



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

Perth-Peel

Regional water plan 2010–2030

Responding to our drying climate

Draft for public comment

Looking after all our water needs

December 2009

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Department of Water

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Acknowledgement of Noongar country and people

Noongar people have lived in south-western Australia for tens of thousands of years prior to European settlement. The Perth-Peel Region is within Noongar country and Noongar people continue to be custodians of the region. The Department of Water welcomes and respects the involvement of the Noongar community in water planning and management in the region.

The Department of Water worked with the South West Aboriginal Land and Sea Council to hold workshops with local Noongar Elders about their views on water planning and management in the Perth–Peel region. The following excerpts from a Noongar statement that arose out of these workshops provide insight into their unique connection and perspective on the water resources of the region:

“We are part of Australian culture and have been for time immortal in the Perth–Peel region. Noongar people of the south-west of Western Australia know how our Dreaming explained the creation of the environment and the relationships between its parts. The Dreaming describes our philosophy of life. We live by this and take our responsibility in our environment seriously. Sun, water, humans, other animals, plants, rain, water and wind are inextricably associated in maintaining balance in eco-systems. Binjareb, Wadjuk and Yued people from various Boodjar (country) in the Perth–Peel Region link into a wider community of Noongar peoples and further to other connected Aboriginal groups.

Noongar knowledge is owned by a collective and has developed over many generations. We as a collective of custodians wish to share our knowledge to manage water resources into the region's future. In the Perth–Peel Region, geographical features and places with energy mark lived experiences of our ancestral spirits' journeys throughout Noongar country. These sites are the foundations of our culture and as custodians we have most important knowledge of sites and the associated activities. They are fundamental to the sense of self. Our ancestral spirits followed pathways to sites, along water ways forming a strong connection with the land and water. Sacred sites and sites of significance are an integral part of Noongar culture. They are places that bear the marks of Noongar creative spirits, who continue to have a presence in land formations and water.

Life in our rivers needs space in order to flow freely and flourish. In Noongar ways of caring for Boodjar, to destroy or damage a site is a distressing and dangerous act, which threatens not only living and unborn generations, but also the spiritual forces and order of the world. Our intent as Noongar people is to protect and maintain our living cultural heritage by addressing the impacts of misuse of the Perth–Peel Region water systems.”

Introduction

Nowhere in Western Australia are there more pressures on our water resources than in the Perth-Peel region. As the region's population and economy grows, the sustainable management of our water resources becomes increasingly challenging. Anticipated future challenges to the region include population growth and a drying climate.

The Perth-Peel Regional Water Plan (the Plan) sets the strategic directions for the sustainable management of the region's water resources to the year 2030. It provides a blueprint for the next 20 years for the management, conservation and development of water resources in the region. It describes the challenges we face and the actions needed to respond to these challenges.

The area covered by the Plan extends from Moora to just north of Waroona. It stretches from the Indian Ocean to the Darling Range. For the purpose of the plan, the Perth-Peel region has been broken into three subregions: Gingin, Perth and Peel (Figure 1).

Defining the challenges

From the earliest days of human settlement on the Swan Coastal Plain, water resources have dominated the landscape and shaped development in the region. The region's water resources are essential to its economic, environmental and social well-being. We have deep cultural links to our waterways including their important role in Noongar history. The iconic Swan River shapes our sense of place. Our waterways are central to the outdoor lifestyle enjoyed by residents and visitors alike.

Our over-all challenge for water management in the Perth-Peel region is to support the responsible development of the region, while ensuring long-term sustainability of our water resources, both for our own benefit and that of future generations and the environment. The challenges we face in trying to achieve this are:

- reaching full or over allocation of some water resources in the Perth subregion
- reduced rainfall, streamflows and groundwater levels with the possibility of less rainfall in the future
- increasing water demand from a growing population
- managing the water needs of urban development
- ongoing water quality issues, mainly in surface water resources

Water supplies

Groundwater is the largest sustainable water resource in the region. It is used to meet public water supply needs as well as for private use by industry, agriculture, local governments and the estimated 170 000 residential 'backyard' bores in the

Perth metropolitan area. The region's underground aquifers support numerous ecosystems, including permanent and seasonal wetlands, springs and caves.

Large water supply dams and reservoirs on the Darling Scarp regulate flows in most of the region's rivers. These large dams contribute high quality water to the Integrated Water Supply Scheme (IWSS) that provides scheme water to Water Corporation customers in the Perth-Peel region as well as Kalgoorlie, the Goldfields and agricultural communities along the Golden Pipeline. The public water supply dams have also significantly reduced downstream flows in the Swan-Canning and Peel-Harvey systems.

Many of these supplies are now being used to their full capacity. To over-use them could result in damage to the infrastructure, water quality and environment that makes the region such a good place to live.

Decline in rainfall

The region is getting less rainfall than ever and it may not return to historical levels. Since the mid-1970s, rainfall has declined by more than 10 per cent during the average 'wet season'. This results in a 50 per cent reduction in stream flow as well as a reduction in aquifer recharge, both of which recharge the supplies discussed above.

Inflows to public water supply dams on the Darling Scarp have decreased dramatically, reducing their reliability as sources of supply to the IWSS. Groundwater resources have also declined, especially in the region's elevated groundwater systems, the Gnangara and Jandakot mounds. Lowering of the watertable has resulted in dependent wetlands drying out for longer periods, making them more vulnerable to acidification and fires. There is also less groundwater available for public or private water supply.

Gnangara Mound is the largest high quality, low cost source of public and private water supply in the region and supports many wetlands of high conservation and/or social value. The combined effects of reduced rainfall, increased vegetation density (for example, pine plantations) and groundwater abstraction for public and private water supply has pushed the Gnangara Mound into an unsustainable condition. Urbanisation on the edges of the Jandakot Mound has altered the water regime and placed Ramsar-listed wetlands at severe risk of drawdown effects.

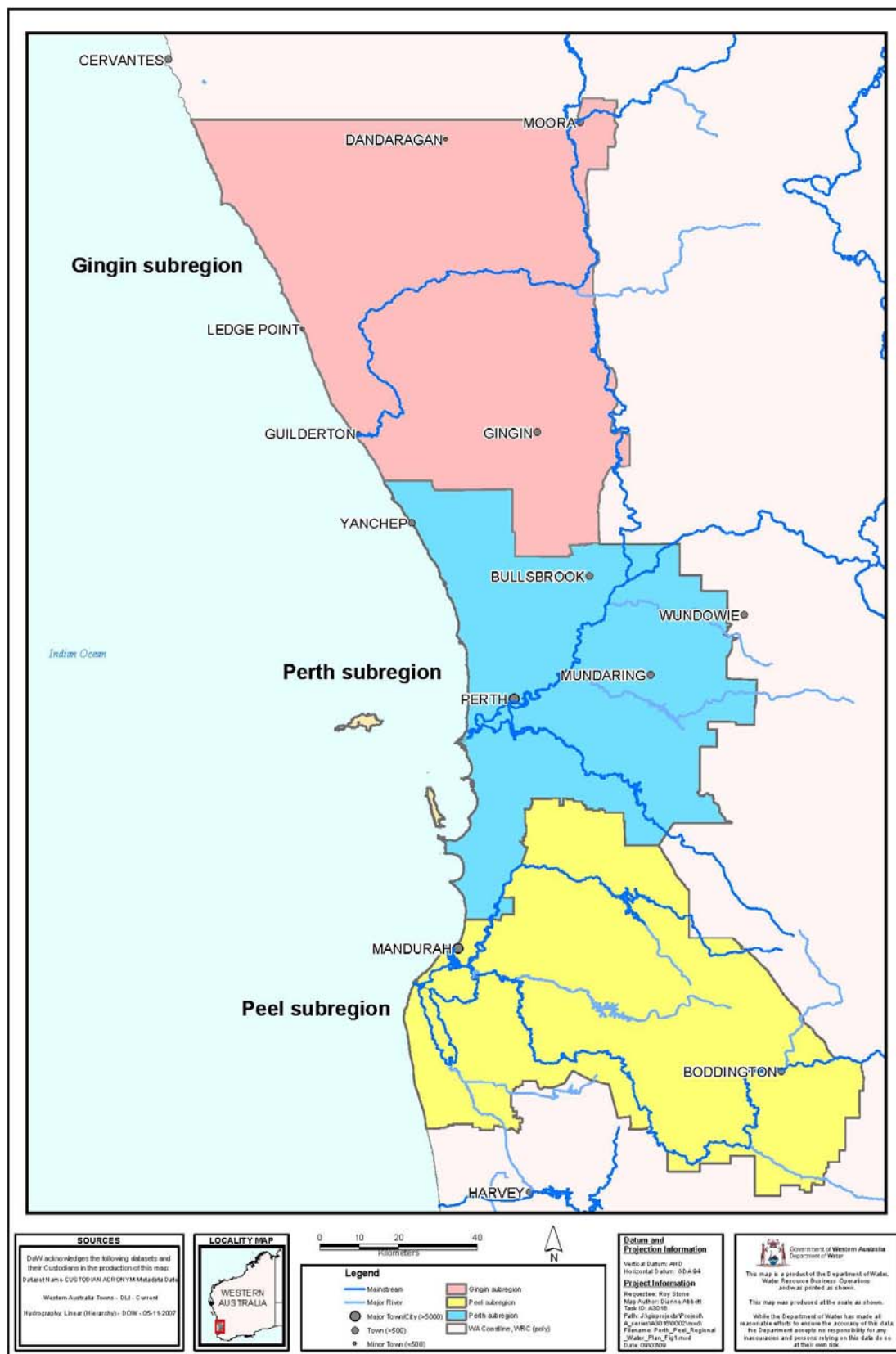


Figure 1 The Perth-Peel regions showing the Gingin, Perth and Peel subregions

A growing Perth

The region is projected to increase from an estimated 1.7 million residents in 2009 to around 2.3 million by 2030. This includes more than half a million new residents in the Perth subregion and a doubling of the population in the Peel subregion.

As the region's population has expanded so, too, has its development footprint in the greater Perth metropolitan area and Mandurah. Future population growth in the Perth and Peel subregions will be accommodated by a combination of urban infill and the creation of new urban areas (WAPC 2009a).

Many of the areas identified for new urbanisation are on the urban-rural fringe. In the Perth subregion, north of the Swan River, there are few groundwater resources available to accommodate population growth. South of the Swan River in the Perth and Peel subregions, the challenges include waterlogging, nutrients stored in soils and sediments and the protection of wetlands of conservation significance.

Urban development on the urban-rural fringe will require careful land development and high levels of water management to achieve sustainability outcomes.

Increasing demand

The expansion of development, coupled with population growth will fuel increased demand for water supply. Depending on the extent of drying, there would be little if any capacity to increase licensed groundwater use in the Perth subregion. The amount of groundwater allocated for public and private use on the Gnangara Mound will need to be progressively reduced over time. If current per capita water consumption rates continue to 2030, demand for public water supply will exceed the IWSS capacity before 2030 even with a second seawater desalination plant in production in 2011.

If the climate becomes drier, lower watertables are likely to result in changes in the condition and species composition of ecosystems that currently rely on groundwater for their survival. In addition, the potential for seawater intrusion will increase in coastal areas where groundwater is abstracted.

Water quality

The same human activities that enabled agricultural and urban development led to water quality problems for many of the region's water resources. Extensive land clearing, rural drainage networks and urban stormwater systems greatly increased the amount of sediment, nutrients and other contaminants (for example, heavy metals, pesticides, herbicides) entering our waterways.

Excessive nutrient levels, or eutrophication, remains a priority environmental issue for the Swan, Canning and Moore rivers as well as the Peel-Harvey estuarine system. More recently, acidification has emerged as an environmental risk for estuarine, floodplain and wetland areas. Activities such as excavation, dewatering or over-abstraction of water can activate soil acidity, which contaminates local groundwater and wetlands.

The challenge is to ensure the long-term sustainability of our water resources, both for our own benefit and that of future generations and the environment. Progress is being made in tackling the water management issues in the region. Programs such as the Swan-Canning Cleanup Program have improved water quality but much remains to be accomplished before our waterways are restored to full health. The sources of public water supply have become more diverse with the introduction of seawater desalination. Waterwise campaigns have reduced consumption rates for scheme water. Urban water management initiatives are facilitating more water sensitive urban development.

As a community, we need to build on recent initiatives and become increasingly sophisticated and innovative in our approaches to water resource management.

Objectives

The Perth-Peel Regional Water Plan's six objectives reflect the challenges facing the region's water resources:

- 1. *Take the drying climate into account in all aspects of water resource management.***
- 2. *Reduce water demand by using water more efficiently and effectively.***
- 3. *Provide water security for public and private water supply consumers.***
- 4. *Facilitate the use of alternative sources of water supply.***
- 5. *Restore and protect waterway and wetland health.***
- 6. *Create water sensitive cities and towns.***

Invitation to make a submission

This document, the *Perth-Peel regional water plan 2010—2030: Responding to our drying climate* has been developed by the Department of Water in partnership with interested parties to provide a strategic vision guiding sustainable management of the region's water resources and water services.

The department welcomes any comments you may wish to make on the plan. It would be helpful if, when making a submission, you include details such as the chapter, page number or action number to which each comment relates. If you wish your submission and identity to remain confidential, clearly print on the top of each page of your submission the word 'confidential'. All submissions will be considered and a statement of responses issued by the Department of Water.

Please send your submissions to:

Project Leader: *Perth Peel regional water plan*
Strategic Water Policy and Planning
Department of Water
PO Box K822
Perth WA 6842

Or email us at <strategicwatermanagement@water.wa.gov.au>.

The draft Plan is available for public comment from 19 December 2009 until **31 March 2010**. This is longer than the customary 2-month consultation period to make allowance for the Christmas break. After the end of the consultation period, the Department of Water will review all public submissions, finalise the Plan and submit it to the Minister for Water Resources for approval. This document will then be made public and adopted as policy.

1 Our drying climate

Objective 1: Take the drying climate into account in all aspects of water resource management.

1.1 Rainfall trends

Since the mid-1970s, the south-west of Western Australia has experienced more than a 10 per cent decline in average 'wet season' rainfall.

