Government of **Western Australia**
Department of **Water**

Securing Western Australia's water future

Great Southern regional water supply strategy

A long-term outlook of water demand and supply

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Great Southern regional water supply strategy

A long-term outlook of water demand and supply





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A message from the Minister

We all count on having reliable and good quality water in our homes and businesses. The reliability of our water services means it's easy to take our water for granted. However, securing sustainable water supplies takes careful planning and a long-term view of our economy and environment.

It may look like the Great Southern gets a lot of rain but we know that average rainfall has been decreasing and this could increasingly affect the reliability of the current water supplies. This long-term trend and the extremely dry winter experienced in Albany and Denmark in 2014 is a reminder that we need to plan ahead.

The Great Southern regional water supply strategy is an essential reference for industry and government in considering how water supplies can be developed to meet the future water needs of the region.

The strategy forecasts the next 30 years of water demand by all water users against the backdrop of increasing population, economic growth and changing rainfall. It combines this with the latest knowledge of water resources to provide a range of water supply options and actions that will continue to support our towns and regional development well into the future.

The success of this strategy relies on the information and expertise from a wide range of organisations and members of the community. I would like to thank all the stakeholders who have contributed their knowledge and vision for the future growth and development of the Great Southern. The strategy also highlights the importance of investing in understanding the limits and extent of new water resources. The Royalties for Regions-funded groundwater investigations now underway, show that more water is available to supply the lower Great Southern towns and to support agricultural and industrial development in the region.

The State Government is committed to providing opportunities for the growth of regional Western Australia. Our planning and investment in securing the water supplies of the Great Southern region is a vital part of developing our regional towns and industry.

Hon Mia Davies MLA

Minister for Water

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Summary

Water demand in the Great Southern region is expected to increase by more than 20 gigalitres a year (GL/year) by 2040. This will be driven by population growth, new mining developments and expansion of industry and irrigated agriculture. At the same time, surface and groundwater availability will decline as the region's climate becomes drier.

The Department of Water has developed the *Great Southern regional water supply strategy* to ensure timely planning and establishment of sustainable water supplies that support long-term regional development.

Six strategies have been developed to secure regional water supplies.

Strategy 1.

Plan and develop new water sources for the Lower Great Southern towns

The *Great Southern regional water supply strategy* outlines a series of actions to ensure the best water supply options for Albany, Mount Barker, Walpole and Denmark are developed at the right time.

The department is investigating whether the existing borefield that supplies the Lower Great Southern towns water supply scheme has the potential to be expanded. Our recent aerial electromagnetic survey will be used to guide a drilling investigation by the Water Corporation. An initial assessment indicates an additional 1 GL/year could be available from this groundwater area. In conjunction with water efficiency measures already in place, this could delay the need to develop a new large source to beyond 2030.

Improving the treatment of water and providing for its transfer from the Denmark River pipehead dam to the Quickup River dam will resolve short-term water deficits for Denmark. A new water source on the Walpole River is being examined to provide greater reliability of supply for Walpole.

Longer-term water supply options include integrating the region's towns into a regional scheme to provide greater flexibility and certainty of water supply.

Strategy 2.

Where practical, maximise use of climate-resilient and cost-effective water sources for independent town water supplies

For their water supplies Cranbrook, Frankland, Borden, Ongerup, Jerramungup, Rocky Gully and Wellstead rely on small, local dams with roaded or bitumen catchments. These sources can experience water quality issues and are vulnerable to climate variability in the future.

The Water Corporation has connected several towns historically supplied from local catchments to the Great Southern towns water supply scheme and has advised that it will continue to identify opportunities for further scheme connections where practical and cost-effective.

Working with surrounding landowners to implement best management land and water use practices, upgrading infrastructure to collect and store water, and maximising the use of non-potable water supplies (such as stormwater or wastewater) will also help to improve supply security and quality.

Strategy 3.

Promote alternative water sources and efficient use of water to reduce use of potable town water supplies

This strategy recognises the importance of developing fit-for-purpose water supplies to reduce pressure on the region's potable town water supply schemes or high-quality groundwater and surface water resources.

Alternative water supplies include wastewater and greywater recycling, stormwater harvesting and rainwater tanks. These technologies can be applied at the scale of lot, estate or suburb. The Shire of Woodanilling has reduced its scheme water use by more than 50 per cent since 2010–11 through a stormwater harvesting project, while the shires of Broomehill-Tambellup, Cranbrook, Kojonup and Plantagenet are also establishing wastewater recycling and stormwater harvesting schemes.

The Department of Water's *Guideline for the approval of non-drinking water systems in Western Australia* (2013a) guides land developers and local governments interested in implementing a development-scale supply of non-drinking water.

Strategy 4.

Investigate groundwater and surface water resources to support regional development

The department's continuing program of resource investigations will identify where water is available to support long-term industry development. This information will be used to guide land use planning so that future growth occurs where sustainable water sources can be established.

At present we are investigating groundwater resources in the Albany hinterland and Albany groundwater area (with funding from Royalties for Regions). This work, to be completed in 2016, will help us to identify new groundwater resources and the potential for additional abstraction from existing resources.

Strategy 5.

Ensure emergency livestock water sources are available for areas with less than 600 mm rainfall

Declining rainfall and greater seasonal variability presents challenges for stock water supplies. During dry seasons on-farm supplies can be insufficient (quantity and/or quality) to meet water needs for stock watering.

The department's rural water planning program provides incentive schemes, planning and technical services, and emergency water arrangements for dryland rural communities.

Strategy 6.

Promote community and inter-agency involvement in water planning and management

The Department of Water will regularly review the water demand/supply balance for water users in the region. We will share information with stakeholders, including the outcomes of our investigations, to ensure decision-making is informed and timely.

Purpose of this strategy

1.1 Background

Water resources are central to maintaining the Great Southern region's environmental, social and economic values. The region contains highly productive agricultural land and world-renowned environmental assets.

Climate change and increased demand are impacting on water resources in the Great Southern region. The record dry winter experienced in Albany and Denmark this year has led to very low water levels in local dams. Predicted population growth in the major centres of Albany, Denmark, Walpole and Mount Barker will exceed the capacity of existing water supplies within the next 10 years. Both issues highlight the need to plan for secure and sustainable water supplies well ahead of time.

The Department of Water is working with the Water Corporation, regional stakeholders and across government to address the water demand and supply challenges arising in the region.

The department's work to date provides a foundation to evaluate potential water source options. This work includes:

1. Investigating water resources: increasing our knowledge of water resources from Walpole to Albany through an assessment of the values of the water resources and issues to consider when evaluating potential supplies for different water uses.

2. Communicating science and policy: we published the *Lower Great Southern water resource development strategy* (DoW 2010a) to help inform and guide planning and management of public water supplies in the region.

3. Gathering and analysing water resource information: we have worked closely with regional stakeholders to address priority water resource issues. Drawing on our expertise and the knowledge of people in the region we have compiled information into supporting documents on:

    - Water use and availability
    - Status of independent town water supplies
    - Status of public drinking water supply planning
    - Managing water use through allocation and licensing
    - Industry and agricultural water use and options for supply
    - Managing urban water
    - Protection and recovery of water resources
    - Water conservation, efficiency and alternative water use
    - Recreational use, Indigenous values and ecological values of water resources

This collection of work provides us with confidence that sustainable water supply options are available to support the region's growth. Our focus is now on working with regional stakeholders and the Water Corporation to ensure water supply options are selected for towns and other water users that meet our objectives for sustainable regional development.

1.2 Regional water supply planning

Water supply planning occurs at various geographic and time scales and at different levels of detail, from statewide strategic planning down to the design of a local water supply (Appendix A). This *Great Southern regional water supply strategy* will help to ensure water supply investment is aligned with state development objectives and land use planning at a regional scale. It will also provide the foundation for more detailed planning at a local area and site scale.

The strategy is based on projections of water demand for all water uses during the next 30 years. To inform future planning, investigations and decision-making, it identifies:

- the timeframes for when demand will exceed existing supply
- the water supply options to meet new demand
- actions and triggers for more detailed water supply planning.

Service providers and self-supply users generally undertake detailed water supply design and cost estimates before decisions are made to progress any supply options. The inclusion of options in this strategy does not imply they will be developed and funded by the government. Appendix B of this strategy has more information on the role of water service providers and self-supply users in planning and developing water supplies.

1.3 Intended outcomes

The *Great Southern regional water supply strategy* will guide government, the community and water users on developing sustainable water sources to meet future demand. Our aim is that decisions on options for water source development will be timely, well informed and transparent.

The strategy supports the following outcomes:

1. Water supply investigations and detailed water supply planning occur in areas that are high priorities for land use planning and regional development.

2 Information and advice is available to government, industry and the community on water resource and supply options for towns and major development projects.

3. Water users make decisions based on knowledge of all available water resources and supply options.

4. Innovative, efficient and integrated water supplies are developed through early detection of water shortages and timely planning.

1.4 Strategy development

This strategy has been developed with input from the Great Southern regional reference group, chaired by the Great Southern Development Commission and the Water supply planning senior officers group, chaired by the Department of Water. Appendix C provides membership details for these groups.

2

Great Southern regional profile

2.1 Strategy area

The strategy area covers about 39 000 km^2 and extends along the Western Australian coastline from Walpole in the west to the eastern border of the Shire of Jerramungup, and north to the shires of Woodanilling and Kent (Figure 1). The strategy area aligns with the Department of Planning and Great Southern Development Commission boundaries.

The Great Southern region supports various economic activities including broadacre and irrigated agriculture, industry, mining, tourism and town-based commerce. Together broadacre cropping, livestock and wool production account for half the region's economic activity.

The region is geographically diverse and the natural environment attracts many residents and visitors. It includes spectacular coastline characterised by sandy beaches and rugged granite cliffs, iconic tourist attractions – such as the Torndirrup, Porongurup, Stirling Range and Fitzgerald River national parks and recently formed Walpole wilderness area – and a series of southern-flowing rivers that provide sheltered estuaries.

Albany is the largest centre, with a population of about 32 000 (ABS 2012a). Both Albany and the nearby coastal town of Denmark have experienced strong population growth, which is expected to continue. The region also includes inland growth towns such as Katanning and small rural towns that support farming areas.

Water for towns, agriculture and industry is supplied by a mix of groundwater and surface water sources.

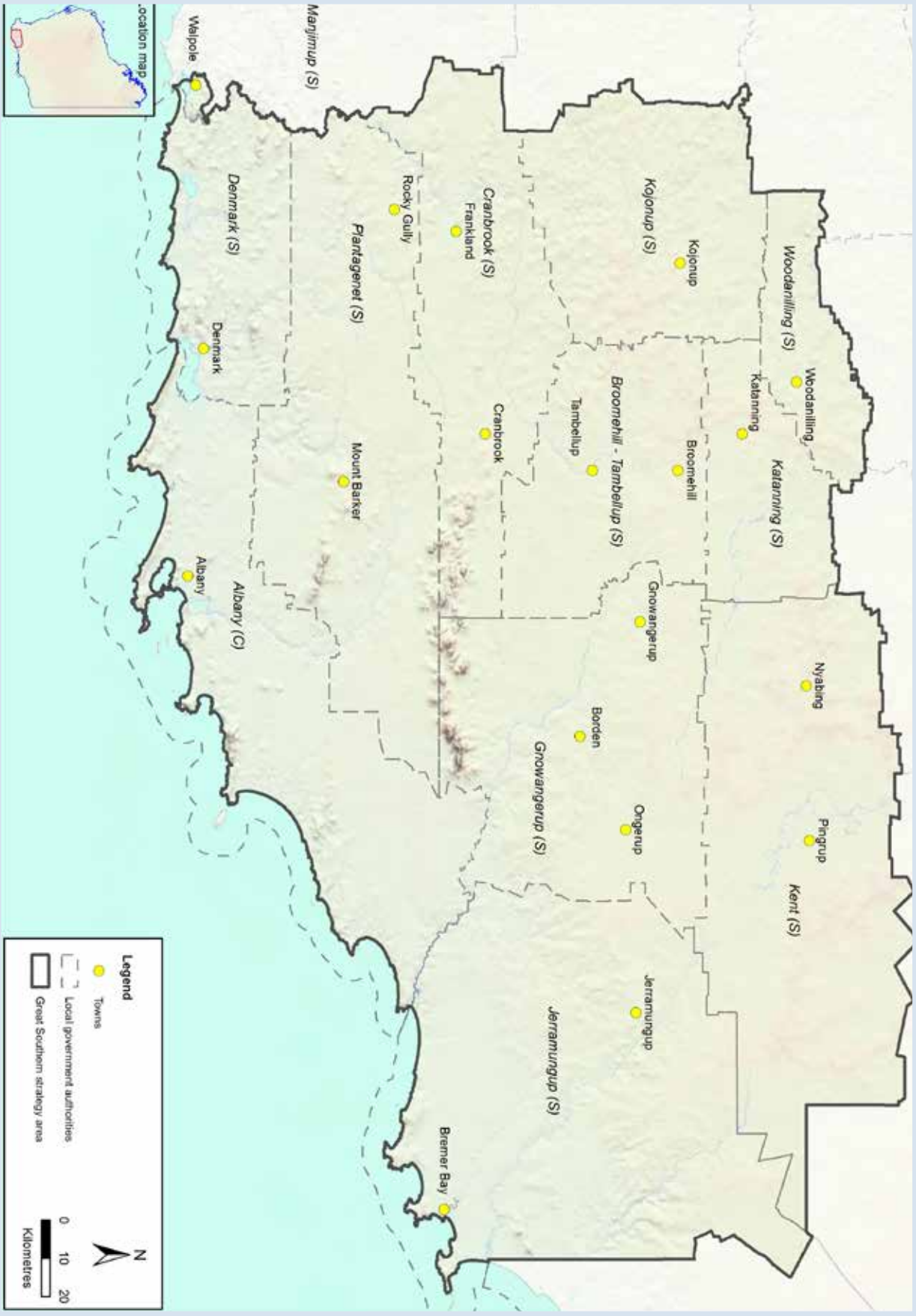

Figure 1 | Great Southern regional water supply strategy area

2.2 Challenges to secure regional water supplies

Increasing demand for water

In 2013, the total licensed and unlicensed water use in the Great Southern region was 31 GL/year. Town water supply schemes support 19 per cent of this demand. The schemes primarily support urban water demand, but also meet some industry and stock watering needs. The remaining 81 per cent of water used in the region is self-supplied. This is primarily for agriculture, including irrigated agriculture and stock watering (see Table 1).

Water demand is expected to increase to 54 GL/year by 2043 under a medium-growth scenario, but could be as high as 64 GL/year under a high-growth scenario (Figure 2). This projected increase is a result of:

- a growing population, particularly in Albany, Denmark, Walpole and Katanning
- potential iron ore and gold mining
- possible expansion of irrigated agriculture.

