4 Adaptation pathways for the Southern Region

This section presents the adaptation pathways for each of the key decision areas identified by the Adaptation Planning project.

In developing the pathways for each key decision area a range of information generated by the project has been drawn on, specifically the outputs and processes shown in Table 4-1.

Table 4-1: Summary of information and sources provided for key decision areas

Information provided for key decision area	Information sources
Discussion regarding why focus on the key decision area is important for the Southern Region	Values workshops[28] Regional Profile[29]
Overview of how climate change will impact the key decision area	Climate Change Scenarios Report[30] Integrated Vulnerability Assessment Technical Report[31] Climate Change Risks, Opportunities and Vulnerabilities in the Southern Region Report[32]
Discussion regarding preferred options for progressing adaptation in relation to the key decision area	Adaptation Planning workshops with Project Champions[33]
Identification of actions for progressing preferred adaptation options	Adaptation Planning workshops with Project Champions and targeted one on one conversations with identified experts where additional expertise was required
Adaptation pathways	Adaptation Planning workshops with Project Champions and targeted one on one conversations with identified experts where additional expertise was required
Figure/s that show preferred adaptation options and features relevant to the key decision area (where information is able to be represented spatially)	On-line map server[34] Regional Profile

4.1 Interpreting the pathways

The pathways in Sections 4.4 to 4.13 set out both the range of adaptation options considered for each key decision area, and the preferred adaptation pathway made up of the preferred options. The timing for each option and the relationship with other preferred options are also shown on the pathways.

Each pathway should be read in conjunction with the description of the relevant key decision area.

[28] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[29] Resilient South (2014a) *Regional Profile – Resilient South*
[30] Resilient South (2014) *Climate Change Scenarios Report– Resilient South*
[31] Resilient South (2014d) *IVA Technical Report – Resilient South*
[32] Resilient South (2014b) *Climate Change Risks, Opportunities and Vulnerabilities in the Southern Region*
[33] Resilient South (2014c) *Engagement Feedback Report – Resilient South*
[34] www.resilientsouth.com

The horizontal axis of the pathway shows both a timescale, and expected changes to the climate that are relevant to the key decision area.

The range of adaptation options considered for the decision area are listed along the left hand side of the pathway.

Against each option is a combination of dots and lines that indicate:

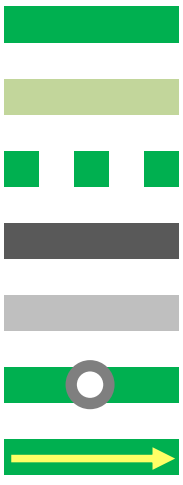
- The contribution of the option to the relevant key decision – whether it fully or partly addresses the decision;
- The favourability of the option;
- The time period over which the option is effective;
- The time period before an option is implemented during which preparatory work is required;
- Decision points where decision makers need to choose between options; and
- The preferred pathway through the options listed.

Figure 4-1 further describes the symbology used, and should be referred to in reading of the pathways.

A vertical line through "decision point" circles identifies a point in time at which a decision needs to be made between different options. The timing of the decision is indicative relative to the x-axis. This is based on the premise that as climate changes some options will become less suitable as adaptation measures and so new ones may be required.

For each pathway, "no changes" is the first listed option. This relates to all aspects of the current approach being taken to the decision area - for example current funding, management, and maintenance regimes. The length of the adjacent line shows how long the current approach with no changes can be expected to effectively address the area of decision making.

Figure 4-1: Pathway legend



A solid, dark green line indicates the time period over which an option could usefully address the relevant key decision

A lighter green line indicates time before an option is implemented during which preparatory work is required

A dashed, thick dark green line indicates that the option contributes to the adaptation solution but only in part

A solid dark grey line indicates an option that is not favoured

A lighter grey line indicates an option that is not preferred but that requires time during which preparatory work would be required if such an option was to be pursued

Circles indicate a decision point, such as when decision makers may need to choose between different options

Yellow line indicates the preferred pathway through the options (as identified by Project Champions)

4.2 Understanding preferred pathways

The preferred pathway (yellow line/s) identifies which options should be progressed now and into the future based on currently available information, including information provided by Project Champions.

The preferred pathway does not preclude current actions that contribute to future adaptation from continuing. The pathways should be reviewed at least every 5 years, at which time new information may suggest that the preferred pathway should take a different course through potential options.

It should be noted that although there was significant stakeholder involvement in the preparation of the pathways, further assessment of options by relevant individual sectors may still be required. In particular, it is acknowledged that further engagement is required with local Kaurna people and the business and manufacturing, viticulture and marine biodiversity sectors.

4.3 Spatial maps and use of map server to progress implementation

Spatial maps accompany the pathways for each key decision area where information is able to be represented spatially and describe preferred adaptation options and features relevant to the key decision area. For each key decision area a regional map is provided, and where relevant, individual Council maps.

These maps can assist in understanding where preferred adaptation options could be targeted for implementation across the Southern Region. The online map server can be utilised to further interrogate where adaptation options could be implemented. For example, heatwaves have been identified as a particular concern for more vulnerable members of the community. One way to adapt during heatwaves is to access facilities which provide respite from the heat such as cooler (air-conditioned) places. The map server can be used to identify the location of such facilities including libraries and major shopping centres as well as census collection area data to identify areas which have a greater proportion of people that may be more vulnerable (e.g. people aged over 65). The map server could be further interrogated to identify where vulnerable communities may not have local and ready access to facilities where they can take relief from extreme heat, and adaptation action can then be planned accordingly.

4.4 Coastal management

Key area of decision making

How do we maintain the Southern Region's natural features (e.g. cliffs, beaches, dunes, estuaries, biodiversity) and built infrastructure along the coast in the face of an increased risk of coastal degradation as a result of coastal inundation, changes in rainfall intensity and increased temperatures?

Why is maintaining the Southern Region's natural features and built infrastructure along the coast important?

The coast and marine environment of Southern metropolitan Adelaide is highly valued for its natural and built assets and is integral to the character of the Region[35]. Beaches and the nearby coastal zone are highly valued and are used by the local community and tourists alike for recreation and contain a number of significant cultural sites. The coast supports unique natural ecosystems such as beaches, dunes, rockyshores and cliffs.

In the northern part of the Region including Glenelg, Somerton Park and Brighton, beaches are backed by built infrastructure that:

- Prevents movement of the sand dunes and vegetation inland; and
- In some cases enhance erosive forces from the sea.

South of Kingston Park there is a much greater diversity of coastal features including:

- Estuaries;
- Rocky shoreline backed by cliffs;
- Beaches fronting more extensive dune systems;
- Jetties;
- Boat ramps;
- Board walks; and
- Surf lifesaving clubs.

How will climate change impact the Southern Region's natural features (e.g. cliffs, beaches, dunes, estuaries, biodiversity) and built infrastructure along the coast?

Sea level rise impacts

The IVA identified that climate change will impact the coastal environment of the Southern Region in a number of ways[36]. Sea level rise, which is projected to increase by nearly 0.8 m by 2100, when combined with naturally occurring storm surge events will result in greater rates of coastal degradation. Where dunes exist, it can be expected that beaches will move further inland while in areas with existing hard structures like rock walls sandy beaches can be expected to disappear over a period of 50-100 years and the effectiveness of existing rock walls diminish. Rising sea levels will also increase the erosion of cliffs along the coast.

[35] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[36] Resilient South (2014d) *IVA Technical Report – Resilient South*

Without adaptation, in some low lying areas periodic inundation of built infrastructure will start to occur leading to direct damage or loss of access to some facilities like surf lifesaving clubs, roads and open space and public realm (e.g. Coast Park, pathways, stairs and ramp access to beaches, playgrounds).

Warmer and drier conditions

While sea level rise will be a significant impact, other aspects of climate change will also affect the coastal zone[37]. For example, warmer and drier conditions will lead to the loss of some types of vegetation increasing the risk of dune erosion. Cliffs will also become more susceptible to erosion as warmer and drier conditions lead to greater cracking, and the chance of more intense rainfall events increases the risk of erosion at the top of cliffs, particularly where stormwater outfall pipes are located.

How might the Southern Region's natural features and built infrastructure along the coast adapt to changes in climate?

The coastal management pathway (refer Figure 4-2) shows a range of adaptation options for the coast, with four being identified by Project Champions as preferred options to be progressed for the Region.

Accelerating current best practice

In the short term adaptation to climate change in the coastal zone should focus on several options that are part of current best practice management, including:

- Awareness raising and education in the community to help people better respond to periodic hazards like flooding from storm events;
- Coordinated planning and monitoring to assist in understanding when the impacts of sea level rise will become critical. Importantly, adaptation will involve increased focus of efforts toward these activities rather than simply continuing with what is already being done; and
- Amendments to Development Plan policy regarding the construction of buildings or other infrastructure on the coast.

Amendments to Development Plan policy is particularly relevant in areas that will be at higher risk in the future, especially where the functional life of infrastructure is in the order of 50 years or more (i.e. when the more significant impacts of climate change are expected to occur). While such areas may not be impacted substantially in the next two to three decades, action now will reduce the need to relocate or protect infrastructure in the future. Review and amendment of Development Plan policy should include:

- Revising policy based on assessment of hazards,
- Promoting development in appropriate locations (and conversely, restricting development occurring in high risk areas); and
- Use of design guidelines that address or respond to anticipated climate impacts where appropriate (e.g. finished floor levels).

[37] Resilient South (2014d) *IVA Technical Report – Resilient South*

Protection strategies

Soft structural options: Soft structural protection options like dune management can play an important role in mitigating the impact of future sea level rise, and should occur now. Dune care programs already exist and should continue or be enhanced where possible, recognising the future role they can play as an adaptation measure. Consideration should also be given to whether sea level rise impacts will make it easier to establish other types of soft structural options such as wetlands. Figure 4.3 shows the locations of back shore dunes that may be the focus for revegetation and dune care activities.

Hard structural options: Assuming that changes to Development Plan policy prove effective in the short to medium term, the preferred adaptation option in some areas in the longer term will be the construction of hard structural options like sea walls, storm tide barriers or cliff base stabilisation that will become necessary to protect built assets in particular. While construction may not be required in the short term, preliminary scoping is advisable to identify future locations for these structures and construction options.

It should be noted that the Southern Region already has some protective hard infrastructure in place that accounts for future sea level rise, for example:

- City of Onkaparinga has commenced installation of cliff toe armouring under its Cliff Stability Strategy, which will also provide protection against rising sea levels[38]; and
- Sea walls that provide protection against existing erosion impacts (e.g. the Broadway in Holdfast Bay) must account for 0.3 metres of sea level rise as standard practice when being upgraded. It is understood that these existing structures can be adjusted to allow for a further 0.7 metres of sea level rise.

Figure 4-3 shows the location of current priorities for cliff stabilisation in the City of Onkaparinga. These may change or be expanded as the City of Onkaparinga Cliff Stability Strategy is reviewed. Figure 4-3 also identifies where hard structural options may require investigation.

Monitoring

Periodically collecting information to determine when action needs to occur will be important for coastal adaptation. The Bureau of Meteorology currently leads the Australian Baseline Sea Level Monitoring Project while measurement of change in the nearshore beach and dune environment is undertaken by the SA Coast Protection Board. It is recommended that a monitoring strategy be developed to inform decision making regarding the timing of construction of hard structural barriers. This could be led by local Councils, potentially through the Metropolitan Seaside Councils Committee, with input from Bureau of Meteorology and the SA Coast Protection Board.

Figure 4-3 shows the location of current boat ramps and jetties which may be suitable locations for beach sand and sea level rise monitoring.

[38] Caton, B (2007) *The Impact of Climate Change on the Coastal Lands of the City of Onkaparinga*

Summary of preferred options for maintaining the Southern Region's natural features (e.g. cliffs, beaches, dunes, estuaries, biodiversity) and built infrastructure along the coast as our climate changes

Now

- Coordinated planning and monitoring;
- Inform and educate the community and encourage behaviour change;
- Review and amend Development Plan policy; and
- Develop soft structural options.

Within 20 to 30 years

- Construct hard structural options like storm tide barriers or sea walls.

Preparatory work

- It is recommended that a monitoring strategy be developed to inform decision making regarding the timing of construction of hard structural barriers.

Figure 4-3 identifies where these preferred options might apply spatially for the Southern Region.

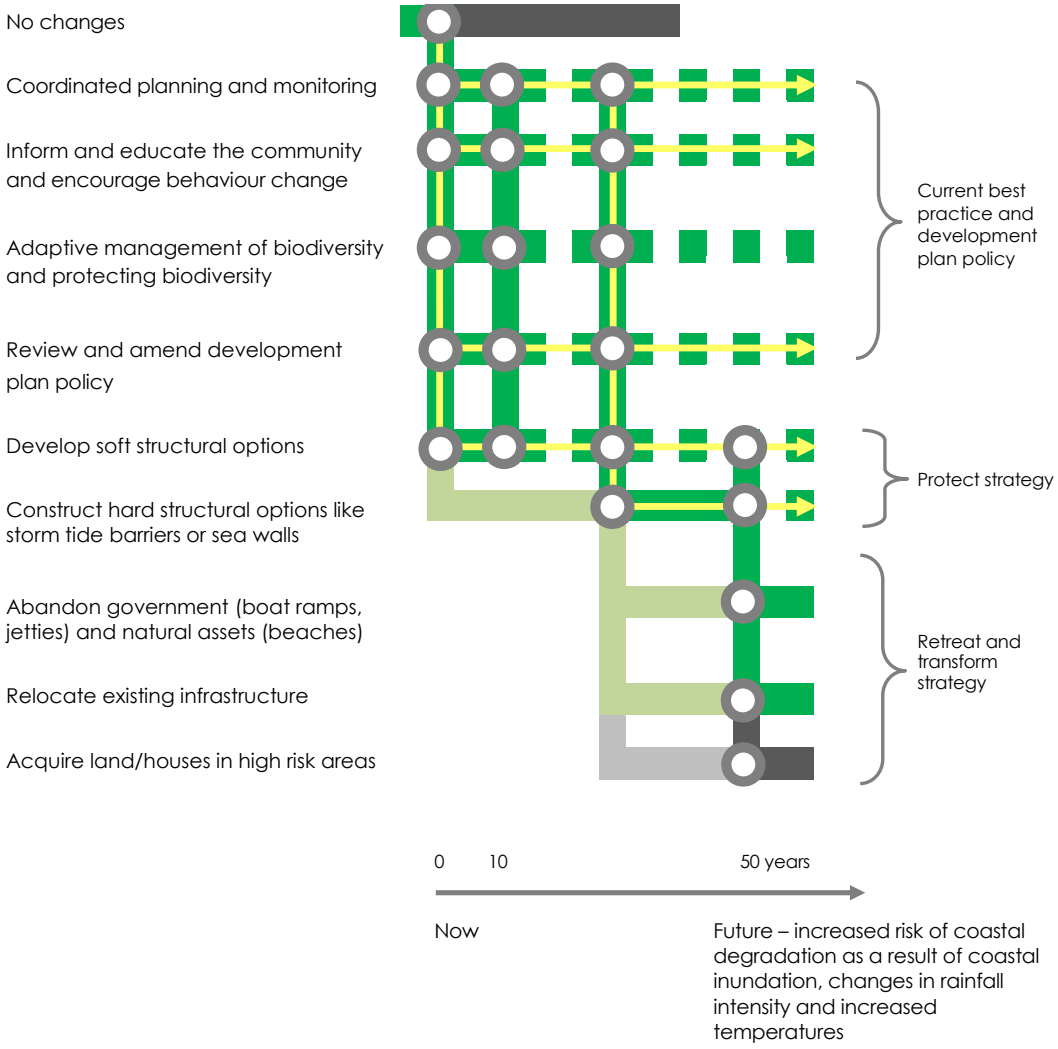
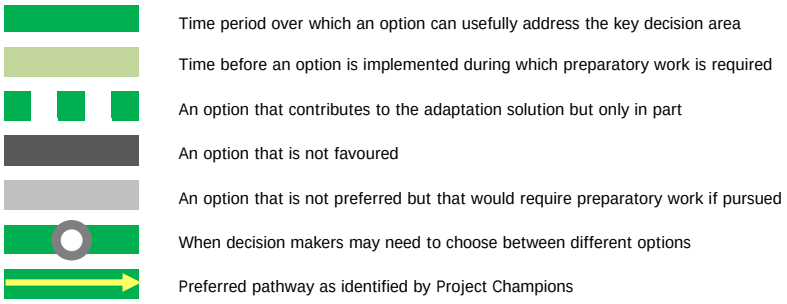
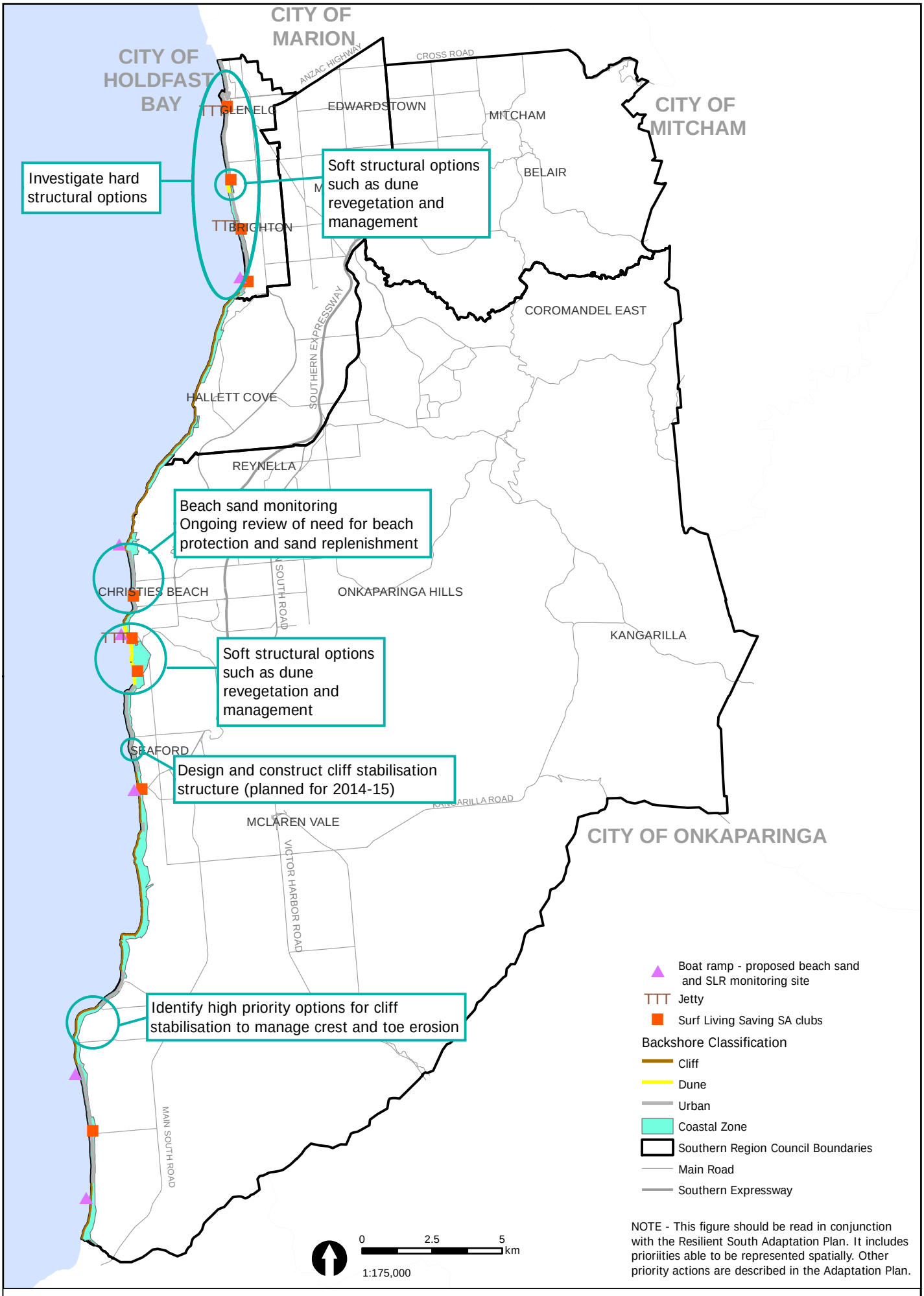


Figure 4-2: Coastal management pathway

See Figure 4-1 for an explanation of how to interpret this figure.

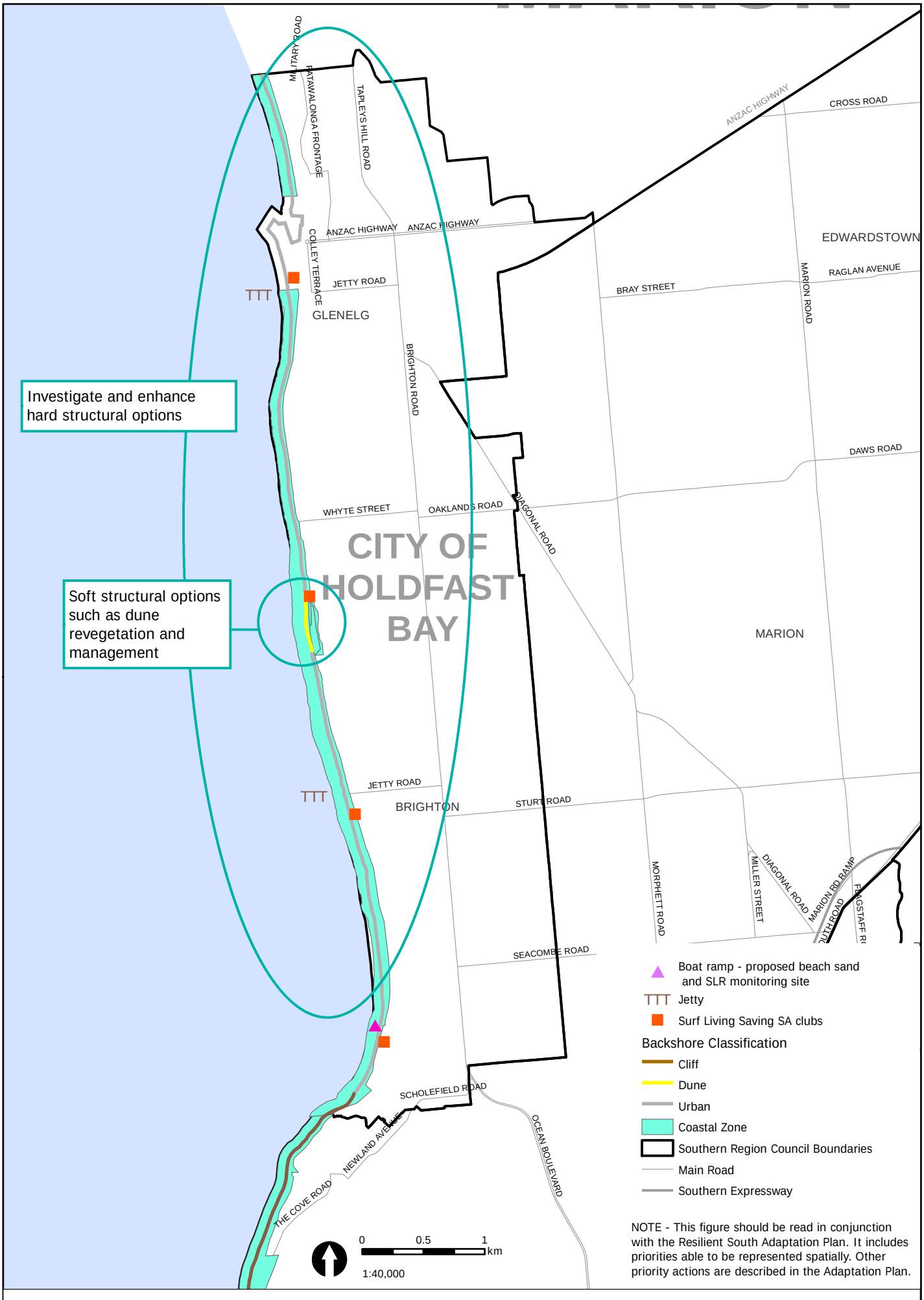




NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes prioriities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.3 Preferred Options for Coastal Management
Resilient South

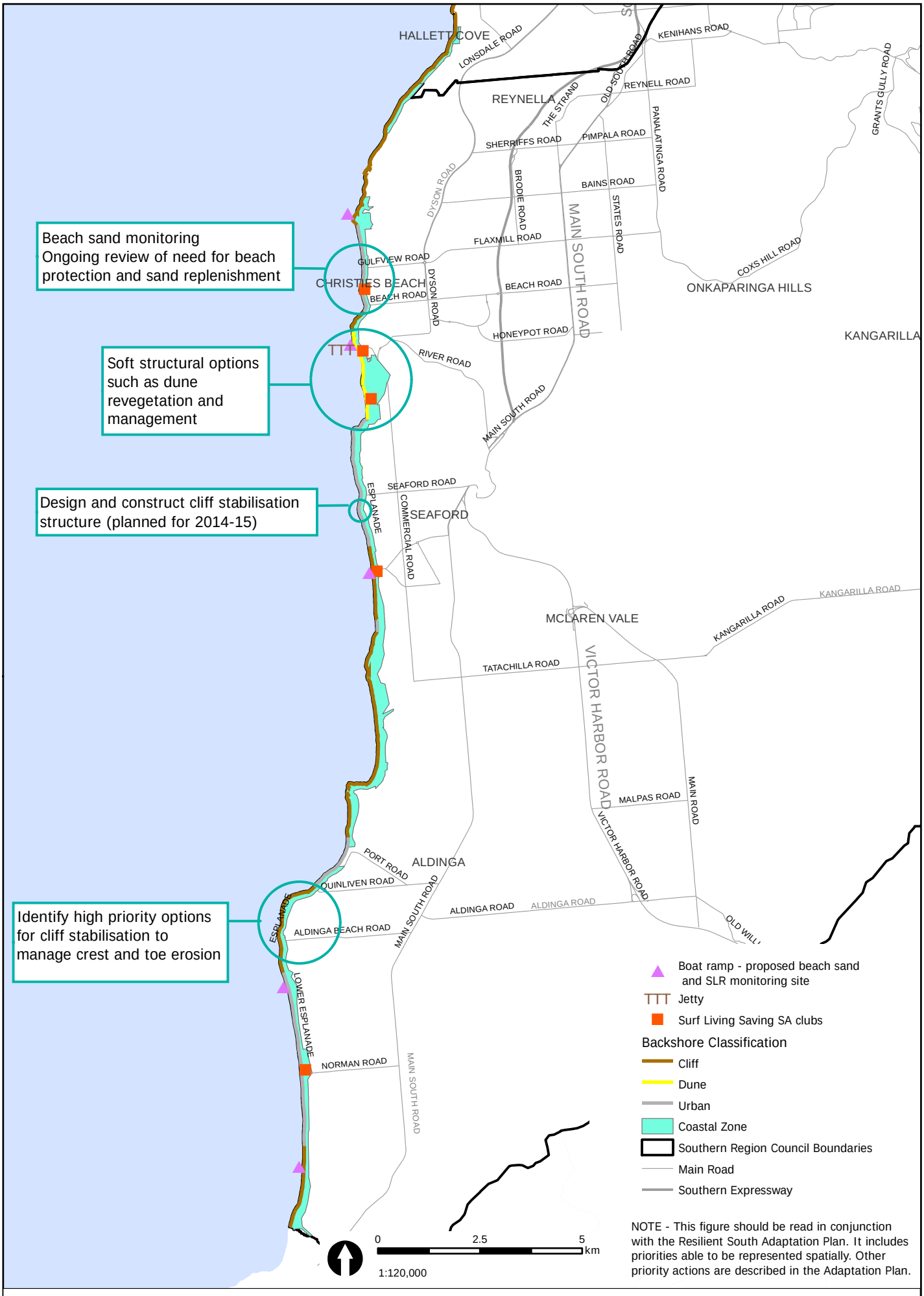


Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.3 (A) Preferred Options for Coastal Management
Resilient South - City of Holdfast Bay

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.3 (B) Preferred Options for Coastal Management
Resilient South - City of Marion



Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.3 (C) Preferred Options for Coastal Management
Resilient South- City of Onkaparinga

4.5 Water resources management

Key area of decision making

How do we manage and/or maximise the quantity and quality of water resources available for a range of uses given less rainfall overall, more frequent and intense rainfall events, more frequent bushfires and increased evaporation?

Why is water resources management important?

The quality and quantity of water is of critical importance to the Southern Region from an environmental, economic, cultural and social perspective[39]. Potable water comes from the River Murray, local catchments and reservoirs and the Adelaide Desalination Plant.

Natural watercourses include the:

- Onkaparinga River (part of the Western Mount Lofty Ranges Water Allocation Plan);
- Sturt River;
- Brownhill Creek;
- Minno Creek;
- Waterfall Creek;
- Field River;
- Christie Creek;
- Pedler Creek;
- Maslin Creek;
- Willunga Creek; and
- Other coastal springs and gullies.

Many watercourses have been highly modified from their natural state having been deepened, widened and the course altered as a result of catchment development and increased catchment runoff.

Groundwater is used across the Region for a variety of purposes including irrigation of:

- Open space and recreational facilities;
- Manufacturing;
- Horticulture; and
- Viticulture.

The enhancement of water security by the use of managed aquifer recharge schemes is also very important in the Southern Region. Within the Region there are two prescribed wells areas (PWAs) where water allocation plans (WAPs) are in place or under development, to guide the management and use of groundwater resources. The Central Adelaide PWA covers most of the area north of the Onkaparinga River and the McLaren Vale PWA covers most of the area to the south. The prescription of these groundwater resources under the *Natural Resources Management Act 2004* means that, when a WAP is adopted and water licenses issued, groundwater cannot be used without a license, except for small volumes for stock and domestic uses.

[39] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*

Floods also create hazards that can impact on all members of the community, infrastructure and service delivery. Flood hazards exist in areas such as the Brown Hill Keswick Creek, coastal catchments in the City of Holdfast Bay and the City of Marion, Pedler Creek floodplain, Silver Sands and Washpool Catchment and the Christie Creek in the City of Onkaparinga.

How will climate change impact water resources management?

Declining rainfall

The IVA identified that reduced rainfall as a result of climate change will decrease the quantity and quality of surface water flows[40]. With the projected increase in evaporation and decrease in rainfall, the winter excess of rainfall over evaporation (which drives catchment water flows and soil water accumulation) is projected to decline from 175 mm in 1980-1999 to 115 mm in 2070[41]. It has been suggested in other catchments in Australia that a single unit reduction in rainfall could lead to a two to three unit reduction in streamflow[42]. How the projected increase in the area of hard surfaces in metropolitan areas compares with declines in rainfall driven by climate change will impact surface water flows needs further assessment. Reduction in the availability of surface water may result in more demand for the use of groundwater in this area, which is not expected to be significantly affected by climate change for a number of decades.

Rainfall intensity

Despite an overall drying trend, an increased frequency of intense rainfall events could have implications for infrastructure both in terms of its ability to cope with extreme events and management of stormwater to prevent flooding and loss of life, as well as opportunities to collect and harvest water for reuse[43]. Warmer and drier conditions could also result in increased demand for maintenance and/or replacement of stormwater infrastructure as a result of soil heavage.

How can we respond to the impacts of climate change on water resources management?

The water resources management pathway (Figure 4-4) shows that a wide range of adaptation options will be required to respond to the projected change in the timing, quantity and quality of water. The pathway indicates that all identified adaptation options are part of the preferred pathway and reflects the significant work that has already been done to address water security issues in the Region supported by Water for Good, the Goyder Project, Water Proofing the South and other related plans and strategies. The options in this pathway reflects the extensive work already undertaken to manage demand and supply of water as well as the decision already taken to construct the desalination plant to address water supply security.

Behaviour change and improved planning

One water management option for immediate action is building on existing initiatives and further investing in supporting behaviour change and improved planning. Behaviour change

[40] Resilient South (2014d) *IVA Technical Report – Resilient South*
[41] Resilient South (2014) *Climate Change Scenarios Report– Resilient South*
[42] Chiew, F.H., and T. A. McMahon (2002) *'Modelling the impacts of climate change on Australian streamflow'* , Hydrological Processes, vol. 16, pp. 1235–1245
[43] Resilient South (2014d) *IVA Technical Report – Resilient South*

was identified as a preferred option to manage potable water security issues during the past water shortages (e.g. the Millennium Drought) and will continue to be a strategy in the future requiring community education and improved knowledge to support it. Research is also required to better understand the changing nature of rainfall events, soil movement impacts, interactions at the coast such as salt water intrusion and ground water recharge. As this research is undertaken, relevant plans will need to be calibrated with this information such as Water Allocation Plans, Stormwater Management Plans and Development Plans. Ongoing investment in reviewing, updating and implementing relevant plans should occur across the Region.

Project Champions were strongly supportive of the option of riparian rehabilitation. Rehabilitation should initially focus on riparian mapping to show high priority areas from a strategic regional ecosystem and water perspective. Priority areas for riparian rehabilitation will include areas located on public land, particularly in the hills, and areas which will provide biodiversity and water quality benefits. Riparian rehabilitation should be driven by an integrated water resources management approach and identify areas for strategic land acquisition to reclaim rivers from concrete or otherwise modified channels.

