6 Strategies for adaptation and mitigation

6.1 Summary of adaptation and mitigation strategies

Strategies and options to support adaptation and mitigation were identified through a series of workshops, together with additional regional consultation. Each of the strategies and options were assessed by stakeholders for their adaptation or mitigation benefit; social, technical and economic feasibility; potential for maladaptation and relevance over time (i.e. 2030, 2050, 2070 and 2090). These options are summarised in Table 2 below.

The options are described in detail in subsequent sections for each of the five planning areas, and where relevant for mitigation options the specific sequestration opportunities are highlighted. The rationale for the options and links to RCS objectives are set out in Section 7.1.

Table 2: Summary of adaptation and mitigation strategies

Adaptation and mitigation strategies	Planning area				
	Victorian Alps	Gippsland Lakes & Hinterland	Strzelecki Ranges	Coastal Landscapes	Wilsons Promontory
Cultural heritage					
Preservation of Aboriginal cultural heritage sites.	✓	✓	✓	✓	✓
Land and soil health					
Support the adoption of land management practices that improve soil health and production outcomes on grazing land.		✓	✓	✓	
Support programs that assist private landholders to adapt or make a planned retreat as a result of drier and warmer average conditions, increased salinity, inundation and erosion.		✓			
Support private land managers along the coast to adapt or make a planned retreat in areas impacted by sea level rise and storm surge.				✓	
Native vegetation and habitat					
Improve the adaptive capacity of vegetation communities through works to protect and improve their condition and connectivity.			✓		
Improve the adaptive capacity of remnant vegetation through works to increase connectivity, improve condition and protect high quality remnants.		✓	✓	✓	

Table 2: Summary of adaptation and mitigation strategies *continued*

Adaptation and mitigation strategies	Planning area				
	Victorian Alps	Gippsland Lakes & Hinterland	Strzelecki Ranges	Coastal Landscapes	Wilsons Promontory
Support carbon sequestration through the establishment of targeted biodiverse plantings in areas that address priorities for biodiversity, land and waterway health.		✓	✓	✓	
Improve the condition of Alpine peatlands to mitigate future impacts from drying climate.	✓				
Waterways and environmental water					
Investigate options to improve water security for domestic, industrial and agricultural uses while protecting flows for environmental outcomes.			✓		
Investigate options to improve security of environmental water for high value waterways and wetlands.		✓			
Identify priorities and develop plan of works to improve hydrological regime of floodplain wetlands and fringing wetlands.		✓		✓	
Diversify approaches used for managing environmental water.	✓				
Consider climate change impacts in future estuary management activities.		✓		✓	✓
Investigate options to lessen the offsite impacts to water quality following extreme events (e.g. flood, fire).	✓	✓	✓	✓	✓
Managing threats and adapting NRM programs					
Refine the approaches used by natural resource managers when planning and implementing fencing, weed control and revegetation programs to take account of changing climatic conditions.		✓	✓	✓	
Support fire management agencies to effectively control fires when they occur to reduce risk of fire to sensitive natural assets and support the recovery of communities from bushfire.	✓	✓	✓	✓	✓

Table 2: Summary of adaptation and mitigation strategies *continued*

Adaptation and mitigation strategies	Planning area				
	Victorian Alps	Gippsland Lakes & Hinterland	Strzelecki Ranges	Coastal Landscapes	Wilsons Promontory
Work with Local Government and State agencies to improve environmental outcomes.		✓	✓	✓	
Support coastal NRM agencies to plan for adaptation or retreat in areas impacted by sea level rise and storm surge.		✓		✓	✓
Improve the adaptive capacity of ecosystems by actively managing existing threats.	✓				✓
Support research and investigation to address knowledge gaps.	✓	✓	✓	✓	✓
Manage impacts to ecosystems from future pressures of increased recreational use.	✓		✓	✓	✓
Region wide strategies					
• Refine monitoring and evaluation programs to inform adaptive management under climate change. • Support increased community awareness and participation in climate change adaptation and mitigation programs. • Continue to coordinate partnership approaches for the planning and delivery of climate change adaptation and mitigation programs.					

6.2 Victorian Alps

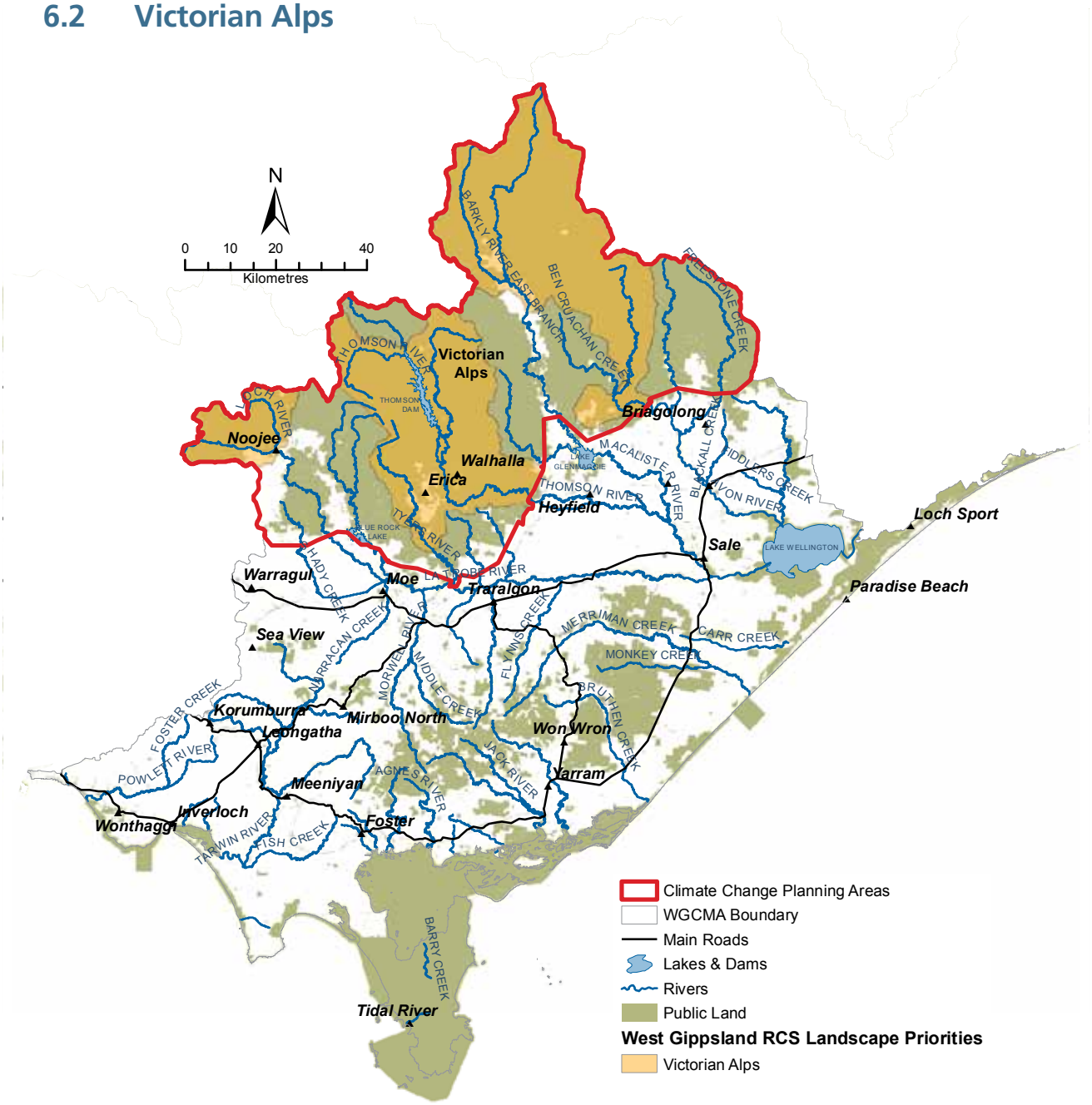

Figure 10: Victorian Alps climate change planning area

The Victorian Alps climate change planning area is characterised by its largely contiguous vegetation and topography. It is valued for its National and State Parks and Wilderness Areas, which provide for a wide array of recreational opportunities. Whilst the snow fields have always been popular, there is a growing trend towards summer recreation. There has been an overall increase in recreational use (e.g. 4WD, cycling, camping, horse-riding and trail bikes) and consequently visitors' desire better road access. Remote areas of the National Parks are now accessible and this will continue to increase. Recreational pressures are likely to increase in both intensity and geographic scope, placing increased pressures on vulnerable ecosystems.

