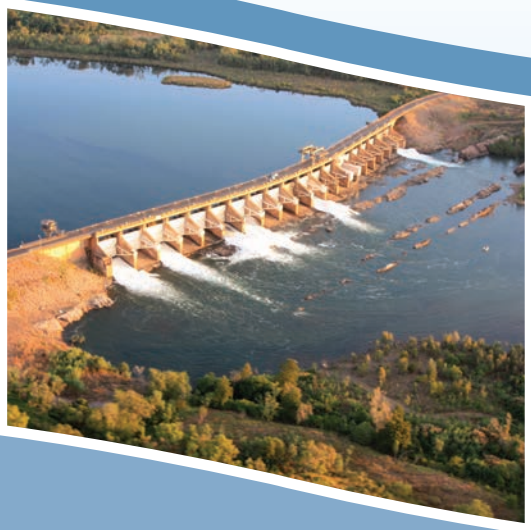
Government of **Western Australia**
Department of **Water**

Ord

surface water allocation plan


Looking after all our water needs

Water resource allocation
and planning report series
Report no 48
September 2013

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Message from the Minister

The Ord River is one of the most significant waterways in Western Australia. It provides for an iconic agricultural project, supports local tourism and sustains the unique Kimberley environment.

Under the State's Royalties for Regions program we are seeing the largest development of irrigated land in the Ord River area since the 1960s. The Ord Irrigation Expansion Project is focused on the development of the Goomig farmlands, some 7400 hectares to the north of Kununurra.

This is the first stage in a longer term plan to maximise the irrigation potential of the region. Further stages of development include 5000 hectares on the Knox Plain and 1000 hectares of irrigable land in the Ord West Bank.

This *Ord surface water allocation plan* supports, first and foremost, water for irrigation.

It outlines how the Department of Water will provide reliable water for irrigation as development continues, while ensuring there is enough water in the lower Ord River to sustain the natural environment.

The plan also provides a blueprint for new water release rules for the Ord River dam power station and defines how licences will be adjusted over time.

The plan builds on many decades of water management by the Department of Water, the Water Corporation and Ord irrigators and sets a new benchmark for water allocation and licensing in the area.

As a strategic document, this plan will ensure the relationship between all water users – agriculture, power generation and the environment – is managed equitably and for the wellbeing of all Western Australians.

Hon Terry Redman, MLA
Minister for Water

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Summary

Ord surface water allocation plan

Purpose of the plan

The Department of Water is responsible for managing and licensing the state's water resources under the *Rights in Water and Irrigation Act 1914* (WA). This water allocation plan sets out how we will allocate and license surface water from existing infrastructure in the Ord River area to manage the competing demands of irrigation, hydroelectricity generation and the lower Ord environment, while also recognising the river's social and cultural values. The plan will guide water licensing in the transition to full allocation from the existing infrastructure.

Our approach for managing surface water allocation and licensing in the Ord:

- secures 865 GL/yr from the existing infrastructure at a very high reliability for current and future irrigation demand
- defines water release rules for the Ord River Dam power station to meet downstream irrigation and environmental commitments while maximising hydroelectricity generation
- shows when water restrictions for hydropower, irrigation and the environment will apply to manage competition for water in dry periods
- establishes how we will license water use and adjust water licences as irrigation and hydroelectricity demands change over time.

Water availability in the Ord surface water area

The department will grant water entitlements up to 905 GL/yr (see table) from the existing infrastructure in the Ord surface water area. Of these, 865 GL/yr will be from the Main Ord and Carlton-Mantinea subareas downstream of Lake Argyle. As these entitlements can only be granted because of Lake Argyle's storage, they are designed to be fully supplied in 95 per cent of years.

The 750 GL/yr at a very high reliability from the Main Ord subarea is particularly important to agricultural development. As of January 2013, 335 GL/yr of this has been licensed to the Ord Irrigation Cooperative (OIC) to supply its members in the Ord Stage 1 area. Most of the extra water for irrigation expansion will be diverted from the Ord River within the Main Ord subarea. This includes water to supply the Goomig, Knox Plain and West Bank areas in Western Australia, and the Keep River Plain in the Northern Territory. Small amounts of water will also be required to supply minor infilling of the Stage 1 area and new self-supply pumpers who divert from the river.