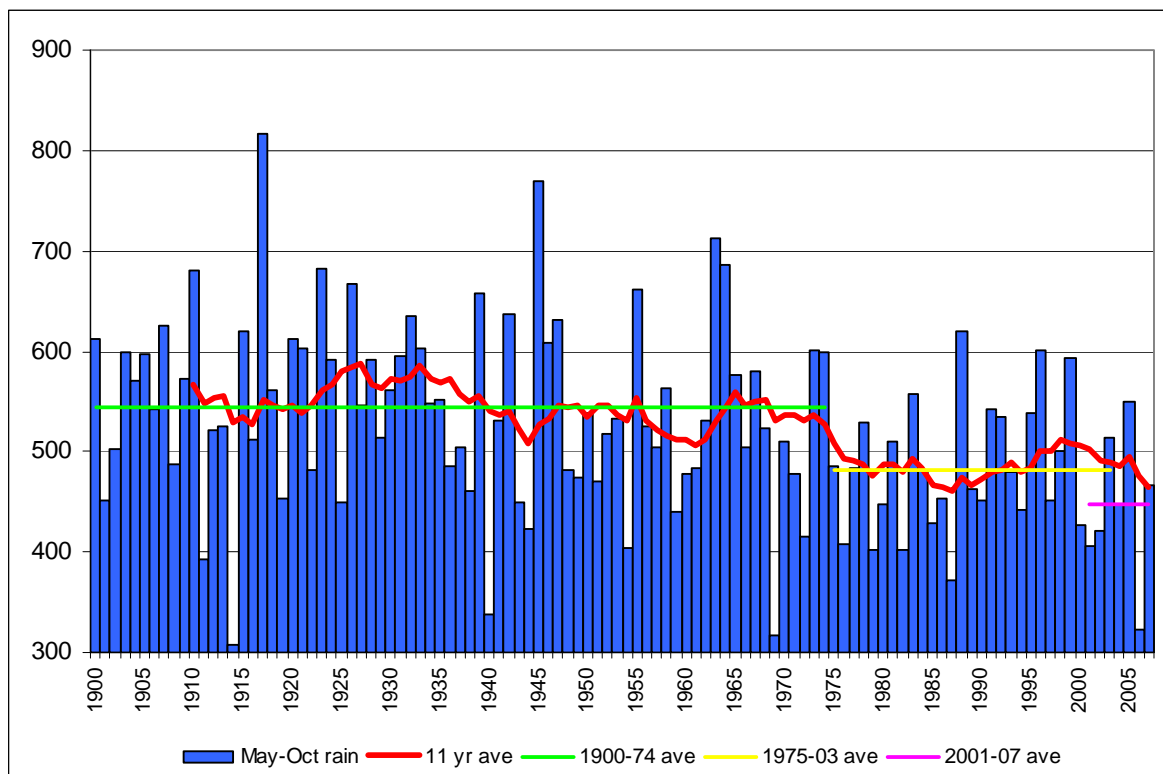


Figure 2 Trends in May to Oct rainfall (mm) in the South West

Figure 2 demonstrates the decreasing trend of rainfall in May to October over more than 100 years. Typically, only 5 to 10 per cent of rainfall ever becomes stream flow. The decline in rainfall has reduced stream flows in the region by around 50 per cent (Bureau of Meteorology). As a result, inflows to public water supply dams along the Darling Scarp have decreased dramatically. Figure 3 presents the decreasing trend in inflows to Perth public water supply dams.

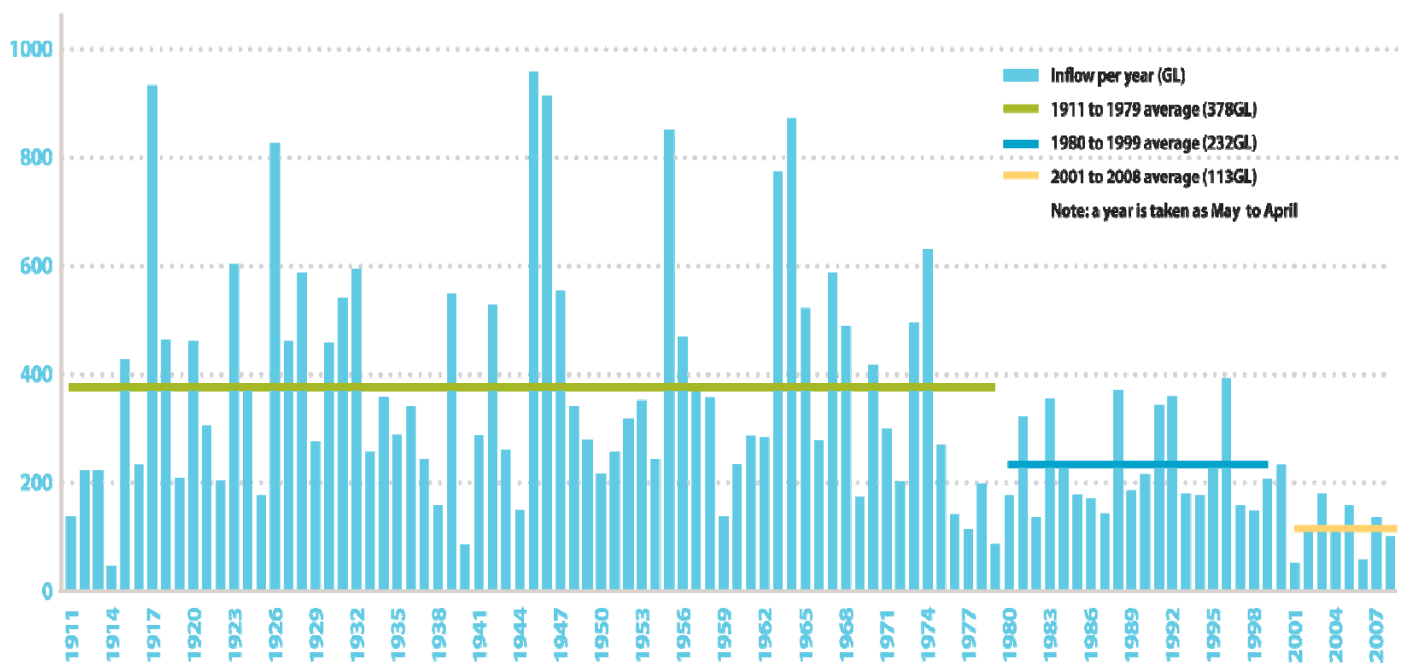


Figure 3 Annual streamflows into Perth dams - GL/y
(Source: Water Corporation)

Small reductions in rainfall can have a more negative effect on groundwater recharge than 1:1, depending on the vegetation cover. The most dramatic declines have occurred in the region's elevated groundwater systems, the Gngangara and Jandakot mounds. Most vulnerable is the superficial (that is, unconfined) aquifer that supports the watertable. The volume of water stored in the Gngangara Mound's superficial aquifer has declined dramatically since the 1970s.

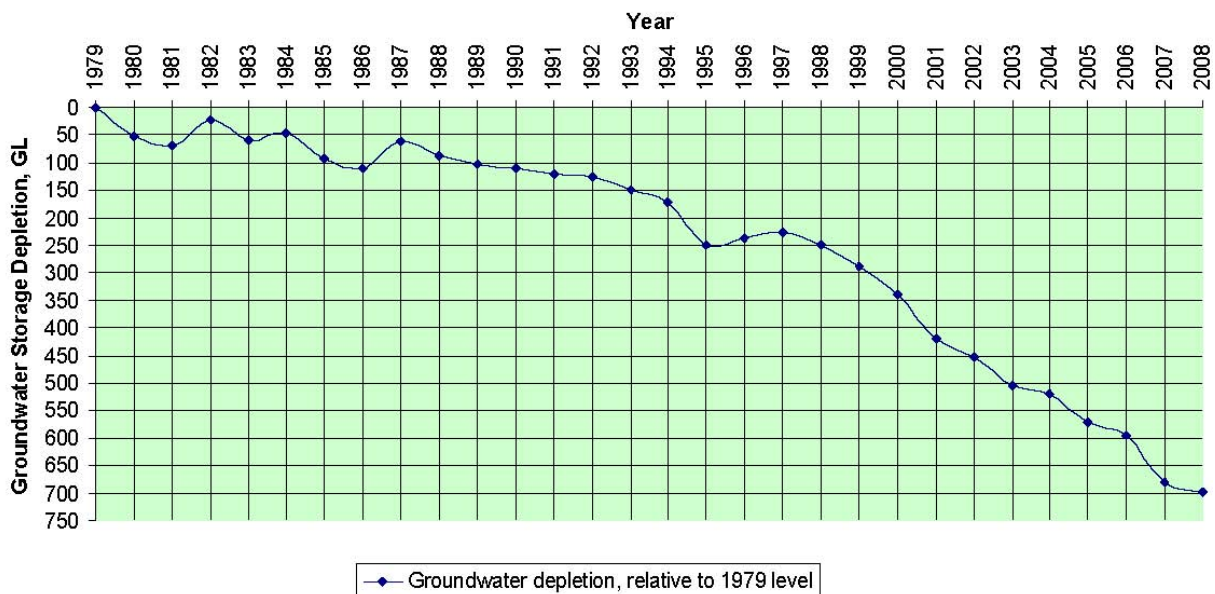


Figure 4 Reduction in groundwater storage in the Gngangara superficial aquifer

While reduced rainfall is the main cause of the decline in the watertable, other factors include increased vegetation density (for example, pine plantations) and groundwater abstraction for public and private water supply. The Jandakot Mound has also declined but to a lesser degree.

1.2 Climate scenarios

The climate is more likely than not to become drier over time. While the exact nature of the changes remains unknown, the region is likely to experience:

- increases in atmospheric and surface water temperatures
- decreases in winter rainfall and streamflow
- decreases in aquifer recharge and lower watertables
- increases in evapotranspiration
- increases in ocean and estuarine water levels (DoW 2009a).

Table 1 displays ‘wet’, ‘median’ and ‘dry’ rainfall scenarios for the region. The scenarios are adapted from Climate Change in Australia (2007) and the regional climate projections are by Sadler (2007). The scenarios are projected changes from the average rainfall experienced in the period 1980–1999 (that is, the ‘1990 baseline’ condition). Under the median climate scenario, the average rainfall in the May–October period would decline by 8 per cent by 2030. Under the dry climate scenario, the reduction would be 15 per cent.

Table 1 May–October regional rainfall scenarios to 2030

Climate scenario	Projected change in rainfall by 2030*	
	Due to drying climate	Plus natural variability
Wet climate scenario (10% probability)	0%	+10% to -10%
Median climate scenario (50% probability)	-8%	+2% to -18%
Dry climate scenario (10% probability)	-15%	-5% to -25%

* relative to the 1990 baseline condition

Water planning and management requires that climate variability must also be taken into account. The combined effect of the dry phase of the natural climate variability cycle and the drying climate could result in rainfall decreases of 18 per cent (median scenario) to 25 per cent (dry scenario) relative to the 1990 baseline condition. A five-year period of such conditions would place significant pressure on the security of public and private water supplies and on the ecological and social values that depend on the water resources of the region.

1.3 Implications

Waterway and wetland health

Further drying of our climate would reduce the amount of freshwater entering the region's waterways. The extent of coastal floodplains will change if sea levels rise. Seawater is likely to migrate further upstream if sea levels rise and storm surges increase. Rivers and estuaries may become more susceptible to algal blooms.

Reduced rainfall and lower watertables would see wetlands drying for longer periods making them more susceptible to acidification and fires. There would likely be a shift in the habitat on the Swan Coastal Plain in favour of those species more suited to drier conditions.

Public and private water supply

Over time, the region's public water supply dams along the Darling Scarp and groundwater sources on the Gnangara and Jandakot mounds are likely to contribute increasingly less water to the IWSS. This is because the drier the climate, the less water will flow into public reservoirs and recharge public groundwater wellfields.

The greatest impact on public and private water supply would be in the Perth subregion. At the present time, there are already some areas with insufficient water for additional licences to be allocated. Under the median and dry scenarios, this situation would become worse with the level of use exceeding the allocation limit. The volume of licensed use and unlicensed domestic bore use would need to be decreased to sustainably manage groundwater in the Perth subregion.

If current per capita consumption rates were to continue to 2030, demand for public water supply would increase to an estimated 390 GL/y. Under both the median and dry climate scenarios, demand would exceed the existing IWSS capacity before 2030 (Table 2).

Table 2 Scheme water demand and supply balance by 2030 (GL/y)

Climate scenario	Existing source available by 2030 (GL/y)				2030 unconstrained demand = 390 GL/y
	Surface water	Groundwater	Seawater desalination*	Total	Supply minus demand (GL/y)
Wet	220	145	95	460	70
Median	130	120	95	345	-45
Dry	95	100	95	290	-100

* Includes Stage 1 of the planned Southern Seawater Desalination Plant near Binningup

If current private use consumption rates were to continue to 2030, demand for private licensed use in the Perth subregion would increase to 300 GL/y, or to 250 GL/y with no growth in horticulture or rural use. In the absence of further constraints on private water supply demand, there would be insufficient groundwater in the Perth subregion to meet demand for additional licensed use under any climate scenario (Table 3).

Table 3 Licensed private water demand and supply by 2030 (Perth subregion)

Climate scenario	Groundwater available for private use by 2030	Available groundwater minus constrained demand (250 GL/y)
Wet	212	-37
Median	175	-74
Dry	142	-107

Although a similar analysis suggests there may be sufficient groundwater to meet private use in the Peel and Gingin subregions, further resource investigations and assessments are needed in these subregions to confirm the amount of available groundwater, its location and quality.

As the climate becomes drier, the potential for seawater intrusion will increase in coastal areas where groundwater is abstracted. This can render groundwater resources unusable for many purposes. Additional monitoring of the seawater interface is needed.

Preparing for the future-The Gnangara Sustainability Strategy

The dramatic decline in the superficial aquifer of the Gnangara groundwater system and the prospect of less rainfall in the future provided the impetus for the Gnangara Sustainability Strategy. Development of the Gnangara Sustainability Strategy commenced in April 2007. Coordinated by the Department of Water, the program is a \$7.5 million cross-government initiative investigating land use, biodiversity conservation and water management options for the Gnangara groundwater system.

The participating agencies are the Department of Water, Department of Agriculture and Food WA (DAFWA), Department of Environment and Conservation (DEC), Department of Planning (DoP), Forest Products Commission, Water Corporation and CSIRO.