There are relatively limited areas of forest utilisation in the planning area occurring within State forest, which encompass activities such as timber harvesting, licensed grazing and apiary.

Two key reservoirs are situated within the planning area: Blue Rock and Thomson. Blue Rock Reservoir supplies water for industrial, domestic and environmental purposes within the region. The Thomson Reservoir is an extremely important source of water for Melbourne, making up about 60% of Melbourne's total storage capacity.[29] Whilst the upper reaches of the rivers that flow through the landscape are currently in excellent to good condition,[11] these high value waterway systems are vulnerable from exposure to reduced and more episodic rainfall, and higher evapotranspiration rates.

The landscape is underpinned by relatively stable soils and contains largely intact ecological vegetation communities and numerous rare and threatened species. The presence of vegetation cover across much of the area contributes to generally high adaptive capacity of native vegetation and soils in particular, although the impacts associated with a likely increase in the intensity and frequency of large fires is likely to pose a significant future challenge to the values of all natural assets within the planning area.

Wetlands listed in the Directory of Important Wetlands of Australia (DIWA), which are valued for their intact hydrology, geomorphologic significance and habitat provision are a key feature of this landscape.[11] They include sensitive subalpine and alpine wetlands, such as Caledonia Fen and Tali Karng, and EPBC listed Alpine Sphagnum Bogs and associated Fens. Unique and restricted flora and fauna species are reliant upon these alpine peatlands and sphagnum bogs. Alpine Ash (Eucalyptus delegatensis) and Mountain Ash (Eucalyptus regnans) are iconic tree species within this landscape. As the alpine peatlands are fed by groundwater and Ash forests require high rainfall, they would be especially vulnerable to a warming, drying trend and an increase in fire frequency and intensity.

The historic sequence of fires, flood and drought has had a large impact on the landscape to date. The true impact of repeated burning on the make-up of vegetation communities is uncertain. The impact of fire will be felt in relation to natural assets within the planning area and more broadly in terms of increased soil loss and reduced water quality in downstream waterways and coastal ecosystems.

Threats that will be accelerated due to climate change in the Victorian Alps relate to the intensity and frequency of fire, new and emerging invasive plant and animal species, and changes in seasonal timing, which alter animal and plant phenology.

A major risk concerns the reduced extent of refugia for plants and animals that are adapted to (and limited by) the very specialised ecosystems of the Alps.[30] Alpine plant and animal species have evolved to cope with environmental extremes, including low temperatures, high winds, snow cover for long periods and seasonal inundation. Subsequently many species are found only in alpine areas and include species at risk of extinction (e.g. the Baw Baw Frog). Alpine-adapted species are vulnerable to climate change impacts, such as changes in snow cover, stream flows and frequency of large scale wildfire.[30]

Table 3: Strategies for climate change adaptation and mitigation – Victorian Alps

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
VA 1 – Support fire management programs that adopt appropriate fire regimes to manage sensitive natural assets and assist the recovery of ecological communities from bushfire.	a	*Explore alternative fuel management techniques so that tolerable fire intervals are not exceeded by planned burns.*	✓			
	b	*Improve fire planning processes and on ground wildfire management activities to protect sensitive natural assets.*	✓			✓
VA 2 – Improve the adaptive capacity of ecosystems in the Victorian Alps by actively managing existing threats.	a	*Active management of invasive plants and animals in the highest value ecosystems in the sub-alpine and alpine areas.*	✓			
	b	*Fence and revegetate wide riparian buffers along priority waterways where there is a private land interface.*	✓	✓		
	c	*Undertake large scale re-seeding of vegetation communities following wildfire (for example Alpine Ash and Mountain Ash).*	✓	✓		
VA 3 – Improve the condition of Alpine peatlands to mitigate future impacts from drying climate.	a	*Consider options to address threats to the hydrological regime of peatlands (including engineering options, willow control, close, re-align or rehabilitate inappropriate tracks, roads and drainage lines and preventing access). *Focus on Baw Baw peatlands as the highest priority.*	✓			✓
VA 4 – Support research and investigation to address knowledge gaps.	a	*Explore implications of climate change for groundwater dependent ecosystems, including springs.*	✓			
	b	*Identify and protect drought refuges across the planning area.*	✓			
	c	*Monitor the responses of highly susceptible ecological communities and keystone species to a changing climate.*	✓			
	d	*Monitoring of invasive species with a focus on new and emerging species.*	✓			

Table 3: Strategies for climate change adaptation and mitigation – Victorian Alps *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
VA 5 – Managing impacts to alpine ecosystems from future pressures of increased recreational use.	a	*Continue to collect information on alpine peatland condition to better understand thresholds and response to current management activities.*	✓			
	b	*Manage access to sensitive areas through zoning of public land to concentrate people in designated areas, improving facilities through construction of boardwalks and formal access tracks, and prohibiting access in some places.*	✓			
	c	*Raise visitor awareness of the values of the alpine areas, their sensitivity to human impacts and the rationale for particular management activities.*	✓			
VA 6 – Diversify approaches used for managing environmental water.	a	*Continue to raise awareness of the purpose and need for environmental water in the Gippsland region.*	✓			
	b	*Factor the vulnerability of waterways (including wetlands) to climate change into environmental water planning.*	✓			
	c	*Investigate options to address identified environmental water shortfalls.*	✓			
VA 7 – Investigate options to lessen the offsite impacts to water quality following extreme events (e.g. flood, fire).	a	*Undertake risk management planning for land use management under climate change.*	✓			
VA 8 – Preservation of Aboriginal cultural heritage sites.	a	*Explore how to best incorporate specific management recommendations relating to climate change impacts on Aboriginal sites into Cultural Heritage Management Plans (CHMPs).*	✓			

