to herbaceous and grassy weeds resulting from woody weed management, the management of herbaceous and grassy weeds is now of similar priority to the management of woody weeds.

The herbaceous and grassy weeds of most concerns in the hills face reserves and roadsides include:

- *Avena fatua* (Wild Oat);
- *Brassica tournefortii* (Wild Turnip) and other Cruciferae;
- *Cynara cardunculus* ssp. *flavescens* (Artichoke Thistle);
- *Euphorbia terracina* (False Caper);
- *Foeniculum vulgare* (Fennel);
- *Lathyrus tingitanus* (Tangier Pea);
- *Piptatherum miliaceum* (Rice Millet);
- *Scabiosa atropurpurea* (Scabious); and
- *Senecio pterophorus* (African Daisy).

Two species that were recognised previously by the Council as a high priority for control included *Asparagus asparagoides* (Bridal Creeper) and *Pennisetum setaceum* (Fountain Grass). Although both weeds have been removed from the hills face reserves and roadsides, vigilance is required to ensure they do not establish again.

The Council's vegetation management vision, principles and actions relating to herbaceous and grassy weed management in the hills face reserves and roadsides are outlined in Section 7.



Figure 7. Woody weeds mapped within the northern hills face reserves, including areas that have been cleared in different years.

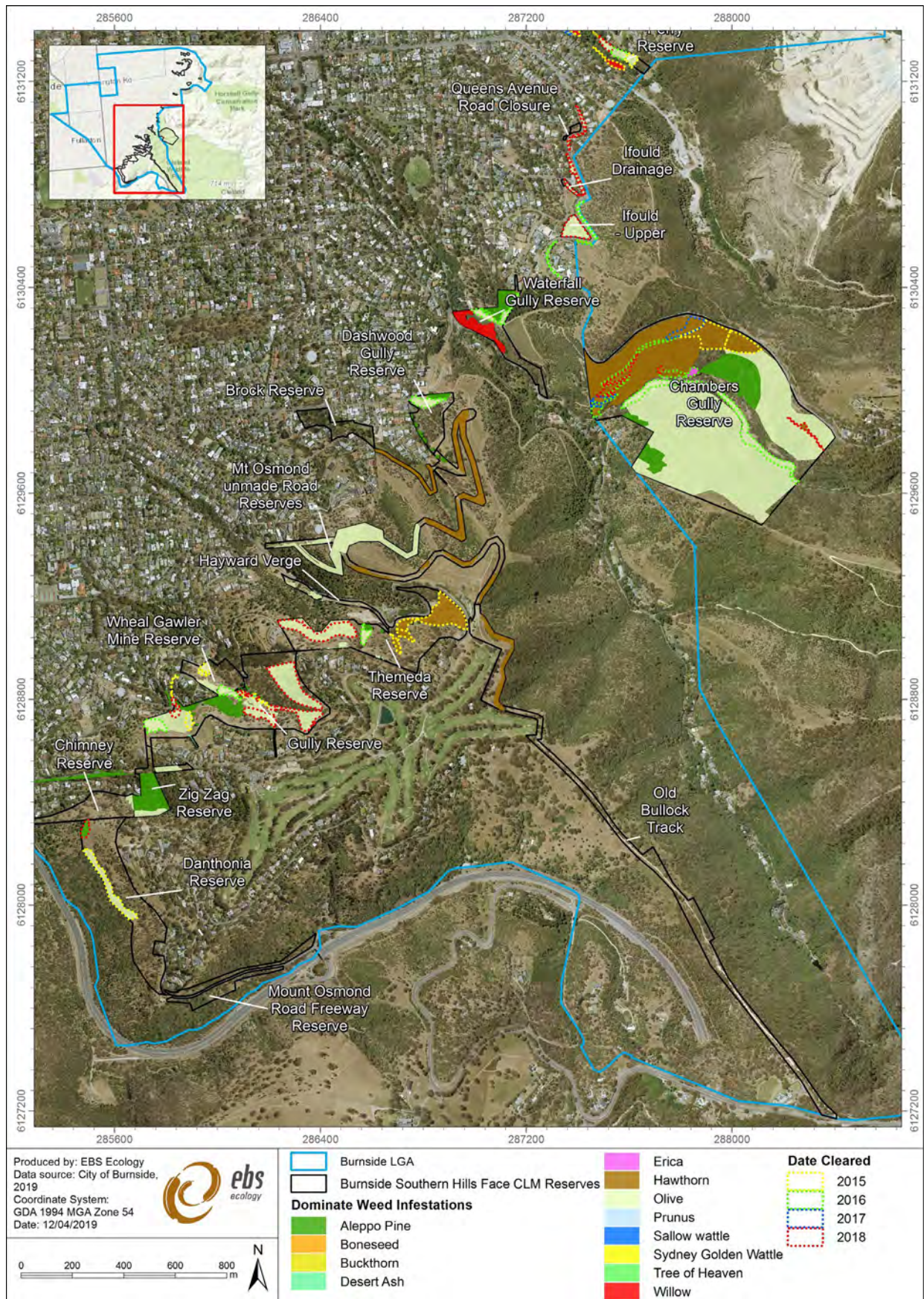


Figure 8. Woody weeds mapped within the southern hills face reserves, including areas that have been cleared in different years.

6 RISKS

Vegetation management within the hills face reserves and roadsides influences, or is influenced by the following risks to the community, environment and economy:

- Bushfire;
- Flooding, erosion and sedimentation;
- Landslip;
- Climate change;
- Introduction, spread and proliferation of introduced plants and animals;
- Loss of habitat and species;
- Plant dieback caused by the root-rot fungus *Phytophthora*; and
- Physical injury to visitors, contractors, volunteers and Council staff.

Each risk is discussed in further detail below.

6.1 Bushfire

The hills face reserves and roadsides constitute a bushfire prone environment with a significant number of people, assets and areas of environmental sensitivity. The climate is typically Mediterranean, with hot dry summers and wet mild winters. In summer the maximum temperature ranges between 24-35°C, although on extreme days the temperature can reach >40°C (BMPU 2016). If a bushfire starts and takes hold during very hot, dry and windy conditions, it will be unpredictable, move very fast and be very difficult for firefighters to bring under control. Spot fires will likely start and move quickly, and embers may come from many directions.

Surviving remnants of native flora indicate that the pre-European vegetation communities of the hill face zone were adapted to frequent, low-intensity fire. Following colonisation, the rapid growth of introduced tree and shrub species has increased fuel loads in the hill face zone, with the widespread establishment of thickets of *Olea europaea* (Olive), *Pinus halepensis* (Aleppo Pine), *Crataegus monogyna* (Hawthorn) and *Rubus fruticosus* (Blackberry). These thickets combined with the remnant vegetation and assets (i.e. residential areas and associated infrastructure) within the hill face zone, make management of the risk of bushfire critical.

Bushfire cannot be eliminated from the landscape and there are circumstances when fire cannot be controlled. However, prevention and preparedness principles, planning and actions can reduce the frequency, spread and impact (health, environmental and financial) of bushfires, and aid in community recovery.

The Council's vegetation management vision, principles and actions relating to bushfire management (including bushfire management zones) in the hills face reserves and roadsides are outlined in Section 7.

6.2 Erosion, runoff and sedimentation

Erosion is the action of surface processes (e.g. wind, water or other natural agents) that removes soil, rock or dissolved material from one location on the Earth's crust, and then transport it to another location. In the hills face reserves, this typically occurs where stormwater is directed onto reserves. Eroding soil and rocks cause a nuisance or risk by:

- Washing onto roads;
- Washing into private properties;
- Silting up stormwater systems and natural drainage features;
- Damaging native flora; and
- Causing gullies that are difficult to manage.

Soil erosion can also occur when soil is bare/exposed due to fire or herbicide application for weed control. Under average fire conditions, the existence of fire-tolerant native perennial grasses on slopes assists with rapid recovery after fire, whereas slopes covered with exotic annual grasses are prone to erosion for a longer period after a fire.

On a smaller scale, areas can become bare when weeds are sprayed, particularly during preparation for sowing or natural regeneration of native grasses. Provided that the soil is not disturbed and there is no extra water running onto the site, the growth of moss on the soil surface is often enough to prevent erosion during the weed control phase of native grass re-establishment. Care must be taken to limit the area of bare ground and to quickly establish a temporary vegetation cover of Rye-corn at sites at risk of erosion. At sites subject to large amounts of stormwater runoff, coir "erosion logs", pegged along the contour, can be used to spread the flow and sediment fencing could be installed to trap eroded sediment while the permanent vegetative cover is established.