In July 2009, the Gnangara Coordinating Committee released a draft water and land management framework for the Gnangara groundwater system. Findings and recommendations included the following:

- A drying climate is the major factor affecting the water balance of the Gnangara groundwater system.
- Under current climate conditions, basing environmental conditions on fixed water level criteria is no longer appropriate for managing the environmental impacts of water abstraction.
- In fully allocated areas, water allocations for private licensed users should be based upon a periodic share of available water.
- Total private licence abstraction should be reduced by approximately 20 per cent by adopting best practice technology and improved water efficiencies and by reducing water available through changes to allocation limits.
- Future public water supply demand can in part be met from coastal borefields that can intercept groundwater outflow to the ocean.
- Future water allocation plans should define areas where no additional domestic bores will be permitted.
- Local re-use of stormwater that currently discharges to the Indian Ocean and Swan River should be encouraged, while protecting flows into the Swan River and its tributaries.
- Where wetlands are predicted to dry out despite land and water management interventions, management should centre on transition to a terrestrial ecosystem.
- Opportunities to augment groundwater levels using recycled water, either directly or in the vicinity of high value ecosystems, should be investigated.

The full draft report is available at www.gnangara.water.wa.gov.au.

1.4 Department of Water responses

The following section outlines the response of the Department of Water to the challenges raised in the chapter on our drying climate. This is comprised of a re-statement of Objective 1 and position statements which explain what needs to happen in response to the challenges. These are followed by the actions which need to be taken in the future.

Objective 1: Take our drying climate into account in all aspects of water resource management.

Positions

- Water resource management should reflect the best available climate science that currently predicts declines in average annual rainfall in the region of 8 to 15 per cent by 2030, in comparison to 1990. Water planning in the region will be based on these reductions in surface water flows and groundwater storages. Adjustments may be required following subsequent data assessments.
- Groundwater-dependent ecosystems such as wetlands should be managed in a way that reflects their dynamic nature including the effects of natural variability (for example, prolonged drying periods or increased rainfall).
- When setting water allocation limits and environmental management objectives, the effects of the drying climate on average annual rainfall and seasonal patterns and natural variability are to be taken into account. Where local water balances are threatened, the department will adjust allocation limits to re-establish water balances.
- Decreasing rainfall is the dominant factor in the significant decreases in the watertable on the more elevated parts of the Gnangara Mound. The department supports the implementation of the water resource management recommendations of the *Gnangara Sustainability Strategy* (Gnangara Coordinating Committee 2009) which includes reductions in the amount abstracted. If rainfall continues to decline, further reductions may be necessary.

Actions 2010-2030

1. Develop a new approach for setting and achieving environmental management objectives for groundwater-dependent environmental values on the Gnangara and Jandakot mounds that includes monitoring of climatic conditions and recognition of trends over time.

2. Refine groundwater availability estimates through further groundwater investigations and assessments:
 - in the Peel subregion to advise south-western and south-eastern corridor development
 - in the primary recharge area for the Yarragadee aquifer on the north-eastern Gnamptogone Mound
 - in the Gingin Groundwater Area.
3. Increase monitoring of the seawater interface in coastal risk areas where groundwater abstraction also occurs (for example, Mandurah, Golden Bay, north-west coastal).
4. Implement the water resource management recommendations of the Gnamptogone Sustainability Strategy, a cross-government initiative.
5. Adjust allocation limits for water resources experiencing decline due to reduced recharge, in order to re-establish local water balances. Where needed, progressively reduce public and private water supply allocations to restore water balances.

2 Responsible water use

Objective 2: Reduce water demand by using water more efficiently and effectively.

2.1 Existing water use

As a community, we have an obligation to use our finite water supply resources in a wise and efficient manner. Figure 5 depicts all water use in the region, both scheme supply and private supply. It can be seen that agriculture and households are the largest total users of water.

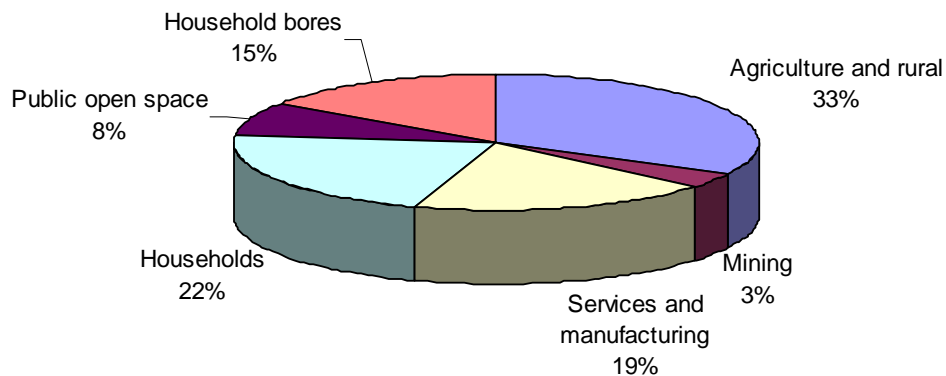


Figure 5 Perth-Peel Region water use by sector in 2008 (770 GL/y)

In comparison, Figure 6 only shows those water users that are using private supply, that is, not including scheme water. It can be seen that agriculture and rural is by far the largest category, accounting for nearly half of all privately supplied water.

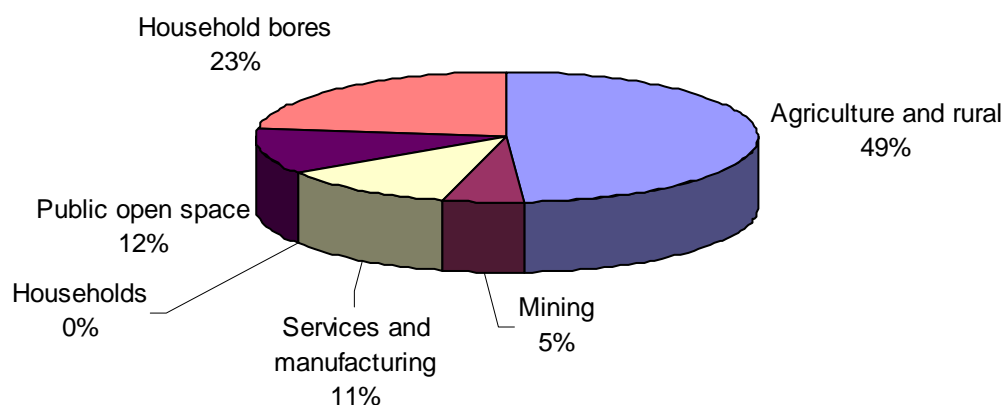


Figure 6 Private supply use by sector in 2008 (515 GL/y)

Public water schemes comprise the other third of water use with households the largest use (Figure 7). Since 2001, per capita consumption of scheme water has averaged 155 kL/y. The Water Corporation has set a per capita target of 125 kL/y of scheme water by 2030 (WC 2009).

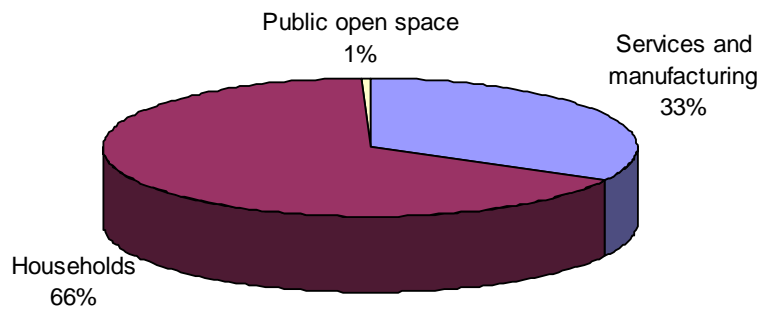


Figure 7 Public water supply use by sector in 2008 (255 GL/y)

2.2 Demand management

There is community support for greater emphasis on demand management in meeting our future water needs. This will require greater water conservation and more efficient and effective re-use of our stormwater and wastewater resources. The aim is to reduce the amount of high quality drinkable water being used for purposes that only require low quality water.

Possible demand management mechanisms include:

- temporary or permanent water restrictions
- water pricing
- improved water system efficiency
- water trading
- increased end use efficiency (for example, housing codes, appliance performance standards)
- use of alternative sources of supply for fit-for-purpose use
- consumer information on real costs and options
- reductions in water allocation limits.

The challenge is to strike the right balance of demand management measures so that water benefits are maximised and economic, social and environmental costs are as low as possible.

2.3 Supply-demand gap

It is anticipated that, if current consumption rates of scheme water continue, there will be a supply-demand gap. A supply-demand gap occurs where the amount of water available (supply) is less than the amount required (demand). To rectify this, the IWSS will require additional sources of supply before 2030. However, a 10 to 20 per cent reduction in demand would largely remove the need to augment the IWSS before 2030, assuming that Stage 1 of the Southern Seawater Desalination Plant is implemented. Tables 4 and 5 demonstrate the dramatic impact that reducing demand could have on the need for additional public and private water supplies. Only under the dry climate scenario would additional supplies be needed before 2030.

Table 4 IWSS supply versus demand scenarios

Climate scenario	2030 supply minus demand (GL/y)		
	Current demand rates continue	10% demand reduction	20% demand reduction
Wet	69	123	160
Median	-46	8	45
Dry	-101	-47	-10

Demand reductions of 10 and 20 per cent of private water use would increase the amount of groundwater available for additional licensed use in the Gingin and Peel subregions. In the Perth subregion, demand would exceed availability (in all scenarios except the wet scenario with 20% demand reduction) but the gap between demand and supply would be significantly narrowed (Table 5).

Table 5 Licensed private use effect of demand on groundwater availability - Perth

2030 demand scenario	Groundwater available by 2030 (GL/y)		
	Wet climate	Median climate	Dry climate
Constrained demand (250 GL/y)	-37	-74	-107
10% reduction	-12	-49	-82
20% reduction	13	-24	-57

2.4 Water conservation

Recent examples of measures taken to conserve water include the following:

- The State Government introduced a range of permanent water conservation measures.
 - The two-day per week scheme sprinkler roster in the Perth area became permanent.

- Use of backyard bores in Perth and Mandurah was limited to three days a week.
 - Business and industry customers using more than 20,000 kL/y of scheme water must participate in the Water Corporation's Waterwise Businesses Program.
 - Local government councils must comply with the daytime sprinkler ban and submit water efficiency plans to the Department of Water.
 - State Government departments must undertake water audits, set water use targets, and use water efficient fittings and appliances.
 - The Water Use in Houses Code was introduced for new residences.
-
- In 2008, the Department of Water established *Statewide Policy No. 16: Policy on Water Conservation/Efficiency Plans*. The policy requires water conservation/efficiency plans for water licences subject to an operating strategy. The department may request that a plan be prepared for other water licences if water is being wasted, if there is an urgent need to improve water use efficiency or if the water resource is fully allocated or under stress (DoW 2008a).
 - The State Government encourages the efficient management of water to irrigate public open space through the development and implementation of water conservation plans. The plans help communities to prioritise and water only highly valued areas, while replacing excess grassed areas with 'water wise' surrounds, verges and public facilities (DoW & DPC 2008).
 - The Water Corporation implemented a wide range of Waterwise programs for its water customers. In its 2009 document, *Water Forever: Directions for our water future* the Corporation announced plans to bolster these with a new Waterwise Homes program and to expand its Waterwise Developments and Waterwise Schools programs (WC 2009).
 - A successful trial winter sprinkler ban of integrated scheme water, garden bores and selected licences was held from 1 July –31 August 2009. As a result, in September 2009 the government announced an in-principle decision for a total sprinkler ban to take place during winter months, starting from 2010.
 - The State Government initiated the Living Smart program, which provides households with information on wise water use in both the home and garden. This initiative is led by the Department of Environment and Conservation and the Department of Transport.
 - Thirty-four of the region's 36 local governments currently participate in the ICLEI Water Campaign™. This capacity building program of the International Council for Local Environment Initiatives works with local governments to reduce water consumption and improve water quality.
 - Waterwise on the Farm, a DAFWA/Department of Water partnership, has worked with farmers to make optimal use of their water supplies. This project works with a range of horticultural industries to achieve objectives

such as increased irrigation efficiency and better understanding of sustainable management practices.

- A DAFWA Development Officer is continuing to work on-farm with vegetable growers to improve irrigation systems and water and nutrient use efficiencies. DAFWA and VegetablesWA collaborated to develop a web-based system that provides growers with advice on the application of irrigation water to specific crops. They are also establishing demonstration sites on vegetable farms to promote best water practices.
- Kwinana area industries increased their reliance on recycled water, conducted water audits and participated in the Kwinana Industries Council's Waterlink program and *Kwinana Industrial Area Water Planning Study* (KIC 2006).

2.5 Department of Water responses

The following section outlines the response of the Department of Water to the challenges raised in the chapter on responsible water use. This is comprised of a re-statement of Objective 2 and position statements which explain what needs to happen in response to the challenges. These are followed by the actions which need to be taken in the future.

Objective 2: Reduce water demand by using water more efficiently and effectively.

Positions

- Water users from all sectors should maximise water efficiency and minimise wastage.
- Residential per capita consumption of scheme water in the region has reduced in recent years through a combination of water rostering, water efficiency measures and public education. The department supports the Water Corporation's efforts to further reduce per capita consumption in all sectors of scheme water use through its Waterwise programs.
- Water efficiency gains must be improved in the private water supply sector (that is, non-scheme water use). This is especially true of the agriculture and rural sector that makes up nearly 50 per cent of private water use in the region.

Actions 2010-2030

6. Prepare a water efficiency strategy for the private water supply sector, that is, non-scheme water use. The strategy will contain:
 - ways to help private water supply users to achieve water efficiency (incentives)
 - targets for water savings and minimum standard requirements (regulations)
 - expectations on industry groups and relevant departments in guiding water users
 - the roles and responsibilities of State Government agencies and private sector organisations
 - information and guidelines on water use.
7. Continue funding the region's ICLEI Water Campaign™ until June 2011.

3 Water security

Objective 3: Provide water security for public and private water supply consumers.

With the availability of groundwater and surface water resources in the region likely to decrease if drying trends continue and consumptive demand increases, water security will become an increasingly important management issue. Water consumers want to know what groundwater and surface water is available in their area, how it will be shared in an equitable manner and how water quality will be protected.