6.3 Gippsland Lakes and Hinterland (including the Latrobe River system)

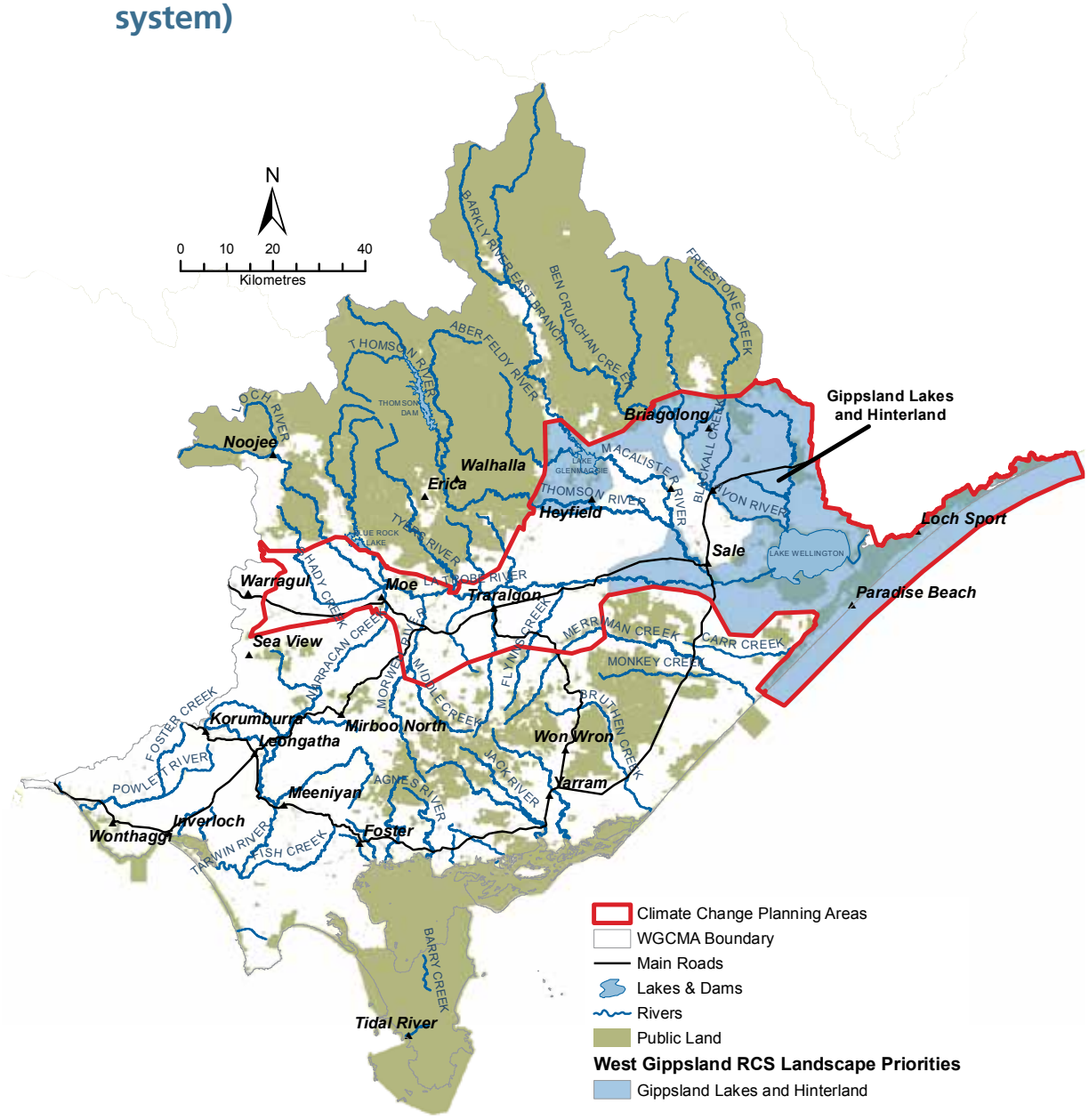

Figure 11: Gippsland Lakes and Hinterland climate change planning area

The Gippsland Lakes and Hinterland climate change planning area is characterised by the iconic Gippsland Lakes and wetlands Ramsar site. The Gippsland Lakes is of high social, economic, environmental and cultural value and is a major drawcard for tourists.

Ongoing protection of the values of significant natural assets within the planning area is of importance, as current threats (e.g. inappropriate fire regimes, invasive plants, flow stress, salinity) are likely to be amplified by climate change.

Natural grassy woodland ecosystems across the planning area have historically been cleared and converted to land used for pasture and cropping. The Gippsland Red Gum Grassy Woodland and associated Native Grassland ecological community is the focus of recent initiatives that are aimed at protecting the high quality areas of the EPBC Act listed community, which may increase their resilience to climate change impacts.

A number of major Gippsland rivers (Latrobe, Thomson, Macalister, Avon and Perry) all drain through floodplains to Lake Wellington and ultimately the Southern Ocean, with the Perry River being one of the few waterways in Victoria to have an intact chain of ponds geomorphology.[11] Many landholders along the major waterways have been involved in programs to remove willows and fence and revegetate riparian areas. Floods have caused major damage to waterways within the planning area, and a program of flood recovery works has also been undertaken over the last 3 - 5 years.

Future climate projections indicate a decline in average rainfall in the upper catchment of the Gippsland Lakes. This is likely to reduce stream flows, posing challenges for the health of waterways flowing into the Gippsland Lakes, as well as exacerbating increasing salinity levels in the lower reaches.

Large areas of floodplain wetlands on the lower Thomson and Macalister Rivers have been fenced and vegetation restored. The management of water regimes in fringing wetlands has received increased attention in recent years, and along with complementary works at sites like the Heart Morass and Sale Common, the condition of these wetlands is improving.

There have been episodic changes in the fringing wetlands and main lakes as a result of increasing salinity of the lakes, changes to river flows and natural events such as drought, fire and flood. Land around Lake Wellington that has been subjected to increased salinisation is already seeing a transition from pasture to saltmarsh.

The predicted increase in sea level and associated impact of storm surges has the potential to profoundly change the values and function of important natural ecosystems of the Gippsland Lakes and hinterland. Changes are already being experienced in some areas as a result of rising sea levels and some values, such as those associated with the Lakes and their fringing wetlands are likely to be rapidly diminished by 2070. This will inevitably mean that difficult trade-off decisions will need to be considered regarding which assets are worthy of protection 'at all costs', or whether there needs to be an acceptance that their future values will be different.

Urban growth is increasing along the western end of the Princes Highway corridor, particularly in Yarragon, Trafalgar, Moe, Morwell and Traralgon. As a result rural drains are becoming formalised and constructed wetlands are being developed for stormwater management.

In addition to urban growth there has been an increase in the number of small lifestyle/hobby farms around the edges of large and small towns. Unlike the urban growth which is concentrated in the west of the planning area (Baw Baw Shire and Latrobe City Council) the increase of hobby farms is occurring across the planning area.

Within the Latrobe Valley the coal industry is a major presence and influence in the landscape. In addition to the land that is taken up by coal mines, the industry holds large water entitlements and discharges water through river systems. AGL have indicated in their Greenhouse Gas Policy released on 17 April 2015 that they will be closing all existing coal-fired power stations in its portfolio by 2050.[31] This may possibly result in the eventual decommissioning of the Loy Yang A coal-fired power station. As noted in the 2011 Gippsland Region Sustainable Water Strategy, any Latrobe Valley open cut mine closure and restoration strategies will need to consider impacts on groundwater and surface water resources.[32]

There is a strong history of large scale commercial farming throughout the planning area, including the Macalister Irrigation District (MID), which is the largest irrigation area south of the Great Dividing Range. A mixture of agroforestry and commercial forestry plantations can be found in the Perry River area and to the south of the Latrobe River around Holey Plains.

Farmers continually adapt to climatic variability in the short and long term and look for opportunities to better use their land. Changes in land use and management practices have been observed throughout the area, particularly since the drought during the early 2000's. Water availability has driven water use efficiency measures on farm and the nutrient reduction focus for the Gippsland Lakes has seen local businesses participating in farm planning and implementation of on farm measures such as reuse dams. In recent years the MID has undergone 'modernisation' with upgrades to irrigation infrastructure both on farm and within the delivery system.

In the MID, the Avon River floodplain and around Seaspray there has been a shift to horticulture from dairy and dryland grazing and cropping. The increase in horticulture includes farms moving from other areas of Australia which have become less reliable in terms of water availability and climate.

A shift from year round high levels of ground cover (pasture) to seasonal cultivation and harvesting practices (i.e. cropping and horticulture) can present an increased risk of sediment and nutrient loss following rainfall events. An increase in farm dams in the catchment (for stock and domestic use and irrigation) can have an impact on catchment yield and contribute to flow stress in rivers.

Fire in the catchment is a major threat to both agriculture and the natural assets. Both wildfire and planned burns are increasing in frequency and area. The impact of large fires on the health of the Gippsland Lakes and the condition and diversity of native vegetation is significant.

Further challenges will be experienced in the hinterland for soils, waterways and floodplain wetlands due to changes in agricultural land uses as a result of both market forces, water availability and a changing climate.

Table 4: Strategies for climate change adaptation and mitigation – Gippsland Lakes and Hinterland

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
GLH 1 – Support programs that assist private landholders to adapt or make a planned retreat as a result of drier and warmer average conditions, increased salinity, inundation and erosion.	a	*Education and awareness programs for private landholders about the impacts and options to manage for drier average conditions, rising sea level, increased erosion and inundation.*	✓			
	b	*Provide incentives to allow for natural regeneration of vegetation communities that are well adapted to increased salinity and inundation (such as saltmarsh and brackish wetland communities).*	✓		✓	
GLH 2 – Work with Local Government and State agencies to improve environmental outcomes.	a	*Explore land use planning mechanisms to protect high value natural assets on agricultural land subject to enterprise change.*	✓			✓
	b	*Explore options to protect high value floodplain and plains wetlands of the Latrobe River valley, Macalister Irrigation District and the Avon and Perry Rivers.*	✓			
GLH 3 – Refine the approaches used by natural resource managers when planning and implementing fencing, weed control and revegetation programs to take account of changing climatic conditions.	a	*Adjust species mixes for revegetation activities to suit changed conditions (drier, warmer, increased salinity, increased inundation).*	✓	✓	✓	
	b	*Consider use of a range of management techniques to maintain diversity within grassy ecosystems.*	✓			
	c	*Consider use of natural regeneration and direct seeding to achieve establishment of native vegetation.*	✓	✓	✓	
	d	*Encourage and provide incentives for landholders to fence and revegetate wider riparian buffers along priority waterways.*	✓	✓	✓	
	e	*Support projects that improve and protect the condition, diversity and structure of existing habitat (particularly Gippsland Grassy Woodland and Seasonal Herbaceous Wetlands).*	✓	✓	✓	
GLH 4 – Improve the adaptive capacity of remnant vegetation through works to increase connectivity, improve condition and protect high quality remnants	a	*Identify appropriate delivery mechanisms to achieve outcomes (including covenants, planning scheme tools and incentives).*	✓			

