NSW GOVERNMENT | Office of Environment & Heritage

Biodiversity Investment Opportunities Map

Mapping Priority Investment Areas
for the Cumberland Subregion

Cover photo: BIO Map Priority Investment Areas comprising Nurragingy Reserve (Core Area) and associated Regional Biodiversity Corridor in the Blacktown LGA.

Photo credit: Western Sydney Parklands Trust.

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Contents

Summary

The Office of Environment and Heritage (OEH) is currently delivering the $10.1-million Linking Landscapes through Local Action project ('Linking Landscapes'), which is part of the NSW Government's Green Corridors Program. Linking Landscapes includes the Biodiversity Investment Opportunities Map (BIO Map) project, which supports the Government's NSW 2021 commitment (Goal 22 Target 2) to 'identify land of strategic conservation value'.

BIO Map identifies Priority Investment Areas (PIAs) where the protection and management of native vegetation can be of greatest benefit to biodiversity. The PIAs identified include:

- **core areas:** large remnants where management will be of greatest benefit to the conservation of key state and regional biodiversity values within a region
- **state and regional biodiversity corridors:** linear areas that link core areas and play a crucial role in maintaining connections between animal and plant populations that would otherwise be isolated and at greater risk of local extinction.

BIO Map can be used as a decision-support tool for funding bodies, including government grant providers. It provides a single, accessible map that will help funding bodies to identify priority areas for biodiversity investment and help ensure that funds are targeted to areas of greatest strategic benefit, based on an assessment of broad-scale biodiversity and stakeholder values.

In addition to informing funding bodies, the identification of PIAs will provide useful information for landowners and land managers on the areas that have increased potential for receiving biodiversity management funds. As such, BIO Map may increase the opportunities for landowners to receive funding to protect their bushland, but participation in any funding program is entirely voluntary. BIO Map will also help community organisations to identify the sites that are the most appropriate targets for their efforts.

BIO Map was not developed to inform land-use planning or development applications, and it is not intended to be used for land-use planning. The reason for this is that BIO Map does not identify all significant vegetation in the Cumberland subregion, and therefore it cannot be assumed that areas not identified as PIAs are of lower environmental value. A finer scale of assessment than that provided by BIO Map is required to support statutory planning processes and decisions. The limitations and assumptions of the BIO Map are set out in detail in section 1.5 of this report.

Landowners' rights to carry out activities such as agriculture and development are not altered by their properties being identified as being within PIAs. However, areas within PIAs may have environmental values that need to be considered as part of existing statutory planning and development approval processes and that would require an appropriately scaled level of environmental assessment, as specified by the relevant planning or consent authority. The identification of land as a PIA does not alter these existing requirements in any way.

BIO Map has been prepared for the Cumberland subregion, a 275 693-hectare area containing the Cumberland Plain, a broad shale basin in Western Sydney. Another BIO Map project has been conducted for the Illawarra region (OEH in preparation).

Mapping criteria were used to identify and map PIAs. Where available, existing data were utilised. New data layers, such as seamless vegetation layers (i.e. continuous and consistent vegetation mapping across the entire study area) and land-use information, were created where required. Conservation planning tools were used to help identify core areas and corridors. The method used to map and identify PIAs is described in section 4 and in the appendices.

The Plant Community Types (PCTs) mapped in the Cumberland subregion were used to define 30 key state and regional biodiversity values to be included in core areas. Core areas were then identified to represent each of these values to a minimum level of 15 per cent of their existing extent within the Cumberland subregion. The minimum representation of 15 per cent was selected to maintain consistency with the target used to define the Priority Conservation Lands (PCLs)

identified by the Cumberland Plain Recovery Plan. This target recognises that many vegetation communities within the Cumberland subregion are substantially cleared and highly fragmented and face ongoing land-use and clearing pressure. Nevertheless, many of the key state and regional biodiversity values substantially exceeded the minimum 15 per cent representation target within core areas. Land within regional biodiversity corridors, which does not count towards the minimum target, also considerably increases the representation of some key state and regional biodiversity values within the PIAs.

Targeted stakeholder consultation informed the outputs of the project. Stakeholders consulted included the Commonwealth Department of the Environment, six state government authorities, 16 local councils and eight non-government organisations.

The project comprised two main rounds of stakeholder engagement. Initial stakeholder consultation included meetings with each of the 31 stakeholders to discuss the BIO Map concept, the mapping criteria and the indicative map. A draft map was subsequently provided to stakeholders for review during the second round of consultation, together with written responses to each stakeholder's comments on the indicative map. Further meetings with stakeholders were held to discuss complex issues. Comments on the draft map were incorporated into the final BIO Map. Feedback from stakeholders was overwhelmingly positive, with several areas added or removed on the basis of stakeholder feedback and the use of more accurate local data.

The final Cumberland subregion BIO Map is presented in Figure 3. The final map identifies a network of 87 core areas and 27 regional biodiversity corridors within the Cumberland subregion. The 87 core areas include all of the PCLs identified by the Cumberland Plain Recovery Plan. The total area represented within the mapped PIAs is 42 124 hectares. This represents approximately 15 per cent of the Cumberland subregion, or approximately 61 per cent of all mapped vegetation within the subregion.

Western Sydney Parklands Trust

Volunteers planting native tubestock at Abbotsbury within the Western Sydney Parklands and within a Regional Biodiversity Corridor.

1. Introduction

1.1 Background

The Biodiversity Investment Opportunities Map (BIO Map) identifies Priority Investment Areas (PIAs) where the protection and management of native vegetation can be of greatest benefit to biodiversity. The use of a BIO Map can help to transparently and accountably distribute biodiversity funds. This report describes the development of a BIO Map for the Cumberland subregion of NSW. A similar project ran concurrently in the Illawarra and is reported on separately (OEH in preparation).

BIO Map has been prepared to help achieve better biodiversity outcomes from the funding available for protecting, conserving and managing remnant natural landscapes. BIO Map provides a guide for effective investment in biodiversity, by targeting biodiversity funding to the strategic locations of greatest benefit. Selected areas that have high biodiversity and connectivity value and are not currently identified for urban development have been identified as PIAs on BIO Map.

BIO Map can be used by organisations that have a role in distributing biodiversity investment funds. PIAs can be targeted by investment funds through a range of sources, including grant programs, incentive programs, and restoration programs. BIO Map provides a template for a connected area network that can be used by federal, state and local government agencies, as well as non-government organisations, to both ensure that limited funds are targeted to the strategic areas of greatest benefit, and that the process of distributing funds is transparent. BIO Map may also provide useful information for landowners and land managers on the areas that have increased potential of receiving biodiversity management funds.

Inclusion of land within the BIO Map does not affect a property's development or land-use entitlements. However, areas within PIAs may have environmental values that need to be considered as part of existing statutory planning and development approval processes. In the case of properties that are within a PIA, there may be increased opportunities for the landowners to receive funding to protect their bushland, but participation in any funding program is entirely voluntary.

1.2 Green Corridors Program

BIO Map was developed by NSW Office of Environment and Heritage (OEH) as part of the NSW Government's Green Corridors Program, which is a government priority action under Goal 22 of NSW 2021: A plan to make NSW number one. The Green Corridors Program is a NSW Environmental Trust-funded program that protects strategic areas of high conservation value vegetation and ensures that there will be more green spaces across Sydney and NSW. The program was implemented with $40 million of funding over 4 years (2011–12 to 2014–15).

The Green Corridors program encompasses four component programs:

- Great Eastern Ranges Initiative
- Green Corridor Reserves
- Growth Centres Biodiversity Offset Program
- Linking Landscapes through Local Action Program.

These component projects operate by:

- linking public and private land conservation via partnerships with local landholders, industry groups, traditional owners, government, non-government organisations (NGOs) and community groups
- purchasing land to add to the reserve system

- private land conservation
- stakeholder identification of corridor locations for strategic biodiversity investment.

BIO Map is part of the Linking Landscapes through Local Action Program, which uses stakeholder engagement to identify corridors for strategic biodiversity investment. The Linking Landscapes through Local Action Program received $10.1 million of funding for three components:

- Biodiversity Investment Opportunities Map (BIO Map): to identify PIAs for biodiversity management within two subregions in the Sydney Basin Bioregion
- A grant program that provides funds to establish BioBank sites to protect and manage public land with identified conservation values
- Conservation Commitments Database: to develop a database that will allow public agencies to identify lands that are protected via secure conservation mechanisms through this and other projects across the state.

BIO Map is a concept that can be applied region-by-region across the state. The Cumberland BIO Map is one of two BIO Map projects, the other being the Illawarra BIO Map, which was developed simultaneously. The success of the two projects will inform the potential for future projects.

1.3 Study area

The Cumberland BIO Map study area is the Cumberland subregion, a 275 693-hectare area defined by IBRA (Interim Biogeographic Regionalisation of Australia) version 7 (Commonwealth of Australia 2012) (Figure 1). The Cumberland subregion contains the Cumberland Plain, a broad shale basin in Western Sydney. The biodiversity of the shale basin is distinctly different from that of the surrounding sandstone vegetation.

Unlike the soils in the surrounding rugged sandstone country, the shale soils of the Cumberland subregion have provided relatively flat and fertile land for agriculture and development. After 200 years of European use of the area, including for rural production, housing development and urban pressures, only about 25 per cent of the original vegetation cover remains, and much of this remaining vegetation is significantly degraded. In fact, the Cumberland Plain Recovery Plan found that only 13 per cent of the native vegetation of the Cumberland Plain remains as intact bushland (DECCW 2011).

The Cumberland subregion contains a relatively small area of formal reserves, with only 5157 hectares (1.9 per cent) of the subregion formally reserved in the National Parks and Wildlife (NPWS) estate. Vegetation outside the formal reserve system is generally highly fragmented, and over 70 per cent of the remaining vegetation of the Cumberland Plain occurs on privately owned land (DECCW 2011). However, 81 large remnants, each over 50 hectares, contain 51 per cent of the remaining bushland; many of these large, intact remnants are owned by public authorities (DECCW 2010b).

With further land-use intensification planned, and with Western Sydney's population expected to grow by 900 000 over the next 20 years (Department of Planning and Environment 2014), it is essential that strategic and efficient plans are made to protect and enhance the remaining fragmented vegetation. The Cumberland subregion BIO Map has been developed to help direct this biodiversity investment in the region.

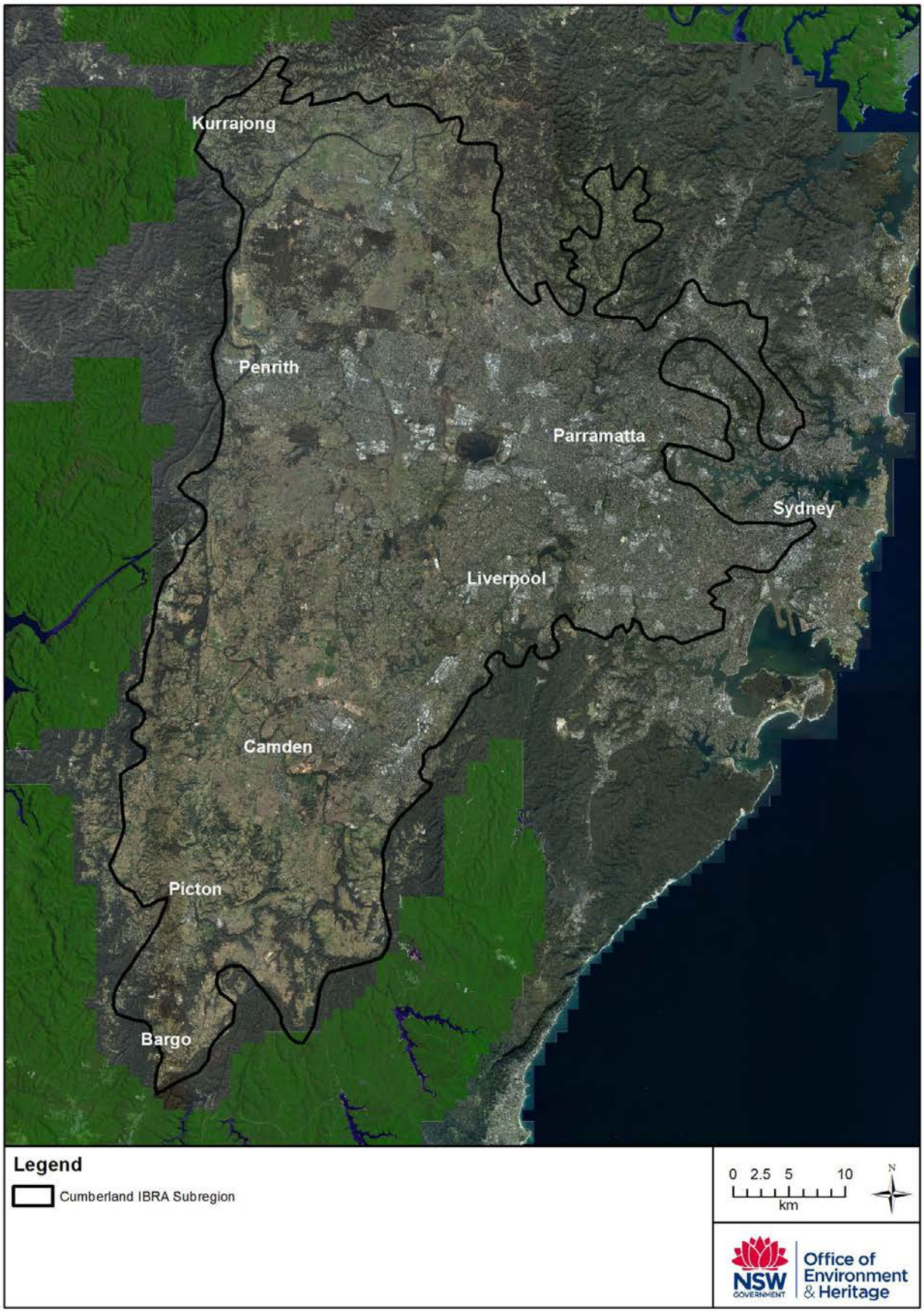

Figure 1 The Cumberland subregion study area

1.4 Priority Investment Areas

Priority Investment Areas, or PIAs, are the areas identified for priority investment of biodiversity funds. PIAs comprise:

- **core areas:** areas of native vegetation and habitat where management will be of greatest benefit to the conservation of state and regional biodiversity values within a region
- **state biodiversity corridors:** key linkages of native vegetation that are identified through state-wide analysis and provide connectivity between Interim Biogeographic Regionalisation of Australia (IBRA) regions and subregions.[1]
- **regional biodiversity corridors:** key linkages of native vegetation within an IBRA subregion, between IBRA subregions or between significant biodiversity features.

The mapping of PIAs draws on the conceptual framework developed for previous state-wide mapping of priority areas for native vegetation management (Drielsma et al. 2012). This state-wide mapping is at a broad scale suitable for regional planning. BIO Map extends the principles of this mapping to a finer scale, incorporating related local- and regional-scale information where suitable and available.

Mapping criteria were developed to identify and map PIAs. Developing these criteria helped to ensure that mapping within and between each project study area was done consistently, while allowing for differences in data availability and land-use constraints.

1.5 Assumptions and limitations

BIO Map is a single-purpose product designed to direct biodiversity funding to areas where it can have the greatest benefit.

BIO Map was not developed to inform land-use planning or development applications and is not intended to be used for land-use planning. The reason for this is that BIO Map does not identify all significant vegetation in the Cumberland subregion, and therefore it cannot be assumed that areas not identified as PIAs are of lower environmental value. A finer scale of assessment than that provided by BIO Map is required to support statutory planning processes and decisions.

BIO Map in itself does not protect land or affect a property's development or land-use entitlements. There is no guarantee that land within the PIAs will be conserved, because protection and management depend entirely on the willingness of landowners.

BIO Map does not identify all state and regional priority investment areas. For example, the Saving our Species program identifies additional priorities. Important habitats and threatened species occur across the Cumberland subregion, on wooded and non-wooded sites, and on land with natural and urbanised land uses. Derived native grasslands[2] and hollow-bearing trees are two examples of important habitat elements in the Cumberland subregion that were not targeted by BIO Map. BIO Map is not a comprehensive inventory of all environmentally significant sites and is not a substitute for appropriate scale-site-based assessments.

BIO Map is only one of a suite of strategies and tools that can contribute to nature conservation in the Cumberland subregion. BIO Map does not remove the need for investment in threatened species, particular landscape units, or corridor types that are outside PIAs. BIO Map does not remove the need for further studies on the location of significant natural elements, or the

[1] IBRA subregions are areas defined under Interim Biogeographic Regionalisation of Australia version 7 (Commonwealth of Australia 2012)

[2] Derived native grasslands are native grasslands that remain after the removal or dieback of previous woody canopy vegetation (shrubs or trees).

development of new or additional programs. BIO Map is a regional-scale map and does not identify local priorities, including local corridors.

BIO Map identifies corridors that link core areas and other significant remnants at a regional scale. The corridors identified in BIO Map are generally vegetated, and their degree of viability has been largely assumed from their current land use and from Local Environmental Plan (LEP) zoning. These corridors provide general habitat cover for spatial and temporal movement of species and genetic material. The corridors are not designed for specific species or ecological purposes other than linking BIO Map core areas and other significant remnants. Where corridors are required for a specific purpose, assessment of the worth of BIO Map corridors for that purpose is recommended.

BIO Map was developed by using regional-scale data. The map should be viewed at 1:15 000 scale. The method for developing BIO Map involved aerial photographic interpretation, assessment of vegetation mapping, and consideration of the Biodiversity Forecaster Tool, the Spatial Links Tool, LEP zonings, configuration and connectivity (see section 4).

Ground truthing to confirm vegetation extent or type (as defined in the regional vegetation maps) was not done as part of the preparation of BIO Map (see section 4). As the core areas and regional biodiversity corridors are, in part, based on vegetation mapping in the subregion, any inconsistencies in this mapping may be transferred to the identification of PIAs. PIAs identified and mapped by BIO Map were reviewed by stakeholders who had both local knowledge and access to local-scale vegetation maps. Although local knowledge was a very useful tool in developing BIO Map, it is possible that not all stakeholders contributed knowledge equally. Out-of-date maps and aerial photographs, as well as inconsistencies in stakeholder input, may have resulted in errors or inconsistencies in the mapping.

Yellomundee Aboriginal Bushcare Group volunteers placing guards around native plants at Yellomundee Regional Park. The Park is part of a Regional Biodiversity Corridor.

Xuela Sledge/OEH

2. Previous investment in the Cumberland subregion

BIO Map has been prepared to help organisations to target funding so that they can achieve better biodiversity outcomes through the protection, conservation and management of remnant natural landscapes. To assess the influence of BIO Map in directing future funding, this section provides a brief assessment of the locations and amounts of historical biodiversity funding in the Cumberland subregion. This information should enable current and future investments to be compared to monitor the effectiveness of BIO Map in directing funding into PIAs.

A number of biodiversity funding sources spanning a period of 5 years, from 2009–10 to 2013–14 inclusive, were reviewed, and the locations and amounts spent were recorded. The list of funding sources is not comprehensive, but it provides a good indication of where state and federal biodiversity funds have been spent within the study area. The list of funding sources reviewed includes:

- NSW Environmental Trust grant programs: funding provided by the Community Bush Regeneration Large Project Stream and Restoration and Rehabilitation (community and government) programs
- Growth Centres Biodiversity Offset Program: funding provided to offset the impacts on biodiversity that are occurring as Sydney's growth centres are developed (OEH 2014a). Note that this funding also includes one-off grants from other sources.
- Local Land Services (formerly Catchment Management Authorities) grant programs: funding through various programs and funding sources to help with natural resource management. Projects that are aligned with Catchment Action Plans and other priorities are funded for landholders or for councils and other organisations.
- Commonwealth Government grant programs: including Caring for Country, Community Landcare grants and the Biodiversity Fund program.

In the 5 years between the 2009–10 financial year and the 2013–14 financial year over $28,000,000 was allocated by the above government programs for the protection and management of biodiversity within the Cumberland subregion. The figures are further broken down in Table 1, and funding locations are displayed in Figure 2.

Table 1 Government biodiversity grants 2009–10 to 2013–14 (Cumberland subregion)

Year	Grant program				Total
	NSW Environmental Trust grant programs	Greater Sydney Local Land Services grant programs	Growth Centres Biodiversity Offset Program*	Commonwealth Government grant programs	
2009–10	$182,547	$731,767	$1,570,741	$71,009	**$2,556,064**
2010–11	$262,590	$99,129	$1,629,467	$119,630	**$2,110,816**
2011–12	$637,147	$1,042,140	$2,089,592	$2,900,810	**$6,669,689**
2012–13	$581,263	$805,887	$8,531,870	$56,750	**$9,975,770**
2013–14	$80,000	$211,821	$6,614,293	$49,540	**$6,955,654**
Total	**$1,743,547**	**$2,890,744**	**$20,435,963**	**$3,197,739**	**$28,267,993**

* This funding also includes grants from other sources.

The largest provider of funds over this 5-year period was the Growth Centres Biodiversity Offset Program and associated grants. This program delivered $20,435,963 worth of funding in the 5 years, focused on the provision of BioBank sites in western Sydney. Commonwealth grant programs have provided $3,197,739 of funding, and the NSW Environmental Trust $1,743,547 in

programs. Greater Sydney Local Land Services (formerly the Hawkesbury-Nepean Catchment Management Authority [CMA] and Sydney Metropolitan CMA) had the largest number of projects with the greatest geographic spread; it spent $2,890,744 on projects within the Cumberland subregion.

An analysis has been conducted to determine the amount of funding previously spent within PIAs mapped for BIO Map. See section 6 for details.

