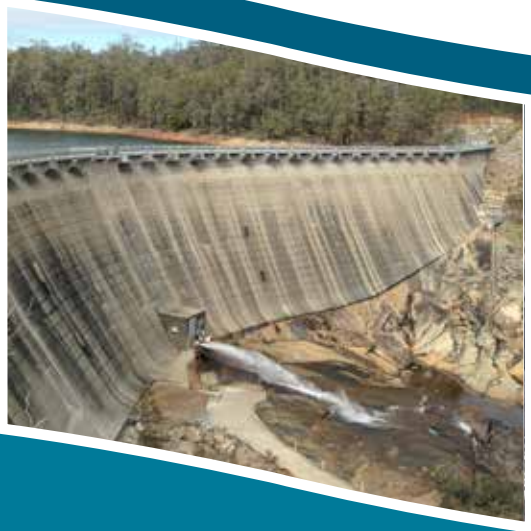
Government of **Western Australia**
Department of **Water**

Lower Collie

surface water allocation plan


Securing Western Australia's water future

Water resource allocation
and planning report series
Report no 47
August 2015

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Message from the Minister

Flowing rivers and reliable irrigation supplies are prime assets for the lower Collie area and have sustained a long history of agricultural and industrial enterprise in this region.

Despite the effects of the drying climate in the South West region, with careful management and innovative approaches, our rivers and reservoirs can continue to provide a valuable water resource and new opportunities for agriculture and industry into the future.

This water allocation plan shows how water is allocated and licensed from the catchments of the Wellesley, Brunswick and lower Collie rivers to provide water security to current and future water users. A key feature of this plan is the improvement to the way water is released from the Wellington Reservoir during the winter months. These carefully considered changes will ensure that the lower Collie River continues to be a healthy environment and an asset to the community for education, recreation, tourism and cultural benefit, as well as continuing to moderate salinity of the reservoir.

The quantity and quality of the water released from Wellington Reservoir is also critical to supplying the Collie River Irrigation District. The increasing salinity of Wellington Reservoir has been limiting the potential of this water resource for irrigated agriculture. As part of the government's commitment under the Water for Food initiative, a $5.7 million project is underway to support development of the Myalup Irrigated Agricultural Precinct and expand the productivity of the nearby Collie River Irrigation District. This project is exploring new ways of treating and using water from Wellington Reservoir as part of a cost-effective water supply system for irrigated agriculture and industry and finding new opportunities for water as a driver for economic growth.

I thank everyone who has helped shape this plan and I look forward to sharing the results of the Department of Water's work on new water options for this area in the near future.

Hon Mia Davies, MLA
Minister for Water

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Summary

Lower Collie surface water allocation plan

The Department of Water is responsible for allocating and licensing the state's water resources.

This *Lower Collie surface water allocation plan* is the Department of Water's first plan to guide the licensing of water from the Wellesley, Brunswick and lower Collie rivers at a catchment scale. This plan shows how allocation limits and licences will provide reliable quantities of water for self-supply water users and the Collie River Irrigation District, and provide sufficient water in rivers for environmental, social and cultural needs.

Purpose of the plan

The Department of Water developed the *Lower Collie surface water allocation plan* to set allocation limits for the plan area, establish winter releases to the lower Collie River and to inform future development decisions in the area, including the potential uses of Wellington Reservoir as a strategic resource for agriculture and industry.

The allocation limits for the Wellesley, Brunswick and lower Collie rivers ensure that taking water is sustainable in the context of the drying climate being experienced in the south-west of Western Australia. This is an important part of maintaining the river environments and contributes to meeting the objectives of the *Leschenault Estuary water quality improvement plan*. The plan also provides current and prospective water users with an assessment of local water availability.

The new operating rules for Wellington Reservoir include changes to the amount and timing of dam releases to the lower Collie River so they are linked more closely to reservoir storage. This adaptive approach to drying climate helps to sustain the environment of the lower Collie River, enables more effective scouring of saline water from the reservoir, and anticipates potential increases in the amount of water taken from the reservoir by setting water sharing rules for dry years.

The allocation plan provides a foundation for other initiatives, such as the Government of Western Australia's Myalup–Wellington Water for Food project, and provides context for the development of new industrial and agricultural water supplies in the area. Modelling completed for the plan shows how future water supplies from Wellington Reservoir may be affected by climate and by the interrelationship between reservoir salinity, river releases and sharing water for multiple uses.

The plan includes actions to support water licensing and to gather information to inform future decisions about the water resources in the area. This includes triggers for re-evaluating allocation limits and the potential for changing releases to the Augustus River (a tributary of the Brunswick River), Henty Brook and the Brunswick River, and triggers relating to future allocation and licensing for Wellington Reservoir.

How the department developed the plan

The plan is based on river yield calculations using long-term river flow data, water licensing information, water use data and the findings of river ecological flow studies. The allocation limits are informed by this science, community feedback and consideration of climate projections and future water demands. For the lower Collie River this included modelling the operation of Wellington Reservoir at its current allocation limit. The modelling results were used to develop the new winter releases from the Wellington Reservoir.

The plan includes small revisions to the allocation limits in the *Lower Collie surface water allocation plan*: Draft for public comment (DoW 2011a) and revisions to the Wellington Reservoir releases following consultation with Harvey Water.

Salinity and water availability from Wellington Reservoir are critical factors and they are concerns for Harvey Water's members and customers. With input from Harvey Water, the winter releases from Wellington Reservoir combine the scouring of saline water while providing variable environmental flows in the lower Collie River.

Allocation and licensing approach

Allocation limits are the department's main tool for guiding licensing decisions and managing water resources at a catchment scale. For the Wellesley, Brunswick and lower Collie rivers we have set allocation limits to maintain a reliable supply for current users who obtain their water from these rivers. These limits allow for some growth in water demand and will sustain the water resource for future use and for the river environment.

The department will issue water entitlements up to the allocation limits set for each part of these river catchments in accordance with the licensing and allocation approach in Chapter 4.

Where river flow is influenced by the operation of dams, as in the case of the Augustus River and lower Collie River, the department will continue to manage the water resource using a combination of allocation limits and licence rules that specify how the dams will be operated to release water.

The allocation limit and current licence entitlement for Wellington Reservoir are not altered by this plan but we will apply updated operating rules to the Wellington Reservoir as described in Chapter 5.

Water availability in the Lower Collie plan area

To manage water allocation, the plan area is divided into 24 resources across the three subareas (Wellesley, Brunswick and Lower Collie and tributaries). Water is available for new or increased self-supply licence entitlements in 16 of the 24 resources. Water from Wellington Reservoir is fully committed at this time.

Most of the available water is in the Wellesley River subareas. Additional surface water may become available in fully-allocated areas as the result of increases in water use efficiency and/or trading of unused water entitlements.

Allocation limits and water availability for subareas at August 2015

Subarea	Total of allocation limits ML/yr	Water available for licensing[1] ML/yr
Brunswick	4165	868
Wellesley River	4620	4173
Lower Collie and tributaries	1894	771
Total	**10 679**	**5812**

1 This is how much water is available for new or increased licence entitlements.

Chapter One

Plan purpose and scope

1.1 Purpose of the plan

The need for the *Lower Collie surface water allocation plan* was identified as one of the priorities for the Department of Water *South West regional water plan 2010-2030: Supporting detail* (DoW 2010a). The *Lower Collie surface water allocation plan* has been developed to ensure that taking water from the Brunswick, Wellesley and lower Collie rivers is sustainable in the context of the drying climate being experienced in the south-west of Western Australia. The plan establishes a set of water resource objectives, allocation limits, licensing rules and actions to guide water licensing at the catchment scale and to support strategic allocation decisions.

The allocation plan provides clarity about water availability for regional industries, including irrigated agriculture, and provides a foundation for considering new water resource options and water supply infrastructure. As part of the department's legislative role in providing for the use of water resources, the plan also protects environmental flows in the local rivers. This contributes to meeting the objectives of the *Leschenault Estuary water quality improvement plan* (DoW 2012) by providing ecologically important river flows and supporting the amenity values of the rivers.

The drying climate presents an increasing risk both to the river environments and to the people and businesses that rely on these rivers as their main source of water. Managing the Brunswick, Wellesley and lower Collie Rivers in accordance with the allocation limits and licensing rules in this plan means that there will be sufficient water for the rivers and to meet current demands for agricultural and other self-supplied water uses. There will also be some water to meet future growth in self-supply demand.

Other water users in the plan area are supplied by Harvey Water which obtains water to supply its Collie River Irrigation District from Wellington Reservoir. This water supply, however, is affected by salinity. The way Wellington Reservoir is operated also influences the environment of the lower Collie River. This allocation plan includes improved operating rules for Wellington Reservoir to achieve both salinity and environmental benefits. The current water entitlement for the reservoir and the way irrigation releases are made are unchanged.

The plan also includes actions and triggers to inform decision-making about the future operation of Wellington Reservoir to take account of the drying climate and the anticipated increase in the use of the reservoir for irrigation and industrial water demands.

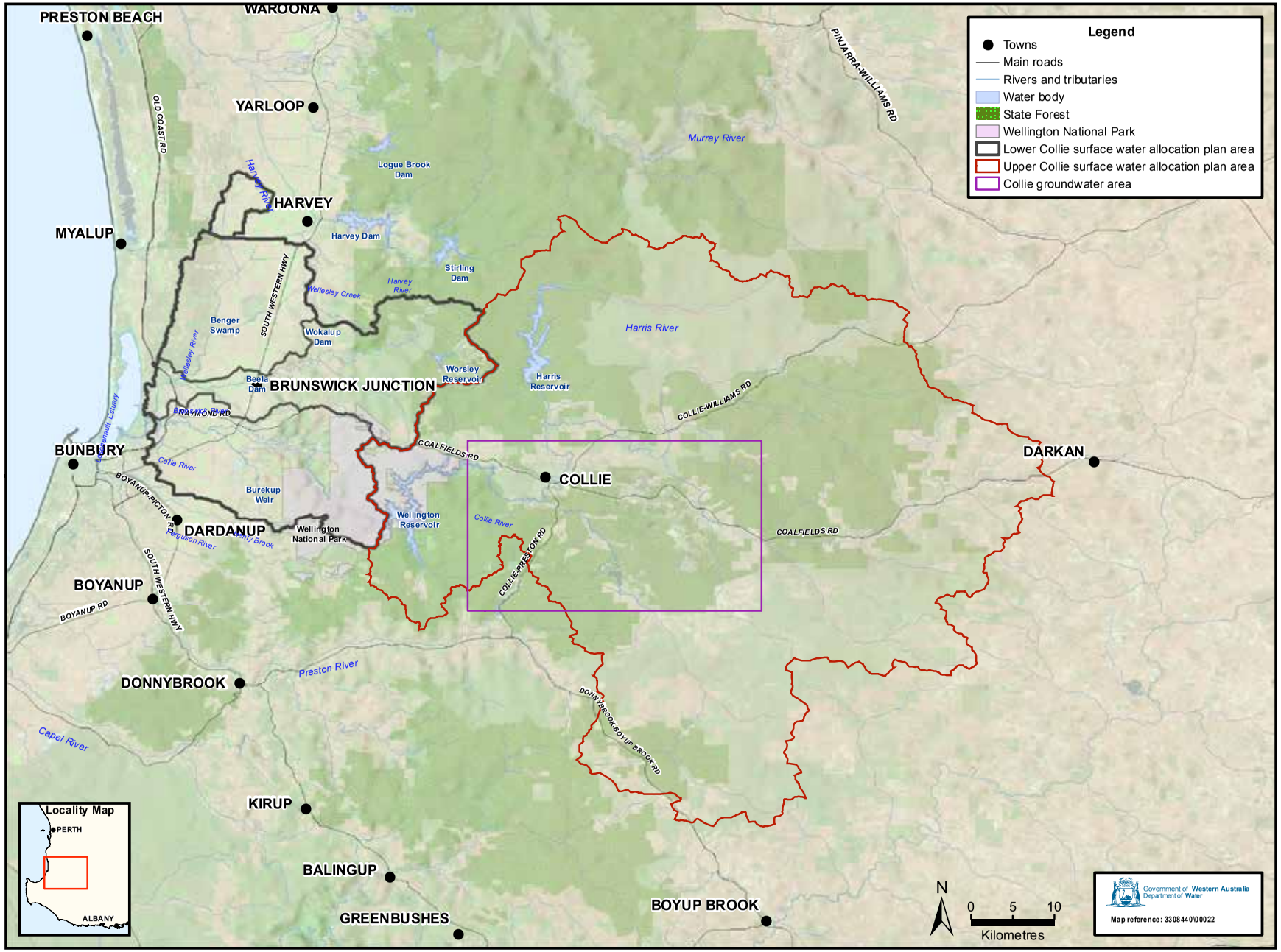


Figure 1

Plan and proclaimed areas

Lower Collie surface water allocation plan

1.2 Plan area

This plan area includes the catchments and tributaries of the Wellesley, Brunswick and lower Collie rivers; an area of approximately 806 km^2, in the south-west of Western Australia (Figure 1). Releases from the Worsley and Wellington reservoirs are also considered in the plan because of their influence on the flows and environments of the rivers.

Nearly all of the plan area is proclaimed under the *Rights in Water and Irrigation Act 1914*, as part of the proclaimed Collie River Irrigation District, the southern part of the proclaimed Harvey Irrigation District and the Brunswick River and tributaries proclamation area. Water users legally require a licence from the Department of Water to take surface water in a proclaimed area, unless the landholder has a riparian right to take water for small scale, non-commercial uses.

1.3 Land use

The area is mostly rural and includes the towns of Brunswick Junction, Roelands and Burekup. The surrounding areas are agricultural with a variety of rural residential developments, farm blocks, and some mining and industrial sites. The plan area includes part of the Wellington National Park, as well as nature reserves, including Benger Swamp and areas of state forest.

Most of the agricultural land in the plan area is used for grazing and horticulture. Water for irrigation is taken from the rivers or supplied by Harvey Water via its Collie River Irrigation District (and a small part of its Harvey Irrigation District). The Collie River Irrigation District is supplied by water released from the Wellington Reservoir and diverted at the Burekup Weir on the lower Collie River. Self-supplied users (those not obtaining water from Harvey Water) take water directly from the upper Brunswick River, Henty Brook and below the Burekup Weir.

The Government of Western Australia's Myalup–Wellington Water for Food project is exploring opportunities to attract private sector investment to increase irrigated agricultural production in the Lower Collie plan area. This may increase the area of land currently irrigated.