Security for water consumers is provided through:

- water allocation plans and licensing processes
- source development planning for public water supply
- protection of high quality groundwater and surface water sources used for public supply of drinking water
- greater reliance on alternative types of private and public water supply including water recycling and desalination (see Chapter 5).

3.1 Water allocation

Water allocation plans

Water allocation plans are the primary means to balance water use with water needed for the environment, including in-situ social, cultural and ecological requirements.

The Department of Water prepares, on a priority basis, water allocation plans for the region's major surface water and groundwater management areas. These water allocation plans aim to :

- ensure that the total volume of water abstracted from all groundwater and surface water management areas reflects the current recharge from rainfall
- optimise the use of water for public and private use through water use efficiency and demand management measures
- protect groundwater-dependent ecosystems from direct impacts associated with abstraction
- protect the quality of groundwater for public and self-supply from impacts associated with abstraction and land use
- adapt management of the water resource based on the results of monitoring programs and the condition of the resource.

Managing limits

Allocation limits are a primary management tool used by the Department of Water to ensure the sustainable use of water resources. An allocation limit is the volume of water available for total licensed use based on the current understanding and management of a resource. Allocation limits are set for each aquifer in a groundwater subarea and for each water course in most surface water subareas. The limits take into account the environmental, economic and social values dependent on the water resource.

Over-allocation of a water management area occurs where the total volume of water allocated to entitlement holders over a given period exceeds the allocation limit. This may be from licensed or unlicensed use. Over-allocation is the trigger for investigating the potential risk of over-use. Over-use occurs when more water is leaving the system than is entering the system. When a water resource is not in balance, dependent environmental, economic or social values can be diminished.

A risk-based approach is used to set and revise allocation limits. A review of an allocation limit may be triggered by resource monitoring data, new information about the resource, data on land use or environmental changes.

The management of over-allocation and over-use is a priority issue for the Department of Water. Table 6 displays the groundwater management subareas where over-allocation problems currently exist in the Perth-Peel region. These have principally resulted from a reduction in allocation limits, which have been set to respond to the drying climate.

Table 6 Over-allocated groundwater subareas in the Perth-Peel region

Plan area	No. of over-allocated groundwater subareas
Gnangara Mound	42 of 89
Perth South and Jandakot	8 of 33
Gingin	5 of 48
Serpentine	2 of 37
Cockburn	2 of 7

Once a resource is designated as over-allocated, no further water licenses are issued and a pathway for dealing with the over-allocation is implemented. In fully or partially over-allocated areas, the Department of Water actively recoups unused water entitlements through audits. Consistent with *Statewide Policy No. 11: Management of Unused Licensed Water Entitlements* (WRC 2003a), recouped water entitlements may be redistributed to applicants that have demonstrated a need for the water or these entitlements may be retired as unavailable for redistribution (for example, to prevent environmental impacts).

Mechanisms available under the current legislation to reduce the total volume of water allocated to entitlement holders are:

- licence amendment

- Ministerial direction
- change of conditions on renewal
- Government participation in water trading.

In the future, licensees will need to use their water entitlements more efficiently and effectively. In some cases, alternative sources of supply will be needed to augment supplies from groundwater abstraction.

Gnangara Mound

In the *Gnangara Sustainability Strategy Draft for public comment* released in July 2009, it was confirmed that public water supply is the most highly valued social and economic use of water from the Gnangara groundwater system (Gnangara Coordinating Committee 2009).

As dam levels have declined, the Water Corporation has relied more on the groundwater resources of the Gnangara Mound to meet demand. The Department of Water has commenced a process of staged reductions of allocations for public and private water supply on the Gnangara Mound. In 2008, the Department of Water reduced the maximum annual IWSS use for the Gnangara and Jandakot groundwater systems from 165 GL to 145 GL. Once the Southern Seawater Desalination Plant is in operation, the average annual IWSS use will be further reduced to 120 GL.

In July 2009, the Gnangara Sustainability Strategy recommended that total private licence abstraction be reduced by around 20 per cent. This is to be achieved through best practice technology and improved water efficiencies, by changes to allocation limits and through the introduction of the concept of water shares (Gnangara Coordinating Committee 2009).

The Department of Water is continuing to conduct site inspections and water use surveys to assess compliance with licensed activities and allocations across the Gnangara system. In fully allocated and over-allocated management subareas, the department is not issuing further water licences and is recouping unused entitlements. Water trading will be established in fully allocated management subareas (DoW 2009b).

Over time, the public and private water allocation limits for the groundwater resources of the Gnangara Mound will be progressively reduced until the system achieves a new state of equilibrium as defined by the Department of Water.

Water shares

Currently, a water licence holder is entitled to extract the same amount of water from a resource every year for the period of their licence. Consistent with the National Water Initiative, the Department of Water will introduce the concept of shares in available water, commencing in areas where a water resource is at or nearing full allocation and there is competition for the resource (for example, the Gnangara

Mound). Periodically (for example, annually or seasonally), the water manager will adjust upward or downward the amount of water available for consumptive use based on the conditions at the time. If the water manager reduces the amount of water available for abstraction, the reduction is shared proportionally across all licensed users.

Metering

The metering of water use provides essential data for water resource accounting, licence compliance assessment and the operation of water markets. This data is especially important in areas with significant environmental features and a high level of licensed private abstraction.

Agriculture is the largest water use sector in the region. While agricultural water use is licensed, not all licensees are required to measure and report their water usage. Metering is the most effective means to quantify use. To date, metering on the Gnamptara Mound has demonstrated that while some horticulturalists are not using their full allocation, others have exceeded theirs.

As of 1 July 2010, the Department of Water will expand the requirements to meter the licensed taking and use of water. Expansion of the Department of Water's meter installation program is a high priority. Through this program, the department will install government-owned meters in priority management areas where there is a high demand for water resources. The priority areas in the region are Gnamptara Mound and Gingin (DoW 2009c). In addition, the threshold for requiring water licence holders to install meters and report water usage to the department in other areas will be changed from water license entitlements of ≥ 500 ML/y to ≥ 50 ML/y.

Domestic backyard bores

If properly located and used, domestic bores significantly reduce the demand on scheme water by providing a second class water supply system for irrigating domestic lawns and gardens. Domestic bores are not licensed by the department. However, the department sets aside a sufficient volume of water to account for unlicensed use in its water allocation planning. This is to ensure that all water users are accounted for and groundwater resources are not overexploited.

Where a watertable is under significant stress and current management approaches have not been successful, the effort in managing unlicensed groundwater use will be stepped up.

3.2 Public water supply

The Water Corporation has adopted a portfolio approach to ensure the long-term security of public water supply services. A primary objective is to make public water supply in the region more climate resilient. The Corporation's *Security through Diversity* program introduced seawater desalination to the portfolio of water supply sources. The 45 GL/y Perth Seawater Desalination Plant opened in 2006 at Kwinana. The Southern Seawater Desalination Plant will come online in 2011.

The Water Corporation document *Water forever - Directions for our water future - A Draft Plan* (2009) describes its 50-year plan to deliver sustainable water and wastewater services to Perth and surrounding areas. The portfolio includes three categories of options: 1) reduce water use, 2) increase water recycling, and 3) develop new water sources.

With the addition of the Southern Seawater Desalination Plant in 2011, it is unlikely that new sources of public supply will be needed before 2015 in the worst case and more likely not before 2020 (WC 2009). The timing of any Water Corporation decision to develop new sources will depend on rainfall trends, the outcomes of demand management efforts and the competitiveness of other water supply options. Figure 8 displays the Water Corporation's future public water supply source options.

Groundwater

The Water Corporation (WC 2009) has identified the following as potential groundwater schemes to augment public water supplies:

- Gingin-Jurien groundwater north of Perth, near Moore River
- North West metropolitan coastal groundwater just north of the existing Neerabup groundwater scheme near Wanneroo
- Jandakot groundwater scheme expansion
- Collie Coal Basin groundwater near the Town of Collie (outside the Perth-Peel region).

Surface water

There are insufficient surface water resources to build any new public water supply dams in the region. In an effort to reduce the decline of inflows to public water supply dams, the Water Corporation is conducting a forest thinning trial in the Wungong Dam catchment. The outcomes of the Wungong Trial will determine if this option is viable for adoption in other drinking water catchments along the Darling Scarp.



Figure 8 Future public water supply options (Source: Water Corporation)

3.3 Drinking water source protection

To protect public drinking water sources from contamination, Western Australia has adopted the 'catchment to consumer' multiple barrier approach recommended by the *Australian drinking water guidelines* (NHMRC & NRMCC 2004). The first barrier to contamination is 'at source' protection, that is, at the catchment. This lowers the risk of contamination and reduces the amount of treatment needed before the water reaches consumers.

Public drinking water source areas (PDWSA) consist of catchments around public water supply reservoirs and the recharge areas of groundwater borefields used for public supply. Protection of PDWSA is achieved through the implementation of drinking water source protection plans, which have undergone an extensive public consultation process.

The plans identify existing and potential threats to a drinking water source and management strategies to avoid, minimise or manage those risks. The State Water Strategy (WA State Government 2003) identified the implementation of drinking water source protection plans for all PDWSA as a state priority. There are 41 PDWSA in the region, 26 of which already have a protection plan in place (Figure 9).

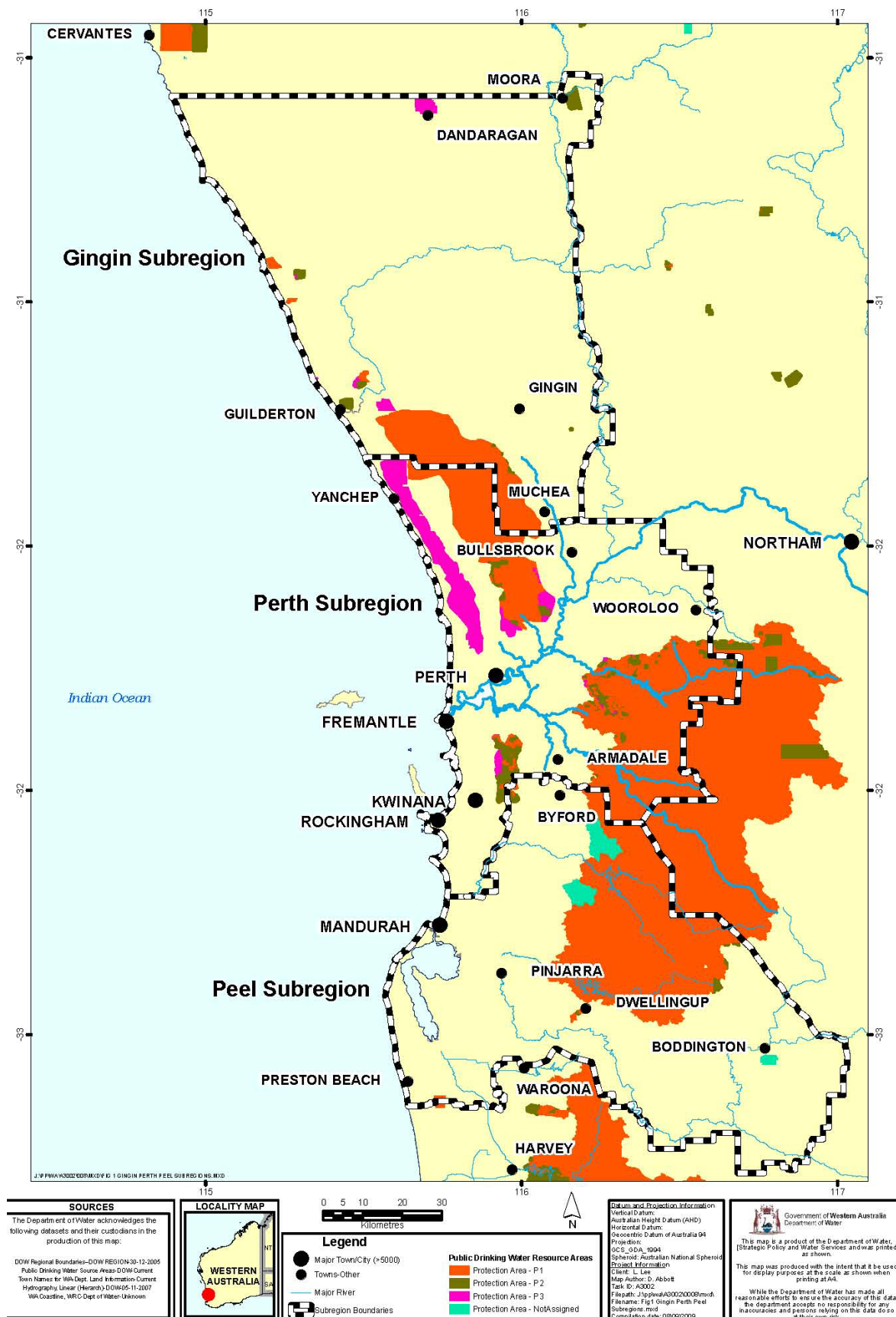


Figure 9 Location of protection areas, Perth-Peel

In recent years, guidance on the land uses permitted within proclaimed or proposed PDWSA was embedded in the State's land planning process through *Statement of Planning Policy 2.7—Public Drinking Water Source Policy* (WAPC 2003). Department of Water decisions regarding recreational activities in PDWSA are guided by *Statewide Policy No.13: Policy and Guidelines for Recreation within PDWSA on Crown Land*.

The 'at source' protection of public drinking water supplies has significantly influenced land use patterns in the region. Drinking water source catchments in the Darling Range have remained undeveloped and largely State forest. On the Swan Coastal Plain, the protection of the groundwater resources of the Gnangara and Jandakot mounds has limited urban development from extending into priority water areas, to protect the quality of the water.

PDWSA provide some of the most popular outdoor recreation areas in the region and contain many areas of importance to biodiversity conservation. As the region's population grows, there is increasing pressure to open the drinking water catchments on the Darling Scarp to more active forms of recreation. This matter is currently being considered by a Parliamentary committee that plans to report its findings by 1 July 2010. The State Government will then be able to determine the best approach for Western Australia.

3.4 Department of Water responses

The following section outlines the response of the Department of Water to the challenges raised in the chapter on water security. This is comprised of a re-statement of Objective 3 and position statements which explain what needs to happen in response to the challenges. These are followed by the actions which need to be taken in the future.