Summary

Subareas	Allocation limit (GL of water entitlements per year)	Annual reliability (per year)	Water available for general licensing
Upper Ord	15	Variable	Yes
Main Ord	750	95%	Yes
Tarrara-Carlton	0	–	No
Carlton-Mantinea	115	95%	Yes
Dunham River	25	Variable	Yes
Total	**905**		

Most of the 115 GL/yr of water entitlements available from the Carlton-Mantinea subarea (starting 56 km downstream of the Kununurra Diversion Dam) is expected to be granted for new irrigated agriculture proposals on either side of the lower Ord River, near House Roof Hill.

The allocation limits for the Main Ord and Carlton-Mantinea subareas were set so that sufficient water would be left in the lower Ord River to maintain a healthy environment. In most situations the environmental flow regime will also support community values.

In most years, the required environmental flows will be met by releases for hydropower and inflow from the catchment downstream of the Kununurra Diversion Dam (particularly from the Dunham River). Releases for environmental flows will be restricted to the minimum required flows during dry years to balance competing demands for water. As more water entitlements are granted, the dry season flows will be lower than they are now.

The department is assessing and advising government on supply options should additional water be needed for irrigation expansion.

If major infrastructure or supply system changes are agreed, then we will update water management arrangements accordingly.

Licensing approach for the Ord area

This plan defines the current rules and restriction policies that govern the release of water at the Ord River and Kununurra Diversion dams and the approach we will use to update these as irrigation and electricity demands change. It also defines trigger levels in Lake Argyle for hydropower, irrigation and environmental water restrictions in dry years.

Power station water release rules

Water release rules apply to water released through the hydropower station at the Ord River Dam. The current set of rules is a condition of the water licence for operation of the Ord River and Kununurra Diversion dams. A set of enhanced rules to optimise water sharing benefits will replace current water release rules when the present power supply agreement is modified. The water release rules are linked with Lake Argyle's water level and power generation is restricted when storage levels in the lake are below average.

The enhanced water release rules allow for:

- 750 GL/yr of water from the Main Ord subarea to be available in 95 per cent of years
- an average of between 238.1 and 248.6 GWh/yr to be generated
- a minimum of 89.4 GWh/yr to be generated
- environmental water to be at or above requirements 93 per cent of the time.

Managing in dry periods

Based on the long-term data record, we expect irrigation supply to be restricted on average in five out of every 100 years, when water levels in Lake Argyle are low. To manage water scarcity in these dry years, this plan sets the trigger levels in Lake Argyle at which restrictions will apply to hydroelectricity production, irrigation and other licensed water use, as well as releases for the environment.

To make it clear when restrictions will apply, trigger levels have been set for both the current and enhanced rules.

Adjusting licences over time

We will adjust water entitlements to match water use (as far as is practical) to maximise the amount of water available for irrigation and hydroelectricity production at each stage of irrigation development. To achieve this, we will review and adjust existing licences (Water Corporation and OIC) when applications for more than 30 GL/yr of new entitlements are made and/or as electricity demands change.

This will ensure that future irrigation expansions can access secure, reliable water while maximising hydroelectricity production while irrigation expands.

How the department developed this plan

We developed the plan using new ecological studies, hydrological modelling and water demand projections completed in the Ord area since the 2006 plan. This work:

- updated our knowledge of the Ord River catchment's hydrology
- defined water availability from Lake Argyle under a range of future demand scenarios
- refined the environmental water needs of the lower Ord River (the environmental water provision).

We have used this information to confirm the water resource objectives and allocation limits of the 2006 plan and set new water release rules for this plan. We based this work assuming a future climate in the Kimberley similar to that experienced in the region from 1906–07 to 2003–04, given global circulation models do not indicate a clear wetting or drying trend for the Kimberley area.