Table 4: Strategies for climate change adaptation and mitigation – Gippsland Lakes and Hinterland *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
GLH 5 – Investigate options to improve security of environmental water for high value waterways and wetlands.	a	*Factor the vulnerability of waterways (including wetlands) to climate change into environmental water planning.*	✓			
	b	*Investigate alternate delivery methods to provide environmental water to high value waterways and wetlands (e.g. use of irrigation infrastructure).*	✓			
	c	*Investigate the feasibility of options that address identified environmental water short falls.*	✓			
GLH 6 – Identify priorities and develop plan of works to improve hydrological regime of floodplain wetlands and fringing wetlands.	a	*Construction of treatment wetlands to capture stormwater from existing developed areas.*	✓		✓	
	b	*Investigate partial re-engagement of old river meanders to increase riverine wetland habitat.*	✓		✓	
	c	*Plan of works to consider earthworks and waterway structures and options to work with landholders to manage water for multiple outcomes (e.g. floodplain wetlands upstream of the Swing Bridge).*	✓			
GLH 7 – Support fire management programs that adopt appropriate fire regimes to manage sensitive natural assets and assist the recovery of ecological communities from bushfire.	a	*Potential areas to focus on include rainforest, riparian and wetland habitats.*	✓			
GLH 8 – Support carbon sequestration through the establishment of targeted biodiverse plantings in areas that address priorities for biodiversity, land and waterway health.	a	*Encouraging landholders in peri-urban areas to undertake biodiverse plantings and allow natural regeneration to occur (with consideration to fire risk).*	✓	✓		
	b	*Fence and revegetate wide riparian buffers along priority waterways.*	✓	✓	✓	

Table 4: Strategies for climate change adaptation and mitigation – Gippsland Lakes and Hinterland *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
GLH 8 – Support carbon sequestration through the establishment of targeted biodiverse plantings in areas that address priorities for biodiversity, land and waterway health *continued*	c	*Improve connectivity and buffer remnant ecosystems, with a focus on rare or unique types including chain of ponds systems.*	✓	✓	✓	
	d	*Improve connectivity and buffer remnant vegetation with a focus on Red Gum Grassy Woodland and Seasonal Herbaceous Wetlands of the temperate plain.*	✓	✓	✓	
GLH 9 – Support research and investigation to address knowledge gaps.	a	*Build on recent knowledge that highlights the potential for blue carbon sequestration in saltmarsh, seagrass and mangrove habitats to explore how restoration programs might be designed to capitalise on opportunities.*	✓		✓	
	b	*Explore implications of climate change for groundwater dependent ecosystems, including springs.*	✓			
	c	*Explore risks and opportunities for water and waterway management in the Latrobe Valley that may arise as the result of any potential decommissioning of the Latrobe Valley coal mines and changes to the power industry in the long-term future.*	✓			
	d	*Identify and protect drought refuges across the planning area.*	✓			
	e	*Improve knowledge of how wetland type and function will change as a result of drier, warmer and more variable climate to inform future management.*	✓		✓	
	f	*Improve knowledge of response of Red Gum Grassy Woodland to warmer, drier conditions to inform future management.*	✓			
	g	*Model future spread of established weeds to inform planning for coordinated control across land tenure.*	✓			
	h	*Monitor the responses of highly susceptible ecological communities and keystone species to a changing climate.*	✓			

Table 4: Strategies for climate change adaptation and mitigation – Gippsland Lakes and Hinterland *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
GLH 10 – Support the adoption of land management practices that improve soil health and production outcomes on grazing land.	a	*Encourage landholders to adopt practices that:* - *Improve ground cover, moisture retention, and reduce runoff following summer rainfall events.* - *Optimise grazing management systems with consideration to stocking rates, nutrient management, herd composition, breeding times and destocking.* - *Follow best management practice techniques (e.g. flexible grazing techniques, use of summer active perennials in pasture systems, changing cultivars to those better adapted to maintain ground cover at all locations, minimum-till, and controlled traffic farming, etc.).*	✓			✓
GLH 11 – Consider climate change impacts from sea level rise, storm surge and catchment processes in future management of estuaries.	a	*Establish long term monitoring programs for estuaries and associated habitats.*	✓			
	b	*Explicitly factor climate change into estuary management.*	✓			
GLH 12 – Support coastal NRM agencies to plan for adaptation or retreat in areas impacted by sea level rise and storm surge.	a	*Identify location and likely impact on natural assets from increased salinity, inundation and coastal erosion.*	✓			
	b	*Investigate options to add land to the national reserve system to provide for migration of habitats.*	✓	✓	✓	
	c	*Relocate infrastructure impacted by storm surge and sea level rise and rehabilitate to prevent further erosion.*	✓			
GLH 13 – Investigate options to lessen the offsite impacts to water quality following extreme events (e.g. flood, fire).	a	*Undertake risk management planning for land use management under climate change.*	✓			
GLH 14 – Preservation of Aboriginal cultural heritage sites.	a	*Explore how to best incorporate specific management recommendations relating to climate change impacts on Aboriginal sites into Cultural Heritage Management Plans (CHMPs).*	✓			