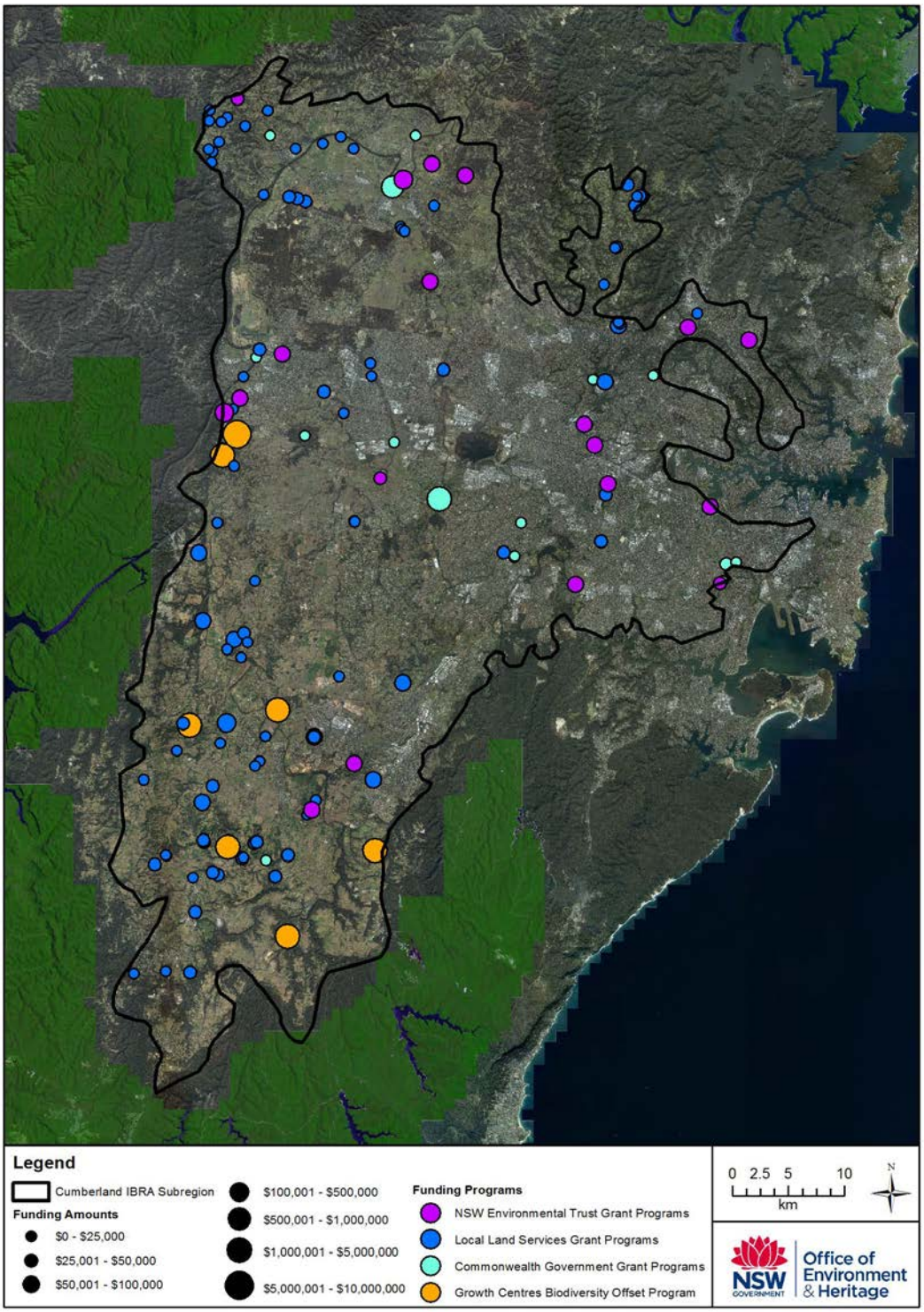

Figure 2 Previous investment in the Cumberland subregion

3. Mapping criteria

A consistent, transparent and repeatable approach to the identification and mapping of PIAs was integral to the creation of the Cumberland subregion BIO Map. A mapping criteria document was prepared in consultation with stakeholders (see section 5); it provides broad guidance on a number of matters related to identifying and mapping PIAs.

Criteria were defined in a number of ways. First, a number of 'general criteria' were prepared to guide the overall standard of data inputs and outputs. Specific criteria for core areas, state biodiversity corridors and regional biodiversity corridors were then defined. The entire criteria table is presented in Appendix 1, with key points summarised below.

3.1 General criteria

The general criteria focus on a number of overarching key principles, ensuring the use of best available input data and the production of a high-quality, regional product. The overall aim of the general criteria was to produce consistent and accurate mapping viewable at a property scale. Stakeholder consultation was identified as a key step in the mapping process to improve the reliability of the map.

As a result of the general criteria the PIAs identified and mapped were required to:

- be mapped over all land tenures (although investment would be limited to only those tenures able to receive it)
- draw on existing data sources (where information was available and suitable); this information was to be compiled into a single investment priority layer
- exclude the identification of lands with current or known planned development, or areas where land was unlikely to be available or suitable for conservation
- not adversely affect development or land-use rights (priority investment information would be used to provide incentives to protect biodiversity)
- be mapped at a property scale by using vegetation or cadastral boundaries, or both
- be prepared with local knowledge and validation and significant stakeholder consultation
- be updated regularly in cases where new data or land-use changes significantly affected the PIAs identified.

The general criteria apply equally to the identification and mapping of core areas and state and regional biodiversity corridors; they reflect the lessons learned from previously completed mapping projects.

3.2 Core area criteria

Core areas are areas of native vegetation and habitat where management will be of greatest benefit to the conservation of state and regional biodiversity values within a region.

The criteria for mapping core areas are identified in Appendix 1: BIO Map criteria and were developed through consultation with stakeholders. The core area criteria allow a degree of flexibility to take into account data availability, land-use patterns and pressures, and areas considered in past studies to be of conservation value. The criteria do not specifically define what values are to be represented within a core area, but instead focus on allowing the definition of 'key' state and regional biodiversity values on a region-by-region basis.

New or existing data can be used to identify the key state and regional biodiversity values, which can include significant vegetation types or remnants, significant threatened species populations and habitat, and other state and regional biodiversity values such as 'matters of national environmental significance' (MNES), important wetlands, karst areas, old-growth forest, rainforest and areas listed by statutory conservation or protection mechanisms. Depending on the type of feature being identified as a core area, a minimum patch size, fragmentation analysis or target may be applied to focus effort on the areas of highest importance. Conservation planning tools, such as the Biodiversity Forecasting Tool[3], may be used to inform or supplement analyses completed within the study area.

The core area criteria focus on viability, including sites that have adequate size and connectivity to allow for protection and management in the long-term. Sites with social value, where stakeholders can demonstrate an existing ongoing commitment, can also be considered for inclusion. In these cases the area must contain the key state or regional biodiversity values being targeted and must be of adequate condition, connectivity, patch size and viability.

3.3 State biodiversity corridor criteria

State biodiversity corridors are key linkages of native vegetation identified through state-wide analysis and provide connectivity between IBRA regions and subregions.

Biodiversity corridors exist at several scales within the landscape, from continent-scale corridors to local corridors allowing the movement of species over small distances. These corridors can consist of vegetation in good condition that connects habitat remnants (Drielsma et al. 2012), but they can also include areas where native vegetation is interspersed with areas of non-native vegetation, disconnected linear elements, or other isolated stepping-stone-type features, termed 'structural connectivity' (Doerr 2010).

State biodiversity corridors provide connectivity between IBRA regions and subregions, and they must have been identified by a previous state-wide assessment of connectivity completed by OEH, such as through the NSW Native Vegetation Management Benefits project (Drielsma et al. 2012). The BIO Map criteria allow the validation of this state-wide information at the local scale: local and regional data sets such as vegetation maps, aerial photos, cadastral boundaries and other suitable data are used to improve the data's accuracy to a property scale.

3.4 Regional biodiversity corridor criteria

Regional biodiversity corridors are key linkages of native vegetation within an IBRA subregion, between IBRA subregions or between significant biodiversity features.

To be considered a regional biodiversity corridor, the corridor must provide a link between significant biodiversity features, such as:

- state biodiversity corridors
- mapped core areas
- large native vegetation remnants
- other significant areas, such as the coastline, NPWS reserves or important council or Crown reserves.

[3] The Biodiversity Forecasting Tool (BFT) is an OEH conservation planning tool that generates priorities by estimating the relative differences in the persistence of biodiversity across a study area as a consequence of changing land use or management at different locations (Northern Rivers Regional Biodiversity Management Plan, DECCW 2010a).

The corridors defined by the criteria include corridors of state and regional significance. Local corridors are not included in the criteria and were therefore not mapped as part of the BIO Map project; they remain the responsibility of local government and Local Land Services, through LEPs and other mechanisms. Local corridors are defined as linkages of native vegetation that either extend from a significant biodiversity feature into the surrounding landscape, or link local landscape features such as reserves, creek lines, gullies, wetlands and ridgelines (adapted from DEC 2004).

OEH

Bush regenerators controlling weeds at the St Mary's Towers BioBank Site at Douglas Park. The BioBank site is within a core area identified in the BIO Map.

4. Method used to map PIAs in the Cumberland subregion

4.1 Use of existing data

Existing data held by a number of different organisations provided a significant resource for identifying PIAs within the Cumberland subregion. The existing mapping was used in one of two ways: the mapping was either incorporated into BIO Map to delineate PIA boundaries or used to inform the mapping of PIAs as a reference layer.

OEH contacted federal, state and local government stakeholders, as well as community groups, during the project to obtain data related to the mapping of PIAs. Data requested included vegetation and threatened species maps, biodiversity strategies and overlays, LEP zones, land-use information, biodiversity priorities, corridor maps, and any other data that could help identify PIAs.

Many organisations were able to supply a range of data to help with the project (Appendix 2: Data sources and their application in BIO Map). Because of inconsistency of scale and purpose between the various data sets, most maps were not completely incorporated into BIO Map. Many, however, were used to validate or inform the PIAs identified and help improve the reliability of BIO Map across the study area.

Where data layers met the requirements of the criteria and were prepared for reasons similar to those of BIO Map they were incorporated into BIO Map. The following data sets were added, either entirely or partially, into the Cumberland subregion BIO Map:

- PCLs identified as part of the Cumberland Plain Recovery Plan (DECCW 2010b)
- lands identified by an OEH review of higher long-term management viability (HMV) lands for inclusion within the Cumberland Plain priority conservation lands mapping. This review was conducted to address Commitment 7 of the Sydney Growth Centres Strategic Assessment Program Report (OEH 2014b).
- Western Sydney Parklands bushland corridor, referenced in the Western Sydney Parklands Biodiversity Strategy 2012–2020 (Western Sydney Parklands Trust 2013)
- Hawkesbury Nepean Catchment regional biodiversity corridors (Hawkesbury-Nepean Catchment Management Authority 2008)
- Land identified in various LEPs, such as land identified as environmental zones within or adjacent to regional biodiversity corridors or core areas and, specifically, lands zoned 7(d1) Environmental Protection (Scenic) in the Campbelltown LEP – District 8 (Central Hills Lands) and a small area of land identified on the Natural Resources Sensitivity Land Map in the Penrith LEP (Penrith Council 2010).

The use of this existing data helped to ensure some level of consistency with the priorities already identified within the study area through other projects. This consistency should reduce confusion between priority mapping outputs available within the region.

4.2 Development of new data

Although many data sets were available from stakeholders for the Cumberland subregion, several regional-scale data layers were required to inform the mapping of PIAs. The layers updated or created for the project are described below.

Vegetation

A layer of vegetation extent and type was required to help identify key state and regional biodiversity values. As a single vegetation layer was not available for the entire Cumberland subregion, several vegetation data layers were combined to achieve complete coverage of the

study area. A composite vegetation data layer was prepared for the project from a number of sources, including the recently released Sydney metropolitan vegetation map data (OEH 2013; Vegetation Information System [VIS] catalogue number 3817) and an update of the Cumberland Plain vegetation map data.

The Cumberland Plain vegetation map data comprise the map prepared by Tozer (2003) (OEH VIS 2221 and VIS 2222) and a 2008 update to part of these data by the NSW Scientific Committee and Simpson (2008) (OEH VIS 3785). The BIO Map project updated these existing data sets by using on-screen aerial photographic interpretation at a scale of approximately 1:10 000, to remove areas of recent clearing not captured in the original mapping. Mapping was updated by using a combination of Sydney Conurbation 2011 (AAM 2011) and SPOT 2012 (Airbus Defence and Space 2012) digital imagery. This update was completed for polygons tagged (Poly_Code) A, B, C, Cmi, Tx or Txr. Txu polygons (VIS 2223; vegetation over urban land) were not considered. Areas of significant regeneration or increased native vegetation extent were then added to the layer, and all polygons were allocated to a Plant Community Type (PCT) (including those originally mapped as '9999- Unclassified' in the original Cumberland Plain mapping) (Appendix 3: Plant Community Types allocated to input vegetation maps).

The Sydney metropolitan vegetation data, which are significantly more recent than the Cumberland Plain data, were not amended or edited in any way, but polygons not considered to represent native vegetation were removed from the layer and were not considered any further. Polygons removed included those tagged Artificial Wetland, Cleared, Plantation (native and/or exotic), Undifferentiated Regenerating Shrubs, Urban Exotic/Native, Water and Weeds and Exotics. PCTs were allocated to the Sydney Metropolitan CMA vegetation types in the original mapping and were accepted unchanged (Appendix 3).

The Sydney metropolitan and updated Cumberland Plain vegetation layers were combined into a single layer. In areas where the two areas overlapped (such as areas around Prospect Reservoir) the Sydney metropolitan layer took precedence over the updated Cumberland Plain vegetation data. Edge matching was then conducted along the boundary between the two data layers.

The final layer provided seamless vegetation coverage of the Cumberland subregion, with vegetation represented by 40 PCTs. The PCTs represent 19 vegetation classes and 10 vegetation formations. The layer formed the basis of the analysis and PIA mapping completed for the project.

Land-use and zoning

A composite land-use and zoning layer was created for the Cumberland subregion to help identify PIAs and avoid conflicts with land currently zoned for development. The composite land-use and zoning layer was created from a number of sources; it includes LEP zoning information, conservation areas such as National Parks Estate and BioBank sites, the Cumberland State Forest boundary, certified and non-certified land within the Western Sydney Growth Centres (where land-use zones are not yet available), Sydney's housing hotspots and potential home sites, and the proposed Badgerys Creek airport site.

The layer resulted in a seamless representation of known or planned land use within the study area, including areas where a recent change in land zoning will lead to land-use intensification. The layer was used to remove areas of known current or future land-use conflict where the viability of PIAs may be reduced.

Biodiversity Forecasting Tool

Several conservation planning tools are available to help identify priority sites and potential links. Conservation planning tools can provide important guidance on the potential for a particular location to be identified as a PIA.

The Cumberland subregion BIO Map used one of these planning tools, the Biodiversity Forecasting Tool (BFT), as one of a number of sources of information to help determine the locations of core areas (see Applying the criteria: core areas). The BFT models the persistence of

biodiversity by using vegetation communities as surrogates for overall biodiversity (Drielsma et al. 2012). The tool analyses grid cells across the region and estimates relative differences in the persistence of biodiversity across the study area as a consequence of changing land use or management (DECCW 2010a). The model takes into account the pre-1750 distribution of vegetation communities, the current extent, condition and configuration (connectivity, size and shape) of vegetation and information on threats and ecological processes (DECCW 2010a).

For the Cumberland subregion the BFT modelling was undertaken for 25 x 25-metre grid cells across the subregion and was based on a range of inputs, including:

- current vegetation condition
- future vegetation condition (takes into account the key threats to biodiversity within the study area and the likelihood that these threats will affect vegetation structure and composition at particular locations if management does not occur)
- potential future improvement in vegetation condition (reflects the potential future improvement in condition should a patch of vegetation be managed for conservation).

More details on the BFT approach, and the outputs of this analysis, are provided in Appendix 4. The areas identified as high priorities in the outputs were considered for inclusion in the core areas.

Spatial Links Tool

The connectivity value of a site or location is determined by how well the location is connected to habitat, and by how well it contributes to the connectivity of other locations (Drielsma et al. 2012). The Spatial Links Tool (SLT) was run for the Cumberland subregion to determine link values across the study area which, when combined with expert judgment, could help to delineate habitat corridors (Drielsma et al. 2007).

Analysis was completed at both 25-metre and 100-metre resolutions, with the results merged to obtain a final spatial links layer. The use of multiple scales helped account for the various scales of species movement within the study area, from local-scale dispersal (such as the movement of small birds) to more regional-scale movements or dispersal (Drielsma et al. 2012).

The SLT does not account for the movement or habitat preferences of every species within the study area. However, it does consider a number of variables associated with species mobility and can help in landscape-scale planning for biodiversity (Drielsma et al. 2012). The SLT identifies potential links across the study area where species movement is considered more likely owing to the lower metabolic costs associated with the pathway selected.

The approach taken to the SLT analysis, and the output, are provided in Appendix 4: BFT mapping approach and results. The results of the analysis were used as one input into the mapping of regional corridors within the Cumberland subregion.

4.3 Applying the criteria: core areas

Identifying key state and regional biodiversity values

The seamless vegetation map prepared for the study area was the main information source used to define key state and regional biodiversity values from which core areas were identified and mapped. The vegetation map identifies the distribution of 40 PCTs. As a first step, the 40 PCTs were reviewed to exclude vegetation types that were not considered typical or representative of the Cumberland subregion. PCTs were removed from consideration as key state and regional biodiversity values if the vast majority of the vegetation type occurred outside the Cumberland subregion. This may occur, for instance, where only small ‘slivers’ of the vegetation type extend into the study area.

In total, 10 PCTs were considered not typical or representative of the Cumberland subregion and were removed from consideration as key state or regional biodiversity values (Appendix 5: PCTs excluded from being considered as key state or regional biodiversity values).

The remaining 30 PCTs (Appendix 6: PCTs identified as key state or regional biodiversity values) were each considered to be key state and regional biodiversity values for the purposes of identifying and mapping core areas, owing to the highly cleared and fragmented nature of the subregion and continued land-use pressure. Of the 30 PCTs considered, 26 are potentially part of Threatened Ecological Communities or are over-cleared vegetation types (i.e. >70% cleared compared with their original extent). Twenty-eight of the PCTs are also mapped, either wholly or partially, in an over-cleared Mitchell Landscape.[4]

The 30 PCTs identified as having key state and regional biodiversity values represent the vast majority of native vegetation in the Cumberland subregion. A significant proportion of the potential threatened species habitat in the region is likely to be adequately represented within these PCTs. As a result of this, threatened species populations or habitat were not specifically targeted during the preparation of the BIO Map. Other programs, such as Saving Our Species, consider threatened species at a site level and should be consulted in conjunction with BIO Map to identify specific sites associated with individual threatened species.

Core area representation targets

Conservation targets are often used when identifying high-priority biodiversity values that require protection or management. In the case of the Cumberland subregion BIO Map, minimum representation targets were applied to ensure that each key state and regional biodiversity value was, where possible, represented in core areas. The representation target does not specify the amount of land to be conserved, protected or funded within the core areas; instead, it specifies the minimum amount of each key state or regional biodiversity value that is to be represented within the core areas.[5]

Often the Comprehensive, Adequate and Representative (CAR) criteria (Commonwealth of Australia 1997) are referenced when applying such targets (DECCW 2010b). The CAR criteria reference the following targets:

- 15 per cent of the pre-1750 distribution of each forest ecosystem
- 60 per cent of the extant area of vulnerable ecosystems
- all remaining areas of rare or endangered ecosystems (Commonwealth of Australia 1997).

The CAR criteria provide guidance rather than mandatory targets and include flexibility to allow for regional variability, social and economic factors.

Many vegetation communities within the Cumberland subregion are cleared significantly below 15 per cent of their original extent. The study area is also highly fragmented, with ongoing land-use and clearing pressure, as well as high land values and management costs (DECCW 2010b). The targets listed in the CAR criteria are therefore difficult to achieve.

Priority Conservation Lands (PCLs) have been prepared for western Sydney as part of the Cumberland Plain Recovery Plan (DECCW 2010b, 2011). These lands identify opportunities to protect up to 40 per cent of the remaining Threatened Ecological Communities on the Cumberland Plain, and they represent the best remaining opportunities to maximise long-term biodiversity benefits for the lowest possible cost, including the least likelihood of restricting land supply (OEH

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[4] Mitchell landscapes are areas of land with relatively homogenous geomorphology, soils and broad vegetation types that have been mapped at 1:250 000 scale. Over-cleared Mitchell Landscapes are those landscapes that are greater than 70% cleared.

[5] The NPWS Estate can also contribute to the target for a key state or regional biodiversity value.

2014b). The PCL mapping was based on a minimum target of 15 per cent of the current extent, a target that reflected the limitations listed above (DECCW 2010b, 2011).

In recognising the above pressures, and to maintain consistency with the PCLs, which have been adopted as core areas by this project (see below), a minimum representation target of 15 per cent[6] of the existing area of each key biodiversity state and regional value within core areas (or NPWS estate) was adopted for the Cumberland subregion BIO Map.

It should be noted that the above target is for the sole purpose of prioritising investment and is not a vegetation retention target. The target does not represent the only biodiversity values that warrant protection within a region.