Figure 4-5 shows where watercourses are located on public land, providing an opportunity for riparian rehabilitation.

Major supply initiatives

The Southern Region has already made significant investments in water resource management infrastructure. Given projected climate change impacts though, it is expected that further major investment will need to be made in water management infrastructure in the Region. Delaying major investment for a decade will provide the opportunity to better understand changing rainfall patterns. The major options likely to be required at this time include further adoption of:

- Water sensitive urban design (WSUD);
- Domestic, commercial and industrial rainwater capture schemes;
- Water recycling and waste water re-use; and
- Managed aquifer recharge.

A key challenge is to determine sequencing and investment in adoption of responses in new developments versus retrofitting existing developments. Although this investment may be a decade away, preliminary work is required now to determine the best mix of options, building on the current Goyder Institute project on the Optimal Water Resources Mix for Adelaide. Additional work now could also focus on targeted monitoring of supply and demand to inform when a decision about additional investment will be required.

Figure 4-5 shows:

- The location of the Tonsley development site at which WSUD opportunities are planned;
- Industry zones where there may be opportunity for rainwater capture;
- Existing waste water treatment plants and opportunities to expand recycled water use from these plants; and
- Wetlands across the Region, a number of which support managed aquifer recharge schemes.

Summary of preferred options for the adaptation of water resources management

Now

- Ongoing research to inform adaptation and management;
- Educate communities;
- Calibrate water resources plans, policy and legislation;
- Review and amend Development Plan policy with focus on water security;
- Improve flood management and riparian rehabilitation; and
- Continued adoption of water sensitive urban design.

Within 10 years

- Increased domestic, commercial and industrial capture of rainwater;
- Greater water recycling and waste water re-use; and
- Increased managed aquifer recharge.

Preparatory work

- Build on the results of the Goyder Institute's project to determine the best mix of investment options regarding capture of rainwater, re-use of recycled and waste water and managed aquifer recharge; and
- Targeted monitoring of supply and demand should commence to inform when a decision about additional investment will be required.

Figure 4-5 identifies where these preferred options might apply spatially for the Southern Region

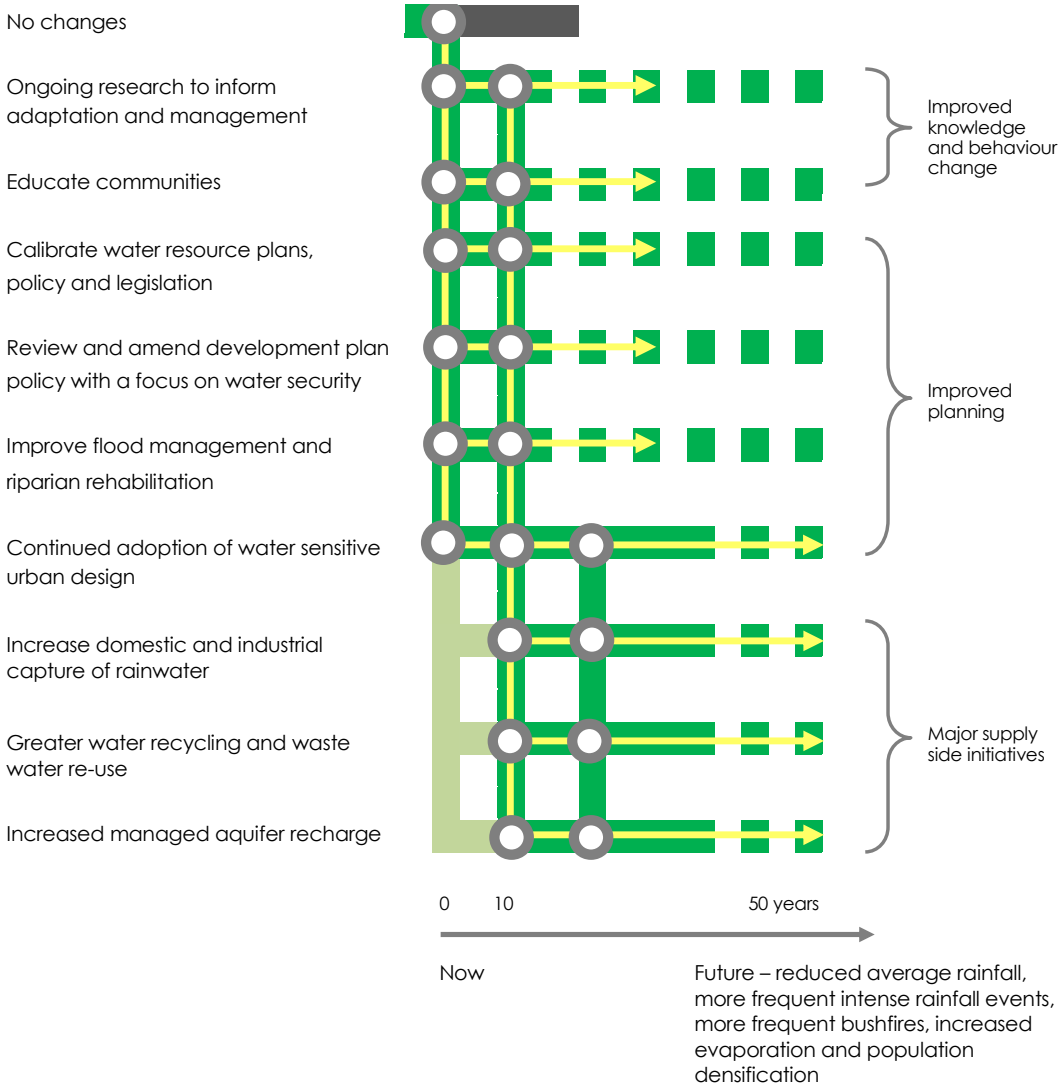
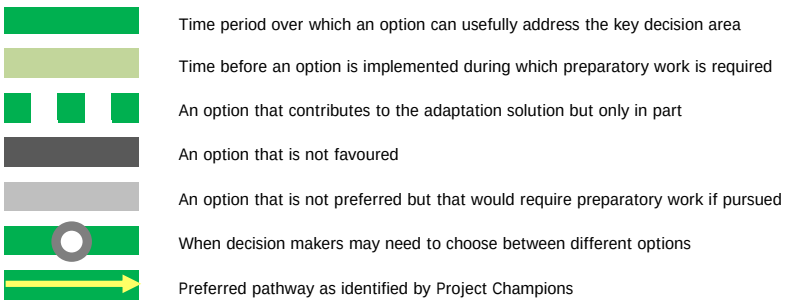
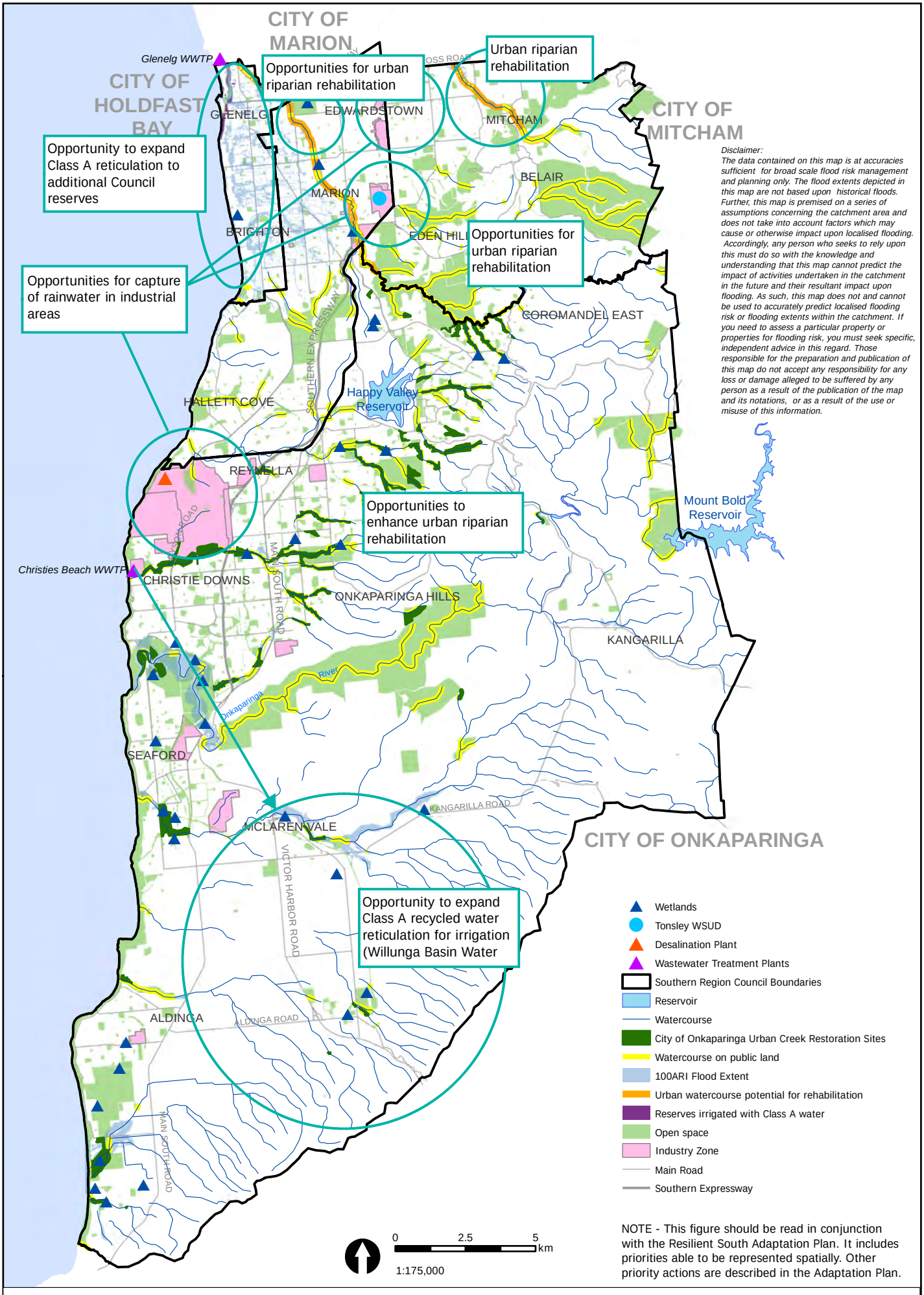


Figure 4-4: Water resources management pathway

See Figure 4-1 for an explanation of how to interpret this figure.



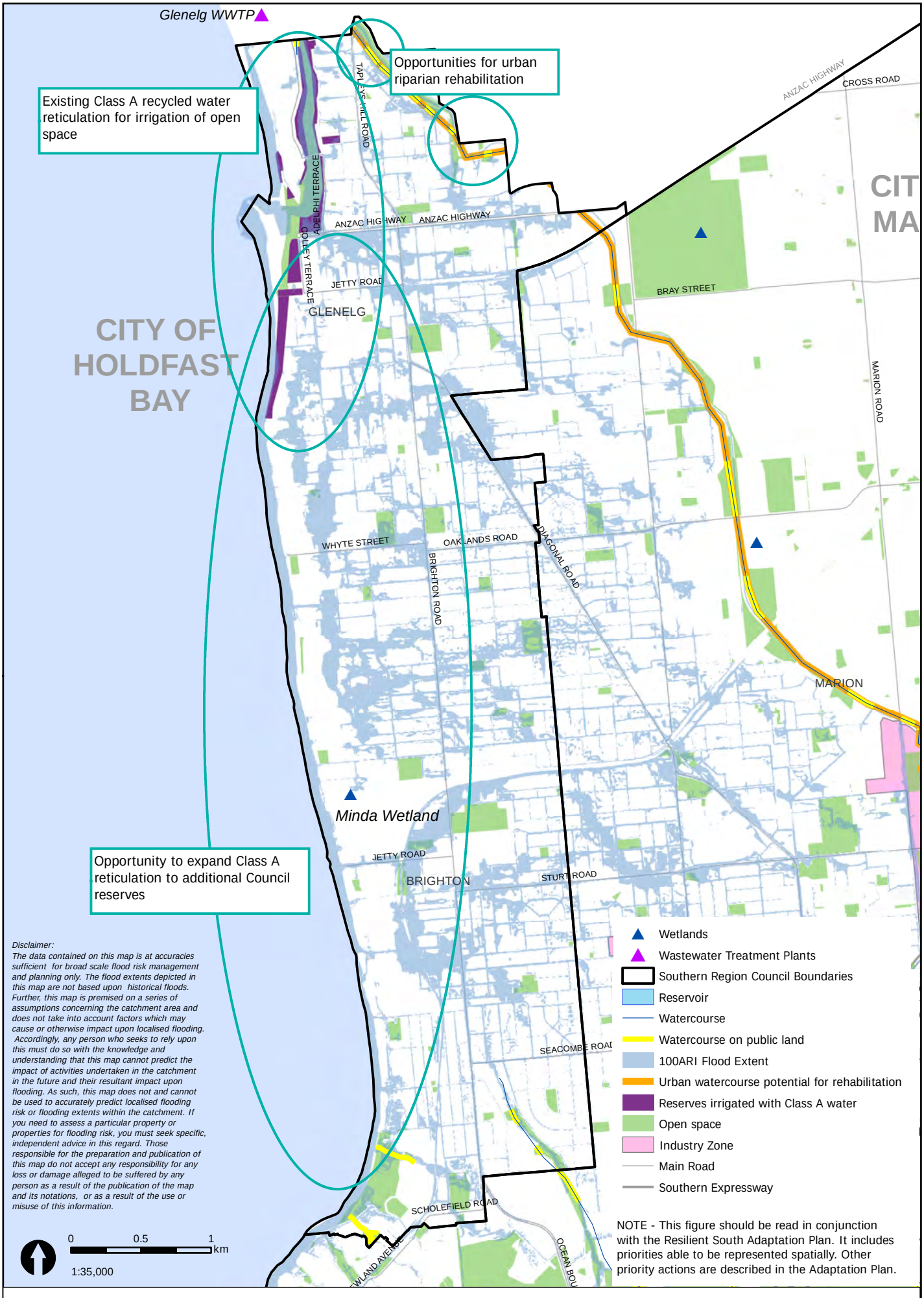


Disclaimer:
The data contained on this map is at accuracies sufficient for broad scale flood risk management and planning only. The flood extents depicted in this map are not based upon historical floods. Further, this map is premised on a series of assumptions concerning the catchment area and does not take into account factors which may cause or otherwise impact upon localised flooding. Accordingly, any person who seeks to rely upon this must do so with the knowledge and understanding that this map cannot predict the impact of activities undertaken in the catchment in the future and their resultant impact upon flooding. As such, this map does not and cannot be used to accurately predict localised flooding risk or flooding extents within the catchment. If you need to assess a particular property or properties for flooding risk, you must seek specific, independent advice in this regard. Those responsible for the preparation and publication of this map do not accept any responsibility for any loss or damage alleged to be suffered by any person as a result of the publication of the map and its notations, or as a result of the use or misuse of this information.

NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.5 Preferred Options for Water Resource Management
Resilient South



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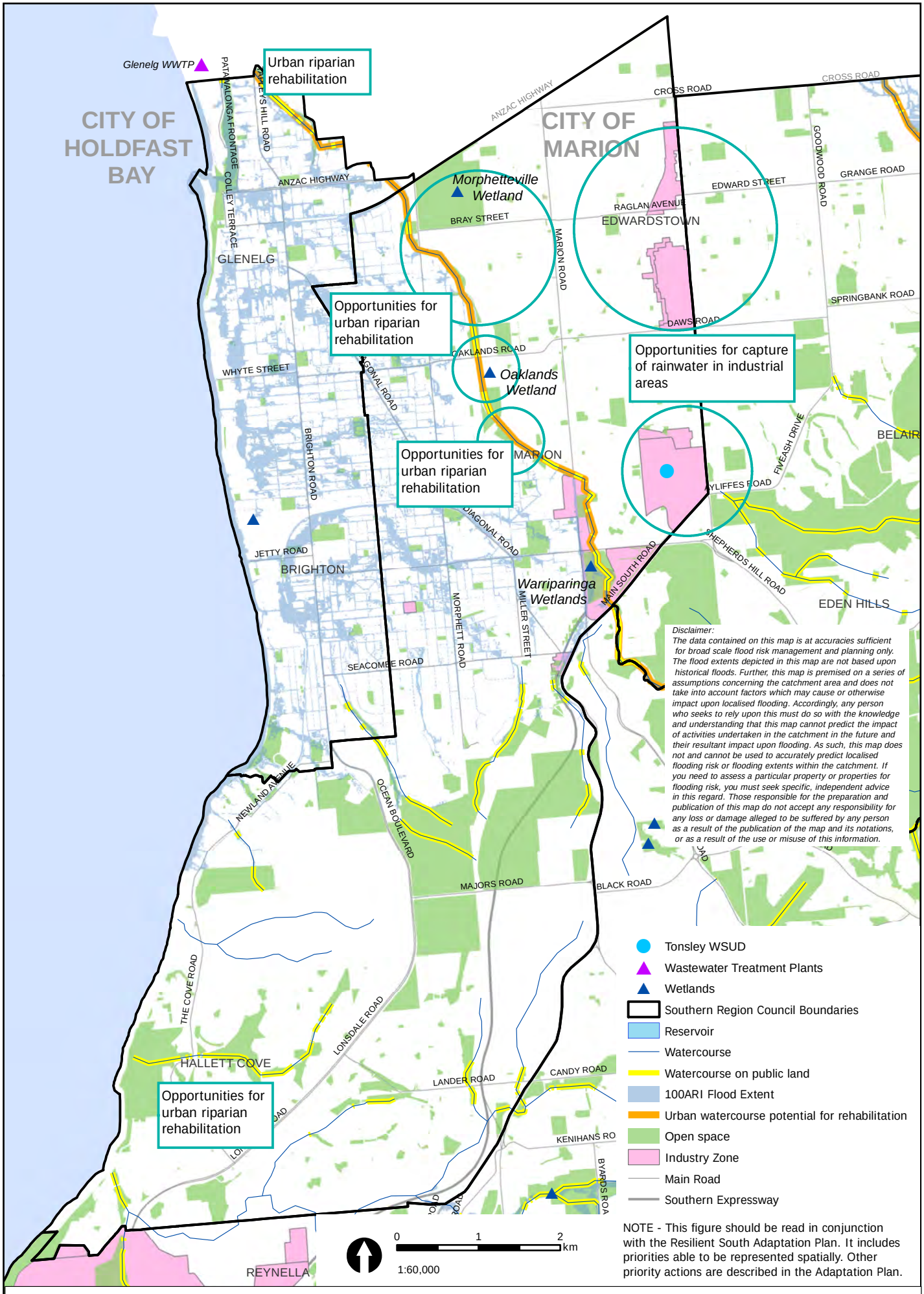
Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

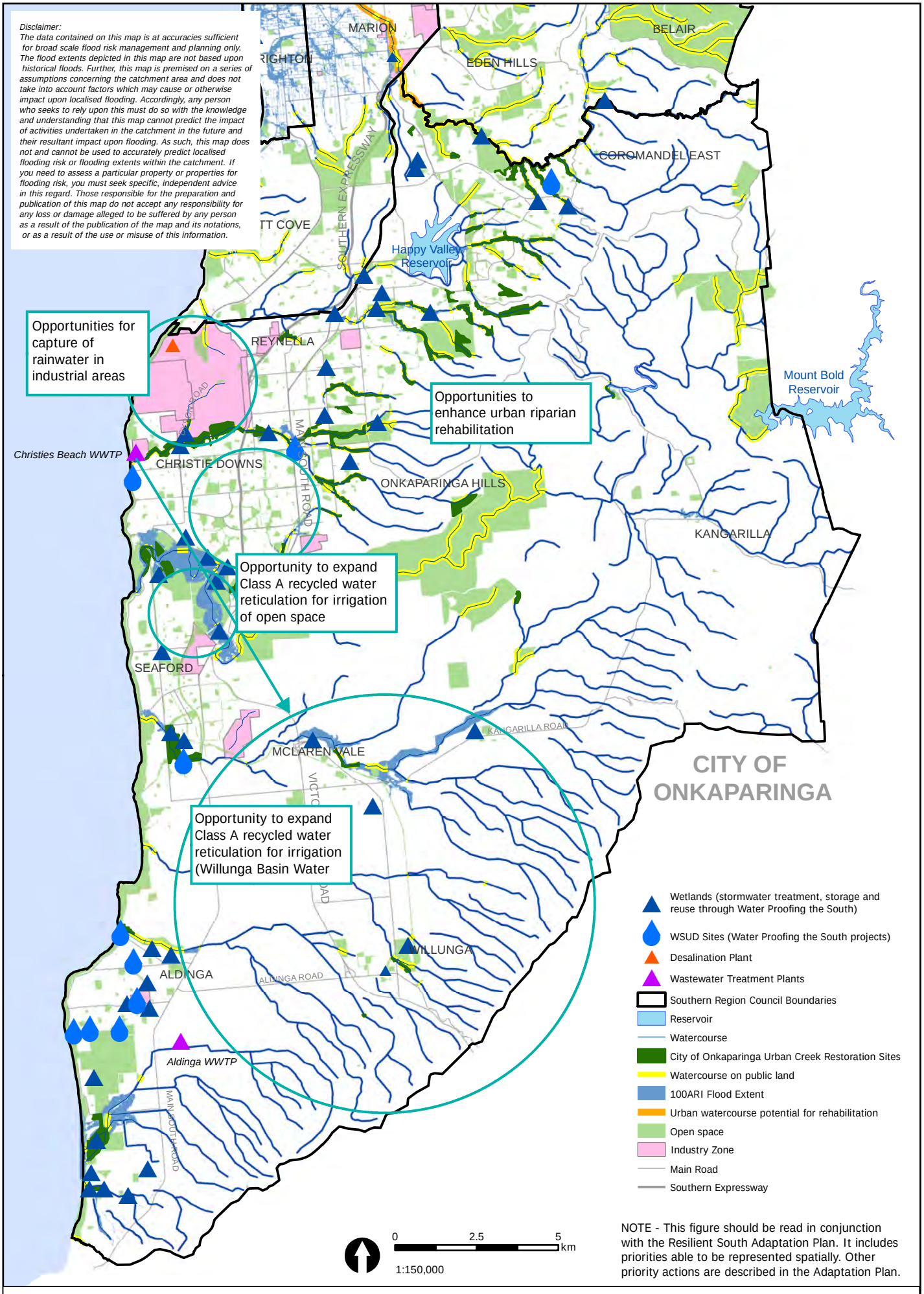
Figure 4.5 (A) Preferred Options for Water Resource Management
Resilient South - City of Holdfast Bay



NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

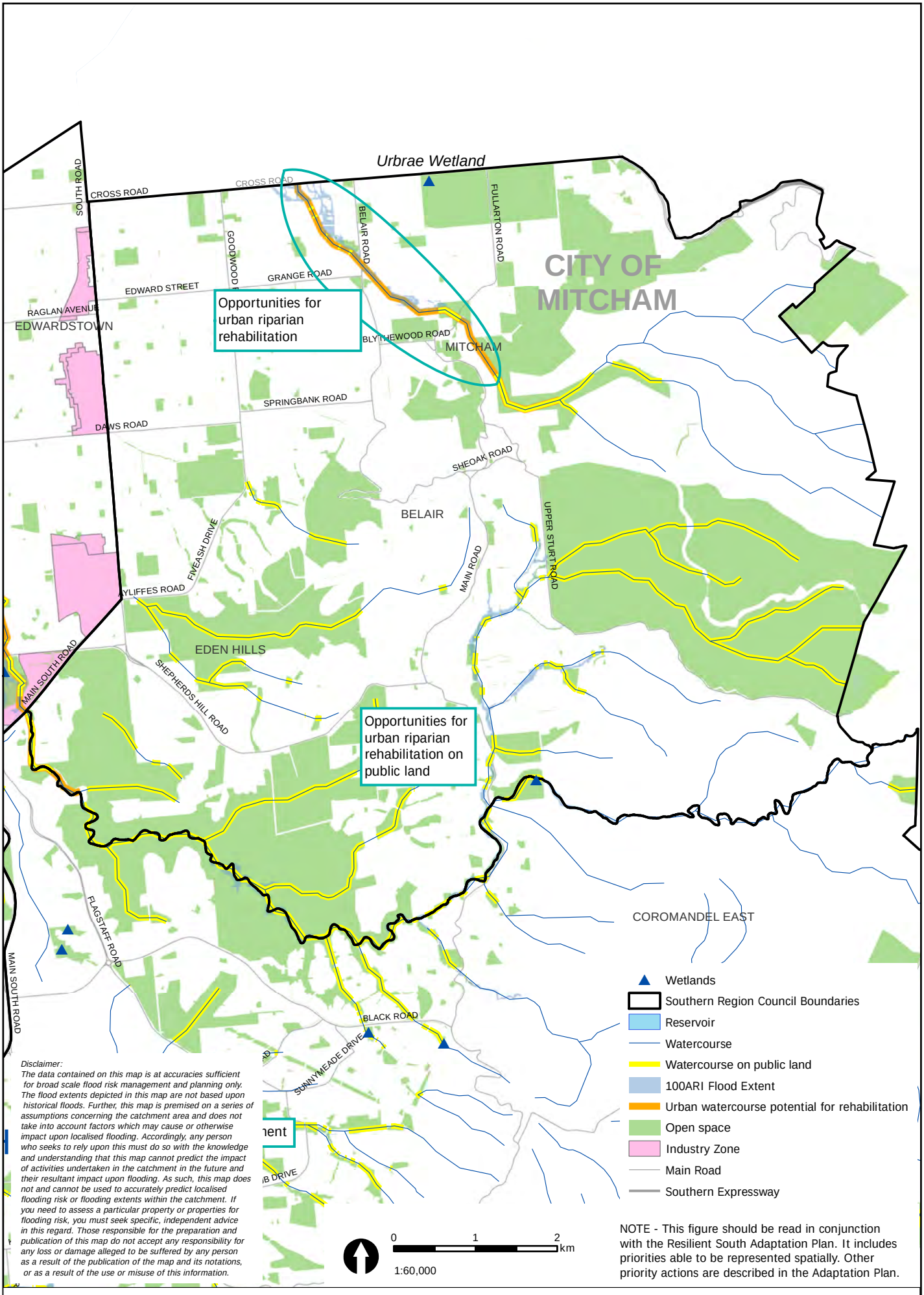
Figure 4.5 (B) Preferred Options for Water Resource Management
Resilient South - City of Marion



NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 29, 2014

Figure 4.5 (C) Preferred Options for Water Resource Management
Resilient South - City of Onkaparinga



Disclaimer:
The data contained on this map is at accuracies sufficient for broad scale flood risk management and planning only. The flood extents depicted in this map are not based upon historical floods. Further, this map is premised on a series of assumptions concerning the catchment area and does not take into account factors which may cause or otherwise impact upon localised flooding. Accordingly, any person who seeks to rely upon this must do so with the knowledge and understanding that this map cannot predict the impact of activities undertaken in the catchment in the future and their resultant impact upon flooding. As such, this map does not and cannot be used to accurately predict localised flooding risk or flooding extents within the catchment. If you need to assess a particular property or properties for flooding risk, you must seek specific, independent advice in this regard. Those responsible for the preparation and publication of this map do not accept any responsibility for any loss or damage alleged to be suffered by any person as a result of the publication of the map and its notations, or as a result of the use or misuse of this information.

NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.5 (D) Preferred Options for Water Resource Management
Resilient South - City of Mitcham

4.6 Natural landscapes

Key area of decision making

How do we manage natural landscapes and associated habitats on all tenures of land (public and private) in the Southern Region when exposed to warmer and drier conditions, more frequent and intense bushfires and the combined effects of sea level rise and storm surge?

Why is managing natural landscapes in the Southern Region important?

Protecting the environment and natural resources of the Southern Region is a high priority reflecting the value the community places on natural assets such as coastal environments, open space, parks and reserves[44]. These assets are important for biodiversity conservation, providing habitat for native fauna and delivering a range of ecosystem services that underpin both social and economic wellbeing for the community such as:

- Areas for recreation, tourism and general amenity;
- Purification of air and water;
- Creation of soil;
- Pollination of native plants and crops; and
- Breakdown of wastes.

The Southern Region has three distinct natural landscape types:

- Hills - Higher rainfall, higher elevation and mainly rural land areas which contain most of the Region's remnant vegetation;
- Plains and hillsface - Lower rainfall area of the Adelaide plains where the majority of the land has been cleared to make way for urban settlements. This landscape type also includes the hills face zone; and
- Coastal - Area along the coast, which contains a mixture of beach, estuary and cliff environments, some of which are heavily modified with no dunes such as in the northern part of the Region.

Natural landscape types are shown on Figure 4-7.

How will climate change impact natural landscapes in the Southern Region?

The IVA found that the natural landscapes of the Southern Region will be significantly impacted by climate change[45]. Some landscape types will undergo transformation and certain ecosystems and species will no longer exist in the Region. The impacts for the three natural landscape types in the Region are likely to include the following:

- The **hills landscape**, which has higher rainfall and retains a greater cover of remnant ecosystems, has some buffering capacity from climate change due to its topographic and microclimatic diversity and its species assemblages show a comparatively high level of climatic stability. Increased bushfire frequency and intensity will be another driver of change in the hills, which has the potential to further exacerbate the direct impact of climate change. A consequence of major disturbances like fire will be opportunities for pest plants and animals to increase in distribution and abundance.

[44] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[45] Resilient South (2014d) *IVA Technical Report – Resilient South*

- The **plains and hillsface landscape**, which has lower rainfall and have been more intensively developed for urban, peri-urban and horticultural uses, has less buffering capacity from climate change and the species assemblages show a comparatively low level of climatic stability. In addition to being impacted by warmer and drier conditions, this landscape will experience fire regime change impacts in the hills face zone and sea level rise impacts at least on the western plains.

- Along the **coast** the main driver of change will be sea level rise in conjunction with storm surge which will lead to beach recession, landward migration of coastal ecosystems and the loss of some dune areas. This represents one of the most significant climate change threats for a natural landscape in the Southern Region. For example, salt marsh complexes, which are expected to be particularly vulnerable to sea level rise, will be unable to migrate to new areas when artificial barriers such as roads or levees limit landward migration.

All three natural landscape types will find it difficult to migrate to more suitable locations in the future because of the fragmented nature of the landscape.

How can we respond to the impacts of climate change on the ability for native ecosystems to persist in the Southern Region?

Natural landscapes pathways (refer Figures 4-6A, B and C) have been prepared reflecting the three natural landscape types in the Region. The sequencing of options in the pathways differs because of the rate and extent of the predicted impact of climate change on each landscape type.

Responses in general should focus on maintaining as much of the natural landscape as possible in the Region, while at the same time seeking to minimise the broader consequences of losses from the Region and support the emergence of new "novel" ecosystems that may support some ecosystem services.

Current best practice ("passive" adaptation)

Adaptation in all three ecosystems requires current best practice planning and management options to be accelerated now, with the preferred pathway for each focussing on:

- Monitoring and research to undertake situation appraisal and review;
- Review and amend Development Plan policy; and
- Addressing current and emerging threats (e.g. rabbits, which can exacerbate cliff destabilisation).

Monitoring and research needs to focus on developing baselines on current distribution and abundance patterns, identifying potential changes and then recording what occurs in the Region. Potential changes include altered resource availability patterns, species interactions, and changes in processes and disturbance dynamics.

Protect strategy ("active" adaptation)

Maintaining habitat values in non-conservation areas is a priority for all three natural landscape types. This includes improving and restoring the matrix of remnant patches in existing primary production systems. While a priority for all three landscape types, it is of more immediate importance for the plains and hills face and coast.

Figure 4-7 shows isolated patches of remnant vegetation, many of which are located within the plains and hills face landscape.

Protecting and improving refugia is of most importance to the plains and hillsface landscape type. It is not as critical for the hills because of the topographic and microclimatic diversity in this area. In contrast, it is not a priority action for the coast because of the limited areas that could perform this function. This option could include protecting isolated patches of native vegetation, providing additional buffers and managing parts of the environment that provide refuge during climatic extremes.

Transformation strategies

In coastal and estuarine areas (refer Figure 4-7) the preferred pathway suggests that within two to three decades, retreat and transformational options will be required such as species translocations (i.e. moving species to new areas outside the Region), ex-situ conservation (e.g. moving species to zoos or seed banks) and ecosystem engineering (i.e. replacing ecosystems no longer viable in the Region with new ones). These are major actions and would be pursued only if there is a risk of species or communities being lost from the Region altogether.

The preferred pathways for the hills and plains and hills face landscape types only pursue these more transformational strategies in about 50 years suggesting that while ecosystems in these regions will be impacted, they are not under threat of being lost completely from the Region within this timeframe.

Species translocations, ex-situ conservation and ecosystem engineering are all major interventions that could have a high cost to implement. They would also require significant coordination between natural resources management organisations within and external to the Region, especially if species were to be moved outside of the Region.

Preliminary work is required now to determine how such an option would be implemented and how species translocations would be managed given historical experiences where native species have been moved into new habitats only to then become a dominant and damaging species. This should commence with a risk and vulnerability assessment to identify those species that cannot adapt and the implications of losing them in the Region.

Summary of preferred options to manage natural landscapes and associated habitats in the Region

Now (hills, plains and hillsface, coastal)

- Monitoring and research to undertake situation appraisal and review;
- Review and amend Development Plan policy;
- Address current and emerging threats; and
- Maintain habitat values in non-conservation areas.