6.4 Strzelecki Ranges

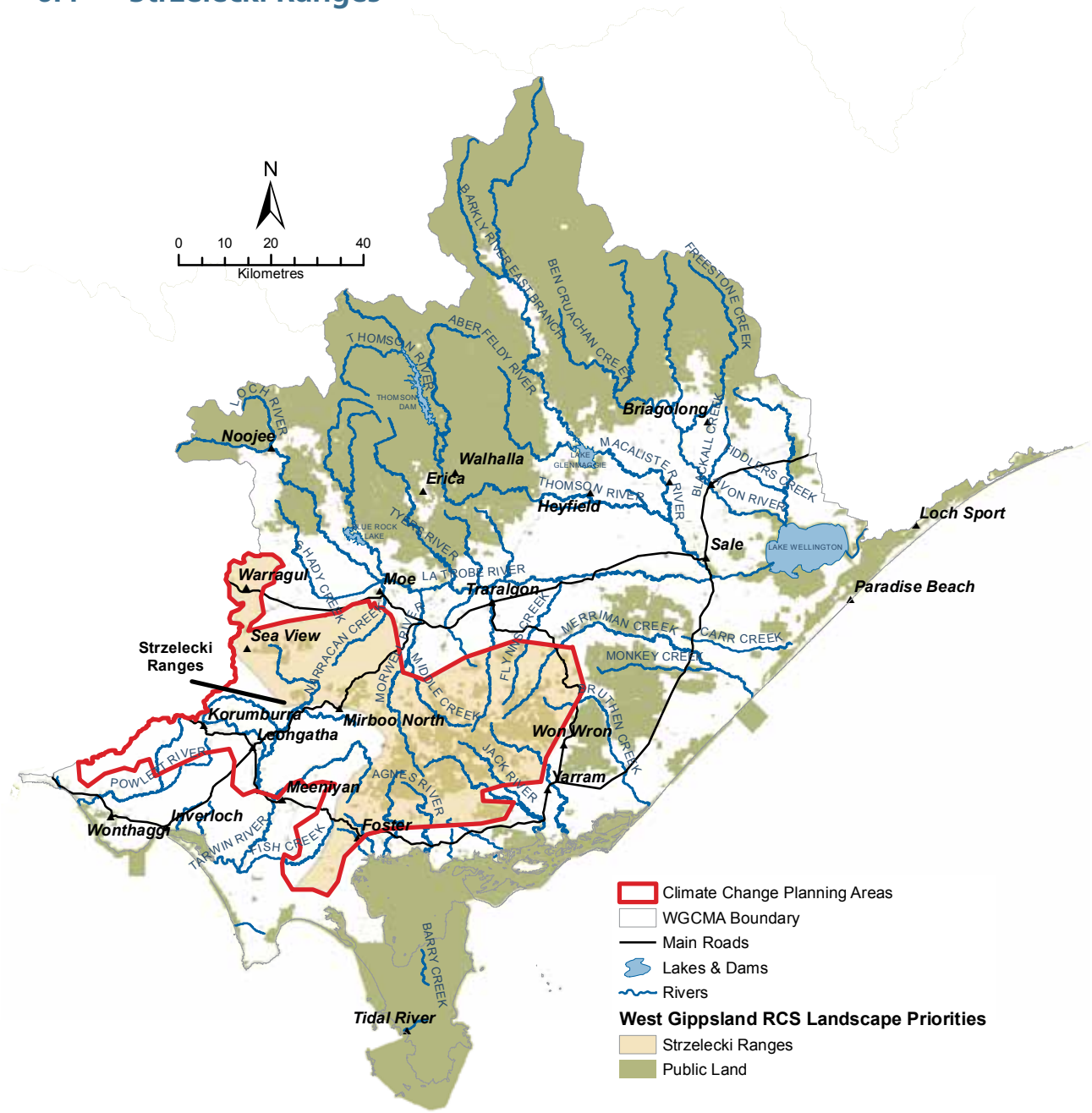

Figure 12: Strzelecki Ranges climate change planning area

The Strzelecki Ranges climate change planning area is characterised by its steep topography, high rainfall and fertile soils. It is a fragmented landscape, containing remnant native vegetation patches of varying sizes. The area is valued for its National Parks and reserves and contains native vegetation of high ecological value (including Cool Temperate and Warm Temperate Rainforests, Wet and Damp Forests), as well as supporting groundwater dependent ecosystems. Within the Strzelecki Ranges, the majestic Tarra Bulga National Park and upper Tarra River attract residents and visitors alike, while also providing habitat for threatened species.[11]

Whilst native vegetation cover across the Strzelecki Ranges is observed to be increasing through revegetation activities (e.g. riparian, steep slopes, shelterbelts), the extent of remnant native vegetation (including mature scattered trees) is still generally declining. New trees planted will take many years to mature and develop habitat hollows which can replace the lost remnant scattered trees. Many invasive plant species have become naturalised across the Strzelecki Ranges. In some cases invasive plants are providing habitat for native fauna and have become novel ecosystems (e.g. hawthorn and blackberry are providing habitat for small birds and mammals within cleared landscapes).

The landscape supports intensive agricultural and forestry production.[11] In general the climate conditions in the Strzelecki Ranges are not as extreme as other places. Deep soils together with reliable rainfall and a mild climate have driven productivity in the area. Mixed grazing, dairy, potatoes and other horticulture, along with an increasing number of lifestyle or small farms, make up the majority of the agricultural land uses.

In recent times there has been substantial change in the mix of enterprises in the Strzelecki Ranges. The area has seen an increase in the number of small producers, particularly in the western part of the Strzelecki Ranges (e.g. garlic, wine, vegetables, eggs); with dairy, beef and sheep still the dominant enterprises in the east. It is likely that the rich red soils (ferrosol) will be sought after for horticulture in the future, with snow peas and bean production having been observed to already be shifting to these areas. For enterprises reliant upon irrigation, there will be a need to alter and match irrigation methods to the soil type, crop type, landform and topography, to minimise water loss under a changing climate.

Steep slopes across the planning area are at risk from tunnel erosion and land slippage. The general trend for dairy is to move to areas lower in the landscape, due to the high costs and additional management issues associated with running enterprises on steep land. There are potential viability issues for potato farming, due to market forces and profitability concerns.

However, the steep slopes and areas of lower productivity across the planning area are suitable for the establishment of vegetation plantings for both carbon sequestration, soil stabilisation and biodiversity benefits.

Extensive willow control, revegetation works and fencing to exclude stock, has been undertaken on the major waterways in the planning area (Tarwin, Powlett, Agnes, Franklin, Albert, Jack, Tarra and Morwell Rivers, and Traralgon Creek). Vegetation quality along waterways in the headwater areas is often very good, including within forestry plantation areas. Water quality is generally poor in the cleared areas and is linked to slope, lack of ground cover, some farm practices, instream erosion and lack of a riparian buffer.

Whilst an increase in fire intensity and frequency, and invasive plants are major threats that are likely to be exacerbated by climate change, future projections of mild warmer winters are seen as being favourable for primary producers due to more pasture growth and less pugging.

Table 5: Strategies for climate change adaptation and mitigation – Strzelecki Ranges

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
SR 1 – Support the adoption of land management practices that improve soil health and production outcomes on grazing land.	a	*Encourage landholders to adopt practices that:* - *Improve ground cover, moisture retention, and reduce runoff following summer rainfall events.* - *Optimise grazing management systems with consideration to stocking rates, nutrient management, herd composition, breeding times and destocking.* - *Follow best management practice techniques (e.g. flexible grazing techniques, use of summer active perennials in pasture systems, changing cultivars to those better adapted to maintain ground cover at all locations, minimum-till, and controlled traffic farming, etc.).*	✓			✓
SR 2 – Support fire management programs that adopt appropriate fire regimes to manage sensitive natural assets and assist the recovery of ecological communities from bushfire.	a	*Explore alternative fuel management techniques so that tolerable fire intervals are not exceeded by planned burns.*	✓			
	b	*Incorporate fire prevention areas (fire breaks, fuel reduction zones, buffers, active patrolling and protection) to protect fire sensitive vegetation communities.*	✓			
SR 3 – Improve the adaptive capacity of remnant vegetation through works to increase connectivity, improve condition and protect high quality remnants.	a	*Encourage landholders to protect small patches of remnant vegetation and single trees on private land.*	✓	✓		
	b	*Increase awareness of the importance and function of small patches of remnant vegetation in the landscape.*	✓			
SR 4 – Improve the adaptive capacity of vegetation communities through works to protect and improve their condition and connectivity.	a	*Identify appropriate delivery mechanisms to achieve outcomes (including covenants, planning scheme tools and incentives).*	✓			
	b	*Implement pest plant and animal control programs for species with a high impact on revegetation works.*	✓	✓		
	c	*Provide a buffer around sensitive vegetation types through revegetation of the target or adjacent vegetation type.*	✓	✓		

Table 5: Strategies for climate change adaptation and mitigation – Strzelecki Ranges *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
SR 5 – Investigate options to improve water security for domestic, industrial and agricultural uses while protecting flows for environmental outcomes.	a	*Improve on farm water security through restructuring of farm water infrastructure.*	✓			
	b	*Investigate alternative options for farm dams based on audit of use (including decommission and adding habitat features).*	✓			
	c	*Encourage increased reuse and recycling of water by agriculture and industry.*	✓			
	d	*Support connection of urban water supply to desalinisation to improve security of domestic and industrial supply and reduce flow-related risks to the Tarwin River and its tributaries in drought periods.*	✓			
SR 6 – Work with Local Government and State agencies to improve environmental outcomes.	a	*Identify productive land and undertake prioritisation and planning to ensure soil and land health and productivity is maintained.*	✓	✓		✓
	b	*Consider feasibility of planning regulations to allow for house construction with conditions for environmental management in the unproductive steep areas.*	✓	✓		✓
	c	*Explore land use planning mechanisms to protect high value natural assets on agricultural land subject to enterprise change.*	✓			✓
SR 7 – Refine the approaches used by natural resource managers when planning and implementing fencing, weed control and revegetation programs to take account of changing climatic conditions.	a	*Consider different species mixes from the range of EVCs across the Strzelecki's in revegetation projects to improve success rates to retain functioning ecosystems.*	✓	✓		
SR 8 – Support carbon sequestration through the establishment of targeted biodiverse plantings in areas that address priorities for biodiversity, land and waterway health.	a	*Consider a range of options to establish perennial vegetation (including shelter belts, deciduous trees, biodiverse plantings, tree crops) across cleared productive areas on farms.*	✓	✓		✓