Incorporating existing data

The criteria prepared for the BIO Map project (Appendix 1: BIO Map criteria) allow the use of appropriate pre-existing data if the information has been publicly released or prepared in consultation with stakeholders. Available data in the study area were reviewed, and two layers were determined to be consistent with the criteria for mapping core areas. The first is the PCLs (DECCW 2010b) prepared as part of the Cumberland Plain Recovery Plan (DECCW 2011). As outlined above, the PCLs used a target of a minimum of 15 per cent of the current extent to identify high-priority areas for Threatened Ecological Communities on the Cumberland Plain, along with key populations of threatened flora. All of the vegetation types represented within the PCLs require representation within core areas as part of the Cumberland subregion BIO Map.

The second layer of existing data for mapping core areas was a review of HMV lands outside the PCLs; this review was undertaken by OEH as part of the Sydney Growth Centres Strategic Assessment (OEH 2014b). It analysed 2400 hectares of vegetation across 3900 hectares of land. It identified three candidate areas that met the criteria for inclusion within the PCLs (OEH 2014b). These areas were Noorumba Reserve, Beulah BioBank site and a vegetation remnant at Leppington. These mapped areas were added as core areas to BIO Map.

To maintain consistency with existing priority information already identified within the study area and reduce confusion between the priority mapping outputs available, the PCLs (DECCW 2010b) and HMV lands (OEH 2014b) were adopted in their entirety for use in BIO Map. They form the basis of the core areas identified in the Cumberland subregion.

Mapping core areas

Inclusion of the PCLs and HMV review areas as core areas resulted in a number of the 30 PCTs identified as key state and regional biodiversity values meeting the target of a minimum 15 per cent of the current extent within the Cumberland subregion.

In total, 21 of the 30 PCTs identified as key state or regional biodiversity values satisfied the minimum target within either the adopted PCLs (DECCW 2010b), the HMV review lands (OEH 2014b), or the existing NPWS Estate. No additional core areas were required for these key state or regional biodiversity values to achieve the minimum target set for the project. Key state and regional biodiversity values represented adequately within the PCLs include, among others, plant communities associated with Cumberland Plain Woodland, Shale Sandstone Transition Forest, Cooks River/Castlereagh Ironbark Forest, Shale Gravel Transition Forest, River-Flat Eucalypt Forest and Castlereagh Scribbly Gum Woodland.

The remaining nine PCTs identified as key state and regional biodiversity values required the targeted addition of new core areas to satisfy the minimum target. The key state and regional biodiversity values outstanding included those communities that are only partially represented in the lands already identified or that were not considered during the Cumberland Plain Recovery

[6] The area of key state or regional biodiversity values within state or regional biodiversity corridors does not contribute to the 15% target of current extent for core areas.

Plan (DECCW 2011) or in PCL (DECCW 2010b) or HMV review (OEH 2014b) mapping. These communities included the critically endangered Blue Gum High Forest and endangered Sydney Turpentine-Ironbark Forest.[7] A full list of the PCTs that required targeted core areas to be defined is provided in Table 2.

Table 2 **Key state or regional biodiversity values that did not meet the minimum target upon the inclusion of Priority Conservation Lands (DECCW 2010b) and lands identified by HMV review (OEH 2014b)**

PCT* number	PCT name	Total area within Cumberland subregion (ha)	Additional area required to meet minimum 15% core area representation target (ha)
774	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	11	1.7
920	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	135	7.0
923	*Melaleuca linariifolia* – Swamp Mahogany swamp forest in drainage lines on the edges of the Cumberland Plain, Sydney Basin Bioregion	2	0.3
1085	Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaus, Sydney Basin Bioregion	154	19.5
1232	Swamp Oak – Prickly Tea-tree – Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin Bioregion and South East Corner Bioregion	11	1.4
1237	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion	647	86.3
1281	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	1937	226.2
1841	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region	427	51.2
1847	Smooth-barked Apple – Grey Gum – Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney	1	0.2

* PCT: Plant Community Type.

The nine key state or regional biodiversity value PCTs required between 0.2 and 226.2 hectares of additional representation in core areas to meet the minimum 15% (of current extent) representation target. The two PCTs that required the largest representation were *Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion* (Sydney Turpentine – Ironbark Forest) (226.2 hectares) and *Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion* (Blue Gum High Forest) (86.3 hectares).

A series of tasks were then completed to identify and map core areas associated with the nine outstanding key state or regional biodiversity values. The analysis focused on identifying viable large patches of the targeted vegetation types, including consideration of current and potential land

[7] Both Blue Gum High Forest and Sydney Turpentine-Ironbark Forest are critically endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

use, connectivity and configuration. The following steps were completed to identify and map core areas (first as indicative core areas, then as draft and final core areas, as outlined in section 5):

- identification of the largest patches of each targeted key state and regional biodiversity value through Geographic Information System analysis
- review of each of the largest patches, from largest to smallest, considering BFT output, condition and connectivity. Sites were not mapped where connectivity or condition values were poor, or where a low BFT result was recorded.
- review of current and planned land-use and zoning information to ensure areas of current or proposed development were not included in a core area
- review of stakeholder comments and addition of areas of high social value as identified by local councils, residents and community groups that can demonstrate ongoing involvement in the biodiversity management of a site. As stated in the mapping criteria (Appendix 1), where an area is considered for inclusion because of social values the area must contain key state or regional biodiversity values and must be of adequate condition, connectivity, patch size and viability. These values were tested for each area suggested during stakeholder consultation.

Land was removed from core areas where it was deemed likely to be affected by development; this included land zoned for urban land uses or areas where land-use intensification or fragmentation was likely. As a general rule, land zoned residential (e.g. R1 to R4 under a standard LEP, or equivalent), industrial (e.g. IN1 to IN4) or business (e.g. B1 to B7) was removed from core areas. Zoning data was obtained from LEPs in force throughout the study area. In addition, most certified lands within the South West and North West Growth Centres, where not already rezoned, were also removed.

Core areas were identified and mapped, initially on an indicative map represented by broad circles (see section 5). After stakeholder consultation and feedback, these areas were then refined into fine-scale boundaries based on either property or vegetation boundaries. The boundaries identified focused on capturing entire patches of the vegetation type identified, not just the amount needed to meet the minimum representation target. Therefore, the areas of some vegetation types, such as *Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion* significantly exceeded their targets.

4.4 Applying the criteria: state and regional biodiversity corridors

Identifying state and regional biodiversity corridors

Corridors (linear areas that link core areas) play a crucial role in maintaining connections between animal and plant populations that would otherwise be isolated and at greater risk of local extinction. The corridors identified for BIO Map include the best remnant canopy vegetation available to create multi-use connections between larger core habitat areas. The aim of identifying these general purpose corridors is to increase the mobility and range of a variety of species by preserving and providing habitat through which species can move from one patch of vegetation to another. Connectivity corridors give species access to an increased range and supply of food, habitats, and breeding partners. Connecting remnants increases the practical size of each remnant by increasing the habitat options of individual species and the potential for exchange of genetic material, enhancing the viability of populations and communities.

As outlined in the BIO Map criteria (Appendix 1: BIO Map criteria), state biodiversity corridors must be identified through a state-wide analysis. Because of the fragmented nature of the Cumberland subregion, no state biodiversity corridors have been identified within the study area: all state biodiversity corridors occur outside the study area.

The process of identifying regional corridors within the Cumberland subregion involved a number of tasks. Regional corridors were indicatively identified by using the results of the SLT, aerial photo

interpretation and vegetation mapping. New data were also considered for inclusion at this stage. Once indicative corridors were identified and mapped, the boundaries of the corridors were refined on the basis of vegetation or cadastral boundaries, or both, and stakeholder comments.

Unlike in the case of core areas, no representative target was used in the mapping of regional biodiversity corridors. Therefore, the representation of many of the key state or regional biodiversity values within a mapped PIA was significantly increased through the inclusion of large areas in the corridors.

Incorporating existing data

The criteria prepared for the BIO Map project (Appendix 1: BIO Map criteria) allow the use of appropriate pre-existing data if the information has been publicly released or prepared in consultation with stakeholders. Corridor data available for the study area were reviewed for use in mapping regional corridors. Although much of the corridor data within the study area were captured at different scales and for different purposes (often capturing local-scale corridors), several layers were considered consistent with the criteria and were accepted for use in BIO Map. The layers included:

- Western Sydney Parklands bushland corridor (Western Sydney Parklands Trust 2013);
- Hawkesbury-Nepean Catchment regional biodiversity corridors (Hawkesbury-Nepean Catchment Management Authority 2008);
- lands zoned 7(d1) Environmental Protection (Scenic) in the Campbelltown LEP – District 8 (Central Hills Lands) (Campbelltown Council 2008)
- a small area of land identified on the Natural Resources Sensitivity Land Map in the Penrith LEP (Penrith Council 2010).

The Western Sydney Parklands bushland corridor (Western Sydney Parklands Trust 2013) identifies the locations of current and proposed future native vegetation within the Parklands. The corridor aims to provide an extensive vegetated link that will contain approximately 2000 hectares of good condition bushland and will provide important links and stepping-stone pathways for native animals (Western Sydney Parklands Trust 2013). It is expected that it will be an important north–south corridor within the Cumberland subregion and will provide important linkages between Prospect Nature Reserve, Kemps Creek Nature Reserve, Western Sydney Regional Park (Abbotsbury Woodland) and several current and planned BioBank sites within the Parklands.

The Hawkesbury-Nepean Catchment regional biodiversity corridors (Hawkesbury-Nepean Catchment Management Authority 2008) identify regional biodiversity corridors within, and connecting to areas outside, the Hawkesbury-Nepean Catchment area. The corridors follow contiguous native vegetation and connect major landscape features, important areas of habitat and areas currently managed for conservation (Hawkesbury-Nepean Catchment Management Authority 2008). These areas were accepted for use in BIO Map where they occurred inside the Cumberland subregion, but PCLs were taken in preference in cases where the Hawkesbury-Nepean CMA and PCL data intersected.

Lands zoned 7(d1) Environmental Protection (Scenic) within the Campbelltown LEP – District 8 (Central Hills Lands) are commonly referred to as the ‘Scenic Hills’ in the Campbelltown Local Government Area (LGA). The areas identified as 7(d1)-zoned lands run from Denham Court in the north to Mt Annan in the south and were included on the basis of stakeholder feedback.

A small area of land identified on the Natural Resources Sensitivity Land Map in the Penrith LEP (Penrith Council 2010) was also adopted as a corridor in BIO Map. The area links two existing PCLs and is located just south of Wianamatta Nature Reserve.

Mapping regional biodiversity corridors

The results of the SLT were reviewed in association with the updated vegetation map and aerial photos of the study area to identify potential corridors. Each potential corridor was reviewed for continuity, width and land use to ensure that the area included:

- predominantly continuous native canopy vegetation cover
- an average minimum width of 100 metres
- to the greatest extent feasible, land unlikely to be subject to a development outcome (areas of current or proposed development were not included in regional biodiversity corridors).

Riparian corridors were identified in the first instance. In fragmented landscapes such as the Cumberland subregion, riparian areas generally contain contiguous native vegetation canopy cover and development outcomes are limited because of flooding and riparian issues. Where riparian corridors were identified, a set of rules was applied to map the extent of such features. The approach mapped the larger or wider extent of the following layers:

- riparian buffer[8] (consistent with the *Water Management Act 2000* (DPI 2012)), or
- lands zoned for environmental protection (e.g. E2 (Environmental Conservation) under standard instruments, or equivalent zones in older instruments), or
- contiguous extant native canopy vegetation in suitable locations. As a general rule, land zoned residential (e.g. R1 to R4 under a standard LEP, or equivalent), industrial (e.g. IN1 to IN4) or business (e.g. B1 to B7) was removed from regional biodiversity corridors.

Non-riparian corridors were more difficult to identify owing to the lower level of native vegetation canopy cover and the presence of current or proposed development areas. However, feedback from stakeholders suggested that riparian and non-riparian corridors favoured different suites of species and that it was important to have both riparian and non-riparian corridors identified. Non-riparian corridors were therefore targeted for inclusion in the draft and final Cumberland subregion BIO Map.

Non-riparian areas were identified for inclusion if the area provided opportunities for connectivity; examples were large contiguous areas with complementary zoning (e.g. the Scenic Hills area of Campbelltown LGA), areas of likely native grasslands, or areas with distinct landscape features (e.g. ridgelines).

[8] Where a drainage line was more than 20 metres wide, the Geographic Information System information used to generate the riparian buffer identified both banks of the drainage line.

5. Stakeholder consultation

5.1 Background

BIO Map is a decision-support tool that funding organisations can use to better target biodiversity funding and achieve strategic outcomes. BIO Map can help by targeting grant funding programs to the strategic locations of greatest biodiversity benefit. Federal, state, and local government agencies, as well as NGOs, are anticipated to be the primary users of the BIO Map decision-support tool. Many of the organisations in these groups were consulted during the development of BIO Map.

5.2 Stakeholders consulted

A stakeholder list was drawn up at the start of the project. The stakeholders were one federal government department, six state government departments, 16 local governments and eight NGOs (Appendix 7: Organisations consulted for the Cumberland subregion BIO Map). After seeing project material distributed by third parties, three additional groups engaged directly with the project from the draft map stage. Those groups were STEP Inc. (community-based environmental conservation), the National Parks Association Macarthur Branch, and interested individuals from Campbelltown.

5.3 Consultation approach

The project included two main rounds of stakeholder engagement, with project staff available at all times during preparation of the BIO Map to respond to queries. The two stages of stakeholder engagement were linked to the following stages of map development:

- **indicative map:** map with lines and circles depicting potential locations of regional biodiversity corridors and core areas (Appendix 8: Indicative BIO Map of the Cumberland subregion). PCLs (DECCW 2010b) were identified on the map as polygons. Regional biodiversity corridors were placed into one of four categories based on the likely significance and value of the corridor (high, moderate, moderate/low and low).
- **draft map:** map of refined regional biodiversity corridors and core areas with polygons now defined (Appendix 9: Draft BIO Map of the Cumberland subregion). Regional biodiversity corridors and core areas were removed and added, mainly on the basis of stakeholder feedback.

Comments on the draft map were incorporated into the final BIO Map.

Initial stakeholder consultation included meetings with each of the 31 stakeholders; at these meetings the BIO Map concept was discussed and the indicative map presented. A draft map was subsequently provided to stakeholders for review during the second round of consultation, together with written responses to each stakeholder's comments on the indicative map. Further meetings were held with some stakeholders to discuss complex issues.

Changes were made between map versions based on the advice of stakeholders. In some cases, core areas were added or removed on the basis of the minimum target for a key state or regional biodiversity value. Appendix 10: Regional biodiversity corridors and core areas identified during each map stage provides details of the regional biodiversity corridors and core areas identified through the staged mapping process.

Indicative map and criteria

Stakeholder engagement was undertaken on the indicative version of the BIO Map (Appendix 8: Indicative BIO Map of the Cumberland subregion) from May to September 2014. The indicative map was drafted to provide a focus for discussion. The map included the PCLs from the Cumberland Plain Recovery Plan as the basic core areas, and it identified locations to be

considered for additional core areas and corridors. Stakeholders were asked to provide comment on three topics:

1. the suitability of the criteria used to develop the BIO Map
2. the suitability of the PIAs identified for conservation management
3. other areas that should be considered for addition to the PIA network.

Comments received fell into four categories: comments on the criteria used, unsolicited comments on larger policy and operational issues, locality-based comments on specific mapped areas and, finally, new areas proposed to be included on the map. The overwhelming response was positive. All stakeholders appreciated the strategic approach and the recognition of environmentally significant lands.

Of the 31 groups consulted, 17 were supportive and had no comment that required investigation or response; 10 were supportive and provided feedback on PIA location, the criteria and/or the operation of BIO Map; and four stakeholders had some reservations about offsetting as a conservation tool, the operation of BIO Map, and/or the level of consultation.

All stakeholder comments were taken into consideration. Location-based comments were analysed from first principles. New areas suggested for inclusion, and existing areas recommended for exclusion, were rated against the mapping criteria. This included a consideration of the PCTs present at the suggested location, patch size, connectivity, land use, results of the BFT and SLT analyses and threatened species records. Areas nominated by stakeholders were included in the next iteration of BIO Map when they were of adequate condition, connectivity, patch size and viability. Regardless of whether submissions resulted in changes to the BIO Map, the reasoning and outcome were communicated to the stakeholder nominating the amendment.

The BIO Map criteria were discussed in meetings and were generally considered by stakeholders to be fit for their purpose. Written responses indicated that the criteria were suitable. Some higher level philosophical queries were raised relating to corridor purpose, map operation and the definition of biodiversity significance. However, some of these discussions, although topical, were outside the scope and timeframe of the project (e.g. new research was required to substantiate them).

A range of policy and operational issues were proffered by stakeholders in meetings and written submissions. A number of the policy issues raised related to a desire for BIO Map to solve or address more environmental issues than were intended by the purpose of BIO Map. One policy issue raised by a number of stakeholders related to the high number of riparian corridors relative to terrestrial corridors. This occurred for the dual reasons of environmental zonings in riparian areas and the subsequent retention of canopy. A number of terrestrial corridors were requested at specific locations (as described in section 4.4). Efforts were made to include these areas.

Further correspondence or meetings were undertaken with the four stakeholders that had reservations about BIO Map so that their points could be better understood and possible solutions explored. Complex issues discussed included the perceived double dipping by identifying council-owned lands and land zoned for environmental protection as PIAs. The ability of these areas to be managed in the future for conservation was a key factor in these discussions.

Changes made on the basis of the comments on the indicative map can be seen by comparing the indicative, draft and final maps (Appendix 8: Indicative BIO Map of the Cumberland subregion, Appendix 9: Draft BIO Map of the Cumberland subregion and Appendix 10: Regional biodiversity corridors and core areas identified during each map stage).

Draft map

The draft BIO Map differed from the indicative BIO Map in that in the draft map:

- core areas and corridors were mapped as a network of proposed PIAs

- boundaries of the network were mapped by using features such as vegetation cover, cadastre, zoning and riparian buffers
- areas were added or deleted from the previous, indicative map in response to stakeholder feedback.

The draft BIO Map (Appendix 9: Draft BIO Map of the Cumberland subregion) was provided to the original 31 stakeholders in November 2014 for comment. An additional three stakeholders contacted OEH after viewing the indicative map and were also given the draft map for comment. Of the 34 stakeholders, 26 provided no comment or a positive comment, seven provided location-based mapping suggestions that they would like investigated, and one continued to hold reservations about the operation of BIO Map.

As with comments on the indicative map, the comments were collated and considered on merit. An additional 16 areas were nominated by stakeholders for inclusion on the BIO Map. As was done with the indicative map, proposed new areas were considered against the mapping criteria: the PCT, patch size, connectivity and land use, the results of the BFT and SLT analyses, and threatened species records. Stakeholders proposing new areas were informed of the outcome of their nominations in February 2015. Changes made on the basis of the comments on the draft map can be seen by comparing the indicative, draft and final maps (Appendix 8: Indicative BIO Map of the Cumberland subregion, Appendix 9: Draft BIO Map of the Cumberland subregion and Appendix 10: Regional biodiversity corridors and core areas identified during each map stage).

Tree planting within Huntington Reserve along Jamison Creek, which flows into a Regional Biodiversity Corridor. The project is funded by an Environmental Trust Restoration and Rehabilitation grant.

OEH

6. Results

6.1 Overview

The final Cumberland subregion BIO Map identifies a network of core areas and regional biodiversity corridors within the Cumberland subregion (see Figure 3). The total area represented within the mapped PIAs is 42 124 hectares. This represents approximately 15 per cent of the Cumberland subregion, or approximately 61 per cent of all mapped vegetation within the subregion. The total areas of core areas and regional biodiversity corridors[9] are presented in Table 3.

Table 3 Total area of core areas and regional biodiversity corridors

Priority Investment Area (PIA)	Mapped vegetation (ha)	No mapped canopy vegetation (ha)	Total area (ha)
Core areas	20 175	4022	24 197
Regional biodiversity corridors	11 672	6255	17 927
Total area (ha)	**31 847**	**10 277**	**42 124**

Of the 42 124 hectares identified, 31 847 hectares comprises vegetation containing native canopy cover. No mapped vegetation is present within 10 277 hectares of the PIAs. Some of these areas are likely to comprise native grassland where the canopy cover has been cleared (and that are therefore not represented on the regional vegetation map), whereas other areas include cleared lands on the boundaries of core areas and corridors to improve management boundaries, or small cleared areas within large remnants that include roads, houses or other infrastructure (DECCW 2010b).

The final map contains 87 core areas (including PCLs[10]) adopted as core areas and 27 regional biodiversity corridors (Table 4). This compares with:

- 87 core areas (including PCLs) and 36 regional biodiversity corridors identified on the indicative map. These indicative areas were identified by lines and circles and were not digitised to the same accuracy as the areas identified in the draft or final BIO Map
- 84 core areas (including PCLs) and 28 regional biodiversity corridors identified on the draft map.

Table 4 Numbers of core areas and regional biodiversity corridors identified in each map version

Map version	No. of core areas (including PCLs)*	No. of regional biodiversity corridors
Indicative	87	36
Draft	84	28
Final	87	27

* The term 'PCLs' refers to Priority Conservation Lands identified in the Cumberland Plain Recovery Plan (DECC 2011).

9 For all statistics, if an area is classified as both a core area and a regional biodiversity corridor, then the area has been counted only towards core areas.

10 PCLs shown on the Cumberland subregion BIO Map extend outside the subregion (shown in blue) owing to differences in the study areas between the BIO Map project and the Cumberland Plain Recovery Plan. These areas are not included in the statistics above.