The east of Eaton area (west and south of Burekup) is also likely to become more urbanised as part of the anticipated population growth in the greater Bunbury area.

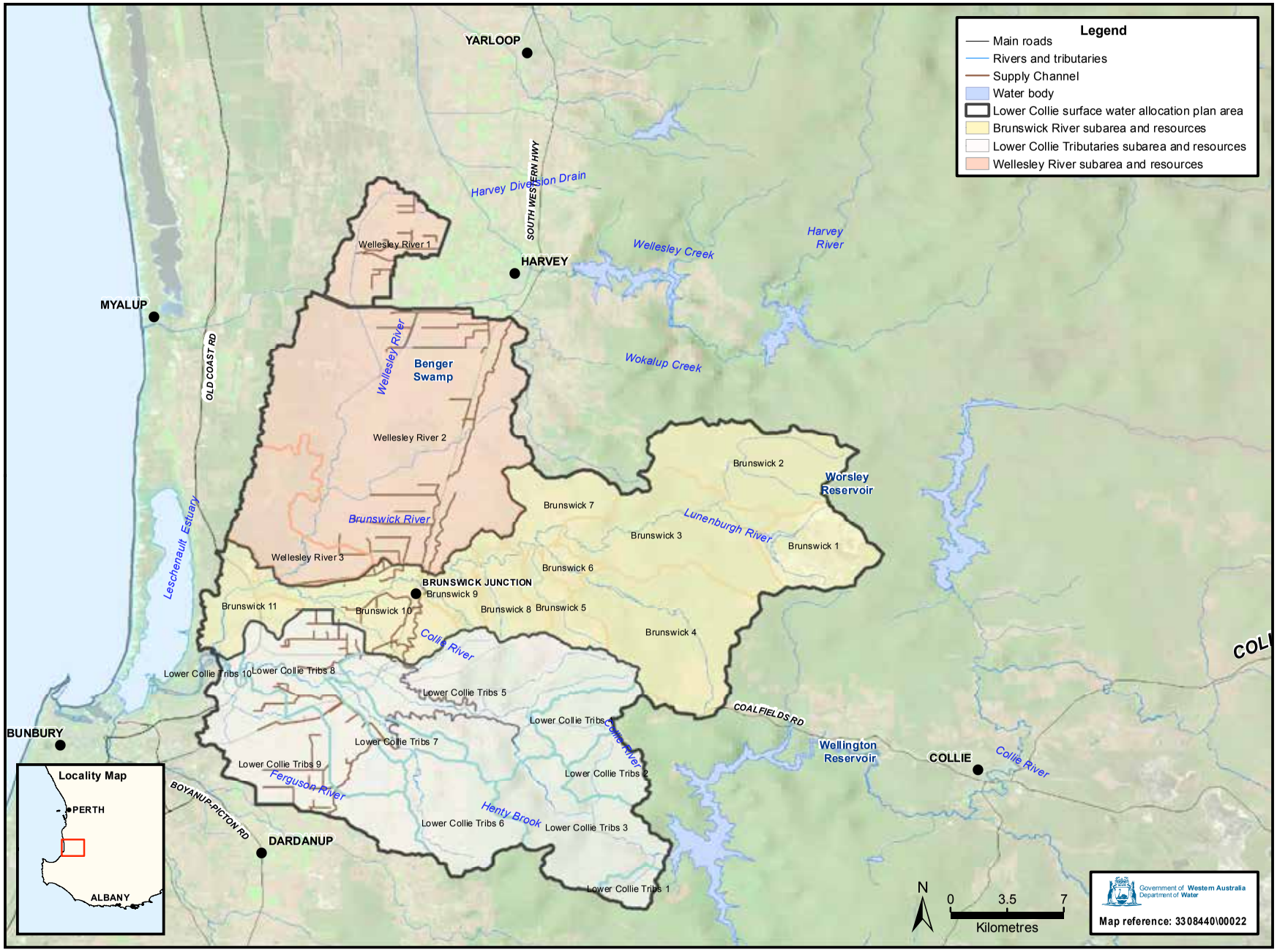


Figure 2
Subareas and resources
Lower Collie surface water allocation plan

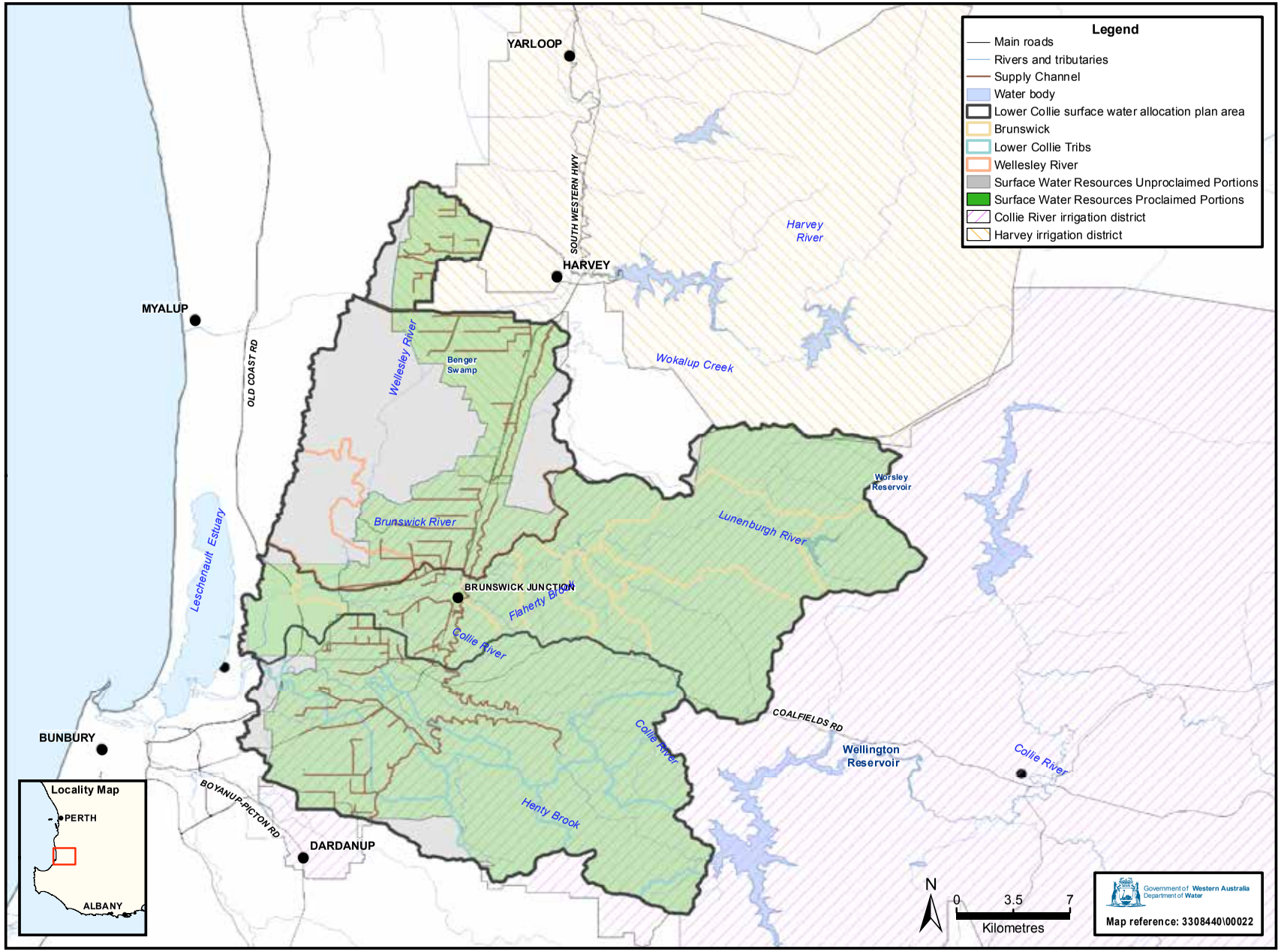


Figure 3

Lower Collie and Upper Collie management areas

Lower Collie surface water allocation plan

1.4 Water resources covered

As well as the main Brunswick, Wellesley and lower Collie rivers, the plan area includes the Augustus and Lunenburg rivers and numerous small tributaries such as the Henty and Flaherty brooks, and Millers Creek. These watercourses flow into the lower Collie River and into the Leschenault Estuary.

For water licensing purposes, the Department of Water divides the plan area into three 'subareas' which are made up of a total of 24 management areas generally referred to as 'resources'. The size and shape of the subareas and resources are based on the hydrological sub-catchment boundaries (Figure 1 and Figure 2).There are:

- ten resources in the lower Collie River and tributaries subarea
- eleven resources in the Brunswick River subarea
- three resources in the Wellesley River subarea.

The rivers and tributaries in the plan area have different flow characteristics and like most of the water courses on the coastal plain between Busselton and Perth, they have been modified for irrigation purposes and the construction of artificial drainage channels (see Figure 2).

In the cleared and uncleared agricultural areas where water is self-supplied and water use is relatively low, rivers generally follow a natural pattern of low or no summer flows and higher winter flows. The rivers in the area support social, cultural and recreational values, and protect river ecology including fish, marron and riparian vegetation.

Flow in the lower Collie River is influenced by summer irrigation releases, winter salt-scouring releases and spills from Wellington Reservoir. Similarly, summer flows in the Augustus River (a tributary of the Brunswick River) are also higher than other nearby rivers because of environmental releases made from the Worsley Reservoir. Elsewhere, such as along the Wellesley River, summer flow can be high where unused irrigation water is returned to the river.

The way the local water resources are accessed and used varies. Most of the agricultural water demand in the area is supplied by the irrigation scheme owned and operated by Harvey Water. Water is released from Wellington Reservoir under a licence held by Harvey Water and is diverted from the lower Collie River at Burekup Weir, supplying more than 40 GL/yr to the irrigation scheme. This water is then distributed by Harvey Water through its Collie River Irrigation District via a network of open channels to Harvey Water's customers.

Considerably less water is licensed to self-supply users taking water directly from the rivers. Approximately 3.5 GL/yr is licensed to user's directly pumping or capturing water in on-stream dams for self-supply. Direct pumping from rivers for small scale stock and domestic use doesn't require a licence from the Department of Water and is estimated to be approximately 1 GL/yr.

Water for bauxite mining is taken directly from the Worsley Reservoir located on the headwater of the Augustus River in the far eastern part of the Brunswick subarea. An average of 2.6 GL/yr is taken from the reservoir for mineral processing.

Public water supply comes from outside the plan area and is delivered by water service providers (Water Corporation and Aqwest). Public water supply systems are not covered by this plan.

1.5 How we developed the plan

The department began work on this plan in 2009. The water resources objectives for the plan are based on community feedback on the social, economic and environmental values associated with the rivers and how these values might be affected by climate and future water demands. The allocation limits for the Wellesley, Brunswick, and lower Collie rivers are based on calculations of how much water the rivers can yield for different water uses. These calculations use long-term river flow data, water licensing information, water use data and the findings of river ecological flow studies.

The plan addresses the need to improve environmental flows in the lower Collie River, which is at risk from a combination of the drying climate and the potential for the reservoir to become fully utilised. Both of these factors would significantly reduce the winter flows in the river as a result of less frequent scouring releases and spills from the Wellington Reservoir. To develop the winter releases from the Wellington Reservoir, we modelled the operation of Wellington Reservoir at its full allocation limit and under different climate scenarios.

The development of the plan also considered how managing water quantity might affect water quality. For example, the updated release rules for Wellington Reservoir have been designed to scour saline water as well as providing water for downstream environmental benefit.

The allocation limits in the plan are informed by the yield calculations to achieve the water resource objectives under future climate and water demand scenarios. The allocation limits provide reliable water supplies and sustain the rivers as viable, healthy water resources.

More information on how we developed the *Lower Collie surface water allocation plan* is described in the *Lower Collie surface water allocation plan methods report* (DoW 2015a). Other work that informed this plan is described in:

- *Surface water hydrology of the lower Collie catchment: supporting information for the Lower Collie surface water allocation plan* (DoW 2011b).
- *Wellington Reservoir water balance simulation: a summary of the Two Res modelling scenarios, Western Australia* (DoW 2011c)

For more information about the allocation planning process, please refer to *Water allocation planning in Western Australia: a guide to our process* (DoW 2011d).

1.6 Stakeholder interests

To start the plan, the Department of Water surveyed stakeholders' interests and values associated with the Collie River and Brunswick River. The interests and concerns included:

- the department's role in catchment and water management
- water supply security
- the reliability of flows for river users
- salinity and the environment
- cultural values linked to flows in the lower Collie River.

The links between water management, water quality and the health of the Leschenault Estuary were also highlighted.

Traditional representatives of the Collie River were also consulted. Traditional cultural values are particularly associated with flowing water in the rivers and the presence of river pools. The lower Collie River plays an important role in the lives of Noongar people both culturally and as a practical source of food, water and recreation.

Our consultation on the plan included:

- Harvey Water – the irrigation service provider
- Water Corporation – the owner and operator of Wellington Reservoir
- local private users (self-supply users, irrigators, commercial users)
- industry representatives (South32 Worsley Alumina Pty Ltd, Bunbury Economic Alliance, South West Development Commission, Southern Cross Water and Infrastructure Pty Ltd, Western Australian Plantation Resources)
- local government (Shire of Harvey)
- local Indigenous elders and traditional representatives of the Collie River
- local environmental groups (Brunswick River Restoration Action Group, Leschenault Catchment Council Inc.)
- other state government agencies (Department of Indigenous Affairs, Department of Agriculture and Food WA, Department of State Development, Department of Parks and Wildlife).

The plan for public comment, released on 25 May 2011, was used to develop the final version of the plan. We received 13 submissions prior to the public comment period closing on 27 August 2011. The submissions were generally supportive and raised several issues, particularly:

- questions about the future security, reliability and quality of water supplied from Wellington Reservoir and the potential for salinity improvement
- the implications of updating the Wellington Reservoir and Worsley Reservoir release rules on reservoir salinity and the sharing of water for supply and the environment
- how future climate projections have been incorporated into future water planning and allocation, and announcements of water availability
- the possibility of a large dam on the Brunswick River.

In response, the plan and the accompanying methods report now include additional explanations and have been expanded with more information on reservoir releases.