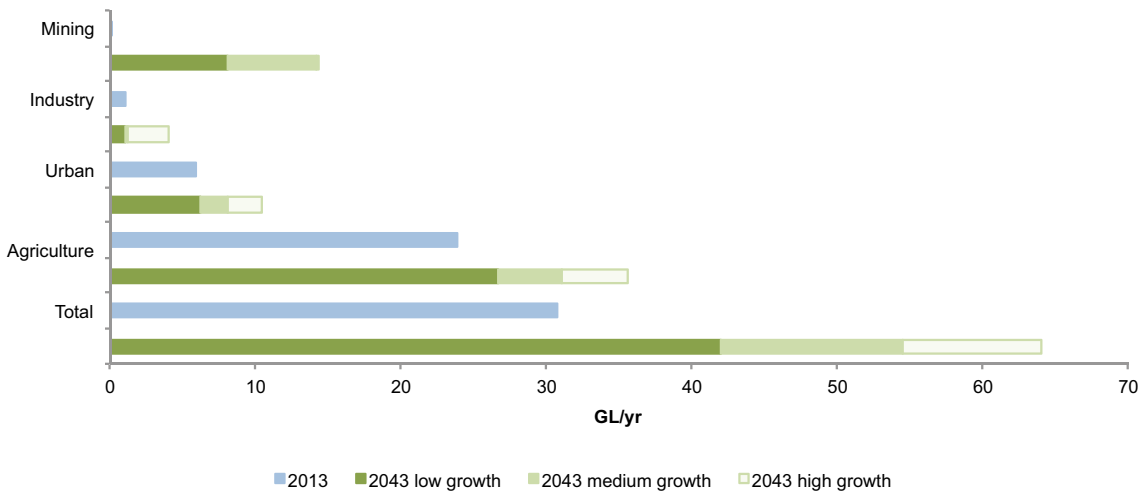

Figure 2 | Projected water demand in 2043 for the Great Southern region

Table 1 Current and projected water demand by sector for the Great Southern region

Sector	2013 water demand (GL/year)	Water quality requirements	Medium-growth scenario		Growth areas
			2043 water demand	Average annual growth (%/year)	
Agriculture[a]	24	Fresh/marginal	31	0.9	Plantagenet, Albany
Town water supply schemes[b]	6	Fresh/marginal	8	1	Albany, Denmark, Katanning
Urban self–supplied	0.6	Fresh/marginal	0.7	0.4	
Industry self–supplied	0.3	Fresh/brackish	0.4	0.9	Albany
Mining	0.1	Fresh/ hypersaline	14	20	Wellstead, Katanning
Total	31		54		

[a] Includes irrigated agriculture, such as viticulture, as well as stock water requirements for broadacre agriculture

[b] Includes urban and industry demand

Climate change

While water demand is projected to increase, water availability is declining as a result of decreased rainfall. Annual average rainfall since 1975 has declined by nine per cent in Denmark and eight per cent in Albany relative to the long-term average. Most inland areas show declines in annual average rainfall of between three per cent (Gnowangerup) and 10 per cent (Woodanilling). In eastern areas such as Jerramungup and Bremer Bay annual average rainfall has remained relatively stable.

A further decline in rainfall of two to six per cent by 2050 is expected in coastal areas and up to 15 per cent by 2050 in inland areas (DoW 2010b). A reduction in rainfall has contributed to reduced runoff and streamflow trends across the region. By 2050 streamflow is expected to reduce by 10 per cent in coastal areas and by up to 40 per cent for inland areas.

Climate change will place more pressure on existing water sources, particularly independent town supplies drawing on local dams and catchments. Declining rainfall will also lead to reduced recharge to groundwater, especially unconfined aquifers. This could result in the reduced availability or reliability of the source in the future.

Table 2 Trends in average annual rainfall in the Great Southern region (BoM 2012)				
Rainfall station	Long-term annual average (1889–2012)	Annual average (1941–1975)	Annual average (1975–2012)	Change in average annual rainfall (%)[a]
Albany (9500)	862	863	795	-8
Bremer Bay (9654)	632	630	640	1
Broomehill (10528)	448	450	424	-5
Cranbrook (10537)	501	520	468	-7
Denmark (9531)	1094	1065	1000	-9
Gnowangerup (10558)	402	400	388	-3
Jerramungup (10707)	455	434	447	-2
Kojonup (10582)	532	525	492	-8
Mount Barker (9581)	732	776	671	-8
Pingrup (10627)	359	366	333	-7
Walpole (9611)	1320	1400	1259	-5
Woodanilling (10659)	460	467	413	-10

[a] Comparison between long-term average and the period from 1975–2012

2.3 Water supplies

Water supply schemes

The Water Corporation operates most of the water supply schemes in the Great Southern region, including two regional water supply schemes (Figure 3). Three local government authorities also operate potable or non-potable supply schemes to small communities (Table 3).

A number of these schemes will require new water sources or upgraded infrastructure to meet future water demand.

The Water Corporation implemented a water efficiency program between 2010 and 2012 to reduce demand on the Lower Great Southern towns and Denmark water supply schemes and help delay the need for new water sources. The program is expected to save 0.7 GL in the first full year of operation (Marsden Jacobs Associates 2012).

In addition, the Water Corporation recently initiated the Waterwise towns program, which aims to reduce water use in targeted towns by 10 per cent over the next year. In the Great Southern region the program is being adopted in Gnowangerup, Katanning, Kojonup, Tambellup and Pingrup (Water Corporation 2014b).

Table 3 Water supply schemes in the Great Southern region

Town/scheme	Water service provider	Water source/s
Potable water		
Lower Great Southern towns water supply scheme – supplies Albany, Mount Barker, Narrikup and Kendenup	Water Corporation	South Coast borefield and Angove Creek pipehead dam
Great Southern towns water supply scheme – supplies Woodanilling, Kojonup, Broomehill, Gnowangerup, Tambellup, Katanning, Muradup, Nyabing and Pingrup	Water Corporation	Harris dam. Supply to some towns is also supplemented by small local dams
Denmark	Water Corporation	Quickup dam and Denmark pipehead dam
Walpole	Water Corporation	Butler's Creek dam, Walpole weir and Swann Road bores
Bremer Bay	Water Corporation	Bremer Bay borefield
Cranbrook, Frankland, Borden, Ongerup, Jerramungup, Rocky Gully, Wellstead	Water Corporation	Small local dams with bitumen or roaded catchments
Windy Harbour	Shire of Manjimup	Local borefield
Non-potable		
Elleker	Water Corporation	Local bore
Porongurup	Water Corporation	Bolganup dam
Peaceful Bay	Shire of Denmark	Local borefield

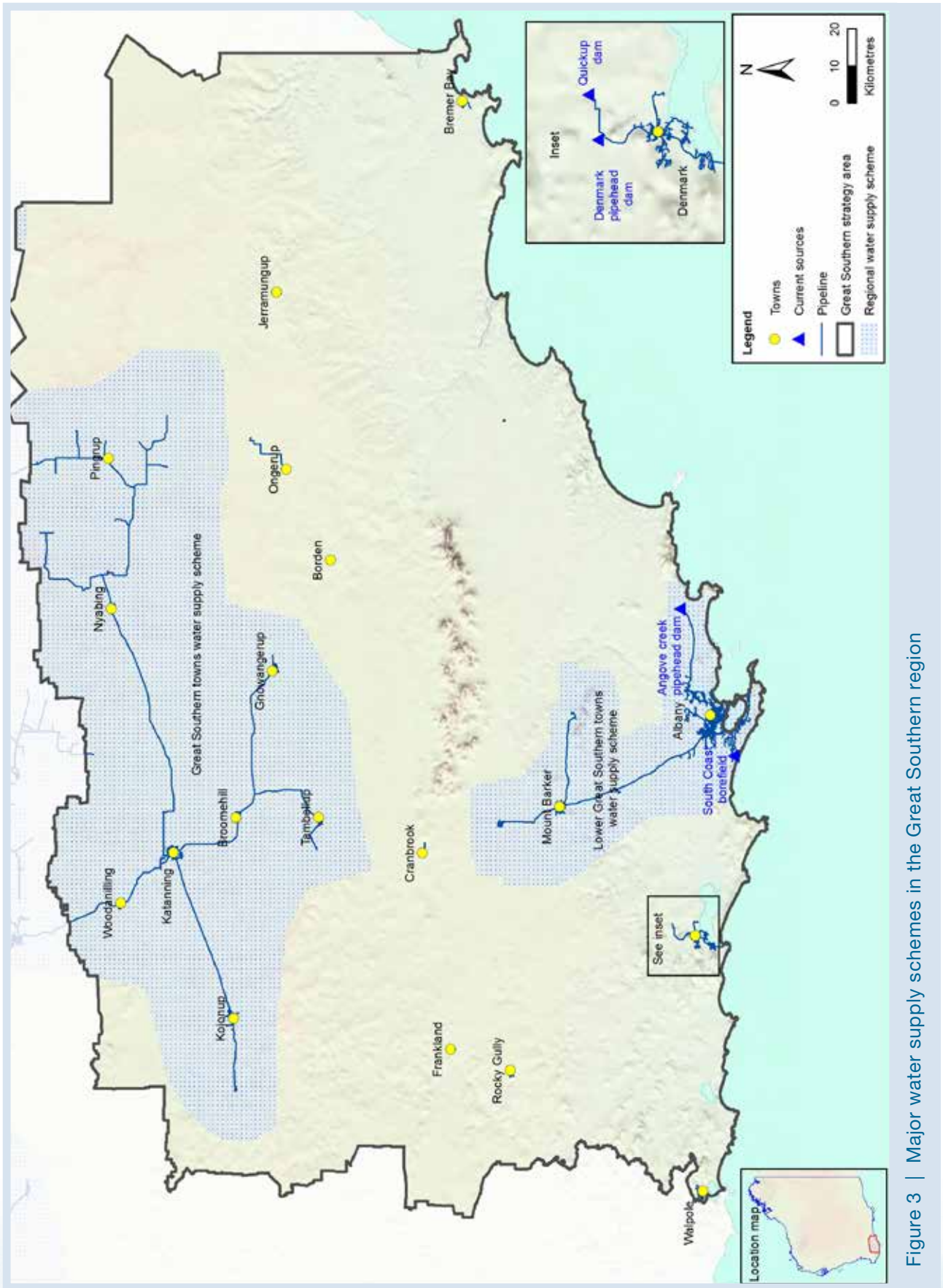

Figure 3 | Major water supply schemes in the Great Southern region

Groundwater

Groundwater is an important water source both for town water supply schemes and self-supplied water.

Most groundwater resources in the region are not proclaimed under the *Rights in Water and Irrigation Act 1914*. Proclamation is a legal process that allows for more intensive management of water resources and evaluates legal entitlements to take water. A licence is required to take water in a proclaimed area. There are only two proclaimed areas – the Albany and Bremer Bay groundwater areas – with a total allocation limit[1] of 6.67 GL/year. At present 0.18 GL/year remains for future licensing.

Unproclaimed resources are usually those with low levels of use with minimal risk to the environment. There is limited information on sustainable yields or water use from these resources.

We have analysed potential groundwater sources between Walpole and Albany to target for further investigation. The geology and stratigraphy of the area were analysed along with yield information, depth to water and salinity. Groundwater zones were categorised according to their potential for public water supply (high yields, fresh), irrigation and industrial (high yields, brackish) or stock and special industry (low yields, saline). The analysis suggests that further groundwater could be developed in the area.

Significant groundwater resources are generally limited to coastal areas, parts of the Stirling Range and small scattered areas corresponding with groundwater-flow divides. There are buried river channels (palaeochannels) with marginally fresh to saline waters in the hinterland but productive yields are limited to within channel boundaries.

In other parts of the region groundwater is more saline so use is limited. Groundwater salinity increases to the north and east across the region as rainfall decreases (Figure 4). As a rule, groundwater salinity increases with depth, due to stratification within the aquifer, as well as with distance along the direction of groundwater flow.

The Department of Water has received funding through Royalties for Regions to investigate prospective areas identified in an assessment of western South Coast water resources. The investigation is focussing on groundwater resources in the Albany hinterland and the Albany groundwater area.

[1] An allocation limit is the annual volume of water set aside for consumptive use from a water resource.

The four-year investigation, to be completed in June 2016, involves airborne geophysical survey, topographic LIDAR (Light Detection and Ranging) surveying and analysis of data using a groundwater model. The data collected during the project will improve our knowledge of the groundwater resources and help us to:

- identify and confirm water quality and new groundwater sources to the north and west of Albany
- map groundwater quality variations and saltwater intrusion in the Albany groundwater area
- quantify the recharge potential of the Albany groundwater area
- produce reports and maps on potential groundwater availability to support development in the region.

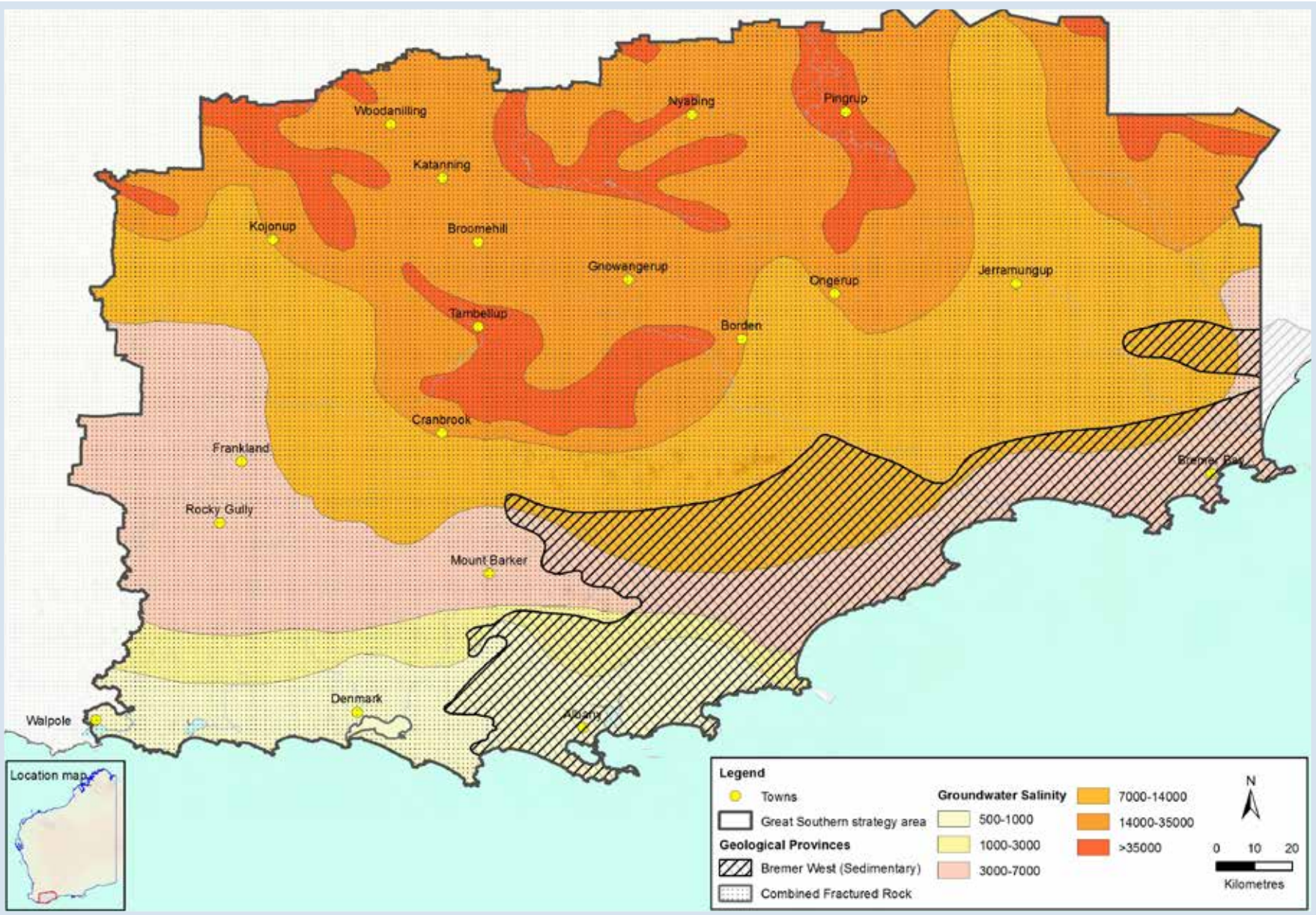

Figure 4 | Groundwater salinity in the Great Southern region

Surface water

There are 55 southern-flowing rivers in the region, along with their tributaries and additional small coastal systems (Figure 5). These rivers are generally fresh and perennial to the west and intermittent and naturally saline to the east. The northern part of the region has several intermittent salt-dominated systems that drain to salt lakes and eventually to the Avon and Blackwood rivers under flooding conditions.