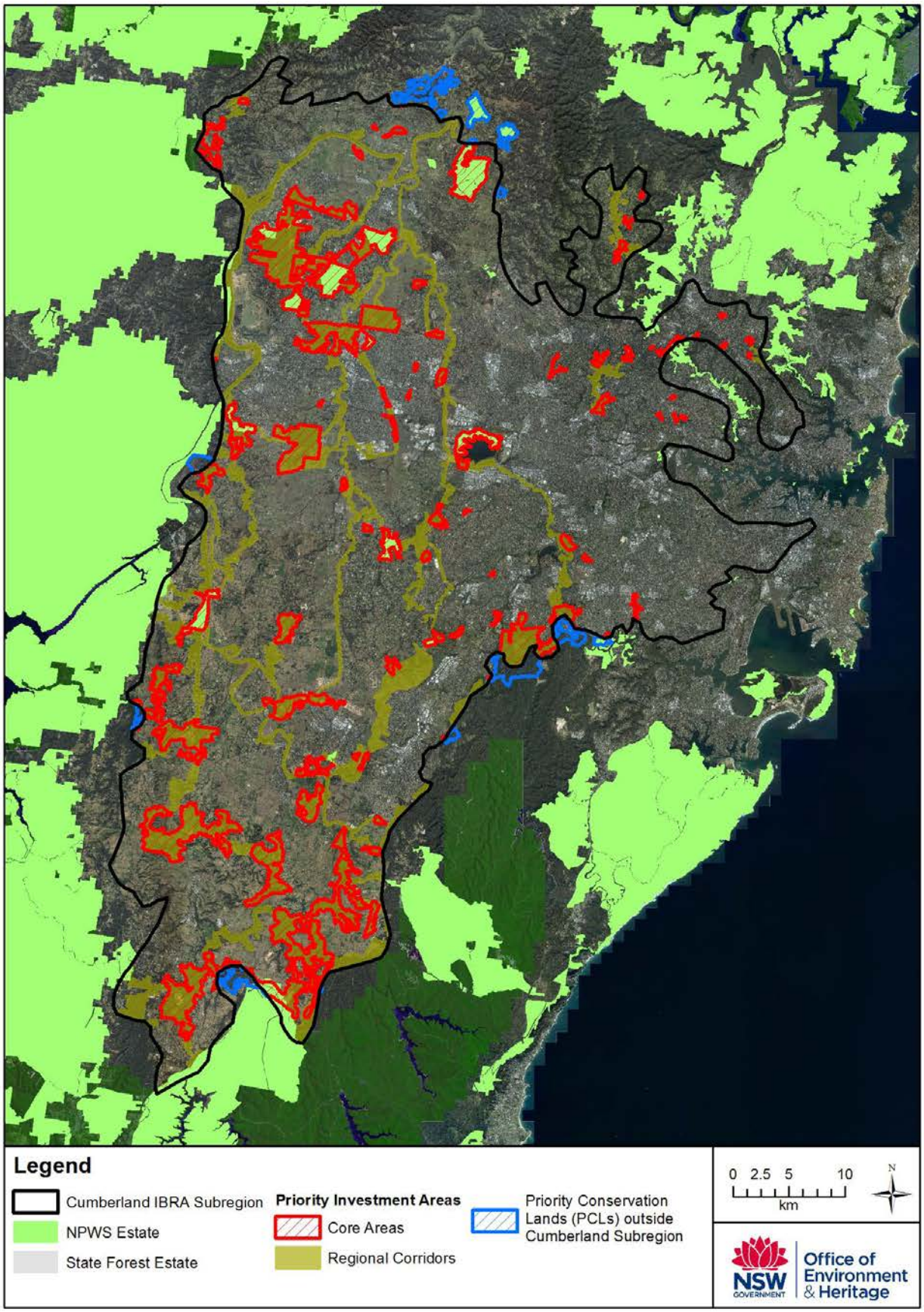

Figure 3 Cumberland subregion BIO Map Priority Investment Areas

6.2 Key state and regional biodiversity values

Of the 30 key state and regional biodiversity values identified in the Cumberland subregion, 28 exceeded the minimum 15 per cent representation target within the core areas[11] (Table 5). Nine of the 30 key state and regional biodiversity values exceeded 50 per cent representation within the core areas identified.

Two key state and regional biodiversity values did not achieve the minimum representation target. These were *Melaleuca linariifolia – Swamp Mahogany swamp forest in drainage lines of the edges of the Cumberland Plain, Sydney Basin Bioregion* (total area within the Cumberland subregion, 1.9 hectares) and *Smooth-barked Apple – Grey Gum – Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney* (total area within the Cumberland subregion, 1.2 hectares). The small area of each value within the study area significantly limited the options available for identifying core areas. The land uses currently occurring at the locations available made these locations not suitable for identification as core areas.

Although not counted towards the minimum representation target, regional biodiversity corridors add a significant area of mapped vegetation to the PIAs. When the areas contributed by regional biodiversity corridors are included, 15 of the 30 key state and regional biodiversity values have over 50 per cent of their total mapped areas within the PIAs.

Western Sydney Parklands Trust

Bush regenerators removing weeds in the vicinity of new native plantings at Horsley Park within the Western Sydney Parklands and within a regional biodiversity corridor.

[11] The NPWS Estate can also contribute to the target for a key state or regional biodiversity value.

Table 5 Representation of key state and regional biodiversity values in Priority Investment Areas (PIAs) (excluded Plant Community Types [PCTs] are not displayed).

PCT no.	PCT name	Total (ha)	15% target	Area in NPWS Estate			Area outside NPWS Estate		Total area in core areas – ha (%)	Total area in PIAs (core areas and regional biodiversity corridors) – ha (%)
				Outside PIAs (ha)	Core areas (ha)	Regional biodiversity corridors (ha)	Core areas (ha)	Regional biodiversity corridors (ha)		
724	Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	2872.4	430.9	0.1	236.0	0.0	965.8	145.1	1201.8 (41.8%)	1346.9 (46.9%)
725	Broad-leaved Ironbark – *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	1314.1	197.1	1.0	369.4	0.0	387.7	18.9	757 (57.6%)	775.9 (59.0%)
774	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	11.4	1.7	0.0	0.0	0.0	9.7	0.0	9.7 (84.7%)	9.7 (84.7%)
781	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	387.5	58.1	40.2	6.3	3.9	116.9	65.3	123.2 (31.8%)	192.5 (49.7%)
830	Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	1357.6	203.6	0.0	6.8	0.0	818.9	143.8	825.7 (60.8%)	969.5 (71.4%)
835	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	8604.1	1290.6	4.4	115.3	60.3	1296.0	3076.6	1411.2 (16.4%)	4548.1 (52.9%)
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	13 539.6	2030.9	7.9	951.9	6.0	2199.2	885.4	3151.2 (23.3%)	4042.6 (29.9%)

PCT no.	PCT name	Total (ha)	15% target	Area in NPWS Estate			Area outside NPWS Estate		Total area in core areas – ha (%)	Total area in PIAs (core areas and regional biodiversity corridors) – ha (%)
				Outside PIAs (ha)	Core areas (ha)	Regional biodiversity corridors (ha)	Core areas (ha)	Regional biodiversity corridors (ha)		
850	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	8961.7	1344.2	0.8	146.1	26.4	2578.7	929.9	2724.7 (30.4%)	3681.0 (41.1%)
877	Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion	577.5	86.6	0.0	0.8	0.8	271.9	39.4	272.6 (47.2%)	312.8 (54.2%)
883	Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion	3791.4	568.7	0.1	428.3	0.0	2013.3	178.4	2441.7 (64.4%)	2620.1 (69.1%)
920	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	135.0	20.2	7.6	0.0	0.0	38.1	5.4	38.1 (28.3%)	43.6 (32.3%)
923	*Melaleuca linariifolia* – Swamp Mahogany swamp forest in drainage lines of the edges of the Cumberland Plain, Sydney Basin Bioregion	1.9	0.3	0.0	0.0	0.0	0.0	0.0	0 (0%)	0 (0%)
941	Mountain Blue Gum – Thin-leaved Stringybark open forest on river flat alluvium in the Burragorang Valley, Sydney Basin Bioregion	100.7	15.1	0.0	1.4	3.6	31.5	0.0	32.9 (32.7%)	36.5 (36.2%)
958	Narrow-leaved Apple – Hard-leaved Scribbly Gum heathy woodland on sand at Agnes Banks, Sydney Basin Bioregion	165.3	24.8	0.0	39.7	0.0	72.7	0.0	112.5 (68.1%)	112.5 (68.1%)
1067	Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	594.6	89.2	0.1	116.1	0.0	419.7	9.4	535.8 (90.1%)	545.3 (91.7%)

PCT no.	PCT name	Total (ha)	15% target	Area in NPWS Estate			Area outside NPWS Estate		Total area in core areas – ha (%)	Total area in PIAs (core areas and regional biodiversity corridors) – ha (%)
				Outside PIAs (ha)	Core areas (ha)	Regional biodiversity corridors (ha)	Core areas (ha)	Regional biodiversity corridors (ha)		
1081	Red Bloodwood – Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin Bioregion	3669.1	550.4	10.4	11.5	371.7	794.9	968.7	806.4 (22%)	2146.9 (58.5%)
1085	Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin Bioregion	153.8	23.1	0.0	2.5	0.0	32.9	25.9	35.4 (23%)	61.3 (39. 9%)
1126	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	22.0	3.3	8.3	0.0	0.0	3.8	0.0	3.8 (17.3%)	3.8 (17.5%)
1181	Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion	6170.4	925.6	56.1	188.0	247.6	1634.3	1637.0	1822.3 (29.5%)	3706.9 (60.1%)
1232	Swamp Oak – Prickly Tea-tree – Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin Bioregion and South East Corner Bioregion	11.3	1.7	0.0	0.0	0.0	7.7	0.0	7.7 (68.2%)	7.7 (68.2%)
1234	Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	91.4	13.7	4.8	0.0	0.0	25.9	15.8	25.9 (28.3%)	41.7 (45.7%)
1236	Swamp Paperbark – Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	7.1	1.1	0.0	0.0	0.0	5.4	1.7	5.4 (75.3%)	7.1 (99.7%)

PCT no.	PCT name	Total (ha)	15% target	Area in NPWS Estate			Area outside NPWS Estate		Total area in core areas – ha (%)	Total area in PIAs (core areas and regional biodiversity corridors) – ha (%)
				Outside PIAs (ha)	Core areas (ha)	Regional biodiversity corridors (ha)	Core areas (ha)	Regional biodiversity corridors (ha)		
1237	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion	647.4	97.1	0.0	10.8	0.0	88.4	5.8	99.3 (15.3%)	105.1 (16.2%)
1253	Sydney Peppermint – White Stringybark – Smooth-barked Apple Forest on shale Outcrops, Sydney Basin Bioregion	256.4	38.5	0.3	0.0	85.0	0.0	162.7	0 (0%)*	247.7 (96.6%)
1281	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	1936.8	290.5	22.7	7.6	24.9	295.6	122.8	303.1 (15.7%)	450.9 (23.3%)
1284	Turpentine – Smooth-barked Apple moist shrubby forest of the lower Blue Mountains, Sydney Basin Bioregion	13.8	2.1	0.0	1.3	2.7	9.7	0.1	11 (79.7%)	13.7 (99.6%)
1395	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	12 311.2	1846.7	11.5	343.4	139.2	2785.9	1914.3	3129.3 (25.4%)	5182.8 (42.1%)
1808	Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline	22.2	3.3	0.0	0.0	0.0	10.4	1.6	10.4 (47.1%)	12 (54.2%)
1841	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region	427.2	64.1	0.0	12.8	0.0	83.6	98.6	96.5 (22.6%)	195 (45.7%)

PCT no.	PCT name	Total (ha)	15% target	Area in NPWS Estate			Area outside NPWS Estate		Total area in core areas – ha (%)	Total area in PIAs (core areas and regional biodiversity corridors) – ha (%)
				Outside PIAs (ha)	Core areas (ha)	Regional biodiversity corridors (ha)	Core areas (ha)	Regional biodiversity corridors (ha)		
1847	Smooth-barked Apple – Grey Gum – Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0 (0%)	0 (0%)

*Target satisfied by area in the NPWS estate.

6.3 Priority Investment Areas and previous investment

To determine the current level of biodiversity funds being invested within the PIAs, the grant funding locations described in section 2 were compared with the PIAs mapped for the Cumberland subregion (Table 6 and Figure 4).

Table 6 Government biodiversity grants, 2009–10 to 2013–14, for the Cumberland subregion, and intersection with PIAs

Year	Grant program								Total	
	NSW Environmental Trust grant programs		Local Land Services grant programs		Growth Centres Biodiversity Offset Program		Commonwealth Government grant programs			
	Within PIAs	Outside PIAs	Within PIAs	Outside PIAs	Within PIAs	Outside PIAs	Within PIAs	Outside PIAs	Within PIAs	Outside PIAs
2009–10	$62,955	$119,592	$173,715	$558,052	$1,570,741	$0	$52,100	$18,909	**$1,859,511**	**$696,553**
2010–11	$56,040	$206,550	$39,090	$60,039	$1,629,467	$0	$20,000	$99,630	**$1,744,597**	**$366,219**
2011–12	$137,147	$500,000	$265,244	$776,896	$2,089,592	$0	$18,020	$2,882,790	**$2,510,003**	**$4,159,686**
2012–13	$198,513	$382,750	$202,144	$603,743	$8,531,870	$0	$19,850	$36,900	**$8,952,377**	**$1,023,393**
2013–14	$0	$80,000	$28,000	$183,821	$6,614,293	$0	$0	$49,540	**$6,642,293**	**$313,361**
Total	**$454,655**	**$1,288,892**	**$708,193**	**$2,182,551**	**$20,435,963**	**$0**	**$109,970**	**$3,087,769**	**$21,708,781**	**$6,559,212**

The majority of the funding available for the Cumberland subregion in the 5-year funding period examined is being spent within the PIAs, with $21,708,781 of a total $28,267,993 spent within the core areas and regional biodiversity corridors identified. Most of this funding is sourced from the Growth Centres Biodiversity Offset Program, which has spent all available funding within the PIAs ($20,435,963). The other funding sources, such as NSW Environmental Trust grant programs ($454,655 of $1,743,547), Local Land Services grant programs ($708,193 of $2,890,744) and Commonwealth Government grant programs ($109,970 of $3,197,739) have all spent significantly less within the PIAs than outside the PIAs, contributing $1,272,818 within the PIAs.

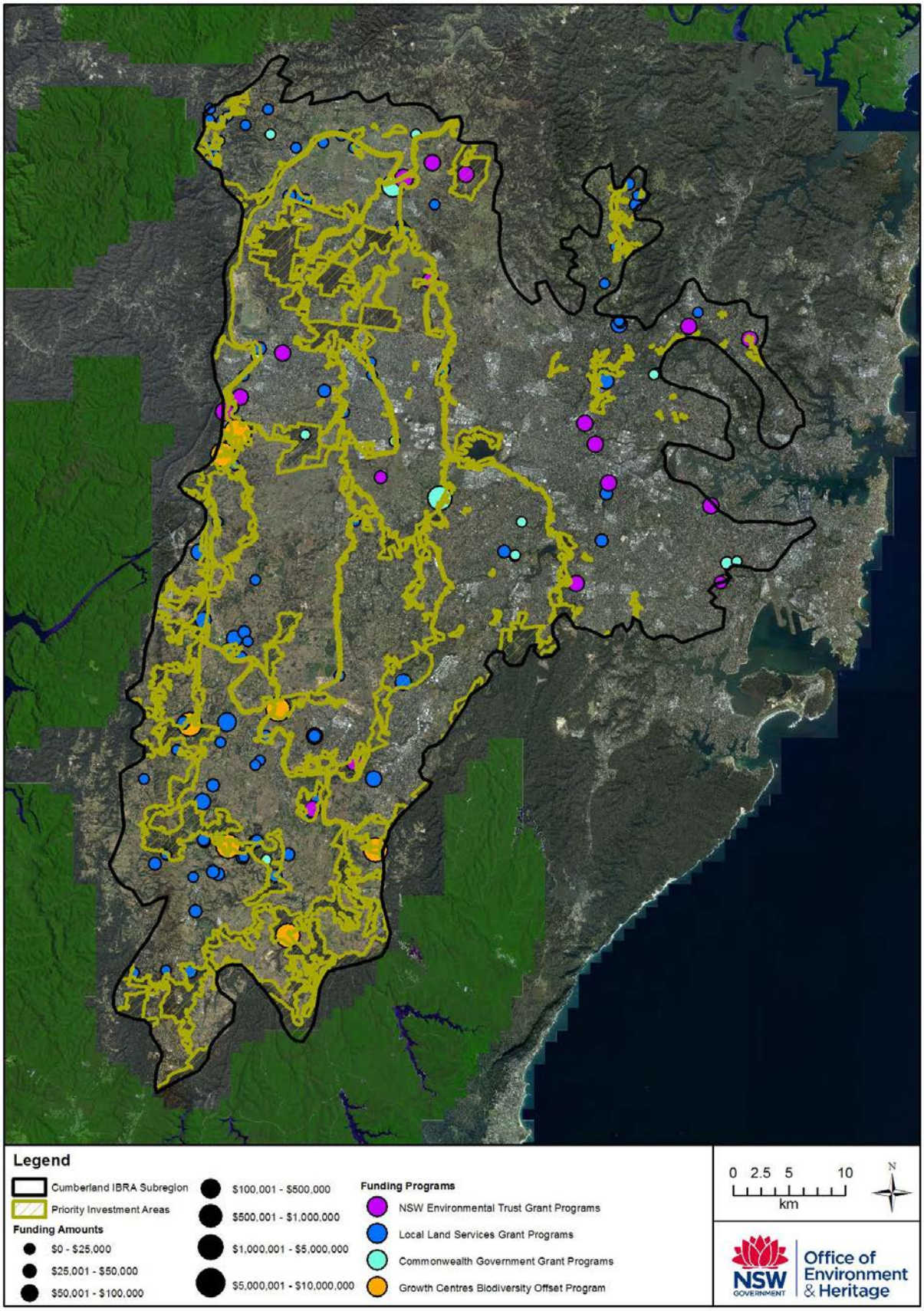

Figure 4 Priority Investment Areas and grant funding locations

6.4 Recommended use of BIO Map data

BIO Map provides a single, accessible map that identifies the best areas for strategic investment in biodiversity management in the Cumberland subregion.

Federal, state and local governments regularly make funding available to support biodiversity management actions through various grant programs and are committed to ensuring that these funds are spent in an effective and accountable way. Identifying priority areas for biodiversity investment is one way of ensuring that, on the basis of an assessment of broad-scale biodiversity and stakeholder values, funds are targeted to areas of greatest strategic benefit.

BIO Map can be used in two ways. First, it can be used to inform funding bodies of the preferred locations at which to invest funds from grant programs. Second, it can provide useful information for landowners and land managers on the areas that have increased potential of receiving biodiversity management funds. BIO Map may thus increase the opportunities for landowners with property that falls within PIAs to receive funding to protect their bushland.

A landowner's right to carry out activities such as agriculture and development is not altered by their property being identified within a PIA. Areas within PIAs may have environmental values that may need to be considered as part of statutory planning and development approval processes; these areas would thus require an appropriately scaled level of environmental assessment as specified by the relevant planning or consent authority. If a property is within a PIA, then the landowner may have increased opportunities to access a range of conservation funding programs. Participation in these programs is entirely voluntary.

6.5 A decision-support tool for grant providers

BIO Map is a decision-support tool and provides guidance on PIAs. By investing in PIAs, fund managers can be confident that they are contributing to strategic conservation outcomes that have broad-based stakeholder support.

BIO Map can be used in different ways, depending on the objectives of the grant funding program. For example, a program may target only biodiversity core areas or only corridors within the project area. Programs targeted toward specific features or landscape units can use BIO Map as an initial filter to target areas for investigation.

OEH recommends that program funding be preferentially targeted to land that is within, or partially within, the PIAs. Methods to achieve this include:

- using a governance framework in which program funds must be spent within priority areas as a first preference before land in other areas or at lower priorities is considered. Criteria can then be used to further prioritise land within the priority areas. The Growth Centres Biodiversity Offset Program is an example of this approach.
- applying a weighting (e.g. 10 per cent to 25 per cent) to grant applications that are located within, or partially within, a PIA. This enables applications outside the priority areas to also be competitive if they provide other benefits.

As would be expected, a grant program would need to undertake site-based assessments to ensure that the land has the specific features that are targeted for funding.

6.6 Supporting Local Land Services programs

Local Land Services identifies regional and local priorities in its Catchment Action Plans to guide its expenditure of funds. In some circumstances, the locations identified in a Catchment Action Plan may differ from those identified in BIO Map because of differences in mapping approaches and objectives.

Depending on the purpose of the funding stream, Local Land Services is encouraged to consider the PIAs identified by BIO Map when allocating its funds. This may include initial prioritising of fund

allocation to areas where BIO Map overlaps with the Catchment Action Plan priorities, before considering investment in other areas.

However, Local Land Services may have funding purposes that differ from those identified by BIO Map, or it may be able to achieve positive biodiversity outcomes outside the mapped PIAs.

6.7 Supporting local government programs

Consultation with councils has identified the benefits of a strategic, regional context of biodiversity priorities to support local biodiversity management planning and prioritisation. BIO Map is a resource that supports the establishment of local priorities by councils.

Councils are able to build on the identified PIAs within their LGAs, enhancing the networks of core areas and corridors identified by adding lands of local biodiversity importance, such as local corridors, in their council areas. PIAs may also help local government to prepare local documents such as biodiversity strategies or to prioritise efforts in applying for grant funding.

Council can use BIO Map information to determine whether any council-owned sites are identified as PIAs, thus increasing the potential to receive funding to manage or conserve these areas. Councils may also wish to prioritise PIAs when spending their own funds in situations where local and regional priorities are aligned.