Table 5: Strategies for climate change adaptation and mitigation – Strzelecki Ranges *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
SR 8 – Support carbon sequestration through the establishment of targeted biodiverse plantings in areas that address priorities for biodiversity, land and waterway health *continued*.	b	*Establish large scale biodiverse plantings on steep slopes and areas of lower productivity.*	✓	✓		✓
	c	*Fence and revegetate wide riparian buffers along priority waterways and gullies (30-40m wide). Target to areas of high risk of erosion and sediment loss.*	✓	✓		✓
	d	*Implement on ground works program to increase vegetation extent to 30% cover in landscape whilst retaining productive agricultural land.*	✓	✓		✓
	e	*Investigate the potential to establish native vegetation on disused road reserve and crown water frontage leases.*	✓	✓		✓
	f	*Protect core habitat areas and increase the extent of vegetation by linking areas of habitat.*	✓	✓		✓
SR 9 – Manage impacts to Strzelecki Ranges ecosystems from future pressures of increased recreational use.	a	*Manage access to sensitive areas through zoning of public land to concentrate people in designated areas, improving facilities through construction of boardwalks and formal access tracks, and prohibiting access in some places.*	✓			
	b	*Raise visitor awareness of the values of the Strzelecki Ranges ecosystems, their sensitivity to human impacts, and the rationale for particular management activities.*	✓			
SR 10 – Support research and investigation to address knowledge gaps.	a	*Explore implications of climate change for groundwater dependent ecosystems, including springs.*	✓			
	b	*Identify and protect drought refuges across the planning area.*	✓			
	c	*Monitor the responses of highly susceptible ecological communities and keystone species to a changing climate.*	✓			
SR 11 – Investigate options to lessen the offsite impacts to water quality following extreme events (e.g. flood, fire).	a	*Undertake risk management planning for land use management under climate change.*	✓			
SR 12 – Preservation of Aboriginal cultural heritage sites.	a	*Explore how to best incorporate specific management recommendations relating to climate change impacts on Aboriginal sites into Cultural Heritage Management Plans (CHMPs).*	✓			

6.5 Coastal Landscapes (including Bunurong Coast, Corner Inlet Nooramunga and Mullungdung)

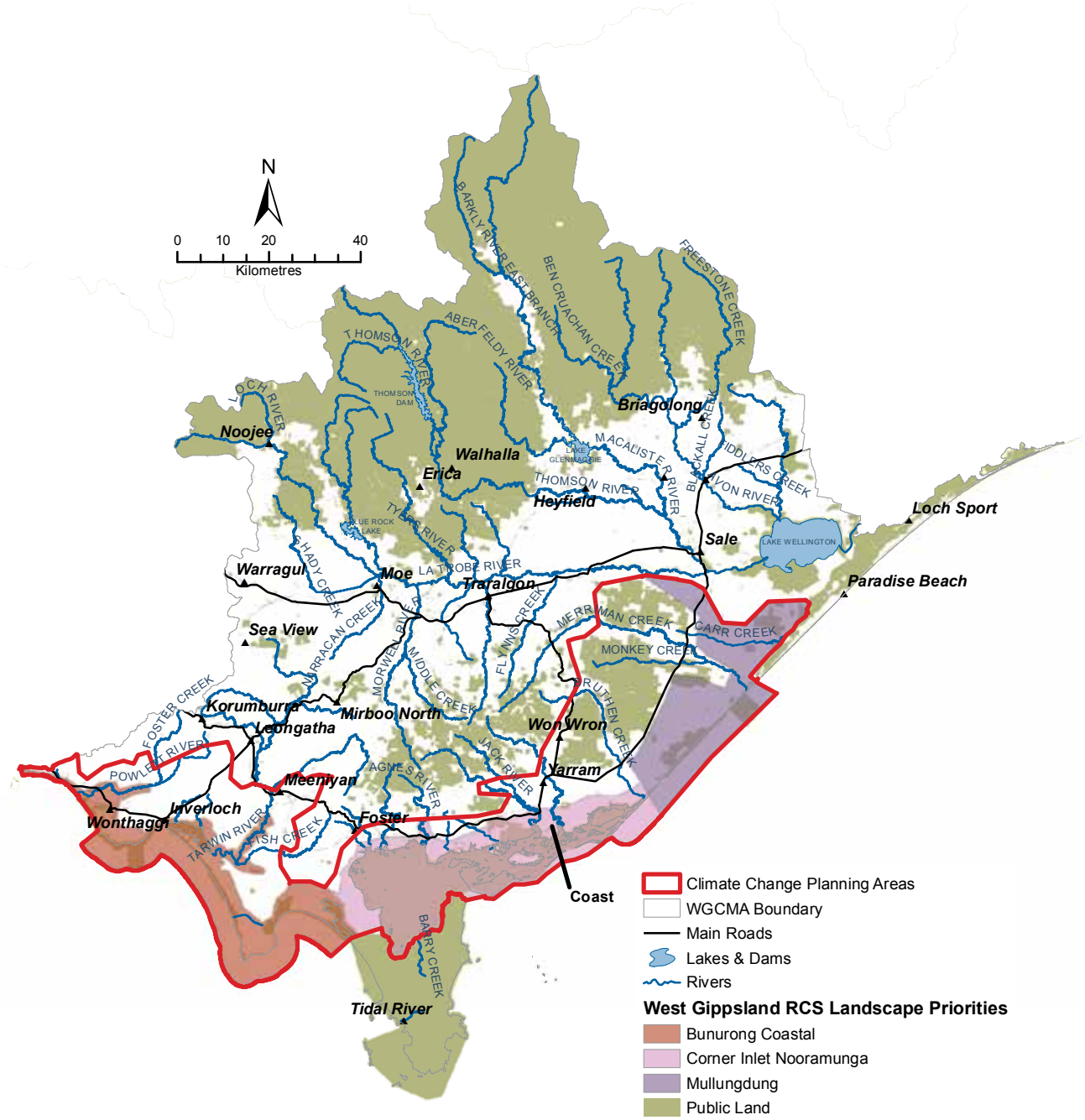

Figure 13: Coastal landscapes climate change planning area

The coastal landscapes climate change planning area encompasses three West Gippsland RCS Landscape Priority Areas (Bunurong Coastal, Corner Inlet Nooramunga and Mullungdung).

The Bunurong Coast is characterised by estuarine and coastal environments containing extensive intertidal rock platforms and sub-tidal rocky reefs, which are home to diverse ecological communities. It contains fossil sites of international and national significance and areas of cultural heritage sensitivity.[11] The Powlett River estuary closes most years and depending on the conditions in summer and autumn it may open naturally or require an artificial opening if public assets and private land becomes impacted. WGCMA and Parks Victoria have been working together to manage estuary openings on the Powlett River and an estuary management plan is currently being developed to help guide overall management of the estuary.

Corner Inlet Nooramunga is characterised by short, dynamic and independent river systems, which drain from the Strzelecki Ranges to the internationally recognised Corner Inlet Ramsar site and Nooramunga Marine and Coastal Park. Corner Inlet is listed in the Directory of Important Wetlands of Australia (DIWA) and is an East Asian-Australasian Shorebird Site, which provides a drought refuge for migratory and resident birds. Corner Inlet supports a commercial fishing industry, as well as recreational fishing and water based activities.[11]

The seagrass and saltmarsh communities found within both the Bunurong Coast and Corner Inlet Nooramunga areas provide habitat for migratory waders, resident birds and native fish. Corner Inlet, Shallow Inlet and Anderson Inlet have been the focus of a range of ongoing NRM programs, including control of Spartina, fencing of saltmarsh and foreshore areas, and pest animal control.

The extensive sandy beaches and marine waters of Ninety Mile Beach are a popular destination for local fishermen, holidaymakers and tourists and have Indigenous cultural heritage significance. Jack Smith Lake and its associated wetlands are listed in the Directory of Important Wetlands of Australia (DIWA) and are valued for the diversity of bird species they support.[11]

The coastal and marine parks and reserves situated along the planning area coastline are valued for their natural scenic values, the recreational opportunities they provide, the range of complex habitats and vegetation communities and numerous threatened species they support.[11] However, storm surge is having an impact on the beaches and coastal vegetation in many places along the coast.