Most of the surface water resources in the region are not proclaimed under the *Rights in Water and Irrigation Act*. There are four proclaimed areas: Angove Creek, Limeburners Creek, Bolganup Creek and the Warren River and tributaries. A licence is required to take water in a proclaimed area. Licensed entitlements for these resources total 2 GL/year. Some of these resources are potable and others are non-potable sources. At present only a portion of the total of licensed entitlements is abstracted. This is because some of the non-potable sources are not currently needed and achieving full allocation for some of the potable sources is constrained.

There is potential to develop pipehead dams within the region to harvest water in wetter years and store water for drier years. The Department of Water has undertaken a regional assessment of all of the coastal rivers. The total notional sustainable yield is estimated to be about 88 GL/year. The most significant flows and potential yields occur in the higher rainfall areas of the region, with the Frankland River having the highest yield of 17 GL/year, the Deep River 11 GL/year, the Denmark River 9.8 GL/year and the Kent River 7.7 GL/year. More than half the potential yield from the region's rivers is marginal, brackish or saline – making it unsuitable for potable water supplies without treatment. Environmental considerations may also reduce availability from some of these systems, given many of the major rivers are located within national parks[2].

Appendix D provides further information on the mean annual flow, potential yield and water quality for surface water resources in the Great Southern region.

It is important to note that streamflow fluctuates from year to year depending on rainfall. The yields are indicative and based on average flows and do not necessarily indicate what can reliably be taken from a resource. The analysis used data to 2003, but with streamflow decreasing as a result of climate change, the yields are likely to have declined.

Current use of surface water within the Great Southern region is estimated to be 19 GL/year (licensed and unlicensed). The Harris dam, near Collie, also supplies around 0.9 GL/year to towns in the Great Southern strategy area through the Great Southern towns water supply scheme.

Infrastructure to harvest surface water, such as bitumen or roaded[3] catchment dams, are also located in the strategy area. Bitumen and/or roaded catchment dams provide potable water for Cranbrook, Frankland, Borden, Ongerup, Jerramungup, Rocky Gully and Wellstead. Roaded catchment dams are also commonly used to capture water for irrigating vineyards in the region.

[2] Further detail on requirements for water supply development within national parks or State Forest can be found in the Walpole wilderness and adjacent parks and reserves management plan (DEC and Conservation Commission WA 2008) and Forest management plan 2014–2023 (DPaW and Conservation Commission WA 2013) respectively.

[3] Roaded catchments are a series of sloping surfaces of compacted clay to promote rainfall runoff. They can harvest 30 per cent more water than from a pasture paddock.

Seawater desalination

Seawater desalination has been identified as a future option for supplying some town water supply schemes in the Lower Great Southern. Desalination has also been proposed for the Southdown magnetite project. New technology means desalination is becoming cheaper and it is one of the few climate-independent options.

The availability and cost of energy, and access to a suitable site, are important factors in considering desalination. Environmental impacts including the carbon footprint of the process and the effects of brine discharge also need to be considered.

Alternative water supplies

Alternative water supplies such as wastewater, greywater, stormwater and rainwater tanks are important supplies for fit-for-purpose use that can help reduce the pressure on the region's potable water supply schemes or high-quality groundwater or surface water resources. These technologies can be applied at the scale of lot, estate or suburb.

The Great Southern region has the highest level of wastewater recycling across the state, with 94 per cent of wastewater reused for irrigating public open space, tree plantations and agriculture (Water Corporation 2012).

Some local governments have implemented or are developing stormwater recycling schemes for irrigating public open space and/or providing emergency agriculture supplies. The shires of Jerramungup, Plantagenet and Denmark have also prepared local planning policies that encourage decentralised water supplies such as plumbed-in rainwater tanks, greywater recycling and water efficient appliances for new residential developments.

The Department of Water's *Guideline for the approval of non-drinking water systems in Western Australia* (2013a) gives advice to land developers and local governments interested in creating a development-scale supply of non-drinking water.

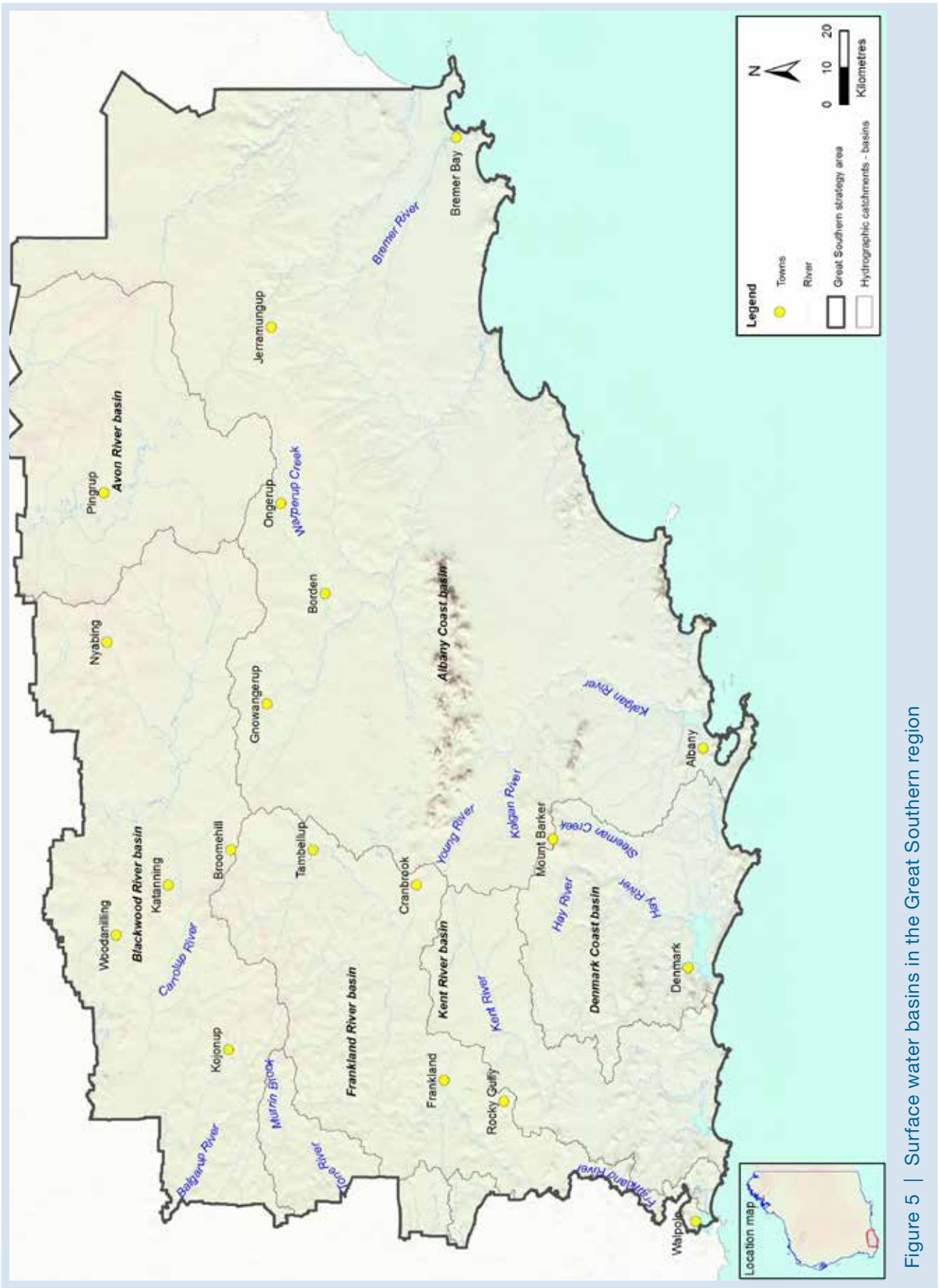

Figure 5 | Surface water basins in the Great Southern region

Water demand and supply options for the Lower Great Southern towns

Ensuring long-term water security for Lower Great Southern towns (Albany, Mount Barker, Denmark and Walpole) is the main water supply issue in the Great Southern region. The Water Corporation, as the water service provider, is responsible for planning and establishing new public drinking water supply options to address any shortfalls.

3.1 Approach

Projecting water demand

In consultation with the relevant state agencies and industry representatives, the Department of Water has developed high-, medium- and low-growth scenarios to predict future demand for the Lower Great Southern towns water supply scheme (LGSTWSS), Denmark and Walpole.

The low- and medium-growth scenarios for the LGSTWSS and Denmark are based on WAPC (2012) band A and band C population projections respectively. The high-growth scenario is based on projections from the Great Southern Development Commission. Projections for Walpole assume a growth rate of between one and two per cent a year. Further detail can be found in Appendix E.

Identifying a short-list of public drinking water supply options

The Department of Water and Water Corporation have been involved in the planning of new drinking water sources for some time.

Between 2006 and 2009 the department, with funding from South Coast NRM Inc., undertook several studies to support the assessment of new water sources. These included an investigation into the streamflow and groundwater resources in the region, identification of the ecological, social and cultural values of water resources, and interpretation of the impacts of climate change on the region's water resources. This work helped to identify and short-list several options.

In 2010, the Water Corporation released *Water Forever: Lower Great Southern*, which identified a short-list of options to be investigated for meeting future demand. These included options for local supply, as well as those that might form the basis of a regional water supply scheme. Further detail on the options is provided in sections 3.2 to 3.4.

The Department of Water's *Lower Great Southern water resource development strategy* (2010) provided a framework to guide the Water Corporation and government in planning and decision-making on new options for the Lower Great Southern towns.

Timeframes for water supply development

Timeframes for developing new large water supplies can range from three to 10 years from conception to implementation. Factors influencing the timeframe include:

- the scale and complexity of the supply option
- the distance from the water source to the demand centre
- how much is known about a water resource; for example, about yield, quality and the effects of abstraction (investigations can take three to five years where knowledge of a water resource is poor)
- the potential effects of the water supply option on environmental, social and cultural values and the approvals required
- the availability of existing infrastructure.

Our planning is based on the assumption that investigations should occur at least five years before the demand is expected to reach the current source capacity, with detailed planning and design occurring three years prior and construction starting two years prior.

Informing planning

Many of the water supply options identified in this strategy require further planning and investigations before a decision can be made to implement them. To ensure we are prepared for the range of growth scenarios we use the high-growth scenario to inform the timing of investigations and other work needed. The decision to invest in constructing a water supply option can then be brought forward or moved back according to actual demand. The medium-growth scenario informs our current estimate of when a new water supply (and investment decision) is likely to be required. This approach is illustrated in Figure 6. It assumes that most options can be investigated and implemented within five years.

We will regularly review the water demand/supply balance to determine if there are any significant changes in the projections and/or the feasibility of the available options.

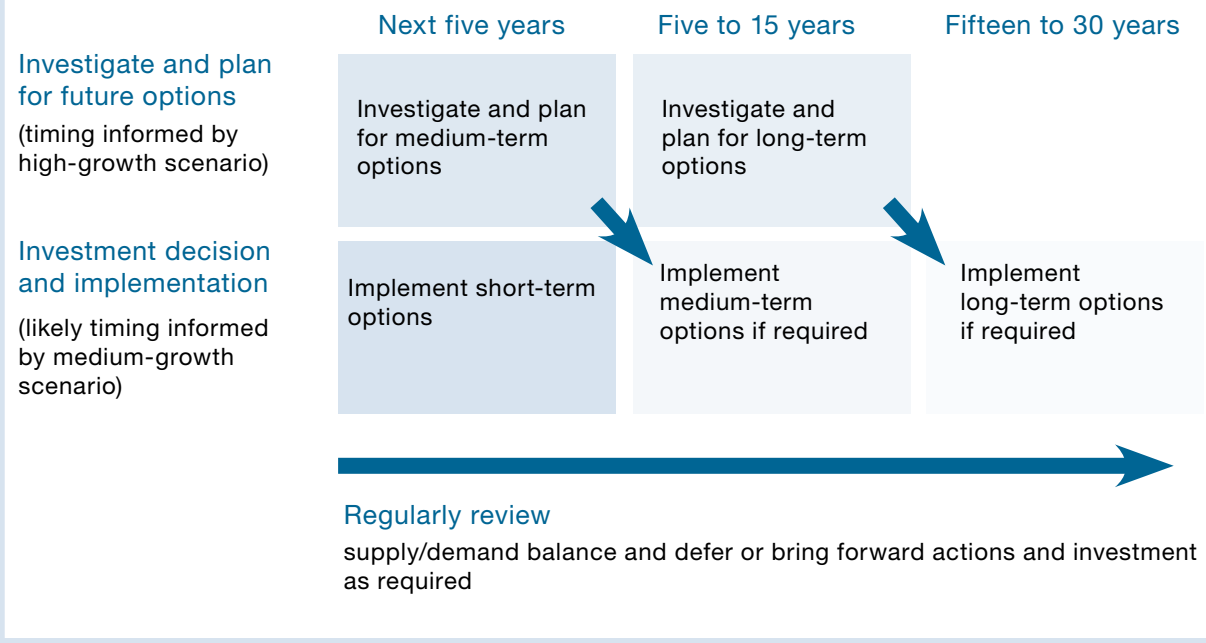

Figure 6 | Conceptual process for informing water supply planning

Water supply management and funding

Detailed source and supply infrastructure planning and implementation is almost always undertaken by water service providers or project proponents for their own business purposes and is not the role of the Department of Water. The private sector finances water supply infrastructure when the water used is predominantly for private benefit.

Public funding is generally limited to strategic planning and investigations to understand water resources and ensure they are secure, as well as various regulatory responsibilities. The state will generally be responsible for the costs of providing water to towns. However, where town expansions are largely for private sector benefit, the government may negotiate a funding arrangement with the private sector for providing town water supply infrastructure to meet the increased demand arising from their project.

Adaptive management

This strategy outlines scenarios for future water demand in the Great Southern region that reflect the uncertainty associated with regional development. Recent history has also shown that water supply solutions not considered even a short time ago can arise from new technologies or investigations.

The department therefore closely monitors the water demand and supply balance for water users in the region. Changes in water demand will trigger a response to move to the different stages of planning and supply development. We will continue to exchange information between government agencies and regional stakeholders on demand issues and supply options to ensure that decision-making is well informed and timely.

3.2 Lower Great Southern towns water supply scheme

Current water supply and demand

The LGSTWSS services the towns of Albany, Narrikup, Mount Barker and Kendenup, as well as farms adjacent to the scheme main. Water for the scheme is obtained from the South Coast borefield south-west of Albany and the Angove Creek pipehead dam at Two People's Bay east of Albany.

Following investigations and assessment, the Department of Water recently increased the Water Corporation's licensed entitlement for the South Coast borefield by 0.5 GL/year to a total of 4.45 GL/year. This ensures security of supply in the short term. Some further expansion of this borefield may be possible and this is being investigated (see Future supply options below).

The Water Corporation is licensed to take 1.6 GL/year from the Angove Creek pipehead dam. However, the full entitlement is not available every year due to water quality issues and environmental water requirements. For planning purposes we have assumed that 0.8 GL/year can be obtained from this source. The Water Corporation is reviewing whether supply can be increased from Angove Creek pipehead dam by improving treatment of coloured water or adjusting the environmental water requirements.

The Albany and Mount Barker communities have significantly reduced their water use. Although the population has increased, water demand has declined during the past five years from a peak of 5.3 GL/year in 2007 to 4.2 GL/year in 2013. If maintained, this helps to delay the need for a new water source.