6.8 Supporting community organisations and projects

BIO Map provides community groups with information on biodiversity investment priorities; this information can help to select sites where it is appropriate to expend effort. As PIAs have an increased chance of receiving funding, and contribute to a wider network of biodiversity conservation, community groups can choose to focus on these areas when considering applications for grant funding or other funding. This may be particularly relevant to new groups, or to existing groups looking for new sites or opportunities.

BIO Map does not identify all areas of state or regional priority; nor does it identify areas of local value. Groups working outside identified PIAs continue to provide positive benefits for biodiversity within the study area.

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Appendix 1: BIO Map criteria

Criterion type: Mapping standards

***Criteria**: Consistent mapping at a property scale*

Mapping guide:

1. Priority Investment Areas can be mapped over all land tenures, but investment will be limited to only those tenures able to receive it.
   - *Existing offsets are generally not available to receive grant funding, but they are often part of key corridors or part of larger core areas. Although these areas will be mapped as PIAs, they will not be available to receive funding and will be identified by a separate layer in the Biodiversity Investment Spatial Viewer (BISV).*
2. Priority Investment Areas are to exclude, where feasible, areas that are likely to be affected by development.
   - *Areas likely to be affected by development include land zoned for urban uses or areas where land-use intensification or fragmentation is likely. As a general rule, land zoned residential (e.g. R1 to R4 under a standard LEP, or equivalent), industrial (e.g. IN1 to IN4 under a standard LEP, or equivalent) or business (e.g. B1 to B7 under a standard LEP, or equivalent) is to be excluded from PIAs.*
3. Priority Investment Areas are to be delineated by using the best available regional information.
   - *Best available information includes the most comprehensive regional-scale vegetation mapping, vegetation classification and land-use information at the time of map production.*
4. Priority Investment Areas are mapped in vector format, validated by using recent aerial photography (less than 10 years old) and mapped at a 'property' scale (~1:10 000 to 1:20 000).
   - *Property scale mapping will help end-users determine whether their study areas are located within a Priority Investment Area.*
5. The boundaries of Priority Investment Areas should generally be aligned with either extant vegetation or cadastral boundaries.
6. Priority Investment Areas are to include predominantly vegetated lands.
   - *PIAs may include cleared land incidentally or as areas of potential connectivity value.*
7. Priority Investment Areas may be considered as both core areas and biodiversity corridors. In these circumstances, land is to be identified as both a core area and biodiversity corridor.
8. Priority Investment Areas will include only those mapping products that have been either publicly released or, if not publicly released, have been prepared in consultation with stakeholders.
   - *If the mapping is not publicly released, stakeholders to be consulted may include (for instance) local council staff, Department of Planning and Environment, Office of Strategic Lands, Department of Premier and Cabinet, Local Aboriginal Land Councils, Local Land Services, non-government organisations such as community and environment groups, and known local experts.*

Criterion type: Core areas

***Criteria**: Core areas of native vegetation and habitat where management will be of greatest benefit to the conservation of state and regional biodiversity values within a region*

Mapping guide:

1. Based on existing mapping OR through regional analysis assisted by conservation planning/decision-support tools, such as the Biodiversity Forecasting Tool (BFT), patch size or fragmentation analysis, or alternative approach depending on the data available within the study area.
2. Core areas are to be mapped by initially defining 'key' state and regional biodiversity values for the study area or region. Key biodiversity values may include **significant vegetation types** (such as state and Commonwealth Threatened Ecological Communities, under-reserved vegetation types, over-cleared vegetation types, vegetation types present in over-cleared landscapes and endemic vegetation communities), **significant vegetation remnants**, **significant threatened flora populations and fauna habitat**, and **other state and regional biodiversity values** such as 'matters of national environmental significance' (MNES), important wetlands, habitat for endemic species, karst areas, old-growth forest, rainforest and areas listed by statutory conservation or protection mechanisms.
3. The following guidelines are to be considered when mapping core areas:
   a. For **significant vegetation types**, a target of 15% of the existing area of each vegetation type within the study area should be used to guide decisions related to the amount of vegetation to be included as a core area.
      - *The above target is for the sole purpose of prioritising investment and is not a vegetation retention target. The target does not represent the only biodiversity values that warrant protection within a region.*

Criterion type: Core areas *continued*

- *Areas in conservation reserves are counted towards the minimum target for each significant vegetation type.*

b. For **significant vegetation remnants**,[12] core areas may comprise large vegetated areas that are significant in the landscape, including non-threatened vegetation communities or important habitat for non-threatened fauna that rely on large, intact patches.
c. For **significant threatened flora populations and fauna habitat**, core areas can comprise significant populations of threatened species within the subregion.
d. For **other state and regional biodiversity values** (such as MNES, important wetlands, habitat for endemic species, karst areas, old-growth forest, rainforest and areas listed by statutory conservation or protection mechanism), no minimum areas apply.

4. In addressing 3 consideration is to be given to:
   a. Areas where biodiversity values are likely to be viable in the long term. Preference is to be given to vegetation in large, well-configured patches, with good condition and connectivity. Consideration should also be given to selecting areas that are representative of the diversity across the region.
   b. Areas of high social value as identified by local councils, residents and community groups that can demonstrate ongoing involvement in the biodiversity management of a site. Where an area is considered for inclusion because of social values, the area must contain key state or regional biodiversity values and must meet minimum standards for condition, connectivity, patch size and viability etc.
5. Core areas are to exclude, where feasible, areas that are likely to be affected by development
   a. Areas likely to be affected by development include land zoned for urban uses or areas where land-use intensification or fragmentation is likely. As a general rule, land zoned residential (e.g. R1 to R4 under a standard LEP, or equivalent), industrial (e.g. IN1 to IN4 under a standard LEP, or equivalent) or business (e.g. B1 to B7 under a standard LEP, or equivalent)) is to be excluded from PIAs.

Criterion type: State biodiversity corridors

***Criteria**: State biodiversity corridors are key linkages of native vegetation identified through state-wide analysis and provide connectivity between IBRA regions and subregions*

Mapping guide:

1. State biodiversity corridors are identified in the Native Vegetation Management Benefits map (Drielsma et al. 2012) as the top 10% of benefits from the 'consolidate' layer, or otherwise meeting the definition above, AND ARE
2. Validated by using regional data and information in order to refine the boundaries mapped at a state scale.
   - *It is recognised that the validation process may result in a new corridor route being selected that achieves the same linkage benefit as the corridor mapped at the state scale. This new route will take into account fine-scale data that identify native vegetation cover.*
3. State biodiversity corridors are to exclude, where feasible, areas that are likely to be impacted by development.
   - *Areas likely to be affected by development include land zoned for urban uses or areas where land-use intensification or fragmentation is likely. As a general rule, land zoned residential (e.g. R1 to R4 under a standard LEP, or equivalent), industrial (e.g. IN1 to IN4 under a standard LEP, or equivalent) or business (e.g. B1 to B7 under a standard LEP, or equivalent) is to be excluded from PIAs.*
4. Corridors generally have a minimum width of 100 metres; however, in some over-cleared landscapes this may not always be achievable. Similarly, in some landscapes with more extensive areas of contiguous vegetation a far greater width (i.e. several kilometres) may be appropriate.
5. Corridors generally comprise continuous native vegetation cover, but most corridors will contain some discontinuities for roads or other purposes. As a general guide, discontinuities are to be less than 100 metres wide, noting that greater discontinuities may be required for some fragmented landscapes or key linkages.
6. In areas of contiguous vegetation, corridors may include entire vegetated areas, or parts of these vegetated areas that have particular vegetation types or landscape features (e.g. escarpment, rainforest or riparian corridors).

[12] Refer to Tables 20, 23 and 31 in the *BioBanking Assessment Methodology* (OEH 2014c) for guidance on defining patch size class by Mitchell Landscape; see Appendix 4 of the Methodology.

Criterion type: Regional biodiversity corridors

***Criteria**: Regional biodiversity corridors are key linkages of native vegetation within an IBRA sub-region, between IBRA sub-regions or between significant biodiversity features.*

Mapping guide:

1. Regional biodiversity corridors provide linkages between significant biodiversity features within an IBRA subregion, including:
    a. state biodiversity corridors
    b. mapped core areas
    c. large native vegetation remnants[13]
    d. Other significant areas, such as the coastline, NPWS Estate or important Council or Crown reserves.
2. Regional biodiversity corridors generally do not extend between several IBRA subregions, but they may cross between two subregions.
3. Regional biodiversity corridors do not include state biodiversity corridors (as defined above) or local corridors.
    - *Local corridors are linkages of native vegetation that either extend from a significant biodiversity feature into the surrounding landscape or link local landscape features such as reserves, creek lines, gullies, wetlands and ridgelines (adapted from DEC 2004).*
4. Regional biodiversity corridors include consideration of areas of high social value, as identified by local councils, residents and community groups that can demonstrate ongoing involvement in the biodiversity management of a site. Where an area is considered for inclusion because of social values, the area must meet minimum standards for connectivity under criteria item 1 above.
5. Regional biodiversity corridors are to exclude, where feasible, areas that are likely to be affected by development:
    - *Areas likely to be affected by development include land zoned for urban uses or areas where land-use intensification or fragmentation is likely. As a general rule, land zoned residential (e.g. R1 to R4 under a standard LEP, or equivalent), industrial (e.g. IN1 to IN4 under a standard LEP, or equivalent) or business (e.g. B1 to B7 under a standard LEP, or equivalent) is to be excluded from PIAs.*
6. Corridors generally have a minimum width of 100 metres; however, in some over-cleared landscapes this may not always be achievable. Similarly, in some landscapes with more extensive areas of contiguous vegetation a far greater width (i.e. several kilometres) may be appropriate.
7. Corridors generally comprise continuous native vegetation cover; however, most corridors will contain some discontinuities for roads or other purposes. As a general guide, discontinuities are to be less than 100 metres wide, noting that greater discontinuities may be required for some fragmented landscapes or key linkages.
8. In areas of contiguous vegetation, corridors may include entire vegetated areas, or parts of these vegetated areas that have particular vegetation types or landscape features (e.g. escarpment, rainforest or riparian corridors).

[13] Refer to Tables 20, 23 and 31 in the BioBanking Assessment Methodology (OEH 2014c) for guidance on defining patch size class by Mitchell Landscape; see Appendix 4 of the Methodology.

Appendix 2: Data sources and their application in BIO Map

Data custodian	Data layer provided	Use in mapping (assist/partially incorporated/completely incorporated)
Department of Planning & Environment	Potential home sites	Assist
	Pre-2006 zoning (where Standard Instrument zoning is not available)	Partially incorporated
	Standard Instrument zoning (where available)	Partially incorporated
	Sydney's housing hotspots	Assist
	Western Sydney Employment Area Expansion Area	Assist
	Western Sydney Employment Area SEPP	Assist
	Western Sydney Employment Area Structure Plan	Assist
	Western Sydney Growth Centres – LEP zoning information and certified boundaries	Assist
Forestry Corporation of NSW	State Forests	Assist
Hawkesbury-Nepean Catchment Management Authority	Hawkesbury-Nepean Catchment Regional Biodiversity Corridors	Partially incorporated
	Potential Priority Habitat (Catchment Action Plan)	Assist
Land and Property Information	Cadastre	Assist
	Local Government Areas	Assist
NSW Office of Environment and Heritage	BioBank Agreements	Assist
	Cumberland Plain Vegetation Mapping (VIS 2221, 2222, 2223, 3785)	Assist
	HMV Review	Completely incorporated
	National Parks Estate	Assist
	Native Vegetation of the Sydney Metropolitan Area (VIS 3817)	Assist
	Priority Conservation Lands	Completely incorporated
	Saving Our Species site-managed species sites	Assist
	Soil landscapes	Assist
	Threatened and Pest Animals of Greater Southern Sydney (DECC 2007)	Assist
	Threatened Species locations	Assist
NSW Office of Water	Hydrolines and watercourses	Assist
The Royal Botanic Gardens and Domain Trust	Mt Annan Regeneration Area	Assist
	Mt Annan Woodland Conservation Area	Assist
Western Sydney Parklands Trust	Bushland Corridor	Completely incorporated
Auburn Council	Council land	Assist
	Duck River vegetation	Assist
	Open space	Assist
	Parks	Assist

Data custodian	Data layer provided	Use in mapping (assist/partially incorporated/completely incorporated)
Bankstown Council	Bushland vegetation	Assist
	Corridors	Assist
	Terrestrial biodiversity overlay – exhibition layer	Assist
Camden Council	Community land	Assist
	Environmentally sensitive land	Assist
	Parks and reserves	Assist
	Riparian corridors	Assist
Campbelltown Council	Bushcare locations	Assist
	Corridors	Assist
	Council land	Assist
	District 8 zonings	Partially incorporated (environment zonings)
	Priority mapping	Assist
Canada Bay Council	Bushcare locations	Assist
	Council vegetation survey	Assist
	E2 zone	Assist
	Environmental buffer	Assist
	Parks management plan	Assist
Canterbury Council	Bushcare locations	Assist
	Corridors	Assist
	Saltmarsh	Assist
	Vegetation communities	Assist
Fairfield Council	Conservation significance assessment	Assist
	Riparian Lands and Watercourses Map	Assist
	Terrestrial biodiversity map	Assist
	Threatened species locations	Assist
Hawkesbury Council	Council reserves	Assist
	Vegetation mapping	Assist

Data custodian	Data layer provided	Use in mapping (assist/partially incorporated/completely incorporated)
Hornsby Shire Council	Bushcare sites	Assist
	Bushland corridor	Assist
	Environmental protection zoning	Assist
	Flora habitats	Assist
	Hornsby Council bush regeneration contract boundaries	Assist
	Hornsby Council bush regeneration work zones	Assist
	Hornsby Council reserves plan of management	Assist
	Hornsby waterbird survey habitats	Assist
	Lembit and Burcher corridor mapping	Assist
	Lembit and Burcher significant habitat	Assist
	Smith and Smith remnant trees	Assist
	Smith and Smith vegetation communities	Assist
	UNSW sea eagle data	Assist
	UNSW survey data	Assist
Hurstville Council	Bushcare sites	Assist
	E1 land	Assist
	Hurstville Council parks	Assist
	Hurstville Council priority wetlands	Assist
	Natural areas	Assist
	Plant communities	Assist
	River Keeper sites	Assist
Kogarah Council	Aquatic vegetation	Assist
	E4 (Environmental Living)	Assist
	Parks	Assist
	Threatened flora	Assist
	Vegetation communities	Assist
Ku-ring-gai Council	Biodiversity corridors	Assist
	Biodiversity protection	Assist
	Bush regeneration sites	Assist
	Endangered Ecological Community vegetation mapping	Assist
	Greenweb	Assist
	Local fauna habitat	Assist
	Natural areas	Assist
	Regional fauna habitat	Assist
	Riparian land and waterways	Assist

Data custodian	Data layer provided	Use in mapping (assist/partially incorporated/completely incorporated)
Liverpool Council	Conservation significance assessment	Assist
	Environmentally significant land	Assist
	Riparian corridors	Assist
	Vegetation	Assist
Parramatta Council	Biodiversity protection	Assist
	Bushcare and bush regeneration	Assist
	City centre zoning	Assist
	Community land	Assist
	Parks	Assist
	Riparian land and waterways	Assist
	Vegetation significance	Assist
	Zoning	Assist
Penrith Council	Environmental conservation zoning	Assist
	Natural resources sensitivity land map	Partially incorporated
	Parks and reserves	Assist
	Public recreation zoning	Assist
Rockdale Council	Environmentally significant land	Assist
	Parks and open space	Assist
	Priority natural areas	Assist
	Significant flora locations	Assist
	Vegetation communities	Assist
Ryde Council	Bushcare (follow-up sites)	Assist
	Bushcare (primary sites)	Assist
	Bushcare (reach extent)	Assist
	Bushcare (reach works)	Assist
	Bushcare (secondary sites)	Assist
	Bushland	Assist
	Parks	Assist
	Riparian environment	Assist
	Weed locations	Assist
	Zoning	Assist

Data custodian	Data layer provided	Use in mapping (assist/partially incorporated/completely incorporated)
The Hills Shire Council	Bushcare sites	Assist
	Constrained land (Rural Development Control Plan)	Assist
	Corridors	Assist
	Darwinia fascicularis habitat	Assist
	Ecological principles layer	Assist
	Important creeks (100-metre buffer)	Assist
	Natural biodiversity	Assist
	Parks and reserves	Assist
	Riparian corridors	Assist
	Subcatchment corridors	Assist
	Threatened species hotspots	Assist
	Vegetation communities	Assist
	Wetlands	Assist
	Yellow-bellied Glider habitat	Assist
Wollondilly Shire Council	Riparian land	Assist
	Vegetation layer (Biometric Vegetation Types)	Assist
	Vegetation prioritisation	Assist

Appendix 3: Plant Community Types allocated to input vegetation maps

Cumberland Plain map unit name (Tozer 2003)	Sydney Metropolitan map units (OEH 2013)	Plant Community Type number	Plant Community Type name	Potential Threatened Ecological Communities
Shale/Gravel Transition Forest	Castlereagh Shale-Gravel Transition Forest	724	Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Shale Gravel Transition Forest in the Sydney Basin Bioregion
Cooks River Castlereagh Ironbark Forest	Castlereagh Ironbark Forest	725	Broad-leaved Ironbark – *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
Elderslie Banksia Scrub Forest		774	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	Elderslie Banksia Scrub Forest
Freshwater Wetlands	Coastal Freshwater Reedland	781	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Moist Shale Woodland	Cumberland Moist Shale Woodland	830	Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moist Shale Woodland in the Sydney Basin Bioregion
Alluvial Woodland Riparian Forest	Cumberland River-flat Forest Cumberland Swamp Oak Riparian Forest	835	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Shale Plains Woodland	Cumberland Shale Plains Woodland	849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion
Shale Hills Woodland	Cumberland Shale Hills Woodland	850	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion
Western Sydney Dry Rainforest Unclassified	Hinterland Ranges Dry Rainforest	877	Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion	Western Sydney Dry Rainforest in the Sydney Basin Bioregion

Cumberland Plain map unit name (Tozer 2003)	Sydney Metropolitan map units (OEH 2013)	Plant Community Type number	Plant Community Type name	Potential Threatened Ecological Communities
Woodland Heath Complex	Coastal Sandstone Heath-Mallee Hinterland Sandstone Dwarf Apple Heath-Woodland	882	Hairpin Banksia – Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	–
Castlereagh Scribbly Gum Woodland	Castlereagh Scribbly Gum Woodland	883	Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
	Coastal Escarpment Littoral Rainforest	910	Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion	Littoral Rainforest and Coastal Vine Thickets of Eastern Australia Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
	Estuarine Mangrove Forest	920	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
	Coastal Flats Swamp Mahogany Forest Hinterland Riverflat Paperbark Swamp Forest	923	*Melaleuca linariifolia* – Swamp Mahogany swamp forest in drainage lines of the edges of the Cumberland Plain, Sydney Basin Bioregion	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Unclassified	Hinterland Flats Eucalypt Forest	941	Mountain Blue Gum – Thin-leaved Stringybark open forest on river flat alluvium in the Burragorang Valley, Sydney Basin Bioregion	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Agnes Banks Woodland		958	Narrow-leaved Apple – Hard-leaved Scribbly Gum heathy woodland on sand at Agnes Banks, Sydney Basin Bioregion	Agnes Banks Woodland in the Sydney Basin Bioregion
	Coastal Upland Damp Heath Swamp	978	Needlebush – Banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion	–

Cumberland Plain map unit name (Tozer 2003)	Sydney Metropolitan map units (OEH 2013)	Plant Community Type number	Plant Community Type name	Potential Threatened Ecological Communities
Castlereagh Swamp Woodland	Castlereagh Swamp Woodland	1067	Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Castlereagh Swamp Woodland Community River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion
Sandstone Ridgetop Woodland Unclassified	Hinterland Sandstone Transition Grey Gum Forest Woronora Sandstone Exposed Bloodwood Woodland	1081	Red Bloodwood – Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin Bioregion	–
Unclassified	Hornsby Enriched Sandstone Exposed Woodland	1083	Red Bloodwood – Scribbly Gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	–
	Coastal Shale-Sandstone Forest Sydney Ironstone Bloodwood – Silvertop Ash Forest	1085	Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin Bioregion	Duffys Forest Ecological Community in the Sydney Basin Bioregion Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion
Unclassified		1086	Red Bloodwood – Sydney Peppermint – Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin Bioregion	–
	Estuarine Saltmarsh	1126	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Upper Georges River Sandstone Woodland Western Sandstone Gully Forest Unclassified	Coastal Enriched Sandstone Sheltered Forest Hinterland Sandstone Gully Blackbutt – Apple Forest	1181	Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion

Cumberland Plain map unit name (Tozer 2003)	Sydney Metropolitan map units (OEH 2013)	Plant Community Type number	Plant Community Type name	Potential Threatened Ecological Communities
	Coastal Freshwater Swamp Forest	1232	Swamp Oak – Prickly Tea-tree – Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin Bioregion and South East Corner Bioregion	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
	Estuarine Swamp Oak Forest	1234	Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
	Coastal Swamp Paperbark – Swamp Oak Scrub	1236	Swamp Paperbark – Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Blue Gum High Forest	Blue Gum High Forest	1237	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion	Blue Gum High Forest in the Sydney Basin Bioregion
	Coastal Sandstone Sheltered Peppermint–Apple Forest	1250	Sydney Peppermint – Smooth-barked Apple – Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion
Unclassified		1253	Sydney Peppermint – White Stringybark – Smooth-barked Apple Forest on shale Outcrops, Sydney Basin Bioregion	–
Turpentine–Ironbark Forest Turpentine–Ironbark Margin Forest Unclassified	Sydney Turpentine–Ironbark Forest	1281	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Sydney Turpentine–Ironbark Forest

Cumberland Plain map unit name (Tozer 2003)	Sydney Metropolitan map units (OEH 2013)	Plant Community Type number	Plant Community Type name	Potential Threatened Ecological Communities
Unclassified		1284	Turpentine – Smooth-barked Apple moist shrubby forest of the lower Blue Mountains, Sydney Basin Bioregion	Sydney Turpentine–Ironbark Forest
Riparian Scrub	Coastal Sandstone Gallery Rainforest	1292	Water Gum – Coachwood riparian scrub along sandstone streams, Sydney Basin Bioregion	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
Shale Sandstone Transition Forest (Low Sandstone Influence) Shale Sandstone Transition Forest (High Sandstone Influence)	Cumberland Shale–Sandstone Ironbark Forest	1395	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest in the Sydney Basin Bioregion
	Coastal Warm Temperate Rainforest	1529	Lilly Pilly – Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
Unclassified	Hornsby Sandstone Exposed Bloodwood Woodland	1642	Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast	–
	Coastal Sandstone Foreshores Forest	1778	Smooth-barked Apple – Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	–
	Estuarine Reedland	1808	Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
	Coastal Enriched Sandstone Moist Forest	1841	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region	–
	Sydney Foreshores Shale Forest	1847	Smooth-barked Apple – Grey Gum – Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney	–

Appendix 4: BFT mapping approach and results

As site based, consistent, field-tested data on condition are not available across the entire Cumberland subregion, the method applied to the BFT used local- and regional-scale datasets to apply a consistent, repeatable and robust approach to the mapping of current condition and future condition. Potential improvement is calculated by using the BFT on the basis of a number of factors (see below).