Largely fragmented remnant native vegetation across the entire planning area is of high biodiversity and natural value, though it is poorly connected to larger remnants located within State Parks and conservation reserves (such as the Mullungdung State Forest). Endangered, rare and vulnerable ecological vegetation classes, including the EPBC Act listed Gippsland Red Gum Grassy Woodland and associated Native Grassland ecological community are found within the planning area.[11]

The extent of native vegetation is believed to be increasing throughout the planning area due to NRM programs focused on revegetating waterways and gullies, and creating wildlife corridors and shelter belts. However, extreme events (e.g. fire) and climate conditions over recent years have impacted on the health of vegetation, with tree deaths from extreme heat, loss of coastal vegetation from storm surge, and inland migration of saline tolerant vegetation being observed.

There is an increasing demand for land and urban development along the coast (particularly in Bass Coast and South Gippsland Shires) and recreational use is on the increase due to the proximity to Melbourne. Recreational pressures are likely to increase in both intensity and geographic scope, placing increased pressures on vulnerable ecosystems.

The hinterland surrounding the coast is a largely cleared environment, with fertile and productive soils underpinning a vigorous and varied agricultural sector. In recent times there has been a change in the types of agricultural production with an increase in horticulture, and some intensive production systems (chickens and feedlot cattle operations) in the Bass Coast and South Gippsland Shires.

Further east the trend is different, with a shift from sheep and beef grazing and cropping to forestry (plantation forestry and agroforestry). In general dairy has moved out of the steeper areas to the flatter floodplain areas, while in the hillier areas beef and lifestyle properties dominate.

There is a growing recognition of Gippsland as a 'food bowl' due to a combination of reliable climate, productive soils and proximity to Melbourne. Across the agricultural industries there appears to be an increased awareness of threats to the natural environment from land management practices and an increase in application of best management practices.

Sea walls were built along the coastline to reclaim intertidal areas and these areas are now used for agriculture. Sea walls and their management continue to be a contentious issue for local government and private landholders along the coast.

As sea level rises and storm surge exacerbates coastal erosion, the coastal zone will be squeezed between the ocean and infrastructure. For many coastal ecosystems, the biggest obstacle to migrate naturally inland is the presence of roads, houses and other infrastructure, such as seawalls and levees.

Climate change is likely to increase the frequency, intensity and extent of existing coastal hazards (such as wildfire, flooding, acid sulfate soils, landslips and landslides, coastal erosion processes and inundation).

Table 6: Strategies for climate change adaptation and mitigation – Coastal Landscapes

Strategies		Options for strategy implementation	Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
CL 1 – Support coastal NRM agencies to plan for adaptation or retreat in areas impacted by sea level rise and storm surge.	a	*Identify natural assets and infrastructure impacted by increased salinity, inundation and coastal erosion.*	✓			
	b	*Investigate longevity of sea walls in providing protection from sea level rise and consider alternate management arrangements.*	✓			
	c	*Investigate options to add land to the national reserve system to provide for migration of habitats.*	✓		✓	
CL 2 – Support private land managers along the coast to adapt or make a planned retreat in areas impacted by sea level rise and storm surge.	a	*Education and awareness programs for private landholders about the impacts and options to manage for rising sea level, increased erosion and inundation.*	✓			
	b	*Investigate land use planning approaches to protect high value agricultural land and provide opportunities for enterprise change.*	✓			✓
	c	*Provide incentives to allow for mangrove and saltmarsh communities to retreat as a result of sea level rise.*	✓		✓	
CL 3 – Support carbon sequestration through the establishment of targeted biodiverse plantings in areas that address priorities for biodiversity, land and waterway health.	a	*Encourage landholders to use local native species in plantings for shade and shelter.*	✓	✓		
	b	*Fence and revegetate wide riparian buffers along priority waterways.*	✓	✓	✓	
	c	*Investigate the potential to establish native vegetation on disused road reserve and crown water frontage leases.*	✓	✓		✓
	d	*Protect retreating mangrove and saltmarsh communities through fencing.*	✓		✓	
CL 4 – Improve the adaptive capacity of remnant vegetation through works to increase connectivity, improve condition and protect high quality remnants.	a	*Identify appropriate delivery mechanisms to achieve outcomes (including covenants, planning scheme tools and incentives).*	✓			
	b	*Undertake local level planning drawing on vulnerability assessment results, biodiversity planning information to identify candidate areas.*	✓	✓		

Table 6: Strategies for climate change adaptation and mitigation – Coastal Landscapes *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
CL 5 – Refine the approaches used by natural resource managers when planning and implementing fencing, weed control and revegetation programs to take account of changing climatic conditions.	a	*Consider inclusion of dry tolerant species and pliable vegetation in revegetation programs.*	✓			
CL 6 – Support fire management programs that adopt appropriate fire regimes to manage sensitive natural assets and assist the recovery of ecological communities from bushfire.	a	*Explore alternative fuel management techniques so that tolerable fire intervals are not exceeded by planned burns.*	✓			
	b	*Potential areas to focus on include rainforest, riparian and wetland habitats and coastal heathland.*	✓			
CL 7 – Support research and investigation to address knowledge gaps.	a	*Build on recent knowledge that highlights the potential for blue carbon sequestration in saltmarsh, seagrass and mangrove habitats to explore how restoration programs might be designed to capitalise on opportunities.*	✓		✓	
	b	*Explore implications of climate change for groundwater dependent ecosystems, including springs.*	✓			
	c	*Identify and assess implications of maintaining novel habitats in the landscape.*	✓			
	d	*Identify and protect drought refuges across the planning area.*	✓			
	e	*Monitor and document the effects of warmer and drier average conditions on different vegetation and determine the best species to include in revegetation programs.*	✓			
	f	*Monitor the responses of highly susceptible ecological communities and keystone species to a changing climate.*	✓			
CL 8 – Consider climate change impacts from sea level rise, storm surge and catchment processes in future management of estuaries.	a	*Establish long term monitoring programs for estuaries and associated habitats.*	✓			
	b	*Explicitly factor climate change into estuary management.*	✓			

Table 6: Strategies for climate change adaptation and mitigation – Coastal Landscapes *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
CL 9 – Support the adoption of land management practices that improve soil health and production outcomes on grazing land.	a	*Encourage landholders to adopt practices that:* - *Improve ground cover, moisture retention, and reduce runoff following summer rainfall events.* - *Optimise grazing management systems with consideration to stocking rates, nutrient management, herd composition, breeding times and destocking.* - *Follow best management practice techniques (e.g. flexible grazing techniques, use of summer active perennials in pasture systems, changing cultivars to those better adapted to maintain ground cover at all locations, minimum-till, and controlled traffic farming, etc.).*	✓			✓
CL 10 – Work with Local Government and State agencies to improve environmental outcomes.	a	*Explore land use planning mechanisms to protect high value natural assets on agricultural land subject to enterprise change.*	✓			✓
CL 11 – Identify priorities and develop plan of works to improve hydrological regime of floodplain wetlands and fringing wetlands.	a	*Construction of treatment wetlands to capture stormwater from existing developed areas.*	✓		✓	
	b	*Plan of works to consider earthworks and waterway structures and options to work with landholders to manage water for multiple outcomes.*	✓			
CL 12 – Managing impacts to sensitive coastal ecosystems from future pressures of increased recreational use	a	*Manage access to sensitive areas through zoning of public land to concentrate people in designated areas, improving facilities through construction of boardwalks and formal access tracks, and prohibiting access in some places.*	✓			
CL 13 – Investigate options to lessen the offsite impacts to water quality following extreme events (e.g. flood, fire).	a	*Undertake risk management planning for land use management under climate change.*	✓			
CL 14 – Preservation of Aboriginal cultural heritage sites.	a	*Explore how to best incorporate specific management recommendations relating to climate change impacts on Aboriginal sites into Cultural Heritage Management Plans (CHMPs).*	✓			