We involved stakeholders throughout the plan's development, including the main licensees (Water Corporation and OIC), as well as other water users, state and federal agencies and local government. In mid 2011 we met with all interested parties to discuss aspects of the plan relevant to them and in 2012 we released the *Ord surface water allocation plan: for public comment* (DoW 2012a). We used the public submissions to clarify, improve and finalise the plan and responded to public submissions in a statement of response (DoW 2013).

Chapter One

Plan context and scope

The Ord River expansion project is now underway, with state government funding committed under the Royalties for Regions program. In 2014, the first water is expected to be delivered to the first 7340 ha of new farmland in the Goomig area, with demand growing rapidly over the next five years. Other stages of agricultural expansion are expected to occur in a similar timeframe, although these are still subject to regulatory approval processes.

1.1 Purpose of the plan

Working alongside our stakeholders, the Department of Water developed this plan in response to:

- state and federal government investment in the Ord River expansion project and the need to provide absolute clarity on the water available for irrigation development from existing infrastructure
- the need to balance new irrigation demand with the growing demand for hydroelectricity and the needs of the downstream environment
- recommendations from the Environmental Protection Authority (EPA) to maintain the post-dam environment of the Ramsar-listed Ord River floodplain and wetlands
- new hydrological and ecological work we have completed since the 2006 plan.

To address these circumstances and support the transition to full allocation from existing infrastructure, this plan:

- sets out how much water is available for consumptive use, especially for irrigation expansion
- explains how we will manage water through consistent and complementary licensing, licence conditions and water release rules that meet the water required for irrigation, hydropower and the environment as often as possible as irrigation developments proceed
- refines environmental water provisions.

The allocation limits and releases from lakes Kununurra and Argyle in this plan are based on current dam infrastructure, existing commitments to hydroelectricity generation and maintaining the downstream environment. Separate and complementary to the plan, we are assessing and advising on water supply options should more water be required for irrigation expansion.

1 Plan context and scope

1.2 Plan area

The *Ord surface water allocation plan* area is in the north-eastern Kimberley. The plan area covers the Western Australian part of the Ord River catchment. It extends from the Western Australian border to west of Halls Creek and north to the Joseph Bonaparte Gulf and includes lakes Argyle and Kununurra and the town of Kununurra (Figure 1).

The plan specifically applies to the Ord River and Tributaries surface water area and the Ord River Irrigation District (Figure 1) proclaimed under Part III of the *Rights in Water and Irrigation Act 1914*. This means that any water diverted from the Ord River and its tributaries in Western Australia will be licensed according to this plan. However, the plan sets aside water for potential irrigation use in the Northern Territory. While water diverted from the Ord River in Western Australia would be managed in line with this plan (chapters 4 and 5), water use in the Northern Territory would require some administrative and minor legislative changes to manage cross-jurisdictional arrangements.

1.3 Water resources covered

This plan covers the surface water resources of the Ord River catchment to its tidal limit (Figure 1), including runoff that contributes to Lake Argyle from the Northern Territory.

To best administer water allocation and licensing, we have divided the plan area into five subareas (Figure 2) based on infrastructure and changes in river channel morphology. The five subareas are the:

- Upper Ord – the catchment upstream of the Ord River Dam, including Lake Argyle
- Main Ord – the catchment between the Ord River Dam and Tarrara Bar gauging station, including Lake Kununurra
- Tarrara-Carlton – the catchment between Tarrara Bar gauging station and House Roof Hill
- Carlton-Mantinea – the catchment between House Roof Hill and the tidal limit
- Dunham River – the Dunham River catchment.

We used these boundaries to set environmental flow provisions and allocation limits. For further information, see Section 2.5 of the supporting methods report (DoW 2012b).