A significant part of finalising the plan has involved refining the winter release proposals for Wellington Reservoir. The Department of Water conducted several iterations of reservoir modelling in consultation with Harvey Water, primarily focused on how the releases scour saline water from the reservoir. This has improved the way the releases operate resulting in more flexibility to manage salinity and more precise provision of environmental flows for the lower Collie River.

The plan has also been updated with some small revisions to the allocation limits based on some new data and includes other minor changes to the licensing rules and plan actions.

For further information on stakeholder interests and the public comment responses, please refer to the *Lower Collie surface water allocation plan: Statement of response* (DoW 2013).

1.7 Plan timeframe

The *Lower Collie surface water allocation plan* will remain in effect until it is amended, replaced or revoked by the Minister for Water.

The department will consider replacing this plan in 2022 unless a plan evaluation shows that an earlier replacement is needed. Reasons to consider replacing the plan may include new proposals for water supply infrastructure in the plan area, changes in the anticipated use of Wellington Reservoir, or changes in our assumptions about future climate and reliability of supply.

Chapter Two

What the plan will achieve

The Department of Water is responsible for managing water resources in Western Australia, consistent with the objects of the *Rights in Water and Irrigation Act 1914*.

The first two objects of Part III of the Act are:

a) To provide for the management of water resources, and in particular –

   i. for their sustainable use and development to meet the needs of current and future users; and

   ii. for the protection of their ecosystems and the environment in which water resources are situated, including by the regulation of activities detrimental to them.

b) To promote the orderly equitable and efficient use of water resources.

Through allocation planning, the department determines the amount of water that can be taken from a water resource consistent with the objects of the Act.

This plan establishes the total volume of water that can be reliably taken every year from each of the 24 water resources in the Lower Collie plan area while leaving sufficient water in the rivers for environmental benefit and amenity. This supports the assessment of licences under clause 7 (2) f Schedule 1 of the *Rights in Water and Irrigation Act 1914*.

2.1 Outcomes

The *Lower Collie surface water allocation plan* contributes to the following outcomes:

- reliable water supplies for self-supply users in a drying climate
- sufficient river flows that maintain social and cultural amenity and ecological values in the context of a drying climate and increasing water demand
- optimised sharing of water from Wellington Reservoir in drier years
- continued and effective scouring of saline water from Wellington Reservoir
- transparency for stakeholders about how allocation decisions are made.

2.2 Water resource objectives

The water resource objectives for the Lower Collie plan area are linked to the primary land uses, the importance of water for use, the type of water supply infrastructure and the social, cultural and ecological values of the rivers.

Our main consideration when setting the objectives was the relative importance of making water available for consumptive uses (including in the Augustus and Wellington reservoirs) and providing flow in the rivers for social, cultural and environmental needs.

The department has set three water resource objectives in the plan area, one for each of three resource groups (Table 1).

Table 1
Water resource objectives for the lower Collie plan area

Resource group	Category	Water resource objective	Resources
1	Important for agriculture	A flow regime that supplies authorised use in almost all years and meets the minimum ecological and social requirements.	Wellesley 1, Lower Collie and tributaries 8, 9 and 10
2	Important for agriculture, industry and environment	A flow regime that supplies authorised use in most years and meets minimum and key ecological and social requirements.	Wellesley 2 and 3, Brunswick 1, 5, 6, 7, 8, 9, 10 and 11, Lower Collie and tributaries 3, 5, 6 and 7
3	Important for environment	A flow regime that reflects catchment rainfall and runoff to protect the flow that these resources contribute to downstream areas and to provides minimum and key ecological and social requirements.	Brunswick 2, 3 and 4, Lower Collie and tributaries 1, 2 and 4

2 What the plan will achieve

Resource group 1: Important for agriculture

For these four resources, consumptive water use is the priority and we want to maximise the amount of water available for use and provide water to meet the minimum ecological values and social amenity. The minimum ecological flow requirements are typically maintenance of low flows to provide pool habitat for aquatic fauna.

Resource group 2: Important for agriculture, industry and environment

In this group of 14 resources, both consumptive water use and providing flows for a higher level of social and environmental amenity is a priority. Existing water uses as well as minimum and key ecological requirements are prioritised in most years. Key ecological requirements include providing adequate flow for inundating riffle reaches in the rivers for macroinvertebrate habitat and for fish migration.

The lower Collie tributaries 3 and 5 resources (for the area upstream of Burekup Weir) are important for the environment because of their high social, cultural and environmental value. The flow regime in this part of the river is strongly influenced by spills and releases from Wellington Reservoir. Both of these resources are included in resource group 2 because river flow requirements here must also be compatible with the salinity management and use of water from Wellington Reservoir (refer to Chapter 5 for more details).

Resource group 3: Important for river environment

The six resources in this group are prioritised for their environmental, social and cultural value. They also have low levels of water use and are unlikely to be in demand as water sources. We want to protect more of the river flow regime for environmental and social amenity. This means maintaining **minimum** and **key** ecological requirements in all years, and higher flows in wetter years. The high flows provide for channel scouring and the inundation of river banks within and downstream of the resource.

Measurable performance indicators for these objectives are outlined in Chapter 6.

2.3 Strategies

To meet the water resource objectives of this plan, the department will implement the following strategies:

1. Manage in accordance with the allocation limits set for each of the 24 resources of the plan area (Chapter 3).
2. Issue water licences according to the local and state-wide licensing policies (Chapter 4).
3. Encourage efficient and innovative ways to abstract, use and store water.
4. Licence the updated rules for the operation of Wellington Reservoir (Chapter 5).
5. Monitor and evaluate the implementation and success of the plan (Chapter 6 and Chapter 7).
6. Complete the actions to implement the plan and support future allocation planning in the Lower Collie Plan area (Chapter 7).

2.4 Measuring the success of the plan

We will evaluate the plan regularly to see if the outcomes and resource objectives are being met. To evaluate the plan we will assess:

- progress on implementing the plan
- our licensing and water use data
- the condition of the water resources using monitoring information (Chapter 6).

We will publish the results in evaluation statements at least every three years. Chapters 6 and 7 provide more information about how the department will monitor and evaluate the performance of the plan.

Chapter Three

Water allocation limits

This chapter sets out:

- the allocation limits, for consumptive use, in each resource
- the water to be left in the rivers for social, cultural and ecological benefits.

3.1 Allocation limit

An allocation limit is an annual volume of water set aside for consumptive use from a water resource. In the Lower Collie plan area, the allocation limit represents the total volume of water that can reliably be taken annually from each resource. This water can be pumped directly from the river or diverted and stored for use.

The allocation limit does not include water to be left in the river. The allocation limit is set to ensure there is sufficient water left in the river to support the social and ecological values of the rivers associated with river flow.

The total allocation limit for each of the 24 resources in the plan area (Table 2) is approximately 10 GL/yr for the plan area (not including the upstream Worsley and Wellington reservoirs). The department will allocate water up to the allocation limit for each resource in accordance with the licensing approach and policies described in Chapter 4. Once a resource is fully allocated, the department will refuse applications for new licences (including increases to existing ones). However, other options such as trading and increasing water use efficiency may be available.

Licence applicants are encouraged to contact our South West regional office in Bunbury on (08) 9726 4111 for up-to-date water availability information and to discuss opportunities for obtaining water by trading or from alternative sources. Water availability information is also available from the department's online Water Register at <www.water.wa.gov.au>.

3.2 Components of the allocation limit

For administrative and accounting purposes, the allocation limit is divided into the following components:

- water that is available for licensing:
  - general licensing
  - public water supply licensing
- water that is exempt from licensing
- water that is reserved for future public water supply.

General licensing

The general licensing component of the allocation limit is the total volume of water that can be issued as annual licence entitlements for all uses other than public water supply. The total available for general licensing is approximately 9.2 GL/yr. As at 30 May 2015, there was approximately 5.8 GL/yr still available to be licensed, mostly in the Wellesley River subarea.

Of the 85.1 GL/yr allocation limit for Wellington Reservoir (set in the *Upper Collie water allocation plan*, DoW 2009a), 68 GL/yr is licenced from release at the dam to supply the Collie River Irrigation Area, and 17.1 GL/yr is committed to an industrial and a power generation water supply.

Public water supply

There are no public water supply licences or reserved water for public water supply in the Lower Collie plan area.

Unlicensed use – water use exempt from licensing

The unlicensed use component of the allocation limit is the volume of water set aside for uses that are exempt from licensing under the Act (Refer to Chapter 4 for further information). Approximately 1.3 GL/yr of unlicensed water use is accounted for in this plan.

Details of how we calculated unlicensed use are given in the *Lower Collie surface water allocation plan methods report* (DoW 2015a). In the future, we may refine our estimates of unlicensed use. Because this component is very small, changes to our estimates would have little to no effect on the amount of water available for licensing.

3 Water allocation limits

Table 2
Allocation limits in the lower Collie plan area

Resource	Allocation limit ML/yr	Allocation limit components ML/yr		Status of water availability[1] (May 2015)
		General licensing	Unlicensed (exempt)	
Brunswick 1	2600	2600	0	Fully allocated
Brunswick 2	201	187	14	Available
Brunswick 3	28	0	28	Fully allocated
Brunswick 4	97	53	44	Available
Brunswick 5	342	305	37	Available
Brunswick 6	80	56	24	Available
Brunswick 7	235	183	52	Available
Brunswick 8	256	215	41	Available
Brunswick 9	130	100	30	Available
Brunswick 10	153	51	102	Available
Brunswick 11	43	13	30	Available
Total	**4165**	**3763**	**402**	
Wellesley 1	648	625	23	Available
Wellesley 2	3928	3856	72	Available
Wellesley 3	44	32	12	Available
Total	**4620**	**4513**	**107**	
Lower Collie tribs 1	0	0	0	Unavailable
Lower Collie tribs 2	0	0	0	Unavailable
Lower Collie tribs 3	4	0	4	Fully allocated
Lower Collie tribs 4	43	0	43	Fully allocated
Lower Collie tribs 5	182	60	122	Fully allocated
Lower Collie tribs 6	741	636	105	Limited
Lower Collie tribs 7	374	0	374	Fully allocated
Lower Collie tribs 8	47	12	35	Limited
Lower Collie tribs 9	493	400	93	Available
Lower Collie tribs 10	10	0	10	Fully allocated
Total	**1894**	**1108**	**786**	
Total for plan area	**10 679**	**9384**	**1295**	

1 This status indicates how much of the general licensing component is allocated and if water is available for new licences. Available water is 'Limited' if more than 70 per cent is allocated. 'Available' means less than 70 per cent allocated. Unavailable means that there is no water allocation limit for this resource.

3.3 How the allocation limits were set

The department set the allocation limits for each resource in the Lower Collie plan area after considering calculations of resource yield. The allocation limit for Wellington Reservoir was not reviewed.

The resource yield is a bulk (volume per year) measure of the amount of water that can be abstracted from the rivers while leaving some water for social and cultural amenity and ecological values such as river habitat. For this plan, we calculated the resource yield using a sustainable diversion limit methodology and three site-specific environmental flow studies on the Wellesley, Brunswick and Lower Collie rivers from which an ecologically sustainable yield was derived. The ecologically sustainable yield was divided between the upstream resource areas based on the catchment characteristics and using sustainable diversion limit calculations.

The yield calculations take into account the continuation of the drying climate trend in the south-west of Western Australia. This increases the likelihood that self-supply users will have reliable water supplies into the future by reducing the risk that too much water is allocated and taken from the rivers.

The yield calculations incorporate streamflow projections centred on 2020 of an 18 per cent decline in average streamflow relative to a 1975 and 2007 baseline (CSIRO 2009). Modelling of releases from Wellington Reservoir incorporated climate projections centred on 2030 Department of Water climate projections.

The allocation limits reflect the relative priorities between making water available for consumptive uses and for maintaining flow in the rivers. For most of the resources, the allocation limits are set at or below the calculated resource yield. For five of the 10 Lower Collie Tributary resources, the allocation limits are greater than the resource yield, prioritising the needs of current water users. In these cases the social, cultural and environmental values of the river are provided for and protected through licensing rules (Chapter 4). The updated operating rules for the Wellington Reservoir (Chapter 5) optimise the release of water during the winter for salt scouring and environmental flows in the lower Collie River.

Further information and background on the selection of yield methods, resource yield calculations and the allocation limit decisions for each resource is contained in the *Lower Collie surface water allocation plan methods report* (DoW 2015a).

3.4 Water that is left in the river

The water not included in the allocation limits contributes to flow in the rivers, serving a number of important functions in the river system, including:

- supporting recreational activities such as marroning, fishing, swimming, picnicking, camping and canoeing
- maintaining, connecting and oxygenating river pools that have social and cultural value as well as providing refuges for aquatic animals
- providing habitat, migratory pathways and breeding opportunities for aquatic animals including fish, crayfish and macroinvertebrates
- supporting aquatic and riparian vegetation
- transporting and reducing the concentration of excess nutrients and salts
- maintaining the shape and form of the river environment.

The quantity, timing and variability of river flow (the flow regime) is critically important to these river functions. These functions require a range of specific flow thresholds.

River flow varies from year to year, depending on the annual rainfall and runoff in the river catchments, and the volume of water that is abstracted from rivers and released from reservoirs. As the climate dries and unallocated water is licensed and used, the amount of water left in the rivers and the frequency that flow meets the required thresholds will also change.

The environment of the lower Collie River is particularly valued. The river has adapted to the presence of the Wellington Reservoir and flows downstream of the dam have generally been sufficient to maintain a high quality and varied river ecology. This is a result of the summer irrigation releases, winter scour releases and spills when the reservoir is full.

Water released from the reservoir into the lower Collie River flows through the Wellington National Park. The flow needed to maintain the normal functions of the river over summer is much lower than in winter. Above Burekup Weir, the ecology is adapted to low summer flows and about 2.25 ML/day is needed for the survival of ecological values over summer. The irrigation releases, which can average 250 ML/day, also act to support a range of social activities downstream of the dam.

The long-term survival and health of the river ecology is dependent on varied flow events at other times of the year and flow variability between years. With reducing rainfall and the likelihood of greater use of the reservoir water, incidental flows from scour release and spills will become less frequent and not sufficient to support in-river needs during May to October.

Local licensing policies (Chapter 4) and reservoir operating rules (Chapter 5) to precisely manage and provide the flow regime from May to October in the five resources downstream of Wellington Reservoir now apply. These policies and rules control the way self-supply water entitlements are taken and, in the case of Wellington Reservoir, the volume and timing of releases to the river.