The inputs for the current condition layer are provided in Table A4-1. The approach used multiple data sources to map condition. The integration of several data sources enabled the assessment to consider the various factors that influence vegetation condition, such as structure and composition, by including information that measures various condition attributes. Input data, which together provided an overall condition score, included remotely sensed foliage projective cover information, land-use data and vegetation condition/disturbance information captured during the vegetation mapping process. These inputs were combined to provide a total score of between 0 (low condition) and 100 (high condition).

Table A4-1 Input data used to measure current condition for use with the BFT

Condition type	Data inputs	Score allocated (between 0 (low) and 100 (high))
Current vegetation condition	• Vegetation mapping • Foliage projective cover information derived from the state-wide Land Cover and Trees Study (SLATS) compared to Biometric benchmark data	0 to 100
	• Vegetation mapping • Land-use data	Reserve/protected: 100 Natural vegetation: 80 Rivers, creeks and drainage: 70 Wetlands: 70 Recreation and semi-intensive uses (vegetated– woody): 70 Production forestry: 60 Grazing – native pastures: 50 Recreation and semi-intensive uses (not vegetated): 40 Grazing – possible native pastures: 30 Plantation forestry: 30 Water bodies (other): 10 Grazing – non-native pastures: 10 Cropping/horticulture: 5 Urban/industry – intensive use: 0
	• Vegetation mapping (condition information derived from attributes captured during vegetation mapping projects- Tozer 2003 and OEH 2013))	Very high: 100 High: 80 Moderate: 60 Low: 40 Very low: 20

The methodology for mapping future condition used spatial data to estimate the consequence and probability of threats occurring within the study area. The future condition was then estimated throughout the study area on the basis of the current condition, the consequence of each threat and the probability of that threat occurring.

The mapping of threats for the Cumberland subregion BIO Map is not exhaustive, and it relies on a simple approach to identifying the key areas of future change within the study area. The aim of the future condition data is to avoid identifying BIO Map areas where land is subject to future urban release, clearing or major land-use change that has a significant impact on vegetation condition. Therefore, the key threats identified and mapped for the BIO Map include land clearing, land degradation (urban interface) and land degradation (road interface). Table A4-2 provides more details.

Table A4-2 Input data used to measure future condition for use with the BFT

Threat type	Threat factors	Consequence condition (0, low condition; 100, high condition)	Probability of occurring (20 year timeframe)
Land clearing	Confirmed development • Growth Centres, Western Sydney Employment Area and Sydney Regional Environmental Plan 30 – Business, Residential, Industrial and Special Uses (Infra) zoning	0	100%
	Likely development • Residential, Business, Mixed Use, Special Uses (Infra) and Industrial zoning outside Growth Centres • Certified lands where zoning information is not available • Potential airport site at Badgerys Creek	0	80%
	Some development potential • Rural, Special Uses, Deferred Matter and Environmental Living zoning in all areas • Non-certified lands within Growth Centres • Western Sydney Parklands Trust • Open Space/Recreation • Community lands • Housing hotspots • Potential home sites	0	5%
	No development potential • National Parks and BioBank sites • Environmental Protection	0	0%
Land degradation (urban)	0.1–25 metres of an urban area	40	70%
	25–50 metres of an urban area	40	50%
	50–100 metres of an urban area	40	35%
	100–250 metres of an urban area	40	20%
	250–500 metres of an urban area	40	10%
Land degradation (roads)	0.1–10 metres of a road	60	70%
	10–25 metres of a road	60	50%
	25–50 metres of a road	60	35%

On the basis of both current condition and projected future condition, a layer of potential future improvement in condition within the study area was generated. Whether a patch of vegetation could improve with management was based on a number of factors, including:

- availability for improvement – i.e. land won't be cleared in the future

- current condition – i.e. the land has some capacity for improvement
- recovery potential – i.e. historical and current land-use practices will not prevent the vegetation from being improved if management is applied. Land use is used as a surrogate for this measure.

The BFT was run using two scenarios:

1. No future threats operating to provide a current 'snapshot' of biodiversity priorities
2. Future threats operating to provide a future estimation of biodiversity priority.

The results of the BFT scenarios were broken into areas identified as 'conserve' priorities and areas identified as 'repair' priorities (Figures A4-1 to A4-4). Areas identified as having high 'conserve' values would have the greatest adverse impact on the region's biodiversity if they were cleared; they represent areas of high conservation value vegetation in relatively good condition (DECCW, 2010a). 'Repair' values are generally subject to greater predicted threats. Minimising threats, restoring or improving these areas, and preventing further degradation would make a significant contribution to the overall biodiversity of the region (DECCW, 2010a). Both layers were considered in determining the overall capacity of a patch to be a core area.

To identify potential habitat links, the SLT used two inputs, namely a habitat (or condition) grid and a weight (or cost) grid. The habitat grid was based on the current condition information described above for the BFT, with condition scored between 0 (low condition) and 100 (high condition). Because the SLT required context data from outside the study area to identify links to the boundary of the Cumberland subregion, a 5-kilometre buffer was applied to the study area for the SLT analysis. The condition data used in the buffer, being derived from land-use data only, were derived by using a simpler method.

The weight (or cost) grid was calculated on the basis of the habitat grid. If an area has higher condition, it is considered to have a lower 'cost' of movement for a species than those areas in lower condition, where a higher 'cost' is assumed. The results of the SLT analysis are provided in Figure A4-5.

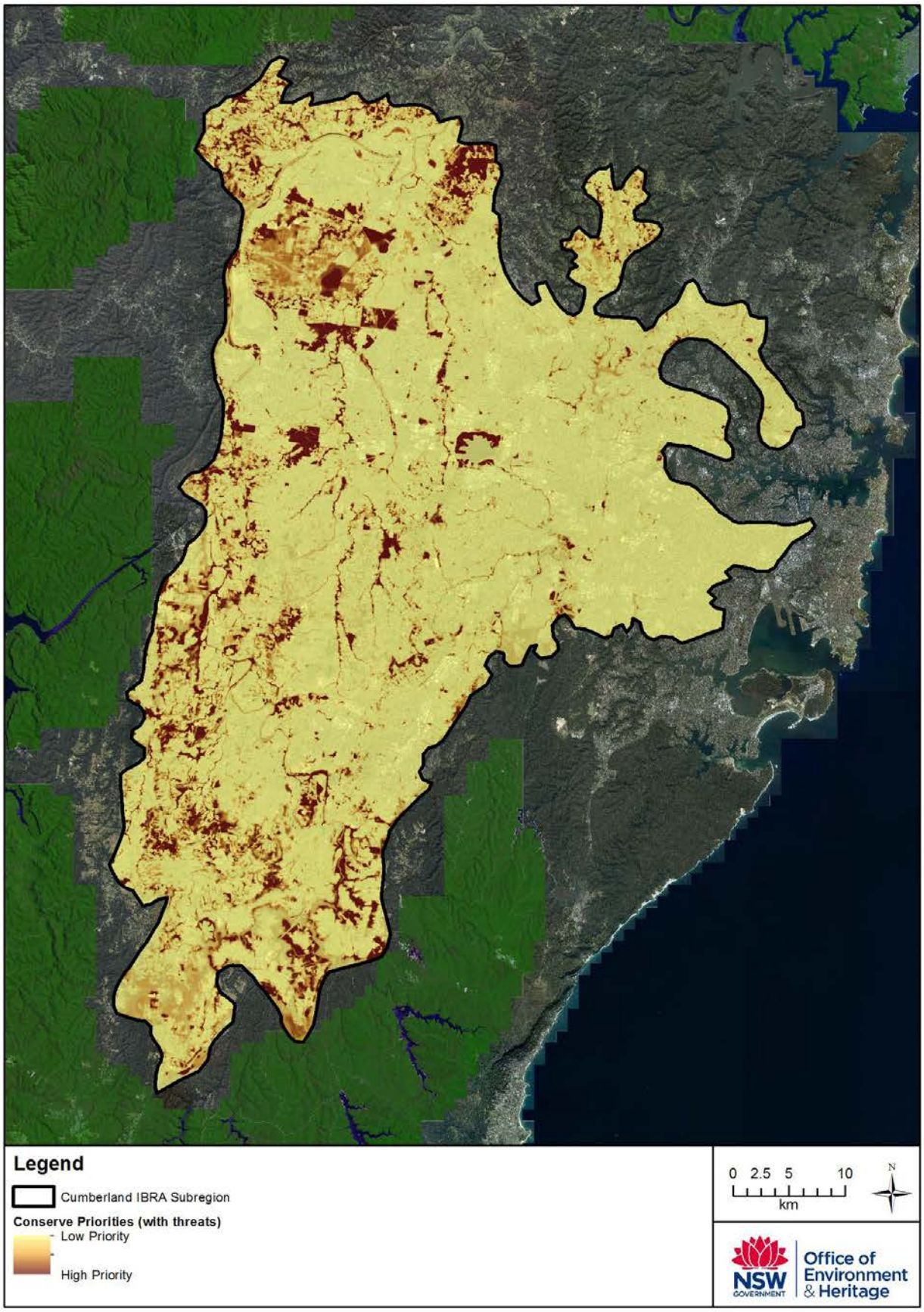


Figure A4-1 BFT outputs: areas identified as 'conserve' priorities (with threats)

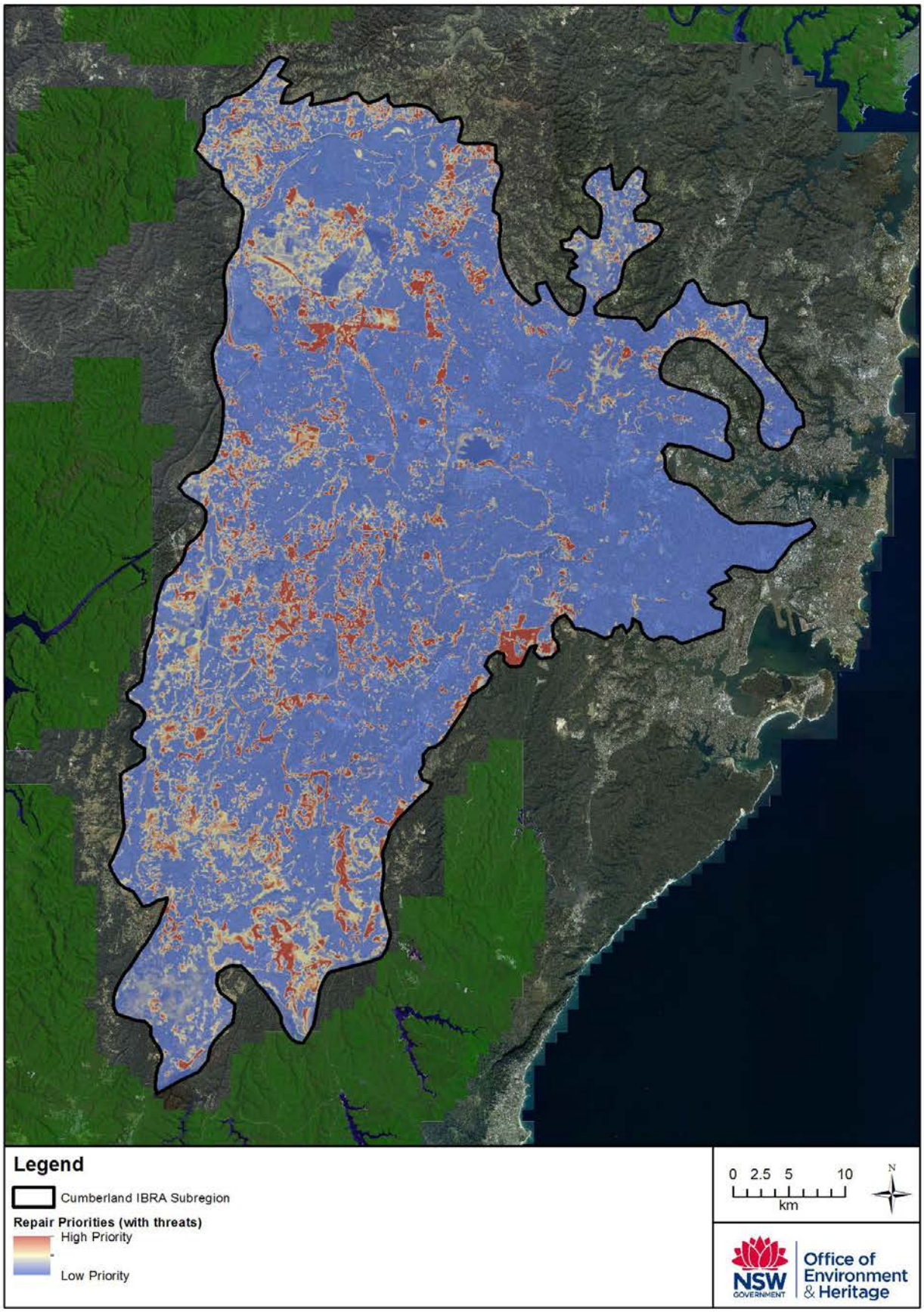


Figure A4-2 BFT outputs: areas identified as 'repair' priorities (with threats)

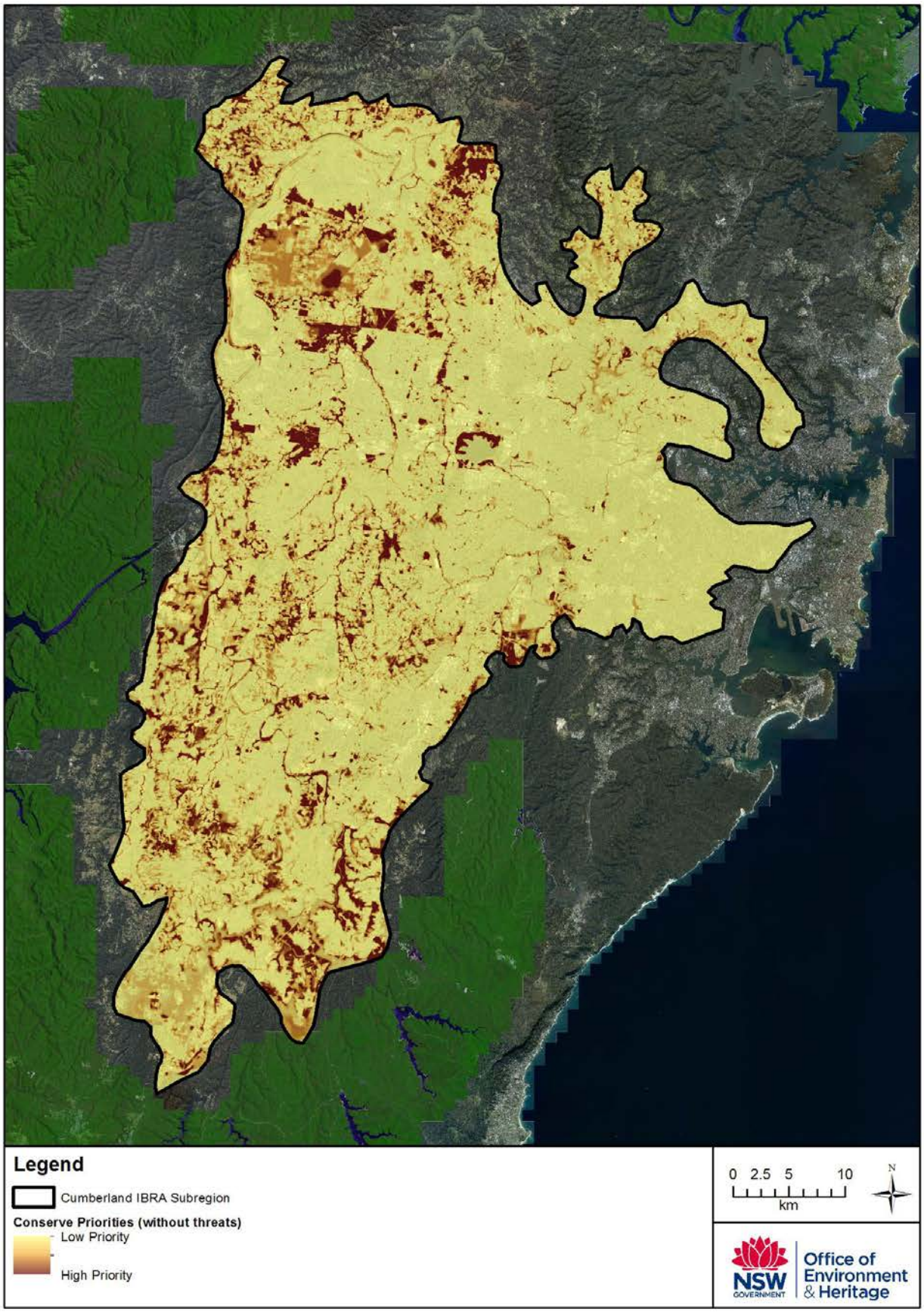


Figure A4-3 BFT outputs: areas identified as 'conserve' priorities (without threats)

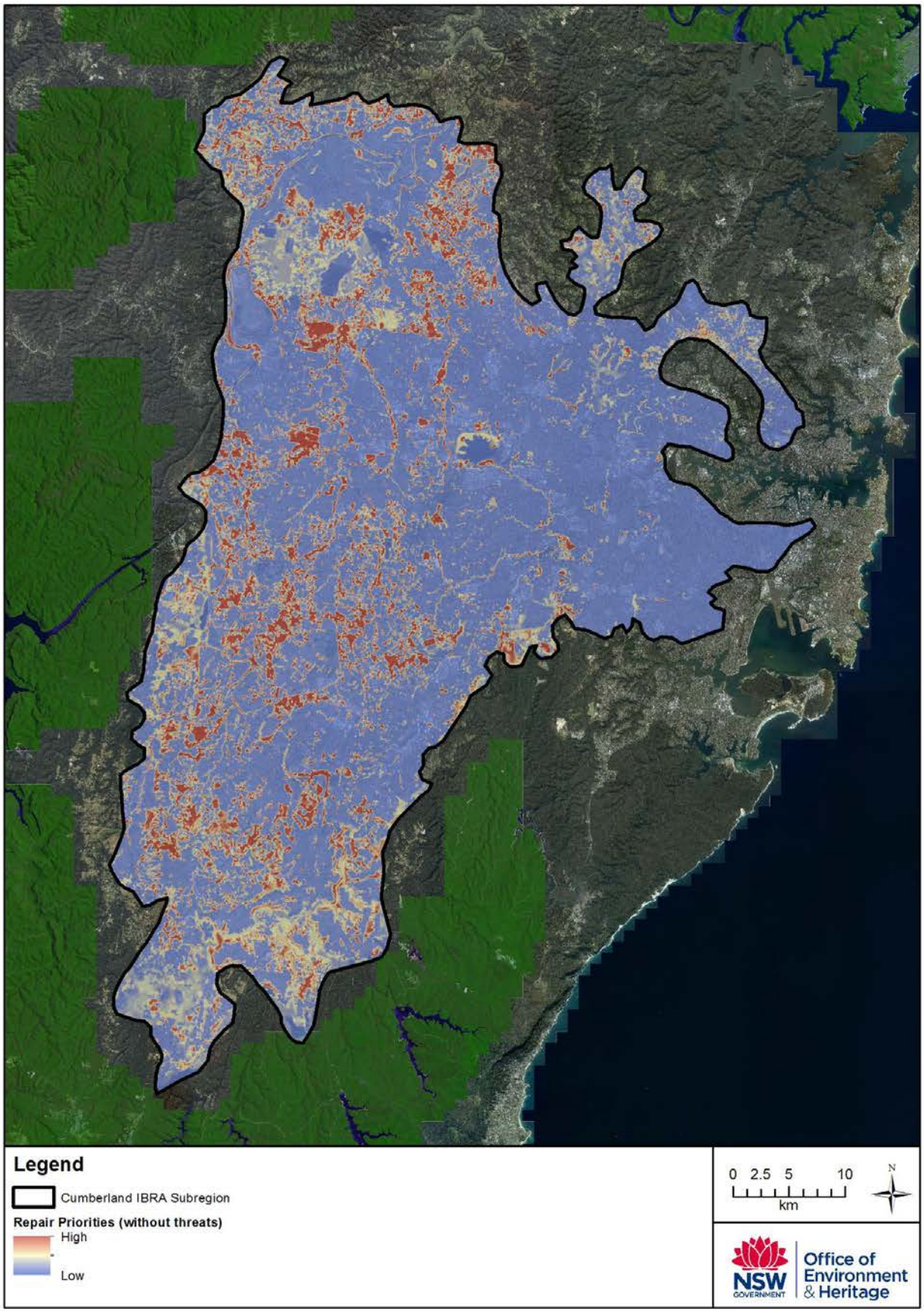


Figure A4-4 **BFT outputs: areas identified as 'repair' priorities (without threats)**