The key to erosion control is vegetative cover, particularly perennial grass cover. The more water flow and slope, the more perennial grass cover required. Land with sparse vegetative cover is poor at absorbing rainfall and will therefore have a higher surface runoff. Surface runoff can also occur if the soil becomes waterlogged and cannot absorb the amount of water falling on it. Surface runoff must be avoided because of soil erosion risk. Furthermore, the ability of the hills face areas to absorb rainfall is important for flood prevention in the suburban areas below.

The risk of surface runoff and erosion means that all land must be vegetated at all times, meaning that, in dry times and during fire danger season, some fuel will necessarily be present in the landscape. This creates conflict between the low vegetative cover needed to minimise bushfire risk and the larger vegetative cover needed to minimise the erosion risk. Sound management of weeds, tree canopy density and fine fuel management is needed to minimise this conflict.

Managing the discharge of water onto reserves from roads and private developments is important. Managing these inflows is labour intensive but where water flows onto reserve land at a high rate, management by vegetation alone becomes impossible and the formation of an erosion gully is inevitable.

Wherever there is surface runoff there will be particles of soil and rubbish that become suspended in the water and sedimentation occurs wherever the water flow slows down. Alluvial fans of sediment commonly form wherever stormwater enters reserves where the land is not very steep. These alluvial fans are moist and rich in nutrients and grow rank annual growth which increases fire hazards in summer. Traditionally, the Council removes sediment that reaches roads or private property because of traffic hazards or because of resident complaints. On Jikara Drive, Council has built a sediment interception structure to collect material eroding mainly in stormwater from Chimney Reserve. Council has also constructed small sediment interception structures at Danthonia Reserve and Magill Stone Mine Reserve and has at other locations diverted stormwater flows away from reserve land. Such visually unobtrusive structures are proposed for other locations. These structures require cleaning at most two (2) times in a year.

The Council's vegetation management vision, principles and actions relating to erosion, runoff and sedimentation management in the hills face reserves and roadsides are outlined in Section 7.

6.3 Landslip

Parts of the hill face zone are potentially at risk of a landslip. Indeed, a major landslip occurred on the southern end of Mount Osmond Road in 1997 and instability is evident along with other road cuttings in the area. Landslips occur where deep soils or scree on sloping land become unstable and slips downhill. Landslips are often facilitated by a saturated soil profile, which can happen following long periods of rainfall when the amount of water that falls exceeds that which can be absorbed and moved downwards into the profile.

The depth of soil that moves will be determined by the strength of the bedrock below. In some areas of the hill face zone, the underlying rock is weathered and unconsolidated shale which can also move with the topsoil when it is waterlogged.

Landslip risk is dependent on several factors, including:

- Rainfall;
- Vegetation transpiration rates;
- The infiltration capacity of soil and underlying rock;
- The degree to which soil is bound together by plant roots;
- The degree to which topsoil is bound to underlying rocks by plant roots;
- The degree of consolidation of the underlying rock;
- Additional stormwater flowing onto an area; and
- The presence of cuttings or excavations.

More information including detailed engineering assessment is being collected over time to accurately quantify landslip risk in some key locations. However, the Council's vegetation management vision, principles and actions relating to erosion, runoff and sedimentation management in the hills face reserves and roadsides, which are outlined in Section 7, are applicable for managing landslip risk.

6.4 Climate change

Australia's weather and climate continue to change in response to a warming global climate. Australia has warmed by just over 1°C since 1910, with most warming since 1950. This warming has seen an increase in the frequency of extreme heat events and increased the severity of drought conditions during periods of below-average rainfall (CSIRO 2018).

Climate change, including increasing temperatures, will likely contribute to changes to the fire regime and rainfall. Fire weather is largely monitored in Australia using the Forest Fire Danger Index (FFDI). This index estimates the fire danger on a given day based on observations of temperature, rainfall, humidity and wind speed. The annual 90th percentile of daily FFDI (i.e. the most extreme 10 per cent of fire weather days) has increased in recent decades across many regions of Australia, especially in southern and eastern Australia, and there has been an associated increase in the length of the fire weather season. Australian rainfall is highly variable and is strongly influenced by phenomena such as El Niño, La Niña, and the Indian Ocean Dipole. Despite this large natural variability, underlying long-term trends are evident in some regions, with a shift towards drier conditions across southwestern and southeastern Australia from April to October (CSIRO 2018).

Climate change will continue in the decades ahead, despite natural variability. Changes in the climate, particularly in weather and climate extremes, can have a very significant impact on our environment and wellbeing, including on ecosystems, agriculture and the built environment (CSIRO 2018).

Changes in temperature, rainfall and the climatic pattern will likely affect plants and biodiversity. At the genetic level, there may be shifts in gene frequencies within populations of species, as well as changes in the patterns of biological trait variation, hybridisation and indeed speciation. At the species level, individual species are likely to have altered distributions, and to experience changes in the lifecycle, phenology (e.g. earlier flowering), habitat use, physiology and extinction rates, and consequently in their interactions with other species (e.g. woody plants out-competing herbaceous plants). There are then likely to be changes in the ecosystem and community structure and composition (e.g. selection for drought tolerance) as well as changes in detrimental attributes such as invasive species richness and abundance.

Some ways in which vegetation management may change in response to climate change may include:

- Altering the fuel reduction and/or weed control regimes as:
 - Die-back and thinning of canopies and understorey vegetation becomes apparent due to lower rainfall and higher temperatures; and
 - The window of opportunity for fuel control burning may be reduced due to longer Fire Danger Seasons.
- Considering the incorporation of a wider provenance of the seed of some species in revegetation projects to promote adaptive evolutionary potential in the changing environment; and
- Focussing on the most drought tolerant local species in revegetation projects.

This framework allows for adaptive management to incorporate new insights and actions relating to climate change through the inclusion of the Operational Reserve Management Plans, internal GIS Resources and Technical Notes, which can be progressively updated.

The Council's vegetation management vision, principles and actions relating to climate change management in the hills face reserves and roadsides are outlined in Section 7.

6.5 Introduction, spread and/or proliferation of introduced plants and animals

The risks and impacts associated with the introduction, spread and/or proliferation of weeds are discussed in Section 5.

Introduced animal species impact native flora and fauna through grazing and predation, respectively. The following species may be of concern in the hills face reserves and roadsides:

- *Dama dama* (Fallow Deer)
- *Felis catus* (Feral Cat);
- *Oryctolagus cuniculus* (Rabbit); and
- *Vulpes vulpes* (Fox).

Rabbits are Australia's most widespread and destructive environmental and agricultural vertebrate pest. They graze on native and introduced vegetation, crops and pastures, which can prevent seedlings from regenerating and reduce crop yields. Furthermore, rabbits damage native plants and directly compete with native wildlife for food and shelter. Their grazing and digging also reduce vegetation cover, which can in turn result in erosion and slope instability.

Fallow Deer have become widely distributed and increasingly reported, often in large numbers, in the AMLR. This species impacts native vegetation and wildlife through grazing, competition, soil erosion and compaction, and weed dispersal.

Feral Cats and Foxes have played a major role in the decline and extinction of many native Australian ground-nesting birds, small to medium-sized mammals and reptiles. Both species have a widespread distribution across Australia and can survive in several different habitats, including semi-urban areas, with both attaining their highest densities in human-dominated habitats.

The Council's vegetation management vision, principles and actions relating to preventing the introduction, spread and/or proliferation of introduced plants and animals in the hills face reserves and roadsides are outlined in Section 7.

6.6 Loss of habitat and species

South Australia's forest and woodland habitat have been extensively cleared since European settlement (Bradshaw 2012), with only 10% of woodlands remaining in the AMLR when broadscale clearing largely ceased in 1980 (Paton and O'Connor 2009). In the Adelaide plains region surrounding the AMLR, clearance has been worse, with only 4% of the remnant vegetation remaining (Oke 1997; Tait *et al.* 2005).

As the hills face reserves constitute the largest area of relatively undeveloped land in the city, land management must aim to protect flora species diversity and provide habitat for the many species of wildlife (see Section 4.3), which could otherwise not survive in the area. Loss of biodiversity and habitat is always a risk of land management activity, particularly where vegetation thinning and fuel reduction is required to manage bushfire risk, and weed removal and spraying is undertaken.