Chapter Four

Water licensing

Water licences are issued under the *Rights in Water and Irrigation Act 1914* to manage and regulate the individual take of groundwater and surface water.

The department uses policies to guide how we assess licence applications and apply licence conditions. Allocation plans specify the local licensing policies that apply in a particular plan area.

This chapter details the policies that apply to licensing in the Lower Collie plan area.

4.1 Legislative requirements

Rights in Water and Irrigation Act 1914

The department manages water on behalf of the state under the Act, which establishes the legislative framework for managing and allocating water in Western Australia.

Water licences

Water users in the plan area require a water licence to lawfully take surface water under Section 5C of the Act. A permit issued under sections 11, 17, and 21A of the Act is required to interfere with the bed and banks of watercourses, including installing pumps or constructing dams.

When assessing a water licence application, the department considers the allocation plan, as well as Clause 7 (2) of Schedule 1 of the Act.

In granting a water licence, the department may apply terms, conditions and restrictions to licences under Clause 15 of Schedule 1 of the Act. This may also include the requirement for an operating strategy.

The department's requirements for altering any licence condition are specified under Clause 24 (1) of Schedule 1 of the Act.

The rights of licensees are covered under Clause 26 of Schedule 1 of the Act. Any decision made on a licence application can be reviewed through the State Administrative Tribunal.

Riparian rights

Riparian rights are defined in the Act under Part III, Division 1B, sections 9 and 10 in a proclaimed area and in Part III, Division 2, sections 20 and 21 in an unproclaimed area. A riparian right grants a person the right to take surface water without a licence, for fire fighting, stock water that is non-intensive (as defined in s21(4)), and/or domestic use in accordance with the Act. This right does not guarantee that water is always available.

Riparian rights do not include the right to obstruct or interfere with a watercourse or wetland.

Compliance and enforcement

The Rights in Water and Irrigation Act 1914 requires people and organisations to acquire appropriate authorisations to take or access water. The department carries out regular compliance monitoring surveys across the state to ensure that the take and use of water is authorised, and is in accordance with the annual water entitlement, licence terms, conditions and restrictions.

Other legislation

In administering the *Rights in Water and Irrigation Act 1914*, we abide by other state and federal legislation.

Environmental Protection Act 1986

Significant development projects may require an environmental impact assessment under Part IV of the *Environmental Protection Act 1986*. This assessment is the responsibility of the Office of the Environmental Protection Authority. The department may refer a licence application to this office if there are potentially significant impacts.

4.2 Water licensing approach

The department's approach to licensing water in the Lower Collie plan area aims to achieve the outcomes and objectives set out in Chapter 2. The department uses the licensing process to allocate the available water up to the allocation limits set in Chapter 3.

First-in first-served

Once government agreements or other obligations are met, the department generally applies a first-in first-served approach alongside other local and state-wide policies when considering applications for water licences. For further information on the first-in first-served approach, please visit <www.water.wa.gov.au>.

The approach to allocating water from the Wellington Reservoir is covered in the *Upper Collie water allocation plan* (DoW 2009a).

Allocating water in low flow (summer) periods

In the Lower Collie plan area low flow periods are from mid-October to mid-June each year[1]. Existing self-supply water users are encouraged to reduce their take during periods of low flow. This can be achieved by improving water use efficiency and by seeking alternative water sources or off-stream storage[2] solutions (see Table 3 for more detail).

1 See *Lower Collie surface water allocation methods report* (DoW 2013) for more detail on low flow management and the winter fill periods, sustainable diversion limits and yield estimates.

2 In a proclaimed groundwater area a licence to construct and take water from an excavation or soak for off-stream storage is required. See the *South West groundwater areas allocation plan* (DoW 2009b) for more information.

Managing the effects of water use

The department requires licensees to manage the effects of their water use on the quality of water in watercourses the Lower Collie plan area. This is to minimise the water quality impacts on other users, the watercourses in the plan area, or the Leschenault Estuary[3].

The department may require the licensee to develop and implement an operating strategy (*Operational Policy 5.08 – Use of operating strategies in the water licensing process,* DoW 2010b). The operating strategy may include requirements to monitor and report on changes in water quality (nutrients, salinity, dissolved oxygen etc.) as part of the licence, and how the effects should be managed.

Land planning changes and subdivisions

Under the *Rights in Water and Irrigation Act 1914* a water licence is not automatically transferred or split between properties when land changes ownership or is sub-divided. Licensees need to contact the department prior to the sale or transfer of the land to ensure that the water licence is transferred to the new owner.

Managing reservoir releases

Water releases from reservoirs are managed through licences issued to the dam operator. Licensing arrangements for reservoirs are described in Chapter 5.

4.3 Licensing policies

Local licensing policies for the Lower Collie plan area

Water licence applications are assessed against the criteria in clause 7(2) of Schedule 1 of the *Rights in Water and Irrigation Act 1914*.

The local licensing policies in Table 3 define specific considerations for licence assessments in the Lower Collie plan area and the Wellington Reservoir.

The local policies apply, either because the local issues are not addressed in statewide policy, or because an alternative, more specific approach is better for managing local issues. Where a local policy within the allocation plan differs from a statewide policy, the local policy in this allocation plan is applied.

State-wide licensing policies

The department's state-wide policies guide our licensing processes and decisions. They ensure that licences are assessed and issued consistently and equitably across the state. These policies can be found on our website at <www.water.wa.gov.au> or by contacting our South West regional office on 08 9726 4111.

3 See *Leschenault Water Quality Improvement Plan,* (DoW 2011b) for more information.

Table 3
Policies specific to surface water licensing in the Lower Collie plan area

Policy group		Policy detail
1. Licence assessment		
1.1	Applications proposing to construct an on-stream dam	1.1.1 The department requires all new on-stream dams with the potential to adversely affect downstream users and the environment to install a low-flow bypass system.
		1.1.2 To assess applications for permits to construct an on-stream dam, the department requires the applicant: • to provide design characteristics (such as location, dam level, surface contours) and the maximum storage capacity of the dam • for large dams (those exceeding 50 000 kL), to provide a capacity survey from a professional surveyor.
		1.1.3 The department may require a licence application to be advertised in a local and state-wide newspaper, at the applicants cost, where it is considered that the impacts of the proposed dam are significant or it is of public interest.
1.2	Applications proposing encroachment of dam water on neighbouring properties	1.2.1 For permit and licence applications where the storage of water encroaches onto a neighbouring property owned by another party, the department will require the applicant to do one of the following before the permit or licence will be granted: • amalgamate all flooded land under a single certificate of title • obtain an easement on the flooded portion of the neighbouring land • enter into a deed of agreement with the affected neighbour and lodge a 'subject to claim' caveat on the adjoining land title.
		1.2.2 For permit and licence applications where the storage of water encroaches onto a publicly owned neighbouring property, the department will require the applicant to do one of the following before the permit or licence will be granted: • purchase or exchange the affected public land from the vestee • lease the affected public land from the vestee.
1.3	Applications proposing to affect low flows	The department will not approve new applications proposing to take water (including by direct pumping) from a watercourse in periods of low flow, unless downstream use and ecological needs can still be met (e.g. by a low-flow bypass).
1.4	Applications in fully-allocated subareas	Once a subarea is fully allocated, the department will refuse applications for new entitlements (or increases to existing entitlements) and will advise on other options such as trading or transfers and efficiency measures.

Table 3 (Continued)
Policies specific to surface water licensing in the Lower Collie plan area

Policy group		Policy detail	
2. Licence conditions			
2.1	Licence conditions in self-supply areas	2.1.1	All new surface water licences may be subject to a condition requiring the installation and maintenance of a department approved flowmeter to measure water use. The frequency of meter readings and reporting requirements will be stated in the licence conditions.
		2.1.2	The licence entitlement is inclusive of water stored, not used, and generally equals the storage capacity of the dams.
		2.1.3	The department may impose conditions on licences that state the times in the year when flows must be allowed to bypass on-stream dams.
2.2	Licence conditions for Wellington Reservoir	2.2.1	The licence to operate the dam includes operating rules to: • link releases to the lower Collie River to storage levels • require use of the bottom offtake value for all releases • specify water sharing arrangements between entitlement holders when reservoir levels are at 115 GL or lower at the beginning of October.
2.3	Licence entitlements for water from Wellington Reservoir	2.3.1	If any of the current commitments to water from the reservoir do not eventuate and the licence applications are withdrawn or refused, the department may reassess: • the allocation limit • the operating rules for the reservoir. This will be done to maintain an acceptable reliability of supply for current and future licences and to meet the water resource objectives of this plan
3. Stock and domestic water use			
3.1	Stock and domestic dams	3.1.1	On-stream dams for non-intensive or non-commercial (stock and domestic[1]) purposes are exempt from licensing to take water, unless they exceed a storage capacity of 8000 kL and/or sensibly diminish the flow.
		3.1.2	The department requires the taking of water from on-stream dams larger than 8000 kL capacity for stock and domestic purposes to be licensed, unless the dams are on a watercourse arising on the property.
4. Managing impacts			
4.1	Environmental impact management	4.1.1	At licence renewal, the department may require licensees with an existing on-stream dam to construct a low-flow bypass system to allow summer flows to bypass the dam, and/or structures that allow the migration of aquatic species.
		4.1.2	As well as a low-flow bypass system, the department may require new on-stream dams to include structures that allow the migration of aquatic species, such as fish ladders.

1 Dams for stock and domestic use generally have a storage capacity of less than 8000 kL.

4.4 Factors that may affect future licensing

The Department of Water developed the *Lower Collie surface water allocation plan* in the context of the current land use, water infrastructure and the water supply and demand situation across the plan area. The main factors that may affect how we license water from the Wellesley, Brunswick and Lower Collie rivers in the future include (but are not limited to):

- changes to the anticipated use and operation of Wellington Reservoir as a result of changing water demands, effects of climate or the development of new salinity management technology
- changes to current recreational and land use development constraints associated with water source protection areas in the plan area
- construction of a piped distribution system in the Collie River Irrigation District
- changes to the releases into the Henty Brook and Brunswick River from the irrigation supply network.

The department will consider these and any other factors when evaluating the *Lower Collie surface water allocation plan* (Chapter 7).

Future changes to Wellington Reservoir

The way Wellington Reservoir is operated is dictated by the interrelated requirements for salinity management, releases to the lower Collie River and the reliability of supply for irrigation and industrial demands (see Chapter 5 for more detail). The department may reassess the licensing of water from Wellington Reservoir and the operation of releases to the lower Collie River subject to the outcome of the Myalup–Wellington Water for Food project. New infrastructure, including new salinity treatment, may require adjustments to the operating rules for Wellington Reservoir.

The Department of Water and its predecessors have been seeking to resolve increasing salinity in Wellington Reservoir since the 1960s. Long-term catchment management through vegetation clearing controls and revegetation has slowed the rise in salinity, but average salinity levels in the reservoir are still around 1100 mg/L. This is constraining agricultural productivity in the Collie River Irrigation District. A number of other options to reduce the salinity of inflows to the reservoir have been examined but, to date, these have not proven feasible or cost effective for development and implementation.

The department is currently exploring water supply options for Wellington Reservoir through the Government of Western Australia's Royalties for Regions funded Water for Food initiative. The Water for Food Myalup–Wellington project is developing investment opportunities and investigating new water resource options to expand the productivity of the Myalup Irrigated Agricultural Precinct and the Collie River Irrigation District. This includes exploring options for reducing the salinity of water supplied from Wellington Reservoir. More information on this project can be found on the Water for Food website <www.waterforfood.wa.gov.au>.

Recreation and land use development for tourism

If recreational and tourism priorities change, the department may reassess the outcomes and water resource objectives of this plan.

The Wellington Reservoir and the Brunswick River (for Beela Dam) catchment areas were designated as public drinking water source protection areas and as a result, some recreational activities and land use developments were not permitted in these areas. Wellington Reservoir and Beela Dam are no longer needed for public water supply. Some of the restrictions have now been removed to create opportunities for recreational and tourism development.

Collie River Irrigation System Planning Project

The Department of Water is supportive of Harvey Water's intent to replace the open water channels supplying the Collie River Irrigation District with a piped system. This would improve the water efficiency of the irrigation system consistent with our licensing approach and our state-wide policy.

Harvey Water has been investigating and developing proposals for replacing the open channel system with pipes in the Collie Irrigation System since 2007. This may be further developed as part of the Myalup–Wellington Water for Food project, as it could offer benefits for agricultural productivity and have the potential to be integrated with new water supply infrastructure for irrigated agriculture. Necessary flows below Burekup Weir would be considered as part of this project.

Water releases into the Henty Brook and the Brunswick River

The department will work with Harvey Water to review the ecological and social water requirements of the Henty Brook and the Brunswick River picnic spot in the context of the likelihood of a drier, warmer future.

Harvey Water diverts an average of 1.8 GL/yr of its water entitlement from the Burekup Weir to the Henty Brook and the Brunswick River. This supports the social amenity of the Brunswick picnic spot as well as supplying water to support flow along part of the Henty Brook for stock and domestic water uses and amenity.

Brunswick River dam concept

The department does not support the construction of a large dam on the Brunswick River at this time. This position is based on community consultation for the Department of Water's *South West regional water plan*, which states that:

> 'In the South West many river systems are already dammed. As pressure increases for 'new' water sources, there could be pressure to build further large scale dams on additional watercourses. Any further large scale damming of the South West's water systems would be detrimental to community and environmental values and generally not supported by the department as other water sources may be more affordable and appropriate' (DoW 2010a).

A Brunswick River dam is not part of the Water Corporation's ten-year strategy *Water forever whatever the weather* (Water Corporation 2011) to drought proof Perth's integrated water supply system.

Chapter Five

Reservoir releases

Along with the current licence to take water for irrigation, it is possible that water commitments for industrial and power generation will take the Wellington Reservoir to full allocation during the timeframe of this allocation plan. Updated operating rules for Wellington Reservoir anticipate the reservoir operating to the current 85.1 GL/yr allocation limit, which, combined with the effects of decreasing rainfall, will reduce the reliability of supply. The update improves the way water is released from the dam outside the irrigation season and how water is shared for water supply, salt scouring and river releases under drying climate conditions.

To improve the volume and timing of flows in the Augustus River, a tributary of the Brunswick River, the department is also investigating the potential benefits and water supply implications of revising the release rules for the Worsley Reservoir.