Future water demand

Projected water demand for the LGSTWSS is presented in Table 4. Water demand for 2013 is based on the average abstraction during the past three years. As noted above, a large reduction in demand has occurred due to water efficiency measures. Our forward projections assume the water efficiency gains to date will be maintained into the future. Projections indicate that under a high-growth scenario a new water supply is needed by 2023 and under a medium-growth scenario by 2030 (Figure 7).

Table 4 Lower Great Southern towns water supply scheme demand to 2043 (GL/year)

Scenario	2013	2023	2033	2043
Low growth	4.2	4.6	4.9	5.4
Medium growth	4.2	4.8	5.3	5.9
High growth	4.2	5.1	6.2	7.4

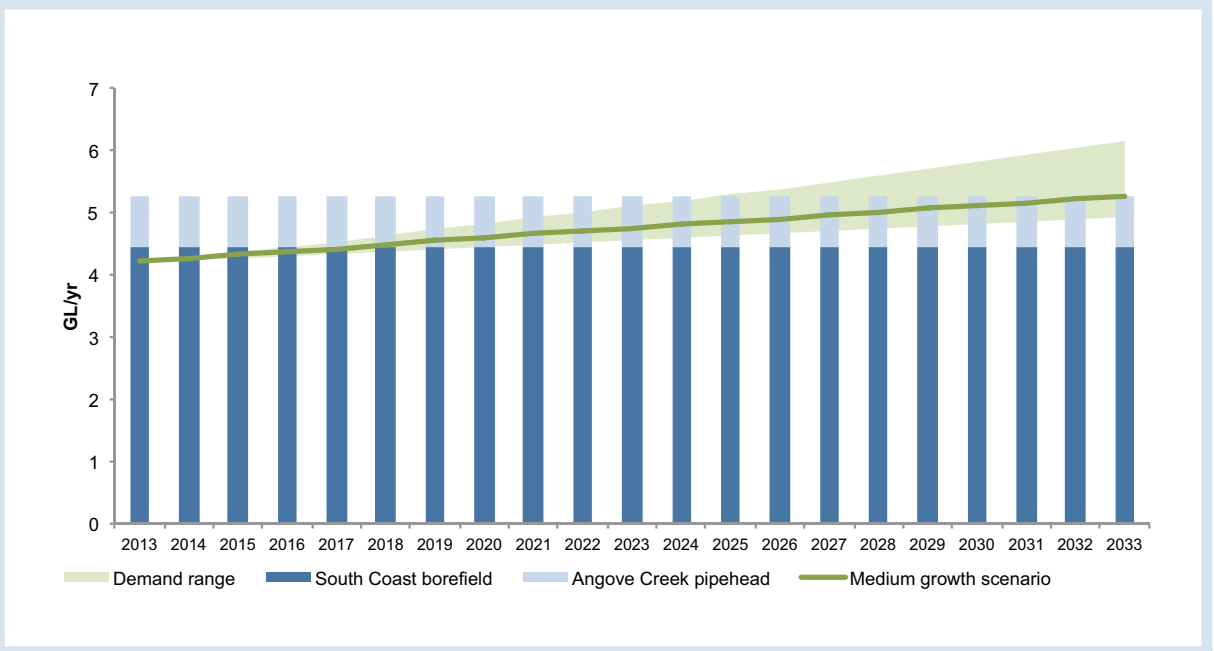

Figure 7 | Projected water demand to 2033 and current water supplies for the Lower Great Southern towns water supply scheme

Future supply options

Water Forever: Lower Great Southern (Water Corporation 2010) outlined how supplies could be maximised through a combination of increased efficiency, greater use of recycled water and development of new sources.

Community feedback on *Water Forever: Lower Great Southern* showed support for improved water efficiencies and recycling. To date the application of these measures has been very effective in helping to delay the need for a new major source. The Water Corporation will continue to identify further opportunities for water efficiency improvements by scheme users.

The Shire of Plantagenet's town planning scheme policy: *Water efficiency in residential development* (Shire of Plantagenet 2013) encourages plumbed-in rainwater tanks, the use of greywater systems and water efficient appliances for new residential developments. Decentralised technologies such as these applied at the lot or development scale can help reduce demand on scheme supplies.

At present wastewater from the Albany and Mount Barker wastewater treatment plants is used to irrigate tree plantations and vineyards respectively. Potentially some of this water could be used to reduce demand on the scheme. Considerations include the cost of replacing infrastructure and the ongoing needs of agriculture operations.

Water supply options short-listed in *Water Forever: Lower Great Southern* were:

- expansion of the South Coast borefield
- aquifer storage and recovery (ASR) of water from the Marbellup Brook
- seawater desalination
- upgrade and reactivation of the Limeburners Creek pipehead dam
- new groundwater sources such as Marbellup groundwater and north-west Albany groundwater.

The Water Corporation and Department of Water are investigating the potential to expand the existing South Coast borefield to the north-west. A desktop assessment suggests this area could provide an additional 1 GL/year. The department has recently completed an aerial electromagnetic survey (AEM) of the area, which will be used to guide a drilling investigation by the Water Corporation.

The Marbellup Brook ASR option involves collecting water from the brook from May to October using a small pipehead structure. The water would then be treated and piped about 10 km for infiltration or injection into a suitable aquifer in the Albany groundwater area for storage and future recovery.

Based on streamflow between 2001 and 2011, the estimated volume able to be abstracted from May to October ranged from 2.3 GL to 3.8 GL. However, the higher volumes have a low level of reliability. The water would also need to be treated before recharge, further reducing the yield. Further work is also required to identify appropriate recharge sites and determine the technical feasibility of ASR locally. The current Royalties for Regions-funded investigation by the Department of Water includes identifying prospective recharge sites. This investigation will be completed by June 2016.

Desalination is a climate-independent supply that received broad support from the community through *Water Forever: Lower Great Southern.* One of the advantages of desalination is the greater ability to increase capacity in stages as demand grows. However, desalination has higher energy requirements than other options and the potential effects of brine disposal need to be considered. In this area brine dispersion is likely to be aided by the high-energy coastal conditions.

New groundwater resources are another future option. The Department of Water's current Royalties for Regions-funded investigation aims to identify prospective groundwater sources within the Albany hinterland. The department recently completed an AEM survey that identified several potential areas for investigation drilling this year.

The Water Corporation is licensed to take up to 0.2 GL/year from the Limeburners Creek. Water quality is poor and the treatment costs are likely to make this a high-cost option for the volume produced.

New large dams within the region have generally lacked community and government support. Rivers that have previously been identified as potential water sources include the Denmark, Styx, Kent and Bow rivers. The department's resource recovery initiative to reduce the Denmark River's salinity to levels suitable for town water supply has been successful, with the average salinity reducing from a peak of 700 mg/L in 1991 to less than 500 mg/L by 2012. Whether there was potential for a new dam at an appropriate location and scale would need to be re-examined.

Strategy for securing supply for the Lower Great Southern towns water supply scheme

Table 5 Lower Great Southern towns water supply scheme water supply strategy

Option	Considerations	Actions	Who	Timing/trigger[a]
Options to delay the need for a new large source				
Promote water conservation, recycling and efficient use of present scheme water supplies	• Savings progressively more difficult to achieve after savings made in previous programs	Continue to identify and deliver water efficiency measures	WC	Ongoing
		Review and expand water conservation plans to minimise use of scheme water for public open space (POS)	DoW/ LGAs	Ongoing
		Promote the use of plumbed-in rainwater tanks, greywater recycling and water efficient appliances through land use planning	DoW/ DoP/ LGAs	Ongoing
		Promote fit-for-purpose supplies such as wastewater and stormwater recycling to reduce demands on scheme supply	DoW/ DAFWA/ LGA/WC	Ongoing
Develop alternative water supplies for large users	• Cost of replacing existing infrastructure	Work with large users to identify alternative supply options	WC	Ongoing
Expand the South Coast borefield	• Further investigation required to confirm yield	Complete investigations and assessment	WC/ DoW	In progress for completion in 2016
		Increase allocation limit if appropriate	DoW	Following investigation
Most likely next source option[b]				
Seawater desalination	• High energy demands and operating costs	Confirm desalination plant site	WC	Five years before source capacity is projected to be reached (in progress)
		Complete pre-feasibility costings	WC	Four years before source capacity is projected to be reached
		Initiate detailed design, costing and approvals	WC	Three years before source capacity is projected to be reached
		Initiate construction	WC	Two years before source capacity is projected to be reached
Back-up option				
Marbellup Brook ASR	• Climate-dependent • High environmental values • Water quality • Variable flow resulting in inefficient use of treatment infrastructure • Option not broadly supported by the local community (WC 2010)	Identify prospective injection sites	DoW	2015
		Undertake detailed feasibility planning including future yield, design, injection trials	WC	Seawater desalination becomes less feasible
Other potential options				
New groundwater sources in the Albany hinterland	• Insufficient existing knowledge of potential sources	Complete groundwater investigations	DoW	In progress for completion in 2016

[a] Timing triggers are indicative and may be subject to change.

[b] Based on current circumstances. This will be re-evaluated following the outcomes of investigations and more detailed costing. We will also regularly re-evaluate existing options currently not included in this short-list and identify potential new options that arise.

3.3 Denmark town water supply scheme

Current water supply and demand

At present water demand for Denmark is about 0.55 GL/year. The primary water source is the Quickup dam. This source has insufficient capacity to reliably meet current levels of demand on its own. Average flow into the dam is about 0.45 GL/year, but in some years flows will be lower. The dam has a storage capacity of 1.19 GL. Two consecutive dry winters will result in a supply shortfall, as was experienced in 2008.

The Denmark pipehead dam is used as a water supply contingency option when water levels in Quickup dam are low. Potable water supply from Denmark dam was restricted for several decades due to elevated salinity levels. Average annual salinity in the Denmark River peaked around 700 mg/L in 1991 following land clearing in the 1950s to 1970s, and has been falling since then as a result of clearing controls and the plantations established under the *Denmark River Water Resource Recovery Plan* (DoW 2011a).

The Department of Water has updated the *Denmark River Water Resource Recovery Plan* to increase monitoring of the river and ensure effective water quality management in the catchment keeps salinity levels low. The plan identifies that actions to reduce salinity have worked and the previously saline town water contingency supply has now returned to a drinkable quality. In 2013 salinity averaged 470 mg/L (potable water standard is 500 mg/L or below).

The Department of Water's modelling supports the abstraction of up to 0.45 GL/year from the Denmark pipehead dam, subject to the required management measures. Agricultural activities within the catchment present a risk of pathogen and nutrient contamination. The water is treated to ensure it meets the *Australian drinking water guidelines* (NHMRC & NRMMC 2011).

Being able to store water from the Denmark pipehead dam within Quickup dam will improve the reliability of this scheme and delay the need for investment in a new large source. This will require construction of a transfer pipeline and additional treatment. This is planned to be implemented by 2016 subject to further assessment, approvals and rainfall over the next two years (Water Corporation 2014a).

Future water demand

Denmark's population is projected to increase by one to three per cent a year, driving an increase in water demand of between 0.3 and 0.6 GL/year by 2043 (Table 6).

Table 6 Denmark water demand projections to 2043 (GL/year)

Scenario	2013	2023	2033	2043
Low growth	0.55	0.64	0.73	0.85
Medium growth	0.55	0.66	0.77	0.91
High growth	0.55	0.71	0.91	1.18

The Quickup dam combined with the existing Denmark pipehead dam provides sufficient supply to meet projected demand in the medium-term (Figure 8). Increased capacity will be required in the longer-term.

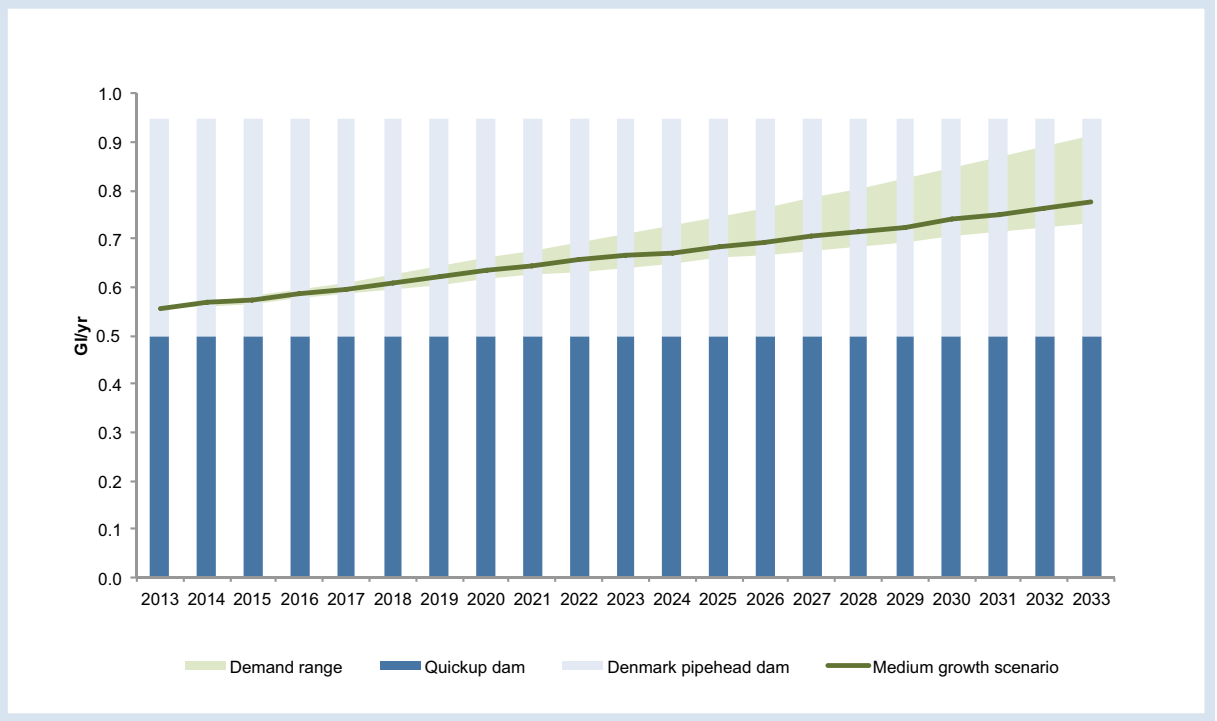

Figure 8 | Projected water demand to 2033 and current water supplies for Denmark

Future supply options

Improved water efficiency, increased water recycling and options to augment the Denmark town water supply scheme were identified in the Water Corporation's *Water Forever: Lower Great Southern* (2010).

Denmark was included in the Water Corporation's recent integrated water efficiency project. The Water Corporation will continue to identify ways to improve water efficiency by scheme users.

The Shire of Denmark has also developed a town planning scheme policy (Shire of Denmark 2010) to encourage the use of plumbed-in rainwater tanks and greywater recycling.

Once the Water Corporation's proposed upgrades are in place – to enable water from Denmark River to be stored in Quickup dam – the potential to increase the dam's storage capacity to 3 GL by raising the dam wall warrants further investigation. This would allow for storage of additional water during years of high rainfall for use during periods of lower rainfall.

Other options that have been identified include:

- a new pipehead dam on the upper Denmark River, potentially supplying about 0.6 GL/year
- connection to the LGSTWSS (this option would only become viable once a new large source is developed for that scheme)
- seawater desalination.