Habitat consists of, but is not limited to, the following components:

- Diverse indigenous plant species and lifeforms, and vegetation structure;
- Sufficient areas to provide support for viable populations;
- The linkage between areas to enable dispersal and re-colonisation from unburnt areas after fire;
- Dead trees, coarse woody debris (logs and large fallen branches) and leaf litter;
- Mature trees that provide hollows; and
- Rocky outcrops with crevices.

It is important for vegetation management actions to reduce bushfire risk and control weeds to consider the impact on biodiversity and habitat. Impacts can be avoided or minimised through biodiversity and habitat assessment before implementing bushfire risk management and weed control actions. Diverse areas and areas of important habitat are also protected as *Bushcare* sites, which are managed using low-impact methods.

Issues about the conservation of the native flora and fauna of Burnside are discussed in more detail in the Council's Biodiversity Policy (2021). The Council's vegetation management vision, principles and actions relating to preventing loss of habitat and species in the hills face reserves and roadsides are outlined in Section 7.

6.7 Plant dieback caused by the root-rot fungus *Phytophthora*

Phytophthora is a parasitic pathogen that lives in soil and water and attacks the roots and basal stems of plants. This pathogen has been introduced to South Australia and can cause extensive damage to native vegetation by causing dieback and death of native plants. Dieback caused by *Phytophthora* has been found in several South Australian sites within high rainfall areas, in particular the AMLR (Figure 9). *Phytophthora cinnamomi* is the species most frequently associated with dying vegetation affected by *Phytophthora*.

New infections of *Phytophthora* are mainly caused through human activities involving the movement of infested soil and roots, and by water. Consequently, the only way to prevent *Phytophthora* from spreading is by controlling these human activities.

Under the *Phytophthora (Dieback) Control Environmental Instruction 21.3* (DPTI 2017), the hills face reserves fall within a High Potential Threat Area, which is conducive to the spread of *Phytophthora* and establishment of disease based on climatic and soil factors, and locations of known infestations. However, given that movement of vehicles is contained to formed areas where possible, weed hygiene measures are implemented (e.g. machinery, equipment and footwear cleaning), and low impact vegetation control methods that do not disturb soil are used (e.g. slashing, weed spraying), the risk of introducing and

spreading Phytophthora in the hills face reserves is reduced. Therefore, Phytophthora management will involve monitoring native vegetation within the reserves for symptoms, with response Phytophthora control and hygiene measures implemented should symptoms be detected.

The Council's vegetation management vision, principles and actions relating to Phytophthora management in the hills face reserves and roadsides are outlined in Section 7.

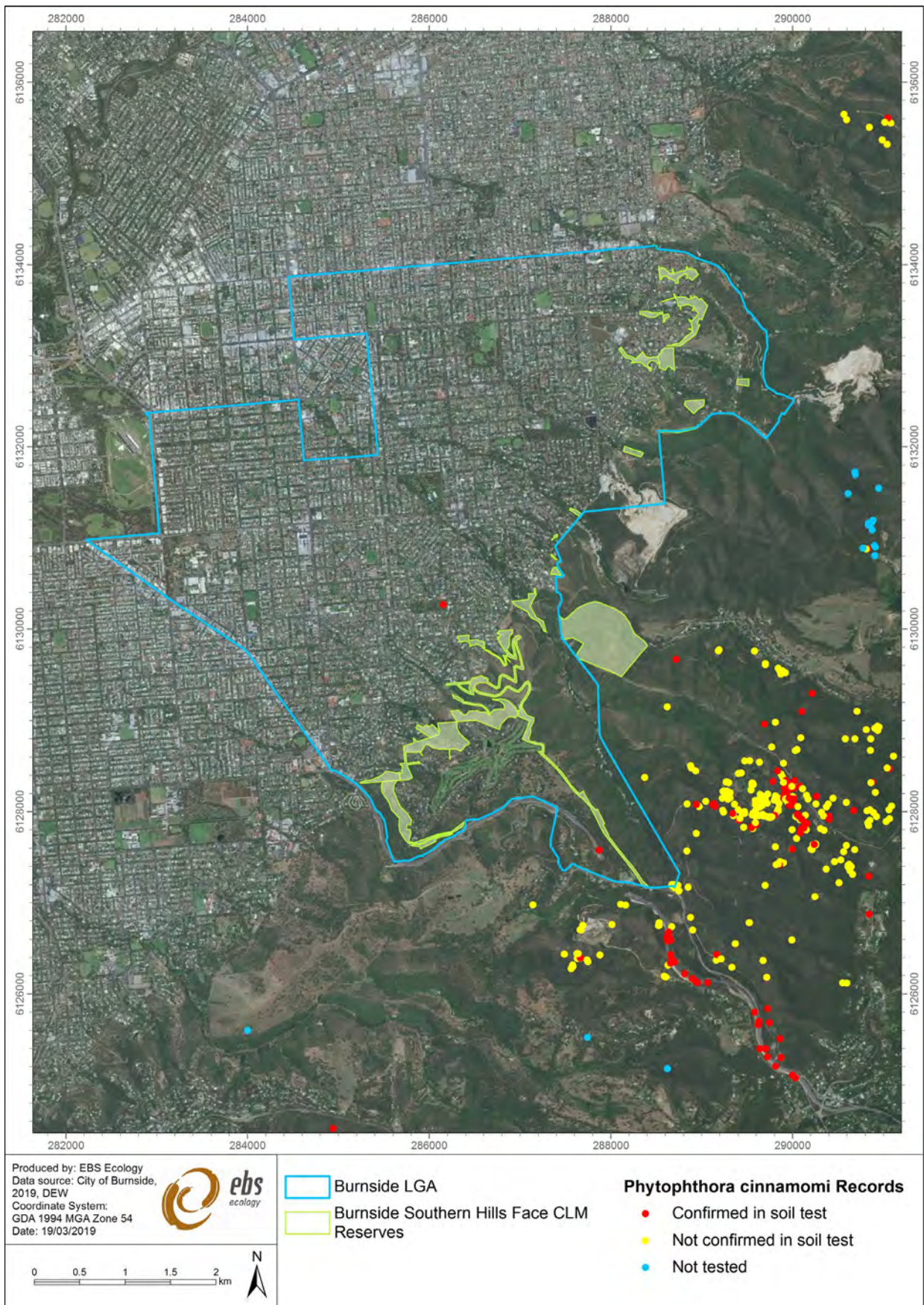


Figure 9. *Phytophthora cinnamomi* records in the vicinity of the hills face reserves (DEW 2019).

6.8 Physical injury to visitors, contractors, volunteers and Council staff

Risks to visitors, contractors, volunteers and staff in the hills face reserves and roadsides arise from:

- Venomous snakes;
- Stinging insects (e.g. bees, wasps, ants);
- Slips, trips and falls;
- Collisions between trail users; and
- Bushfire.

Each risk of physical injury to visitors, contractors, volunteers and staff is summarised further below. The Council's vegetation management vision, principles and actions relating to preventing physical injury to visitors, contractors, volunteers and staff in the hills face reserves and roadsides are outlined in Section 7.

6.8.1 Venomous snakes

All-natural and semi-natural environments will have populations of snakes. *Pseudonaja textilis* (Eastern Brown Snake) is classed as the second most venomous terrestrial snake in the world and is also the most common snake found in South Australia. This species is well adapted to semi-urban environments, is known to visit backyards and occur in reserves throughout the AMLR. Other snake species that may be encountered in the hills face reserves are *Austrelaps labialis* (Pygmy Copperhead) and *Pseudechis porphyriacus* (Red-bellied Black-snake). Snakes will mainly be seen from September to May, being highly active earlier in the warmer months whilst out searching for a mate and on the hunt for food, being hungry after coming out from hibernation.

6.8.2 Stinging insects

All-natural and semi-natural environments will have populations of stinging insects. Stinging insects of concern in the hills face reserves include bees, wasps, and ants, whose stings can cause burning pain and swelling. *Vespula germanica* (European Wasps) have been identified as a pest in the city. This species is aggressive, more so than bees, and will attack when their nests are disturbed. Unlike bees, wasps can sting more than once, and do not die after stinging.