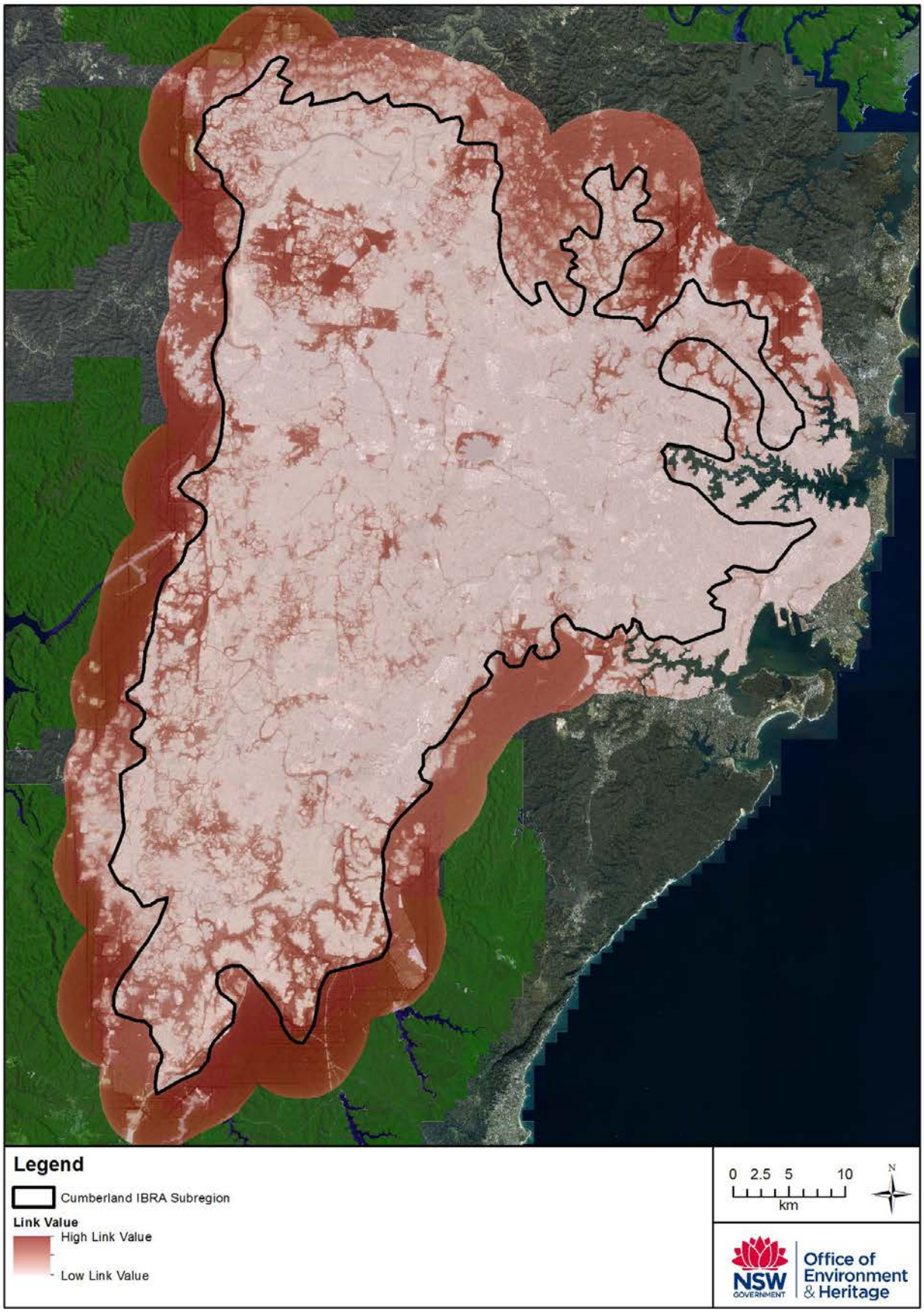


Figure A4-5 Spatial Links Tool: link values

Appendix 5: PCTs excluded from being considered as key state or regional biodiversity values

The 40 Plant Community Types (PCTs) within the Cumberland subregion were reviewed to exclude vegetation types that were not considered typical or representative of this subregion. PCTs were removed from consideration as key state and regional biodiversity values if the vast majority of the vegetation type occurred outside the Cumberland subregion. This may occur, for instance, where only small 'slivers' of the vegetation type extend into the study area. In total, 10 PCTs were considered not typical or representative of the Cumberland subregion and were removed from consideration as key state or regional biodiversity values (Table A5-1).

Table A5-1 Plant Community Types excluded from being considered as key state or regional biodiversity values

Plant Community Type number	Plant Community Type name	Vegetation formation	Vegetation class
882	Hairpin Banksia – Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	Heathlands	Sydney Coastal Heaths
910	Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion	Rainforests	Littoral Rainforests
978	Needlebush – Banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion	Freshwater Wetlands	Coastal Heath Swamps
1083	Red Bloodwood – Scribbly Gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests
1086	Red Bloodwood – Sydney Peppermint – Blue-leaved Stringybark heathy forest of the southern Blue Mountains, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Hinterland Dry Sclerophyll Forests
1250	Sydney Peppermint – Smooth-barked Apple – Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests
1292	Water Gum – Coachwood riparian scrub along sandstone streams, Sydney Basin Bioregion	Forested Wetlands	Eastern Riverine Forests
1529	Lilly Pilly – Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin	Rainforests	Northern Warm Temperate Rainforests
1642	Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests
1778	Smooth-barked Apple – Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests

Appendix 6: PCTs identified as key state or regional biodiversity values

The 40 Plant Community Types (PCTs) within the Cumberland subregion were reviewed to exclude vegetation types that were not considered typical or representative of this subregion. In total, 30 PCTs were identified as key state or regional biodiversity values (Table A6-1).

Table A6-1 Plant Community Types identified as key state or regional biodiversity values

Plant Community Type number	Plant Community Type name	Vegetation formation	Vegetation class
724	Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrub/grass subformation)	Cumberland Dry Sclerophyll Forests
725	Broad-leaved Ironbark – *Melaleuca decora* shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrub/grass subformation)	Cumberland Dry Sclerophyll Forests
774	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Sand Flats Dry Sclerophyll Forests
781	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Freshwater Wetland	Coastal Freshwater Lagoons
830	Forest Red Gum – Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Grassy Woodland	Coastal Valley Grassy Woodlands
835	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Grassy Woodland	Coastal Valley Grassy Woodlands
849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Grassy Woodland	Coastal Valley Grassy Woodlands
850	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Grassy Woodland	Coastal Valley Grassy Woodlands
877	Grey Myrtle dry rainforest of the Sydney Basin Bioregion and South East Corner Bioregion	Rainforests	Dry Rainforests
883	Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Sand Flats Dry Sclerophyll Forests
920	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Saline Wetlands	Mangrove Swamps
923	*Melaleuca linariifolia* – Swamp Mahogany swamp forest in drainage lines of the edges of the Cumberland Plain, Sydney Basin Bioregion	Forested Wetland	Coastal Swamp Forests

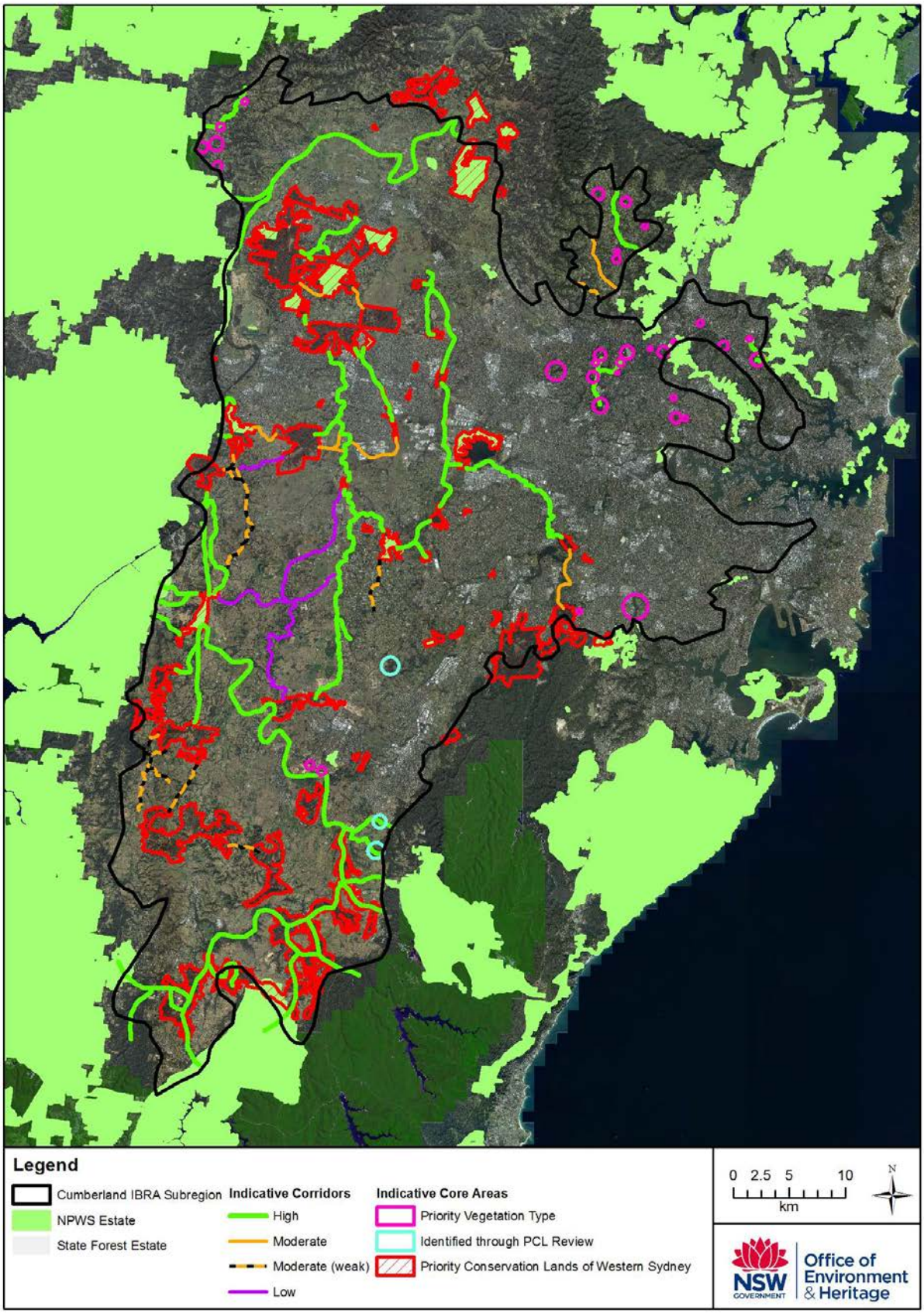
Plant Community Type number	Plant Community Type name	Vegetation formation	Vegetation class
941	Mountain Blue Gum – Thin-leaved Stringybark open forest on river flat alluvium in the Burragorang Valley, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrub/grass subformation)	Central Gorge Dry Sclerophyll Forests
958	Narrow-leaved Apple – Hard-leaved Scribbly Gum heathy woodland on sand at Agnes Banks, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Sand Flats Dry Sclerophyll Forests
1067	Parramatta Red Gum woodland on moist alluvium of the Cumberland Plain, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrub/grass subformation)	Cumberland Dry Sclerophyll Forests
1081	Red Bloodwood – Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Hinterland Dry Sclerophyll Forests
1085	Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests
1126	Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Saline Wetlands	Saltmarshes
1181	Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests
1232	Swamp Oak – Prickly Tea-tree – Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin Bioregion and South East Corner Bioregion	Forested Wetland	Coastal Floodplain Wetlands
1234	Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Forested Wetland	Coastal Floodplain Wetlands
1236	Swamp Paperbark – Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Forested Wetland	Coastal Floodplain Wetlands
1237	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion	Wet Sclerophyll Forests (Shrubby subformation)	North Coast Wet Sclerophyll Forests
1253	Sydney Peppermint – White Stringybark – Smooth-barked Apple Forest on shale Outcrops, Sydney Basin Bioregion	Wet Sclerophyll Forests (Grassy subformation)	Northern Hinterland Wet Sclerophyll Forests
1281	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrub/grass subformation)	Cumberland Dry Sclerophyll Forests
1284	Turpentine – Smooth-barked Apple moist shrubby forest of the lower Blue Mountains, Sydney Basin Bioregion	Wet Sclerophyll Forests (Shrubby subformation)	North Coast Wet Sclerophyll Forests
1395	Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrub/grass subformation)	Cumberland Dry Sclerophyll Forests

Plant Community Type number	Plant Community Type name	Vegetation formation	Vegetation class
1808	Common Reed on the margins of estuaries and brackish lagoons along the New South Wales coastline	Freshwater Wetland	Coastal Freshwater Lagoons
1841	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region	Wet Sclerophyll Forests (Shrubby subformation)	North Coast Wet Sclerophyll Forests
1847	Smooth-barked Apple – Grey Gum – Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney	Wet Sclerophyll Forests (Grassy subformation)	Northern Hinterland Wet Sclerophyll Forests

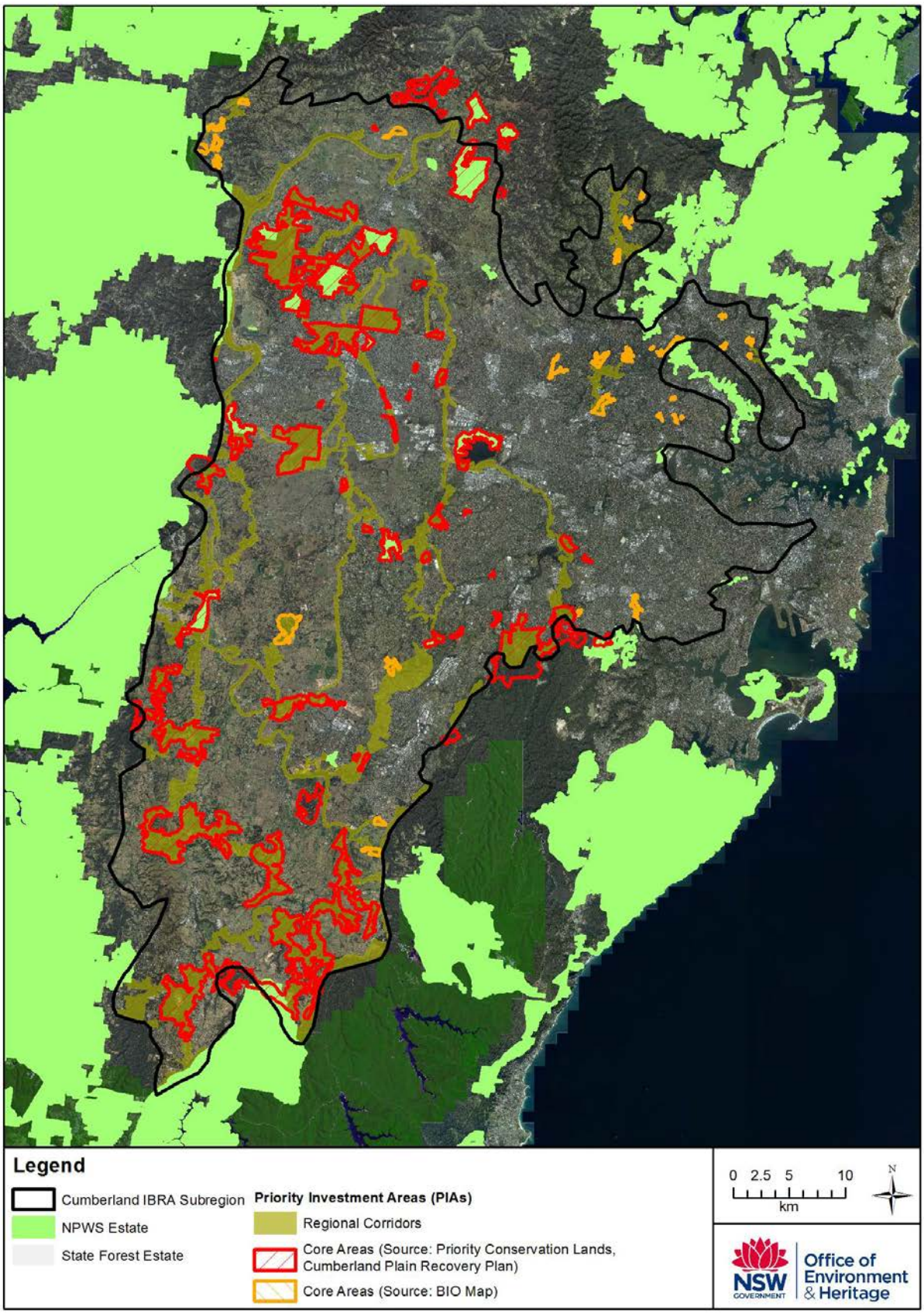
Appendix 7: Organisations consulted for the Cumberland subregion BIO Map

Authority	Organisation
Federal Government	Department of the Environment
State Government	Greater Sydney Local Land Services
State Government	Natural Resources Commission
State Government	NSW Government Architect's Office
State Government	NSW Department of Planning & Environment
State Government	Office of Strategic Lands
State Government	Western Sydney Parklands Trust
Local Government	Bankstown
Local Government	Blacktown
Local Government	Camden
Local Government	Campbelltown
Local Government	Canterbury
Local Government	Fairfield
Local Government	Hawkesbury
Local Government	Hornsby
Local Government	Hurstville
Local Government	Ku-ring-gai
Local Government	Liverpool
Local Government	Parramatta
Local Government	Penrith
Local Government	Ryde
Local Government	The Hills
Local Government	Wollondilly
Local Community Environment Group	Blacktown and District Environment Group
Local Community Environment Group	Cumberland Conservation Network
Local Community Environment Group	Western Sydney Conservation Alliance
Local Community Environment Group	STEP Inc. (made contact during project)
Local Community Environment Group	National Parks Association Macarthur Branch (made contact during project)
Individual	Interested individual from Campbelltown (made contact during project)
State-wide Environment Group	Greening Australia
State-wide Environment Group	Nature Conservation Trust of NSW
State-wide Environment Group	Nature Conservation Council of NSW
State-wide Environment Group	NSW National Parks Association
Development Industry	Urban Development Institute of Australia

Appendix 8: Indicative BIO Map of the Cumberland subregion



Appendix 9: Draft BIO Map of the Cumberland subregion



Appendix 10: Regional biodiversity corridors and core areas identified during each map stage

Provided below are maps (Figures A10-1 to A10-3) and associated tables (Tables A10-1 and A10-2) highlighting the core areas and regional biodiversity corridors mapped by the BIO Map project for the Cumberland subregion. The maps identify the locations of all regional biodiversity corridors and core areas, including those that were not adopted because of stakeholder comment or other factors. Please note that the adopted Priority Conservation Lands are not tagged in the maps or tables below, as they were incorporated and accepted as a first step in the mapping process.