Strategy for securing supply for Denmark

Table 7 Denmark future water supply strategy

Option	Considerations	Actions	Who	Timing/trigger[a]
Options to delay the need for a new source				
Promote water conservation, recycling and efficient use of present scheme water supplies	• Savings progressively more difficult to achieve after savings made in previous programs	Continue to identify and deliver water efficiency measures	WC	Ongoing
		Review and expand water conservation plans to minimise use of scheme water for POS	DoW/ LGAs	Ongoing
		Promote the use of plumbed-in rainwater tanks and greywater recycling through land use planning	DoW/ DoP/ LGAs	Ongoing
		Promote fit-for-purpose supplies such as wastewater and stormwater recycling to reduce demands on scheme supply	DoW/ DAFWA/ LGA/ WC	Ongoing
Denmark River pipehead dam	• Water quality	Initiate detailed design, costing and approvals for additional treatment and transfer capability	WC	In progress
		Initiate construction	WC	Two years before source capacity is projected to be reached
Raise Quickup dam wall	• Timing – best if Denmark pipehead transfer capability is in place first • Environmental flow requirements	Initiate detailed design, costing and approvals	WC	Three years before source capacity is projected to be reached
		Initiate construction	WC	Two years before source capacity is projected to be reached
Most likely next source option[b]				
A new pipehead dam on the upper Denmark River OR Connection to the LGSTWSS	Upper Denmark pipehead: • requires further investigation of the potential impacts • water quality risks. Connection to the LGSTWSS: • cost • timing – depends on timing of a new large source for LGSTWSS	Complete sustainable yield investigations and water quality assessment for the pipehead option	WC / DoW	Five years before source capacity is projected to be reached
		Complete pre-feasibility costings	WC	Four years before source capacity is projected to be reached
		Assess options and confirm preferred option	WC with advice from DoW	Four years before source capacity is projected to be reached
		Initiate detailed design, costing and approvals for preferred option	WC	Three years before source capacity is projected to be reached
		Initiate construction	WC	Two years before source capacity is projected to be reached
Other potential options				
Seawater desalination	• High energy demands and operating costs • Availability of suitable sites close to town			

[a] Timing triggers are indicative and may be subject to change.

[b] Based on current circumstances. This will be re-evaluated following the outcomes of investigations and more detailed costing. We will also regularly re-evaluate existing options currently not included in this short-list and identify potential new options that arise.

3.4 Walpole town water supply scheme

Current water supply and demand

The Walpole town water supply scheme's demand is presently about 56 ML/year (0.056 GL/year). The scheme is supplied by the Butler's Creek dam, a weir on the Walpole River and new groundwater bores. The sources are highly climate-dependent.

Walpole's primary water source is the Butler's Creek dam to the town's north-east. Water use increases substantially over summer due to an influx of tourists to the town. Additional supply is sometimes required during these months to supplement Butler's Creek dam.

Water flows into the Walpole River weir have been low, with flow stopping completely in recent years. During the summers of 2007, 2008 and 2011, water needed to be carted from neighbouring towns.

The Water Corporation has constructed two new groundwater bores along Swann Road, North Walpole, to provide additional supply during the summer months. They were first used in late 2011. The bores were anticipated to improve the security of supply for Walpole in the short-term; however, they are low yielding and abstraction is constrained by the area's high environmental values.

Future water demand

Walpole's population is projected to increase by one to two per cent per year, driving an increase in water demand of between 20 and 45 ML/year (0.02 and 0.045 GL/year) by 2043 (Table 8). A new water supply is needed to ensure security of supply for current levels of demand and meet future projections (Figure 9).

Table 8 Walpole water demand projections to 2043 (ML/year)

Scenario	2013	2023	2033	2043
Low growth	56	61.5	68	75
Medium growth	56	64.5	75	87
High growth	56	68.0	83	101

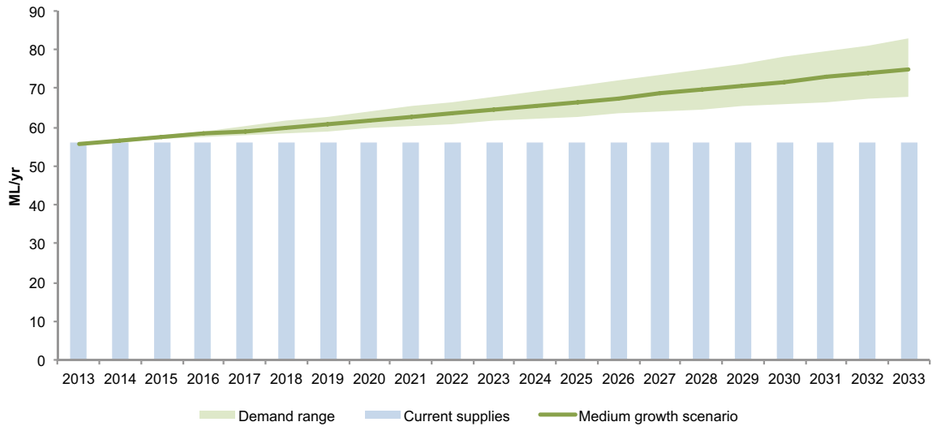

Figure 9 | Projected water demand to 2033 and current water supplies for Walpole

Future supply options

The Water Corporation is working to develop a new water source for Walpole. Nevertheless, water carting may still be needed if low rainfall occurs before a new source comes online.

In addition to the Swann Road bores, the Water Corporation outlined the following local water supply options for Walpole in *Water Forever: Lower Great Southern*:

- a dam on the Samuel's Brook approximately 8 km north-west of Walpole
- seawater desalination
- other groundwater in the area.

A further option has been identified since the release of *Water Forever: Lower Great Southern*. This option involves water being pumped from the Walpole River upstream of the existing weir into an off-stream storage dam. The Water Corporation is now investigating this option as a priority.

Connection to the LGSTWSS is another longer-term option. The distance (70 km) means this would be likely to cost more than local sources.

Construction of pipehead dams (of appropriate size and location to minimise impacts on environmental values and agricultural land) may also provide a longer-term option. Pipehead dams can be used to abstract water in wetter years to store for supply in drier years.

Strategy for securing supply for Walpole

Table 9 Walpole future water supply strategy

Option	Considerations	Actions	Who	Timing/trigger[a]
Options to delay the need for a new source				
Promote water conservation, recycling and efficient use of present scheme water supplies	• Savings progressively more difficult to achieve after savings made in previous programs	Continue to identify and deliver water efficiency measures	WC	Ongoing
		Review and expand water conservation plans to minimise use of scheme water for POS	DoW/ LGAs	Ongoing
		Promote the use of plumbed-in rainwater tanks and greywater recycling through land use planning	DoW/ DoP/ LGAs	Ongoing
		Promote fit-for-purpose supplies such as wastewater and stormwater recycling to reduce demands on scheme supply	DoW/ DAFWA/ LGA/ WC	Ongoing
Water carting	• Cost • Capacity of the source where water is being carted from • Reduced reliability of supply for fire fighting	Manage through standard Water Corporation processes	WC	As required
Most likely next source option[b]				
Walpole River pumpback to off-site storage	• Water quality	Complete sustainable yield and water quality assessment and pre-feasibility costings	WC	In progress
		Initiate detailed design, costing and approvals	WC	Following pre-feasibility assessment
		Initiate construction	WC	Following design and approvals
Back-up option				
Samuel's Brook pipehead dam	• Environmental values	Undertake more detailed feasibility planning and approvals	WC	Walpole River pumpback to off-site storage becomes unviable
Other potential options				
Seawater desalination	• High energy demands and operating costs • Availability of suitable sites close to town			
Connection to the LGSTWSS	• Cost • Timing – depends on timing of a new large source for the LGSTWSS • Potential source for Denmark as well			
Local groundwater	• Limited existing information on yields and quality • Environmental constraints			

[a] Timing triggers are indicative and may be subject to change.

[b] Based on current circumstances. This will be re-evaluated following the outcomes of investigations and more detailed costing. We will also regularly re-evaluate existing options currently not included in this short-list and identify potential new options that arise.

Water demand and supplies for the remainder of the Great Southern region

4.1 Great Southern towns water supply scheme

The Great Southern towns water supply scheme (GSTWSS) is the main scheme supply for inland towns in the region. The scheme provides potable water to nine towns in the Great Southern region: Broomehill, Tambellup, Gnowangerup, Katanning, Nyabing, Pingrup, Kojonup, Woodanilling and Muradup. It also supplies water to towns within the Wheatbelt and Goldfields regions.

Water is sourced from the Harris dam near Collie. An average of 7.8 GL/year has been supplied to the scheme during the past three years. An estimated 0.9 GL/year of this goes to the nine towns located within the Great Southern region.

The storage volume within Harris dam varies seasonally with annual rainfall and associated streamflow. In 2013 storage levels reached a low of 45 per cent.

This will be insufficient to meet future demand on the GSTWSS. The Water Corporation is investigating several options to improve water security for the scheme, including pumping water from Stirling dam into Harris dam. The opportunity to connect towns in the scheme's lower half – if a large source is developed in Albany – is also a potential option.

In addition to increasing supply, options to reduce demand on the scheme are also important. Table 10 summarises opportunities for reducing water demand. Current funding opportunities are summarised in Chapter 5.

Katanning

Katanning is one of nine south-west towns included in the state government's Regional centres development plan (SuperTowns). This initiative aims to position these towns to take advantage of an expected doubling of the state's population during the next 30 to 40 years. New infrastructure and the creation of new business opportunities and investment are vital to this positioning. The Shire of Katanning's growth plan identifies a range of new employment opportunities that could see the population increase from the current 4700 to around 12 500 by 2031 (Shire of Katanning 2012).

Katanning is supplied from the GSTWSS. Current water use is 0.4 GL/year. Water demand is projected to increase to 1 GL/year by 2043 if the population of Katanning increases to the extent outlined in the plan.

A key issue for Katanning is the limitation on water delivery due to the low flow capacity of the existing pipeline infrastructure of the GSTWSS. Infrastructure upgrades are required to ensure water demand can be met in the short to medium term.

4.2 Independent town water supply schemes

Potable water supply for Cranbrook, Frankland, Borden, Ongerup, Jerramungup, Rocky Gully and Wellstead is sourced from small local dams with roaded or bitumen catchments. Water demand is not expected to increase significantly in these towns; however, water quality and the cost of maintaining local catchments are challenges for ongoing reliable supply. Supply capacity has been reached for several towns and infrastructure costs associated with new development exceed the market value of new lots. The reliance on small, individual surface water catchments also makes these sources vulnerable to climate change into the future.

The Water Corporation has connected a number of towns historically supplied from local catchments to the GSTWSS. It will continue to identify opportunities for further scheme connections where practical and cost-effective. This could include connecting some towns to the LGSTWSS in the future – if a new large source is developed.

Working with surrounding land owners to implement best land and water management practices, upgrading infrastructure to collect and store water and maximising the use of non-potable water supplies (such as stormwater or wastewater) are other options for improving supply security and quality.

Ways to increase the amount of water collected include improving the condition of roaded catchments, bituminising or resealing catchments and using liners. Covers could reduce the amount of water lost to evaporation. The Water Corporation identifies and prioritises potential upgrade works. In some cases, carting of water during dry periods can provide a cheaper and safer option. However, the reliability of supply for fire fighting purposes needs to be considered and planned for.

Non-potable water sources can be used for irrigating public open space, residential non-drinking water demands, industry and agriculture to reduce existing demand on scheme supplies. Opportunities for reducing water demand on scheme supplies are summarised in Table 10. Current funding opportunities are summarised in Chapter 5.

In 2012, the Shire of Woodanilling received a grant through the Community Water Supply Program to complete drainage diversion works for a stormwater harvesting project to irrigate Woodanilling's sports oval and community park. As a result of the project, scheme water use has reduced by more than 50 per cent since 2010–11, with further reductions anticipated. The shires of Broomehill-Tambellup, Cranbrook, Kojonup and Plantagenet were recently awarded $1.65 million through the Royalties for Regions program to establish wastewater reuse and stormwater harvesting to irrigate public open space.

In addition to supplying urban water needs, some schemes also supply water for agricultural purposes, either through 'agreements for water supply' and use of reticulated supply or through standpipes connected to scheme supplies (used as emergency farmland supplies). Improved on-farm water supplies and emergency agricultural supplies can also reduce pressure on scheme supplies.

Bremer Bay's water is supplied from a borefield south-west of the town. It is anticipated that expansion of the existing borefield will support town growth.

Table 10 Options for reducing scheme water demand

Option	Examples
Targeted efficiency programs with households and businesses	Water Corporation's *Waterwise towns program*, which provides personalised water use advice to households and businesses and retrofits with Waterwise products for targeted towns. See <www.watercorporation.com.au/save-water/water-saving-programs/waterwise-towns-program> for more information.
Water conservation measures and policies	Various local government policies and strategies such as replacing high-water-use gardens with Waterwise plants, waterless parks, water efficient appliances etc.
Reuse of wastewater for fit-for-purpose use	Irrigation of public open space and golf course in Katanning; Shire of Jerramungup and Kojonup reuse wastewater combined with stormwater for public open space irrigation.
Capture and reuse of stormwater for fit-for-purpose use	Projects in the shires of Woodanilling, Broomehill-Tambellup, Cranbrook, Kojonup and Plantagenet for irrigation of public open space.
Use of redundant local catchment dams for non-potable use where towns have been connected to a regional scheme	Proposed transfer of Nieve dam and Nyabing dam to the Shire of Kent for non-potable purposes.
Desalination of groundwater as an alternative supply	Trials in Merredin, Katanning and Wagin.
Plumbed-in rainwater tanks in viable locations	Shires of Jerramungup, Plantagenet and Denmark: local planning policies encourage plumbed-in tanks and greywater systems for new residential developments.
Reuse of greywater for fit-for-purpose use	
Improved agricultural water supplies to reduce demand on the scheme	Development of a new dam and soak in the Shire of Cranbrook, upgrades to Quartermaines, Mindarabin and Kwobrup dams in the Shire of Kent and proposed new dam in Jacup.

4.3 Industry

Existing industries in the region include the port at Albany, food processing (meat and dairy), timber processing and grape processing. Current industry water use is estimated at 1 GL/year. Most industrial water users near towns use scheme supplies, however 0.3 GL/year is estimated to be self-supplied.

During the years 2000 to 2010 the plantation timber industry expanded rapidly. This led to proposals for value-adding industries including wood fuel pellets, biomass power generation and lumber-based products. Special industry sites such as Mirambeena (Albany) and Yerriminup (Mount Barker) were established to support the development of these industries. However, the economic downturn has meant the industry sites have not grown as anticipated. Under a medium-growth scenario only a very limited increase in water demand is anticipated. Our high-growth scenario reflects a potential recovery of the plantation industry, requiring about 3 GL/year of additional water by 2043. Other regional towns have also attracted industries value-adding to primary production, such as the abattoir and meat processing plant in Katanning, and there is potential for further inland industry development.