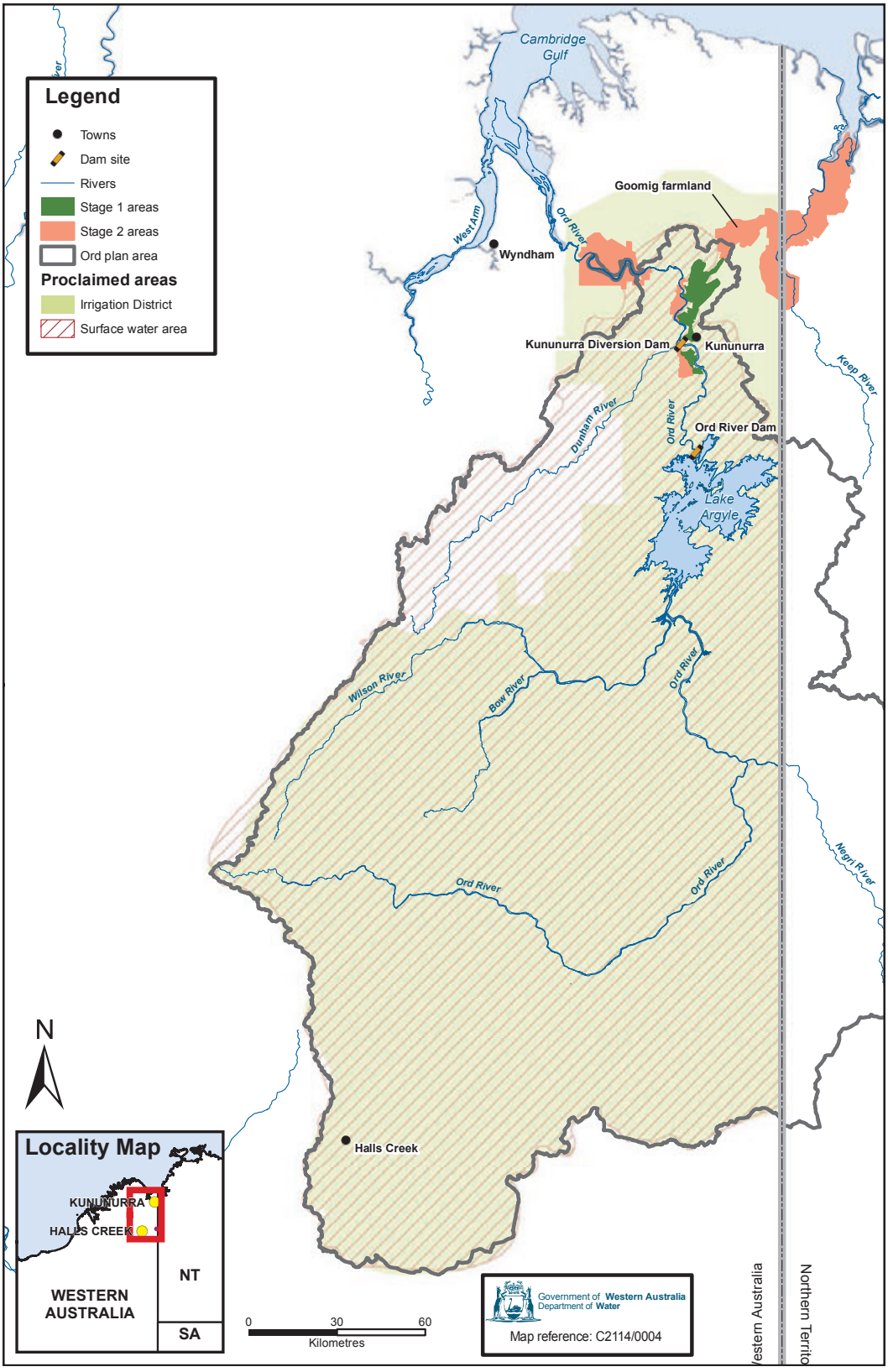

Figure 1
Plan area, proclaimed areas and irrigation areas (stage areas)
Ord surface water allocation plan