5.1 The updated rules for Wellington Reservoir

The updated rules for managing Wellington Reservoir consist of:

- release rules – the operating arrangements for irrigation releases (these are unchanged) and new winter releases for reservoir salinity management and environmental flows in the lower Collie River
- an offtake rule – to contribute to the removal of dense, saline water from the bottom of the reservoir, all water taken or released from the reservoir is to come from the lower offtake point on the dam
- water sharing rules – the dam storage triggers which govern how water is shared between future licence entitlements for irrigation releases, industrial demand, power station cooling and winter releases to the river.

The Water Corporation is the owner of the dam and is responsible for the releases from the dam. These are governed by its licence from the Department of Water and the associated water management operating strategy.

Irrigation releases

Releases for irrigation are managed under the licence and water resource management operating strategy held for the reservoir by the Water Corporation. Irrigation releases are made in accordance with Harvey Water's licence to take water from Wellington Reservoir. Any other private commercial or contractual arrangements between Water Corporation and Harvey Water are not affected by this plan.

The current water entitlement held by Harvey Water is for 68 GL/yr from Wellington Reservoir. This includes water losses between the release point (the dam) and the diversion point (Burekup Weir). Harvey Water diverts the balance of its entitlement at Burekup Weir, approximately 13 km downstream of Wellington Reservoir, into the open channel irrigation network of the Collie River Irrigation District.

The irrigation releases are demand driven and commence when irrigators begin ordering water, usually in October when the irrigation season begins. Irrigators order water two to three days in advance of when it is needed and orders from numerous irrigators are aggregated to increase efficiency. The release rate is managed on a daily basis.

New winter release rules

The winter release rules for Wellington Reservoir are made up of three components: daily releases, peak event releases and operator releases. Each component contributes to management of the reservoir salinity, environmental flow targets in the lower Collie River and the reliability of supply from the reservoir (Table 4).

Table 4
Function of the winter releases for Wellington Reservoir

Outcome	Winter release component and function		
	Daily releases	Peak event releases	Operator releases
Salinity management	Daily scouring	Monthly scouring events	Optional, targeted scouring
Environmental flows	Provide minimum river flows	Provide required peak flow events	Optional, additional, peak flow events
Reliability of supply	Releases linked to storage level to limit impact on reliability of supply	Triggered at higher storage levels only	Triggered at higher storage levels only

For operational simplicity, the rate at which water is released is linked to reservoir storage levels. The total amount of water released each month is dependent on the volume of reservoir water stored on the first day of the month from May to October (see Appendix A for the monthly volume of the release components and the associated monthly storage triggers).

5 Reservoir releases

Releases for salinity management

The salinity of irrigation releases made from Wellington Reservoir is critical to irrigators purchasing their water supply from the Harvey Water Collie River Irrigation District.

Since the 1960s water in Wellington Reservoir has become brackish due to increasingly saline inflows from the Collie River East Branch. Outside the irrigation season, the Water Corporation in accordance with the criteria set in its licence from the Department of Water, has reduced salinity levels in the reservoir by releasing saline water from the bottom of the reservoir at the maximum rate of 500 ML/day. These releases lower the salinity of irrigation releases made later in the year. Scour releases were not designed to meet any specific social or environmental flow objectives in the lower Collie River. However, the salinity of the scour water (between 800 and 1600 mg/L) has been within the tolerance range of native fish.

The winter release rules for Wellington Reservoir replace the criteria previously used to trigger the scouring of saline water from the dam. The winter releases have been designed to be as effective as scouring in managing the salinity of Wellington Reservoir. They also combine the benefit of providing environmental flows in the river with operational flexibility in scouring water from the reservoir.

A comparison of the updated release rules and the criteria for scour releases is shown in Table 5. Linking all releases from the reservoir to storage levels has the dual benefit of making winter releases from the dam more predictable and consistent while also offering additional flexibility to the dam operator – particularly through the scheduling of the new peak and operator release components.

Table 5
Comparison of scouring criteria and updated release rules

Criteria for scour releases		Equivalent in updated release rules
Time of year	1 June to 30 September.	1 May to 31 October
Salinity concentration	The base salinity is greater than 1000 mg/L.	Peak event and optional operator releases can be scheduled to target salinity build up.
Salinity profile	The difference between surface and bottom level salinity is greater than 400 mg/L.	
Storage	Storage on 1 October is expected to be greater than 100 GL.	Storage on the first day of the month (May to October).

Releases for environmental flows

The range of daily and peak event release components results in a more variable winter flow regime in the lower Collie River. This mimics the range of flows more typical of unregulated rivers in the region. This in turn will provide the necessary flow thresholds to support the current diversity and increase the resilience of the river ecology under a drying climate.

These releases are not intended to return the river to a pre-dam condition and they are not designed to be sufficient on their own to trigger migration and spawning of larger bodied fish. This will still require episodic peak flows runoff in the catchment and tributaries downstream of the dam, and/or reservoir spills.

The condition of the river and its ecology is ultimately dependent on the frequency and distribution of wetter and drier years. For example, multiple high flow rate events are needed at least once every three years to support recruitment of western minnow and pygmy perch which have short breeding cycles. In drier years, the winter releases are designed to provide a minimal 'survival' habitat for aquatic fauna.

Peak event releases are also triggered by storage. These release events are made at 500 ML/day for the specified number of days and can be made at any time of the month (back-to-back or on separate days).

Optional operator releases are available during July, August and September to scour additional water from the reservoir. The combination of peak event and operator releases allows for a degree of operational flexibility in targeting releases to minimise the build-up of saline water at the base of the reservoir.

River flows below Burekup Weir

Water released from Wellington Reservoir for irrigation is diverted into the channels of the Collie River Irrigation District at Burekup Weir. During the irrigation season there are irregular spills over the weir. This water supports self-supply water users and contributes to the downstream environment.

The minimum summer flow target for the self-supply users and river downstream of the Burekup Weir is 6 ML/day at the Rose Road gauging station (AWRC reference 612043). This minimum flow is expected to provide water, to:

- maintain dissolved oxygen above levels critical to the survival of native fish and crayfish in the pools downstream of the weir
- inundate rocks and wood in the river that provide habitat for macro-invertebrates, which are a food source for native fish
- maintain summer breeding habitat for cobbler and connection with Brunswick River population
- allow downstream carbon movement and maintain connectivity between pools.

Outside the irrigation season, releases and spills from Wellington Reservoir may flow over Burekup Weir and contribute to downstream flows in the lower Collie River. Flow over Burekup Weir are greatest following peak rainfall events that coincide with spills from Wellington Reservoir. These high flows are beneficial because they generally result in channel scouring and inundation of high benches and riparian vegetation.

5.2 Sharing water from Wellington Reservoir

The relative proportion of reservoir water available for consumptive uses (irrigation and future industrial demands) and non-consumptive uses (salinity management and environmental releases) was an important issue for the development of this allocation plan. Achieving the water resource objectives and the outcomes for the lower Collie River requires precise management of the releases from the dam in order to maintain salt scouring and a good level of reliability for water users.

Water in Wellington Reservoir is shared between consumptive and non-consumptive water uses, through a combination of restriction rules that apply to licence holders and the new winter release rules. Both of these water sharing mechanisms are based on reservoir storage, with less water available for all purposes as storage declines. The relative proportion of water for licensed entitlements and winter releases may vary slightly from year to year.

Restriction rules

In accordance with the *Rights in Water and Irrigation Act 1914* the Department of Water can issue directions to reduce water usage in times of water shortage. Water restrictions rules are already an established feature of the water resource management operating strategy for Wellington Reservoir. These rules reduce the water for licensed water users in years when storage is low, ensuring the water is shared and reliability is managed in an orderly and predictable way.

Restrictions are determined and announced by the Department of Water once each year according to the storage level at 1 October. If triggered, the restrictions apply to each water licence for the following 12 months.

The reservoir storage, and therefore likelihood of restrictions, varies from year to year depending on inflows, how much of the reservoir's 85.1 GL/yr allocation limit is taken and how much water is released or spilled. To date, restrictions have not been necessary. This is because water use has been lower than the reservoir allocation limit and inflows have been sufficient to keep storage above the current trigger level of 100 GL.

Figure 4 illustrates how entitlements from the reservoir are restricted when the reservoir is fully allocated. If the reservoir storage is at or above 115 GL on 1 October, there are no restrictions and 100 per cent (85.1 GL) of the licensed entitlements can be taken during the following 12 months. When triggered, licence holders are restricted to taking a percentage of their normal licenced entitlement for the following 12 months. If storage on 1 October was 80 GL, for example, then 60 per cent (about 51 GL) of licensed entitlements could be taken. No abstraction is permitted if the reservoir storage is 25 GL or lower on 1 October. Similarly, no winter releases are required should storage reaches this level during May to October.

The water sharing and winter release rules are designed around a baseline reliability of 75 per cent under a historical climate scenario (equivalent to inflows during 1976–2003) when the reservoir is fully allocated to 85.1 GL/yr.

An initial 100 GL storage level trigger for restrictions, will apply until any further entitlements are approved and used. When the reservoir is fully allocated the storage level trigger will be increased to 115 GL. Interim restriction triggers will apply prior to the reservoir is becoming fully allocated.

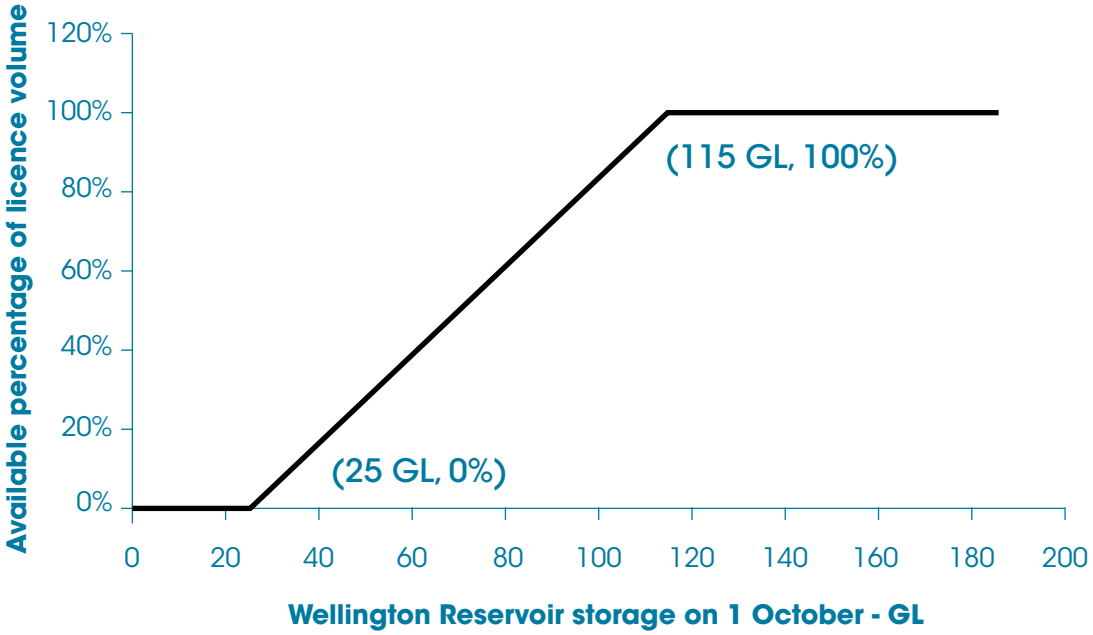


Figure 4
Restrictions to irrigation and industrial water entitlements, when the reservoir is fully allocated

If the 5.1 GL/yr commitment for power generation is issued at 100 per cent reliability, the interim trigger levels will not be directly proportional to annual water entitlements. The department will calculate interim restrictions as additional entitlements are licensed.

Interim restriction triggers will be defined and revised in consultation with the dam operator and licence holders according to:

- the amount of water licensed from the reservoir
- requirements for reliability
- the seasonal demand pattern
- carry-over storage for the following year and water required for releases.

Table 6 illustrates the initial and interim restriction triggers and the associated reliability of entitlements under the historical climate scenario.

Table 6
Initial, interim and fully allocated restriction triggers

Water allocation	Total of water entitlements (GL/year)	Reservoir storage levels that trigger restrictions (on October 1) GL	Reliability if future climate is similar to 1976-2003 (%)
Current irrigation entitlement	68	100	94
Current irrigation entitlement plus 12 GL/yr of entitlements for new industry	80	106	85
Full allocation – current irrigation entitlement plus 12 GL/yr for new industry plus 5.1 GL/yr for power generation (unrestricted)	85.1	115	75

The development of the updated operating rules for Wellington Reservoir includes provision for a 5.1 GL/yr entitlement for future power generation at 100 per cent reliability. In exceptional circumstances, the department may require a temporary restriction on the water used for power generation.

The *Lower Collie surface water allocation plan methods report* (DoW 2015a) provides more detail on the demand scenarios investigated for the reservoir restrictions.

Restrictions on releases to the river

Winter releases to the lower Collie River now vary from a maximum, when the reservoir is nearly full, down to a minimum when storage is above 25 GL (Table 7). All releases to the river cease if the reservoir storage is below 25 GL at the start of the month in May to October.

Table 7
Variations in the winter releases from Wellington Reservoir

Component	Winter releases		
	Storage trigger and timing	Minimum[2] total release per month (GL)	Maximum[3] total release per month (GL)
Daily releases[1]	> 25 GL during May to end October	0.45	9.3
Peak event releases[1]	> 55 GL during June to end October	0.5	3.5
Operator releases	> 40 GL during July to end September	0.3	6.5

1 Daily and peak event releases are not cumulative – the release each day is the minimum of the daily release and a maximum of 500 ML/day. The total amount of water released each month ranges from 450 ML to a maximum of 10 700 ML.

2 Assuming the minimum release each month.

3 Assuming the reservoir is close to being full at the start of each month.

5.3 How the updated rules for Wellington Reservoir were developed

To find optimal rules for managing the reservoir the department simulated different water sharing and release rules using a specially developed water balance and salinity model of Wellington Reservoir. These simulations focused on the release of water from the dam to the lower Collie River outside the irrigation season during May to October.

The goals of the modelling exercise were to develop:

- winter releases that are at least as effective at managing salinity as the scour releases
- a winter releases regime that provides a mix of daily minimum flow with some high flow (peak) events each month during May to October
- updated rules for the operation of Wellington Reservoir that meet the salinity and environmental flow objectives (Chapter 3) and maintain sufficient storage to meet all licensed entitlements in most years.