Objective 3: Provide water security for public and private water supply consumers.

Positions

- Water allocation plans will ensure that a water resource system is 'in balance', that is, the amount of water extracted or leaving the system does not exceed the amount of water entering the system.
- Where groundwater monitoring reveals that water levels are steadily declining, the department will cap the issuing of water entitlements until such time as further investigations and/or an allocation plan are completed.
- Significant water use in highly allocated areas will be metered to prevent over-use and potential adverse impact on other users and the environment, and will be subject to compliance and enforcement initiatives.

- If licensed allocations are to be reduced in order to manage an over-utilised system, licence holders should be given at least three years notice. This will allow them to maintain their business activity through sourcing alternative water or making improvements in water efficiency prior to the reduction.
- Water allocations should be a share of the available resource which changes depending on rainfall, rather than a fixed volume that does not recognise rainfall variation.
- In general, domestic garden bores in the Perth-Peel Region should not be licensed or metered as the management resources required are too high, with limited benefit to resource management and environmental outcomes. However, additional domestic bores should not be permitted in areas of high risk (such as a declining watertable, acid sulfate soils, proximity to wetlands or the salt water interface) and should be accounted in allocation planning as an estimated abstraction. Where the watertable is under significant stress and current management measures have not been successful, the efforts in managing unlicensed use will be stepped up.
- Water service providers must provide the department with water shortage contingency plans and source development plans. The plans are to be updated at least every five years and should identify prospective sources including potential source protection areas.
- The department supports the review of recreation in drinking water source catchments to determine what types of recreation are appropriate to ensure the ongoing availability of safe, reliable, quality drinking water.

Actions 2010-2030

8. Complete investigations of the Yarragadee aquifer recharge zone in the northern portion of the Gnangara Mound. This will include determining management measures to protect water quality in the recharge zone.
9. Prepare new water allocation plans for surface water and groundwater management areas in the region in the following order of priority:
 - Gnangara groundwater
 - Murray groundwater
 - South West Coastal groundwater
 - Serpentine groundwater
 - Gingin groundwater
 - Perth South and Jandakot groundwater
 - Canning surface water.
10. Implement water recovery strategies for all over-allocated resources.

11. Establish mechanisms to provide entitlement holders with a 'share' of the available water resource in all major surface water and groundwater management areas. When the Southern Seawater Desalination Plant comes into operation post 2011 it will contribute to the annual allocation to the IWSS for public supply. A new formula will be needed to replace the current variable groundwater abstraction rule (VGAR), a sliding scale that bases groundwater allocations on the total water stored in IWSS dams at their peak in October of each year (DoW 2008b).
12. Continue to implement the department's meter installation program in priority areas (that is, the Gnangara Mound and Gingin).
13. In collaboration with DAFWA, determine the water supply needs and water availability for the region's priority agricultural areas.
14. Ensure all public drinking water source areas in the region have up-to-date public drinking water source protection plans by 2020. The priority for development will be aligned with water allocation planning.
15. Continue to work with WA Planning Commission and Department of Planning and local government planners to have public drinking water source areas included in the Metropolitan Regional Scheme, Peel Region Scheme, local planning schemes and other planning documents in support of *State Planning Policy 2.7—Public Drinking Water Source* (WAPC 2003).

4 Alternative sources of water supply

Objective 4: Facilitate the use of alternative sources of water supply.

The Perth-Peel region has traditionally relied on groundwater and surface water resources for water supply. As their availability declines, alternative water sources will play a larger role in meeting the region's water needs. Alternative sources include water recycling, rainwater tanks, the use of lower quality groundwater resources for fit-for-purpose use (for example, community bores) and desalinated water (for example, seawater desalination plants).

Water recycling is the multiple use of water (usually sourced from wastewater or stormwater) treated to a standard appropriate for its intended use. Recycled water can reduce the burden on drinking water resources and local groundwater by providing a fit-for-purpose water solution.

Key reasons to recycle water include:

- Recycled water can be used for applications that require lower quality water, thus conserving high quality water for high value uses.
- Wastewater as a source for recycling is independent of climate and available any time of year.
- The recycling process draws on less energy than some other water sources, such as desalination.
- Recycling improves short-term as well as long-term water supply security.
- As the cost of major new scheme sources rises, the cost effectiveness of using recycled water improves (DoW & DPC 2008).

Community attitudes toward water recycling have changed significantly over the past 20 years. Wastewater and stormwater are no longer viewed as waste for disposal but as valuable water resources. A 2008 Perth survey reported over 90 per cent community support for water recycling to public open space uses, watering home gardens and lawns and toilet flushing. Over three-quarters supported irrigating fruit and vegetables with recycled water. Currently, 48 per cent of residents would support the use of recycled water for drinking water, an increase of 17 per cent since 2005.

New regulatory frameworks are being developed to complement the growing importance of alternative water supply sources in meeting the region's future water needs. As the alternative water supply sector matures, new water service providers (public and private) are likely to enter the water supply arena.

4.1 Desalination

Desalination offers a high level of supply security because it does not rely on rainfall. The downside is high energy use and higher investment costs than traditional groundwater and surface water schemes.

The following desalination options are part of the Water Corporation portfolio of water options:

- Stage 2 of the Southern Seawater Desalination Plant that could double its production capacity from 50 to 100 GL/y
- replacing the IWSS water currently supplied to the Kalgoorlie area with potable water transferred to the area via pipeline from a new seawater desalination plant at Esperance
- constructing more seawater desalination plants north and south of Perth
- desalinating some water from the salinity-affected Wellington Dam
- geothermal desalination, an emerging technology that may be feasible in the longer term.

4.2 Large-scale recycled water schemes

Currently only 6 per cent of wastewater is recycled in the metropolitan area. Most of the water that leaves the region's wastewater treatment plants (WWTP) ends up in ocean outfalls. There is potential to develop large-scale recycled water schemes utilising these flows. Through Water Forever, the Water Corporation has set a recycling target of 30 per cent of all metropolitan wastewater by 2030 (WC 2009).

Within the next few years, the region's three major WWTPs (Beenyup, Subiaco and Woodman Point) will be joined by new WWTPs at Alkimos and East Rockingham. Figure 10 displays the Water Corporation's wastewater system for Perth and Mandurah by 2060 (WC 2009).

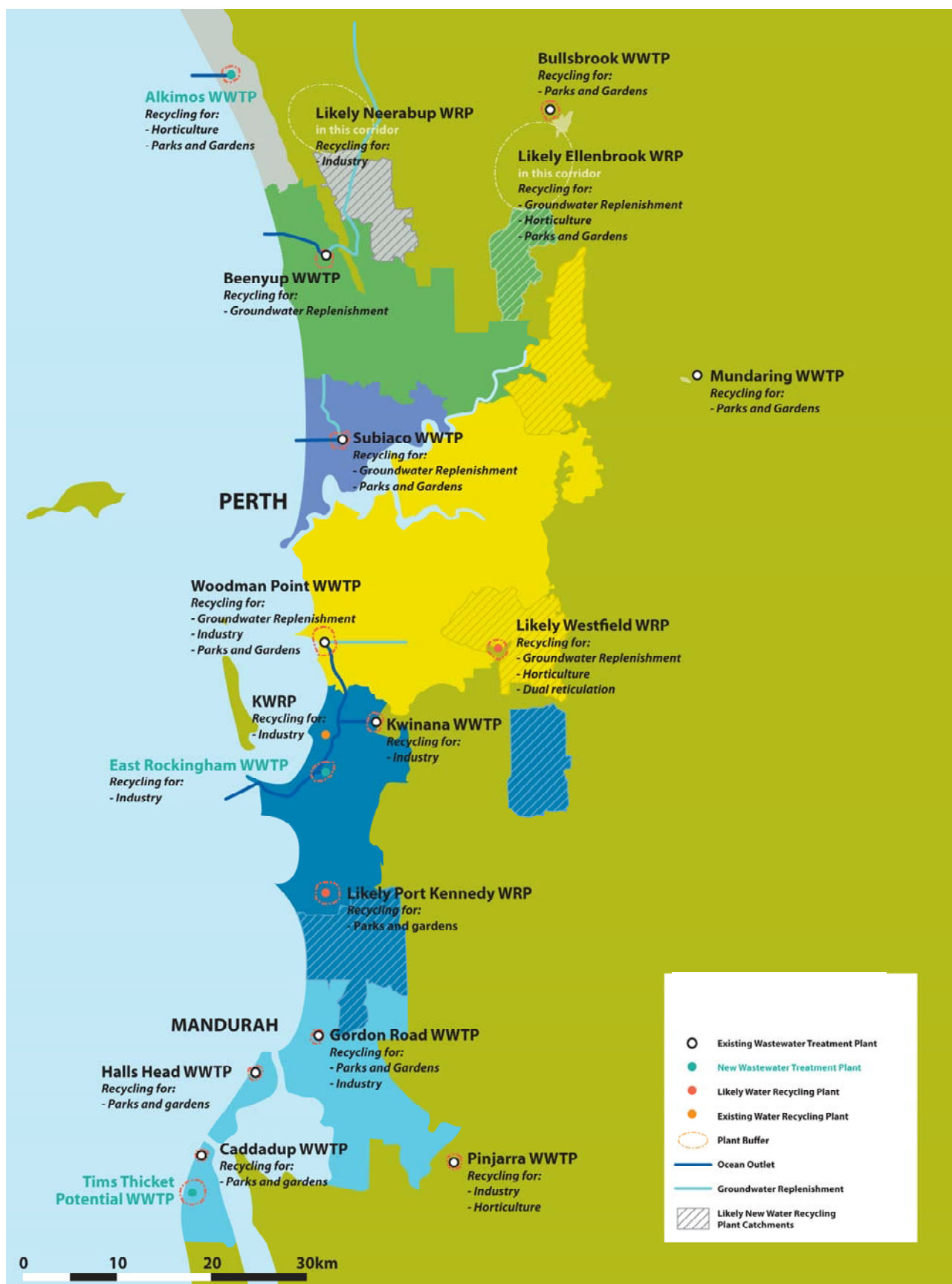


Figure 10 Future Wastewater options (Source: Water Corporation)

Wastewater inflows to the region's WWTPs could reach between 167 and 193 GL/y by 2030 (Figure 11). Table 7 provides the Water Corporation's estimate of recycled water potential for each WWTP in the region (WC 2009). This indicates about 50–58 GL/y of water recycling by 2030 and 125–160 GL/y by 2060.

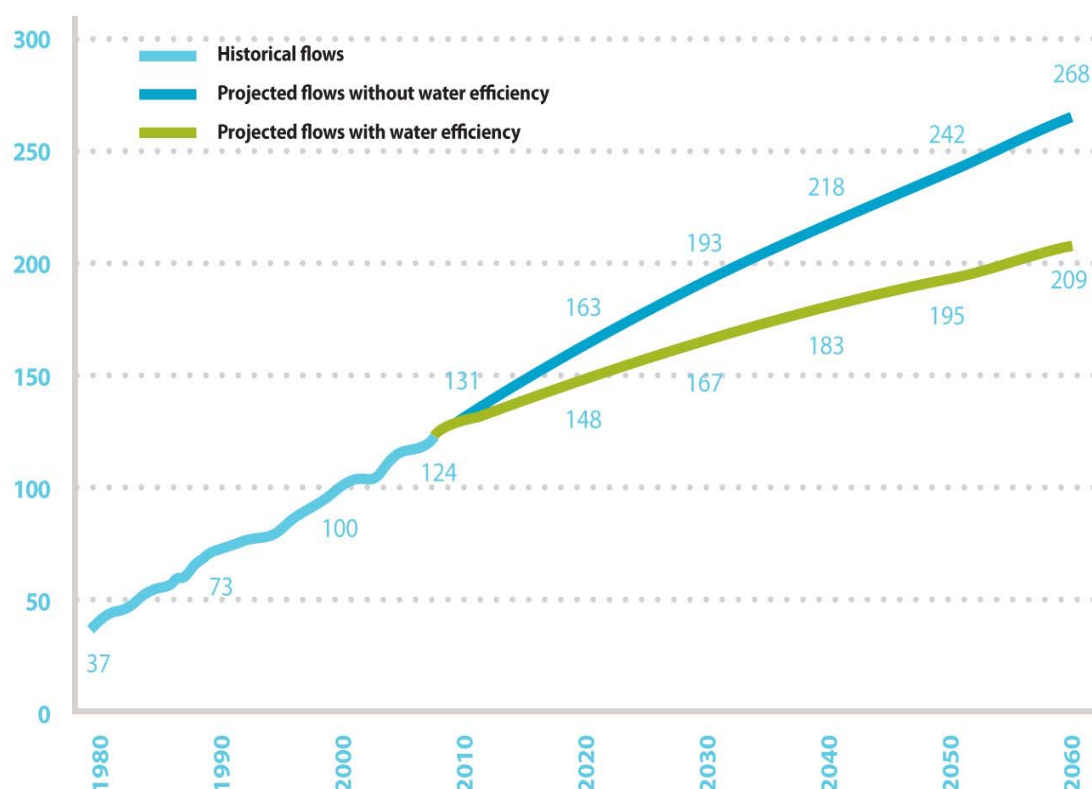


Figure 11 Projected wastewater flows for Perth and Mandurah - GL/y

Source: Water Corporation

Table 7 Estimate of WWTP recycling opportunities (Source: Water Corporation)

Wastewater systems	Estimated water recycling by 2030 (%)	Estimated water recycling by 2060 (%)
Alkimos	40	60
Beenyup	70	60
Subiaco	10	65
Woodman Point	20	65
East Rockingham	20	65
Greater Mandurah	12	20
Overall	30%	60%

It is costly to treat and transport recycled water long distances via pipelines to potential users. This favours uses located in reasonable proximity to WWTPs. An example is the use of recycled water from the Subiaco WWTP to water McGillivray Oval in Floreat.

Recycled wastewater can be an attractive option for industrial uses located in areas where groundwater resources are fully allocated. The Kwinana Industrial Area represents the largest concentration of industrial activity in the state. Even with water efficiency best practices, the demand for industrial water in the Kwinana Industrial Area will increase as existing industries expand or new industries locate in the area.

In 2004, the Water Corporation opened the Kwinana Water Reclamation Plant. Using recycled water from the Woodman Point WWTP, the plant provides 6 GL/y of high quality industrial water to Kwinana industries. The *State Water Recycling Strategy* supported the expansion of the existing water reclamation plant to 9.6 GL/y by 2010 (DoW & DPC 2008).