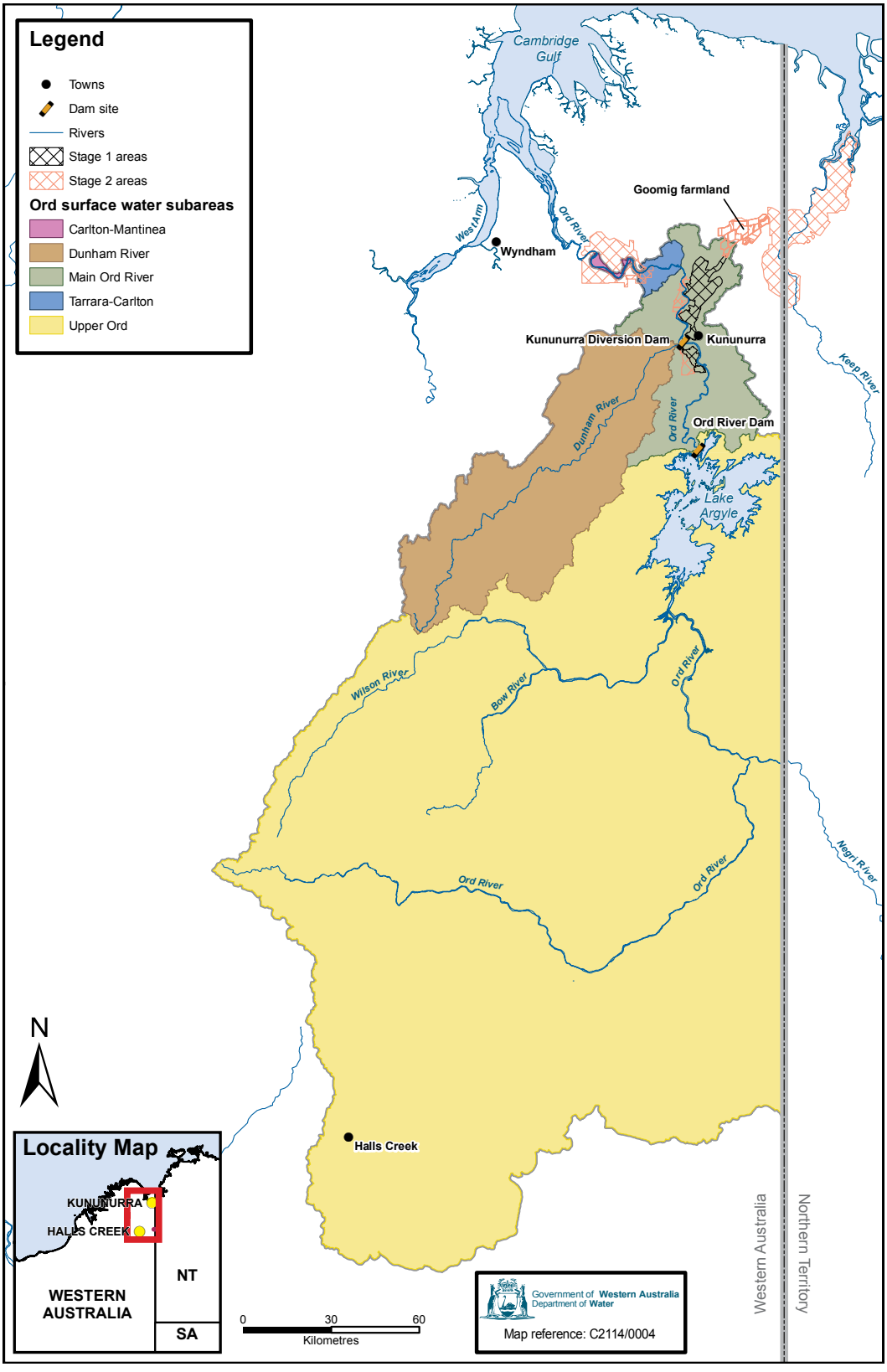

Figure 2
Subarea boundaries
Ord surface water allocation plan

1.4 How we developed the plan

We developed this plan using new ecological studies and hydrological modelling undertaken since 2006. This work:

- used extra rainfall and flow data to update our understanding of the Ord River catchment's hydrology
- defined water availability from Lake Argyle under a range of future demand scenarios, based on a past sequence of dam inflow (1906–07 to 2003–04)
- defined how much water needs to remain in the lower Ord River to meet environmental needs (the environmental water provision).