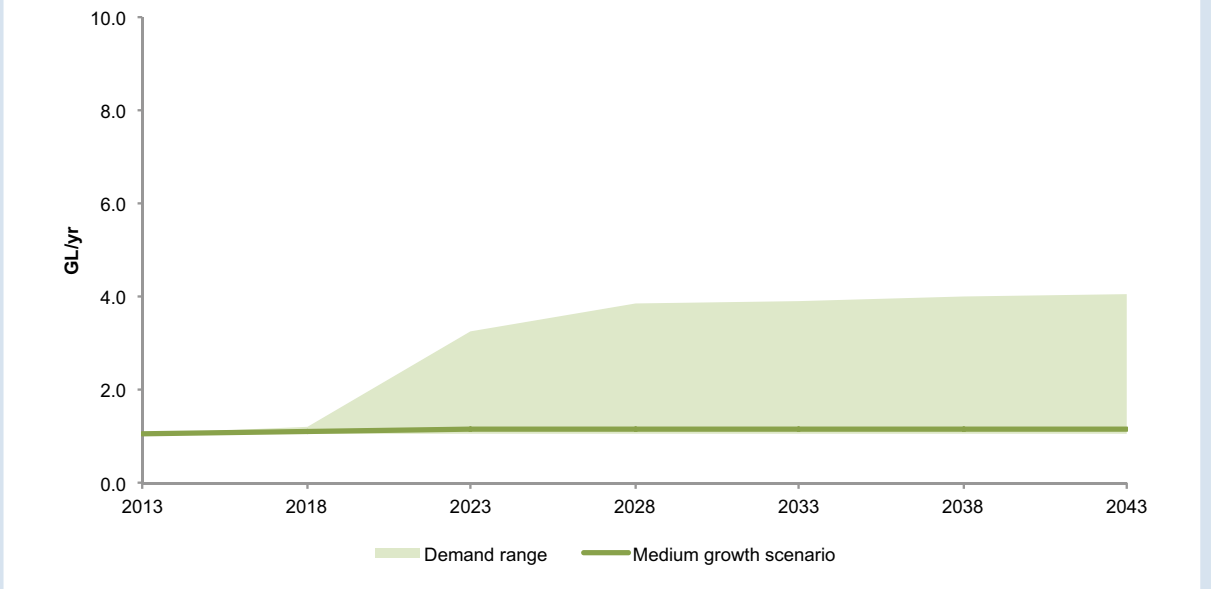

Figure 10 | Projected industry water demand to 2043 in the Great Southern region

Potential supply options include the Marbellup Brook, wastewater recycling and local groundwater (Table 11).

Table 11 Potential supply options for industry use

Option	Considerations
Local groundwater	• Limited information on yields and quality • Department of Water Royalties for Regions investigation is underway, which will improve regional understanding • Local investigations would still be needed
Marbellup Brook	• Yield reliability and quality • High ecological values • Also a future town water supply option
Wastewater recycling	• Currently used for irrigation • Water quality and treatment requirements
Town water supply scheme	• Would require extension of the existing pipeline infrastructure • Pressure on existing scheme capacity

4.4 Agriculture

Current water demand for agriculture is estimated at 24 GL/year. Agricultural land uses in the Great Southern include broadacre farming, livestock, horticulture, plantations and nurseries (Table 12).

Declining rainfall and greater seasonal variability present challenges for agricultural water supply now and in the future. With less rainfall, there is less water available in dams, lower levels in natural soaks, increased depth to fresh groundwater resources and decreased streamflow.

Agricultural water demand fluctuates from year to year, with market conditions and seasonal variability influencing production. Agriculture in the region is forecast to grow in line with historical trends, with water use expected to increase to about 31 GL/year under a medium-growth scenario.

Table 12 Current agriculture water use in the Great Southern region

Agriculture type	Ha of production / no. of stock[a]	Shire where activity primarily occurs	Current water use	Current water sources
Horticulture				
Grapes (primarily for wine production)	2906 ha	Plantagenet, Cranbrook, Kojonup	13 GL/year	Local groundwater, surface water from natural or roaded catchments, wastewater recycling
Vegetables	296 ha	Albany		
Fruit and nuts	591 ha	Cranbrook, Plantagenet		
Livestock				
Beef cattle	207 277	Albany, Plantagenet	8 GL/year	Local groundwater or surface water, primarily from overland flow into storage dams
Dairy cattle	7 602	Albany, Denmark, Plantagenet		
Sheep	3 683 774	Kojonup, Broomehill-Tambellup, Gnowangerup, Plantagenet		
Pigs	40 870	Plantagenet, Cranbrook, Kojonup		
Chickens	113 040	Albany, Cranbrook		
Other (deer, horses)	10 356	Plantagenet, Denmark		
Nurseries				
Plant nurseries	122 ha	Albany	1 GL/year	Local groundwater or surface water
Plantations				
Blue gum plantations	140 000 ha	Albany, Denmark, Plantagenet, Cranbrook	2 GL/year[b]	Primarily rainfall and uptake of groundwater by tree roots; 2 GL/year of treated wastewater

[a] ABS 2012b

[b] Irrigation with treated wastewater only. Does not include groundwater uptake from tree roots.

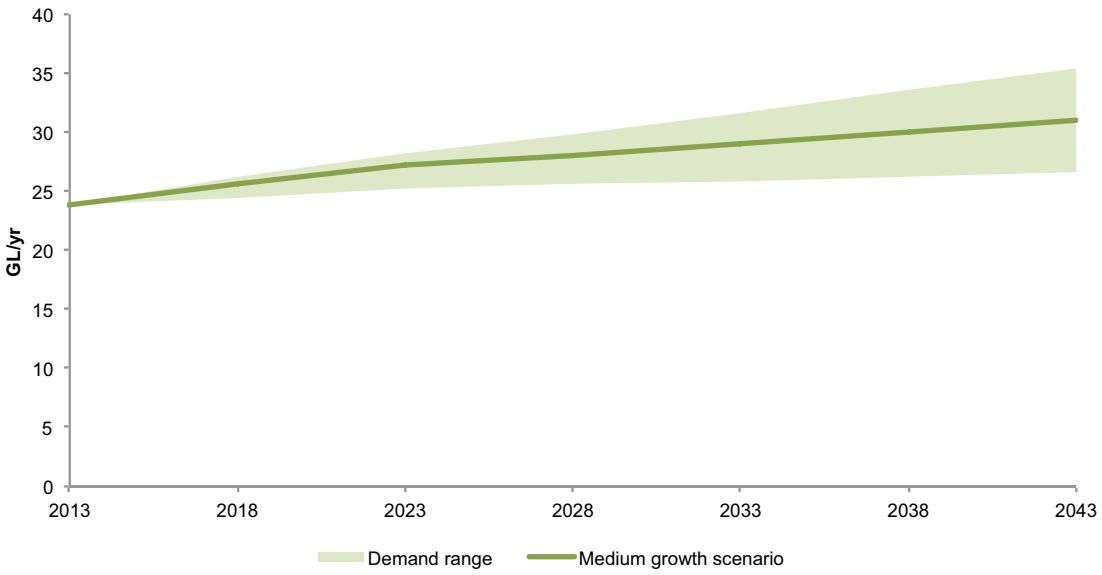

Figure 11 | Projected agriculture water demand to 2043 in the Great Southern region

Broadacre agriculture

During dry seasons on-farm supplies are often not sufficient (quantity and/or quality) to meet water needs for stock watering and chemical spraying. Fewer wet winters means there is an increased need to store water so that it lasts longer.

A range of emergency farmland supplies are available across the Great Southern when on-farm supplies are unavailable. These include standpipes connected to scheme water supplies, agricultural area (AA) dams constructed during the development of agriculture in the south-west, and community dams and bores built more recently. The Department of Water's emergency farmland water response plans give farmers a process to follow in the event that water is sought from off-farm sources, as well as details on local emergency supplies. In the Great Southern, plans have been prepared for the shires of Jerramungup, Gnowangerup and Kent.

Funding is also available through the department's farm water supply planning scheme and farm water rebate scheme to help identify, plan and implement on-farm water supply improvements (see Table 15, Chapter 5 for more information).

Considerable work has been undertaken in the Great Southern to address rising saline groundwater beneath farming land and rural towns. This water could supplement farm and emergency community water supplies and alleviate the pressure on schemes (such as the GSTWSS) that supply potable water.

In 2011, we commissioned consultant engineers and hydrogeologists URS to study saline to hypersaline groundwater resources within the Darling Escarpment area. The project described and evaluated options for water treatment, salt harvesting and waste disposal to produce potable and industrial quality water using various technologies. Costs of desalination varied according to the chemical composition and necessary pre-treatment, the volume and salinity of the water, the salt recovery process, brine disposal, infrastructure to supply and desalination plant capital costs and energy (URS 2011). To progress desalination as an option for agricultural water resource security in the region, it will be necessary to improve understanding of the region's saline groundwater sources and safe environmental disposal of the saline effluent, and identify areas where this option is most cost-effective.

Irrigated agriculture

Population growth will significantly increase Western Australia's demand for fruit and vegetables. Foreign investors are also seeing the opportunity to purchase local land and water resources to secure future access to food. From a statewide perspective the south coast of the Great Southern region is the coolest area of the state. Rainfall ranges from 300 to 1100 mm across the region, with rainfall being greater than 600 mm in the region's south-west and around Bremer Bay. Under a warming and drying climate scenario, this may present an opportunity for expansion of horticulture for local or broader use (Lang unpublished).

The Department of Agriculture and Food (DAFWA), in consultation with the Department of Water and other agencies, has undertaken a desktop analysis to identify priority areas in the Great Southern for further investigation into horticultural development (Lang 2010). The study used available (broad) land-capability information, groundwater bore yields and water quality information to identify five areas:

- Manypeaks
- Narrikup
- Denmark
- Marbellup
- Walpole

Generally, the most economically viable water source for irrigated agriculture is local groundwater or surface water harvesting. Surface water is often captured using a roaded catchment area that feeds into a storage dam. There is potential to improve the availability of supply through better design and maintenance of roaded catchments. An average well-maintained roaded catchment in the Frankland area can harvest an additional 65 ML/year compared with a poorly maintained catchment (Lang et al 2010).

Supplies of fresh groundwater resources within the region are limited. In general, the groundwater resources of the inland area (<600 mm rainfall zone) are mostly saline. DAFWA has identified potential groundwater sources inland and along the coast that could support agriculture in the future (Table 13). These include both fresh and brackish water sources. Brackish water sources would need treatment (desalination) before use. Detailed investigation of water quality and water yields is required to confirm this potential.

The Department of Water is working on improving our knowledge of groundwater availability in the Albany hinterland area and Albany groundwater area (Royalties for Regions-funded project to be completed in June, 2016). This work includes a number of the areas that DAFWA has identified for further investigation into potential for horticulture. The study will confirm where groundwater sources are located, potential yield, recharge and salinity information. This information can then be used to guide where to target more detailed drilling investigations and pump testing.

Table 13 Potential groundwater sources for irrigated agricultural use[a]

Location	LGA	Aquifer type	Existing use	Yields[b]	Yield certainty	Salinity range
Inland resources						
Beaufort palaeochannel	Woodanilling/ Kojonup	Palaeochannel	Small-scale agricultural processing, domestic and stock watering	Low	Low	Fresh–brackish
		Surficial	Small-scale agricultural processing, domestic and stock watering	Low	Low	Fresh–saline
Western South Coast resources						
Manypeaks	Albany	Sedimentary (Werillup)	Feeds into Angove Creek, which is a public water source	Low-moderate	Low	Fresh–saline
Redmond–Narrikup	Albany/ Plantagenet	Sedimentary (Werillup and Pallinup)	Feeds into Marbellup Brook: used for agricultural purposes, especially stock	Low–moderate	Low	Fresh–saline
Bremer Bay	Bremer Bay	Superficial and sedimentary (Werillup and Pallinup)	Part of the area is proclaimed: used for a range of purposes	Low–moderate	Low–medium (proclaimed portion)	Fresh–saline
North Stirlings	Broomehill-Tambellup/ Gnowangerup	Palaeochannel	Emergency water supplies	Low–moderate	Low	Saline
		Surficial		Low–high	Low	Fresh–saline
Albany groundwater area	Albany	Surficial, superficial and sedimentary (Werillup)	Proclaimed groundwater area: used for a range of purposes	Low–moderate	Low–medium	Fresh–brackish

[a] DAFWA unpublished; Kern 2007

[b] Low: bore yield of <100 000 kL/year, moderate: bore yield 100 000 to 200 000 kL/year, high: bore yield >200 000 kL/year

4.5 Mining

At present mining water demand in the Great Southern region is estimated to be 0.6 GL/year. This is primarily for silica sand mining near Mindijup, which uses local groundwater resources.

New projects proposed in the region include the Southdown magnetite project 90 km north-east of Albany and Ausgold's gold project near Katanning. The development of these projects could increase water demand to 14 GL/year (Figure 12).

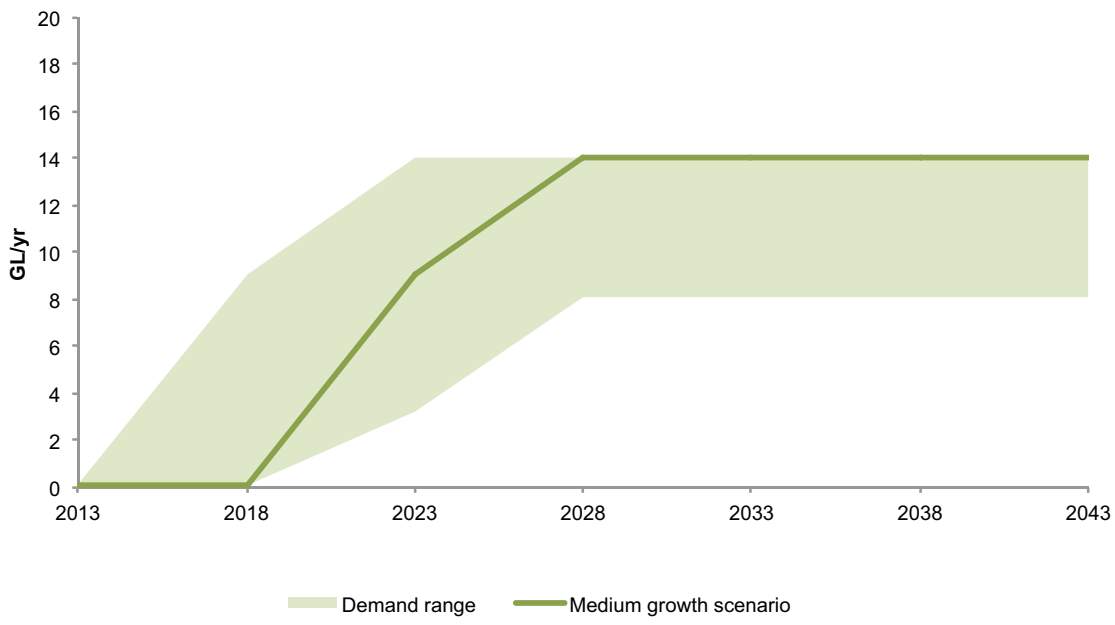

Figure 12 | Projected mining water demand to 2043 in the Great Southern region

The water requirement for the Southdown project is estimated to be between 10 and 12 GL/year at full production. Groundwater is likely to provide the water for the construction phase. For ongoing operations water will be sourced from a seawater desalination plant at Cape Riche (approved by the Environmental Protection Authority in early 2012, subject to conditions). The project is currently on hold.

Ausgold Ltd is exploring gold reserves near Katanning. The project is proposed to proceed within the next five to 10 years. Water use is estimated to be 2 GL/year at full production. Local groundwater may be sufficient to meet the project's water demand, although groundwater investigations are needed to confirm yields, quality and reliability.

The Great Southern region has several other known mineral deposits. These are generally located outside of proclaimed groundwater and surface water areas, where our knowledge of water availability is limited. Abstraction of water from these areas is subject to the proponent/s investigations and case-by-case assessment by the Department of Water.

In this area of variable and limited freshwater resources, consideration of the *Western Australian water in mining guideline* (DoW 2013b) is important to minimise costs associated with water supply. The guideline identifies the following objectives for mine-site water supply planning:

- ensure all possible water sources are considered when planning water supply for mining operations
- ensure high-quality water is used only in situations where it is essential or no other suitable water source is available
- maximise water use efficiency at all mine-sites, particularly water deficit sites, to reduce the need for water to be abstracted from the environment
- optimise the use of mine dewatering surplus on-site to reduce the effects of releases to the environment.

Limited local water of appropriate quality, and the costs and constraints of long-distance water movement, should drive lower-cost methods to use water more efficiently. This includes the adoption of new technologies to treat local groundwater and the use of lower quality water for existing processes.