Now (plains and hillsface)

- Protect and improve refugia.

Within 20-30 years (coastal)

- Move species and ecosystems and implement ecosystem engineering (coastal and estuarine).

Preliminary work

- Commence work with Department of Environment, Water and Natural Resources (DEWNR), Natural Resources Management (NRM) organisations, the South Australian museum, research institutions and the Royal Zoological Society of South Australia to undertake a risk and vulnerability assessment to identify those species that cannot adapt and the implications of losing them in the Region.

Figure 4-7 identifies where these preferred options might apply spatially for the Southern Region.

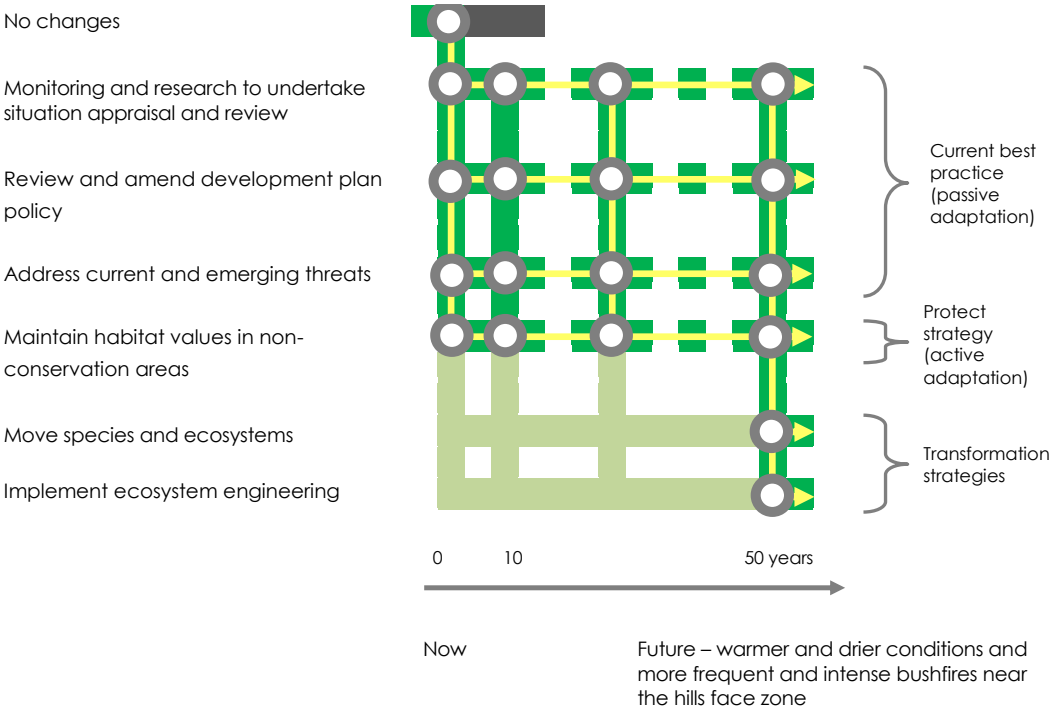
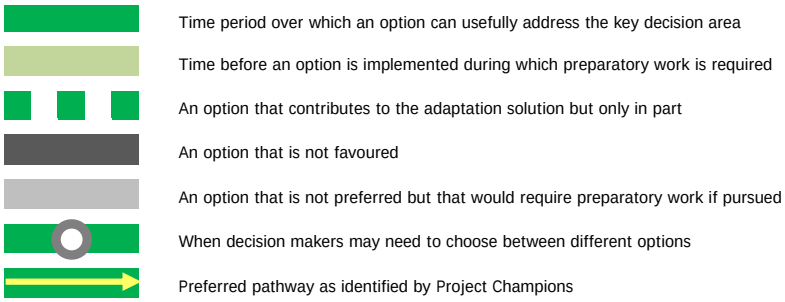


Figure 4-6A: Natural landscapes pathway (hills)

See Figure 4-1 for an explanation of how to interpret this figure.



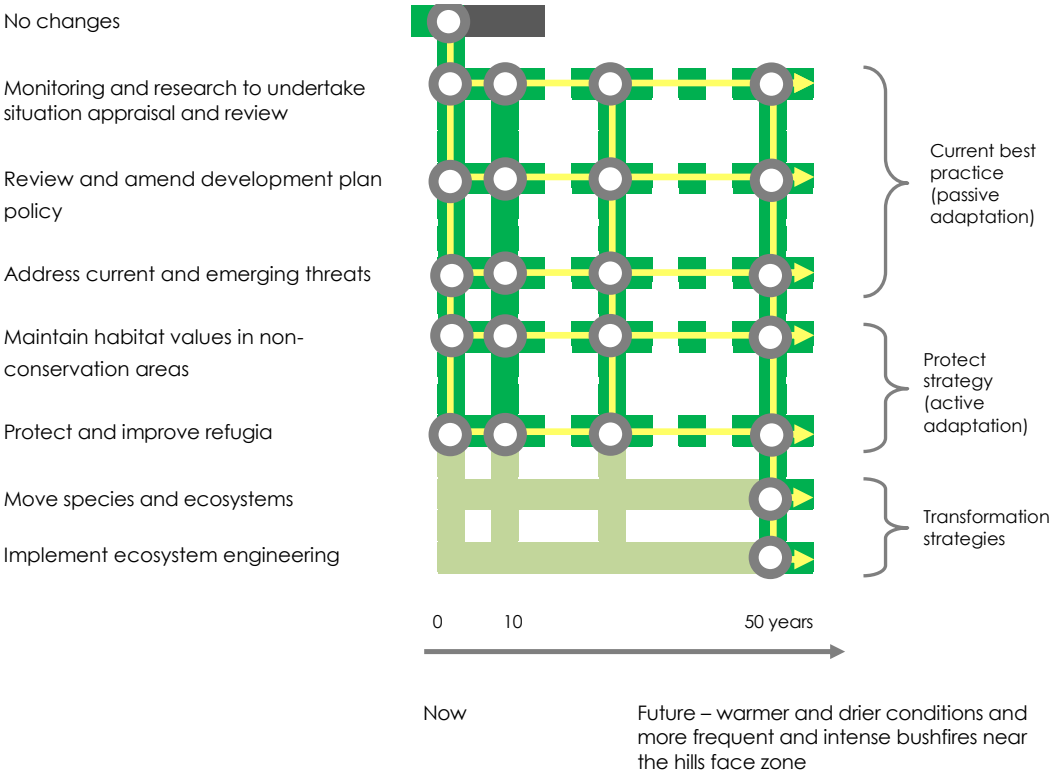
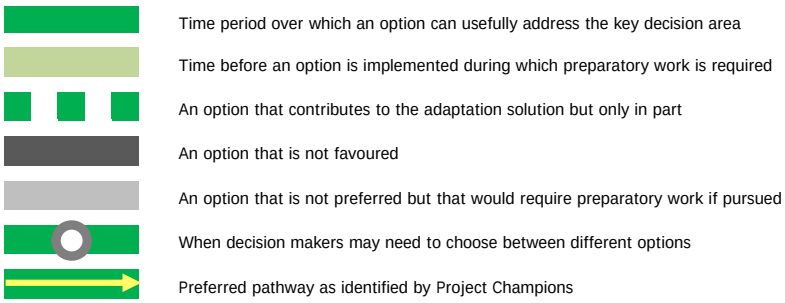


Figure 4-6B: Natural landscapes pathway (plains and hills face)

See Figure 4-1 for an explanation of how to interpret this figure.



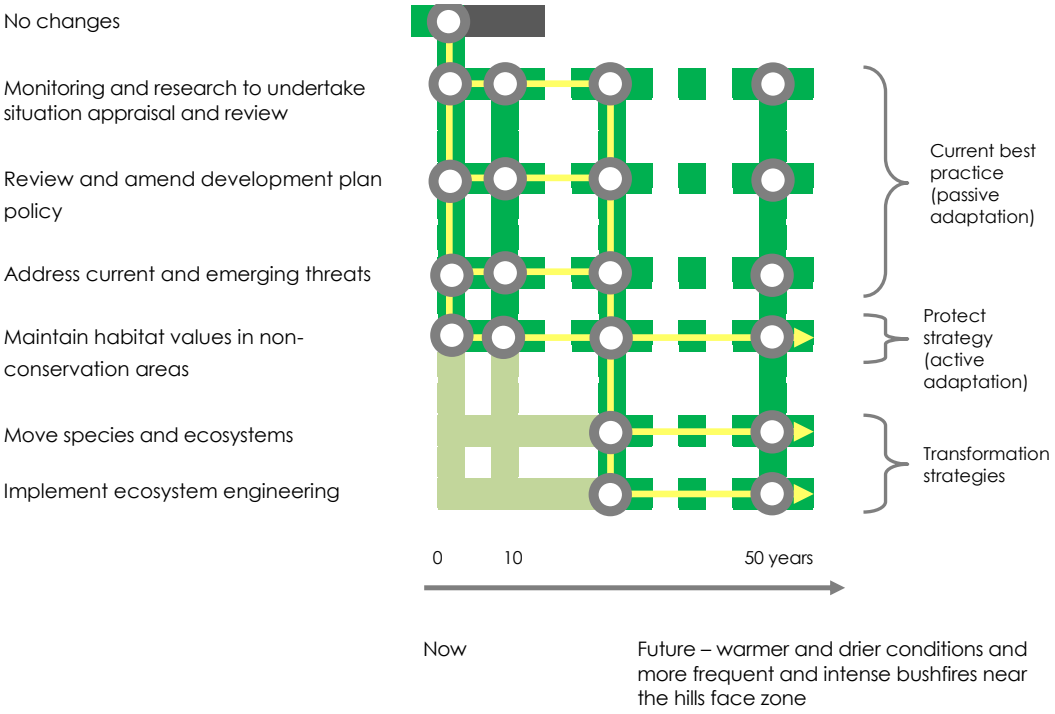
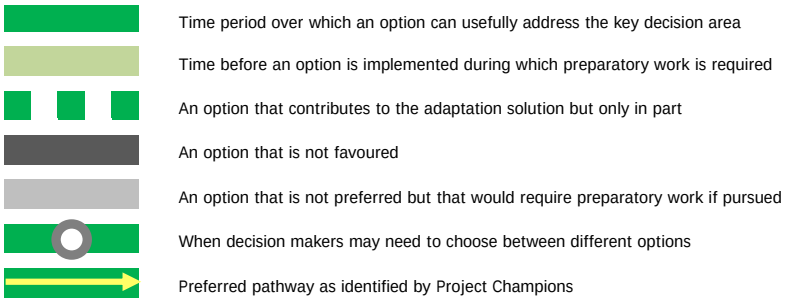
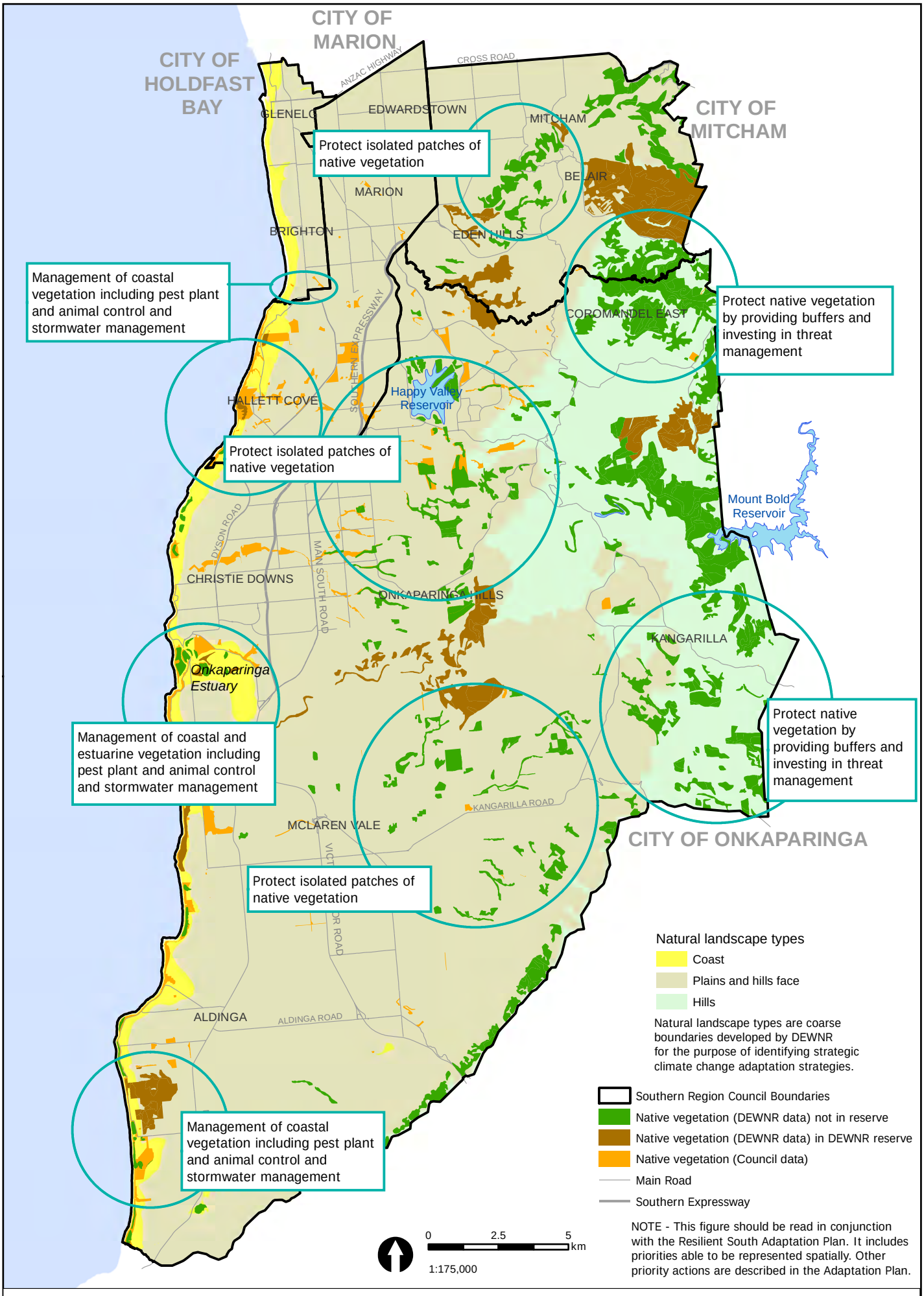


Figure 4-6C: Natural landscapes pathway (coastal)

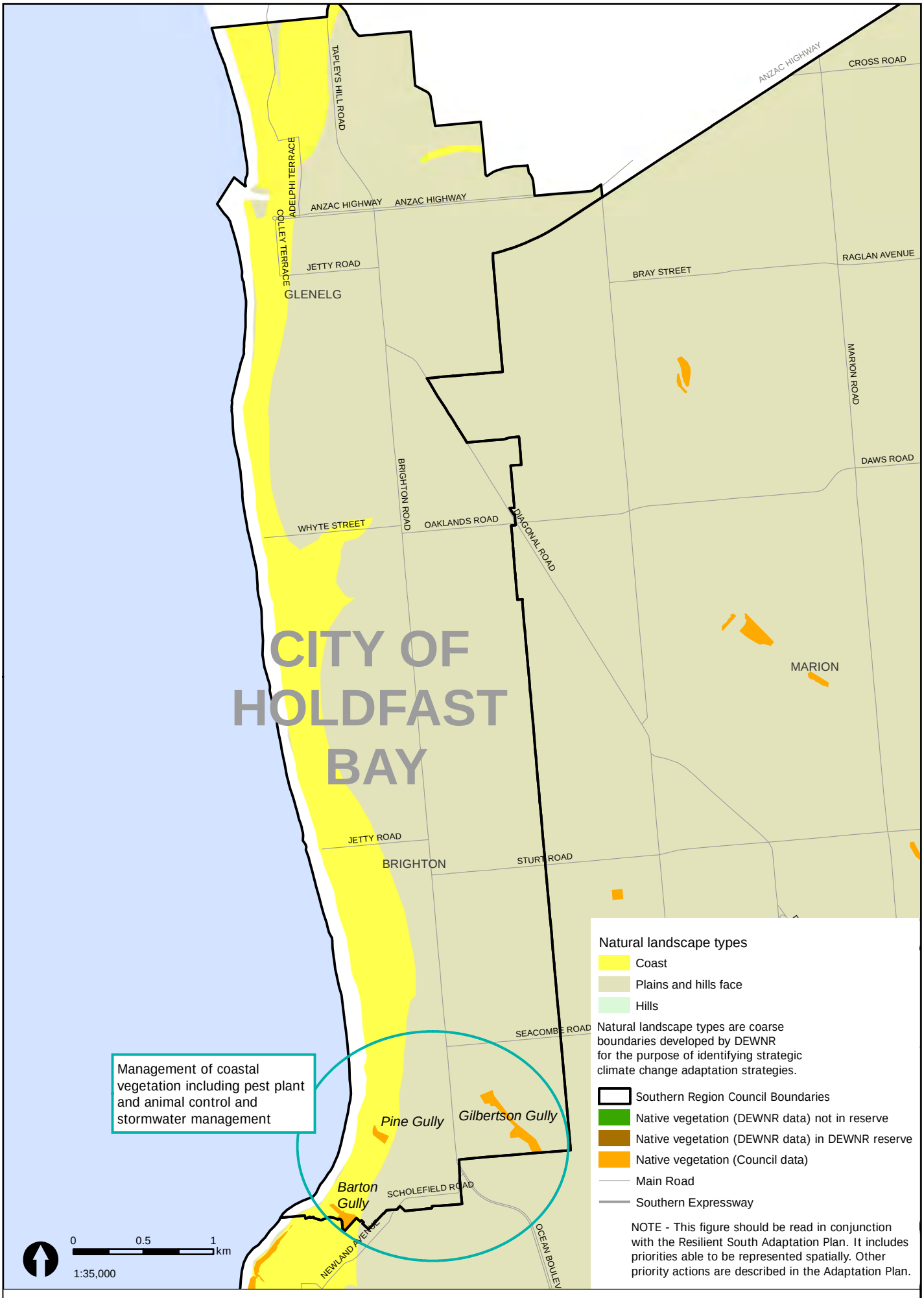
See Figure 4-1 for an explanation of how to interpret this figure.





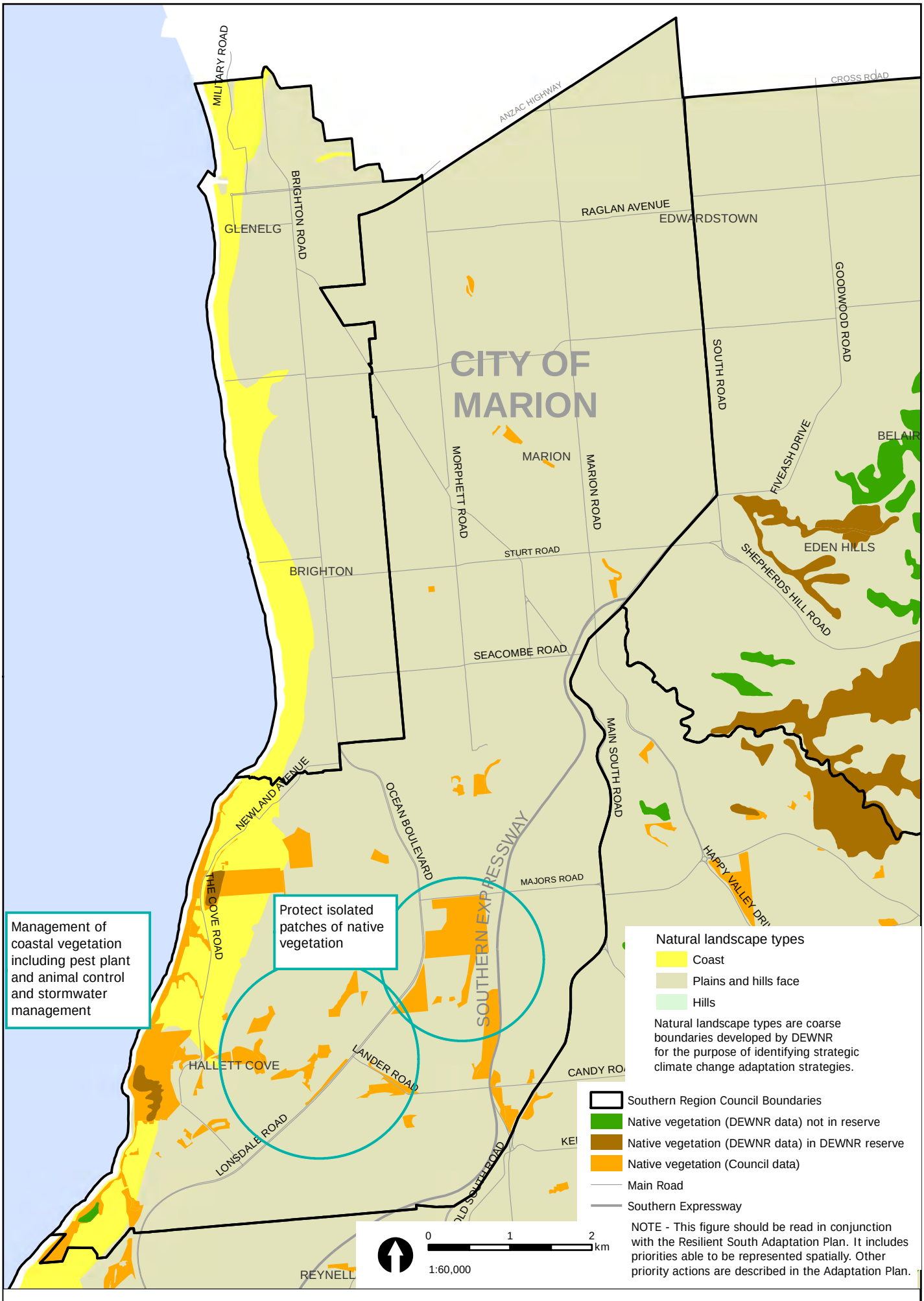
Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 29, 2014

Figure 4-7 Preferred Options for Natural Landscapes
Resilient South



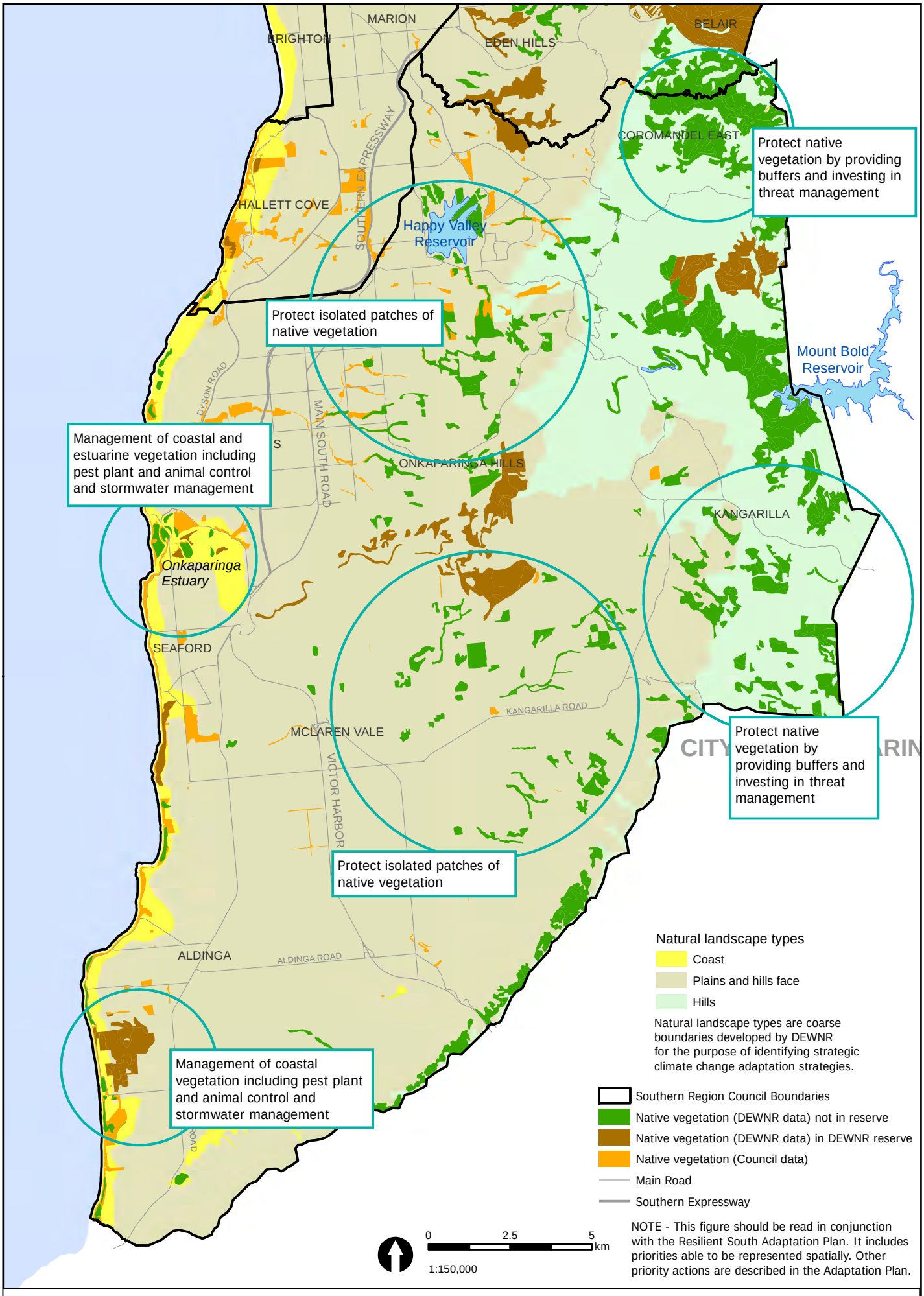
Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 29, 2014

Figure 4-7 (A) Preferred Options for Natural Landscapes
Resilient South - City of Holdfast Bay



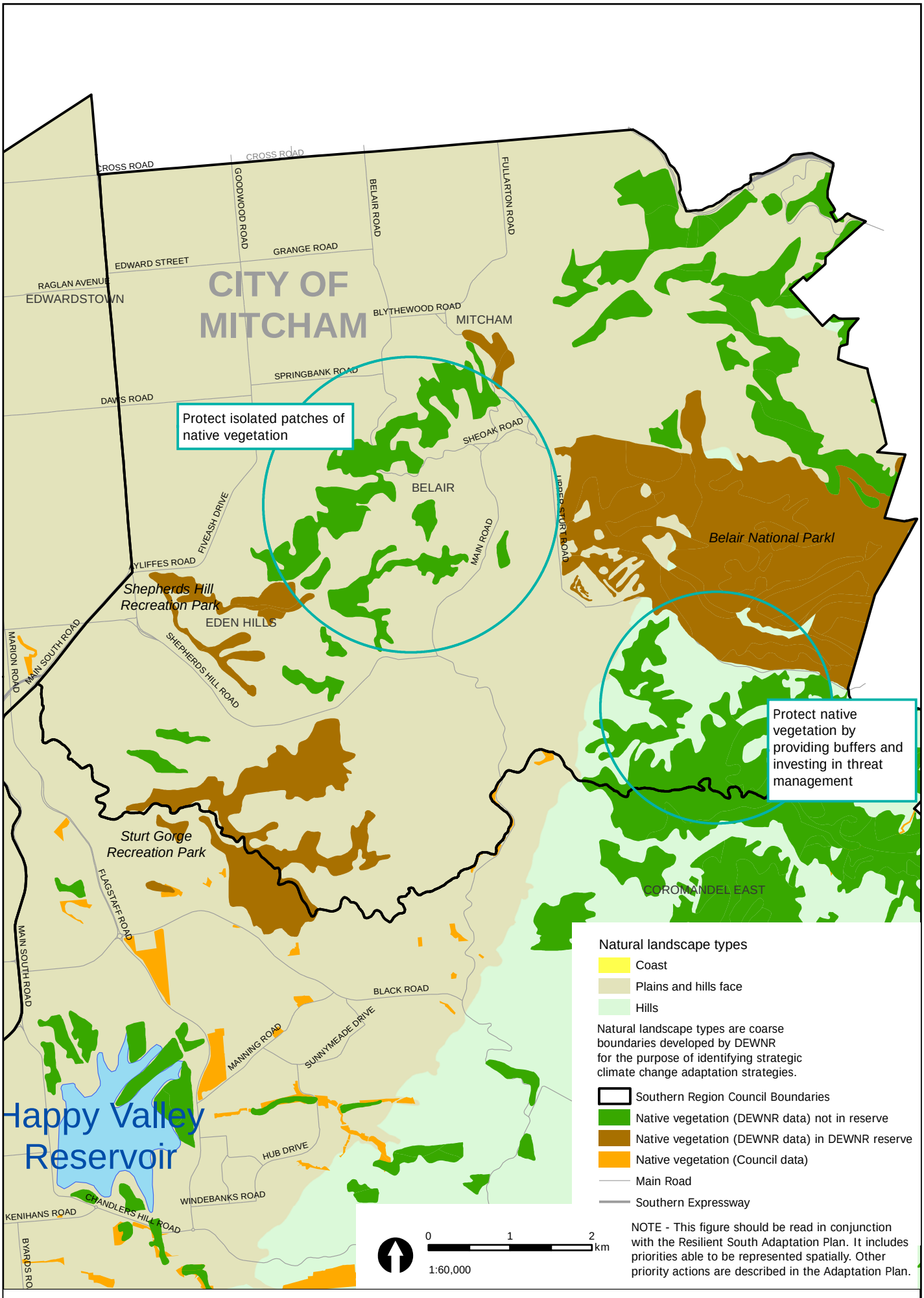
Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
June 28, 2014

Figure 4-7 (B) Preferred Options for Natural Landscapes
Resilient South - City of Marion



Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
June 28, 2014

Figure 4-7 (C) Preferred Options for Natural Landscapes
Resilient South - City of Onkaparinga



Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
June 28, 2014

Figure 4-7 (D) Preferred Options for Natural Landscapes
Resilient South - City of Mitcham

4.7 Marine biodiversity

Key area of decision making

How do we protect marine biodiversity given increasing sea surface temperatures, ocean acidification and changing stormwater input due to changing rainfall patterns?

Why is protecting marine biodiversity important?

The waters and biodiversity of Gulf St Vincent are highly valued by the Southern Region and beyond[46]. The Gulf waters are used for commercial fishing, recreational pursuits such as fishing, diving and boating and have high conservation significance. Marine biodiversity consists of important areas of native flora and fauna. Notable in the Region are extensive areas of seagrass, kelp and reef, although the area of seagrass has reduced as a consequence of pollution induced dieback. As a result work has already commenced to consider ways to reduce water quality impacts in Adelaide's coastal waters (e.g. the Environment Protection Agency's Adelaide Coastal Water Quality Improvement Plan[47]).

How will climate change impact marine biodiversity?

The IVA found that increasing sea surface temperatures, ocean acidification, rising sea levels and changing rainfall patterns will have a negative impact on marine biodiversity[48]. For example:

- The waters of Gulf St Vincent are warmer than the surrounding Southern Ocean and characterised by a unique flora and fauna. Warming of these waters poses a unique challenge where the full range of the current species may no longer be able to persist in the Region, yet species more tolerant of warmer conditions may be unable to migrate to the Region;
- Ocean acidification is expected to threaten calcifying marine organisms such as coral, plankton, crustaceans (e.g. crabs and prawns) and molluscs (e.g. scallops, cephalopods); and
- Changes to rainfall patterns could have a major impact on sea grass. Low rainfall combined with an increased frequency of intense rainfall events can have an adverse impact on marine biodiversity. This is because if rivers and creeks are not regularly "flushed" and an intense rainfall event occurs there will most likely be a higher nutrient load released to the Gulf compared to regular flows with lower nutrient loads.

Stress from changing temperatures, acidification and pollution will create ecological disturbances in the marine ecosystem. Marine pest plants and animals by their nature are less likely to be sensitive to climate change impacts than native species. Declining native species diversity and distribution will likely result in increases in the population size and distribution of pest plant and animal species.

[46] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[47] Environment Protection Authority (2013) *Adelaide Coastal Water Quality Improvement Plan*
[48] Resilient South (2014d) *IVA Technical Report – Resilient South*

How can we respond to the impacts of climate change on marine biodiversity?

The marine biodiversity pathway (refer Figure 4-8) shows four preferred options that all require implementation now and form the current preferred pathway.

Research: More information is required about the potential impacts of climate change on the marine environment. Research needs to focus on the sensitivity and adaptive capacity of key marine species (e.g. seagrasses and kelp) to climate change impacts including research into the effects of individual stressors (e.g. increased temperatures) and multiple stressors (e.g. increased temperature and intensity of rainfall). Figure 4-9 shows benthic habitat including locations of seagrass communities.

Management plans: Management plans will provide an important tool to help respond to climate change and must consider emerging issues. Stormwater Management Plans and Water Quality Improvement Plans have scope to consider impacts on the receiving environment including marine biodiversity. Figure 4-9 shows locations where there is a high density of stormwater outlets that may be the focus for end of pipe management. More effort is required to develop marine pest plant and animal management plans.