The Kwinana Industrial Council has estimated that industry in the Kwinana Industrial Area will need an additional 37 GL/y of water by 2030 (KIC 2006). The planned East Rockingham WWTP in the greenfield East Rockingham Industrial Park offers an opportunity to develop a third pipe scheme for new industry in the area. Managed aquifer recharge could also play a role in meeting industrial water needs.

The greatest potential use of recycled wastewater in the Perth-Peel region is via managed aquifer recharge (MAR), where recycled water is stored in depleted aquifers for later use or environmental benefit. Storing the water in an aquifer can further improve its quality over time. The water stored in a MAR scheme can be:

- removed later for a variety of fit-for-purpose consumptive uses
- used to replenish coastal aquifers under threat from seawater intrusion
- used to alleviate the stress on groundwater-dependent ecosystems (for example, caves and wetlands) by elevating the local watertable.

The Department of Water, CSIRO and Water Corporation are currently assessing the merits of using different types of MAR systems on the Swan Coastal Plain. This includes the feasibility of using MAR to improve water levels at Perry Lakes in Floreat.

The Water Corporation is conducting a three-year Groundwater Replenishment Trial to determine whether recycled wastewater can be used as a source of public drinking water in the future. A small volume of wastewater from the Beenyup WWTP will be treated to drinking water quality and then injected into the Leederville aquifer where it will be closely monitored.

Provided that the trial is successful, that all regulatory approvals can be obtained, and there is community support, the Water Corporation will develop a full-scale scheme by 2030 (WC 2009). This would provide around 35 GL/y of water for public water supply. The *State Water Recycling Strategy* (DoW & DPC 2008) reserved water from the Beenyup Wastewater Treatment Plant for this purpose.

To date, the high relative cost of sourcing water supply from recycled wastewater has been a significant barrier to its use. In 2009, the Economic Regulation Authority completed an inquiry into pricing for recycled water. The findings will inform future pricing policies for recycled water in Western Australia.

4.3 Small-scale alternative supplies

This category includes backyard and community bores, rainwater tanks, sewer mining and grey water re-use. Table 8 displays the estimated potential savings in scheme water through the adoption of these alternative supplies for non-potable uses.

Table 8 Potential savings in scheme water by 2030

Source	Scheme water savings by 2030
Community bores	10 GL/y
Sewer mining schemes	10 GL/y
Residential rainwater tanks	2.3 to 13.9 GL/y *
Grey water re-use	2 GL/y

**Savings would depend on the level of rebate or regulation*

Community bores

One in every four homes in the Perth metropolitan area has a domestic backyard bore. By using local groundwater for outdoor purposes such as lawn watering, demand for IWSS is reduced by an estimated 30 GL/y. There is some limited potential for additional backyard bores in the region. However, not all areas are suitable for backyard bores due to elevated salinity, proximity to important wetlands and limited groundwater availability.

The efficiency of backyard bores has long been a source of contention between bore owners and those solely on scheme water. In new residential areas, community bores offer an alternative to backyard and council operated bores for watering lawns, gardens and parks. A community bore utilises local groundwater from an unconfined aquifer. The timing and amount of irrigation is centrally controlled. A separate pipe system distributes the water for irrigating public open space and domestic gardens.

Rainwater tanks

In the Perth metropolitan area, only 7.2 per cent of households use rainwater tanks as compared with 19 per cent of all Australian households. Rainwater tanks have been less popular here due to the pattern of high rainfall in winter and very little rainfall during summer months. The ability to access groundwater through backyard bores is another factor. There are no planning requirements relating to rainwater tanks in new dwellings.

Water collected by tanks can be used outdoors (for example, gardens and lawns) and for non-potable indoor uses (for example, toilet flushing). For residential rainwater tanks the limiting factors are cost and the amount of garden area a householder is willing to sacrifice to install the tank. As shown in Table 9, the unit

cost of residential rainwater tanks is relatively high when compared to other sources of water (Marsden Jacob Associates 2009).

Table 9 Unit cost of water by type of source

Source	Cost per kilolitre of water
Residential rainwater tanks	\$4 to \$17
Desalination	\$2 to \$3
Water recycling through groundwater replenishment	\$1.50 to \$3
Industrial water recycling	\$1 to \$2
Enhanced efficiency of water use	in many cases less than \$1.50
Groundwater sources	in many cases less than \$1

Depending on the level of rebate or regulation, rainwater tanks could provide between 2.3 and 13.9 GL/y per year by 2030 (Marsden Jacob Associates 2009).

Sewer mining

Sewer mining involves tapping into a sewer main upstream of a treatment plant and extracting wastewater to be treated in a small on-site treatment plant for nearby non-potable use. Currently, there are no sewer mining schemes in Western Australia and only a small number in the eastern states.

4.4 Stormwater

Stormwater is water that accumulates on land as a result of rainfall or storms, and in urban areas can include runoff from roads and roofs. Each year, around 120 GL of water is discharged from urban stormwater and rural drainage networks to the Swan River and the Indian Ocean.

The percentage of stormwater harvested and reused is very small. Some Kwinana area industries harness on-site stormwater for treatment, storage in basins or wetlands, and re-use. The Town of Cottesloe is using stormwater to replenish a local aquifer rather than discharging it to the ocean.

The extent to which stormwater could be harvested and reused is unknown. Factors that may limit stormwater re-use include:

- its role in recharging local groundwater
- its importance in providing environmental flows to urban wetlands and the Swan River
- the need for treatment to remove pollutants (for example, fertilisers)
- declining volumes of stormwater if the climate becomes drier.

4.5 Department of Water responses

The following section outlines the response of the Department of Water to the challenges raised in the chapter on alternate sources of water supply. This is comprised of a re-statement of Objective 4 and position statements which explain what needs to happen in response to the challenges. These are followed by the actions which need to be taken in the future.

Objective 4: Facilitate the use of alternative sources of water supply.

Positions

- In principle, the Department of Water supports the use of alternative water supplies, including recycled water, to provide fit-for-purpose water that reduces demand for scheme water and/or supports environmental water needs.
- Alternative supplies that could affect groundwater tables (for example, community bores or stormwater recycling) must meet the water balance objectives established in an allocation plan.
- The department supports the concept of Managed Aquifer Recharge to bolster groundwater levels and alternative sources of water supply.
- The department is responsible for coordinating and expediting policy development across government in the area of water recycling and for streamlining administrative processes.
- In the future, new heavy and general industry should be required to investigate the installation of a third pipe to distribute recycled water. Where feasible and cost effective, existing heavy industrial areas should be retrofitted to facilitate the use of recycled water.
- The department supports reserving water from the Beenyup Wastewater Treatment Plant to ensure there is a source of wastewater available should the Groundwater Replenishment Trial be successful and receive community support as a supply source for scheme water (that is, drinking water).

Actions 2010-2030

16. Coordinate with other state government agencies to establish a transparent and efficient approvals process for alternative water sources, which safeguards the environment, public health and water resources.
17. Evaluate the feasibility of using managed aquifer recharge to support wetlands, the coastal saltwater interface and urban private supply use.
18. Evaluate opportunities to maximise retention of stormwater via recharge of the superficial aquifer, as a source of non-potable water supply or to support water-dependent ecosystems.
19. Report on the effectiveness of community bores in new residential estates such as The Green at Brighton.

20. Develop a Department of Water position regarding the use of community bores.
21. Working in partnership with the Water Corporation, create an online Waterwise Communities Toolkit to promote water conservation and recycling to local government, developers and other users. It will provide access to information on water recycling and wise water use, including:
 - the availability of shallow groundwater
 - the availability of sources for recycled water
 - key land planning considerations
 - alternative water supply solutions
 - streamlined application and approval processes.

5 Waterways and wetlands health

Objective 5: Restore and protect waterway and wetland health.

5.1 Values

Waterways include rivers, streams, floodplains, estuaries and inlets. Wetlands are supported by groundwater. The Swan Coastal Plain has lost an estimated 80 per cent of its wetlands. Many of those that remain are degraded.

The region's waterways and wetlands provide habitat for aquatic and terrestrial flora and fauna. This includes many wetlands of state and national significance. The Forrestdale and Thomsons Lakes and the Peel-Yalgorup System are Ramsar-listed due to their international significance as breeding grounds for migratory waterbirds.

The region's waterways and wetlands are valuable tourism assets and prized recreational areas. They support many cultural and heritage values of importance to the Noongar community and the broader community. Waterways drain land and carry floodwaters, and are important sources of public and private water supplies.

Most wetlands on the Swan Coastal Plain are connected to regional groundwater systems via the superficial aquifer. Other groundwater-dependent ecosystems include cave fauna communities and some banksia woodlands.

On the highly fragmented landscape of the Swan Coastal Plain, waterways provide critical ecological linkages connecting terrestrial and aquatic environments (WAPC 2009b).

5.2 Pressures

The region's waterways and wetlands have been significantly altered and their health diminished by human activities. This includes the damming of streams, groundwater abstraction, agricultural activities, land clearing, urban and industrial land uses, artificial drainage networks and recreation (Table 10). The resulting problems, including excessive nutrient levels, sedimentation, altered river flows and acidification, are difficult to reverse.

Table 10 Summary of waterway and wetland health problems and causes

Problem	Causes
Excessive nutrient levels	Artificial fertiliser application and livestock in rural catchments
	Garden fertilisation and animal wastes in urban and industrial areas
Erosion and sedimentation	Clearing of native vegetation
	Loss/damage of fringing vegetation
	Boat wash
	Civil works
	Dewatering

Problem	Causes
Altered water regimes	Weather events
	Increase in impervious surfaces due to urbanisation
	Artificial drainage of areas with shallow watertables
	Damming of waterways
Loss or degradation of fringing vegetation	Groundwater abstraction
	Dredging
	Altered water regimes
	Boat wash
	Severe weather events
Contamination	Direct human impact - trampling, arson, rubbish dumping
	Human use of chemicals in urban and industrial areas
	Contaminated groundwater
Acidification	Water based recreation
	Artificial drainage of areas adjoining wetlands with shallow watertables
	Declining watertables due to current drying trends
	Groundwater abstraction for public and private supply

Many of the region's ecosystems depend on specific water regimes to sustain their functions. If these are not met, ecological values can be diminished as well as associated social and economic values (for example, recreation, heritage, fishing).

Public water supply dams along the Darling Scarp severely limit downstream flows in rivers such as the Helena, Canning and Serpentine. Due to their importance in providing drinking water, returning river flows to pre-dam conditions is not feasible. However, some changes to the flows from these dams are needed to improve river health.

Further drying of our climate would reduce the amount of fresh water entering the region's waterways and supporting its wetlands. Seawater is likely to migrate further upstream if sea levels rise and storm surges increase. Rivers and estuaries may become more susceptible to algal blooms.

Population growth will further intensify development in proximity to the Swan and Canning rivers as well as the Peel Inlet and Harvey Estuary. It will also place additional recreational pressures on waterways from activities such as fishing and boating.

5.3 Key waterways and wetlands

Swan-Canning river system

Eutrophication remains a priority environmental issue for the entire Swan River, as well as the middle and upper Canning River. Actions taken since the mid-1990s through the Swan-Canning Cleanup Program have reduced nitrogen and phosphorous levels in tributaries. Yet much remains to be accomplished, especially in priority subcatchments (SRT 2008) such as Ellen Brook (Figure 12). Areas of intensive agriculture on the Gnangara Mound pose a risk of nutrient 'plumes' in groundwater that can eventually discharge to rivers and estuaries.

Non-nutrient contamination is an emerging environmental issue. A recent assessment of non-nutrient contamination identified the middle portion of the Swan River comprising Claisebrook, Maylands, Belmont Race Course, Burswood and Central Business District sites as the highest priority area along with the Bull Creek and the Lower Canning sites in the Canning River (Nice 2009). Sources of the non-nutrient contaminants include stormwater drains, disused waste disposal sites and old industrial sites.

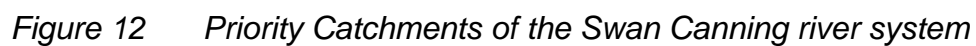
Acidification is an environmental risk in estuarine, floodplain and wetland areas. Due to the composition of soils on the Swan Coastal Plain, soil acidity can be activated and contaminate local groundwater. This can be triggered by excavation and dewatering activities or the lowering of the groundwater table due to the climate drying or over-abstraction. Incidences of acidification have occurred in Bassendean, Guildford, Bayswater and the City of Stirling.

Gnangara and Jandakot mounds

Declining watertables on the Gnangara and Jandakot mounds threaten groundwater-dependent ecosystems and their social and economic values. Wetlands monitored on the Gnangara Mound are also at significant risk from fire and drought-induced acidification.

Limestone caves in Yanchep National Park are drying out for longer periods, placing further stress on critically endangered Aquatic Root Mat Communities. Despite efforts to artificially rehydrate some caves or artificially supplement water levels in several wetlands, there has been a general deterioration of the environmental, social and cultural values of groundwater-dependent ecosystems on the Gnangara Mound.

Urbanisation on the edges of the Jandakot Mound has altered local hydrologic regimes and increased the pressure on wetlands. Groundwater-dependent wetlands, including the Ramsar-listed Forrestdale and Thomsons Lakes, are at severe risk of drawdown.



Peel-Harvey estuarine system

Large modifications to surface water hydrology have occurred in the Peel-Harvey catchments as a result of agricultural and urban development where seasonal wetlands once existed. Extensive drainage networks intercept surface and ground waters and continue to have major impacts on river flows and water quality in the estuary.

The opening of the Dawesville Channel in 1994 has aided in improving water quality in the Peel Inlet and Harvey Estuary. However, water quality and environmental problems remain in the rivers, and in areas such as the Serpentine Lakes. The lower Murray and Serpentine rivers are prone to algal blooms and fish kills. In addition to elevated nitrogen and phosphorous loads, the system suffers from habitat loss, erosion, acid soil drainage and elevated bacteria levels.

Fragmented governance arrangements have hindered efforts to improve the health of the estuarine system. A new governance model is needed to facilitate the achievement of management objectives for the Peel-Harvey estuarine system.