Working with water users and other government agencies involved in the area, we used this new work to confirm the water resource objectives and allocation limits and set the water release rules in this plan. The plan's objectives closely align with the government's commitment to expand irrigated agriculture in the Ord area, while providing enough water for hydroelectricity generation and the riverine environment downstream of Lake Kununurra.

In setting the allocation limits and release rules we assumed the future climate will be similar to that experienced in the Kimberley between 1906 and 2004. Our use of past climate records is appropriate given the global circulation models used to project future climate in the region do not indicate a clear wetting or drying trend to 2030.

The 99-calendar-year sequence (1906–2004) of streamflow used includes very dry conditions (e.g. the 1930s) and very wet years (the past 10 years of records). The allocation limits and release rules have been set to share water effectively under the full range of these conditions.

We have revised the environmental water provision in response to recommendations from the EPA to maintain the post-dam environment of the Ramsar-listed Ord River floodplain and wetlands (EPA 1999). The EPA made these recommendations based on the requirements of the Council of Australian Governments' Water Reform Framework of 1994.

We established the plan's current and future licensing approach by working with the Water Corporation, Pacific Hydro, Ord Irrigation Cooperative (OIC), Department of Regional Development and Lands and Department of Agriculture and Food (DAFWA).

For more information about water allocation planning, see *Water allocation planning in Western Australia: a guide to our process* (DoW 2011c). For more details of the information and process we used to develop the allocation limits and licensing approach, see *Ord surface water allocation plan methods report* (DoW 2012b).

1.5 Main stakeholder interests

Engaging and consulting with stakeholders was a major part of developing the *Ord surface water allocation plan*. In the Ord area, a number of groups are interested in water allocation (Table 1).

1 Plan context and scope

Table 1
Stakeholders of the Ord plan

Interest group	Stakeholders
Agriculture and irrigation	Ord Irrigation Cooperative (and SunWater[1]), self-supply irrigators, Department of Agriculture and Food and Department of Regional Development and Lands
Public water supply	Water Corporation (the bulk water supplier)
Individuals	Commercial businesses, boat operators and riparian water users
Indigenous	Native title holders, Miriuwung Gajerrong Corporation, Indigenous interest groups
Industry	Pacific Hydro, Rio Tinto
Local government	Shire of Wyndham – East Kimberley
Other state agencies	Department of Environment and Conservation and Office of the Environmental Protection Authority
Federal agencies	Department of Sustainability, Environment, Water, Population and Communities, National Water Commission

In mid 2011 we updated stakeholders on the progress of the Ord plan for public comment and met with all interested parties in Perth and Kununurra to discuss aspects of the plan that involved them. In 2012 we released the *Ord surface water allocation plan: for public comment* (DoW 2012a) for a 15-week public comment period (May 25 to September 14, 2012).

The main interests raised by stakeholders through consultation and submissions on the plan for public comment included:

- whether adequate water was being allocated for irrigation expansion and how the plan related to the Royalties for Regions Ord-East Kimberley expansion project and the Ord Final Agreement
- what the water availability was, both overall and per hectare for new farm lots, as well as reliability of supply (95 per cent of years)
- priority of water allocation when Lake Argyle was approaching full allocation, including possible expansion into the Northern Territory and new Cockatoo Sands areas in Western Australia
- how much water was left in the lower Ord to maintain the environment, suitable water quality and water-based recreation and how we would monitor biological impacts
- how water release rules and hydropower, irrigation and environmental water restrictions would apply in dry years and be evaluated over time

[1] SunWater was the preferred water service provider for the Goomig farmlands, but has since withdrawn.

- water supply options if/when demand exceeded the allocation limits
- how the plan related to the National Water Initiative and clarity on the department's position to recoup unused entitlements
- a need to better communicate the key technical concepts behind the plan.