Threat reduction: While better understanding the precise impacts of climate change on marine biodiversity in the Region requires further research, work can commence now to reduce non-climate change threats by further reducing stormwater and wastewater discharges and managing the potential spread of marine pest plant and animal species.

The best mix of adaptations options and whether new actions should be considered and in what sequence should be reviewed within 10 years once the results of further research becomes available.

Additional engagement is required in future adaptation planning projects to further develop this pathway.

Summary of preferred options for protecting marine biodiversity

Now

- Research;
- Address marine biodiversity in water management plans;
- Marine pest and plant animal management plan; and
- Reduce non-climate change threats to marine biodiversity.

Within 10 years

- Reassess potential climate impacts and adaptation options once the result of further research becomes available.

Figure 4-9 identifies where these preferred options might apply spatially for the Southern Region

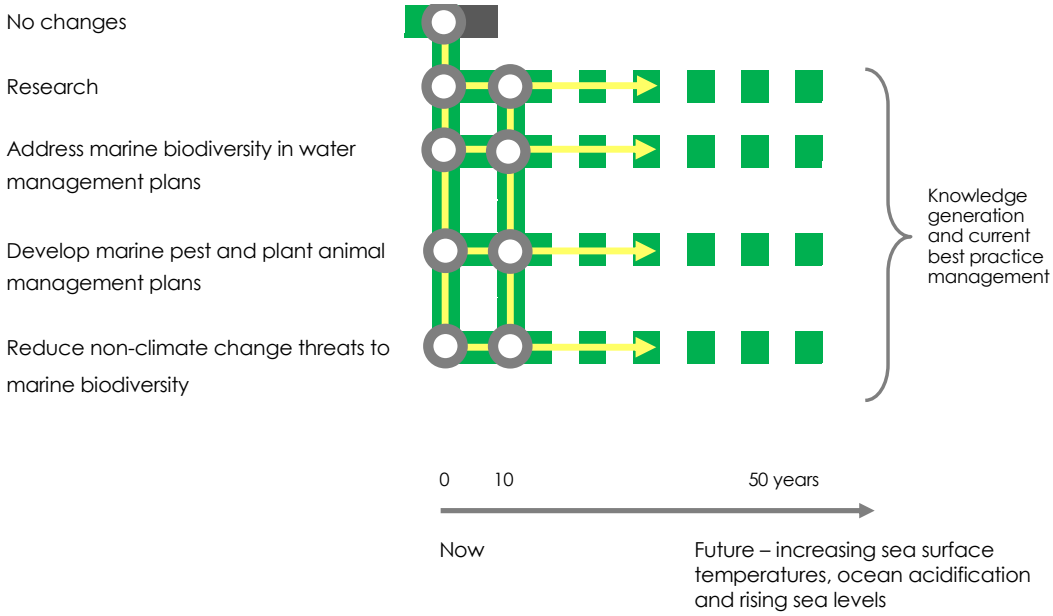
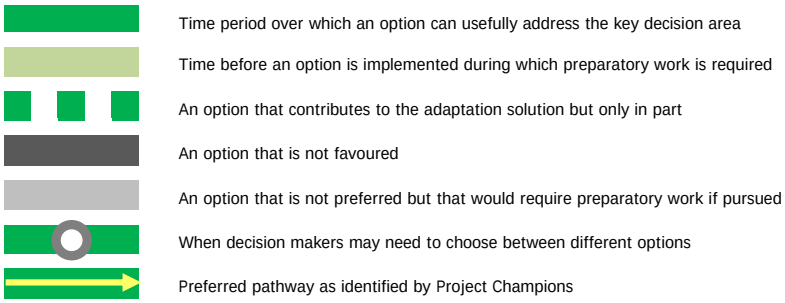
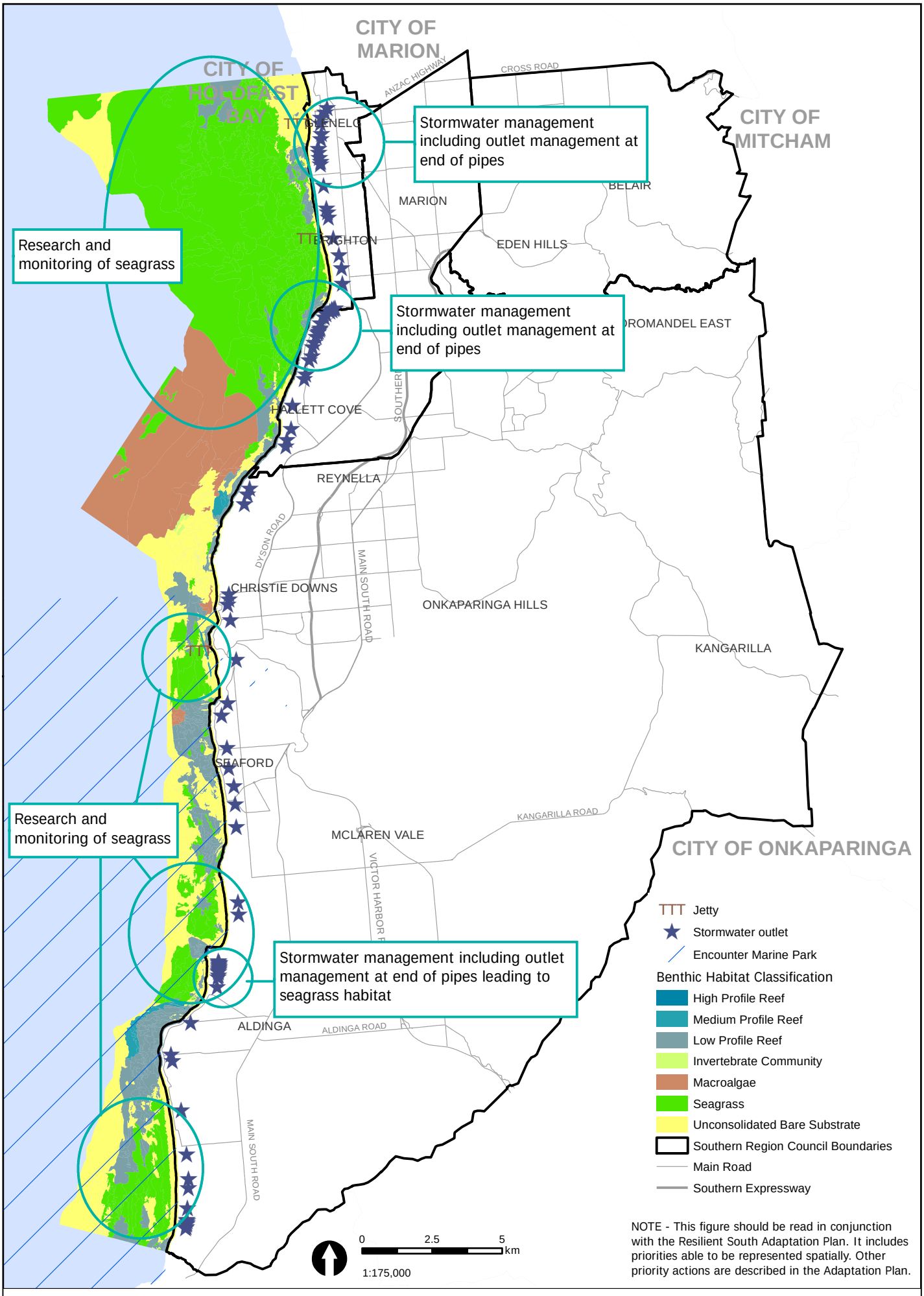


Figure 4-8: Marine biodiversity pathway

See Figure 4-1 for an explanation of how to interpret this figure.

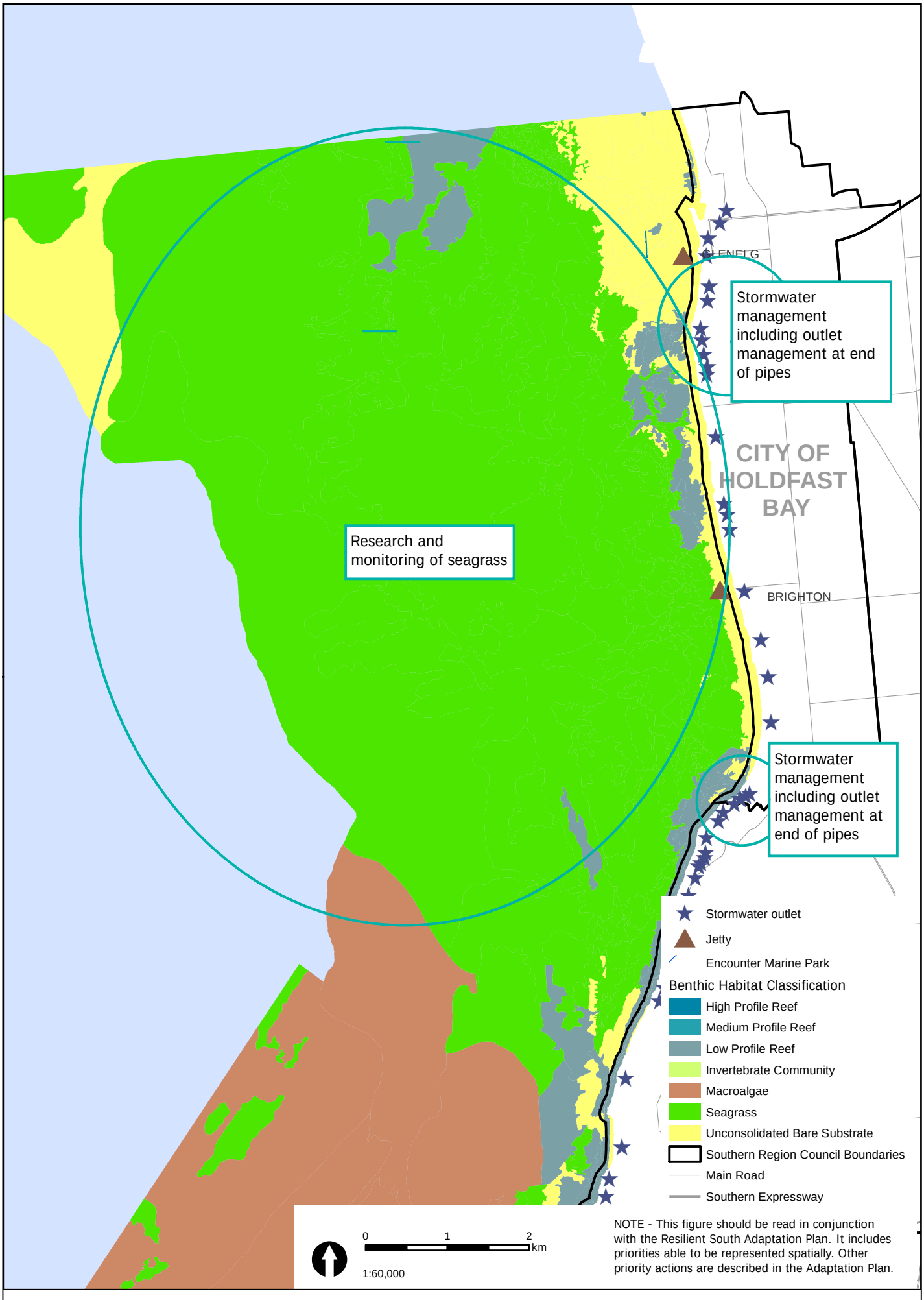




NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

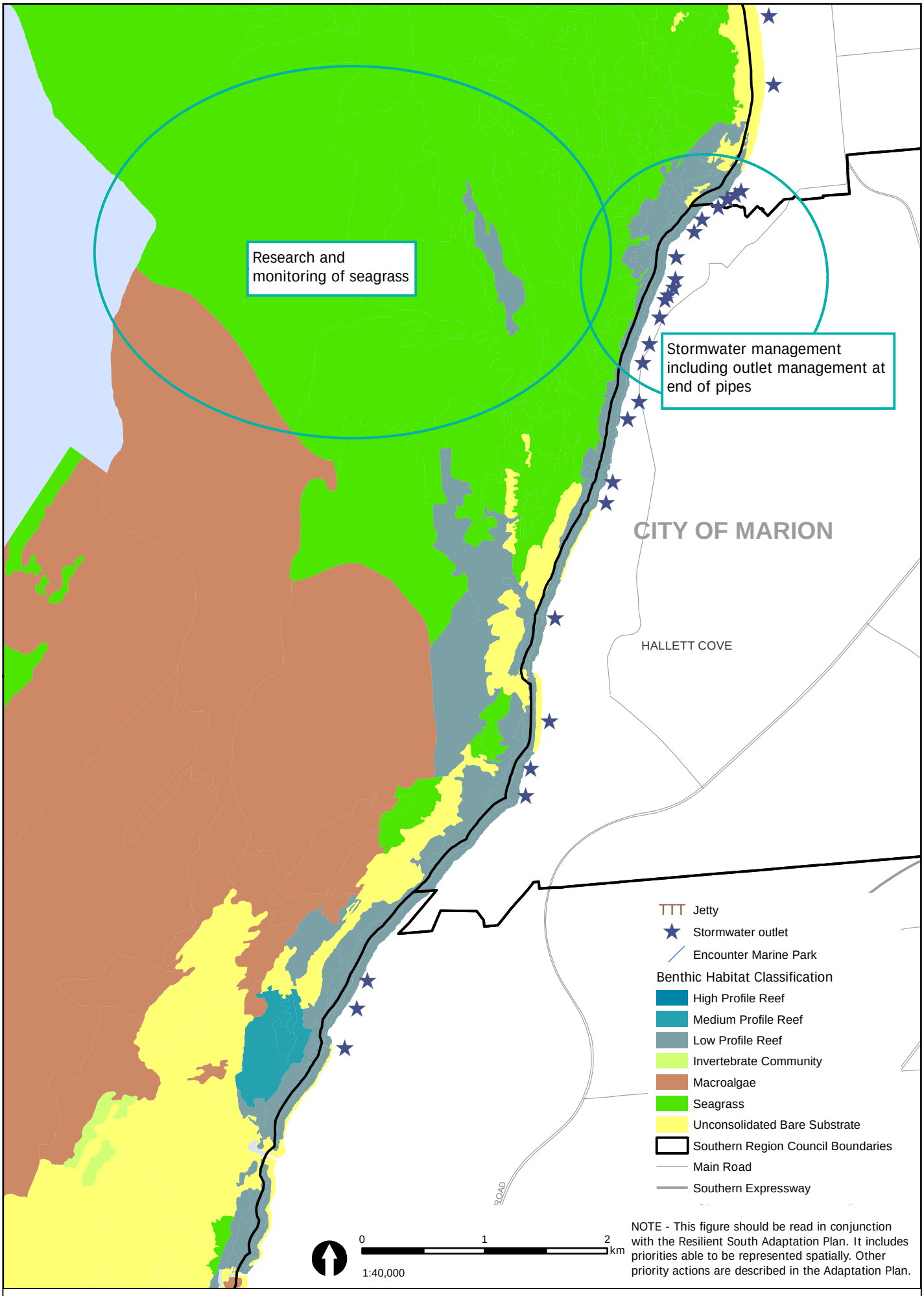
Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
Junly 28, 2014

Figure 4.9 Preferred Options for Marine Biodiversity
Resilient South



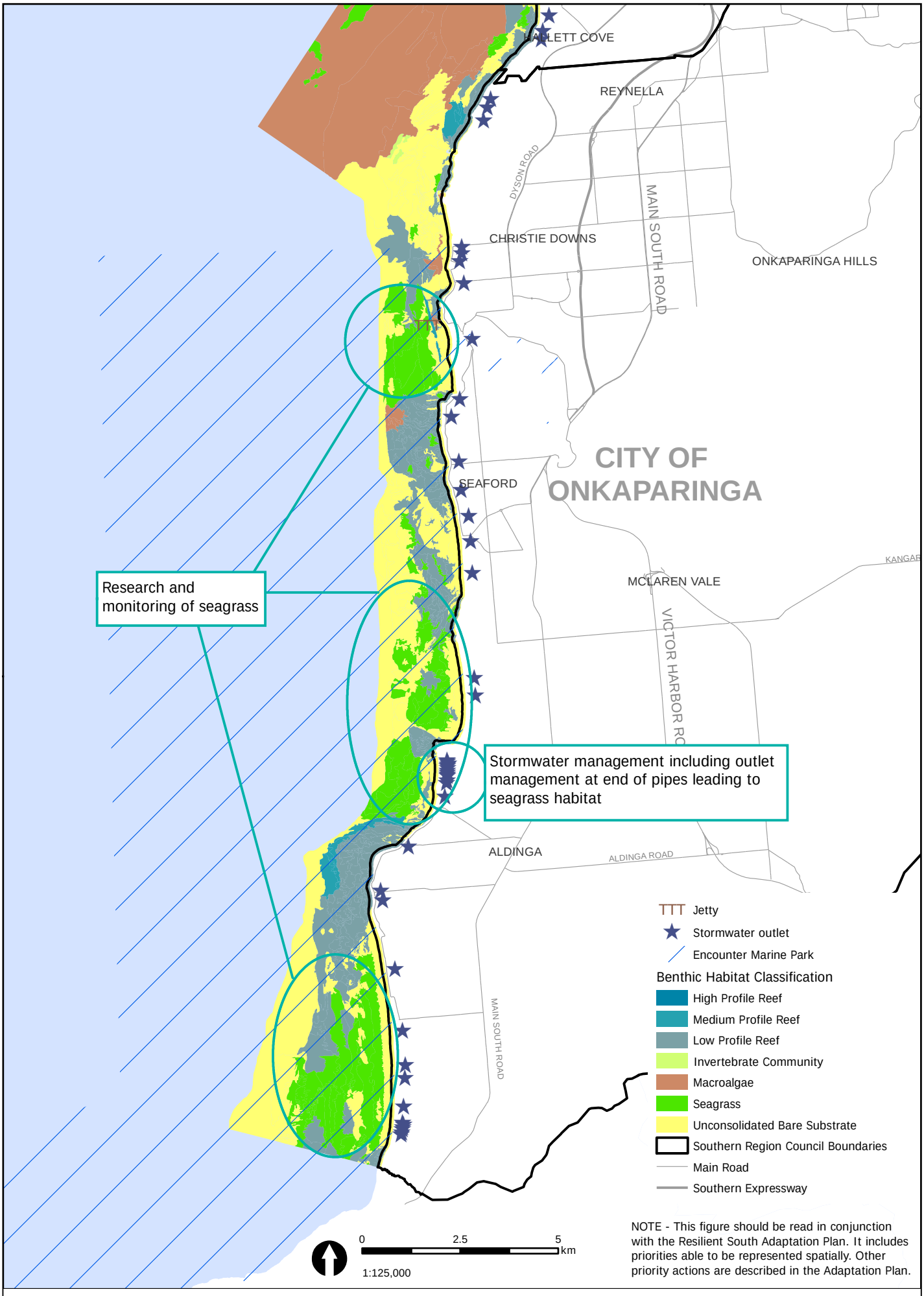
Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
Junly 28, 2014

Figure 4.9 (A) Preferred Options for Marine Biodiversity
Resilient South - City of Holdfast Bay



Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
Junly 28, 2014

Figure 4.9 (B) Preferred Options for Marine Biodiversity
Resilient South - City of Marion



Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
Junly 28, 2014

Figure 4.9 (C) Preferred Options for Marine Biodiversity
Resilient South - City of Onkaparinga

4.8 Vulnerable members of the community

Key area of decision making

How do we support and facilitate the safety and wellbeing of vulnerable members of our community so that they are more resilient in the face of more frequent intense rainfall events, more frequent bushfires and heatwaves, increased temperatures and increased risk of coastal inundation as a result of sea level rise?

Why is supporting vulnerable members of the community important?

Members of the community who are already vulnerable due to isolation from transport services, poor health and dependence on others for care and mobility (such as frail aged, children and those people receiving support from social services) will be more vulnerable to climate change impacts, particularly during extreme events. These may be impacts on access to health care services and school attendance rates.

Areas where more than 50% of the resident population is over 65 years old are located in the northern areas of the City of Marion and western areas of the City of Mitcham[49]. In contrast, nearly 60% of areas in the City of Onkaparinga have more than 25% of the resident population aged 0-19 years. Supporting and facilitating the safety and wellbeing of vulnerable members of the community is a priority for Project Champions in the Region[50]. 'Preparing for Climate Change' is also a priority of the SA Public Health Plan.

How will climate change impact vulnerable members of the community?

The IVA found that without adaptation climate change will adversely impact vulnerable members of the community in the Region, and that impacts associated with climate change will further exacerbate existing vulnerability[51]. The types of impacts will vary between council areas as climate risks change from the hills to the plains and coast.

Heatwaves

Heatwaves are of significant concern across the entire Region for vulnerable members of the community and are known to cause greater morbidity and mortality than other climate extremes. Access to heat refuges or cooler (air conditioned) places is an essential part of people's adaptive capacity under such circumstances. Yet many elderly people and those reliant on assistance for core activities in particular may not have access to air-conditioning or the ability to finance its use, may live in non-climate sensitive housing or may not be mobile enough to access heat refuges or other support services when needed. School attendance rates can also be negatively impacted by heatwaves, although schools are sometimes seen as heat refuges for people with insufficient cooling in their home.

Bushfires

Some older people living independently find it more difficult to maintain properties to reduce bushfire risk and may need to rely on community bushfire response plans. People living in bush fire risk zones that are geographically isolated from transport face similar risks as older people with low mobility. In contrast, while children under 12 years may be more mobile

[49] Resilient South (2014a) *Regional Profile – Resilient South*
[50] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[51] Resilient South (2014d) *IVA Technical Report – Resilient South*

and likely to be taken to safe havens, they are also more impacted by smoke and likely to experience psychological impacts from bushfire events which may in turn impact school attendance rates during and after bushfires.

Flooding

Increased flood risk either from more frequent, intense rainfall events or rising sea levels and storm surge will impact people that are less mobile in the community, including people aged over 65 years and those geographically isolated from transport.

How can we respond to the impacts of climate change on vulnerable members of the community?

The vulnerable members of the community pathway (refer Figure 4-10) shows a range of preferred adaptation options. All but one of these options have been identified by Project Champions for immediate acceleration, emphasising the need for an urgent response.

Accelerating current best practice and protection strategies

A number of preferred options are already considered best practice and require further expansion, including:

- Supporting service systems to assist the young, elderly/frail aged and those reliant on assistance for core activities;
- Developing emergency management plans such as the Red Cross Emergency REDiPlan which provides people with general information to help them prepare for an emergency;
- Facilitating access to counselling and trauma services;
- Recognising the role of carers; and
- Supporting non-government organisations which provide many of these services.

Emergency management planning and building social connectivity were also considered current best practice activities that require further support and expansion (Section 4.9 further describes emergency services adaptation actions). Building social connectivity can be achieved in a number of ways including education and awareness raising about the health impacts of climate hazards and how to prepare for and recover from extreme events, developing a culture of civic leadership and community action, building social participation, protecting and promoting individual health and well being, and encouraging collaboration to enhance formal and informal support networks. Project Champions strongly encouraged diverse thinking on how to raise awareness and suggested greater use of social media, engagement with special interest groups and State-wide advertising campaigns.

Figure 4-11 identifies areas of higher vulnerability (e.g. higher proportion of population aged over 65 years, low income, low educational attainment, aged living facilities and schools) where education and awareness programs could be targeted regarding flooding, heatwave and bushfire.

Other adaptation options to protect vulnerable members of the community include:

- Provision of essential services subsidies to offset the full cost of electricity as a way to support people on low incomes to use air-conditioners or other cooling strategies during heat waves. Essential services adaptation actions are described further in Section 4.8;

- Utilising and expanding existing technology for emergency situations such as existing services like the Red Cross Telecross service, which checks on the well being of isolated people with a daily phone call;
- Establish emergency response centres and provide assisted transport such as for elderly people and young children and/or students; and
- Developing and maintaining a vegetated public realm to create climate resilient neighbourhoods, reduce the impacts of the urban heat island effect, and contribute to the health and wellbeing of communities.

Figure 4-11 shows:

- Areas with lowest income households which could be supported through essential services subsidies; and
- Libraries and major shopping centres which may provide relief from extreme heat.

Figure 4-12 shows areas with highest vulnerability to heatwave and increased presentation at hospital emergency departments on hot days adapted from research into heatwave vulnerability in Australian cities[52]. These areas could be targeted for public realm vegetation.

Emerging protection strategy

Fundamental to re-thinking how to support and facilitate the resilience of vulnerable members of the community is encouraging climate sensitive housing and infrastructure, including the incorporation of alternative energy sources. Implementation of this option should commence within 10 years. Not only will this benefit vulnerable members of the community but if adopted more broadly could result in more climate resilient urban development. This could be achieved through increasing solar rebates and rewarding ecofriendly households and businesses. Preparatory work needs to commence now to determine how best to encourage design and construction of climate sensitive housing and infrastructure.

Summary of preferred options for supporting and facilitating the resilience of vulnerable members of the community to the impacts of climate change:

Now

- Support for service systems to assist the young, elderly/frail aged and those reliant on assistance for core activities;
- Develop emergency management plans;
- Education, awareness raising, cultural change and building social connectivity;
- Provide essential services subsidies;
- Continue to develop technology for emergency situations;
- Establish emergency response centres and provide assisted transport; and
- Develop and maintain vegetated public realm.

[52] Loughnan, M., N. Tapper, et al. (2013*). A spatial vulnerability analysis of urban populations during extreme heat events in Australian capital cities*, pp.128.

Within 10 years

- Construct climate sensitive development.

Preparatory work

- Investigate ways to support adoption of climate sensitive development.

Figures 4-11 and 4-12 identify where these preferred options might apply spatially for the Southern Region.

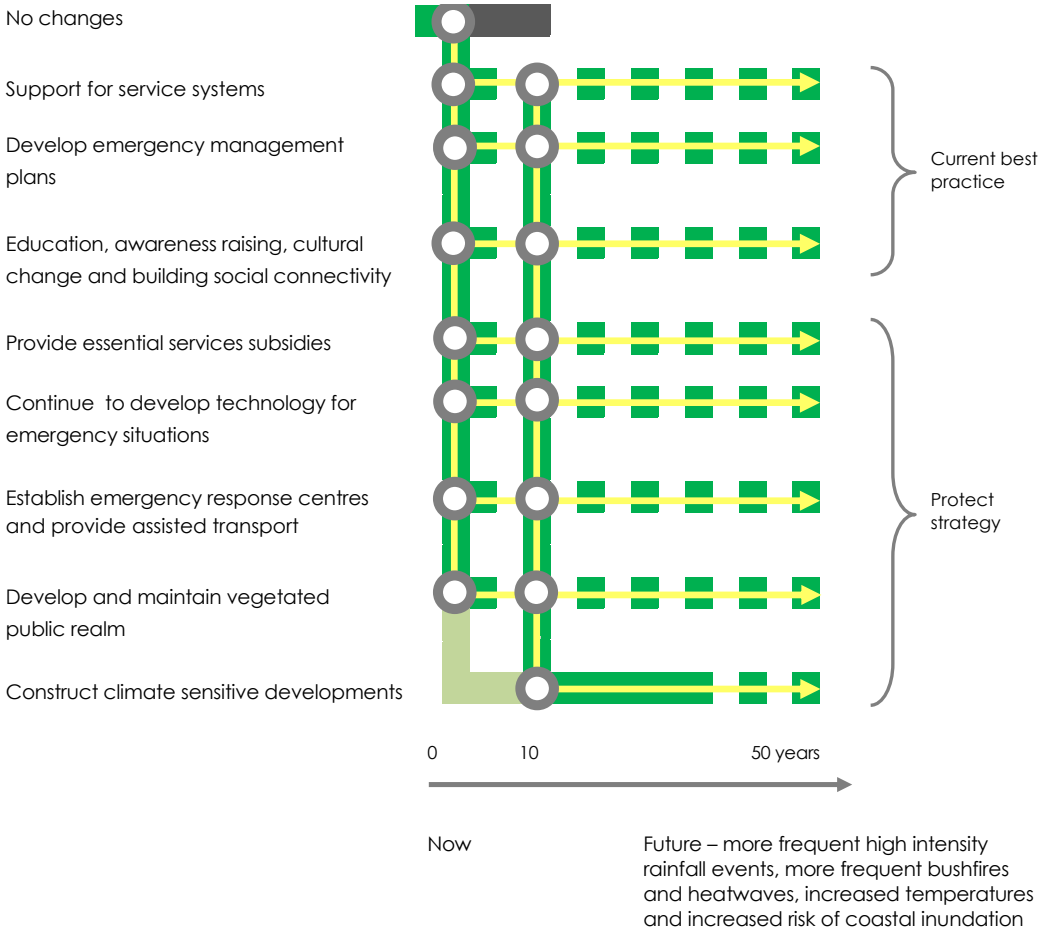
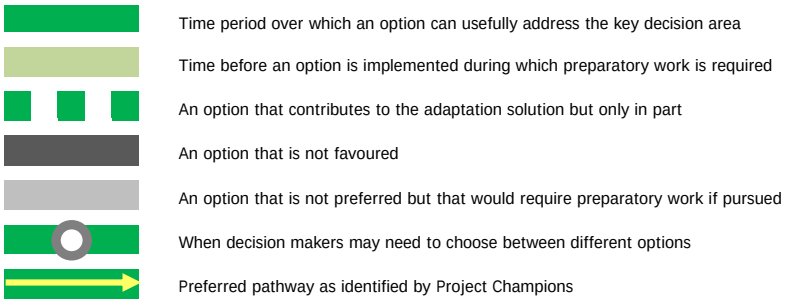
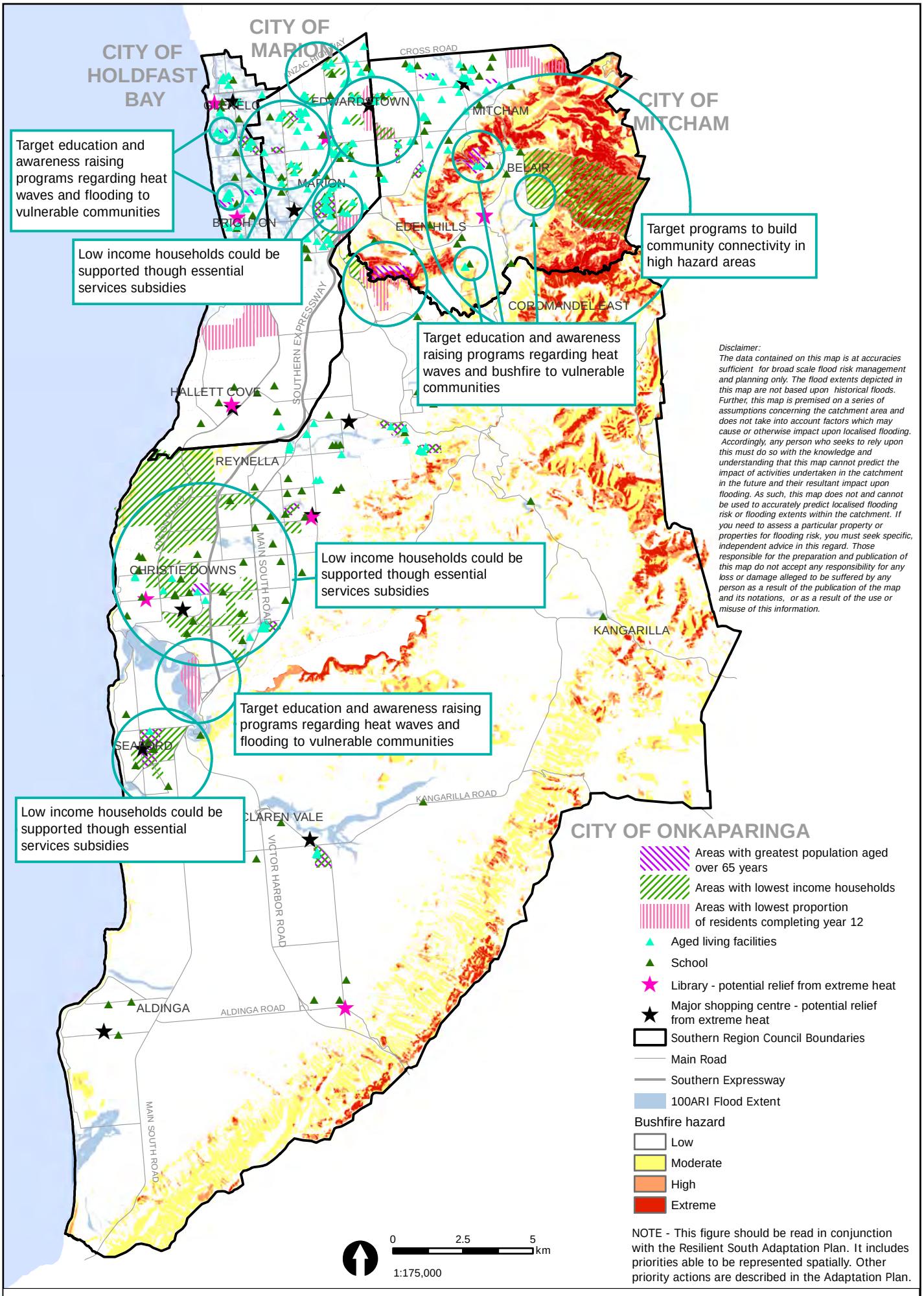


Figure 4-10: Vulnerable members of the community pathway

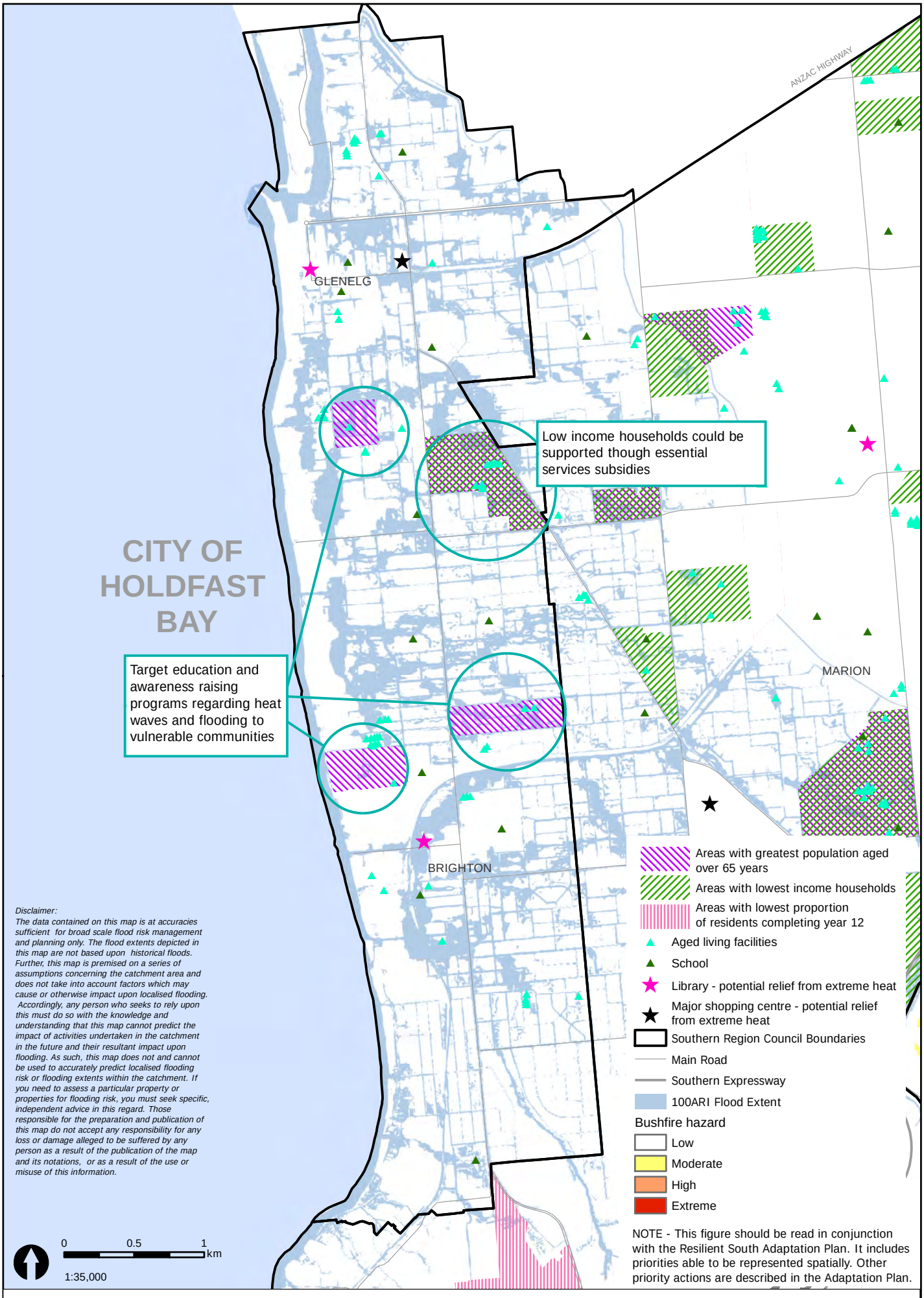
See Figure 4-1 for an explanation of how to interpret this figure.





Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 30, 2014

Figure 4.11 Preferred Options for Vulnerable Members of the Community (1)
Resilient South

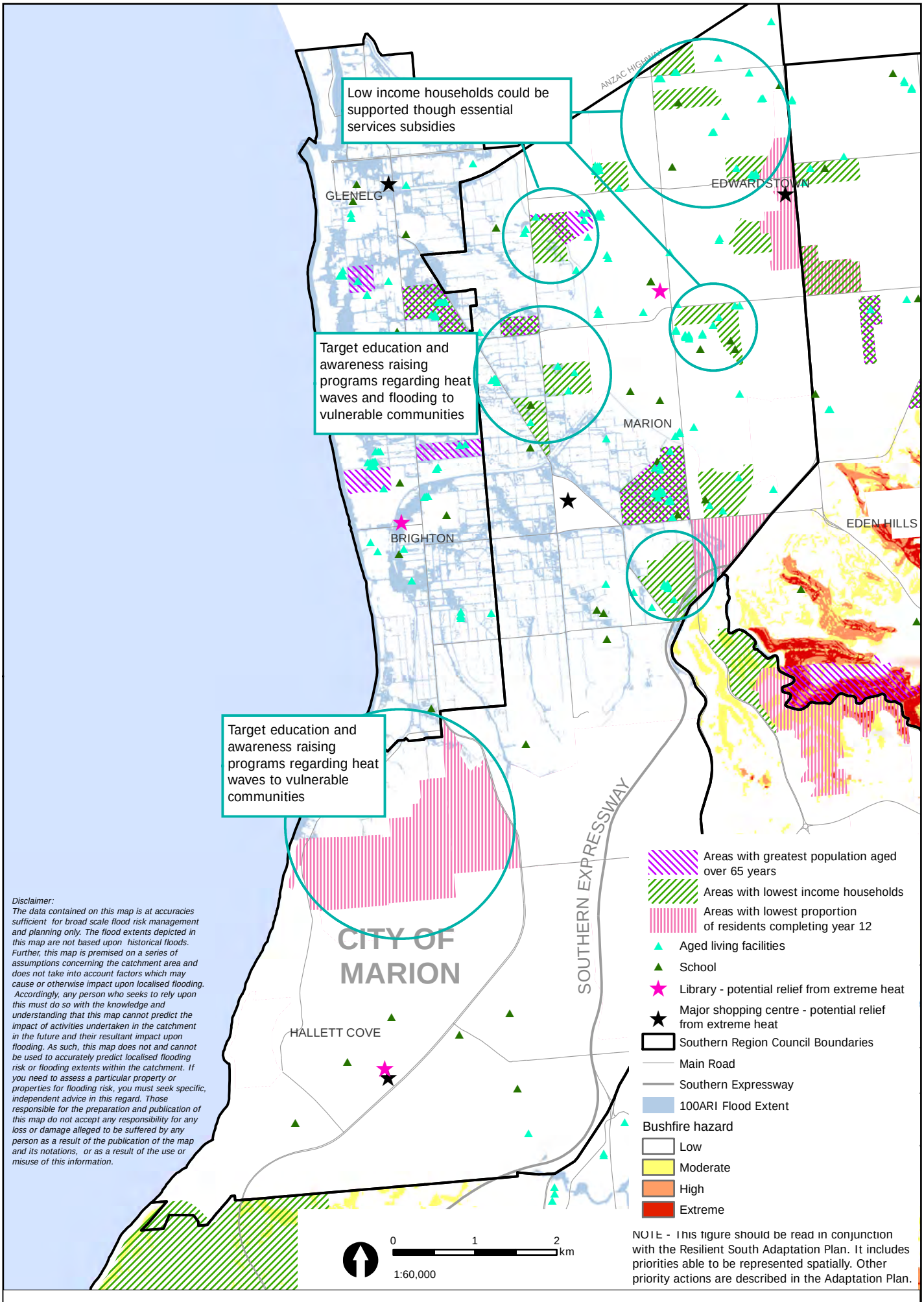


Disclaimer:
The data contained on this map is at accuracies sufficient for broad scale flood risk management and planning only. The flood extents depicted in this map are not based upon historical floods. Further, this map is premised on a series of assumptions concerning the catchment area and does not take into account factors which may cause or otherwise impact upon localised flooding. Accordingly, any person who seeks to rely upon this must do so with the knowledge and understanding that this map cannot predict the impact of activities undertaken in the catchment in the future and their resultant impact upon flooding. As such, this map does not and cannot be used to accurately predict localised flooding risk or flooding extents within the catchment. If you need to assess a particular property or properties for flooding risk, you must seek specific, independent advice in this regard. Those responsible for the preparation and publication of this map do not accept any responsibility for any loss or damage alleged to be suffered by any person as a result of the publication of the map and its notations, or as a result of the use or misuse of this information.

NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 30, 2014

Figure 4.11 (A) Preferred Options for Vulnerable Members of the Community (1)
Resilient South - City of Holdfast Bay

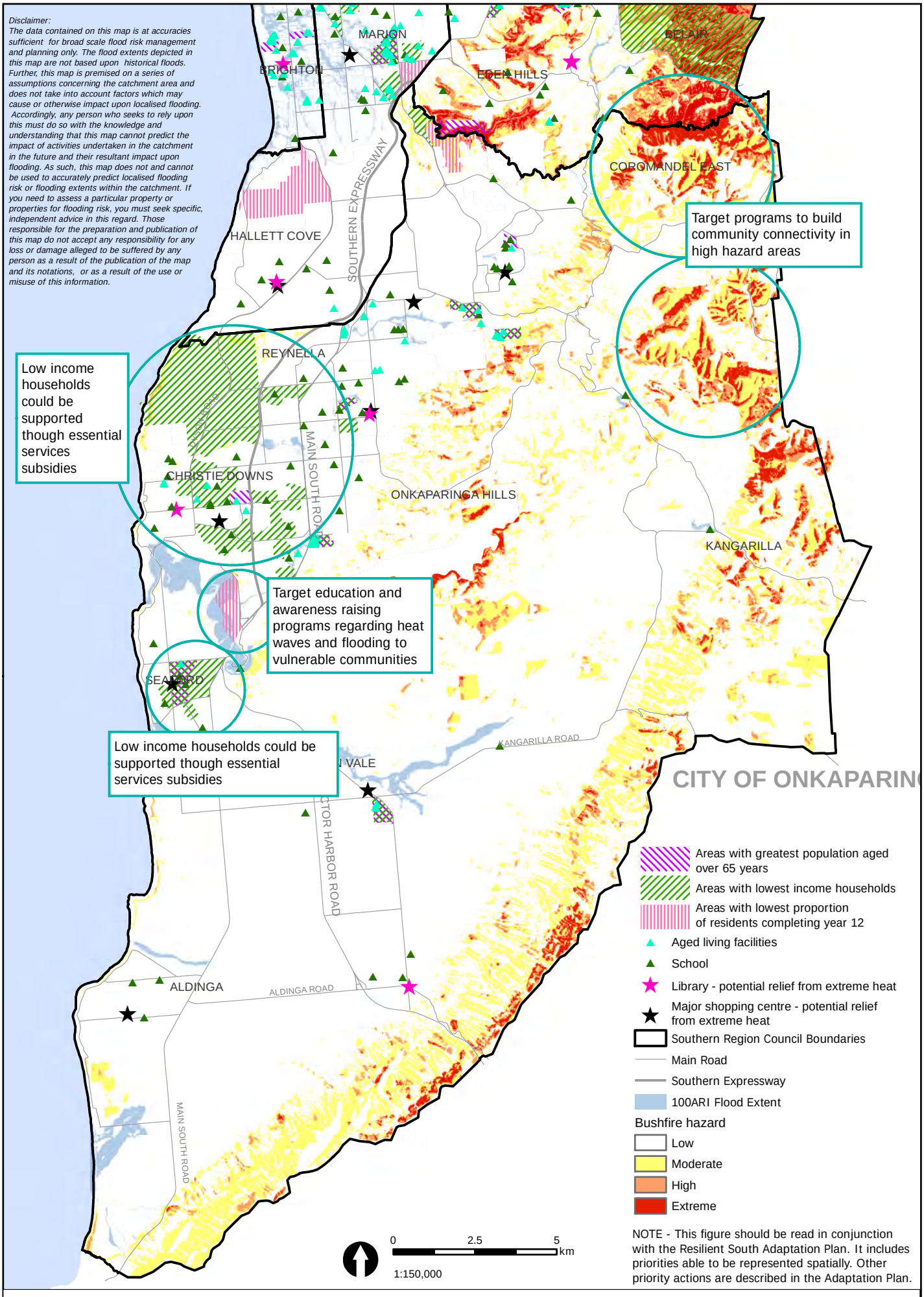


Disclaimer:
The data contained on this map is at accuracies sufficient for broad scale flood risk management and planning only. The flood extents depicted in this map are not based upon historical floods. Further, this map is premised on a series of assumptions concerning the catchment area and does not take into account factors which may cause or otherwise impact upon localised flooding. Accordingly, any person who seeks to rely upon this must do so with the knowledge and understanding that this map cannot predict the impact of activities undertaken in the catchment in the future and their resultant impact upon flooding. As such, this map does not and cannot be used to accurately predict localised flooding risk or flooding extents within the catchment. If you need to assess a particular property or properties for flooding risk, you must seek specific, independent advice in this regard. Those responsible for the preparation and publication of this map do not accept any responsibility for any loss or damage alleged to be suffered by any person as a result of the publication of the map and its notations, or as a result of the use or misuse of this information.

NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

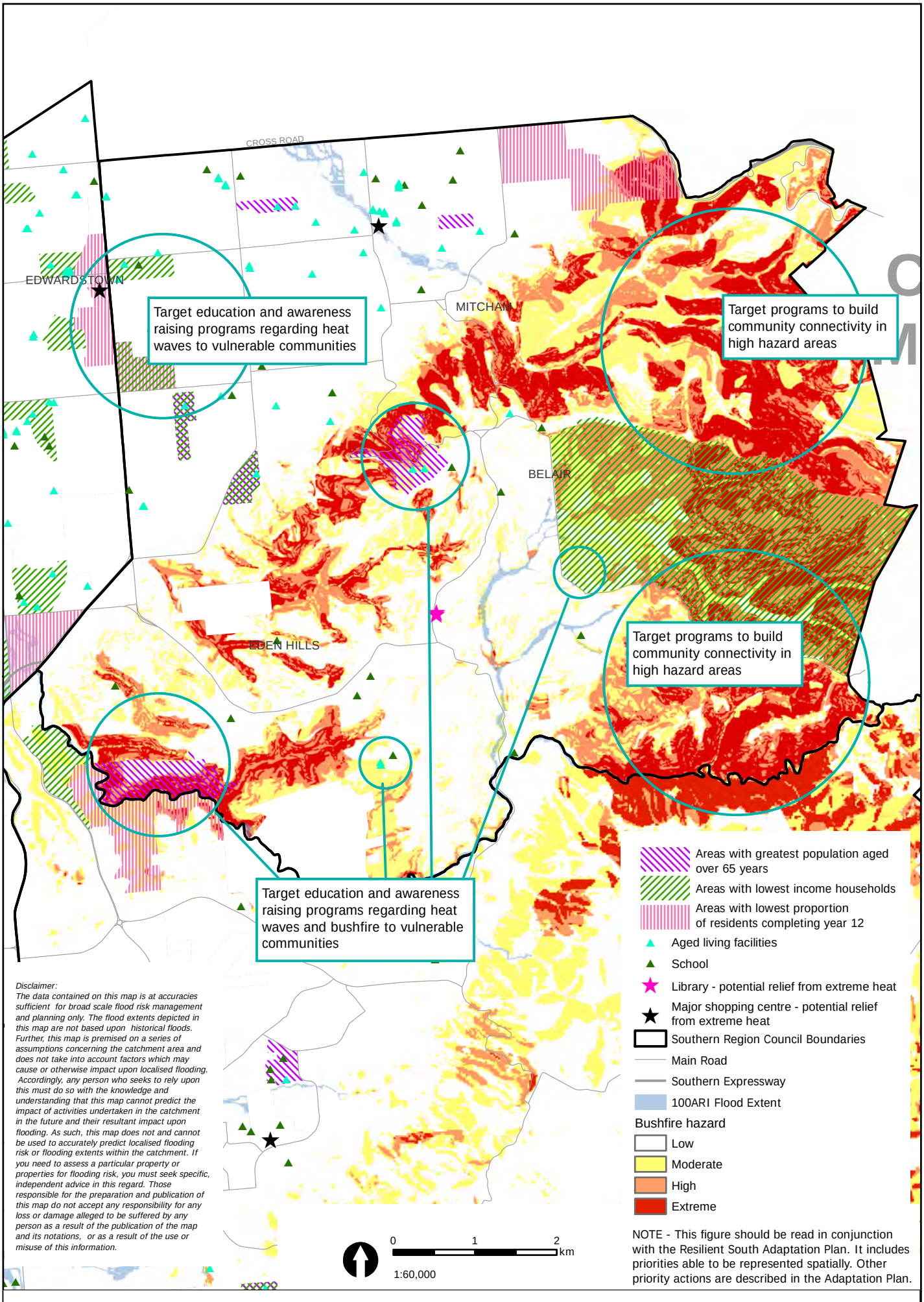
Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.11 (B) Preferred Options for Vulnerable Members of the Community (1)
Resilient South - City of Marion



Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 28, 2014

Figure 4.11 (C) Preferred Options for Vulnerable Members of the Community (1)
Resilient South - City of Onkaparinga

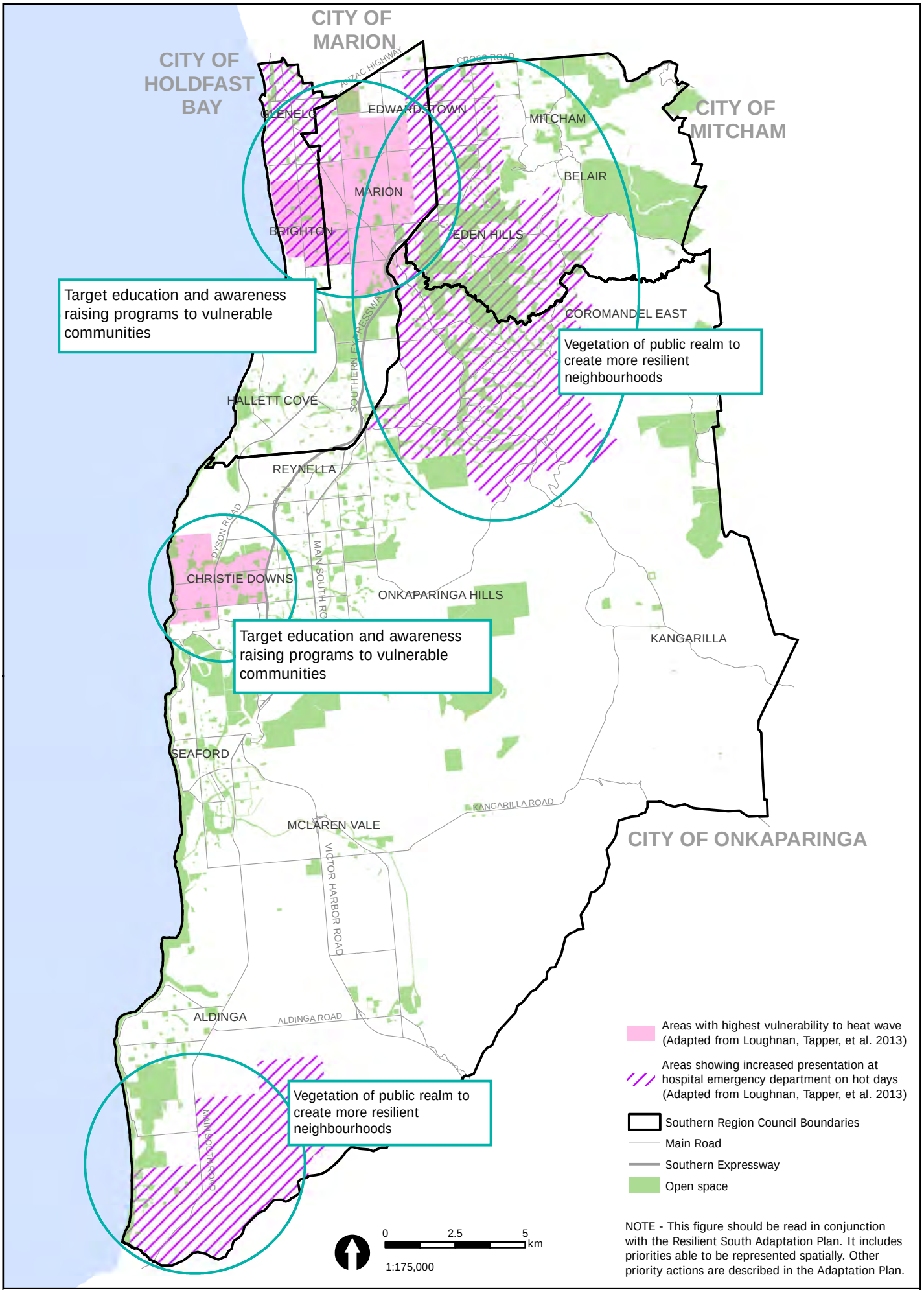


Disclaimer:
The data contained on this map is at accuracies sufficient for broad scale flood risk management and planning only. The flood extents depicted in this map are not based upon historical floods. Further, this map is premised on a series of assumptions concerning the catchment area and does not take into account factors which may cause or otherwise impact upon localised flooding. Accordingly, any person who seeks to rely upon this must do so with the knowledge and understanding that this map cannot predict the impact of activities undertaken in the catchment in the future and their resultant impact upon flooding. As such, this map does not and cannot be used to accurately predict localised flooding risk or flooding extents within the catchment. If you need to assess a particular property or properties for flooding risk, you must seek specific, independent advice in this regard. Those responsible for the preparation and publication of this map do not accept any responsibility for any loss or damage alleged to be suffered by any person as a result of the publication of the map and its notations, or as a result of the use or misuse of this information.

NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

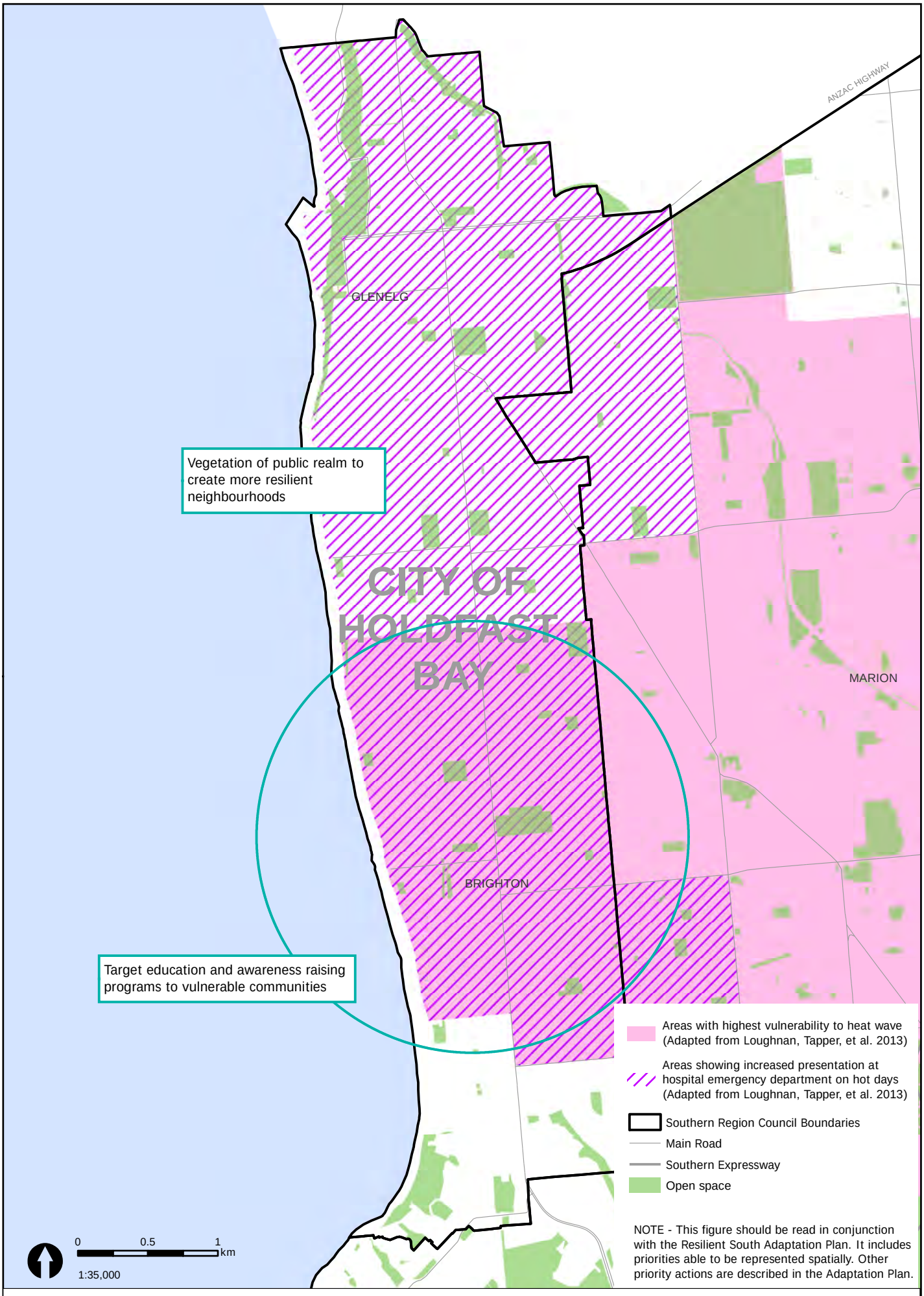
Data Sources: DPTI, Councils, DEWNR
Prepared for the Resilient South Project
July 24, 2014

Figure 4.11 (D) Preferred Options for Vulnerable Members of the Community (1)
Resilient South - City of Mitcham



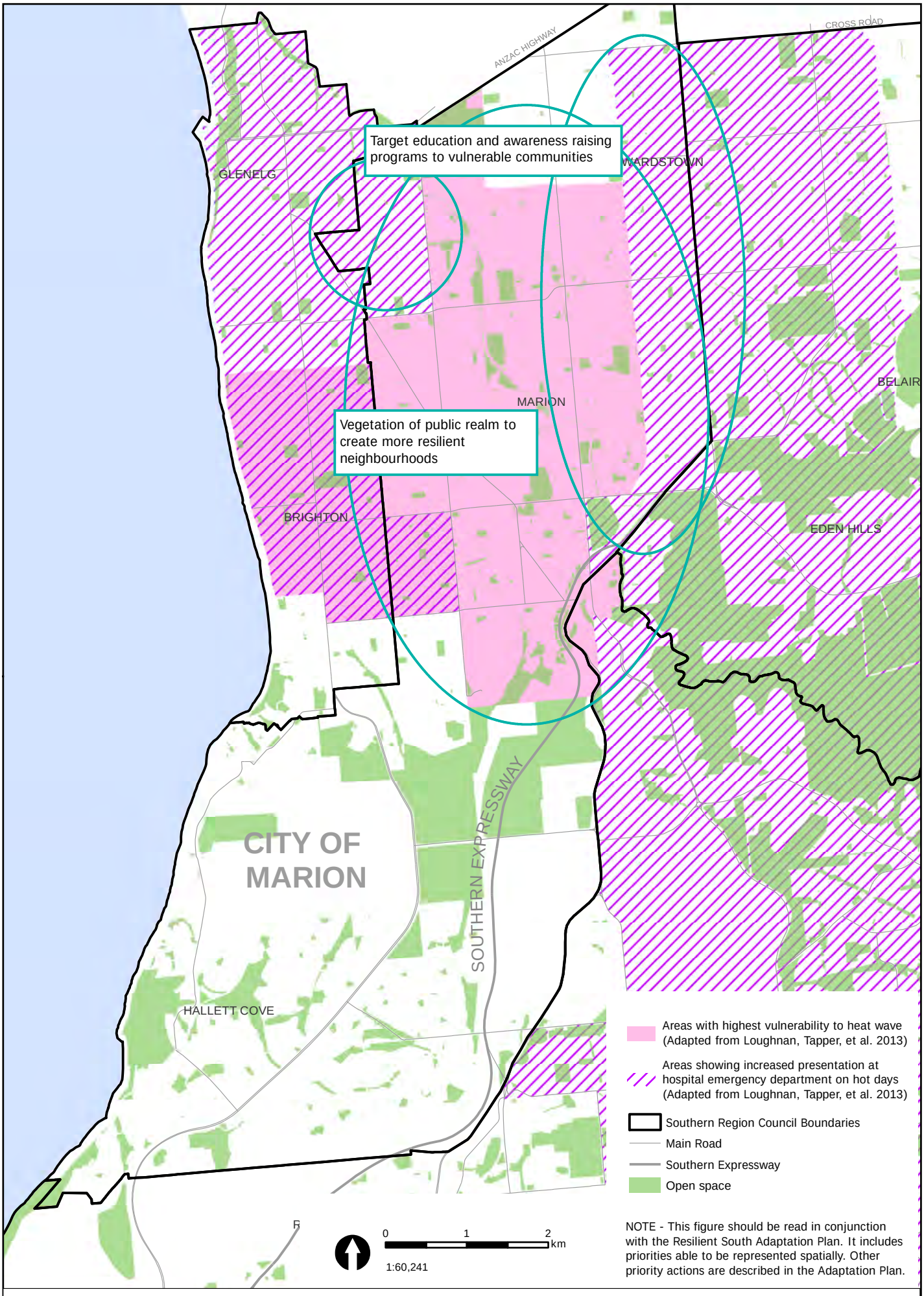
Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.12 Preferred Options for Vulnerable Members of the Community (2)
Resilient South



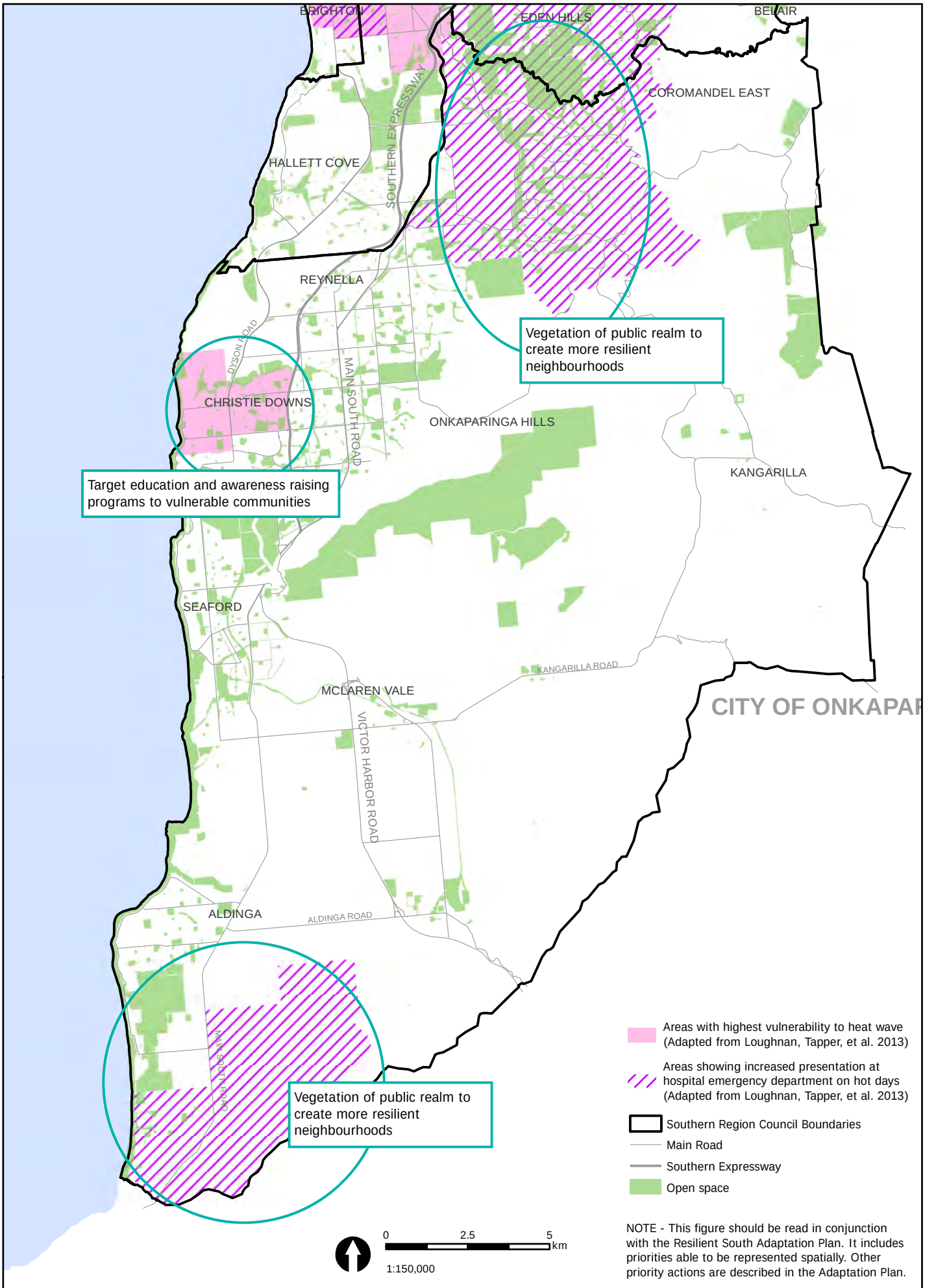
Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.12 (A) Preferred Options for Vulnerable Members of the Community (2)
Resilient South - City of Holdfast Bay



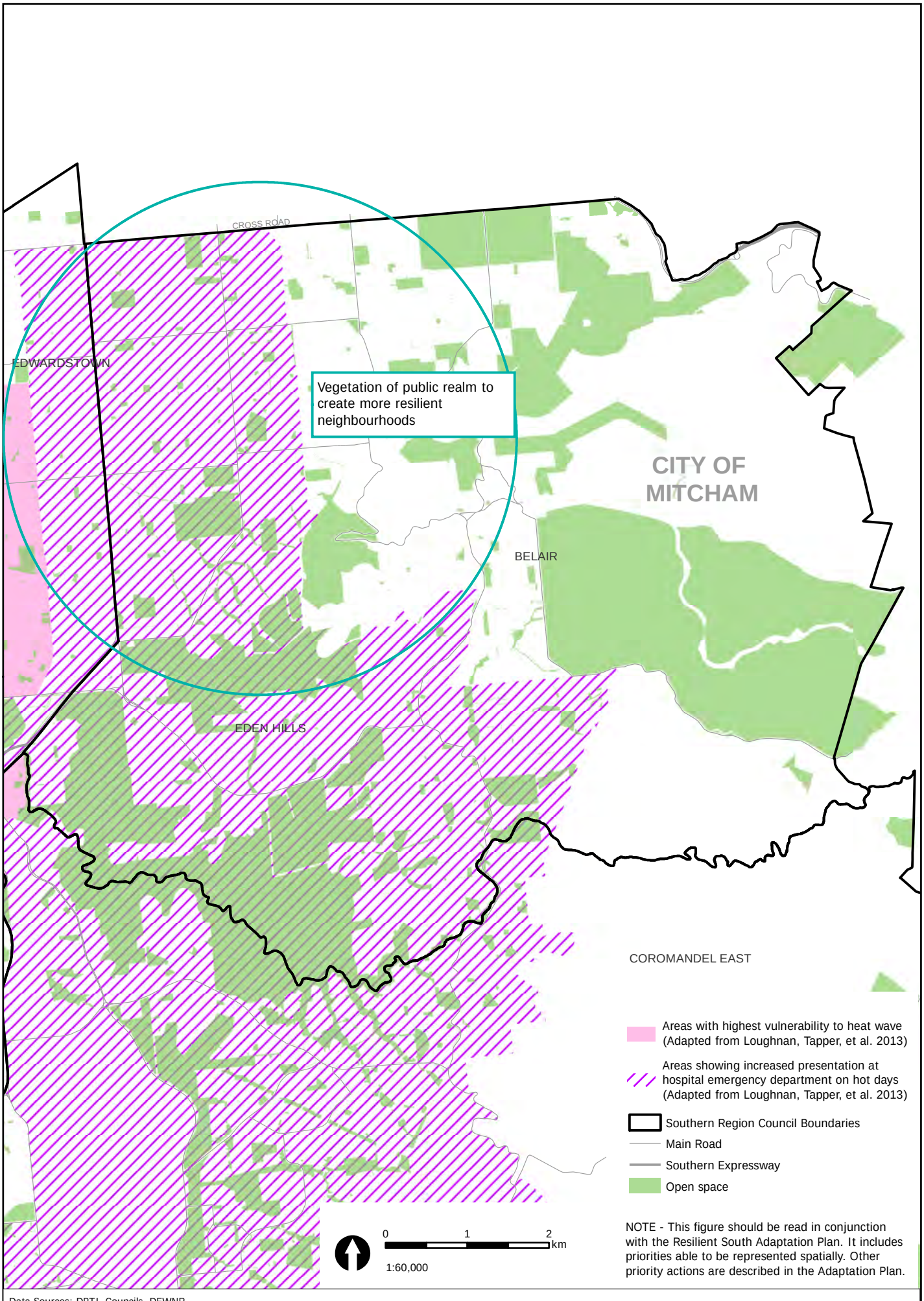
Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.12 (B) Preferred Options for Vulnerable Members of the Community (2)
Resilient South - City of Marion



Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.12 (C) Preferred Options for Vulnerable Members of the Community (2)
Resilient South - City of Onkaparinga



Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.12 (D) Preferred Options for Vulnerable Members of the Community (2)
Resilient South - City of Mitcham

4.9 Emergency services

Key area of decision making

How can we better manage demand for emergency services given more frequent intense rainfall events, more frequent bushfires and heatwaves and increased risk of coastal inundation as a result of sea level rise?