6.8.3 Slips, trips and falls

A network of trails and fire tracks within the hills face reserves exists to provide safer access for recreational walkers, staff, contractors and volunteers. In particular, the trail network that has been developed in the Mount Osmond area is frequently used by residents and visitors. Although the trail network helps to minimise slips, trips and falls, it is difficult to eliminate this risk. Slips, trips and falls may occur due to the unstable or slippery ground and loose objects along trails, particularly during or following wet conditions.

Extra risks arise to field workers from the presence of steep slopes and rocky outcrops and the use of mechanical equipment. In winter, exposed wet rocks are very slippery and in summer, dry grass, particularly if cut, is also very slippery. Any manual work on slopes is hazardous and, beyond a slope of

45° and near drop-offs, it will be necessary for field workers to use a rope and safety harness. These areas are mapped in the *Rope and Harness Management Areas* GIS Layer. For more information refer to the Council's Safe Work Method *Working on Slopes*.

6.8.4 Collisions between trail users

While the Council's trail network is extensive, it is yet to be formalised for all trail users, which will minimise conflict. The main potential for conflict exists between mountain bike riders and walkers/runners. This issue has been addressed in the review of the hills face trails, with proposed actions to allocate trails and provide signage for walker only, shared and bike-only trails, as well as the trail users code of conduct.

6.8.5 Bushfire

There are no physical restrictions to prevent access to the hills face reserves and roadside on Extreme or Catastrophic Fire Days. This is due to the diffuse nature of multiple entry points to reserves. It is expected that visitors to the hill face reserves will ensure they are fully aware of the situation for the day, whether that is bushfire risk or inclement weather, and take the necessary precautions.

The actions to be taken by staff and contractors when an Extreme or Catastrophic Fire Danger Day (FDD) has been declared, including when a bushfire has commenced in the area, are detailed on the Council's website [LINK HERE](#). In summary on Extreme FDDs all operations in the declared Fire Danger Area will be risk assessed with most non-essential services and work deferred. On Catastrophic FDDs all work and services will be deferred, with only Emergency Services (SA Police, CFS and SES) support being provided.

Visitors that are in the hill face zone during these declared situations are deemed to be there at their own risk.

7 VEGETATION MANAGEMENT

7.1 Vision

Ecological communities within the hills face reserves and roadsides have been transformed into hybrid, non-historical systems based on a variety of local and external factors, including biotic changes (e.g. extinction, invasion) and abiotic changes (e.g. land use, management practices, climate change). The existing ecological communities constitute hybrid rather than novel systems since they retain some original characteristics (e.g. dominant overstorey species) as well as novel elements (e.g. woody weed understoreys).

Given the strong influence of novel elements, land use and bushfire risk, and the anticipated impacts of climate change, it is extremely difficult, if not impossible, for the Council's Conservation and Land Management Program to return the vegetation within the hills face reserves and roadsides to its pre-European state. Therefore, it is more appropriate and achievable to set vegetation management objectives (see Section 1.1) that relate to desired vegetation structures to reduce bushfire risk, protect and enhance biodiversity, control weeds, and improve landscape aesthetics for residents and recreational visitors.

The Council's desired vegetation structures and landscape aesthetics in the hills face reserves and roadsides include:

- Fuel within Bushfire Management Zones (BMZs) (see Section 7.2 below) managed per the CFS standard or better (ETRG 2017);
- Open indigenous tree canopies with:
 - Few to no trees within 20 m of property boundaries;
 - Patchy tree canopies with gaps and open spaces; and
 - Trees within Asset Protection Zones (see Section 7.2.1) have the bottom of their crowns trimmed up to 2 m or greater.
- Shrubs:
 - In widely-spaced groups;
 - Absent within 10 m of property boundaries;
 - Sparse in Asset Protection Zones (see Section 7.2.1); and
 - In clumps beyond Asset Protection Zones but still consistent with a moderate or better overall fuel hazard rating.
- Ground covered with native grasses and wildflowers managed by slashing (and prescribed burning if suitable and necessary) to prevent fuel accumulation;
- Patchy scrub, particularly away from Asset Protection Zones (see Section 7.2.1), that provide habitat for woodland bird species;

- A transition from weed dominated landscapes to native vegetation through weed control, facilitated natural regeneration and revegetation;
- Reserves that are resistant and resilient to the risks and impacts of erosion, runoff and sedimentation;
- A trail network that provides safer access for visitors, contractors, volunteers and staff, and separates the reserves into convenient management units; and
- Aesthetically pleasing and uplifting reserves that are reasonably accessible and where weeds are controlled, native flora and fauna thrive, and illegally dumped waste is eliminated or removed swiftly.

7.2 Bushfire Management Zones (BMZs)

In South Australia, BMZs are areas where fuel management actions are regularly undertaken to reduce the risk and impacts of bushfires on life, property and environmental assets. Given the significant bushfire risk in the hills face reserves and roadside, BMZs has been identified as a treatment to reduce bushfire risk.

The BMZs used within this framework are based on the standards provided in the *Bushfire Management Zone Standard and Guideline for Use*, prepared by the Ecological Technical Reference Group (ETRG) of the State Bushfire Coordination Committee (ETRG 2017). There are three BMZs:

- Asset Protection Zones (A-zones);
- Bushfire Buffer Zones (B-zones); and
- Conservation Zones (C-zones).

BMZs are mapped in Figure 10 and Figure 11 and the *Bushfire Management Zones* GIS Layer.

7.2.1 Asset Protection Zones

A-zones surround or are adjacent to an asset listed in the CFS Bushfire Management Area Plan Risk Register. They are designed to reduce fire spread and intensity, radiant heat and direct flame contact to an asset. A-zones should be maintained on an annual basis to ensure that the Overall Fuel Hazard (OFH) (as an average throughout the zone) is reduced to a level of Moderate or below throughout the fire season (see DENR (2012) for OFH level assessment guidelines).

The Bushfire Attack Level (BAL) assessment process defined in *Australian Standard AS3959* is used to determine the width of an A-zone (Standards Australia 2011), which is dependent on vegetation type adjacent to the asset and the effective slope of the surrounding land (Table 7). A BAL of 12.5 kw/m², an FFDI of 100, and the fuel load for the relevant vegetation type are used to calculate the width (ETRG 2017).

Vegetation type was determined by corresponding the broad vegetation mapping within the hills face reserves (see Section 4.1.2) to the vegetation types described in *AS3959* and the *SA Vegetation-Fuel Guide* (DEWNR 2016). The slope was calculated using a 10 m contour data layer that was converted into a slope layer. When calculating the width of an A-zone, the slope of the land between the asset and the

classified vegetation is limited to 20° since the establishment and maintenance of an A-zone may become impractical when the slope is greater than 20° (Standards Australia 2011).