6.6 Wilsons Promontory

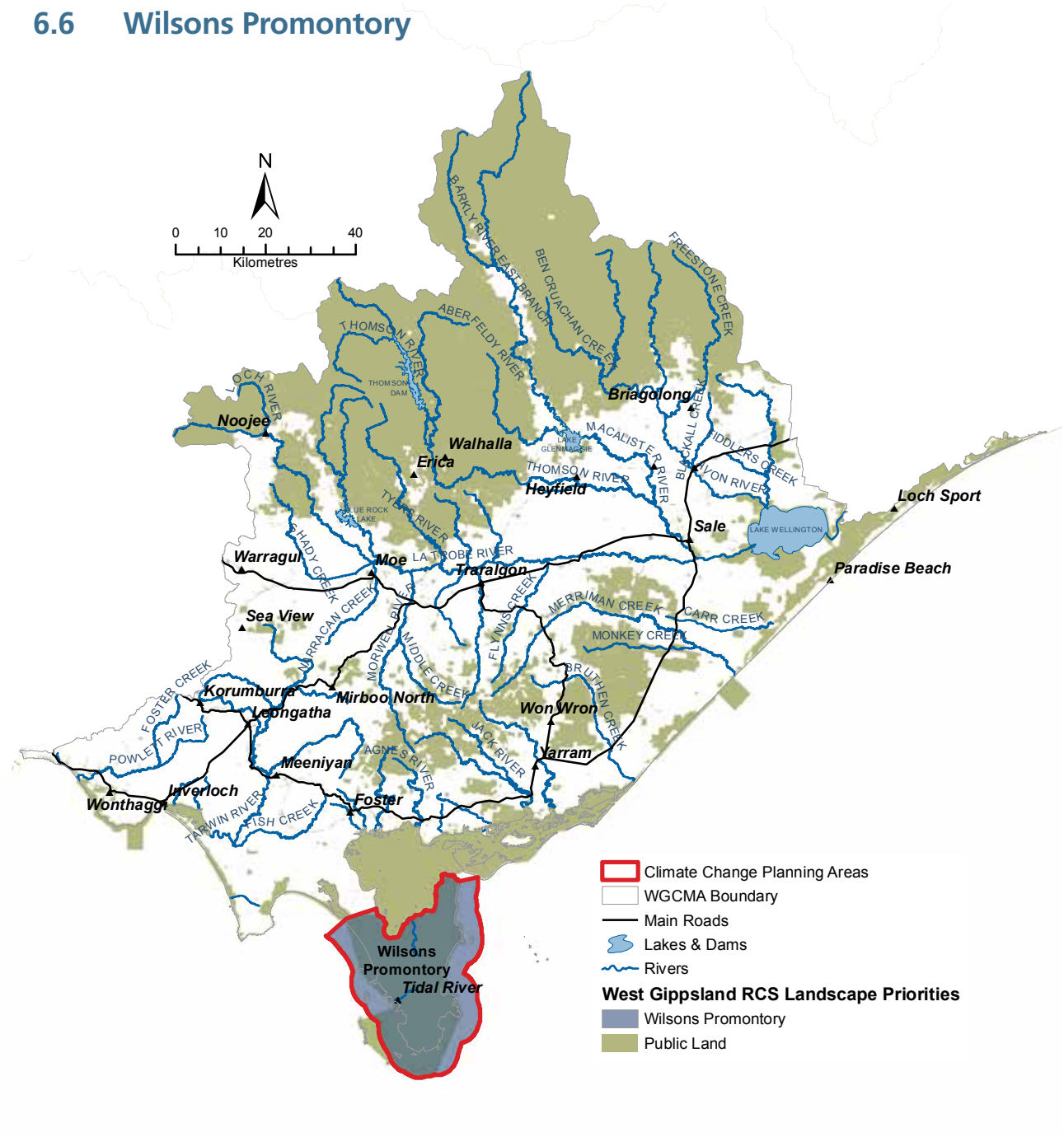

Figure 14: Wilsons Promontory climate change planning area

The Wilsons Promontory climate change planning area is characterised by the largely contiguous native vegetation that is located within the iconic Wilsons Promontory National Park. It is further defined by its marine environment, which contains the Wilsons Promontory Marine National Park. It offers spectacular scenery of huge granite mountains, open forest, rainforest, sweeping beaches and coastlines.[33]

The National Parks are highly valued by both residents and tourists for their natural scenic values, educational and recreational opportunities and Indigenous cultural heritage significance.[11]

The landscape is underpinned by relatively stable soils and contains largely intact and diverse ecological vegetation communities and numerous rare and threatened species.[11]

Warm Temperate and Cool Temperate Rainforest, tall open forests, woodlands, heathlands, swamp and coastal communities are all found within Wilsons Promontory. The heathlands, influenced by the frequency and intensity of fire, are rich in species and provide habitats for a variety of fauna, including many threatened species. Over 30 species of native terrestrial mammals have been recorded in the National Park.[33]

The presence of vegetation cover across much of the area contributes to generally high adaptive capacity of native vegetation and soils in particular, although recent intense fires have had an impact on the landscape. Impacts associated with a likely increase in the intensity and frequency of large fires is likely to pose a significant future challenge to the values of natural assets within the planning area.

Coastal features include expansive intertidal mudflats, sandy beaches and sheltered coves interrupted by prominent headlands and plunging granite cliffs in the south, backed by coastal dunes and swamps. In the intertidal zone adjoining Corner Inlet, large areas of highly productive tidal mudflat are exposed at low tide. The coastal dunes are a near perfect example of coastal succession ranging from bare dunes to protected woodlands.[33]

Tidal River's close proximity to the main day visitor, camping and overnight accommodation is a popular site for activities including walking, sightseeing, swimming, kayaking, boating and recreational fishing.[11] There has been a growth in infrastructure to support visitation to Wilsons Promontory both within and outside the National Park in recent years. Recreational use is likely to increase, placing increased pressures on vulnerable ecosystems. An increase in invasive plant and animal species (e.g. Northern Pacific Seastars that have been found in Tidal River[33]) in response to changing climatic conditions may pose a major threat to the natural ecosystems within the planning area.

Table 7: Strategies for climate change adaptation and mitigation – Wilsons Promontory

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
WP 1 – Support coastal NRM agencies to plan for adaptation or retreat in areas impacted by sea level rise and storm surge.	a	*Identify location and likely impact on natural assets from increased salinity, inundation and coastal erosion.*	✓			
	b	*Increase the width of vegetated riparian buffers in the Tidal River settlement and allow for salt tolerant vegetation to establish.*	✓			
	c	*Relocate infrastructure impacted storm surge and sea level rise and rehabilitate to prevent further erosion.*	✓			
WP 2 – Support fire management programs that adopt appropriate fire regimes to manage sensitive natural assets and assist the recovery of ecological communities from bushfire.	a	*Explore alternative fuel management techniques so that tolerable fire intervals are not exceeded by planned burns.*	✓			
	b	*Improve fire planning processes and on ground wildfire management activities to protect sensitive natural assets.*	✓			✓
WP 3 – Improve the adaptive capacity of ecosystems in Wilsons Promontory by actively managing existing threats.	a	*Active management of invasive plants and animals in the highest value ecosystems in Wilsons Promontory.*	✓			
	b	*Undertake large scale re-seeding of vegetation communities following wildfire.*	✓	✓		
WP 4 – Support research and investigation to address knowledge gaps.	a	*Explore implications of climate change for groundwater dependent ecosystems, including springs.*	✓			
	b	*Identify and protect drought refuges across the planning area.*	✓			
	c	*Monitor the responses of highly susceptible ecological communities and keystone species to a changing climate.*	✓			
	d	*Monitoring of invasive species with a focus on new and emerging species.*	✓			

Table 7: Strategies for climate change adaptation and mitigation – Wilsons Promontory *continued*

Strategies	Options for strategy implementation		Adaptation	Carbon mitigation		
				Biodiverse carbon plantings	Blue carbon	Soil carbon
WP 5 – Manage impacts to Wilsons Promontory ecosystems from future pressures of increased recreational use.	a	*Manage access to sensitive areas through zoning of public land to concentrate people in designated areas, improving facilities through construction of boardwalks and formal access tracks, and prohibiting access in some places.*	✓			
	b	*Raise visitor awareness of the values of Wilsons Promontory, their sensitivity to human impacts and the rationale for particular management activities.*	✓			
WP 6 – Consider climate change impacts from sea level rise, storm surge and catchment processes in future management of estuaries.	a	*Establish long term monitoring programs for estuaries and associated habitats.*	✓			
	b	*Explicitly factor climate change into estuary management.*	✓			
WP 7 – Investigate options to lessen the offsite impacts to water quality following extreme events (e.g. flood, fire).	a	*Undertake risk management planning for land use management under climate change.*	✓			
WP 8 – Preservation of Aboriginal cultural heritage sites.	a	*Explore how to best incorporate specific management recommendations relating to climate change impacts on Aboriginal sites into Cultural Heritage Management Plans (CHMPs).*	✓			