Why is managing the demand for emergency services important?

Emergency services are highly valued in the Southern Region and are essential for the functioning of the community, protecting vulnerable members of the community (e.g. people with existing medical conditions) and protection of the economy of southern metropolitan Adelaide[53]. The Region is well served by the emergency services sector with SA Ambulance Services, Country Fire Services, Metropolitan Fire Services, SA Police, State Emergency Services (SES), St John Ambulance and Surf Life Saving Clubs located across the area.

Work undertaken by SA Health[54] found that increased ambulance call-outs, heat-related hospital and emergency presentations and mental and renal health outcomes are of particular concern for the Southern Region during heat waves. These findings tie in with physiological, age-related, behavioral and cognitive factors that are known to contribute to health problems during extreme heat.

How will climate change impact the demand for emergency services?

The IVA found that climate change will increase the demand for emergency services in the Southern Region[55]. This will place pressure on already stretched resources that are often dependent on an aging and declining group of volunteers. This finding is important given that one of the broader aims of the Resilient South Adaptation Planning project is to improve emergency response capabilities relevant to climate change impacts.

Bushfire was the major climate risk identified by Project Champions as having the potential to increase demand for emergency services. Fire risk (measured using the FFDI[56]) is projected to increase in the future with, for example, the number of very high fire risk days increasing by 41% by 2070. High bushfire hazard zones in the Region exist in:

- Areas around Belair National Park;
- The upper parts of the Sturt River (which is the boundary between Mitcham and Onkaparinga);
- Flagstaff Hill;
- The Onkaparinga Gorge, between Clarendon and Mount Bold; and
- Along the Willunga Escarpment.

Another climate factor that will increase demand for emergency services is heatwaves, which will increase significantly in frequency and duration by 2070[57]. While there is some ability to cope with periodic increases in demand for health services during heatwaves (e.g. additional

[53] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[54] Resilient South (2014a) *Regional Profile – Resilient South*
[55] Resilient South (2014d) *IVA Technical Report – Resilient South*
[56] The Forest Fire Danger Index (FFDI) provides an estimate of fire risk based on factors like temperature, humidity, wind speed, fuel load and slope.
[57] Resilient South (2014) *Climate Change Scenarios Report– Resilient South*

ambulance staff put on to address increased call outs), demand is likely to exceed the capacity to respond, particularly if the frequency and duration of heatwaves increases.

Increasing intensity of rainfall events may also increase demand for SES services as flooding of low lying areas and alongside watercourses becomes more frequent (see also Section 4.4 for water resource management impacts and adaptation options). A more significant potential flooding risk though will come from rising sea levels and increased coastal inundation. Without adaptation, it can be expected that increased flooding of low lying infrastructure, public realm and open space will occur during storm surge events which will increase the demand for emergency services.

How can we manage the demand for emergency services?

The emergency services pathway (refer Figure 4-13) shows a range of adaptation options, with four being identified as preferred options to be progressed for the Region. All are considered part of current best practice management:

Community connectivity, communication, education, awareness and preparation: Improving community connectivity, communication, education, awareness and preparation provides individuals with greater capacity to manage their own risk and if emergency situations are avoided reduces demand on emergency service providers. This is an appropriate strategy for flood, fire and heatwave risk and can build on existing strategies already adopted by emergency services providers and Local Government. Figure 4-14 identifies areas of higher flood and bushfire risk where education and awareness and community connectivity programs could be targeted.

Development Plan policy: Reviewing and amending Development Plans can provide policies to:

- Restrict development in high risk areas such as ensuring that vulnerable members of the community are not housed in buildings in high risk zone e.g. aged care facilities and schools in bushfire zones; and
- Encourage development with improved resilience (e.g. by including higher floor levels in buildings in areas at flood risk or adoption of improved design guidelines that could reduce the potential urban heat island impacts that will be exacerbated by future heatwaves).

The benefits of changing Development Plan policy will take some time to take effect, with changes only applying to new development, not existing development.

Figure 4-14 shows areas of high bushfire and flood hazard where Development Plan policy review could focus.

Number of trained volunteers: As the demand for emergency services rises, the number of trained volunteers will need to increase. This will require training support for emergency services organisations and strategies to attract more volunteers.

Stormwater management: Further investment in stormwater management will be required to better manage future flood threats due to the impact of increasing stormwater run-off – a consequence of more intense rainfall events and greater run-off being generated from increasing hard surfaces as the number of medium density dwellings increases. This may be a significant issue in the inner southern suburbs. For example, a discussion paper prepared

for Holdfast Bay and Marion councils[58] found that it is likely that only 15% of the site area in future residential developments will be permeable surfaces given changing lot sizes, compared with 50% under the current situation.

Future investment should include maintenance and upgrade of existing drainage infrastructure and stormwater management infrastructure such as detention/retention basins and consolidation of recent investment in stormwater management across the Region.

Better management of stormwater represents a cross sectoral priority and opportunity for the Region because it can assist with water resources management (see Section 4.5) objectives and maintaining open space and public realm (see Section 4.10) through providing additional water for irrigation.

Summary of preferred options for managing the demand for emergency services

Now

- Improve community connectivity, communication, education, awareness and preparation;
- Review and amend Development Plan policy;
- Increase the number of trained volunteers; and
- Continue to improve stormwater management.

Preparatory work

- Undertake further investigations now to determine the most appropriate location and design requirements for stormwater management infrastructure to cope with a projected increase in flood risk

Figure 4-14 identifies where these preferred options might apply spatially for the Southern Region.

[58] Jensen Planning and Design (2011) *Discussion Paper: Development Potential within the Catchment,* prepared for Cities of Holdfast Bay and Marion

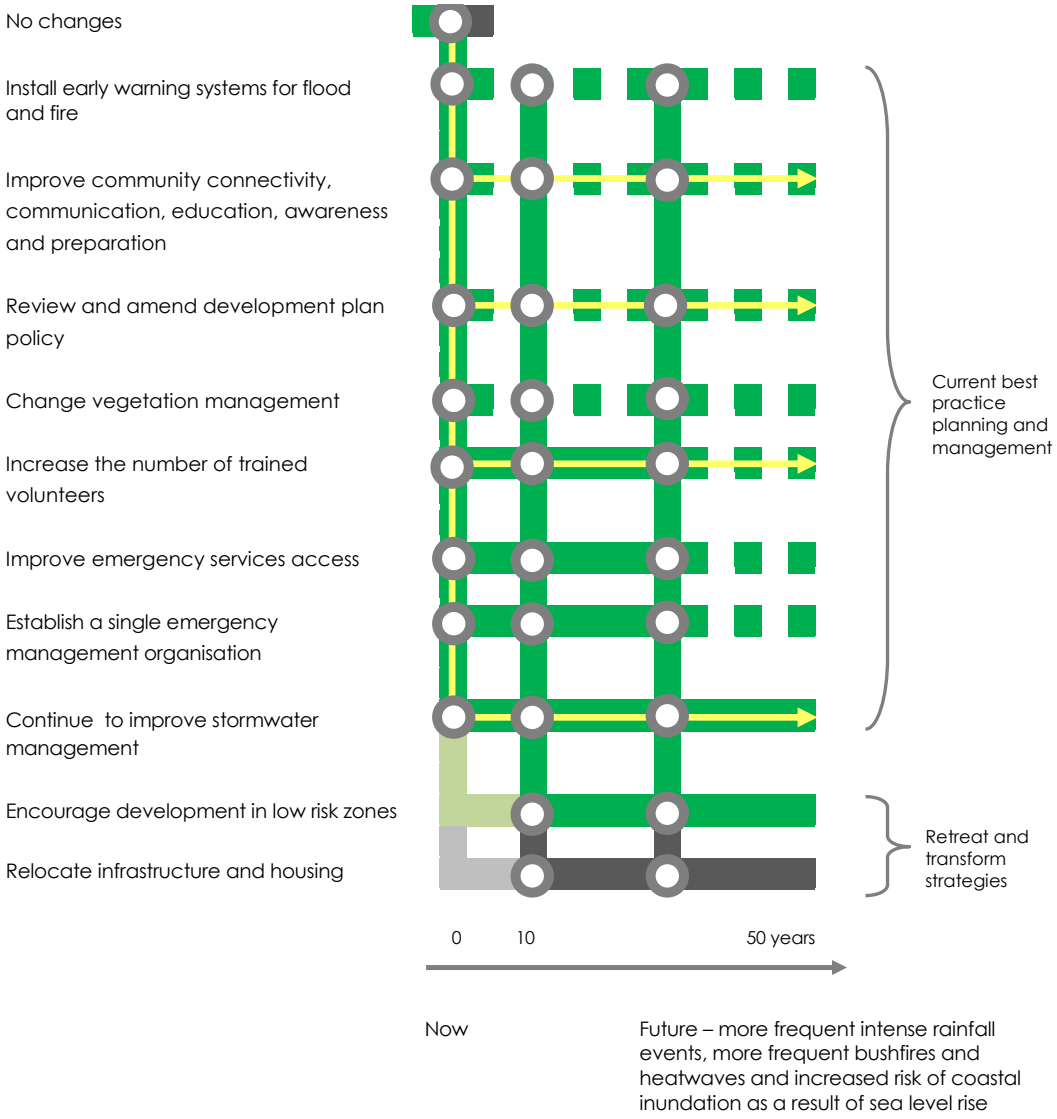
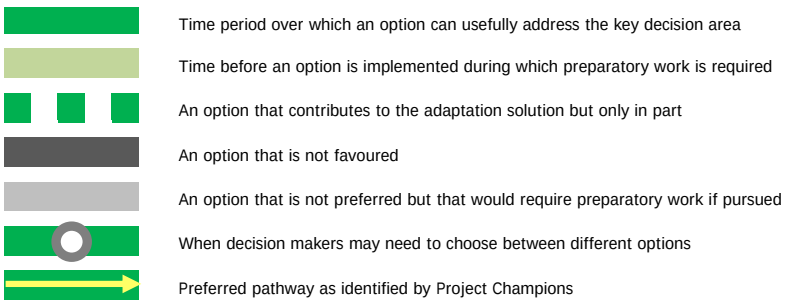
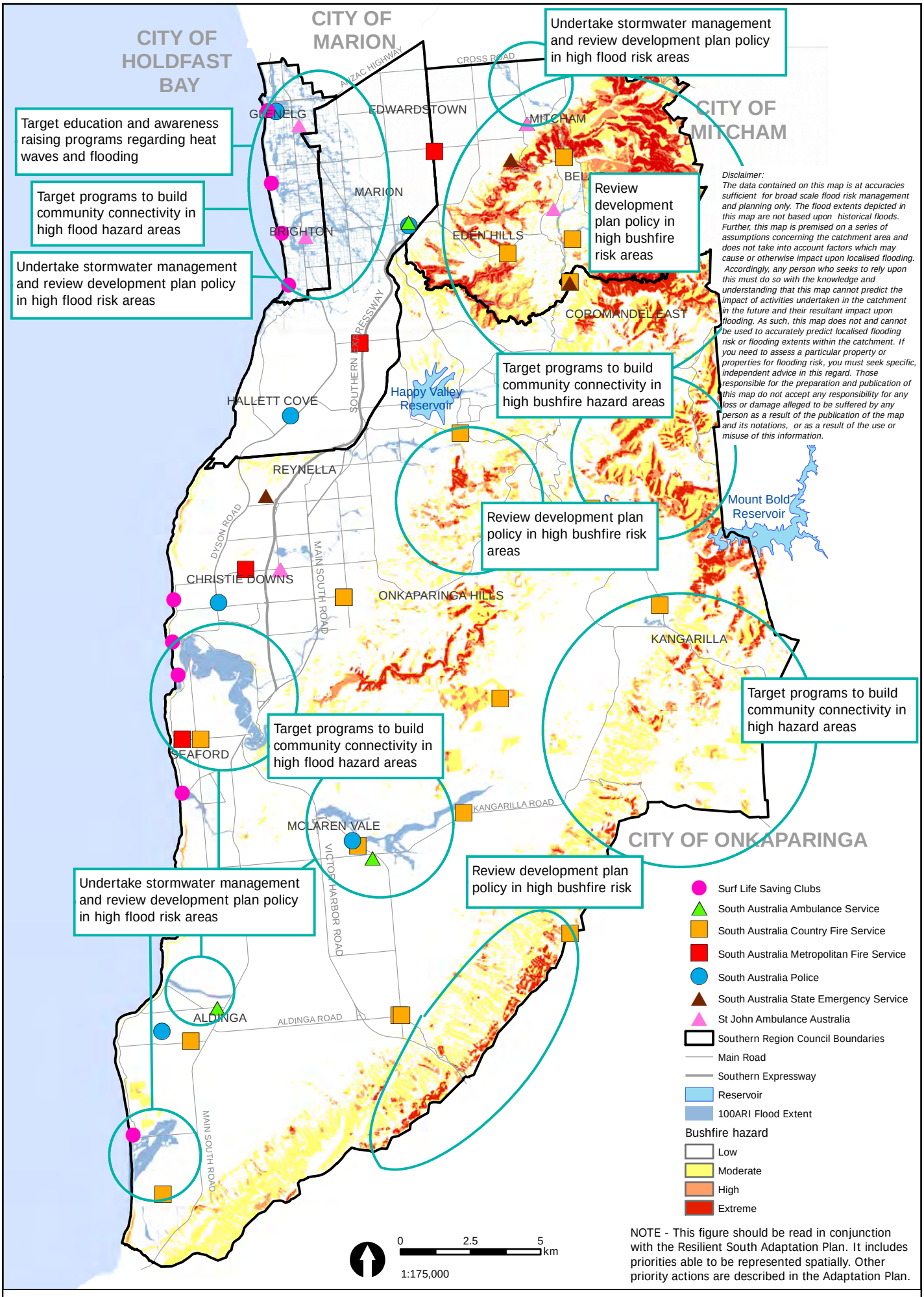


Figure 4-13: Emergency services pathway

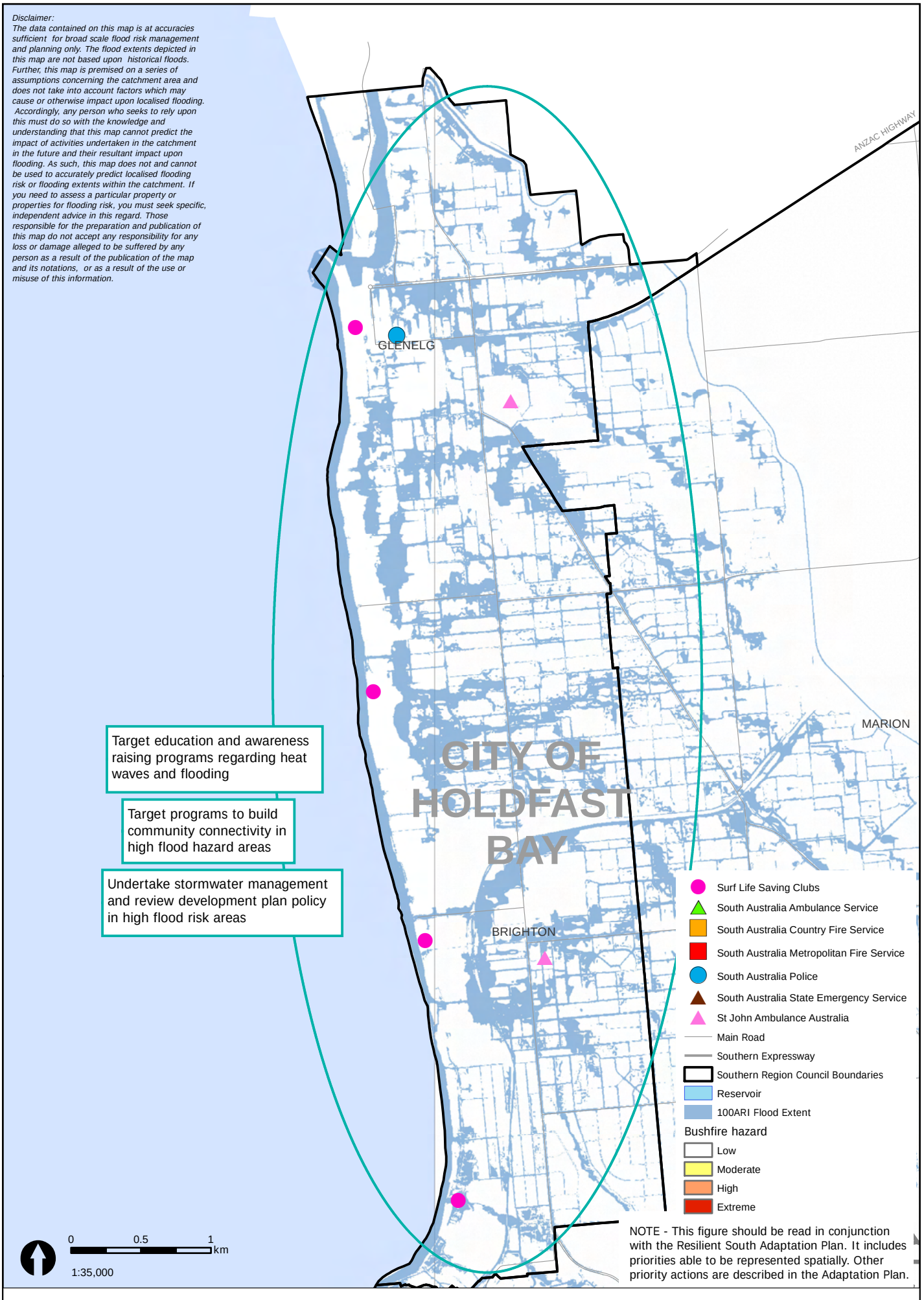
See Figure 4-1 for an explanation of how to interpret this figure.





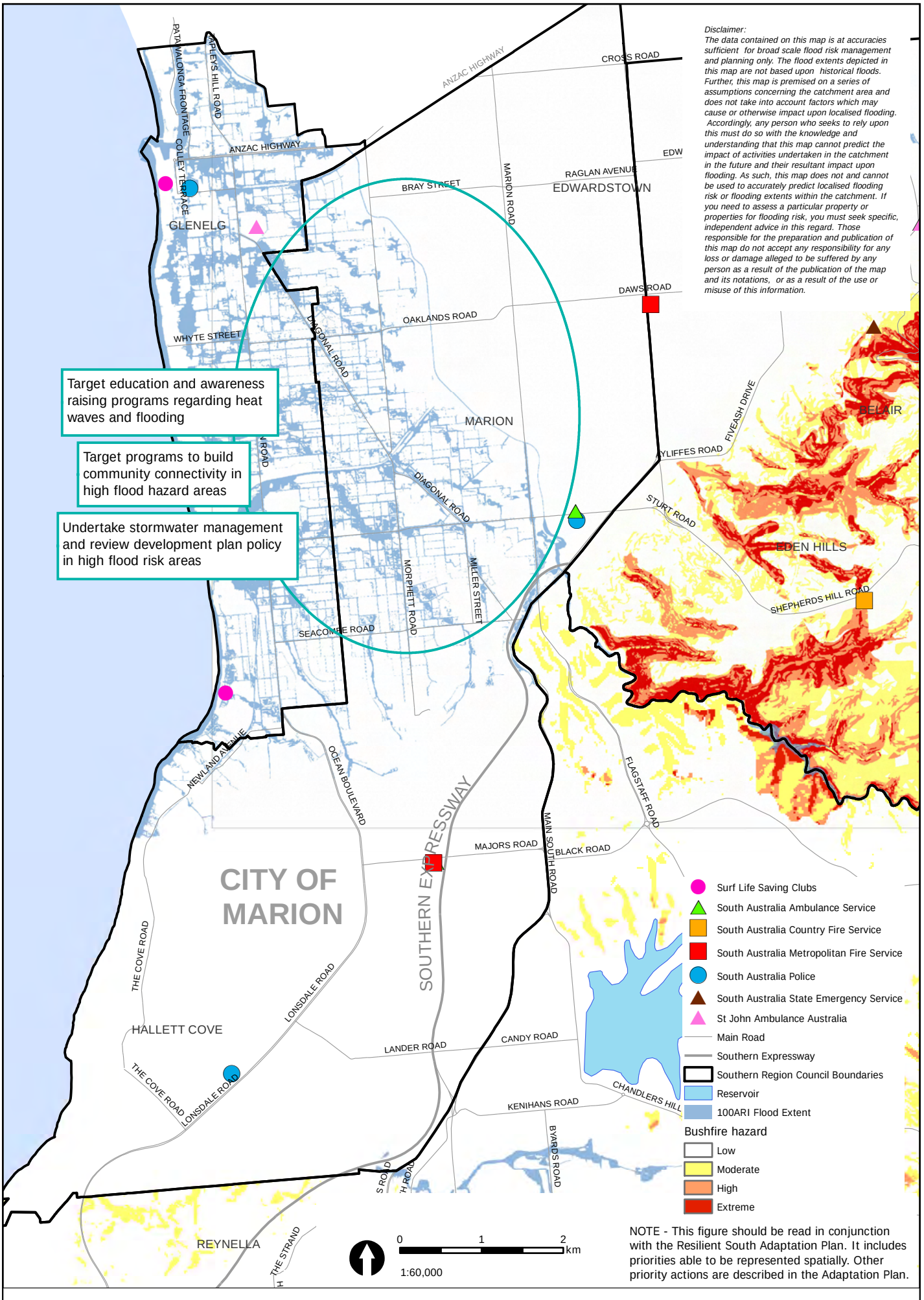
Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 28, 2014

Figure 4.14 Preferred Options for Emergency Services
Resilient South



Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 28, 2014

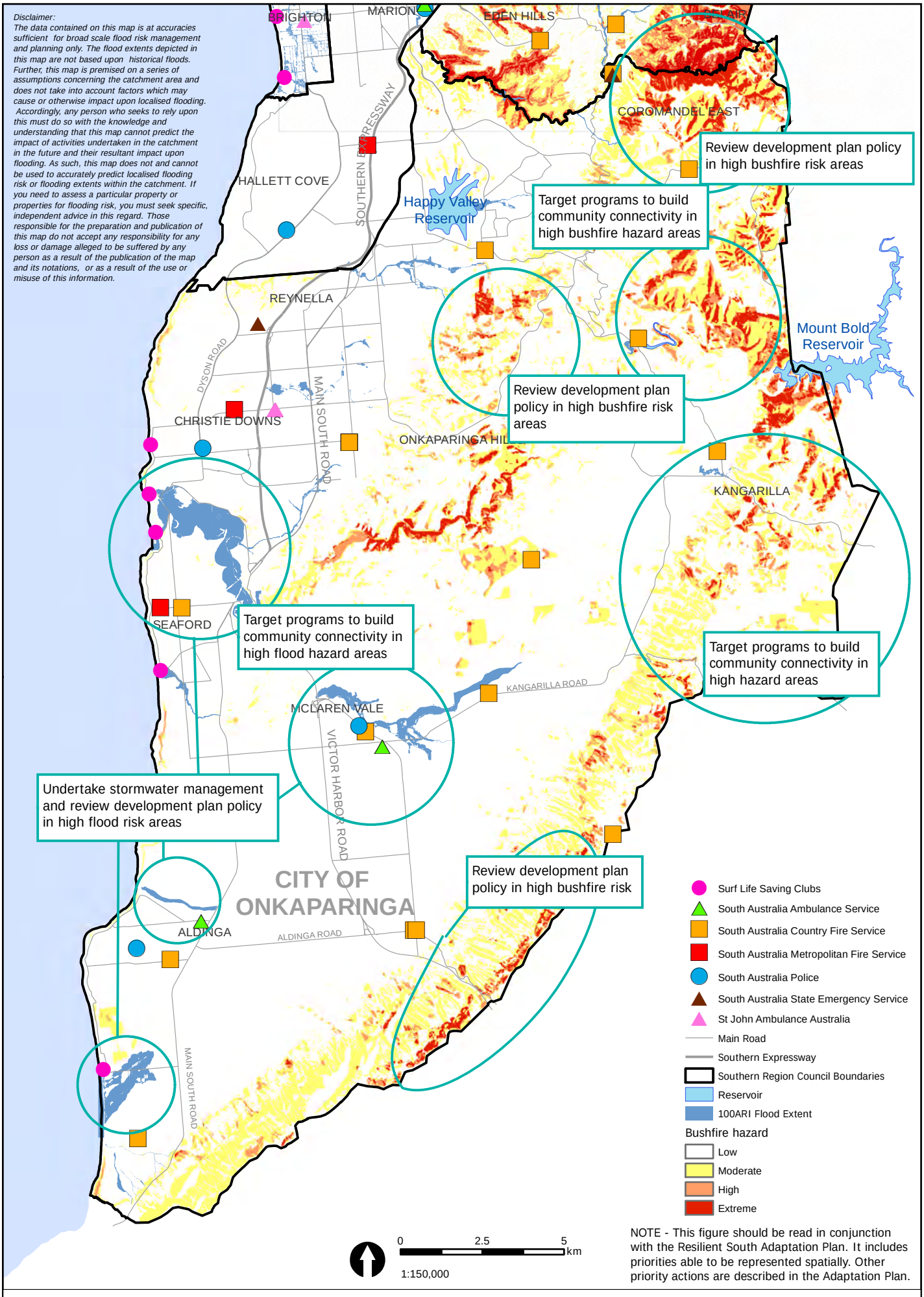
Figure 4.14 (A) Priorities for Emergency Services
Resilient South - City of Holdfast Bay



NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 28, 2014

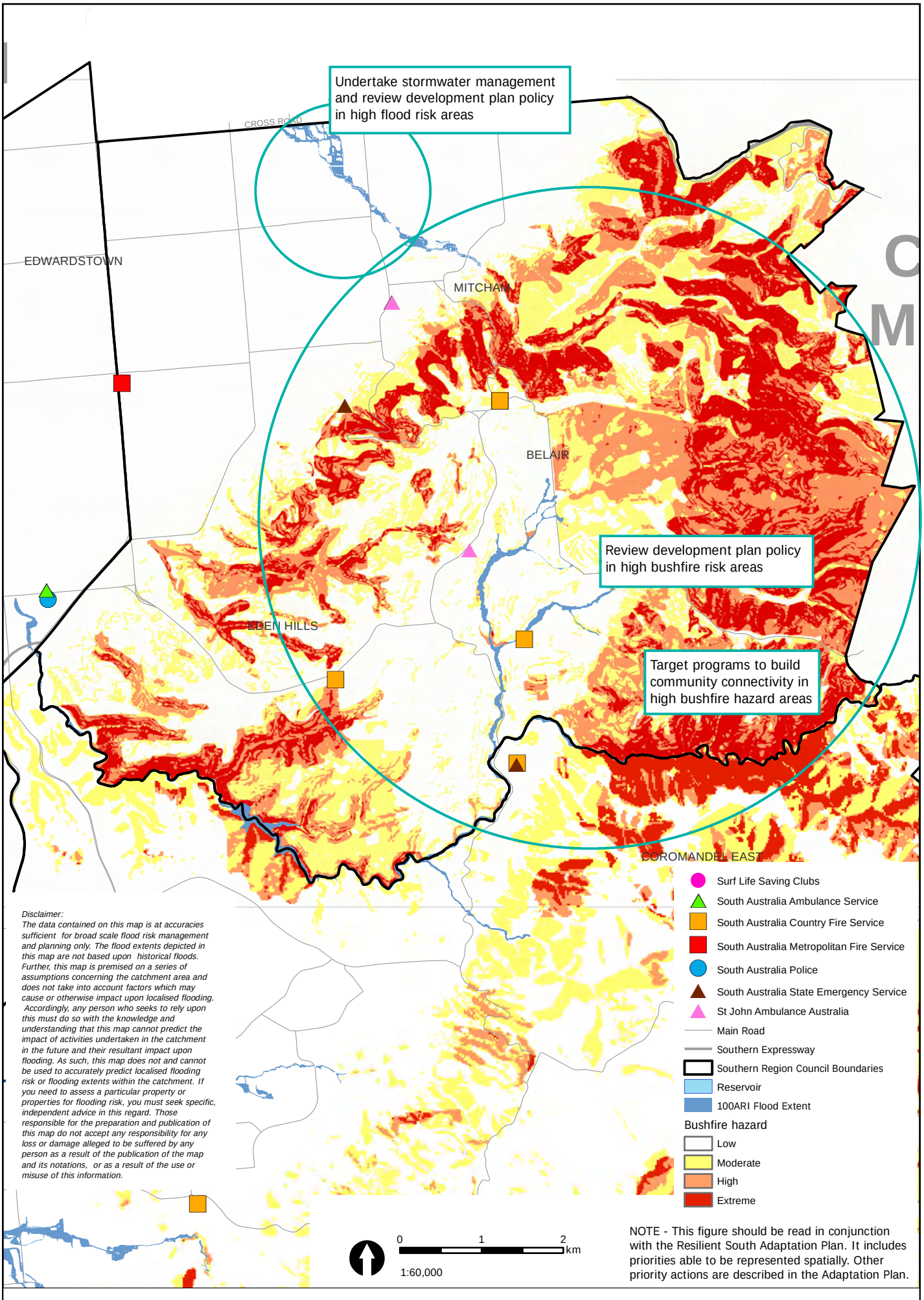
Figure 4.14 (B) Priorities for Emergency Services
Resilient South - City of Marion



NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 28, 2014

Figure 4.14 (C) Priorities for Emergency Services
Resilient South - City of Onkaparinga



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Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 28, 2014

Figure 4.14 (D) Priorities for Emergency Services
Resilient South - City of Mitcham

4.10 Open space and public realm

Key area of decision making

How do we provide, protect and enhance quality, useable open space and public realm in the face of less rainfall, more frequent flash flooding events, higher average temperatures, more frequent bushfires and heatwaves, increased evaporation and greater risk of coastal inundation?