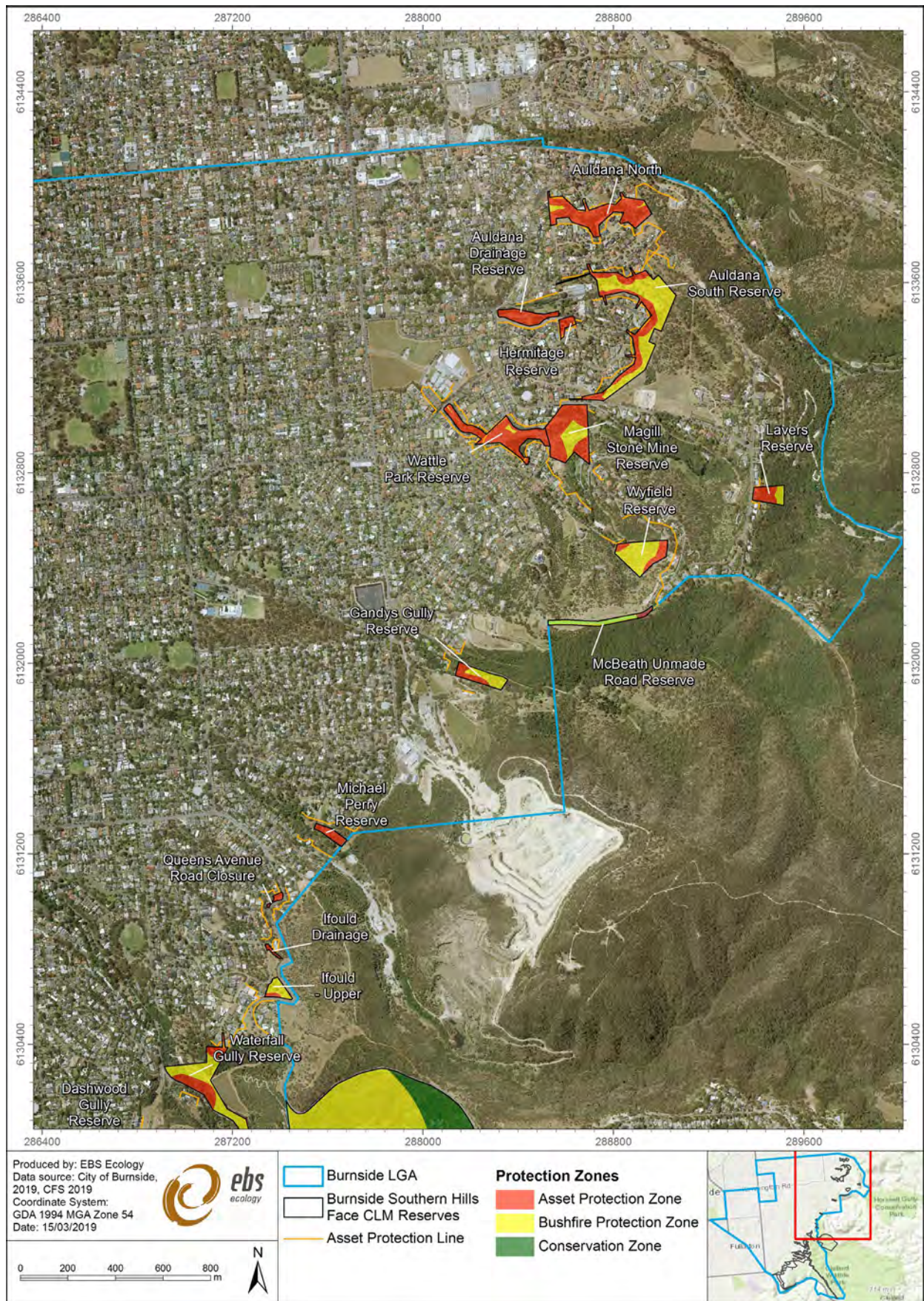


Figure 10. Assets Protection and Bushfire Buffer Zones in the northern hills face reserves.

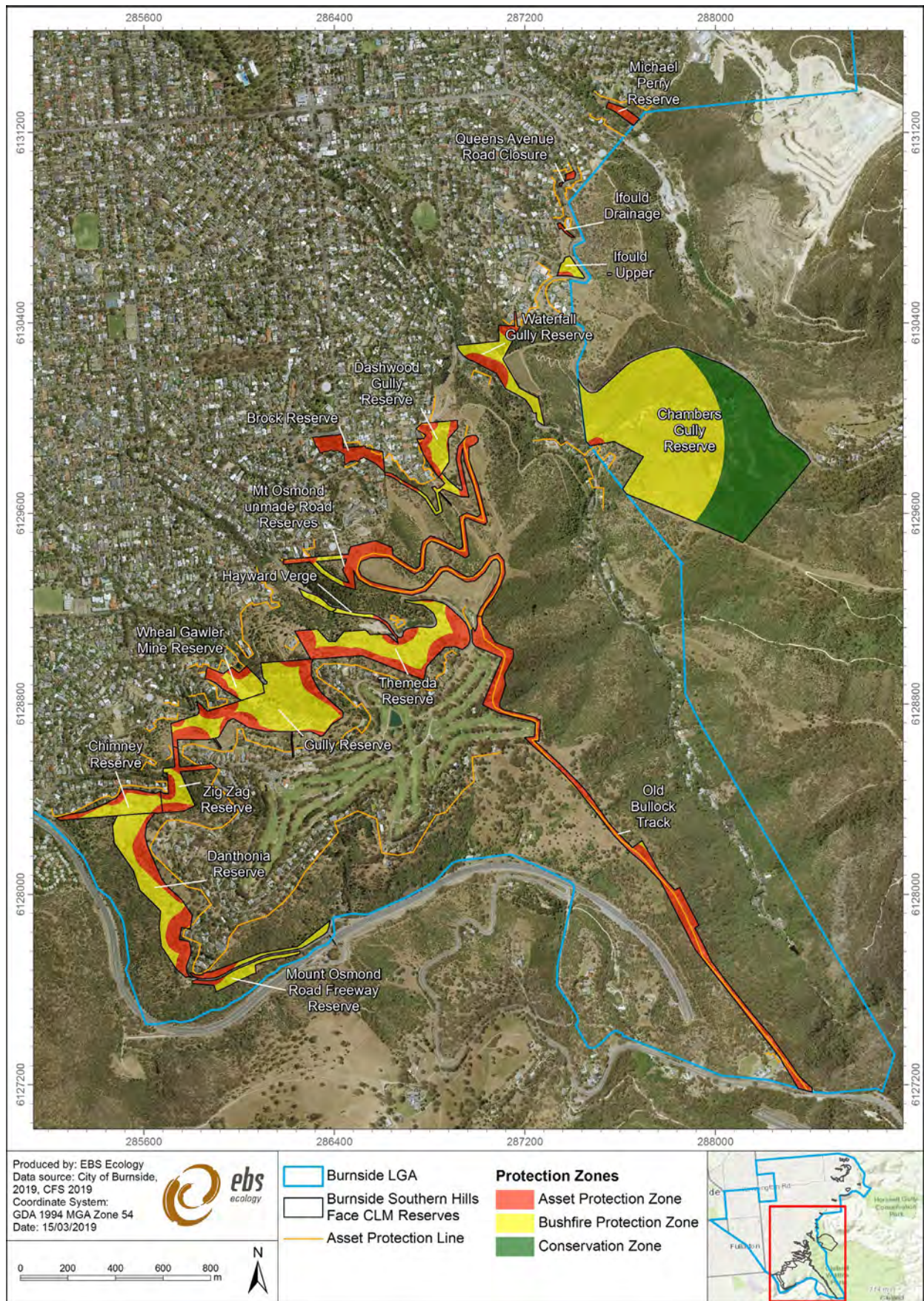


Figure 11. Asset Protection, Bushfire Buffer and Conservation Zones in the southern hills face reserves.

Table 7. Determination of Asset Protection Zone width based on vegetation type and slope (adapted from ETRG (2017)).

Vegetation Type	Slope*	A-zone width (m)
Forest	All upslopes and flat land (0°)	48
	0-5°	57
	5-10°	69
	10-15°	82
	15-20°	98
Woodland	All upslopes and flat land (0°)	33
	0-5°	41
	5-10°	50
	10-15°	60
	15-20°	73
Shrubland	All upslopes and flat land (0°)	19
	0-5°	22
	5-10°	25
	10-15°	28
	15-20°	31
Grassland	All upslopes and flat land (0°)	19
	0-5°	22
	5-10°	25
	10-15°	28
	15-20°	32

***Slope of the land between the asset and the classified vegetation is limited to 20° since the establishment and maintenance of an A-zone may become impractical when the slope is greater than 20° (Standards Australia 2011).**

7.2.2 Bushfire Buffer Zones

B-zones are areas, beyond A-zones, where additional fuel management can reduce the risk of bushfire impact on assets. A B-zone is designed to reduce fire spread, intensity, and short-medium distant spotting to increase the area of reduced fire behaviour near an asset and provide an area of advantage for firefighters to suppress a larger bushfire (reduced spot fire ignition, increased firefighter safety).

B-zones should be managed so that the OFH level does not exceed High (as an average throughout the zone). The width of a B-zone should be determined by the potential short-medium spotting distances and rates of spread of bushfire expected in the relevant fuel type. The CFS recommended width is up to 500 m for forests and woodlands (without Stringybarks present) (ETRG 2017). Given the size of the hills face reserves, the balance of the reserves beyond the A-zones is made up of B-zones.

7.2.3 Conservation Zones

C-zones are areas, beyond A- and B-zones, of vegetated land where the primary fire management objective is for nature conservation, heritage/cultural value management or other land management purposes. C-zones do not have an OFH prescription. A C-zone may be of any size or shape as appropriate to provide for managing risks to the conservation of native vegetation, biodiversity and environmental assets.