Mining companies often reuse the water produced from mine dewatering for mineral processing and dust suppression. Where there is excess water from dewatering, opportunities for use by third parties may arise.

There is also potential for offshore oil production to occur south of the Great Southern region (DMP 2008). At this stage the project size and water requirements are unknown.

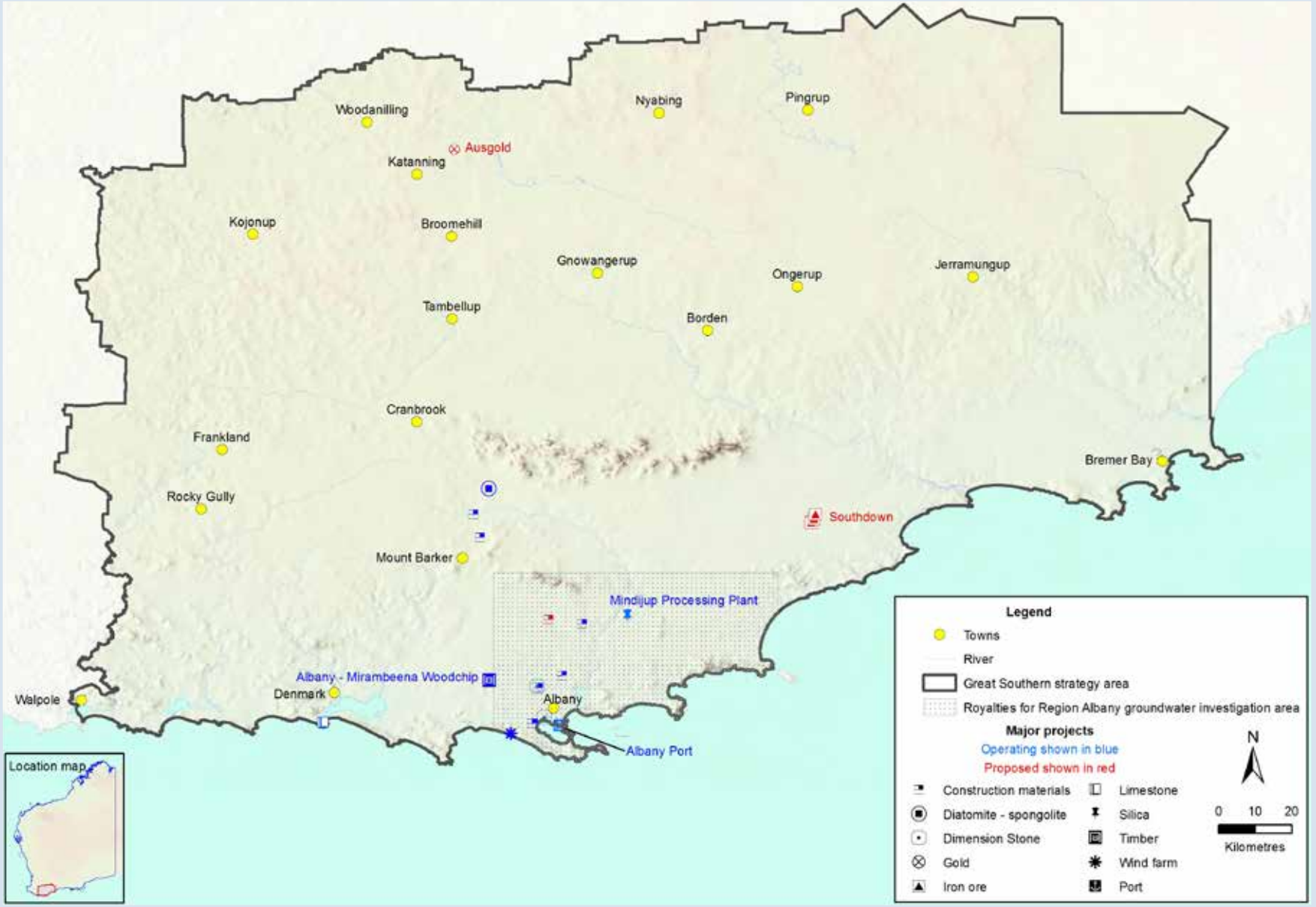

Figure 13 Major mining and industry projects in the Great Southern region

5

Strategies for ensuring secure water supplies for the Great Southern region

Regional projections show water use increasing during the next 30 years for all water sectors. Table 14 identifies a range of water supply strategies and actions to support regional development. Current funding opportunities are summarised in Table 15.

The Department of Water has also published a range of guidelines and policies to support water users, government and developers. These include:

- *Guideline for the approval of non-drinking water systems in Western Australia: urban developments*
- *Lower Great Southern water resource development strategy*
- Operational policy 1.01: *Managed aquifer recharge in Western Australia: allocation and water quality management*
- Rural water note 7: *Emergency farmland water supplies*

Further detail can be found in Appendix F.

The Department of Water will continue to monitor the water demand and supply balance for water use in the region and share information with stakeholders to ensure decision-making is informed and timely.

Table 14 Strategies and actions to support regional development

No.	Action	Lead agency	Timing
Strategy 1: Plan and develop new water sources for the Lower Great Southern towns			
1.1	Implement actions detailed in tables 5, 7 and 9 to develop new water supplies for the LGSTWSS, Denmark and Walpole.	As detailed in tables 5, 7 and 9	As detailed in tables 5,7 and 9
Strategy 2: Where practical, maximise use of climate-resilient and cost-effective water sources for independent town water supplies			
2.1	Consider all options to improve the climate resilience of water supplies for the independent towns including: • identifying and assessing potential connections of towns to regional water supply schemes including links between the LGSTWSS and GSTWSS • carting water from climate-resilient sources • improving runoff to and reducing evaporation from storage dams • water efficiency measures • desalination of brackish/saline groundwater	WC	Ongoing
Strategy 3: Promote alternative water sources and efficient use of water to reduce use of potable town water supplies			
3.1	Provide technical and/or financial assistance to local government and communities to identify and develop fit-for-purpose water supplies for irrigation of public open space and agriculture.	DoW	Ongoing
3.2	Work with existing and proposed industries to share knowledge and technical expertise on water efficiencies and alternative water supplies.	DoW/WC	Ongoing
3.3	Provide advice on urban and industry development proposals to ensure consideration of water efficiency, alternative water supplies and water sensitive urban design.	DoW/WC	Ongoing
3.4	Promote the use of rainwater tanks, greywater recycling and water efficiency for new developments through town planning policies.	DoP/LGAs	Ongoing
3.5	Promote, where practical, low-water-use gardens.	LGAs	Ongoing
3.6	Consider extension of the farm water rebate scheme to cover farms on scheme supplies	DoW	2014–15

Table 14 Strategies and actions to support regional development

No.	Action	Lead agency	Timing
Strategy 4: Investigate groundwater and surface water resources to support regional development			
4.1	Complete Royalties for Regions-funded investigations of the Albany groundwater area and Albany hinterland to identify prospective water sources for regional development.	DoW	In progress for completion in 2016
4.2	Prioritise prospective water sources for more detailed investigation through the state groundwater investigation program.	DoW	Following RfR investigation
4.3	Support self-supply users by providing the best-available information on water resource availability and quality to stakeholders.	DoW	Ongoing
Strategy 5: Ensure emergency livestock water sources are available for areas with less than 600 mm rainfall			
5.1	Prioritise local government authorities in the 600 mm and below rainfall isohyet to complete emergency farmland water response plans.	DoW	2015
5.2	Develop emergency farmland water response plans for all high-priority local authorities in the 600 mm and below rainfall isohyet.	DoW	2018
5.3	Provide seasonal response updates to assist in planning for emergency supplies.	DoW	Monthly from May to October
Strategy 6: Promote community and inter-agency involvement in water planning and management			
6.1	Continue regular dialogue on water supply planning and knowledge sharing through the regional planning group.	DoW	Annual
6.2	Regularly review the water demand/supply balance and status of actions.	DoW	As required following annual update
6.3	Promote integration of water planning within local government's water conservation, emergency farmland water and water management plans.	DoW	Ongoing

Table 15 Current funding opportunities for improving water supply security

Funding program	Shires covered	Description	Further information
Farm water supply planning scheme	All Great Southern shires except Manjimup and Denmark	Rebate for undertaking a farm water audit	DoW 2013c
Farm water rebate scheme		Rebates for implementing on-farm water supply improvement works identified though the farm water audit	
Community Water Supply Program		Up to $100 000 for: • construction of community farmland emergency water supplies • construction of facilities for the harvesting and storage of water for community purposes • refurbishment of agricultural area water supplies.	DoW 2013d
More dollars per drop	Albany, Plantagenet, Cranbrook, Broomehill-Tambellup, Kojonup, Manjimup	• Free individual on-farm assessments for up to 300 growers across the fruit, vegetable, viticulture and dairy industries • Training and access to online decision support tools	DAFWA 2014
Waterwise towns program	Towns of Gnowangerup, Katanning, Kojonup, Pingrup and Tambellup	• Free, personalised telephone coaching service to help reduce water use • Free Waterwise products and services for eligible households	WC 2014b
Royalties for Regions	All Great Southern shires	Includes Country Local Government Fund, the Regional Community Services Fund and the Regional Infrastructure and Headworks Fund, which provide funding for: • improving infrastructure and headworks • establishing across-government strategic and community service projects • providing a range of contestable grant opportunities • building capacity in local communities.	DRDL 2011

Appendices

Great Southern regional water supply strategy

Appendix A

Water supply planning hierarchy

Water supply planning can be carried out at various geographic and time scales and at different levels of detail (Figure A1). At the strategic scale (large geographic areas and further into the future) there may be a wider range of options able to be considered. At smaller scales and a closer timeframe, fewer options may be available or appropriate as the cost benefits can be assessed with greater detail and certainty.

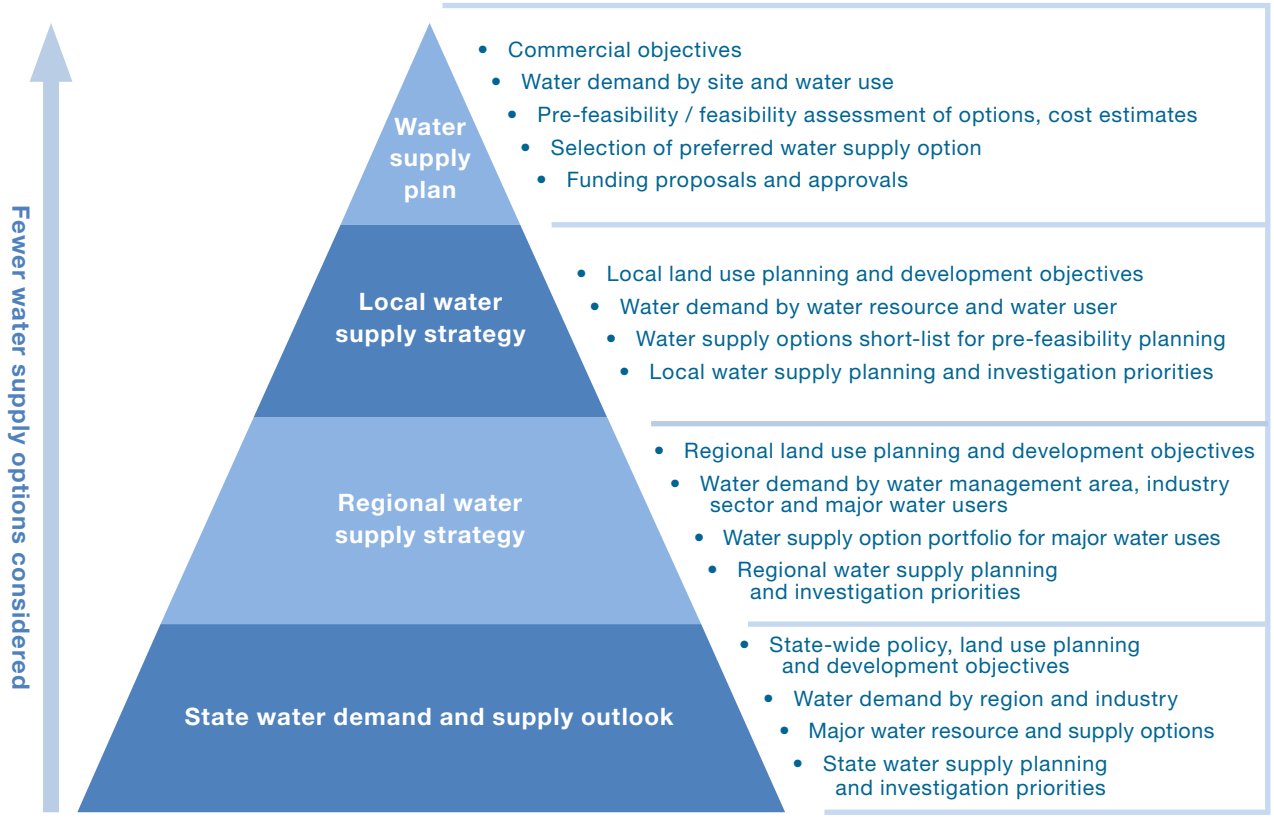

Figure A1 | Conceptual model showing the different scales of water supply planning and type of information considered at each level

Appendix B

Water supply planning roles and responsibilities

The Department of Water has established policies and guidelines to manage and regulate the state's water resources according to the objects of the *Rights in Water and Irrigation Act 1914* and Rights in Water and Irrigation Regulations 2000. We are also responsible for implementing other water management legislation, including the *Country Areas Water Supply Act 1947 and* the *Water Services Act 2012.*

In addition to our legislative functions, the department coordinates cross-agency advice on future water demand and water supply options. This includes providing policy direction for the best use of the state's water resources, and assessing and advising on how much water is available and the options to meet current and future demand. Water service providers and self-supply water users also have roles and responsibilities (Table A1) in water supply planning and development.