Why is quality, useable open space and public realm important?

Open space and the public realm are highly valued in the Southern Region. Open space and public realm contributes to the amenity, vibrancy and wellbeing of the community[59] and provides:

- Formal and informal recreation opportunities;
- Spaces and places for relaxation, community interaction, children's play and health and fitness;
- Biodiversity hubs and habitat for native fauna and a connection to nature;
- Vegetation which assists with reducing the urban heat island affect; and
- Places for outdoor civic events to be held by Councils.

The Southern region has 8,700 ha of open space including parks and recreational areas. This is a significant proportion of metropolitan Adelaide's open space and includes more than 1,700 local reserves, 470 playgrounds, 34 km of sandy beaches and irrigated open space, and extensive public realm facilities including footpaths, walking and cycling trails.

How will climate change impact quality, useable open space and public realm?

The IVA found that without adaptation climate change will have major impacts on the quality of useable open space and public realm[60]. This will occur at the same time as these facilities come under increasing demand as the region's population increases and urban development densifies.

The amenity and quality of open space assets will be impacted by:

- Reduced water availability

  The ability to maintain amenity and playing standards through irrigation of open spaces (including playing fields) will be influenced by increased water costs and access to appropriate water sources. As the ability to irrigate declines, so too will the amenity and quality of open space resulting in reduced use and less opportunities for community members to be active. In turn this could place increased pressure on a smaller number of facilities. However, for some open space, there may be a need to maintain specific playing standards of turf for reasons of liability and permeability. There will also be increased desire to maintain green open space to offset the impacts of the urban heat island effect.

[59] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[60] Resilient South (2014d) *IVA Technical Report – Resilient South*

- Temporary damage or delays caused by extreme events (heatwave or bushfire), periodically unsuitable climate and/or the longer term desire of users to avoid unfavourable weather (particularly summer heat).

  This may alter the time of day spaces are used for outdoor civic events, disrupt sporting calendars, force the rescheduling of events and shorten sporting seasons. It also may create demand for investment by Council in facilities that accommodate changed use patterns or meet expectations of the community such as improving shade over children's playspaces and along walking trails or increased demand for indoor facilities.

Public realm (e.g. cycling and walking paths, streetscapes, street trees, seating and beach access/stairs) will be most at risk where climate hazards cause direct physical damage or impact on the usability of infrastructure, leading to increased maintenance, repair and replacement costs.

How can we respond to the impacts of climate change on the quality and useability of open space and the public realm?

The open space and public realm pathway (refer Figure 4-15) shows two adaptation options identified by Project Champions as preferred options to be progressed for the Region.

Accelerating current best practice

The first preferred option is to encourage change in the way we use and manage public realm and open space. This could work to:

- Change the time of day people recreate or the hours during which outdoor civic events are held;
- Review relevant event guidelines for risk assessment of heatwave and bushfire events;
- Review the way open space is provided and managed regionally (which could include focussing efforts on the provision of a smaller amount of high quality areas); and
- Alter community expectations about standards of infrastructure and experiences provided by open space and public realm.

Protection strategy

The second preferred option is to develop more climate sensitive outdoor infrastructure in preference to developing more indoor recreation infrastructure. This will benefit people wanting to recreate outdoors and assist Councils holding outdoor civic events. Climate sensitive outdoor infrastructure can be designed and constructed to take into account anticipated climate impacts, for example:

- Utilise materials that are more resilient to extreme weather such as extreme heat, wind and rainfall;
- Design and construct footpaths and trails that can cope with extreme rainfall, flooding from storm surge events and heat; and
- Provide shade via vegetation or built structures for playspaces and playgrounds and adjacent to walking and cycling paths.

Guidelines for the design and construction of this type of infrastructure should be developed and incorporated into Asset Management Plans.

Figure 4-16 shows playgrounds and open space located throughout the region. As can be seen, there is a large number of playgrounds and open space areas, and further analysis and prioritisation for shading and other climate sensitive infrastructure measures will be required. Figure 4-16 also shows areas with highest vulnerability to heatwave and increased presentation at hospital emergency departments on hot days. These areas could be targeted for public realm vegetation.

Future decisions

The open space and public realm pathway shows that reassessment of the mix of adaptation options needs to occur within one decade and then again within two decades. This reflects the general uncertainty as to the extent to which climate change will impact open space and public realm in the Region as well as the ability to access water for irrigation from alternative sources.

Summary of preferred options for responding to the impacts of climate change on quality, useable open space and public realm.

Now

- Encourage change in the way we use and manage public realm and open space; and
- New climate sensitive outdoor infrastructure.

Figure 4-16 identifies where these preferred options might apply spatially for the Southern Region.

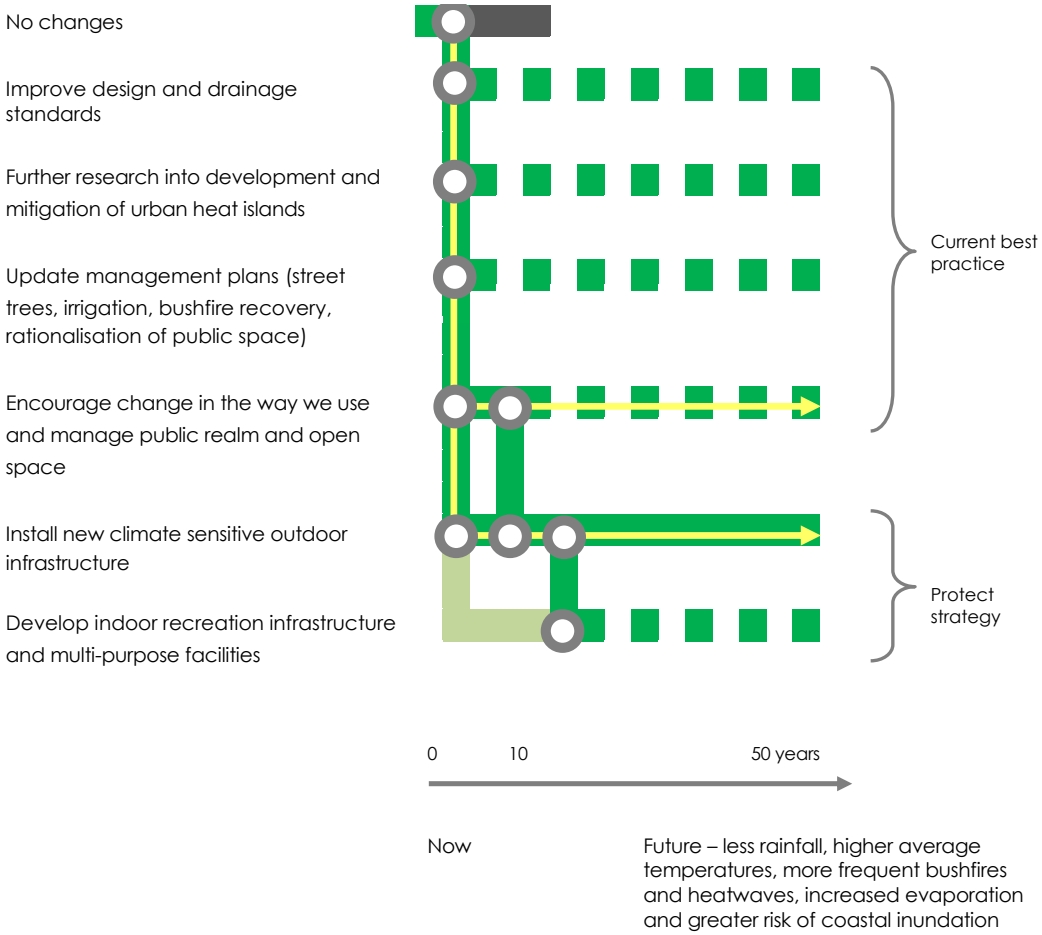
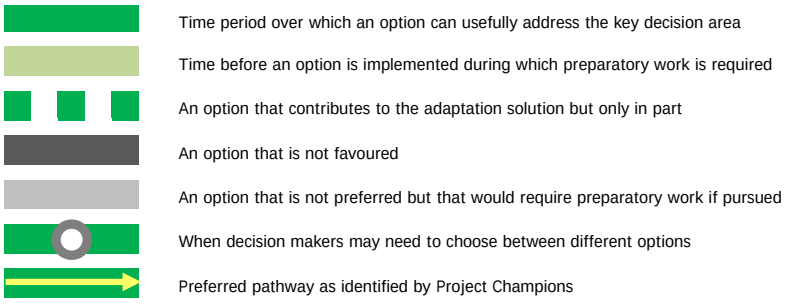
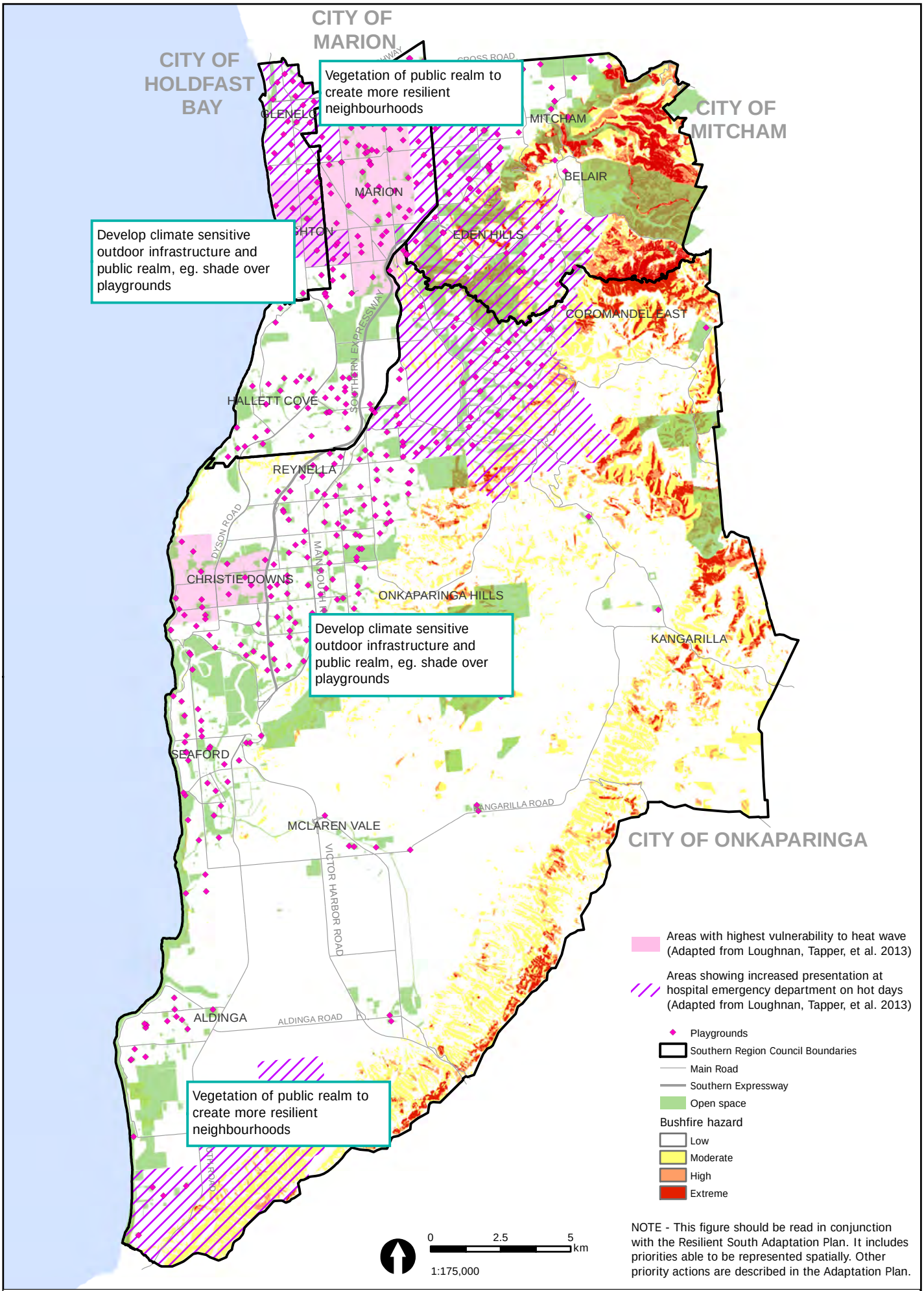


Figure 4-15: Open space and public realm pathway

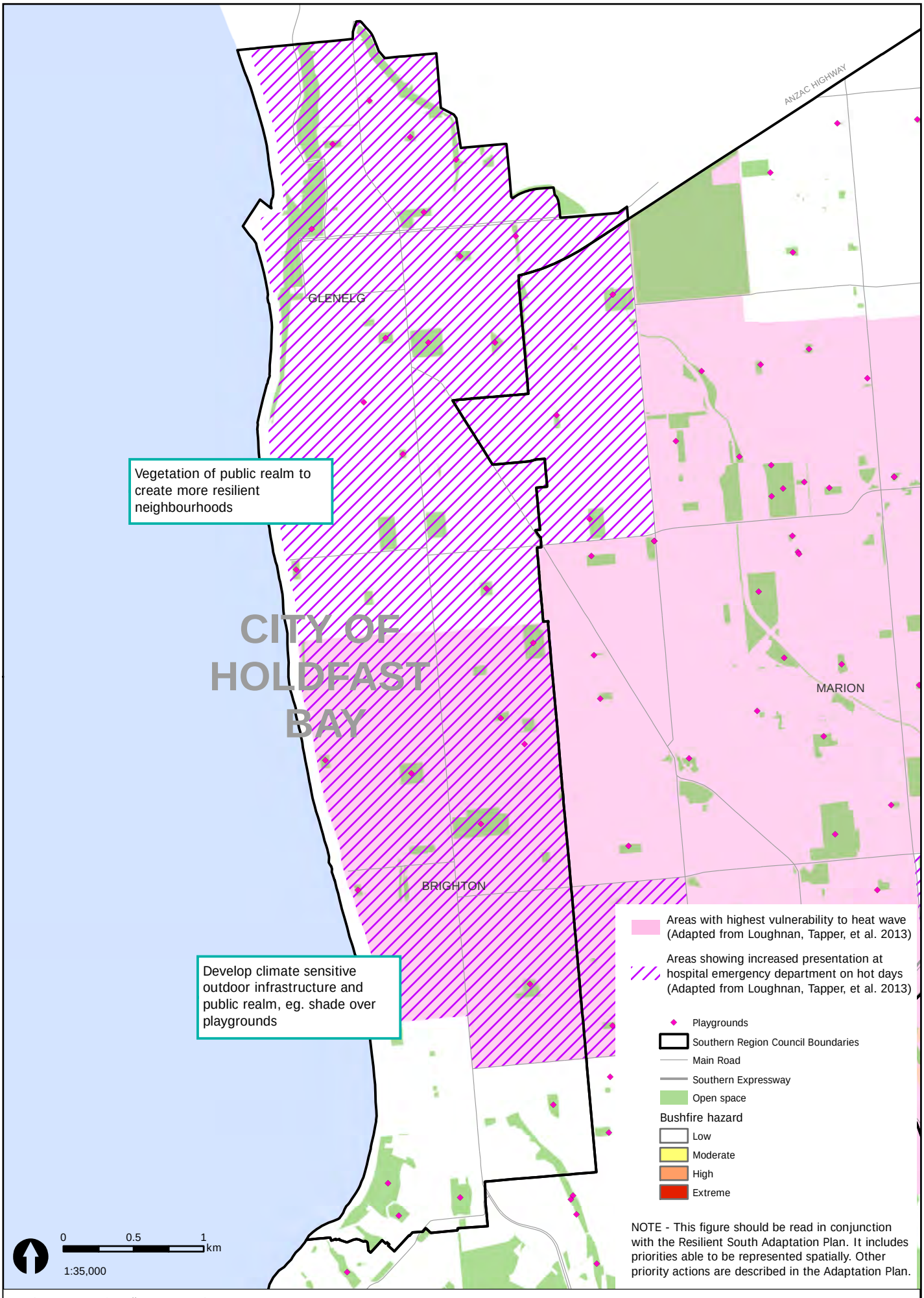
See Figure 4-1 for an explanation of how to interpret this figure.





Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.16 Preferred Options for Open Space and Public Realm
Resilient South



Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
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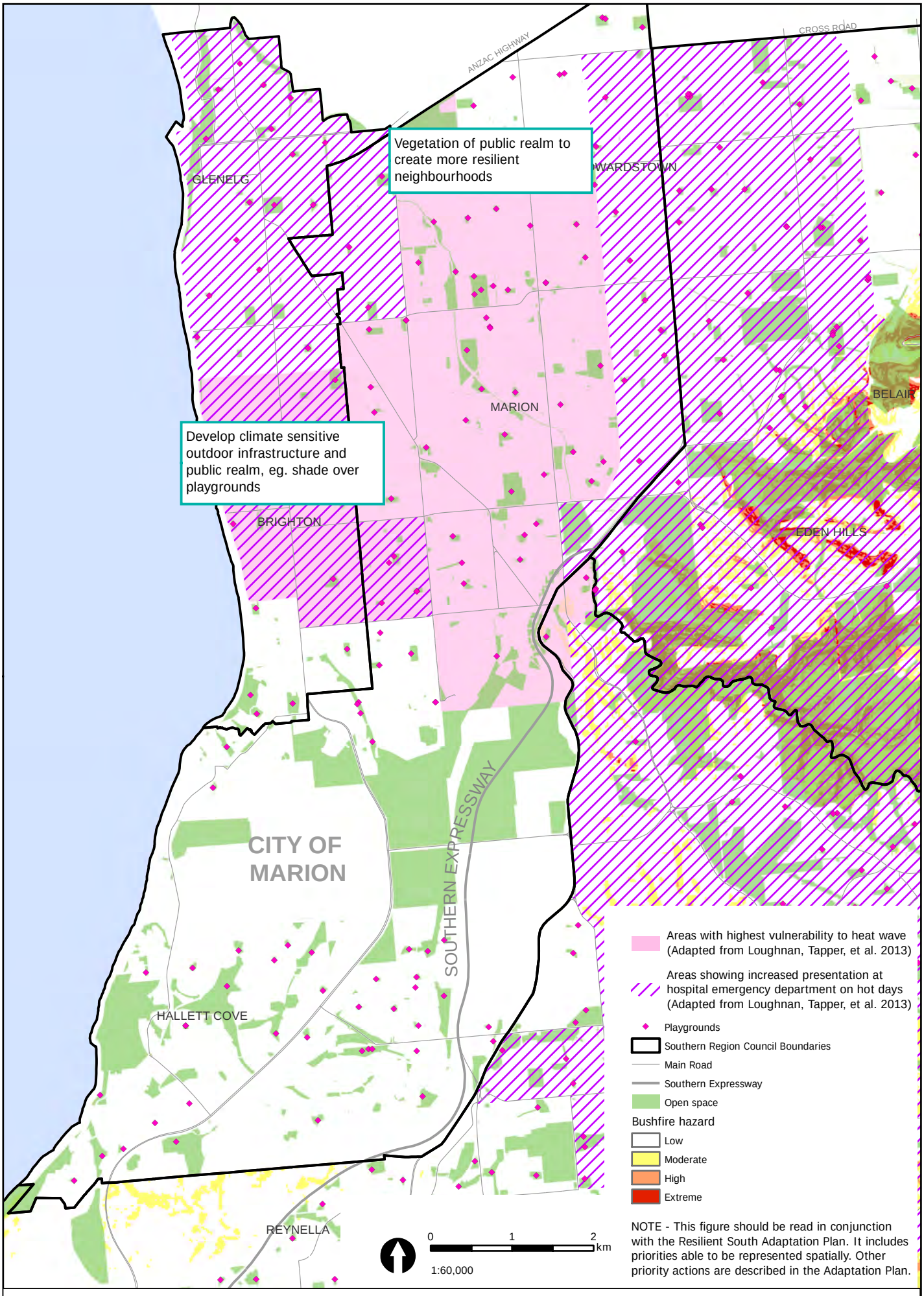
Figure 4.16 (A) Preferred Options for Open Space and Public Realm
Resilient South - City of Holdfast Bay



Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
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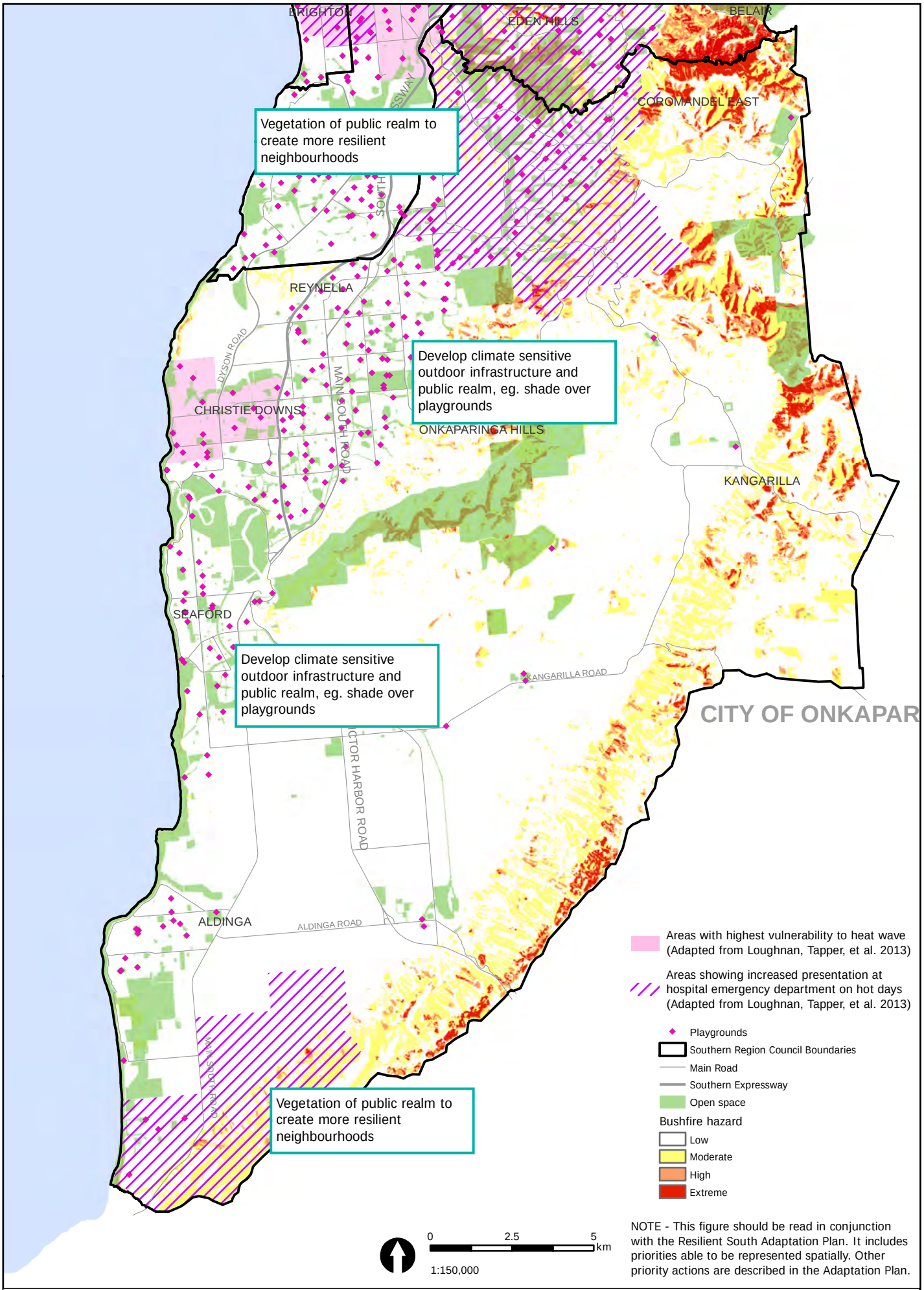
Figure 4.16 (B) Preferred Options for Open Space and Public Realm
Resilient South - City of Marion



Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
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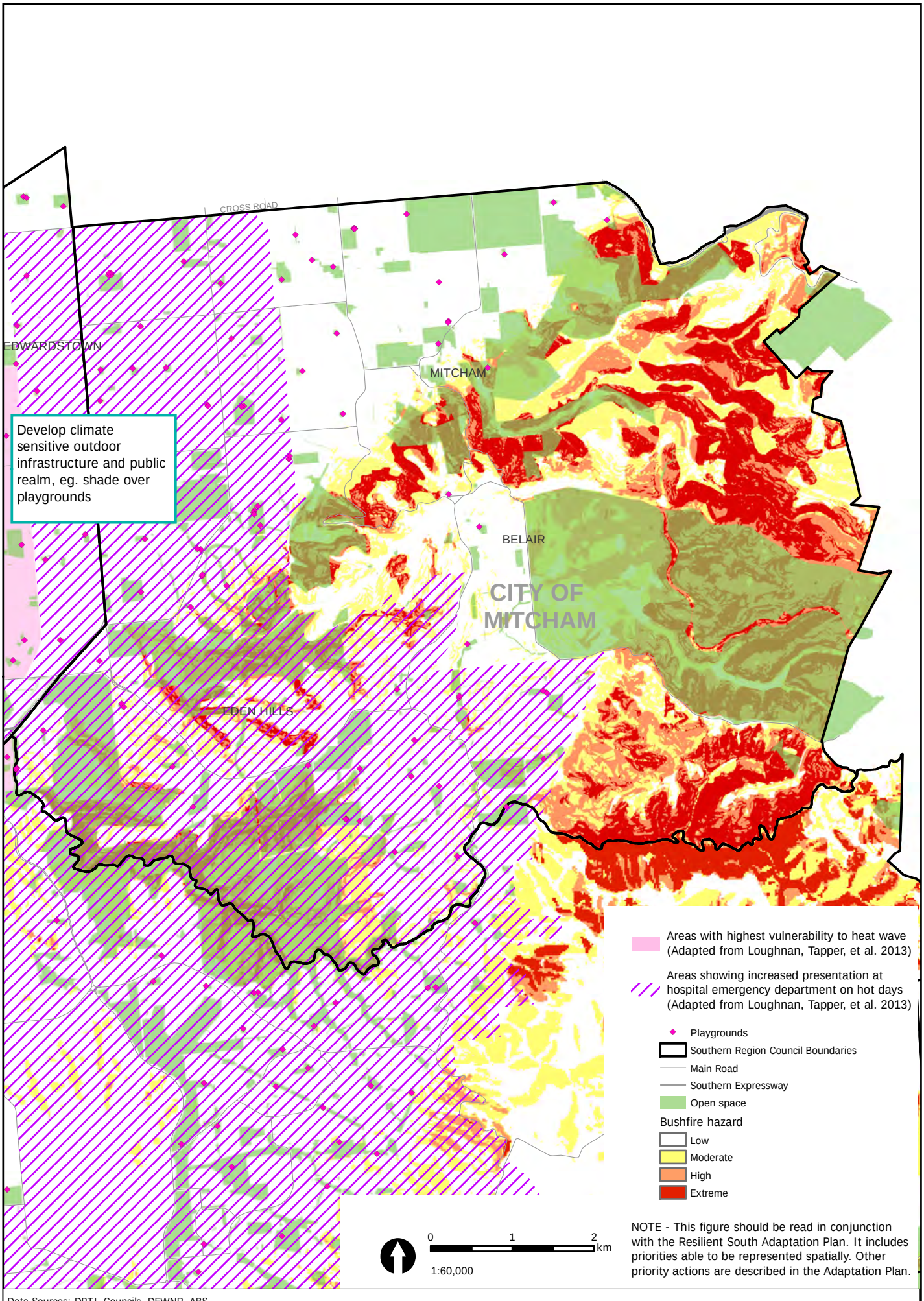
July 28, 2014

Figure 4.16 (C) Preferred Options for Open Space and Public Realm
Resilient South - City of Onkaparinga



Data Sources: DPTI, Councils, DEWNR, ABS, Loughnan, Tapper, et al. (2013)
Prepared for the Resilient South Project
July 28, 2014

Figure 4.16 (D) Preferred Options for Open Space and Public Realm
Resilient South - City of Mitcham

4.11 Essential services

Key area of decision making

How do we maintain the continuity of supply of essential services given more frequent intense rainfall events, potential flooding along the coast from sea level rise and storm surge and more frequent bushfires and heatwaves?

Why is the continuity of supply of essential services important?

Essential services[61] are vital to the Southern Region's economy and underpin a vibrant, productive and healthy community[62]. Responsibility for their provision within the region rests largely with private companies who also provide these services across other parts of the State, for example:

- ElectraNet owns and manages the electricity transmission network;
- SA Power Networks operates the electricity distribution network, delivering electricity to properties from high voltage lines through substations and distribution lines;
- Envestra owns the natural gas distribution network;
- SA Water is responsible for provision of potable water supplies and management of waste water networks; and
- Telecommunications is provided by various organisations including Telstra, Vodafone and Optus as well as the South Australian Government Radio Network.

The operating standards and costing of most essential service providers is determined by independent regulators.

How will climate change impact the continuity of supply of essential services?

The IVA found that climate change could have a negative impact on the delivery of many essential services in the region[63]. The primary concern was for electricity and telecommunications. Increased loads on the electricity supply network and more frequent power outages were identified as potential impacts of heatwaves. Power outages can occur when electricity supply loads need to be managed across the network but may also be a risk management strategy utilised on high fire risk days. This will be most significant in the hills part of the region within the Mitcham and Onkaparinga Council areas.

There are many flow on impacts of power outages including disruptions to:

- Business operations;
- Traffic lights;
- Schools;
- Shops;
- Food services;
- Hospitals and healthcare services; and
- Public safety.

[61] The focus of Project Champion's discussions which have driven the development of this key decision area and associated pathway map has largely been on electricity and to a lesser extent telecommunications.
[62] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[63] Resilient South (2014d) *IVA Technical Report – Resilient South*

Vulnerable members of the community such as older /frail aged people, people requiring assistance with core activities and economically disadvantaged people can be particularly susceptible to disruption to essential services, for example power outages may prevent access to cooling, cordless phones and other electric appliances (including medical equipment). While much of the potential disruption to essential services could come from heatwaves and bushfire conditions, sea level rise and flooding from storm surge events could also cause direct damage to essential services infrastructure. This in turn will impact on demand for emergency services (discussed further in Section 4.9).

Although most climate change impacts on essential services were considered to be strongly negative, potable water supplies were considered to be less vulnerable than other essential services because of the ability for the desalination plant to continue to produce potable water even during drought times.

How can we maintain the continuity of supply of essential services under the impacts of climate change?

The essential services pathway (refer Figure 4-17) shows that a wide range of adaptation options will be required to respond to the potential impacts of climate change. When considering how best to adapt, all options form part of the preferred pathway. However, this reflects an absence of clear priorities rather than the result of a ranking process. This is not unexpected because the future of continuity of essential services provision remains uncertain at present with the balance between electricity supply from traditional network providers versus distributed systems (e.g. solar PV) currently in flux.

Active management, improved planning and protection

A range of existing options employed by service providers will continue to be important in the near future such as strategic power outages on high fire risk days and management of vegetation near power lines. Figure 4-18 shows the location of high voltage transmission lines and where they traverse areas of high bushfire hazard. Improved planning and protection will also need to continue involving streetscape planning to reduce impacts on essential services infrastructure and strategic protection of key distribution assets from bushfire (refer Figure 4-18).

While some of these activities are part of normal operations, Project Champions indicated that many are at odds with the objectives of their sector and are a potential source of maladaptation. For example:

- Power outages on high fire risk days may reduce bushfire risk but can also impact vulnerable members of the community through preventing access to electricity for air-conditioning, medical equipment and cordless phones on extreme hot weather days; and
- Native vegetation clearance can work at cross purposes with aims to protect and maintain native ecosystems.

Alternate supplies and protection strategies

The major focus of future adaptation for the continuity of supply of essential services will be on alternate supplies and protection options. It is expected that a decision between major options will need to be made within 10 years. Distributed energy through solar PV has already been adopted in a significant way in South Australia and is now a major consideration in the management of power supply and demand for the State. Linked with

further adoption of distributed energy will be whether there is success in developing more advanced and cost effective power storage solutions.