Moore River system

In the Moore River catchment there is little urban development. Agricultural activities including fertiliser usage, stock access to waterways and septic tank usage are the primary source of high nutrient levels in the Moore River Estuary. Floodplain connectivity has been damaged by levee systems constructed to prevent flooding of private properties. This has contributed to severe bank erosion and sedimentation of pools in the Moore River.

5.4 Recent initiatives

Unfortunately, there are no quick-fix solutions to improving the health of our waterways and wetlands. For waterways such as the Peel-Harvey estuarine system, achieving significant water quality improvements will require decades of active management and significant funding resources.

Recent and ongoing actions include:

- In 2009, the Department of Water completed a review of the Moore River floodplain mapping and floodplain management strategy for Moora.
- The department revised the Swan and Canning River floodplain mapping in 2008.
- NRM groups are implementing a range of programs to improve waterway health and protect cultural heritage. This includes on-the-ground riparian management, Rivercare programs, cultural heritage management actions and the facilitation of community and Government partnerships.
- The State Parliament passed the *Swan and Canning Rivers Management Act 2006*.

- *Statement of Planning Policy 2.10: Swan-Canning River System* (WAPC 2006) was established to facilitate integrated planning and decision making in relation to the river.
- The Swan River Trust's *Healthy Rivers Action Plan* (2008) will improve water quality in the Swan-Canning river system by:
 - reducing nutrient and non-nutrient contaminant inputs to the system
 - minimising sediment loads entering the rivers
 - increasing oxygen levels in the rivers
 - protecting and rehabilitating foreshores.
- The State Government has developed a *Fertiliser Action Plan* to improve fertiliser usage through best management practices.
- Water Quality Improvement Plans were prepared for the Swan-Canning (SRT 2009) and Peel-Harvey (EPA 2008) waterways but await funding for implementation.
- *Statement of Planning Policy 2.9: Water Resources* and the principles of better urban water management promote the use of water sensitive urban design at all stages in the land development process (Chapter 7).
- WAPC's *Acid Sulfate Soils Planning Guidelines* (2009) and DEC's *Acid sulfate soils risk maps* (DEC 2008) assist agencies, developers and individuals to achieve best practice environmental management in areas where acid sulfate soils may occur.
- Identification of groundwater-dependent cultural values in the *Study of groundwater related Aboriginal cultural values on the Gnangara Mound WA* (Estill & Associates 2005) was an important input to the development of the *Gnangara Groundwater Areas Water Management Plan, Draft for Public Comment* (DoW 2008c).

5.5 Department of Water responses

The following section outlines the response of the Department of Water to the challenges raised in the chapter on waterway and wetland health. This is comprised of a re-statement of Objective 5 and position statements which explain what needs to happen in response to the challenges. These are followed by the actions which need to be taken in the future.

Objective 5: Restore and protect waterway and wetland health.

Positions

- In its water resources planning and management processes, the department seeks to ensure that essential natural ecological processes and the biodiversity of water-dependent ecosystems are maintained. The water regimes required to maintain the ecological values at a low level of risk are determined on the basis of the best available scientific information (WRC 2000).
- Returning river flows to pre-dam conditions is not feasible for most rivers regulated by public water supply dams on the Darling Scarp. However, some modifications to the flow release regimes (for example, volume, timing) from these dams are needed to improve waterway health downstream.
- Urban and rural drainage networks will be managed in the future for environmental and social objectives in addition to flood protection. Revegetation and other management mechanisms are required to manage contaminants to improve the quality of water discharged to waterways and wetlands from drainage networks.
- The department's water plans will include environmental objectives that support ecological linkages identified through land planning processes, the Perth Biodiversity Project and the South West Biodiversity Project.
- The retention and restoration of riparian buffers and foreshore areas to natural waterways and wetlands should be improved.
- The department supports the implementation of the Swan River Trust's *Swan-Canning water quality improvement plan* (SRT 2009) and the Environmental Protection Authority's *Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System -Phosphorus Management* (EPA 2008).
- The department recognises the importance of identifying and protecting water-dependent Aboriginal cultural values as an integral part of managing the region's water resources.

Actions 2010–2030

22. Determine and require appropriate environmental flow regimes from public water supply dams on the Darling Scarp.
23. Prepare a strategy to determine and manage the desired flows (hydrologic regime) and improve the quality of water discharged from drains to waterways and wetlands including:
 - identification of responsibilities of infrastructure owners
 - targets for water quantity and quality
 - regulatory arrangements for implementation.
24. Implement the *Assessment Framework for Prioritising Waterways for Management in Western Australia* (DoW 2009) to assist in determining regional waterway priorities.
25. Continue to undertake waterway health monitoring and scientific investigations in support of healthy waterway initiatives in the Swan-Canning and Peel-Harvey systems.
26. Identify foreshore areas suitable for reservation through the land planning process and recommend reservation to DoP and local governments.
27. Integrate water-dependent Noongar cultural values into water planning and management in the region and explicitly identify how these have been incorporated.
28. Continue to increase the capacity of department staff to engage with Indigenous issues, while providing ongoing opportunities for Indigenous engagement and employment in water resource management.

6 Water sensitive cities

Objective 6: Create water sensitive cities and towns.

6.1 Urban water management

Future population growth in the Perth and Peel subregions will be accommodated by a combination of urban infill and the creation of new urban areas. Many of the areas identified for new urbanisation are on the urban-rural fringe. North of the Swan River, many of these areas have few available groundwater resources. South of the Swan River, the challenges include the presence of wetlands of conservation significance, high watertables and nutrient legacies from agricultural activities.

Traditional approaches to urban development too often resulted in poor environmental outcomes. Wetlands were replaced by artificial lakes to form the centrepiece of new residential developments. Natural drainage courses were replaced by stormwater drains to quickly remove 'excess' water from the landscape.

Integrated water cycle management offers a new approach to urban development, one that recognises all urban water flows as potential resources. It manages the urban water cycle as a single system which includes water supply, sewerage and stormwater management, water recycling and waterway health.

Water sensitive urban design, also known as urban water management, is used to integrate water cycle management into urban planning and design. Urban water management is committed to increasing the cycling of water within urban areas and reducing the impacts on our waterways and aquifer-dependent ecosystems. It is a significant shift in the way water and related environmental resources and water infrastructure are addressed in the planning and design of urban areas.

Water sensitive urban design principles include the following:

- Protect and enhance natural water systems and their hydrological regimes in urban developments.
- Integrate stormwater treatment into the landscape through multi-use corridors that maximise the visual and recreational amenity.
- Protect water quality by minimising discharges of nutrients and other contaminants to waterways and wetlands.
- Manage run-off and peak flows through local detention measures and by minimising impervious areas.
- Add value while minimising the cost of drainage infrastructure.

The challenge is to apply these new urban water management approaches to all new urban developments and to create 'water sensitive' cities and towns.

6.2 Integrated land and water planning

Integrated land and water planning is the process by which decision-makers at various levels of the land and water planning decision-making processes implement water sensitive urban design and achieve integrated water cycle management. It is the coordinated consideration and implementation of water resource management requirements with other land use planning requirements. In the past, a lack of integrated land and water planning has been one of the major barriers to effective urban water design.

In Western Australia such planning is implemented through *Better Urban Water Management* (WAPC 2008). *Better Urban Water Management* is designed to facilitate better management and use of our urban water resources by ensuring an appropriate level of consideration is given to the total water cycle at each stage of the planning system.

The *Directions 2013: Draft Spatial Framework for Perth and Peel* (WAPC, June 2009a) provides the framework for future growth and development of Perth and Peel within which more detailed policies and programs will be progressively developed and refined. The draft framework recognises *Better Urban Water Management* as the preferred methodology for the implementation of urban water management.

Better Urban Water Management describes how water resources should be considered at each land use planning stage. It identifies actions, investigations and agencies responsible for provision of particular water resource information. Water resource information derived at each planning stage is used to inform the subsequent planning stage. In this way, an appropriate level of consideration is given to integrated water cycle management at each stage of the planning process.

The integrated land and water planning framework will deliver a change in traditional management responses to water resource management issues by facilitating coordinated actions by stakeholders at all levels of the land development process. As part of the *Better Urban Water Management* framework, this Perth-Peel Regional Water Plan provides strategic level guidance to WA Planning Commission on water planning priorities to 2030.

Other recent actions include:

- *Statement of Planning Policy No. 2.9: Water resources* (WAPC 2006) highlighted the planning system's significant role in total water cycle management and water sensitive urban design through its strategic planning and statutory approvals process.
- The Department of Water's *Urban Drainage Initiative* resulted in the preparation of drainage and water management plans for major urban expansion areas. These plans are the Swan Urban Growth Corridor District Water Management Plan; North East Corridor Urban Water Management Strategy; Draft Jandakot Structure Plan Area Drainage and Water Management Plan; Byford Townsite District Water Management Plan; and Southern River Integrated Land and Water Management Plan.

- The *Southern Metropolitan and Peel Sub-Regional Structure Plan* (WAPC 2009a) provides a strategic planning framework with clear direction for the planning and management of urban growth in the corridor to 2031.
- The *New WAter Ways Strategy* (NWWBM, 2009) increased the capacity of state and local government and industry practitioners to implement water sensitive urban design principles.
- The *Stormwater Management Manual for Western Australia* provides guidance on best practices in stormwater management (DoW 2007).
- Natural Resource Management groups and local governments have produced guidelines for the application of water sensitive urban design in their areas.

6.3 Urban density

Changing components of urban form, such as density, can improve the efficient functioning of cities and their environmental performance, although the interaction among variables is complex. Increasing the density of urban developments (R20+) could generate water management benefits, including:

- less residential outdoor water use
- increasing opportunities for third pipe through a greater concentration of services
- more efficient use of water infrastructure
- increased groundwater recharge.

The water management costs and benefits of increased urban density should be included in decisions regarding urban form in the region.

6.4 Department of Water responses

The following section outlines the response of the Department of Water to the challenges raised in the chapter on water sensitive cities. This is comprised of a re-statement of Objective 6 and position statements which explain what needs to happen in response to the challenges. These are followed by the actions which need to be taken in the future.

Objective 6: Create water sensitive cities and towns.

Positions

- Water management objectives should be a key consideration in future land planning, in order to appropriately manage the impacts of urban development on water resources and the environment, with a focus on total water cycle management.
- Urban developments should seek to maintain the hydrological characteristics and water balance within its catchment.

- Drainage plans will direct developers to maximise local retention and management of stormwater in new developments in order to maintain or increase recharge to local groundwater resources.
- The Department of Water will continue to collaborate with the Department of Planning in defining the roles and expectations for state and local government decision-makers, engineers, planners and the development industry under the *Better Urban Water Management* framework.
- The water planning priorities described in the Perth-Peel Regional Water Plan should be considered as part of decisions relating to the finalisation of the *Directions 2031: Draft Spatial Framework for Perth and Peel* (WAPC 2009a).
- The Department of Water strongly supports the creation of guidelines or codes to imbed urban water management at all stages of land development and to evaluate its effectiveness.
- The department recommends that urban planners consider the water management implications of changing urban density and form in the region.

Actions 2010-2030

29. Prepare a subregional scale drainage and water management plan for the Murray River drainage area. The Murray Drainage and Water Management Plan will help determine the extent and nature of urban development in the area covered by the *Southern Metropolitan and Peel Sub-Regional Structure Plan* (WAPC 2009).
30. Complete new or update existing floodplain mapping and floodplain management plans by 2011 for the Murray, Serpentine and Dandalup rivers in that order of priority.
31. Update the floodplain management plans for the Swan, Canning and Helena rivers by 2015.
32. Report on the findings of the department's urban water research and development program.
33. Evaluate and report on the water management costs and benefits of increasing urban density in the Perth-Peel region.
34. Improve the State Water Planning Framework concurrently with the Department of Planning's *Building a Better Planning System* (DoP 2009) initiative to review the land planning system to improve land and water planning links.
35. Develop a GIS base of all plans and policies at a post code level to assist water users, developers, local governments and planning agencies to better understand their requirements.

7 Plan implementation

Table 11 displays the schedule of actions to be undertaken by the Department of Water and partnering agencies. Many of these actions will require additional support and funding to achieve full implementation.

7.1 Engagement processes

Implementing the regional water plan will include the following stakeholder engagement activities:

- The Department of Water will undertake stakeholder engagement as part of all water management planning projects identified in the Action Plan (for example, new allocation plans). These engagement processes will be designed on a project-specific basis.
- The department will put in place a mechanism for the strategic level engagement of peak stakeholder bodies in the process of formulating and implementing water policy in the Perth-Peel region.
- The department will engage with Noongar stakeholders on water resource management issues in the Perth-Peel Region through a Noongar Cultural Advisory Group, as required. The advisory group, to be established by the South West Aboriginal Land and Sea Council (SWALSC), will include regional representatives who have cultural heritage connections in the region, SWALSC as the peak Noongar organisation, and Noongar people with expertise in water and natural resource management. The reference group will also provide a forum for discussions between the Department of Water and the Noongar community with respect to implementation of the National Water Initiative (for example, Indigenous access to water).
- Stakeholder and community engagement will be part of the plan review process described below.

7.2 Plan review

The Department of Water will conduct a full review of the Plan every five years. Reviews will focus on changes (in legislation and policy, the environment, technology, knowledge and public attitudes) that have occurred in the intervening period.

In addition, the Department of Water will issue an annual report card on its website regarding the status of actions in the Plan.