The only hills face reserve, where a C-zone is applicable, is Chambers Gully Reserve, given its size and the lack of nearby assets listed in the Bushfire Management Area Plan Risk Register. Fuel management may be conducted in the C-zone of this reserve if there is a requirement to:

- Conserve significant flora, fauna, habitat and other natural assets;
- Conserve significant cultural and heritage assets;
- Protect dispersed scientific and recreational assets; and
- Manage fire regimes in line with the *Ecological Fire Management Guidelines for South Australia* (DEWNR 2013).

7.3 Approaches

7.3.1 Slashing

Slashing is the primary approach to fine fuel reduction, with other objectives including:

- Maintenance of access along fire tracks;
- Creation of fire breaks along roadsides and within B-zones; and
- Enhancing biodiversity.

Slashing is used to control annual and perennial grassy and herbaceous weeds. Care is taken to minimise damage to native flora. Depending on the sensitivity of the management area, slashing is conducted using handheld brushcutters (general areas) or tractors (more accessible areas). Specialist contractors are engaged for slashing works in Bushcare sites.

7.3.2 Woody weed control

Two techniques are predominantly used for woody weed control (Natural Resources AMLR 2019):

- Drill and Fill – used for large woody weeds such as Olive, which it is best known for killing, and Hawthorn; and
- Cut and Swab – used for smaller woody weeds such as Boneseed.

Woody weed control reduces the near-surface and elevated fuels, lowers risks to reserve users' health and improves aesthetics. Care is taken to balance retention of habitat in standing dead timber, which holds little fuel risk, and removal of debris to lower fuel risk.

7.3.3 Weed spraying

Weed spraying with herbicide is used to remove herbaceous and grassy weeds. The majority of spraying will involve either spot spraying to ensure no off-target damage or the use of selective herbicides designed to retain native understorey species (e.g. native grasses) (Natural Resources AMLR 2019). Spraying is undertaken during the correct season when weeds are actively growing.

7.3.4 Weed hygiene

To restrict or prevent the introduction or further spread of weeds already present in the hills face reserves and roadsides weed hygiene is critical. Contractors ensure that slashing and mowing equipment is clean and free of seeds, debris and soil before leaving a site or a weed-infested management zone that is surrounded by better quality zones. This is also beneficial to prevent the spread of *Phytophthora*.

7.3.5 Tree establishment

As part of the Council's Conservation and Land Management Program, local plants are propagated at the Council Biodiversity Nursery and planted in the hills face reserves where revegetation is required, including following woody weed removal. Plantings aim to establish an open woodland structure to suppress weed growth and limit bushfire fuel.

7.3.6 Prescribed burns

The use of prescribed burns to manage bushfire risk was heavily emphasised in the SHFR VMP. However, this approach was not used during the life of that document. This was because, while the theory is sound, the practicality of conducting prescribed burns within the hills face reserves and roadsides is fraught regarding the risk, permission needed (e.g. NVC) and skilled personnel to implement. For these reasons, this approach is unlikely to be used. If prescribed burns are to be used, which may be viable in more remote and larger reserves (e.g. Chambers Gully Reserve), these will be planned, including the development of guiding principles and conducted in consultation with DEW and the CFS.

7.4 Principles and actions

The Council's principles and related actions of vegetation management in the hills face reserves and roadsides are outlined in Table 8.

Table 8. The Council principles and related actions of vegetation management within the hills face reserves and roadsides.

Principle	Actions	Responsible Officer
Reduce the risk and impacts of bushfire on life, property and environmental assets in the hills face reserves and roadsides by managing A-zones (see Section 7.2)	Maintain A-zone on an annual basis to ensure that the OFH (as an average throughout the zone) is reduced to a level of Moderate or below throughout the fire season (see <i>Overall Fuel Hazard Guide for South Australia</i> (DENR 2012)).	Technical Officer Conservation and Land Management (CLM)
	Maintain A-zone at widths specified in the <i>Bushfire Management Zones</i> (Figure 10 and Figure 11).	Technical Officer CLM
	Surface and shrub fine fuels (leaves, twigs, bark etc. <6 mm in diameter) are to be reduced where practical and maintained so the OFH is Low.	Technical Officer CLM
	Tree canopies should be separated where practical and have lower branches pruned to a minimum of 2 m above the ground. New plantings should aim to have canopies separated by 2 m when mature.	Technical Officer CLM
	Understorey plants should not be vertically or horizontally continuous. Shrubs should be clumped to avoid even coverage. Shrubs and trees should be separated to minimise vertical fuel ladders.	Technical Officer CLM
	Dead shrubs/understorey plants and dead overstorey material should be removed.	Technical Officer CLM

	Dry grass should be maintained at 10 cm or less.	Technical Officer CLM
	The Fire Protection Officer is to inform landholders in an annual mail out (normally September/October) that heath or shrub understorey species within 2 m of an asset to be protected should be removed.	Fire Prevention Officer
	The Fire Protection Officer is to inform landholders in an annual mail out (normally September/October) that, where the asset is a building, tree branches overhanging the roof should be removed or trimmed to at least 2 m clear of the roof.	Fire Prevention Officer
Reduce the risk and impacts of bushfire on life, property and environmental assets in the hills face reserves and roadsides by managing B-zones (see Section 7.2)	Maintain B-zone on an annual basis to ensure that the OFH (as an average throughout the zone) is reduced to a level of High or below throughout the fire season (see <i>Overall Fuel Hazard Guide for South Australia</i> (DENR 2012)).	Technical Officer CLM
	Maintain B-zone at widths specified in the <i>Bushfire Management Zones</i> GIS Layer (the balance of all reserves beyond A-zones, except Chambers Gully Reserve which is larger) (Figure 10 and Figure 11).	Technical Officer CLM
	Biodiversity protection management actions relevant to B-zones are discussed below.	Technical Officer CLM
Manage C-zones for nature conservation, heritage/cultural value management or other land management purposes (see Section 7.2).	Fuel management may be conducted in the C-zone of Chambers Gully Reserve if there is a requirement to: <ul style="list-style-type: none"> • Conserve significant flora, fauna, habitat and other natural assets; • Conserve significant cultural and heritage assets; • Protect dispersed scientific and recreational assets; and • Manage fire regimes in line with the Ecological Fire Management Guidelines for South Australia (DEWNR 2013). 	Technical Officer CLM
Reduce the risk and impacts of bushfire on life, property and environmental assets in the hills face reserves and roadsides using best practice management	Management actions include, but are not limited to, slashing, targeted woody weed control, herbaceous and grassy weed spraying, selective thinning and/or prescribed burning (if necessary and conditions allow).	Technical Officer CLM
	Slashing in all A-zones and as much of the B-Zones as practical to be completed before the commencement of the fire danger season (typically 17 November, but may vary based on seasonal conditions).	Technical Officer CLM
	Slashing should be conducted more than once a year if seasonal conditions favour growth throughout the year. Repeat slashing will typically target the areas of high growth only, with priority given to A-zones followed by B-zones.	Technical Officer CLM
	Roadsides within road reserve boundaries should be slashed if they are untended by adjacent residents and consist mainly of grassy and herbaceous weeds.	Technical Officer CLM
	Areas that are all exotic species (with scattered native grass and colonising species) can be cut or burned as often as needed for bushfire risk reduction purposes without damage to native flora.	Technical Officer CLM
	Dead twiggy material should be removed from the ground and to a height of 2 m, concentrating on material 6 mm diameter or less (fine fuel).	Technical Officer CLM
	Illegally dumped waste will be removed to reduce bushfire risk.	Technical Services and Operations
	Weed control actions that also relate to best practice bushfire risk management are discussed below.	Technical Officer CLM
Protect biodiversity in the hills face reserves and roadsides	Any native sub-shrub individuals will be protected from slashing, weed removal and spraying, and fire during prescribed burns.	Technical Officer CLM
	Dense areas of native grasses should only be slashed after setting seed and at a height of 50-100 mm to retain perennial tussocks.	Technical Officer CLM