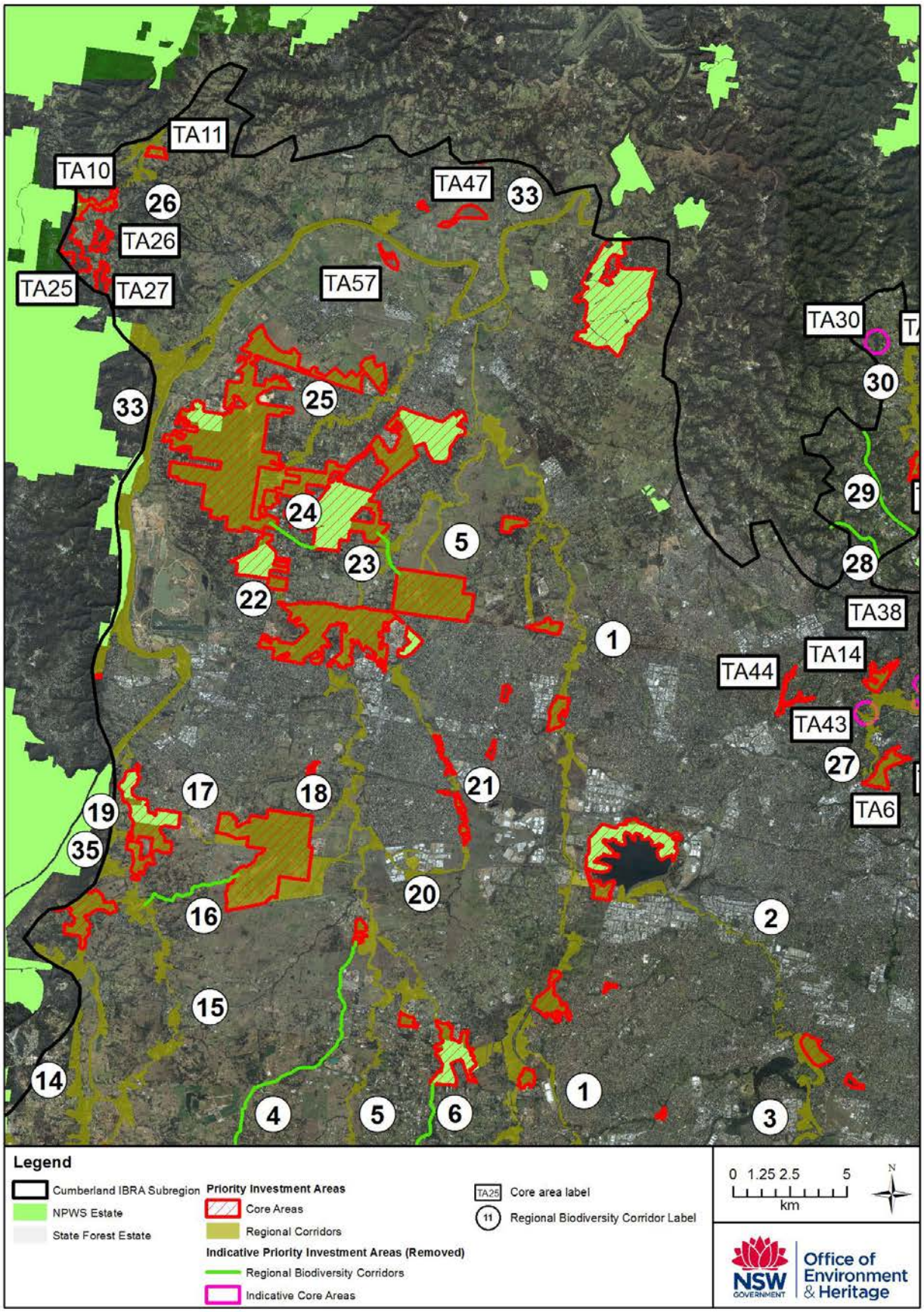


Figure A10-1 Priority Investment Areas identified during the project: map 1 of 3

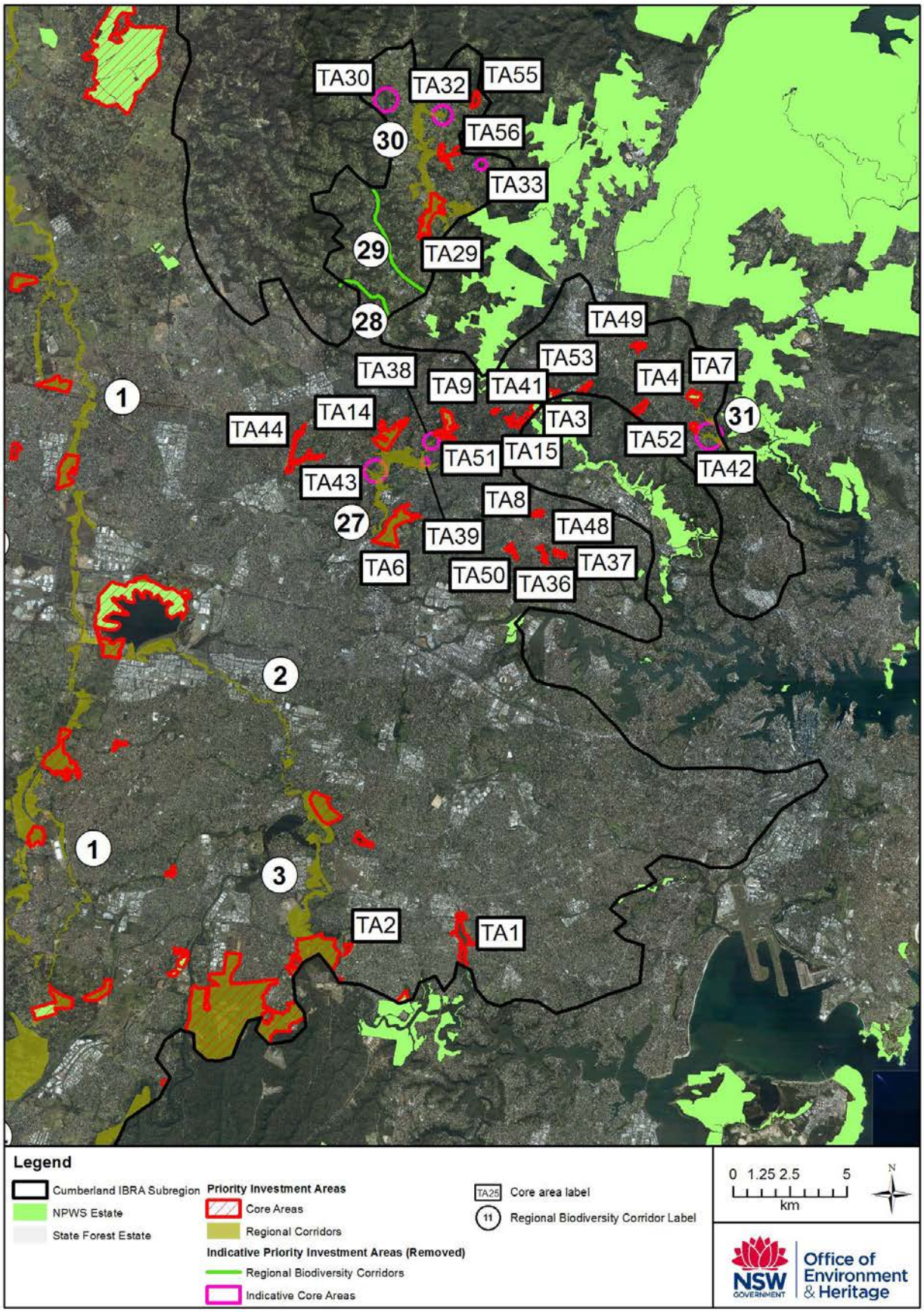


Figure A10-2 Priority Investment Areas identified during the project: map 2 of 3

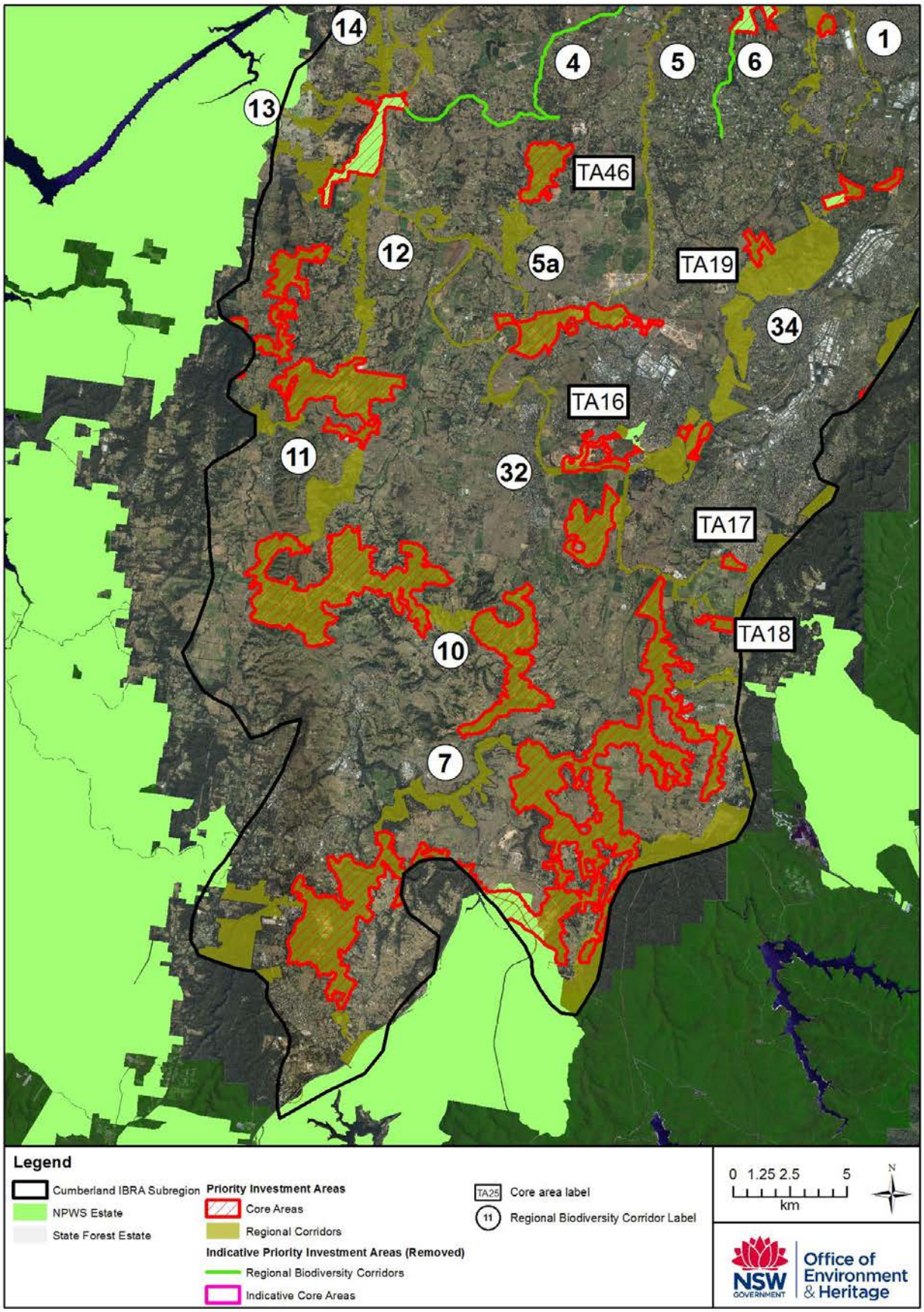


Figure A10-3 Priority Investment Areas identified during the project: map 3 of 3

Table A10-1 Regional biodiversity corridors identified during each map stage

Regional biodiversity corridor ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Boundary delineation technique
1	Fairfield, Liverpool, Blacktown	✓	✓ (Amended)	✓ (Amended)	Extent increased to both the north and the south on the basis of stakeholder feedback. Bringelly Road upgrade has affected the southern end of the corridor. OEH and the Western Sydney Parklands Trust will work together to find solutions to this.	Mixture of riparian and non-riparian corridor. Northern riparian component aligned with Eastern Creek. Southern riparian component aligned with Hinchinbrook and Cabramatta Creeks. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed). Non-riparian component derived from Western Sydney Parklands Trust Bushland Corridor data (Western Sydney Parklands Trust 2013).
2	Fairfield, Bankstown, Holroyd	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Prospect Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
3	Bankstown, Liverpool	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Georges River. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
4	Liverpool, Penrith	✓	×	×	Corridor removed from draft and final maps owing to land use incompatibility and stakeholder feedback.	N/A
5	Liverpool, Penrith, Camden	✓	✓ (Amended)	✓ (Amended)	Corridor runs along length of South Creek. Corridor extended significantly at the northern end after stakeholder feedback.	Riparian corridor aligned with South Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed). Southern end of corridor is zoned RE1 – Recreation within the SW Growth Centre and is also Biocertified. RE1 is considered a sympathetic land use and has therefore been included in BIO Map.

Regional biodiversity corridor ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Boundary delineation technique
5a	Liverpool	✓	✓ (Amended)	✓ (Amended)	Initial alignment revised on the basis of land-use incompatibility and stakeholder feedback. Smaller corridor now leads to core area TA 46, with southern alignment also adjusted.	Predominantly non-riparian corridor based on vegetation extent and/or cadastral boundaries.
6	Liverpool	✓	×	×	Removed, as corridor did not connect two significant biodiversity features as defined in the criteria.	N/A
7	Campbelltown	✓	✓	✓	Corridor merged to form one contiguous link. Now referred to as Corridor 7.	Line work predominantly based on Hawkesbury-Nepean Catchment Regional Biodiversity Corridors (Hawkesbury-Nepean Catchment Management Authority 2008) and PCL boundaries (DECCW 2010b).
8	Campbelltown, Wollondilly	✓				
9	Wollondilly	✓				
10	Wollondilly	✓	✓	✓	Adopted without change.	Non-riparian corridor based on vegetation extent and/or cadastral boundaries.
11	Wollondilly	✓	✓ (Amended)	✓ (Amended)	Original alignment updated in response to stakeholder feedback – particularly feedback on a requirement for more non-riparian corridors. Corridors 11 and 11a merged for final map. Now referred to as Corridor 11.	Corridor contains riparian and non-riparian components. Corridor based on vegetation extent, cadastral boundaries, slope and stakeholder feedback. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
11a	Wollondilly	✓	✓ (Amended)			
12	Wollondilly	✓	✓	✓	Adopted without change.	Corridor contains riparian and non-riparian components. Non-riparian components based on vegetation extent and/or cadastral boundaries. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).

Regional biodiversity corridor ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Boundary delineation technique
13	Wollondilly	✓	✓	✓	Corridors merged for final map. Now referred to as Corridor 13.	Corridor contains riparian and non-riparian components. Non-riparian components based on vegetation extent and/or cadastral boundaries. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
13a	Wollondilly	✓				
14	Wollondilly, Penrith	✓	✓	✓	Adopted without change.	Non-riparian corridor based on vegetation extent and/or cadastral boundaries.
15	Liverpool, Penrith	✓	✓	✓	Corridor between Nepean River and Mulgoa PCL via Mulgoa Creek.	Corridor contains riparian and non-riparian components. Non-riparian components based on vegetation extent and/or cadastral boundaries. Riparian corridor boundary is aligned with Mulgoa Creek and Duncans Creek and is derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
16	Penrith	✓	×	×	Removed because of land use incompatibility.	N/A
17	Penrith	✓	✓	✓	Adopted without change.	Corridor aligned with E2 zone.
18	Penrith	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Blaxland Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
19	Penrith	✓	✓	✓	Adopted without change.	Corridor contains riparian and non-riparian components. Non-riparian components based on vegetation extent and/or cadastral boundaries. Riparian corridor boundary aligned with Mulgoa Creek and derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).

Regional biodiversity corridor ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Boundary delineation technique
20	Penrith	✓	✓	✓	Adopted without change.	Corridor contains riparian and non-riparian components. Non-riparian components derived predominantly from E2 zones. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
21	Penrith	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Ropes Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
22	Penrith	✓	✓	✓	Adopted without change.	Corridor derived from Penrith Council Natural Resources Sensitivity Land Map (Penrith Council 2010) overlay.
23	Penrith	✓	×	×	Removed in response to stakeholder feedback.	N/A
24	Penrith	✓	×	×	Removed in response to stakeholder feedback.	N/A
25	Penrith	✓	✓	✓ (Amended)	Northern end extended to Hawkesbury River in response to stakeholder feedback.	Riparian corridor aligned with Rickabys Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
26	Hawkesbury	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Little Wheeny Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).

Regional biodiversity corridor ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Boundary delineation technique
27	Parramatta, The Hills Shire	✓	✓	✓	Adopted without change.	Corridor contains riparian and non-riparian components. Non-riparian components derived predominantly from environmental zones. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
28	The Hills Shire	✓	×	×	Removed owing to land-use incompatibility.	N/A
29	The Hills Shire	✓	×	×	Removed owing to land use incompatibility.	N/A
30	Hornsby	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Colah Creek. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
31	Ku-ring-gai	✓	✓	✓	Adopted without change.	Riparian corridor aligned with Stony Creek and High Ridge Gully. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
32	Hawkesbury, Penrith	✓	✓	✓	Adopted without change.	Riparian corridor aligned with the Hawkesbury River. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).
33	Wollondilly, Campbelltown, Camden, Liverpool	✓	✓	✓	Adopted without change.	Riparian corridor aligned with the Nepean River. Corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed).

Regional biodiversity corridor ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Boundary delineation technique
34	Campbelltown, Camden	×	✓	✓	Added in response to stakeholder feedback.	Predominantly non-riparian corridor aligned with environmental zoning based on Campbelltown LEP District 8 line work (Campbelltown Council 2008).
35	Penrith	×	✓	✓	Added in response to stakeholder feedback.	Corridor contains riparian and non-riparian components. Non-riparian components based on vegetation extent and/or cadastral boundaries. Riparian corridor boundary derived from largest extent of riparian buffer, environmentally zoned land or contiguous vegetation (with areas zoned for development removed). Corridor incorporates Fernhill BioBank site.

Table A10-2 Core areas identified during each map stage. Note that PCLs are excluded from the table; only details related to core areas created as part of the BIO Map project are provided.

Core area ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Targeted key state or regional biodiversity value* (for core areas included in final BIO Map)
TA 1	Hurstville, Bankstown, Canterbury	✓	✓	✓	Adopted without change.	Mangrove forest in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion
TA 2	Bankstown	✓	✓	✓	Adopted without change.	Swamp Oak – Prickly Tea-tree – Swamp Paperbark swamp forest on coastal floodplains, Sydney Basin Bioregion and South East Corner Bioregion
TA 3	Hornsby	✓	✓	✓	Adopted without change.	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
TA 4	Ku-ring-gai	✓	✓	✓	Adopted without change.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 5	The Hills Shire	✓	✓	✓	Now combined with TA14 for final map. Allocated to TA 14.	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
TA 6	Parramatta	✓	✓	✓	Adopted without change.	Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin Bioregion
TA 7	Ku-ring-gai	✓	✓	✓	Adopted without change.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 8	Parramatta	✓	✓	✓	Adopted without change.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 9	The Hills Shire	✓	✓	✓	Large area of business-zoned land removed, as this area did not meet mapping criteria.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 10	Hawkesbury	✓	✓	✓	Extended significantly in response to stakeholder comments.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion

Core area ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Targeted key state or regional biodiversity value* (for core areas included in final BIO Map)
TA 11	Hawkesbury	✓	✓	✓	Adopted without change.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 14	The Hills Shire	✓	✓	✓	Now combined with TA 5 for final map. Allocated to TA 14.	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
TA 15	Hornsby	✓	✓	✓	Adopted without change.	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
TA 16	Camden	✓	×	✓	Removed from draft map in response to stakeholder comment. Further consideration led to the core area being included in the final BIO Map with a revised boundary.	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion
TA 17	Campbelltown	✓	✓	✓	Line work adopted from the HMV review (OEH 2014b).	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
TA 18	Campbelltown	✓	✓	✓	Line work adopted from the HMV review (OEH 2014b).	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
TA 19	Campbelltown	✓	✓	✓	Line work adopted from the HMV review (OEH 2014b).	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
TA 24	Camden	✓	×	✓	Removed from draft map in response to stakeholder comment. Further consideration led to the core area being included in the final BIO Map with a revised boundary. Combined with TA 16 for final map. Allocated to TA 16.	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion
TA 25	Hawkesbury	✓	✓	✓	Extended significantly in response to stakeholder comments.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 26	Hawkesbury	✓	✓	✓	Adopted without change.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 27	Hawkesbury	✓	✓	✓	Adopted without change.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion

Core area ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Targeted key state or regional biodiversity value* (for core areas included in final BIO Map)
TA 28	Hornsby	✓	✓	✓	TA 28 and TA 29 combined for final map. Allocated TA 29. Boundary extended due to stakeholder comments.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 29	Hornsby	✓				
TA 30	The Hills Shire	✓	×	×	Removed in response to stakeholder comments.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 32	Hornsby	✓	×	×	Removed in response to stakeholder comments.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 33	Hornsby	✓	×	×	Removed in response to stakeholder comments.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 36	Ryde	✓	✓	✓	Adopted without change.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 37	Ryde	✓	×	✓	Removed from draft map in error. Included in final map.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 38	The Hills Shire	✓	×	×	Removed in response to stakeholder comments.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 39	The Hills Shire	✓	×	×	Removed because target was already met for vegetation type.	Red Bloodwood – Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin Bioregion
TA 40	Ku-ring-gai	✓	×	×	Removed in response to stakeholder comments.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 41	Hornsby	✓	✓	✓	Observatory Park added in response to stakeholder comments. Area zoned for residential removed from core area for final map.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 42	Ku-ring-gai	✓	×	×	Removed because target for vegetation type was already met.	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region

Core area ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Targeted key state or regional biodiversity value* (for core areas included in final BIO Map)
TA 43	The Hills Shire	✓	×	×	Removed because target for vegetation type was already met.	Smooth-barked Apple – Turpentine – Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region
TA 44	The Hills Shire	✓	✓	✓	Adopted without change.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 46	Camden	×	✓	✓	Included in response to stakeholder comments. Site supports a wide range of threatened and rare fauna. Small increase in area in response to stakeholder comments in final map.	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
TA 47	Hawkesbury	×	✓	✓	Included in response to stakeholder comments. Site supports threatened and migratory fauna.	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion
TA 48	Ryde	×	✓	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 49	Ku-ring-gai	×	✓	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 50	Ryde	×	✓	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 51	The Hills Shire	×	✓	✓	Selected in response to the removal of other core areas through stakeholder consultation. Additional area of targeted value was therefore required. Site contains large, important patch of targeted key state or regional biodiversity value.	Sydney Blue Gum – Blackbutt – Smooth-barked Apple moist shrubby open forest on shale ridges of the Hornsby Plateau, Sydney Basin Bioregion
TA 52	Ku-ring-gai	×	✓	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion

Core area ID	Councils	Included in indicative map	Included in draft map	Included in final map	Notes	Targeted key state or regional biodiversity value* (for core areas included in final BIO Map)
TA 53	Ku-ring-gai	×	×	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 55	Hornsby	×	✓	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 56	Hornsby	×	✓	✓	Included in response to stakeholder comments. Site supports targeted key state or regional biodiversity value.	Turpentine – Grey Ironbark open forest on shale in the lower Blue Mountains, Sydney Basin Bioregion
TA 57	Hawkesbury	×	×	✓	Included in response to stakeholder comments. Site supports threatened and migratory fauna.	Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion

* Core area may also include a number of other Plant Community Types.