Different winter release rules were developed, tested against these goals and iteratively adjusted.

Optimising the rules for salinity management

Relative to a hypothetical scenario where no scour releases are made from the reservoir during May to October, the department's modelling shows that scour releases reduces average reservoir salinity by approximately three per cent. In comparison, the new winter release rules have been simulated to reduce average reservoir salinity by approximately nine per cent. Similarly, irrigation supply salinity is reduced by an average of five per cent with the previous scour rules, and eight per cent with the new winter releases.

The salinity of the water supplied and released from the Wellington Reservoir is influenced by the dam offtake point used to take water from the reservoir. Water from the bottom level offtake on the dam wall is more saline than water from the middle level offtake.

The new offtake rule means that irrigation releases and new or additional water commitments are supplied from the bottom level offtake on the dam (or other supply infrastructure at a similar level) so that water taken for one licensee does not affect the water quality for other licensees. This offtake rule applies as a condition on licences for water supplied from the reservoir. Releases to the river will be made from the lower level offtake using the updated release rules. This scours saline water from the bottom of the reservoir.

Salinity of water supplied or released from the reservoir varies considerably throughout the year and from year to year depending on seasonal conditions. This is shown in the modelling results presented in the *Lower Collie surface water allocation plan methods report* (DoW 2015a). The effect on salinity from the winter release rules and the offtake rule is illustrated in Figure 5. The winter releases can result in reduced salinity in the irrigation supply relative to the scour releases and to a hypothetical no-releases scenario.

The Department of Water will work with the Water Corporation and Harvey Water to monitor the effectiveness of the winter release rules (refer to Chapter 7).

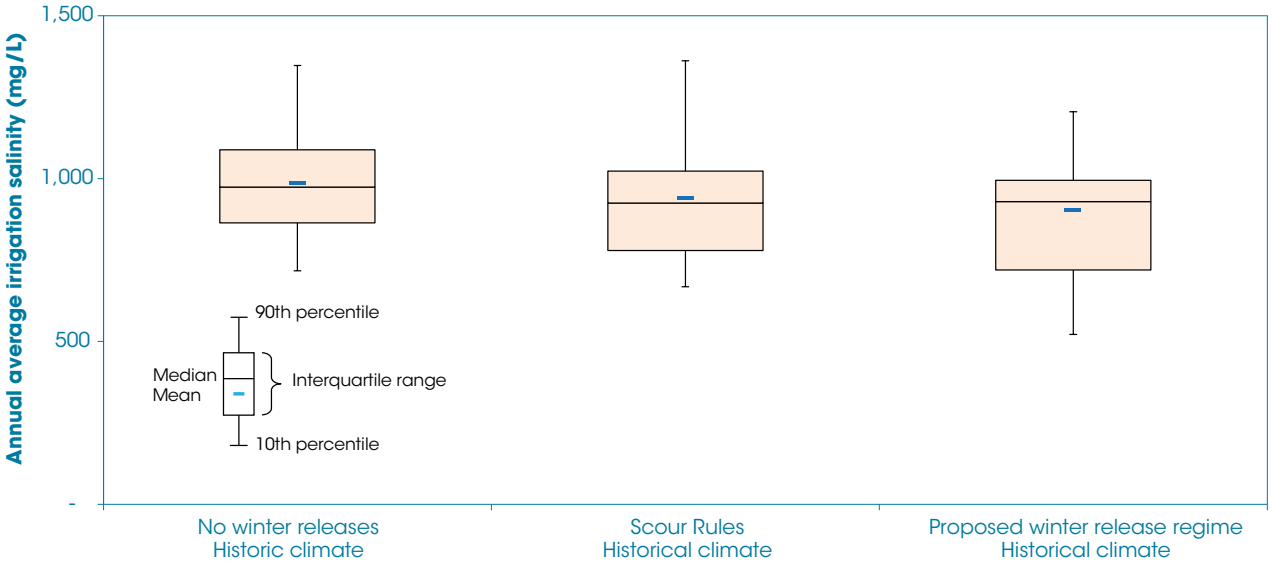


Figure 5
Wellington Reservoir operating rules and salinity of irrigation releases

5 Reservoir releases

Winter releases

The distribution of releases from June to October is based on achieving the environmental flow thresholds in the lower Collie River between the dam and the Burekup Weir, as identified through environmental flow studies. The release regime has been designed to mimic the distribution and frequency of flow events (but not the magnitude) in the flow series from the Mungalup Tower gauging station upstream of Wellington Reservoir.

The release rates are based on achieving target flows and depths of water needed to maintain diversity and improve the abundance of endemic native fish, benchmarked to the median inflow year to Wellington Reservoir and the following flow thresholds:

- A minimum daily release of 15 ML/day is required to inundate gravel runs and riffles which provide winter habitat for aquatic macro-invertebrate and forage habitat for fish (Bennett & Green 2011).
- 406 ML/day is required to maintain active channel morphology, scour pools and prevent incursion of terrestrial vegetation, as well as inundate aquatic and trailing vegetation as habitat for invertebrates and vertebrates and as spawning sites for fish and amphibians (Bennett & Green 2011).
- 518 ML/day is required for upstream migration of small-bodied fish during spawning season, or the flow threshold of 728 ML/day (500 ML/day release plus tributary inflows) required for upstream migration of cobbler (Bennett & Green 2011).

The timing and volume of daily releases and the number peak event releases vary depending on the volume of storage in the Wellington reservoir (see Appendix A). The releases are also linked to the critical storage levels in Wellington Reservoir such as the minimum storage volume that triggers restrictions (that applies between 25 GL and 115 GL storage on 1 October).

The daily release component is designed to provide the minimum flow threshold of 15 ML/day. Daily releases also mitigate the rapid decline in flows in the lower Collie River that can occur in the period between the end of summer irrigation releases and the onset of winter inflows from tributary creeks.

The peak event releases are based on the observed number of peak flow events (above 800 ML/day and less than 1200 ML/day) observed at the Mungalup Tower gauging station. Up to eight releases of 500 ML/day can occur each month depending on the reservoir storage level. Making peak releases in sequences of two, three or four days to coincide with runoff from tributaries downstream (such as Falcon and Stone brooks) maximises the environmental benefit in the lower Collie River.

A maximum monthly volume has been allocated to the dam operator for salt scouring of the reservoir. These are the residual of the target environmental water provision after accounting for the daily and peak event release components, and are made at the discretion of the operator.

5.4 The allocation limit for Wellington Reservoir

Reservoir modelling for the *Lower Collie surface water allocation plan* shows how the reliability of the reservoir will change as the climate dries in the south-west of Western Australia. This is an important consideration when assessing requirements for water supply. Prior to current or new licence applications for Wellington Reservoir being processed, the department will discuss the likely reliability of the water supply with the proponent and may re-evaluate the yield of the reservoir (see Table 10 – Actions to support future planning).

Changes in the reliability of the reservoir are driven by declining rainfall resulting in lower average reservoir inflows. Figure 6 shows recorded flows at the Mungalup Tower gauge which records approximately 90 per cent of the inflows to the reservoir. Average flows at Mungalup have declined from about 101 GL/yr to less than 64 GL/yr in the last decade. The department's modelling indicates that flows at Mungalup Tower could average approximately 68 GL/yr by 2030. Under this scenario, total inflows to Wellington Reservoir would average approximately 80 GL/yr.

The 85.1 GL/yr allocation limit can be supplied in approximately 75 per cent of years, and as the climate dries it is likely to be available less often into the future (Figure 7). Reservoir simulations show that, based on the historical sequence of inflows, the allocation is available in 24 out of 32 years. Under a median drying climate scenario, the same sequence of inflows would result in the allocation limit being available in 10 out of 30 years. The importance of reliability of supply will be subject to the nature of water use, and availability of alternative supplies.

Variations in reservoir inflow mean that the amount of water supplied each year will also vary. A simulated mean annual water balance for the reservoir is illustrated in Figure 8. This shows how much water flows into the reservoir and the relative proportions of the water supplied, released and spilled. Under the median climate scenario, the average supply for irrigation, industrial and power generation demands totals 57.4 GL/yr. This compares with average winter releases totalling 11.5 GL/yr (assuming the optional operator releases are also made). Under this scenario, average winter releases are approximately one fifth the volume of the water available for water supply purposes.

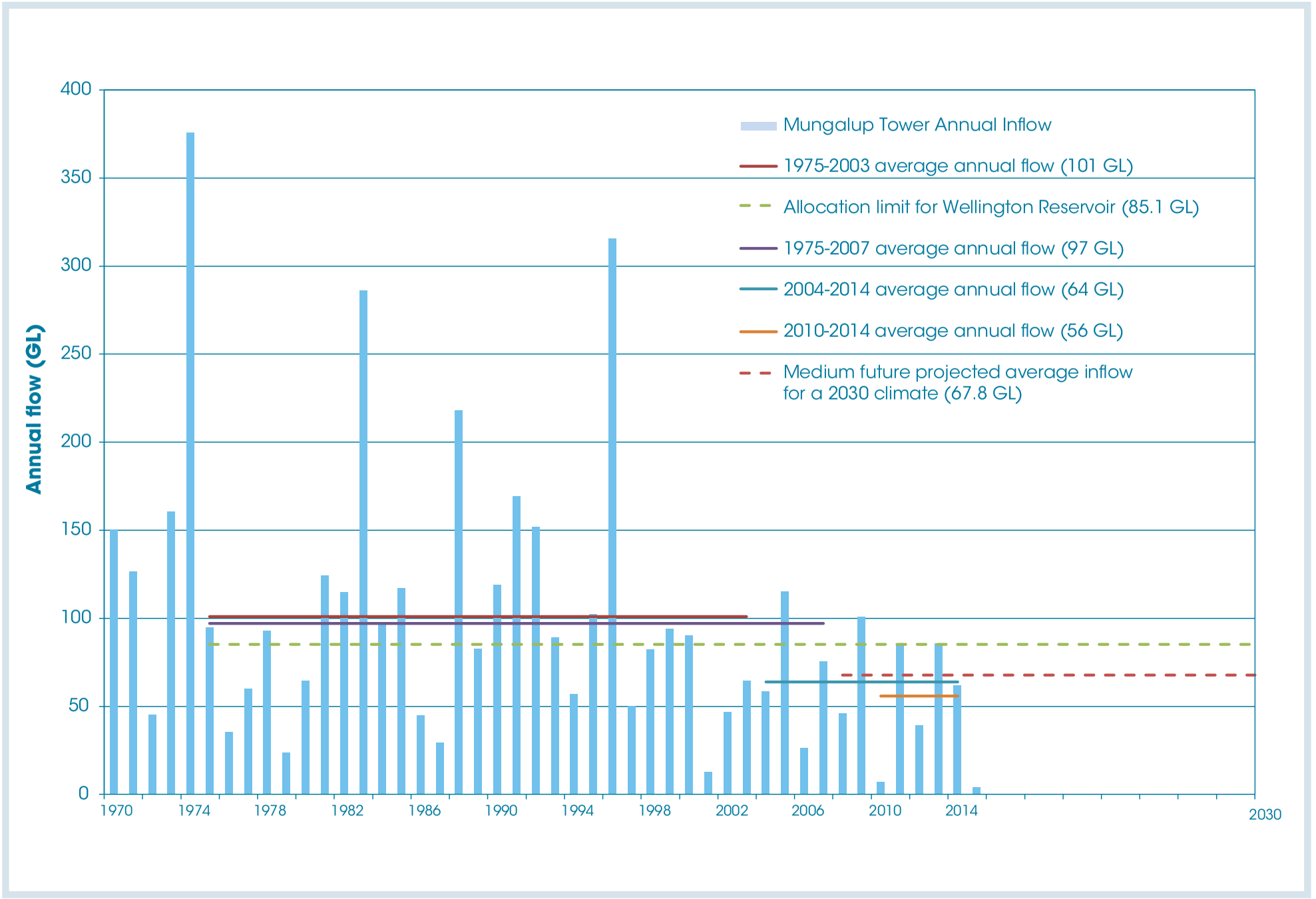


Figure 6
Inflows to Wellington Reservoir (Mungalup Tower)