Protection options offer a different solution and focus on increasing the review of the existing distribution system. Options include:

- Increased electricity feeder automation, which allows for real time automated, distribution network management;
- Undergrounding of power cables;
- Upgrading cooling systems for telecommunication exchanges; and
- Installation of backup power supplies.

Summary of preferred options for maintaining the continuity of supply of essential services

Now

- Strategically manage power outages on high fire risk days;
- Manage native vegetation near power lines;
- Conduct streetscape planning that considers impacts on essential services infrastructure;
- Protect key assets from bushfire (e.g. feeders); and
- Increase distributed energy.

Within 10 years

- Increase electricity feeder automation;
- Undergrounding of power cables;
- Upgrade cooling systems for telecommunicates exchanges; and
- Install backup power supplies.

Preliminary work

- Conduct a feasibility study into the costs and benefits of different supply and protection strategies, involving regional organisations, essential services providers and regulators.

Figure 4-18 identifies where these preferred options might apply spatially for the Southern Region.

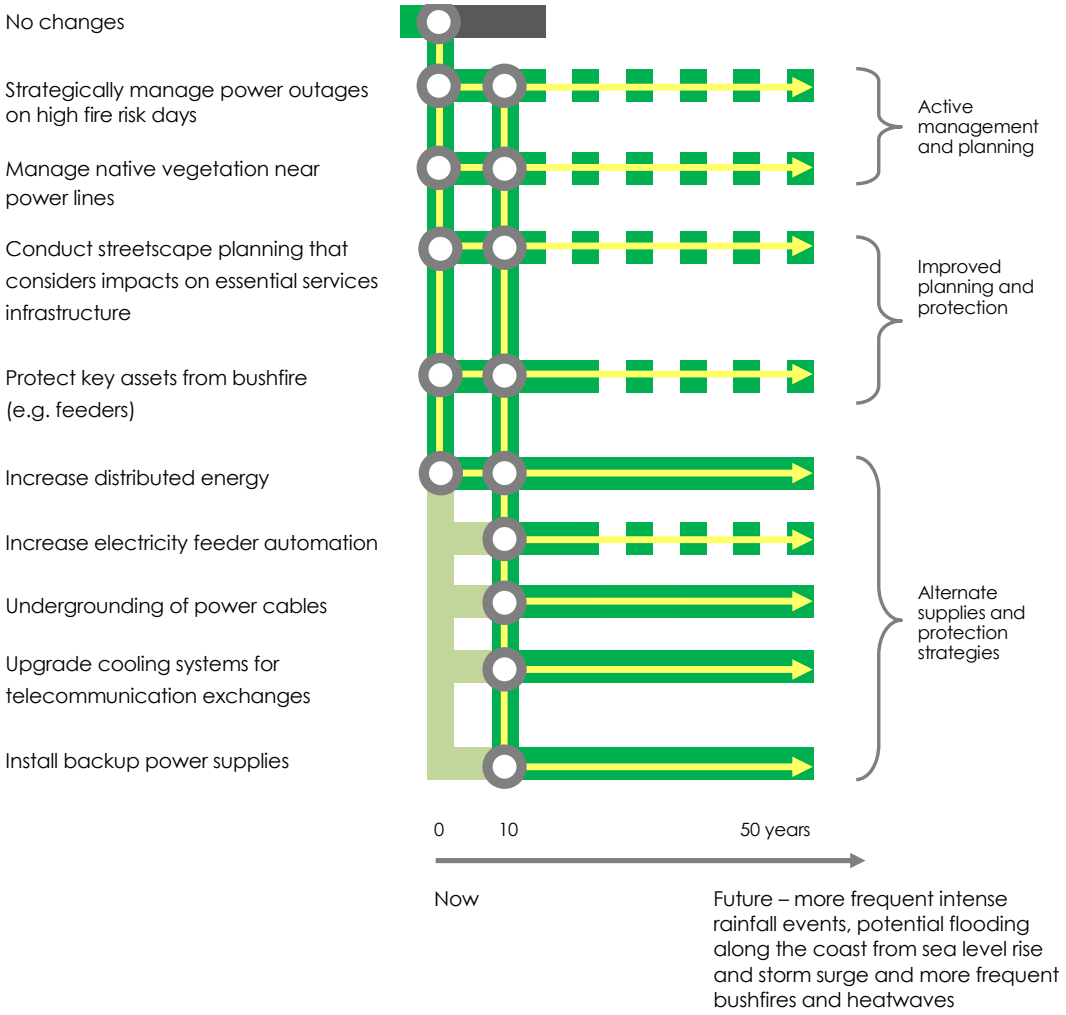
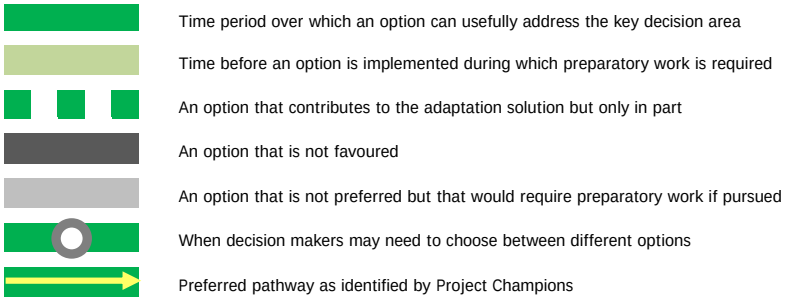
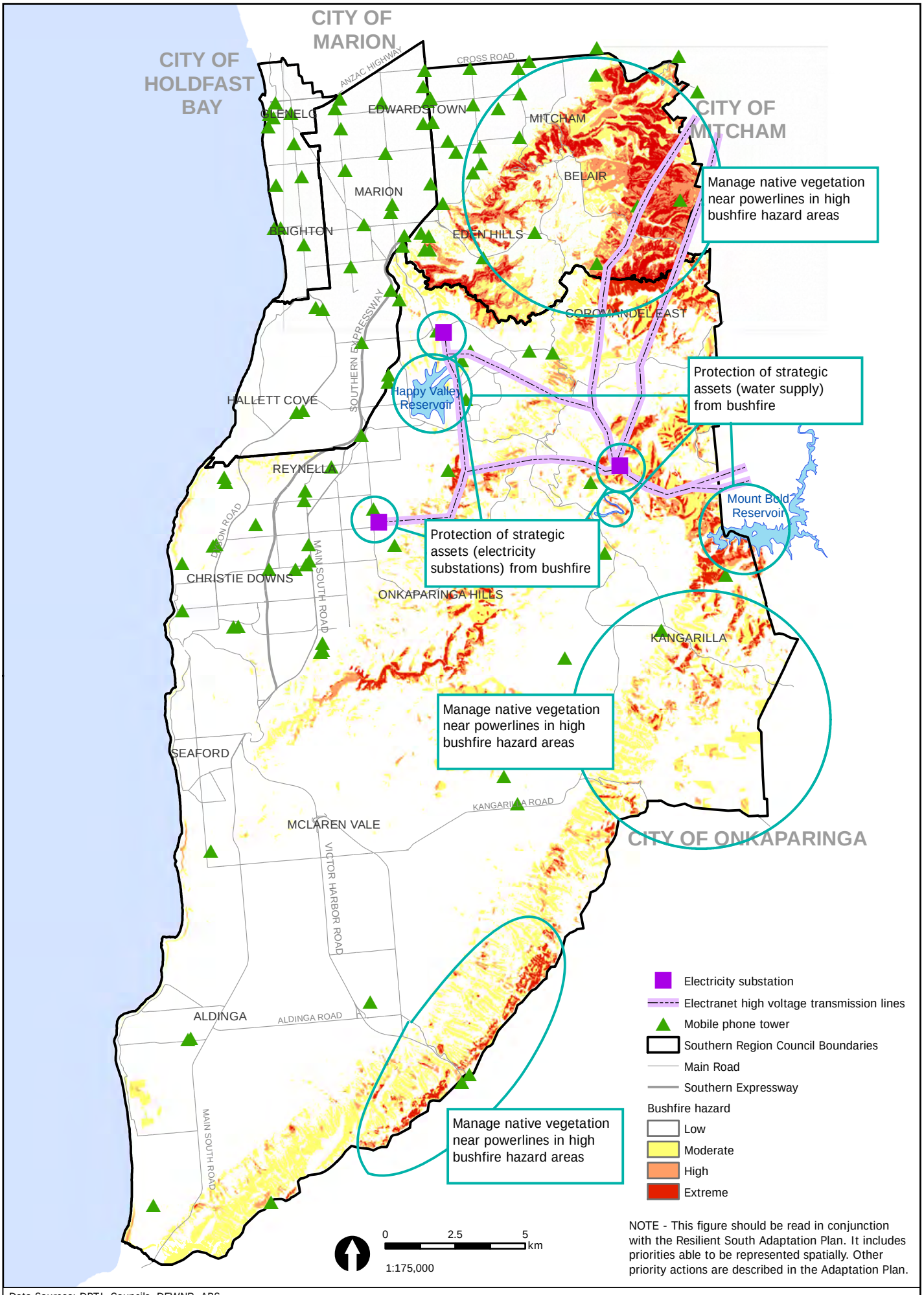


Figure 4-17: Essential services pathway

See Figure 4-1 for an explanation of how to interpret this figure.





NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR, ABS, http://onwireless.com.au/spench-net.html
Prepared for the Resilient South Project
July 28, 2014

Figure 4.18 Preferred Options for Essential Services
Resilient South

4.12 Manufacturing and business

Key area of decision making

How do we maintain and increase the viability of the manufacturing and business sector given increasing bushfire hazard, flood events, sea level rise and more frequent heatwaves?

Why is maintaining and increasing the viability of the manufacturing and business sector important?

Manufacturing and business are an important part of the Southern Region's economy. ABS Census data indicates that 80% of people who work in the Region live in the Region, meaning that a high proportion of the population spend the majority of their time in the Region[64]. Retail trade accounts for 16% of jobs in the Region, manufacturing 9% and accommodation and food service 7%.

Manufacturing connects with other industries in the Region such as wine production and the motor vehicle and transport sectors with large manufacturing and light industrial areas located in Lonsdale and Edwardstown. There are a number of major infrastructure projects that have been recently completed (e.g. Seaford rail extension and rail electrification) or that are underway in the Region (e.g. Southern Expressway duplication) that draw on manufacturing services. The business sector relies heavily on retail and trade activity, with major shopping centres at Marion, Glenelg, Mitcham and Colonnades.

While other sectors focus on maintaining or protecting assets and services, the aim of the manufacturing and business sector is continued growth to help build the Region's economy and create new jobs to support a growing population.

How will climate change impact the manufacturing and business sector?

The IVA found that without adaptation climate change could impact on the value of the manufacturing and business sector in the Region[65]. Impacts can occur as a result of:

- *Heatwaves and extreme heat* which can reduce organisational productivity and the cost of doing business such as by increasing the need to change operating hours (e.g. manufacturing facilities with uncooled workshops or working environments). Even where changing operating hours to minimise work during the hottest times of the day is an option, this could raise other issues such as noise impacts on people in neighbouring residential areas;
- *Bushfire* frequency increases, which could impact on the ability for customers to access shopping centres or in direct damage to buildings and infrastructure; and
- *Sea level rise and storm surge effects* combining to periodically inundate low lying areas close to the coast.

How can we respond to the impacts of climate change on the manufacturing and business sector?

The manufacturing and business pathway (refer Figure 4-19) shows a range of adaptation options, however, the majority were considered by Project Champions to only contribute to adaptation and are not a solution in their own right.

[64] Resilient South (2014a) *Regional Profile – Resilient South*
[65] Resilient South (2014d) *IVA Technical Report – Resilient South*

Current best practice

The preferred pathway focuses on two adaptation options for immediate implementation. Reviewing and amending Development Plan policy is considered a priority so as to avoid manufacturing and business facilities being located in areas at risk from climate hazards such as bushfire and coastal flooding. Planning and environmental policy could also be reviewed so as to allow more flexible operating hours for businesses in industrial areas.

Business continuity planning through educating and building capacity in the manufacturing and business sector is also an immediate priority and includes providing information systems and websites and targeted programs for home industries and small business to better understand climate impacts on energy, water and emergency services provision. Figure 4-20 shows commercial and industrial zones where education and capacity building programs could be targeted.

Protect strategy

It is expected that as the impacts of climate change start to increase, there will be greater focus on maintaining the continuity of supply of essential services for manufacturing and business, with a particular focus on electricity. This is considered an immediate priority and may include backup power supply options and greater adoption of distributed energy solutions. Business case assessments are required to determine the best combination of options.

Summary of preferred options for maintaining and increasing the viability of the manufacturing and business sector

Now

- Review and amend Development Plan policy;
- Educate and build capacity of the manufacturing and business sector; and
- Improve the continuity of supply of essential services, especially electricity.

Preparatory work

- Conduct business case assessments for options to improve the continuity of supply of essential services.

Figure 4-20 identifies where these preferred options might apply spatially for the Southern Region.

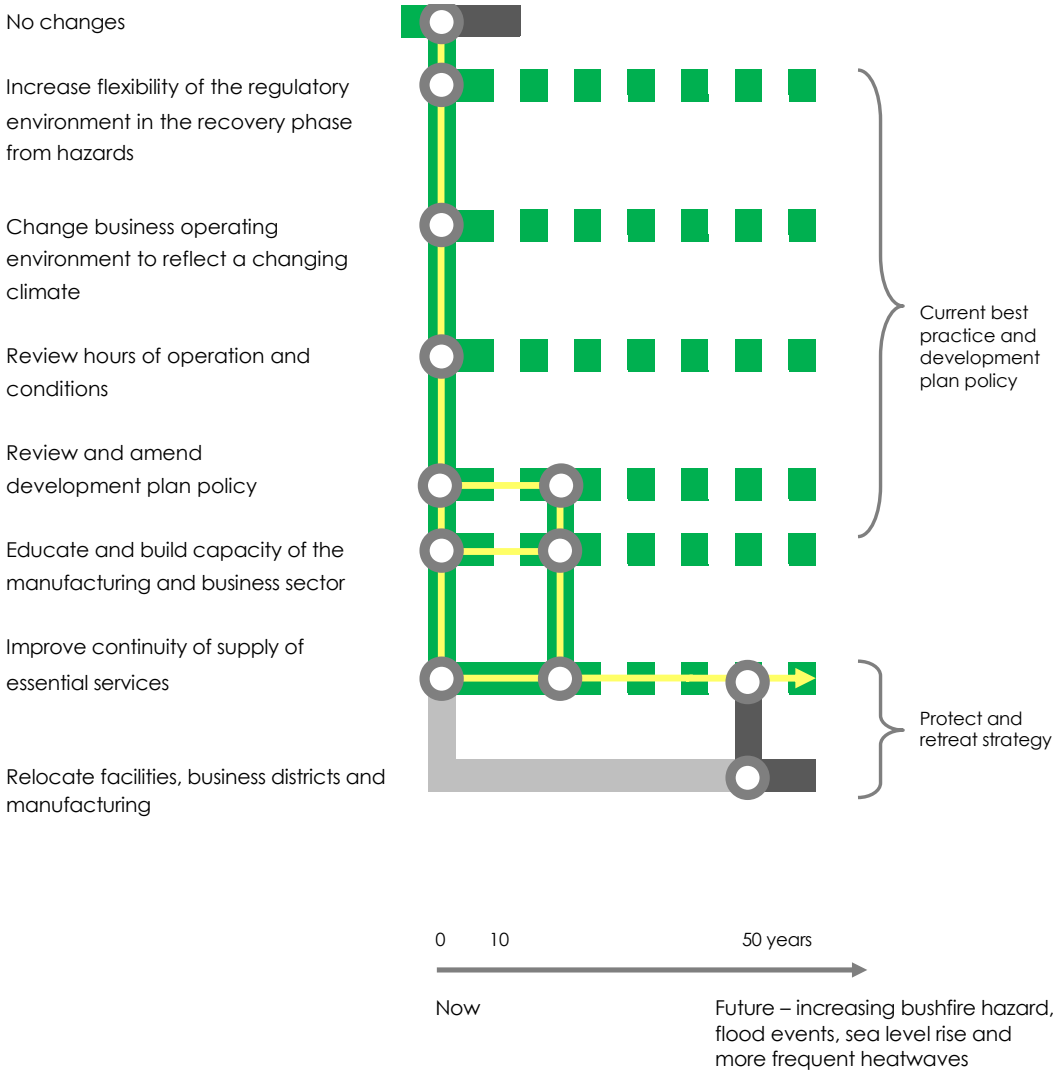
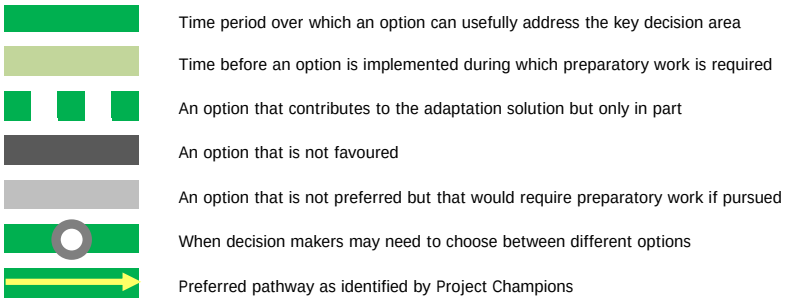
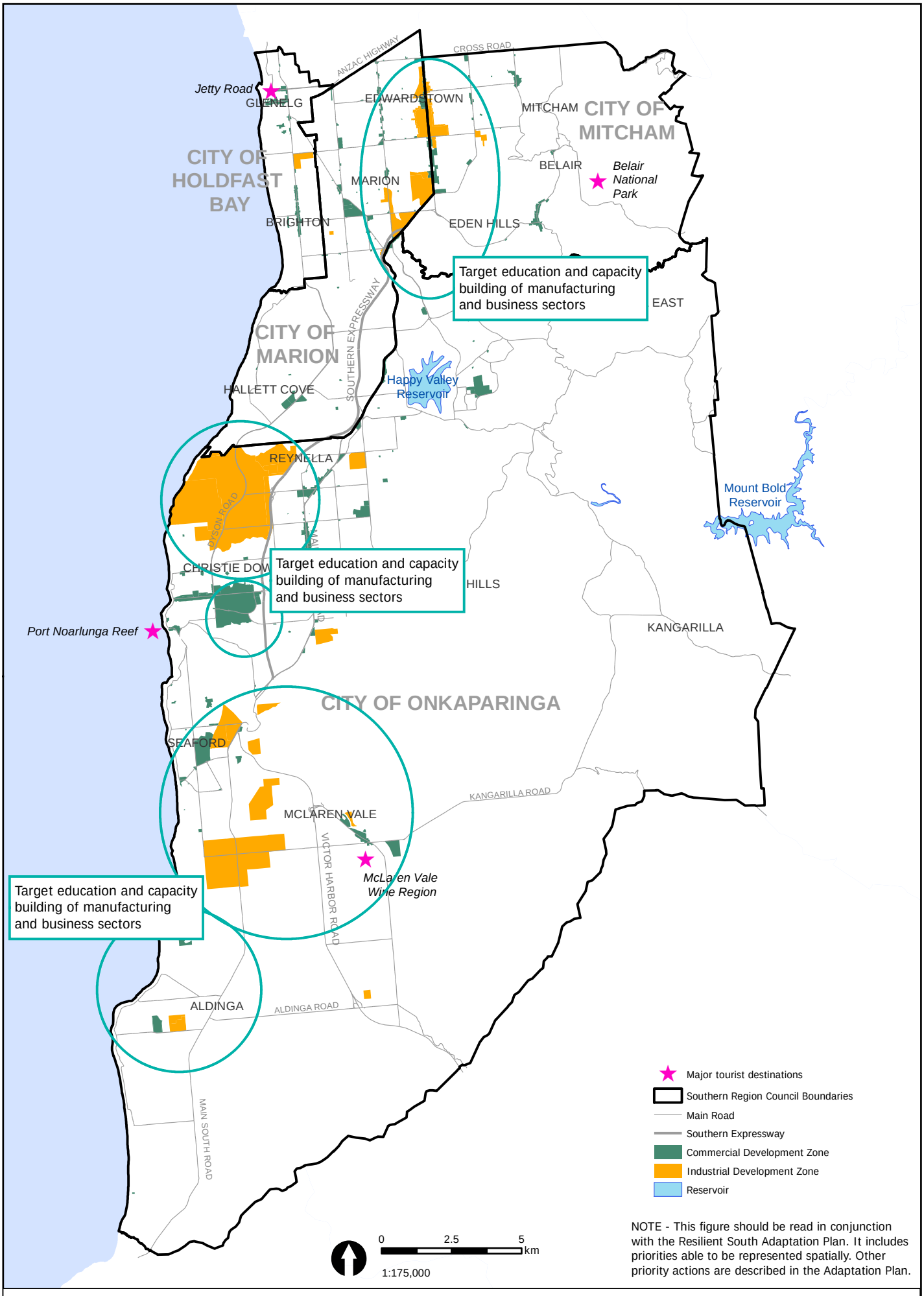


Figure 4-19: Manufacturing and business pathway

See Figure 4-1 for an explanation of how to interpret this figure.





NOTE - This figure should be read in conjunction with the Resilient South Adaptation Plan. It includes priorities able to be represented spatially. Other priority actions are described in the Adaptation Plan.

Data Sources: DPTI, Councils, DEWNR, ABS
Prepared for the Resilient South Project
July 28, 2014

Figure 4.20 Preferred Options for Manufacturing and Business
Resilient South

4.13 Viticulture

Key area of decision making

How do we maintain the productivity of local viticulture given a warmer and drier climate with more frequent and intense bushfires?

Why is maintaining the productivity of local viticulture important?

Viticulture is recognised as an important part of the Southern Region's economy[66]. McLaren Vale is the major wine grape growing and wine production area within the Region.

Viticulture is a major contributor to the agriculture, forestry and fishing sector in the region accounting for almost 55% of employment in the sector[67]. It also has flow on benefits to other sectors such as manufacturing and tourism. In addition to being an important part of the Region's economy, the viticulture sector focused on McLaren Vale contributes to the character and aesthetic of the region in the same way as the coast and hills.

How will climate change impact the productivity of local viticulture?

The IVA found that a warmer and drier climate with more frequent and intense bushfires could impact on the productivity of local viticulture[68] as follows:

- Warmer conditions will change the timing of flowering and harvest;
- Extreme hot weather can result in burning of fruit;
- A drier climate will reduce soil moisture availability requiring greater reliance on irrigation; and
- Warmer nights can affect plant water relations, reducing recovery periods from high daytime temperatures and potentially changing the composition of the fruit.

Some response strategies for dealing with increasing temperatures can create issues in their own right. For example, promoting more canopy cover in the crop to protect berries requires more water to be used and the shading from the plant's increased canopy can result in increased risk of splash effect leading to mildew problems as well as slower ripening times.

Increased bushfire risk is of concern because:

- Bushfires can directly damage vines and wine processing and manufacturing infrastructure. Vineyards located in Clarendon, Blewitt Springs, McLaren Flat, the Range and Sellicks Hill are all located in areas of higher bushfire hazard; and
- Smoke taint can occur as a result of fires in the district in general and can be hard to detect. Increased risk of smoke taint in wine has led to at least one winery interstate establishing operations in a less bush fire prone region.

[66] Resilient South (2013a) *Stage 1 Stakeholder Engagement Report – Resilient South*
[67] Resilient South (2014a) *Regional Profile – Resilient South*
[68] Resilient South (2014d) *IVA Technical Report – Resilient South*

How can we respond to the impacts of climate change on the productivity of local viticulture?

The viticulture pathway (refer Figure 4-21) shows that a range of current best practice options can contribute to adaptation but that in the longer term more transformational strategies will need to be considered. All options described below are part of the preferred pathway.

Current best practice management

Assisting vines to better cope with climate extremes already occurs and will need to continue as part of adaptation for the viticulture sector, focussing on vine canopy management such as sprays and shading to reduce heat impacts and shading to reduce rain damage. Planting cover crops between rows will also continue to be an important option to prevent erosion during more frequent, intense rainfall events. Figure 4-22 shows the locations of vineyards in the Region.

One of the greatest concerns for viticulturists in the Region will be bushfire damage, either directly to vines and infrastructure or indirectly to wine through smoke taint. Bushfire management plans are considered essential and increased adoption is required. Smoke taint testing is a well-established practice and guidelines on how to undertake it can be obtained from the Australian Wine Research Institute website. Figure 4-22 shows the close proximity of vineyards to high bushfire hazard.

Continuous improvement in water management practices has been a feature of the Southern Region in the past and will continue to be important in the future. There needs to be a continued focus needs on irrigation efficiency to reduce demand for water. However, while this option was favoured by Project Champions it was noted that with current technology there is limited additional opportunity for further irrigation efficiency savings. Figure 4-22 identifies the expansion of use of recycled water for vineyard irrigation.

Protect and transform strategies

Viticulturists have already started to rethink whether current varieties are still appropriate for the Region and new options are understood to have been trialled. This shift to varieties more resilient to higher temperatures and less rainfall in the future will need to continue and be accelerated where possible.

The Region has already done significant work to develop alternate water supplies, such as has been achieved through Willunga Basin Water in McLaren Vale to alleviate pressure on groundwater resources. Within 10 years, it is expected that further identification of alternative irrigation sources to increase supply options will be required.

Summary of preferred options for maintaining the productivity of local viticulture

Now

- Plant cover crops between rows to prevent erosion;
- Improve vine canopy management;
- Develop bushfire management plans;
- Undertake smoke taint testing and mini fermentation;
- Adopt irrigation efficiency measures; and
- Plant varieties more resilient to higher temperatures and less rainfall.

Within 10 years

- Develop alternate irrigation sources.

Figure 4-22 identifies where these preferred options might apply spatially for the Southern Region.

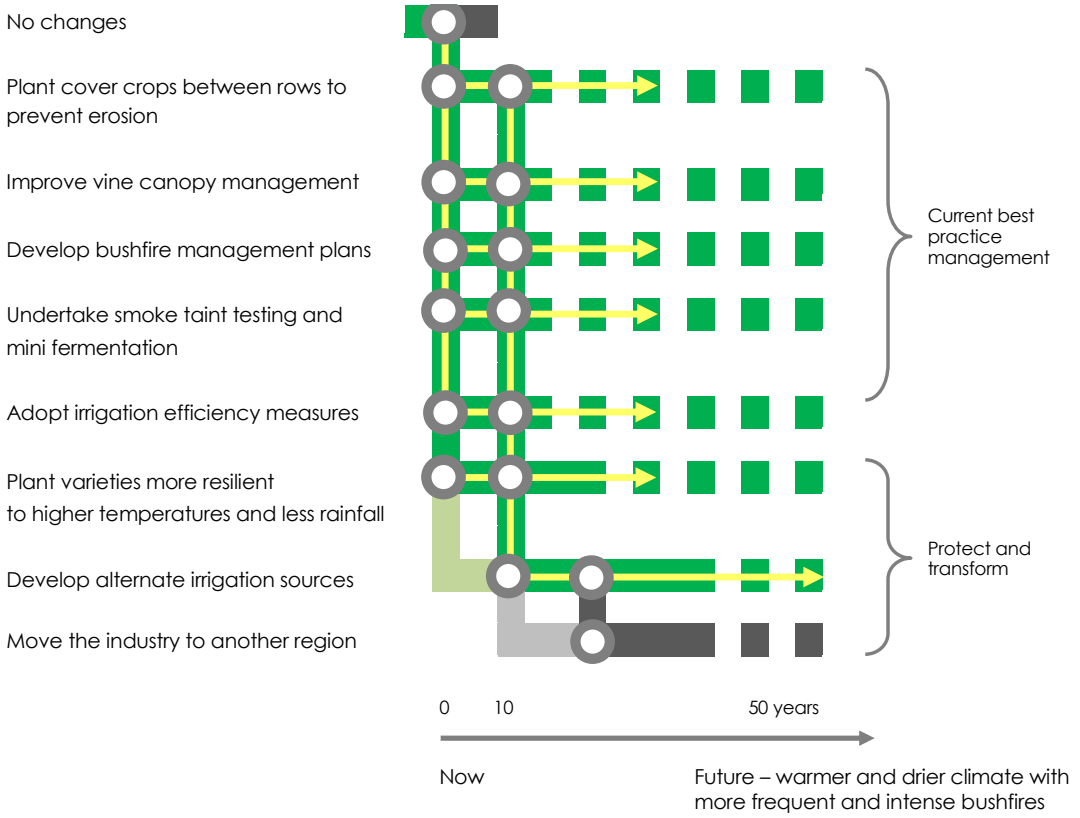
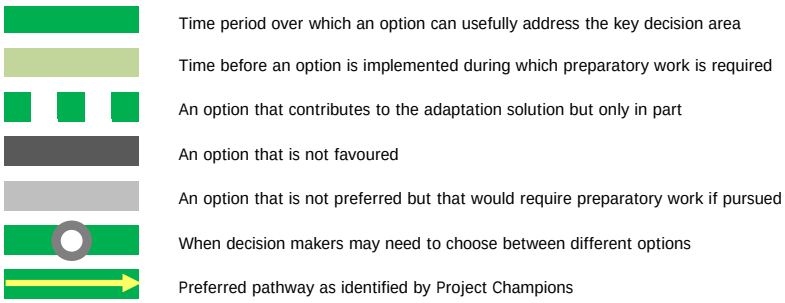
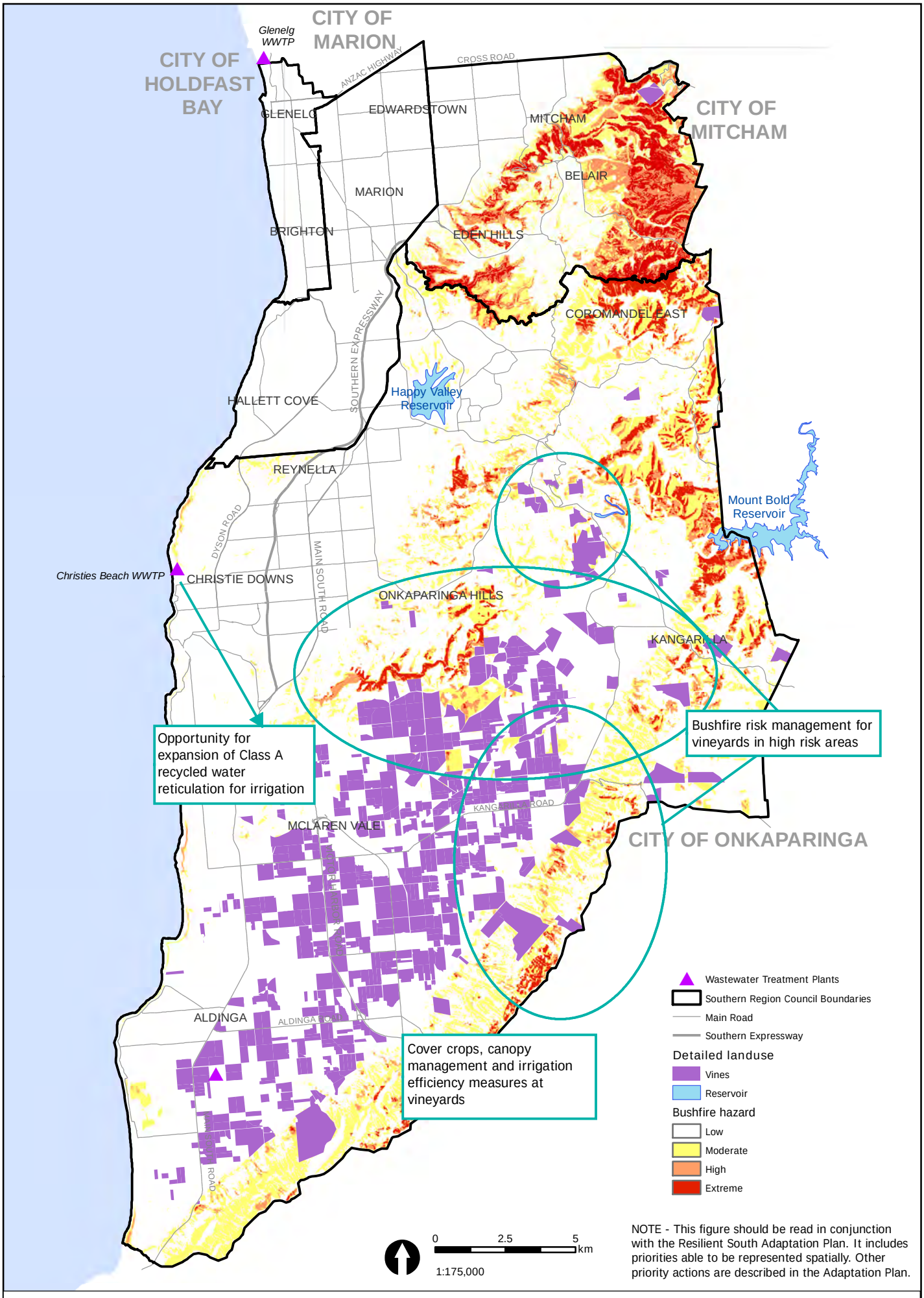


Figure 4-21: Viticulture pathway

See Figure 4-1 for an explanation of how to interpret this figure.





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Data Sources: DPTI, Councils, DEWNR, ABS
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July 28, 2014

Figure 4.22 Preferred Options for Viticulture
Resilient South