	Roadsides should not be slashed if they contain significant indigenous vegetation (native grasses may be cut if timed appropriately, i.e. after seed dispersal).	Technical Officer CLM
	Primary clearance of woody weeds is not to take place if native birds are nesting or Ring Tail Possum dreys are present.	Technical Officer CLM
	Young trees in appropriate locations will be protected during slashing and fire during prescribed burns.	Technical Officer CLM
	The highest quality native grassland areas should be carefully weeded or spot sprayed by staff or trained volunteers.	Technical Officer CLM
	Standing hollows and the frames of dead trees should be retained for habitat (possums, birds) where safe to do so based on bushfire risk.	Technical Officer CLM
	Fallen logs and cut logs should be retained for habitat (fungi, insects, lizards) where safe to do so based on bushfire risk.	Technical Officer CLM
	Weed spraying should not be undertaken on days where spray drift is a risk.	Technical Officer CLM
	The presence of Phytophthora will be inspected visually. The primary symptoms of infection are root lesions resulting in stunted roots, discolouration of root and eventually root rot (looked for in any cleared native vegetation). Secondary symptoms are similar to those produced by water stress, such as wilting and loss of turgor pressure, leaf chlorosis, twig dieback, occasional leaf fall and eventual plant death (Hook 2011).	Technical Officer CLM
	If symptoms of Phytophthora are detected, control measures will be reviewed and an investigation will be conducted to determine the cause of the symptoms to rectify the issue. If a serious threat is apparent engage a suitably qualified environmental scientist to conduct baiting to detect Phytophthora and assess risk.	Technical Officer CLM
	If an area of Aleppo Pine is to be removed, this should be undertaken in stages and coincide with the establishment of Yellow-tailed Black Cockatoo habitat and food resources in other areas of the reserve.	Technical Officer CLM
	Vegetation condition within detailed vegetation associations and management units in the hills face reserves is rated in each Reverse Management Plan according to the proportion of native species present and the level of weed infestation (see Appendix 1 for rating system). This allows for targeted management to protect biodiversity in better sites.	Technical Officer CLM
	Illegally dumped waste will be removed carefully to not damage native flora and alleviate smothered native flora.	Technical Services and Operations
Enhance biodiversity in the hills face reserves and roadsides	Indigenous tree canopy species, selected to match the physical environment, should be established as woody weeds removed.	Technical Officer CLM
	Dead trunks should be retained for habitat after cutting off the smaller dead branches unless they pose a serious bushfire risk.	Technical Officer CLM
	Vegetation condition within detailed vegetation associations and management units in the hills face reserves is rated in each Reverse Management Plan according to the proportion of native species present and the level of weed infestation (see Appendix 1 for rating system). This allows for targeted management to enhance biodiversity in poorer sites.	Technical Officer CLM
Control weeds in the hills face reserves and roadsides	Woody weeds should be treated and followed up throughout reserve management units on a staged basis to minimise disruption to native birds.	Technical Officer CLM
	Introduced perennial grasses should be spot sprayed and followed up.	Technical Officer CLM
	Large biomass and other noxious herbaceous weeds should be spot sprayed with selective herbicide and followed up.	Technical Officer CLM
	Introduced grasses should be eliminated on an area by area basis with replacement by native ground cover species (bite and hold strategy).	Technical Officer CLM

	Slashing and mowing equipment should be clean and free of seeds and debris before leaving a site or a weed-infested management zone that is surrounded by better quality zones.	Technical Officer CLM
	Care is taken when spraying to minimise non-target damage, including not spraying when rain is expected within 6 hours or if the breeze is strong enough to shake the foliage of trees or shrubs (Natural Resources AMLR 2019).	Technical Officer CLM
	Spraying is undertaken during the correct season when weeds are actively growing.	Technical Officer CLM
	Vegetation condition within detailed vegetation associations and management units in the hills face reserves is rated in each Reverse Management Plan according to the proportion of native species present and the level of weed infestation (see Appendix 1 for rating system). This allows for targeted management to control weeds in poorer sites.	Technical Officer CLM
	Illegally dumped waste will be removed to prevent the accumulation of excess nutrients and associated weed proliferation.	Technical Services and Operations
Mitigate the introduction, spread and proliferation of feral animals in the hills face reserves and roadsides	Contractors and staff to look for and report signs of feral animals including scats, tracks, burrows, damage to vegetation and signs of predation (e.g. carcasses, feathers).	Technical Officer CLM
	If any feral animal species is observed frequently and/or in high numbers, control will be undertaken in consultation with Natural Resources AMLR.	Technical Officer CLM
	Illegally dumped waste will be removed to reduce potential cover for feral animals.	Technical Services and Operations
Improve landscape aesthetics in the hills face reserves and roadsides	See actions to protect and enhance biodiversity, and control weeds (above).	Technical Officer CLM
	The trail network will be improved and maintained	Technical Officer CLM
	Illegally dumped waste will be removed.	Technical Services and Operations
	Inform adjoining landholders of the conservation, weed and bushfire issues associated with illegal dumping, including garden waste.	Technical Officer CLM
Mitigate erosion, runoff, sedimentation and landslip in the hills face reserves and roadsides	Introduced grasses should be eliminated on an area by area basis with replacement by native ground cover species (bite and hold strategy).	Technical Officer CLM
	Care must be taken to limit the area of bare ground and to quickly establish a temporary vegetation cover of appropriate native grass species at sites at risk of erosion.	Technical Officer CLM
	At sites subject to large amounts of stormwater runoff, coir logs, pegged along the contour (or similar erosion and sediment controls) should be used to spread the flow while the permanent vegetative cover is established	Technical Officer CLM
	In emergencies, erosion should be controlled using measures such as biodegradable erosion control mats, hydro-mulch and soil binders.	Technical Officer CLM
Mitigate climate change in the hills face reserves and roadsides	Insights into the localised effects of climate change will be gained as part of the ongoing vegetation management in the hills face reserves and roadsides. Among other variables, information will be collected on the following: <ul style="list-style-type: none"> • Composition, cover, establishment, recruitment and mortality of flora species and communities, including weed species; • Timing and extent of fire danger seasons; • Timing and load of fuel management activities; and • Fire history. 	Technical Officer CLM
	Data will be analysed using GIS software to search for trends and correlations with climatic data such as rainfall and	GIS Officer

	temperature, the results of which may be used to inform future management	
	New insights and actions relating to climate change will be incorporated through the inclusion of the Operational Reserve Management Plans, internal GIS Resources and Technical Notes, which can be progressively updated.	Technical Officer CLM
Mitigate physical injury to visitors, contractors, volunteers and Council staff in the hills face reserves and roadsides	Trails have been constructed to provide safe access for visitors, contractors, volunteers and staff.	Technical Officer CLM
	Visitors, contractors, volunteers and staff will be made aware of cliffs, steep and unstable slopes, and mines through signage and training (for workers).	WHS and Risk Management Coordinator
	Vegetation within the Trail Corridor will be cleared and trimmed where necessary.	Technical Officer CLM
	Potential conflict between mountain bikers and walkers/runners will be mitigated through trail allocation and signage for walker only, shared and bike-only trails, and trail users code of conduct	Technical Officer CLM
	Contractors will use ropes and safety harnesses for management activities on slopes greater than 45° and near drop-offs, or where an individual sees fit.	WHS and Risk Management Coordinator
	Contractors, volunteers and staff will be made aware of, and how to respond to encounters with, venomous snakes and biting insects through signage and training (for workers).	WHS and Risk Management Coordinator
	Feral bee and wasp nests in proximity to trails and volunteer sites will be removed. Visitors can report nests via the Customer Service number (08 8366 4200) and online report form https://action.burnside.sa.gov.au/	Technical Services and Operations
	Contractors, volunteers and staff will be made aware of bushfire risk through signage and training.	WHS and Risk Management Coordinator
The actions to be taken by staff and contractors when an Extreme or Catastrophic Fire Day has been declared, including when a bushfire has commenced in the area.	WHS and Risk Management Coordinator	

7.5 Monitoring and reporting

Monitoring and reporting are important to assess progress against the framework's objectives, provide overall trends and inform future Vegetation Management Frameworks. The following monitoring will be undertaken:

- Woody weed coverage – to be recorded annually by mapping the areas treated each year. This way an annual total of extent, treatment and follow-up will be reported;
- Native vegetation condition – in the individual Operational Reserve Management Plans each Management Zone will be assessed for native vegetation condition and indigenous species diversity. Changes in these variables will be reported periodically; and
- Overall fuel hazard level – each vegetation management zone will be assessed for Overall Fuel Hazard (DENR 2012).

8 MANAGEMENT ISSUES

8.1 Access

Safe access for volunteers, contractors and staff is a serious management issue based on the steep terrain of the hills face reserves. Over the last 15 years, trails have been constructed to provide safer access for staff and contractors. However, there is currently no vehicle access to several hills face reserves. The most weed-infested areas are also difficult to access.