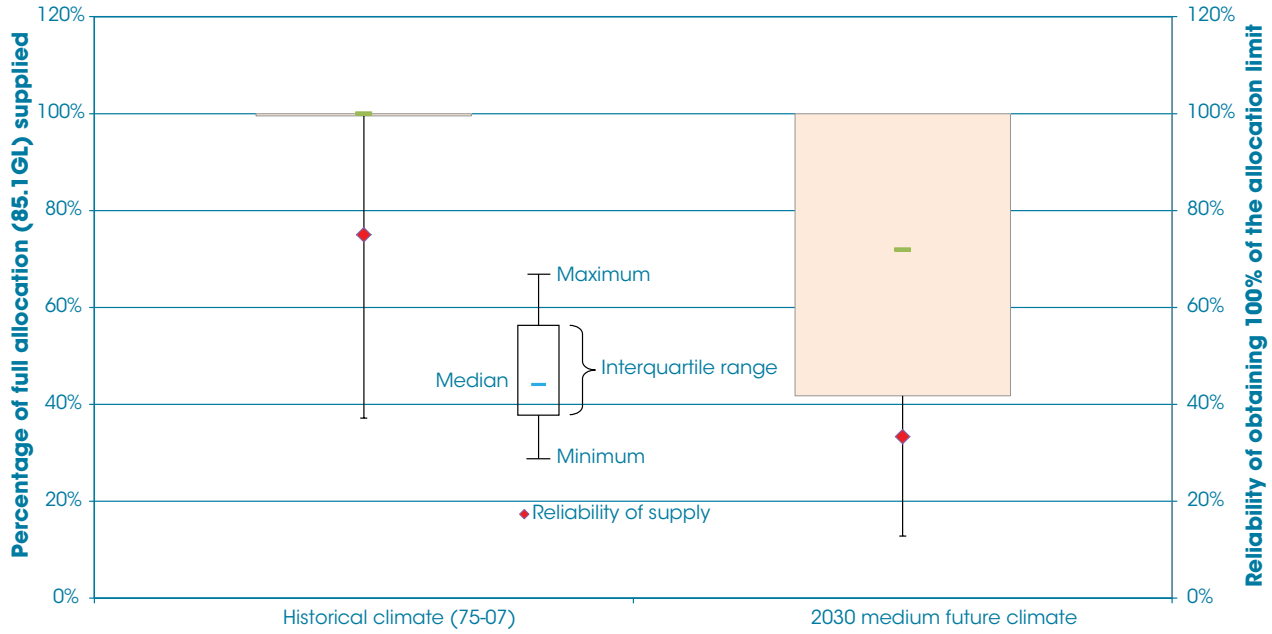


Figure 7
Simulated water supply from Wellington Reservoir at full allocation

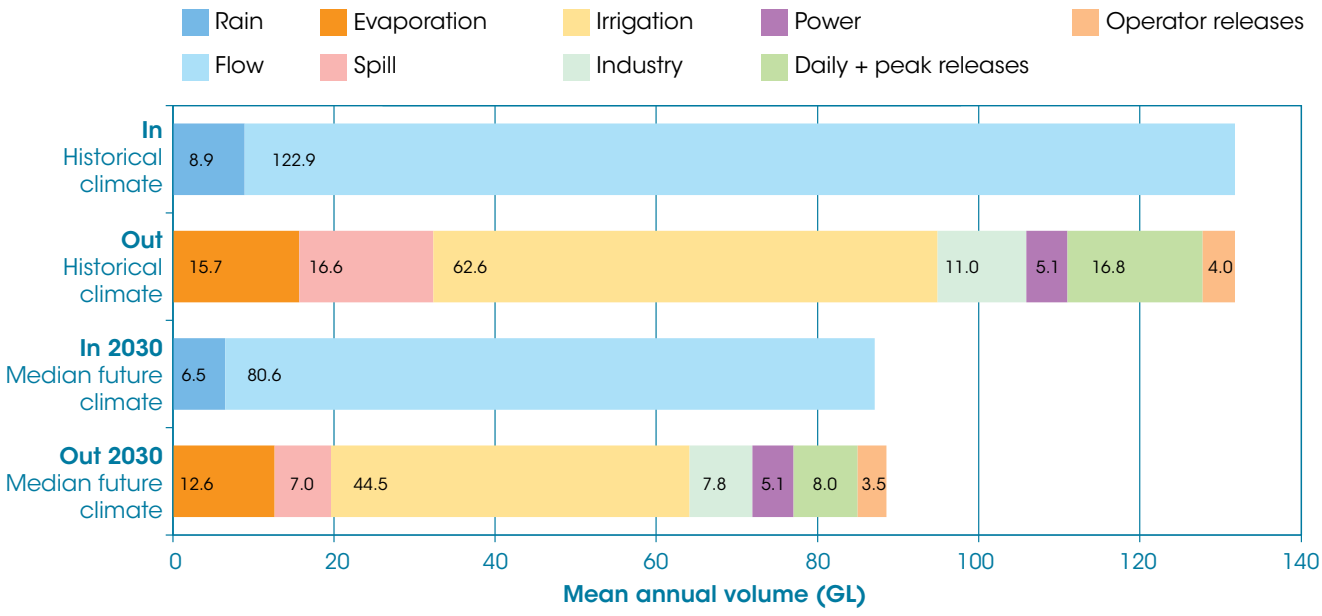


Figure 8
Simulated water balances for Wellington Reservoir

5.5 Releases from Worsley Reservoir

Worsley Dam was constructed on the Augustus River in 1982 and the reservoir has a storage capacity of 5.2 GL. The reservoir water is used for mineral processing by South32 Worsley Alumina Pty Ltd. Water is also released from the dam in the summer to provide environmental flows in the Augustus River.

Operation of Worsley Reservoir is managed under a water licence, which allows the take of 2.6 GL/yr on average over ten years. Since 1996 a condition on the licence held by South32 Worsley Alumina Pty Ltd has required a release of water to the Augustus River at the rate of 35 m^3/h from 1 December to 28 February (about 0.07 GL/yr). Outside this period there is no requirement to release water. The release was intended to maintain downstream ecological values in the Augustus River but in practice it provides a permanent summer flow between December and the end of February downstream of the dam. This artificial summer flow regime is not typical for this type of small river in the region.

The Department of Water is proposing to change the current releases from the Worsley Reservoir to reflect patterns of rainfall and runoff that are more typical of other rivers in the local area. This would improve the climate resilience of the Augustus River if the summer releases are greatly reduced or cease as a result of increased water supply demand and reducing inflows to the reservoir. The department's intention is that summer releases will be reduced and winter releases will be introduced. Releases will be linked to reservoir inflow and storage (or other water quality parameters). Baseline monitoring has been carried out during the development of this plan and is informing discussions with South32 Worsley Alumina Pty Ltd.

Chapter Six

Monitoring program

This monitoring program sets out how the department monitors water resources in the plan area. It tells us how the resources are performing over time and in particular, how they are responding to abstraction and climate change and whether we need to adapt our management of abstraction.

6.1 Evaluating resource objectives

The department will regularly review river flow data and carry out ecological monitoring to determine whether the plan's resource objectives are being met. The monitoring and performance indicators are shown in Table 8.

Table 8
Monitoring and performance indicators in the plan area to assess resource objectives

Priority	Water resource objectives	Resource	Performance indicators	Performance measure
Important for agriculture	A flow regime that supplies authorised use in almost all years and meets the minimum[1] ecological and social requirements.	Lower Collie 8 Lower Collie 9 Lower Collie 10	Dry season low flow downstream of Burekup Weir	Number of days between November and April that flow is 6 ML/day or more at Rose Road flow gauging station (612043).
		Wellesley 1	Dry season low flow in the Wellesley River	Number of days between November and April when flow is less than 1.7 ML/day at Cross Farm gauge (612032).
Important for agriculture, industry and environment	A flow regime that supplies authorised use in most years and meets minimum and key ecological and social requirements.	Brunswick 1 Brunswick 5 Brunswick 6 Brunswick 7 Brunswick 8 Brunswick 9 Brunswick 10 Brunswick 11 Wellesley 2 Wellesley 3	Seasonal pattern of flow in Augustus River by 2017	Compare season flow pattern at the Augustus River gauge (612024) with season pattern at Hamilton gauge (612004).
			Dry season low flow in Brunswick and Wellesley River	Number of days each year that flow is greater or equal to 1.7 ML/day at Cross Farm gauge (612032).
			Winter flows in the Brunswick and Wellesley rivers	Number days per year that flow is greater than or equal to 22 ML/day on the Brunswick River at Cross Farm gauge (612032) for: • 3 or more consecutive days (migration) • 20 or more consecutive days (spawning).
		Lower Collie 3 Lower Collie 5 Lower Collie 6 Lower Collie 7	Dry season minimum flow downstream of Burekup Weir	Number of days in the dry season that flow is less than 6 ML/day at Rose Road gauge (612043).
			Wet season minimum flow upstream of Burekup Weir	Number of days in the wet season that flow is greater than or equal to 15 ML/day at the Wellington Flume gauge (612013).
			Wet season peak event flows upstream of Burekup Weir	Number of peak event flows (500 ML/day) of two or more consecutive days at the Wellington Flume gauge (612013).

1 The *Lower Collie surface water allocation plan methods report* (DoW 2015a) defines the 'key' and 'minimum' ecological objectives for the lower Collie and Brunswick rivers.

Table 8 (continued)
Monitoring and performance indicators in the plan area to assess resource objectives

Priority	Water resource objectives	Resource	Performance indicators	Performance measure
Important for environment	A flow regime that reflects catchment rainfall and runoff to protect the flow that these resources contribute to downstream areas and to maintain minimum and key ecological and social requirements.	Brunswick 2 Brunswick 3 Brunswick 4	Minimum dry season flow in Brunswick River	Number of days in the dry season when flow is greater than or equal to 1.7 ML/day at Cross Farm gauge (612032).
			Key flows[2] in the Brunswick River for most of the year	Number of days in wet season when flow is greater than or equal to 22 ML/day at the Cross Farm gauge (612032): • 3 or more consecutive days (migration) • 20 or more consecutive days (spawning).
		Lower Collie 1 Lower Collie 2 Lower Collie 4	Achievement of key winter flows in the lower collie EWR site	Water depth in the EWR study reach, that inundate and connect: • riffle habitat • spawning habitat in August/September • fish passage.
			Inter-annual seasonal pattern of flow in lower Collie River	Comparable inter-annual and seasonal proportion of annual flow at Mount Lennard's[3] gauging station with that at Mungalup gauge.
			Diurnal minimum dissolved oxygen in pools upstream of Burekup Weir	Diurnal minimum ≥ historic minimum.
			Diversity and abundance of endemic freshwater fish	Monitor the diversity of species in lower Collie River Monitor change in the abundance of freshwater fish against baseline.
			Evidence of recruitment	Age structure that includes young of year and sub-adults (+0, +1, +2 fish).

2 A flow that maintains dissolved oxygen above thresholds known to cause stress in fish and other aquatic biota.

3 Proposed for re-opening as part of this allocation plan

6.2 River flow monitoring

The department has periodically operated 20 streamflow gauging stations on rivers in the Lower Collie plan area since 1939. Gauging stations are also operated by Water Corporation and South32 Worsley Alumina Pty Ltd to fulfil conditions of their surface water licences.

We will review monitoring data from the following gauging stations to determine whether the water resource objectives are being met:

- Brunswick River, Cross Farm (612032)
- Brunswick River, Sandalwood (612022)
- Collie River, Rose Road (612043)
- Hamilton River (612004)
- Augustus River, operated by South32 Worsley Alumina Pty Ltd (612024)
- Collie River, Wellington Flume, operated by the Water Corporation (612013)
- Wellesley River, Wellesley (612039)
- Mount Lennards (612006).

The locations of the gauging stations are shown in Figure 9.

6.3 Water quality monitoring

Our water quality monitoring of the pools in the lower Collie River include logging of dissolved oxygen, temperature, pH, conductivity and turbidity. These data will be used to further develop the monitoring program to include measurable indicators based around diurnal variation in oxygen and minimum oxygen levels as a result of the release regime.

6.4 Ecological monitoring

The lower Collie River downstream of the Wellington Reservoir and the Augustus River are priorities for ecological monitoring.

Monitoring the lower Collie River above Burekup Weir

The department will develop the ecological monitoring program for the lower Collie River (Table 10, Action 10) to assess the effectiveness of the new winter releases, and inform potential improvements to the winter releases from Wellington Reservoir and the management of spills over Burekup Weir.

It will take several seasons for the effect of the new winter release regime to be seen in fish populations. During this period, the department will monitor fish abundance in the lower Collie using the following sampling and data analysis protocols (Storer et al. 2014).

Phase 1: Establishing baseline condition

To establish a baseline, the populations of pygmy perch, western minnow and nightfish will be monitored annually for a three-year period. Data from this phase of monitoring will be used to assess the abundance of these species and the variation in abundance between years and between location.

From this baseline any change in fish populations can be measured. The data will be used to develop testable indicators of changes in fish abundance.

The data will also be used to specify future monitoring requirements including limits of detectable change, sample sizes and sampling frequency needed to evaluate performance indicators.

Phase 2: Evaluating performance

Monitoring will occur at intervals of between every three to five years depending on analysis of data collected in Phase 1.

Monitoring the lower Collie River below Burekup Weir

To inform future management or planning, the department will work with Harvey Water and the Water Corporation to develop an ecological monitoring program for the lower Collie River (Table 10, Action 7). This will be used to inform and assess improvements to the management of spills over (or future releases from) Burekup Weir.

Monitoring of the Augustus and Brunswick rivers

The Department of Water is working with South32 Worsley Alumina Pty Ltd to determine and update release requirements (as a condition of its licence for Worsley Reservoir) and to establish a baseline data set before changing the release regime. The department will work with South32 Worsley Alumina Pty Ltd to set up an ongoing ecological monitoring program for the Augustus River to monitor the effects of changes to the release regime (Action 5 and Action 6 in Table 9).

Figure 9

Streamflow monitoring sites and current ecological sampling reaches for the plan area

Lower Collie surface water allocation plan

Chapter Seven

Implementing and evaluating the plan

The department will implement the *Lower Collie surface water allocation plan* according to the strategies in Chapter 2.

This chapter sets out the actions necessary to implement and evaluate the plan.

7.1 Implementing the plan

A number of additional actions will be completed during the next seven years to implement the plan (Table 9).

7 Implementing and evaluating the plan

Table 9
Actions to implement the Lower Collie surface water allocation plan

No.	Action	Responsibility [1]	Timeline
Resource assessment			
1	Work with Harvey Water and the Water Corporation to improve management and measurement of spills over the Burekup Weir (Section 6.2)	Water Allocation Planning, Water Resource Assessment and South West Region	2015–16
2	Assess if, and by how much, streamflow in the plan area has declined and identify which climate scenario the streamflow trend most reflects. Use this information to guide evaluation of the plan.	Water Resource Assessment	Every five years (beginning 2015)
Licensing			
3	Prioritise self-supply licence compliance in the lower Collie tributaries 5 and 8 and Brunswick 2, 4, 7 and 8, 9, 10, 11[2].	South West Region	2015
4	Revise licences and the operating strategy for Wellington Reservoir to: • refine release rules from the reservoir • update water sharing rules and restriction triggers • modify the offtake rule.	South West Region, Water Allocation Planning and Water Resource Assessment	As required
5	Develop river flow regime, potential release rules and ongoing ecological monitoring program for the Augustus River below the Worsley dam in consultation with South32 Worsley Alumina Pty Ltd.	Water Allocation Planning, Water Resource Assessment and South West Region	2015 onwards
6	Subject to Action 5, update South32 Worsley Alumina Pty Ltd's licence (and associated operating strategy) for the Worsley Reservoir.	South West region, Water Allocation Planning and Water Resource Assessment	To be confirmed

1 Department of Water branch responsible for the action

2 Additional licences in these areas can only be issued once existing unlicensed commercial use is verified and, subject to assessment, licenced.

The department adjusts and improves management of water resources over time to ensure that we maximise the amount of water available for use while still protecting the resource. Table 10 includes actions that are required to inform future water allocation planning in the Lower Collie plan area as the climate continues to dry.