Table A1 Water supply planning roles

	Department of Water	Water service providers	Self-supplied water users
Geographic scale of planning	State, regional and local	Regional, scheme or development	Site and property
Water uses covered	All water uses	Scheme water (potable, non-potable, domestic, commercial, irrigation, industrial)	Mining, agriculture, industry, domestic, commercial, parks/gardens
Scale and range of water supply options assessed	All realistic major options meeting legislative requirements and policy objectives	Range of feasible options leading to a preferred option to meet policy and commercial objectives	Small range or preferred option to meet commercial objectives or private needs
Type of water resource investigations	Water yield, quality and sustainability of water resources	Water yield and quality at a range of locations to meet licensing requirements and scheme needs	Water yield and quality at a specific location to meet licensing requirements and commercial or private needs
Role in supplying water	Licensing abstraction from water resources	Constructing scheme infrastructure and supplying customers	Constructing infrastructure for private use

Appendix C

Stakeholders consulted

Table A2 Membership of the regional reference group and water supply planning senior officers group

Group	Membership
Great Southern regional reference group	• Department of Water • Great Southern Development Commission • Great Southern Region, Water Corporation • Department of Indigenous Affairs • Department of Agriculture and Food WA • Department of Environment and Conservation • Department of Planning • Shire of Denmark • Shire of Plantagenet • Shire of Cranbrook • Shire of Kojonup • Shire of Woodanilling • Shire of Katanning • Shire of Broomehill-Tambellup • Shire of Kent • Shire of Gnowangerup • Shire of Jerramungup • Shire of Manjimup • Centre for Excellence NRM, UWA • South Coast NRM Inc.
Water supply planning senior officers group	• Department of Water • Department of State Development • Department of Treasury • Department of Premier and Cabinet • Department of Agriculture and Food WA • Department of Planning • Department of Regional Development • Department of Finance • Water Corporation

Appendix D

Surface water resources

Table A3 Information on coastal rivers in the Great Southern region

River	Mean average flow (1975 to 2003) GL/year	Potential yield GL/year	Water quality[a]
Fitzgerald River	Not available	Not available	Not available
St Mary River	Not available	Not available	Not available
Boondadup River	Not available	Not available	Not available
Gairdner River	Not available	Not available	Not available
Hunter River	Not available	Not available	Not available
Bremer River	Not available	Not available	Not available
Bitter Water Creek	Not available	Not available	Not available
Pallinup River	Not available	Not available	Not available
Cheynes Bay Streams, collective total	12	0.7 (SDL)	Unknown
Eyre River	3	0.2 (SDL)	Low saline
Willyun Creek	10	1.2 (SDL)	Low saline
Cordinup River	3	0.7[c] (SDL)	Low saline
Wongerup Creek	1	0.6[c] (SDL)	High brackish
Bluff River	0.5	0.2 (SDL)	Marginal-brackish
Waychinicup River	9[c]	0.2 (SDL)	Marginal
Normans Creek	1	0 (SDL)	Fresh – marginal
King Creek	1	0 (SDL)	Fresh – marginal
Taylor Inlet tributary, collective total	3	0.2 (SDL)	Fresh
Angove River	2[c]	0.8[d]	Fresh
Goodga River	4[c]	0.2 (SDL)	Marginal
Kalgan River	44[c]	2 (SDL)	High brackish – low saline
Chelgiup Creek	5[c]	0 (SDL)	Marginal
Napier Creek	13	0.5 (SDL)	High brackish
Bolganup Creek	<0.1	0.2 (Lic)	Marginal
King River	13	0.6[e] (SDL)	Fresh
Johnston Creek	1	0 (SDL)	Marginal

[a] See Table A4

[b] SDL node boundary larger than MAP estimate location/catchment

[c] Actual flows shown not modelled flows

[d] Current use based on EWR study for Water Corporation surface water resources Angove Creek and Limeburners Creek and adjusted to 'infield' abstraction from licensing processes

[e] Based on average annual ecologically sustainable yield from Department of Water EWR studies

Table A3 Information on coastal rivers in the Great Southern region

River	Mean average flow (1975 to 2003) GL/year	Potential yield GL/year	Water quality[a]
Willyung Creek	4	0.3 (SDL)	Fresh
Mill Brook	8	0.2 (SDL)	Marginal brackish
Yakamia Creek	3	0.2[b] (SDL)	Fresh
Limeburners Creek	0.8 (0.5[c])	0.2[b] (EWR/Lic)	Fresh
Robinson Drain	2	0.1 (SDL)	Marginal
Munster Hill Drain	0.9	NA	Marginal
Seven Mile Creek	4	0.2 (SDL)	Fresh – marginal
Five Mile Creek	3	0.5[b] (SDL)	Marginal
Marbellup Brook	16	5[e] (ESY)	Fresh – marginal
Torbay Drain	14	1 (SDL)	Fresh
Hay River	67	5 (SDL)	High brackish
Mitchell River	11	0.6 (SDL)	Fresh
Sleeman River	10	0.6 (SDL)	Fresh
Cuppup River	11	0.9 (SDL)	Fresh
Sunny Glen Creek	5	0.3 (SDL)	Fresh
Denmark River	23[c]	10[e] (ESY)	Marginal
Quickup River	3	~0.4 (current use)	Fresh
Scotsdale Book	19	6[e] (ESY)	Fresh
Little River	7	2 (SDL)	Fresh
Kordabup River East	5	0.7 (SDL)	Fresh
Kordabup River West	6	0.7 (SDL)	Fresh
Kent River	79[c]	8 (SDL)	Marginal – brackish
Nile Creek	20	2 (SDL)	Fresh
Styx River	22	2 (SDL)	Fresh
Bow River	56	4 (SDL)	Fresh
Frankland River	156[c]	17 (SDL)	High brackish – low saline
Walpole River	19	2 (SDL)	Fresh
Deep River	38[c]	4 (SDL)	Fresh

[a] See Table A4

[b] SDL node boundary larger than MAP estimate location/catchment

[c] Actual flows shown not modelled flows

[d] Current use based on EWR study for Water Corporation surface water resources Angove Creek and Limeburners Creek and adjusted to 'infield' abstraction from licensing processes

[e] Based on average annual ecologically sustainable yield from Department of Water EWR studies

Table A4 Water quality descriptors	
Description	Salinity mg/L
Fresh	< 500
Marginal	501–1500
Brackish	1501–5000
Saline	5001–50 000
Hypersaline	> 50 000

Appendix E

Method for projecting water demand

Establishing current water demand

In November 2013 water entitlement data was uploaded from the department's water resource licensing database. Licences were apportioned to one or multiple usage categories to calculate the base year water demand from which growth is projected. Adjustments to water resource license entitlement data occurred to estimate the actual volume of water taken and used (Table A5).

Table A5 Assumption used to determine current water demand

Issue	Action
Groundwater and surface water licence status	Licences which have the following status were included: draft-renewals and amendments (the latest in force volume), in force and conditional approvals
Scheme water supply licences	Potable and non-potable schemes – average water abstraction during the past three years
Unlicensed mining sector	Estimates based on other silica sand companies mining similar volumes
Water used within the region but sourced outside	GSTWSS – only included the volume used within the region.
Unlicensed stock and domestic	Number of livestock – from 2010–11 Agricultural Census (ABS 2012b) – by typical water requirements per head (Marwick 2007)
Unlicensed agricultural sector	Department of Agriculture and Food WA crop calculator applied to estimated production from the 2010–11 Agricultural Census (ABS 2012b)

Predicting future water demand

The *Water demand scenario modelling tool* was used to project future water demand at a sub-regional scale in five-year increments to 2043. The tool uses economic growth rates from the Monash-TERM model that are based on historical trends in Western Australia.

The Great Southern region was divided into two sub-regions:

- Pallinup: shires of Kent, Woodanilling, Katanning, Kojonup, Broomehill-Tambellup, Gnowangerup and Jerramungup
- King: shires of Cranbrook, Plantagenet, Denmark, Albany and Manjimup (partial)

The Monash-TERM model provides growth rates for three water use indicators – value added (as $ million), employment and population growth. The model provides low-, medium- and high-growth scenarios that contain different economic assumptions, including the intensity and duration of the resources boom.

The Monash-TERM model projects growth in three phases. The duration and intensity of the phases vary in low-, medium- and high-growth scenarios for modelling water demand:

- For the low-growth scenario the resources boom continues until around 2012, but is followed by a more rapid cooling off period, with growth rates after 2020 at around the historical lows for Western Australia.
- For the medium-growth scenario the current rate of growth for the resource-based industries continues until around 2014, after which it declines to historical average rates of growth.
- For the high-growth scenario the resources boom continues for longer and a high (yet historically plausible) rate of growth for the Western Australian economy is sustained through to 2030.

Water demand projections after 2032 were extrapolated to follow the same trajectory as for the period 2021–31 as economic modelling trends from the Monash-TERM model were only available to 2031.

An inter-agency working group advised on changes to modelled scenarios based on expected 'trend-breaking' industry developments and population growth (e.g. SuperTowns). Growth projections in published reports were converted to estimates of water use and added to the growth forecasts from the Monash-TERM model.

After growth rates were applied to the base year water demand for 60 usage codes (Australian New Zealand Standard Industrial Classification codes), water demand was consolidated into four sectors:

- mining (metal and non-metal)
- industry (meat production, power, wood processing, industrial processing)
- agriculture (horticulture, pasture and crops, fisheries, rural stock and domestic)
- urban (residential use, parks and gardens, commercial, road construction).

Assumptions are summarised in Table A6.

Table A6 Water demand scenario assumptions

Scenario	Assumptions
Low–growth	• Urban – WAPC (2012) Band A (low) population projections • Mining – DSD low-growth iron ore projections, Monash-TERM model low-growth scenario for other sectors • Agriculture – Monash-TERM model low-growth scenario • Industry – Monash-TERM model low-growth scenario
Medium–growth	• Urban – WAPC (2012) Band C (median) population projections • Mining – DSD medium-growth iron ore projections, gold mining near Katanning, Monash-TERM model medium-growth scenario for other sectors • Agriculture – Monash-TERM model medium-growth scenario • Industry – Monash-TERM model medium-growth scenario
High–growth	• Urban – Great Southern Development Commission projections for Albany and Denmark (2% and 3% respectively); 2% for Walpole; Shire of Katanning growth plan for Katanning; WAPC (2012) – Band E (high) population projections for remaining towns • Mining – DSD high-growth iron ore projections, gold mining near Katanning, Monash-TERM model high-growth scenario for other sectors • Agriculture – Monash-TERM model high-growth scenario • Industry – Monash-TERM model high-growth scenario, plus recovery of the plantation industry requiring 2.5 GL/year by 2027

Water use per ‘unit output’, ‘person’ or ‘employment’ was assumed to remain constant under all growth scenarios. Potential reductions in demand as a result of improved water use efficiency measures per ‘unit output’ or per ‘person’ are therefore not included within the demand scenarios.

Assumptions need to be made as part of the process of projecting future water demand. The reliability and certainty of assumptions decreases the further ahead they are applied. Therefore, while demand projections are reasonably likely to reflect reality in the short-term, the longer the forecast timeframe, the more likely it is that forecasts will not reflect what actually occurs.

It is difficult – if not impossible – to predict the occurrence of a global financial crisis or the impact of natural disasters or climate change, all of which may significantly alter the water demand projections. Long-term forecasts of water demand should be considered as ‘high-level estimates’ only and should not be used as a basis for detailed investment decisions. However, they provide important information for contingency plans and future risks management.

While water demand scenario modelling is used for this strategic assessment of water supply options, it is recognised that a more detailed analysis would be required to support specific future water supply planning and investment decisions. Actual water demand is also often constrained by non-water related issues such as the economic feasibility of projects, planning approval, native title or environmental clearances.

Appendix F
Policies, plans and guidelines for water supply development

Table A7 Relevant policies, plans and guidelines	
Water supply option	Policy, plan or guideline
Water efficiency	Operational policy 1.02: *Policy on water conservation / efficiency plans* (DoW 2009a)
Alternative water supplies	*Guideline for the approval of non-drinking water systems in Western Australia: urban developments* (DoW 2013a)
	Guidelines for the non-potable uses of recycled water in Western Australia (DoH 2011)
	Water sensitive urban design: rainwater storage and reuse systems (DoW 2011b)
Groundwater or surface water resources	Operational policy 1.01: *Managed aquifer recharge in Western Australia: allocation and water quality management* (DoW 2009b)
	Safe use of bore water in rural areas (DoW 2010c)
	Operational policy 5.08: *Use of operating strategies in the water licensing process* (DoW 2011c)
	Operational policy 5.12: *Hydrogeological reporting associated with a groundwater well licence* (DoW 2009c)
	Strategic policy 5.03: *Metering the taking of water (*DoW 2009d)
	Strategic policy 2.03: *Managing unlicensed groundwater use* (DoW 2009e)
	Drinking water source protection plans, assessments and reviews (various dates): – *Angove Creek Catchment Area drinking water source protection plan* – *Bolganup Creek Catchment Area drinking water source protection plan* – *Bremer Bay Water Reserve draft drinking water source protection plan* – *Denmark River Catchment Area drinking water source protection assessment* – *Marbellup Brook Catchment Area drinking water source protection plan* – *Quickup River Dam Catchment Area drinking water source protection plan* – *South Coast Water Reserve and Limeburners Creek Catchment Area drinking water source protection plan* – *Walpole Weir and Butler's Creek Dam catchment areas drinking water source protection plan*
	Walpole wilderness and adjacent parks and reserves management plan (DEC and Conservation Commission WA 2008)
	Forest management plan 2014–2023 (DPaW and Conservation Commission WA 2013)
Emergency agriculture supplies	Rural water note no. 7: *Emergency farmland water supplies* (DoW 2007)
	Emergency farmland water response plans (various dates): – *Shire of Jerramungup* – *Shire of Gnowangerup* – *Shire of Kent*
All options	*Western Australian water in mining guidelines* (DoW 2013b)
	Lower Great Southern water resource development strategy (DoW 2010a)
	Better urban water management (WAPC 2008)

Glossary

Abstraction	Withdrawal of water from a surface water or groundwater source of supply.
Allocation limit	Annual volume of water set aside for a water resource.
Aquifer	A geological formation or group of formations capable of receiving, storing and transmitting water.
Environmental water requirements	The water regime needed to maintain the current ecological values (including assets, functions and processes) of water-dependent ecosystems consistent with the objectives of an ecological water requirements study.
Estimated sustainable yield	The difference between the observed daily flow and the modelled EWR (i.e. ESY + EWR = observed flow). This is the volume of water that can be abstracted without putting the river ecology at unacceptable risk.
Fit-for-purpose	Water that is of suitable quality for the intended end purpose; implies that the quality is not higher than needed.
Garden bore	A bore used for providing the household and household garden watering requirements.
Groundwater	The water that occurs in pore spaces and fractures in rocks beneath the ground surface. Also see Aquifer.
Groundwater area	The boundaries proclaimed under the *Rights in Water and Irrigation Act 1914* and used for water allocation planning and management.
Groundwater dependent ecosystem	An ecosystem that is at least partially dependent on groundwater for its existence and health.
Licence (or licenced entitlement)	A formal permit that entitles the licence holder to take water from a watercourse, wetland or underground source under the *Rights in Water and Irrigation Act 1914*.
Management area	A defined surface water area or groundwater area proclaimed under the *Rights in Water and Irrigation Act 1914*.
Mtpa	Million tonnes per annum
Potable	Fresh and marginal water generally considered suitable for human consumption.
Salinity	The measure of total soluble salt or mineral constituents in water. Water resources are classified based on salinity in terms of total dissolved solids (TDS) or total soluble salts (TSS). Measurements are usually in milligrams per litre (mg/L) or parts per thousand (ppt).
SuperTown	Nine towns in the southern half of Western Australia were chosen to receive Royalties for Regions (Regional Centres Development Plan) funding to support economic growth.
Surface water	Water flowing over or held in streams, rivers and wetlands on the surface of the land.
Sustainable divertible limit	The maximum volume of surface water that can be taken from a defined sub-catchment area (SDL node), beyond which there is potentially unacceptable risk of a detectable, negative effect on the environment.
Water entitlement	The quantity of water that a person is entitled to take on an annual basis in accordance with the *Rights in Water and Irrigation Act 1914* and a licence.
Water use efficiency	Increasing water supply efficiency (e.g. reduction of leaks) and water demand efficiency (e.g. doing more with less water) to minimise the taking and use of water.
Yield	The amount of water that can be abstracted out of the system, after environmental water requirements are met.

Shortened forms

ABS	Australian Bureau of Statistics
DAFWA	Department of Agriculture and Food WA
DEC	Department of Environment and Conservation (superseded)
DoH	Department of Health
DoW	Department of Water
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife (formerly part of DEC)
DRDL	Department of Regional Development and Lands
DSD	Department of State Development
ESY	Estimated sustainable yield
EWR	Environmental water requirements
GSTWSS	Great Southern towns water supply scheme
LGA	Local government authority
LGSTWSS	Lower Great Southern towns water supply scheme
MAR	Managed aquifer recharge
NRM	Natural resource management
POS	Public open space
RfR	Royalties for Regions
SDL	Sustainable divertible limit
WC	Water Corporation
WAPC	Western Australian Planning Commission

Volumes of water

One litre	1 litre	1 litre	(L)
One thousand litres	1000 litres	1 kilolitre	(kL)
One million litres	1 000 000 litres	1 megalitre	(ML)
One billion litres	1 000 000 000 litres	1 gigalitre	(GL)

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Notes

Notes

RECYCLED CONTENT

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