Table 11 Department of Water Action Plan (2010–2030)

Department of Water Action	Completion			Key Partners
	2010–15	2015–20	2020–30	
Objective 1: Take our drying climate into account in all aspects of water resource management.				
1. Develop a new approach for setting and achieving environmental management objectives for groundwater-dependent environmental values on the Gngangara and Jandakot mounds that includes monitoring of climactic conditions and recognition of trends over time.				EPA, DEC
2. Refine groundwater availability estimates through further groundwater investigations and assessments: <ul style="list-style-type: none">• in the Peel subregion to advise south-western and south-eastern corridor development• in the primary recharge area for the Yarragadee aquifer on the north-eastern Gngangara Mound• in the Gingin Groundwater Area.				
3. Increase groundwater monitoring of the seawater interface in coastal risk areas where groundwater abstraction also occurs (for example, Mandurah, Golden Bay, north-west coastal).				
4. Implement the water resource management recommendations of the Gngangara Sustainability Strategy, a cross-government initiative.				GSS agencies – DoW, DAFWA, DEC, DoP, Forest Products Commission, CSIRO
5. Adjust allocation limits for water resources experiencing decline due to reduced recharge, in order to re-establish local water balances. Where needed, progressively reduce public and private water supply allocations to restore water balances. .				
Objective 2: Reduce water demand by using water more efficiently and effectively.				
6. Prepare a water efficiency strategy for the private water supply sector (that is, non-scheme water use). The strategy will contain ways to help private water supply users to achieve water efficiency				Private water supply

Department of Water Action	Completion			Key Partners
	2010–15	2015–20	2020–30	
(incentives), targets for water savings and minimum standard requirements (regulations), expectations on industry groups and relevant departments in guiding water users, the roles and responsibilities of state government agencies and private sector organisations, and information and guidelines on water use.				sectors, DAFWA
7. Continue funding the region's ICLEI Water Campaign™ until 1 June 2011.	2011			
<i>Objective 3: Provide water security for public and private water supply consumers.</i>				
8. Complete investigations of the Yarragadee aquifer recharge zone in the northern portion of the Gngangara Mound. This will include determining management measures to protect water quality in the recharge zone.				
9. Prepare new water allocation plans for surface water and groundwater management areas in the region in the following order of priority: Gngangara groundwater, Murray groundwater, South West Coastal groundwater, Serpentine groundwater, Gingin groundwater, Perth South and Jandakot groundwater, Canning surface water.				
10. Implement water recovery strategies for all over-allocated resources.				
11. Establish mechanisms to provide entitlement holders with a 'share' of the available water resource in all major surface water and groundwater management areas. When the Southern Seawater Desalination Plant comes into operation post 2011 it will contribute to the annual allocation to the IWSS for public supply. A new formula will be needed to replace the current variable groundwater abstraction rule (VGAR), a sliding scale that bases groundwater allocations on the total water (GL) stored in IWSS dams at their peak in October of each year (DoW 2008b).				
12. Continue to implement the department's meter installation program in priority areas (that is, the Gngangara Mound and Gingin).				
13. In collaboration with DAFWA, determine the water supply needs and water availability for the				DAFWA

Department of Water Action	Completion			Key Partners
	2010–15	2015–20	2020–30	
region's priority agricultural areas.				
14. Ensure all public drinking water source areas in the region have up-to-date public drinking water source protection plans by 2020. The priority for development will be aligned with water allocation planning.				DoP, WC
15. Continue to work with WA Planning Commission and Department of Planning and local government planners to have public drinking water source areas included in the Metropolitan Regional Scheme, Peel Region Scheme, local planning schemes and other planning documents, in support of <i>State Planning Policy 2.7–Public Drinking Water Source</i> .				DoP, LGAs
<i>Objective 4: Facilitate the use of alternative sources of water supply.</i>				
16. Coordinate with other state government agencies to establish a transparent and efficient approvals process for alternative water sources, which safeguards the environment, public health and water resources.				WC, DoH
17. Evaluate the feasibility of using managed aquifer recharge to support wetlands, the coastal saltwater interface and urban private supply use.				WC, CSIRO, LGAs, DoH
18. Evaluate opportunities to maximise retention of stormwater via recharge of the superficial aquifer, as a source of non-potable water supply or to support environmental services.				
19. Report on the effectiveness of community bores in new residential estates such as The Green at Brighton.	2010			
20. Develop a Department of Water position regarding the use of community bores.				WC
21. Working in partnership with the Water Corporation, create an online Waterwise Communities Toolkit to promote water conservation and recycling to local government, developers and other users. It will provide access to information on water recycling and wise water use, including the				

Department of Water Action	Completion			Key Partners
	2010–15	2015–20	2020–30	
availability of shallow groundwater, the availability of sources for recycled water, key land planning considerations, alternative water supply solutions and streamlined application and approval processes.				
Objective 5: Restore and protect waterway and wetland health.				
22. Determine and require appropriate environmental flow regimes from public water supply dams on the Darling Scarp.				
23. Prepare a strategy to determine and manage the desired flows (hydrologic regime) and improve the quality of water discharged from drains to waterways and wetlands including identification of responsibilities of infrastructure owners, targets for water quantity and quality and regulatory arrangements for implementation.				SRT, NRM councils
24. Implement the <i>Assessment Framework for Prioritising Waterways for Management in Western Australia</i> (DoW 2009) to assist in determining regional waterway priorities.				SRT, NRM groups
25. Continue to undertake waterway health monitoring and scientific investigations in support of healthy waterway initiatives in the Swan-Canning and Peel-Harvey systems.				SRT, NRM groups, EPA
26. Identify foreshore areas suitable for reservation through the land planning process and recommend reservation to DoP and local governments.				DoP, LGAs, landowners
27. Integrate water-dependent Noongar cultural values into water planning and management in the region and explicitly identify how these have been incorporated.				Noongar Cultural Advisory Group, SWALSC

Department of Water Action	Completion			Key Partners
	2010–15	2015–20	2020–30	
28. Continue to increase the capacity of department staff to engage with indigenous issues, while providing ongoing opportunities for indigenous engagement and employment in water resource management				department staff, Noongar Cultural Advisory Group, SWALSC
Objective 6: Create water sensitive cities and towns.				
29. Prepare a subregional scale drainage and water management plan for the Murray River drainage area. The Murray Drainage and Water Management Plan will help determine the extent and nature of urban development in the area covered by the <i>Southern Metropolitan and Peel Sub-Regional Structure Plan</i> (WAPC 2009b)	2010			DoP, LGAs
30. Complete new or update existing floodplain mapping and floodplain management plans by 2011 for the Murray, Serpentine and Dandalup rivers in that order of priority.	2011			LGAs
31. Update the floodplain management plans for the Swan, Canning and Helena rivers by 2015.	2015			LGAs
32. Report on the findings of the department's urban water research and development program.				DoP, LGAs, NRM
33. Evaluate the water management costs and benefits of increasing urban density in the region.				DoP
34. Improve the State Water Planning Framework concurrently with the Department of Planning's <i>Building a Better Planning System</i> (DoP 2009) initiative to review the land planning system to improve land and water planning links.				
35. Develop a GIS base of all plans and policies at a post code level to assist water users,				

Department of Water Action	Completion			Key Partners
	2010– 15	2015– 20	2020– 30	
developers, local governments and planning agencies to better understand their requirements.				

Appendices

Appendix A — Stakeholder Engagement in developing this draft

Table 12 summarises the roles and responsibilities of government agencies involved in water resource management.

Table 12 Government agency responsibilities in water resource management

Organisation	Responsibilities/Roles
Department for Planning and Infrastructure	Strategic and statutory land planning; infrastructure planning
Department of Agriculture and Food Western Australia	Sustainable agricultural practices; Natural Resource Management
Department of Environment and Conservation	Regulates waste and wastewater discharges; manages conservation areas and wetlands
Department of Health	Manages compliance with drinking water quality guidelines
Department of the Environment and Water Resources (federal)	<i>Water for the Future</i> funds water projects in the areas of climate change, using water wisely, securing water supplies and healthy waterways
Department of Water	Water resource and water industry policy, management and regulation
Economic Regulation Authority	Licences water service providers and conducts inquiries into water pricing and other matters
Environmental Protection Authority	Environmental protection policies
Local governments	Urban water management at a local scale
Peel Development Commission	Promotes sustainable development in the Peel region
Swan River Trust	Advocate and resource manager for Swan-Canning river system
Water Corporation	Public water service provider, sewage treatment, drainage/irrigation services in defined areas
Western Australian Planning Commission	Sets overarching policy for land planning in Western Australia
Wheatbelt Development Commission	Promotes sustainable development in the wheatbelt region, which overlaps with the Perth-Peel region in the vicinity of Gingin.

Water Governance

The Minister for Water Resources is responsible for the sustainable management of the State's water resources. The Minister is supported in this role by the Department of Water. The department is responsible for water policy and planning and the overall management of water resources. This includes the preparation and implementation of regional-scale water plans in Western Australia.

Optimising the management of water resources requires the coordinated efforts of key water stakeholders and the broader community (Figure 13 in following appendix).

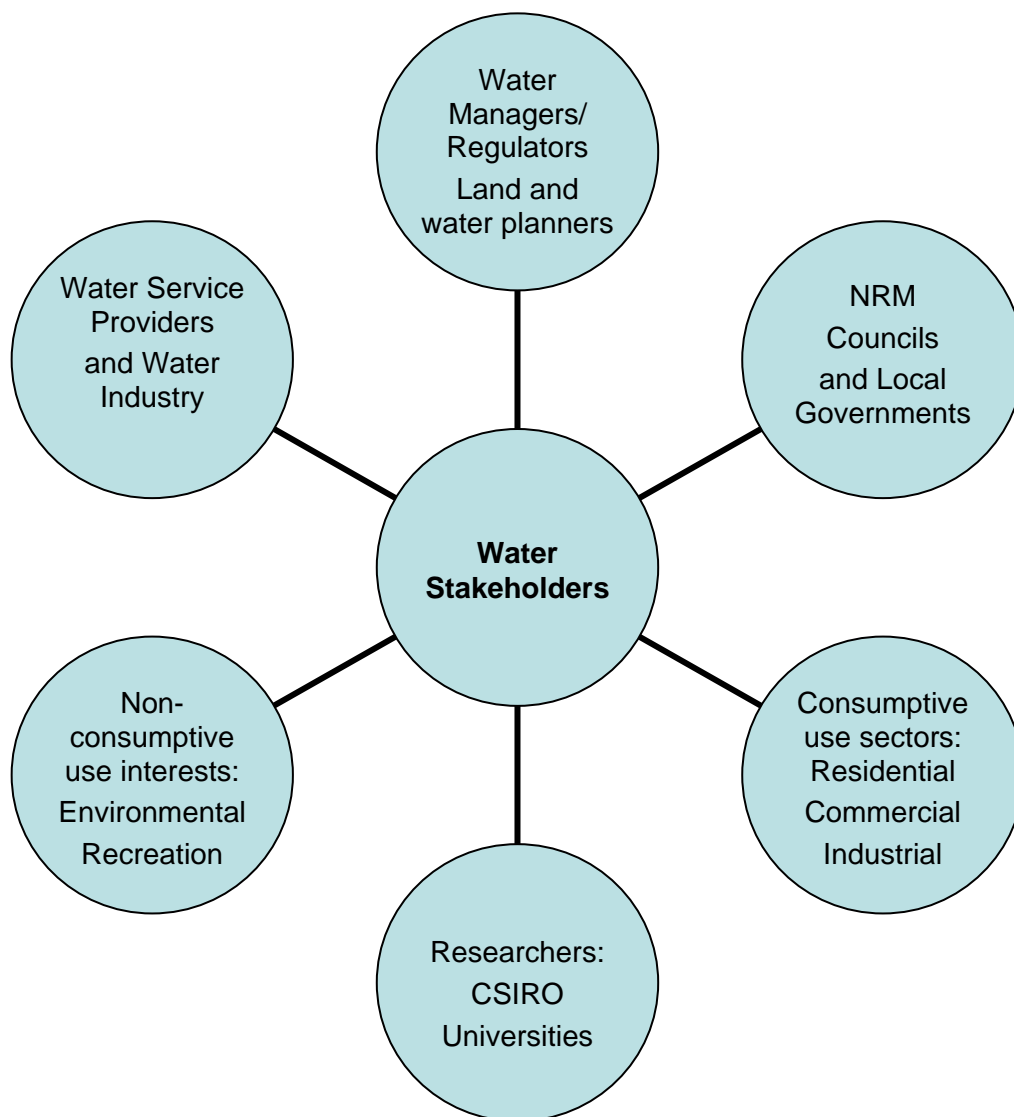


Figure 13 Water stakeholders

Stakeholder engagement

The development of the Plan commenced with an issue scoping exercise with key water stakeholders. The Department of Water then prepared four background papers and a discussion paper:

1. Water efficiency, recycling and alternative water supplies
2. Waterways and wetlands
3. Climate change, water demand and availability scenarios to 2030
4. Land and water planning
5. Perth-Peel regional water plan: A summary of proposed actions for discussion.

These documents formed the basis for a second round of stakeholder consultations in 2009. Representatives of the following organisations participated in the consultation phase for the *Perth-Peel Regional Water Plan: A summary of proposed actions for discussion*.

- Chamber of Minerals and Energy
- City of Perth
- City of Rockingham
- City of Wanneroo
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Conservation Council of WA
- Department of Agriculture and Food Western Australia
- Department of Environment and Conservation
- Department of Planning
- Department of Sport and Recreation
- Department of Treasury
- Department of Water
- Eastern Metropolitan Regional Council
- Environmental Protection Authority's Services Unit
- International Council for Local Environmental Initiatives – Local Governments for Sustainability (Water Campaign)
- Kwinana Industry Council
- Peel Development Commission
- Peel-Harvey Catchment Council
- Perth Region NRM (formerly the Swan Catchment Council)
- Shire of Mundaring
- South West Aboriginal Land and Sea Council (SWALSC)
- Swan River Trust
- Tiwest Joint Venture (Kwinana)
- Urban Development Institute of Western Australia
- VegetablesWA
- WA Farmers Federation
- WA Local Government Association – New Waterways
- Water Corporation

The Department of Water wishes to thank those individuals and organisations that contributed to the discussion paper. Their comments helped formulate this document.

Appendix B — Acronyms and abbreviations

BoM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation
DoH	Department of Health
DoP	Department of Planning
DPC	Department of Premier and Cabinet
DWMP	district water management plan
EPA	Environmental Protection Authority
GSS	Gnangara Sustainability Strategy
ICLEI	International Council for Local Environmental Initiatives
IWSS	Integrated Water Supply Scheme
KIA	Kwinana Industrial Area
KIC	Kwinana Industries Council
LGA	local government authority
MAR	managed aquifer recharge
NRM	natural resource management
PDWSA	public drinking water source area(s)
PHCC	Peel-Harvey Catchment Council
SRT	Swan River Trust
SWALSC	South West Aboriginal Land and Sea Council
VGAR	variable groundwater abstraction rule
WAPC	Western Australian Planning Commission
WC	Water Corporation
WRC	Water and Rivers Commission
WSUD	water sensitive urban design
WWTP	wastewater treatment plant

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 thousand million litres	1 000 000 000 litres	1 Gigalitre	(GL)

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