Table 10
Actions to support future planning

No.	Action	Responsibility [1]	Timeline
Monitoring			
7	Support evaluation by: • monitoring to establish the current abundance of freshwater fish in the lower Collie River • develop performance indicators based on current abundance of freshwater fish in the lower Collie River. • designing and implementing a monitoring program to evaluate change in fish abundance against performance criteria.	Water Allocation Planning, Water Science Branch and Water Resource Assessment	Phase 1: 2015 to 2017 Phase 2: 2018 onwards
Resource assessment			
8	Re-evaluate the yield of the Wellington Reservoir to reflect inflows to the reservoir under a drier future climate (Section 5.1).	Water Allocation Planning and Water Resource Assessment	2015 onwards, as required to support licensing decisions
9	Establish the social and environmental water requirements of the Brunswick picnic spot and the Henty Brook (Section 4.4).	Water Allocation Planning	To be confirmed
10	Work with the Department of Parks and Wildlife to identify management options for Benger Swamp in a drying climate.	Water Allocation Planning	To be confirmed

1 Department of Water branch responsible for the action

7 Implementing and evaluating the plan

7.2 Evaluating the plan

The department will evaluate the performance indicators and objectives annually. We will take appropriate opportunities to communicate the results to stakeholders.

We will publish a comprehensive evaluation statement at least every three years to ensure that all stakeholders are informed of how the resource and management framework is performing.

The evaluation statement will include:

- the allocation status for each resource, including any changes in licensed entitlements since the plan release or last evaluation
- the status of the plan management and actions due in the evaluation period
- our performance against the plan outcomes and resource objectives
- whether we need to adapt our water resource management.

The statement will be available on the department's website, <www.water.wa.gov.au>, or from the department's South West regional office in Bunbury.

Appendices

Lower Collie surface water allocation plan

A

Appendix A
Components of the winter releases from Wellington Reservoir

Table A1
Daily releases from Wellington Reservoir

Storage (1st day of month) GL	Daily release rate[1] ML/day					
	May	June	July	August	September	October[2]
≤ 25	0	0	0	0	0	0
> 25 ≤ 40	15	15	15	15	15	15
> 40 ≤ 55	15	15	15	15	15	15
> 55 ≤ 70	15	15	30	15	15	15
> 70 ≤ 85	15	15	60	30	15	15
> 85 ≤ 100	15	20	60	60	15	15
> 100 ≤ 115	15	45	90	120	30	15
> 115 ≤ 130	15	90	140	160	50	15
> 130 ≤ 145	15	90	230	200	100	25
> 145 ≤ 160	15	90	230	200	160	40
> 160 ≤ 175	15	90	230	200	160	40
> 175 ≤ 185	15	90	230	300	260	90
> 185	15	90	230	300	260	90

[1] No releases are required when reservoir storage is less than or equal to 25 GL on the first day of the month.

[2] If irrigation releases are required during October and are higher than the daily release no additional water needs to be released.

Table A2
Peak event releases from Wellington Reservoir

Storage (1st day of month) GL	Number of peak event releases (at 500 ML/day)					
	May	June	July	August	September	October[1]
≤ 25	-	-	-	-	-	-
> 25 ≤ 40	-	-	-	-	-	-
> 40 ≤ 55	-	-	-	-	-	-
> 55 ≤ 70	-	-	1	1	-	-
> 70 ≤ 85	-	-	1	2	-	-
> 85 ≤ 100	-	-	2	3	-	-
> 100 ≤ 115	-	1	2	4	1	-
> 115 ≤ 130	-	6	3	4	2	-
> 130 ≤ 145	-	6	3	5	2	-
> 145 ≤ 160	-	6	6	6	2	-
> 160 ≤ 175	-	6	6	6	3	-
> 175 ≤ 185	-	6	7	7	6	3
> 185	-	6	7	7	6	3

[1] No releases are required when reservoir storage is less than or equal to 25 GL on the first day of the month.

Appendix A
Components of the winter releases from Wellington Reservoir

A

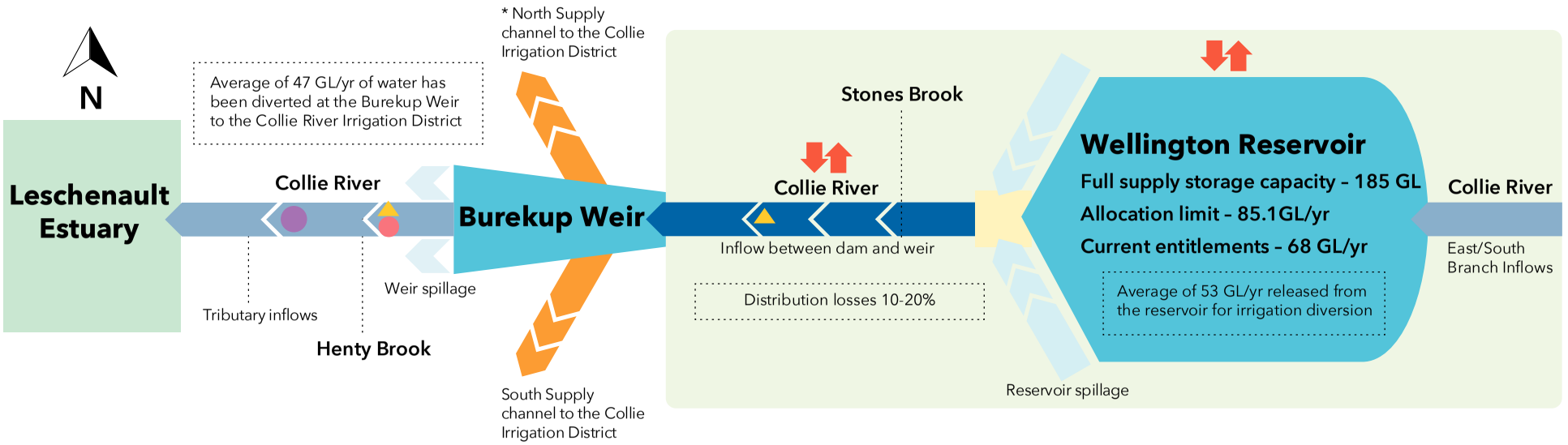
Table A3
Volume of daily and peak event releases from Wellington Reservoir

Storage (1st day of month) GL	Total monthly release ML/month					
	May	June	July	August	September	October[1]
≤ 25	0	0	0	0	0	0
> 25 ≤ 40	465	450	465	465	450	465
> 40 ≤ 55	465	450	465	465	450	465
> 55 ≤ 70	465	450	1400	950	450	465
> 70 ≤ 85	465	450	2300	1870	450	465
> 85 ≤ 100	465	600	2740	3180	450	465
> 100 ≤ 115	465	1805	3610	5240	1370	465
> 115 ≤ 130	465	5160	5420	6320	2400	465
> 130 ≤ 145	465	5160	7940	7700	3800	775
> 145 ≤ 160	465	5160	8750	8000	5480	1240
> 160 ≤ 175	465	5160	8750	8000	5820	1240
> 175 ≤ 185	465	5160	9020	10 700	9240	4020
> 185	465	5160	9020	10 700	9240	4020

[1] If irrigation releases are required during October and are higher than the daily release no additional water needs to be released.

Table A4
Volume of operator releases from Wellington Reservoir

Storage (1st day of month) GL	Maximum operator release ML/month					
	May	June	July	August	September	October
< 25	-	-	-	-	-	-
≥ 25 ≤ 40	-	-	-	-	-	-
> 40 ≤ 55	-	-	2425	1940	-	-
> 55 ≤ 70	-	-	2820	1940	1455	-
> 70 ≤ 85	-	-	2640	1880	1455	-
> 85 ≤ 100	-	-	2640	1760	1455	-
> 100 ≤ 115	-	-	2460	380	1410	-
> 115 ≤ 130	-	-	3600	340	1350	-
> 130 ≤ 145	-	-	3780	300	1200	-
> 145 ≤ 160	-	-	3780	300	1020	-
> 160 ≤ 175	-	-	3780	3600	1020	-
> 175 ≤ 185	-	-	3780	2400	5760	-
> 185	-	-	6480	4800	5760	-



Releases or diversions specifically to meet demand of:

	Irrigation and winter releases (daily, peak event and operator releases)		Wellington National Park		Downstream licensees and riparian users
	Spills over the weir and local inflows		Release valves		Environmental flow study site
			Shentons Elbow stream flow gauge		Rainfall/Evaporation/Distribution losses

*The north supply channel can be diverted to a sump at sandalwood road and from there transferred to Harvey Dam.

Figure A1
A conceptual model of Wellington Reservoir and Burekup Weir

Appendix B
Map information and disclaimer

B

Datum and projection information

Vertical datum: Australian Height Datum (AHD)

Horizontal datum: Geocentric Datum of Australia 94

Projection: MGA 94 Zone 50

Spheroid: Australian National Spheroid

Project information

Client: Guy Chandler, Melissa Gaikhorst

Map author: Gary Floyd, Martin Drake, Timothy Fardon and Michael Fifield

Filepath: J:\gisprojects\Project\C_series\C2117

Filename: J:\gisprojects\Project\C_series\C2117\0007_Plan_Maps

Compilation date: 13 August 2015

Disclaimer

These maps are a product of the Department of Water, Water Assessment and Allocation Division and were printed as shown.

These maps were produced with the intent that they be used for information purposes at the scale as shown when printing.

While the Department of Water has made all reasonable efforts to ensure the accuracy of this data, the department accepts no responsibility for any inaccuracies and persons relying on this data do so at their own risk.

Sources

The Department of Water acknowledges the following datasets and their custodians in the production of this map:

Western Australia Towns – Landgate – 2012
Road Centrelines – Landgate – 2012
WA Coastline, WRC (Poly) – DoW – 2006
Surface Water Allocation Subareas – DoW – 2007
RIWI Surface Water Areas and Irrigation Districts – DoW – 2012
Surface Water Resources – DoW – 2010
Hydrography, Linear (Hierarchy) – DoW – 2007
Hydrography, Linear – DoW – 2004
Water Dam Area – Water Corporation – 2009
GEONOMA – Landgate – 2012
WIN Sites – DoW – 2012

Shortened forms

List of shortened forms	
AWRC	Australian Water Resources Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DoW	Department of Water
EWR	Environmental water requirement
WRC	Water and Rivers Commission

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

Glossary

Abstraction	The permanent or temporary withdrawal of water from any source of supply, so that it is no longer part of the resources of the locality.
Allocation limit	Annual volume of water set aside for consumptive use from a water resource.
Catchment	The area of land from which rainfall runoff contributes to a single watercourse, wetland or aquifer.
Climate change	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Consumptive use	The use of water for private benefit purposes including irrigation, industry, urban and stock and domestic use.
Dam	Embankments constructed to store or regulate surface water flow. A dam can be constructed in or outside a watercourse.
Ecosystem	A community or assemblage of communities of organisms, interacting with one another, and the specific environment in which they live and with which they also interact, e.g. lake, to include all the biological, chemical and physical resources and the interrelationships and dependencies that occur between those resources.
Environment	Living things, their physical, biological and social surroundings, and interactions between all of these.
Environmental water provision	The water regimes that are provided as a result of the water allocation decision-making process taking into account ecological, social, cultural and economic impacts. They may meet in part or in full the ecological water requirements.
Environmental water requirement	The water regime needed to maintain the current ecological values (including assets, functions and processes) of water dependent ecosystems consistent with the objectives of an environmental flow study.
Groundwater	Water which occupies the pores and crevices of rock or soil beneath the land surface.
Licence (or licensed entitlement)	A formal permit which entitles the licence holder to take water from a water course, wetland or underground source under the *Right in Water and Irrigation Act 1914.*
Water management strategies	The department of water develops management strategies to identify the ways in which we will achieve the resource objectives in an area.
Over allocated	Sum of water access entitlements is more than 100% of the yield estimate.
Reliability	The frequency with which water allocated under a water access entitlement is able to be supplied in full. Referred to in some states as 'high security' and 'general security'.

Glossary

Reservoir	A natural or artificial place where water is collected and stored for use, especially water for supplying a community, irrigating land, or furnishing power.
Reservoir simulation	Computer simulations of reservoir behaviour are carried out to determine the quantities of water that can be reliably diverted from reservoirs or released to meet downriver water demands (including downstream environmental flows). Simulations of this type are used to determine how best to allocate and manage water resources given the available storage and the highly variable nature of stream flow.
Riffles	Swift-flowing areas, where the water is rippled or broken and cascades over rocks. Logs are known as riffle zone.
Riparian right	The right of a riparian landowner to take water from a watercourse that flows through their property, unlicensed and free of charge for the purpose of stock and domestic use, without sensibly diminishing the flow of water downstream.
Water resource objective	The Department of Water develops resource objectives to identify whether we need to maintain, increase, improve, restore or reduce surface and groundwater flow, and or water quality in an area.
Self-supply	Water diverted from a source by a private individual, company or public body for their own individual requirements.
Salinity	The measure of total soluble salt or mineral constituents in water. Water resources are classified based on salinity in terms of total dissolved salts (TDS). Measurements are usually in milligrams per litre (mg/L) or parts per thousand (ppt).
Social value	A particular in situ quality, attribute or use that is important for public benefit, welfare, state or health (physical and spiritual).
Stock and domestic	Water that is used for ordinary domestic purposes associated with a dwelling, such as water for cattle or stock other that those being raised under intensive conditions; water for up to 0.2 hectares (if groundwater) or two hectares (if surface water) of garden from which no produce is sold. This take is generally considered a basic right.
Subarea	A subdivision within a surface or groundwater area, defined for the purpose of managing the allocation of groundwater or surface water resources. Subareas are not proclaimed and can therefore be changed internally without being gazetted.
Surface water	Water flowing or held in streams, rivers and other wetlands on the surface of the landscape.
Streamflow	The net flow of water through a stream channel that integrates all contributing components, e.g., overland flow, interflow, and groundwater discharge.

Glossary

Take	In relation to water, means to remove water from, or reduce the flow of water in, a watercourse, wetland or underground water source, including by: • pumping • stopping, impeding or diverting the flow of water.
Trade	Where an entitlement is permanently traded to another person and the water will be taken from another location. Note: A prerequisite for a water transaction is accurate measurement (i.e. metering).
Transfer	Where an entitlement is permanently transferred to another person but water will be taken from the same location.
Watercourse	A watercourse includes the bed and banks of anything referred to in paragraph (a), (b) or (c). (a) any river, creek, stream or brook in which water flows; (b) any collection of water (including a reservoir) into, through or out of which anything coming within paragraph (a) flows; (c) any place where water flows that is prescribed by local by-laws to be a watercourse.
Water entitlement	The quantity of water that a person is entitled to take annually in accordance with the *Rights in Water and Irrigation Act 1914* or a licence.
Yield estimate	Establishes the amount of water that can be abstracted whilst still meeting the environmental water objectives for the resource.

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Legislation

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Notes

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