Rope anchor points are required above steep slopes in reserves to facilitate safe management access using ropes and harnesses. Slashing is currently undertaken to maintain access along fire tracks and the trail network.

8.2 Potential fire hazards on private land

As outlined in the Council's *Bushfire Hazard Management Policy*, the Fire Prevention Officer will conduct an annual mail out (normally September/October) to remind landholders with land that may pose a fire hazard (typically vacant blocks and sites that have known risks) of their obligations to reduce the potential fire risk through appropriate land management techniques such as slashing. Landholders are required to undertake this work by one month before the start of the Fire Danger Season, typically 1 December of each year. Council Officers will then undertake inspections to verify that the work has been undertaken and if not, the landholder will be issued with a notice under Section 105F of the FES Act to undertake the work.

Council Officers may undertake random inspections of dwellings located in high-risk fire zones and require property owners to undertake works to manage that risk. Property owners will be given time to undertake the work commensurate with the extent of risk noting resource requirements. The Fire Prevention Officer will assist the resident, in consultation with the SA CFS, to determine a Land Management Fire Risk Plan (LMFRP) to manage the risk-taking into consideration any priority actions.

Council Officers may undertake further inspections to determine whether the LMFRP is in action. Any property owners who fail to action their LMFRP and whose land still poses a high potential fire risk may be issued with a notice under Section 105F of the FES Act outlining the required works. Typically, property owners will be provided 21 days to comply with the notice, unless the Officer believes the land requires more urgent attention.

Where no action is taken by land and/or property owners after follow-up inspections, the Fire Prevention Officer may engage a contractor to undertake the works using the appropriate resources and techniques. If such an action is taken Council will recover the costs of the action through a fee levied on the land and/or property owner by Council in addition to an expiation notice that may be issued for non-compliance.

8.3 Weeds on private land

Private landholders are often reluctant to undertake weed management on their properties if weeds are also growing on Council reserves and roadsides. Following through on the weed control visions, principles

and actions detailed within, this framework should foster acceptance of measures and encourage improved management of private land. Management of weeds on private land is not addressed in this plan.

8.4 Illegal dumping

Illegal dumping is the disposal of waste on public or private land or into water bodies without a licence, permit or approval from the relevant authority such as the EPA or Council. Illegal dumping is a minor but important issue in the hills face reserves. Illegal dumping is problematic to vegetation management since it can:

- Smother native flora;
- Import nutrients, which can lead to the accumulation of excess nutrients (e.g. phosphorus and nitrogen) and associated weed proliferation; and
- Increase the risk of bushfires.

Furthermore, illegal dumping is unsightly and puts human health and safety at risk, especially when hazardous chemicals or asbestos are involved.

Illegal dumping in the hills face reserves generally constitutes adjacent landholders disposing of green and hard (e.g. iron sheets, timber, building materials) waste over fences, roadside and reserve entry dumping of green waste, littering of fast food packaging and dog waste bags in reserve car parks and trails, and dog waste bags thrown into vegetation.

Illegally dumped waste will be removed carefully to not damage native flora. The Council will inform adjoining landholders of the conservation, weed and bushfire issues associated with illegal dumping, including garden waste. The Council offers residents one free at-call hard waste collection service per financial year, and free disposal of garden waste, within the hill face zone, into skip bins before the bushfire danger season.

Council expects visitors to hill face reserves to take all waste they generate back home with them for placement in the appropriate domestic waste bin. Council will therefore not consider the provision of additional public waste bins within hill face reserves.

The Council have provided residents with the opportunity to report illegal dumping via their Customer Service number (08 8366 4200) and online report form (<https://action.burnside.sa.gov.au/>).

9 APPENDICES

Appendix 1. Condition ratings used to rate vegetation associations and management units in the hills face reserves. Adapted from *Guide to Roadside Vegetation Survey Methodology in South Australia* (Stokes et al. 2006).

Condition Rating	Condition Overview	Description
1	Excellent	Very little or no sign of alien vegetation in the understorey; close resemblance to probable pre-European condition.
2	Good	A high proportion of native species and native cover in the understorey; reasonable representation of probable pre-European vegetation.
3	Moderate	Substantial invasion of aliens, but native understorey* persist; for example, maybe a low proportion of native species and high native cover, or a high proportion of native species and low native cover
4	Poor	The understorey consists predominantly of alien species, although a small number of natives persist.
5	Very Poor	The understorey consists only of alien species.

10 GLOSSARY AND ABBREVIATION OF TERMS

ALA	Atlas of Living Australia
AMLR	Adelaide Mount Lofty Ranges
AS	Australian Standard
Asset	Anything of value within communities that may be impacted by bushfire, including residential areas, infrastructure, and commercial, environmental, heritage and community valued sites.
A-zone	Asset Protection Zone – surrounds or is adjacent to an asset listed in the Bushfire Management Area Plan Risk Register.
BAL	Bushfire Attack Level – level of radiant heat that is likely to impact an asset.
Bark Fuel	The flammable bark on tree trunks and upper branches.
BMAP	Bushfire Management Area Plan
BMC	Bushfire Management Committee
BMPU	Bushfire Management Planning Unit
BMZ	Bushfire Management Zone
BOM	Bureau of Meteorology
B-zone	Bushfire Buffer Zone – an area, beyond an Asset Protection Zone, where additional fuel management can reduce the risk of bushfire impact on assets.
Canopy Fuel	The crowns (leaves and fine twigs) of the tallest layer of trees in a forest of woodland. Not measured as part of Overall Fuel Hazard.
CLM	Conservation and Land Management
CFS	Country Fire Service (South Australia)
COB	Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
C-Zone	Conservation Zone – an area of vegetated land where the primary fire management objective is for nature conservation, heritage/cultural value management or other land management purposes.
DEH	Department for Environment and Heritage
DENR	Department of Environment and Natural Resources (now DEW)
DEW	Department for Environment and Water
DEWNR	Department of Environment, Water and Natural Resources (now DEW)
DotE	Department of the Environment (now Department of the Environment and Energy)

DPTI	Department of Planning, Transport and Infrastructure
EBS	Environmental and Biodiversity Services Pty Ltd
Elevated Fuel	Shrubs and juvenile understorey plants up to 2-3 m in height, generally having an upright orientation. Includes canopy <4 m in height when there is no identifiable separation between lower shrubs.
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ETRG	Ecological Technical Reference Group – within the State Bushfire Coordination Committee.
FES Act	<i>Fire and Emergency Services Act 2005</i>
FFDI	Forest Fire Danger Index – combines a record of dryness, based on rainfall and evaporation, with meteorological variables for wind speed, temperature and humidity to measure the degree of danger of fire in Australian forests.
GIS	Geographic Information System – a framework for gathering, managing and analysing data using spatial information.
ha	Hectare/s
HILLS FACE ZONE	Hills Face Zone – a large planning zone in Adelaide, South Australia, which restricts development in the Adelaide Foothills and Mount Lofty Ranges and extends from Gawler in the north to Sellicks Beach in the South.
HFR VMF	Hills Face Reserves Vegetation Management Framework
km	Kilometre/s
m	Metre/s
MNES	Matters of National Environmental Significance
NatureMaps	An initiative of DEW that provides a common access point to maps and geographic information about South Australia's natural resources in an interactive online mapping format.
Near-surface Fuel	Grasses, low shrubs and heath, sometimes containing suspended components of leaves, bark and twigs. Can vary from a few centimetres to 0.6 m in height and includes a mixture of horizontal and vertical orientations.
NR AMLR	Natural Resources Adelaide and Mount Lofty Ranges
NRM	Natural Resources Management
NRM Act	<i>Natural Resources Management Act 2004</i>
NV Act	<i>Native Vegetation Act 1991</i>
NVC	Native Vegetation Council
OFH	Overall Fuel Hazard = (the sum of influences of) Bark Hazard + Elevated Fuel Hazard + Surface Fine Fuel Hazard.

SBCC	State Bushfire Coordination Committee
SHFRVMP	Southern Hills Face Reserves Vegetation Management Plan
Surface Fuel	Leaves, twigs and bark, including partly decomposed fuel, on the forest floor. Components are generally horizontally layered. Usually contributes the greatest to fuel quantity.