We have discussed and clarified these issues raised in submissions with respondents and addressed them in finalising the plan, as appropriate. For further information on stakeholder interests and how they were considered in finalising the plan, see the *Ord surface water allocation plan: statement of response* (DoW 2013).

1.6 Plan timeframe

The *Ord surface water allocation plan* is in effect until it is replaced by a new water allocation plan, amended or revoked by the Minister for Water.

We will assess whether to amend or replace this plan in 2019, or earlier if the annual evaluation process (Section 7.2) identifies the need. When additional new agricultural expansion areas are agreed and their water supply needs are clarified, we may amend parts of the plan.

We are assessing and advising government on water supply options, should more water be required for irrigation expansion. If there are major changes to the current dam infrastructure or supply system, changes to licences and a new plan will be needed.

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 Part III of the *Rights in Water and Irrigation Act 1914,* specifically:

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

c. to foster consultation with members of local communities in the local administration of this Part, and to enable them to participate in that administration

d. to assist the integration of the management of water resources with the management of other natural resources.

Allocation plans are developed so that water resources across the state are managed consistent with these objectives while addressing area-specific issues.

This chapter outlines the framework for how the Ord River's surface water resources will be managed. It clearly states:

- the outcomes we expect to see
- how the water resource should perform to meet the outcomes – the water resource objectives
- the strategies we will use to deliver the water resource objectives.

2.1 Outcomes

Outcomes are the broad ecological, social and economic consequences of our water resource management. The expected outcomes of this plan are:

- secure and reliable water supplies for a strong and expanding irrigation industry
- a healthy lower Ord River environment
- as much hydroelectricity production as possible, within the limits of the water needed by irrigators and the downstream environment
- traditional Indigenous access, water-based tourism and recreational opportunities that complement the irrigation, environmental and power outcomes.

2.2 Resource objectives

Water resource objectives state how we want the water resource to perform as a result of the management we put in place. They are specific and measurable, and ensure the outcomes can be met. This plan's resource objectives are as follows:

a. flows measured at Tarrara Bar meet the environmental water provision, including:
   i. the baseflow component for wet and dry seasons
   ii. annual and inter-annual wet season peak flows
   iii. infrequent wet season flood events
b. water levels in Lake Argyle are maintained above irrigation restriction levels in 95 per cent of years.

2.3 Strategies

We have identified five key strategies to meet the resource objectives and deliver the outcomes. They are:

- issue licence entitlements within the allocation limits for each subarea
- manage water releases at the Ord River and Kununurra Diversion dams through this plan's release rules
- adjust releases over time as irrigation development proceeds
- adjust releases in periods of drought
- optimise the water available for new development and power generation by recouping unused water entitlements.

These strategies are described in detail in chapters 4 and 5.

2.4 Measuring the success of the plan

The department will evaluate the plan annually and publish an evaluation statement at least every three years. We will assess how we have implemented the strategies and whether the resource objectives and outcomes are being met. If necessary we will adapt our management.

We will communicate the results of evaluations to key stakeholders at the annual Ord River stakeholders meeting (see Section 5.6).

More information about how we will monitor the Ord River's surface water resources and evaluate the performance of the plan is given in chapters 6 and 7.

Chapter Three

Current and projected water demands

The Ord River and its tributaries provide water for the regionally important irrigated agriculture and mining industries. The river also provides water for other significant demands such as hydroelectricity and the environment. At times the demands are complementary and at other times they are in competition.

Competition for water will increase as new irrigation areas are developed and as more power is needed to supply underground mining. This competition will become more intense in dry years, as water released for hydroelectricity generation draws down storage for the next season's irrigation.

This chapter provides the water demand context for the plan and includes:

- irrigation demands now and into the future
- power supply demands now and into the future
- environmental, social, tourism and cultural water demands
- how to balance all these demands.

3.1 How water is distributed in the Ord

The approach to managing different demands for water from the Ord River is influenced by where the demand point is located and how water is distributed. The distribution of water and the location of demands is shown in Figure 3.

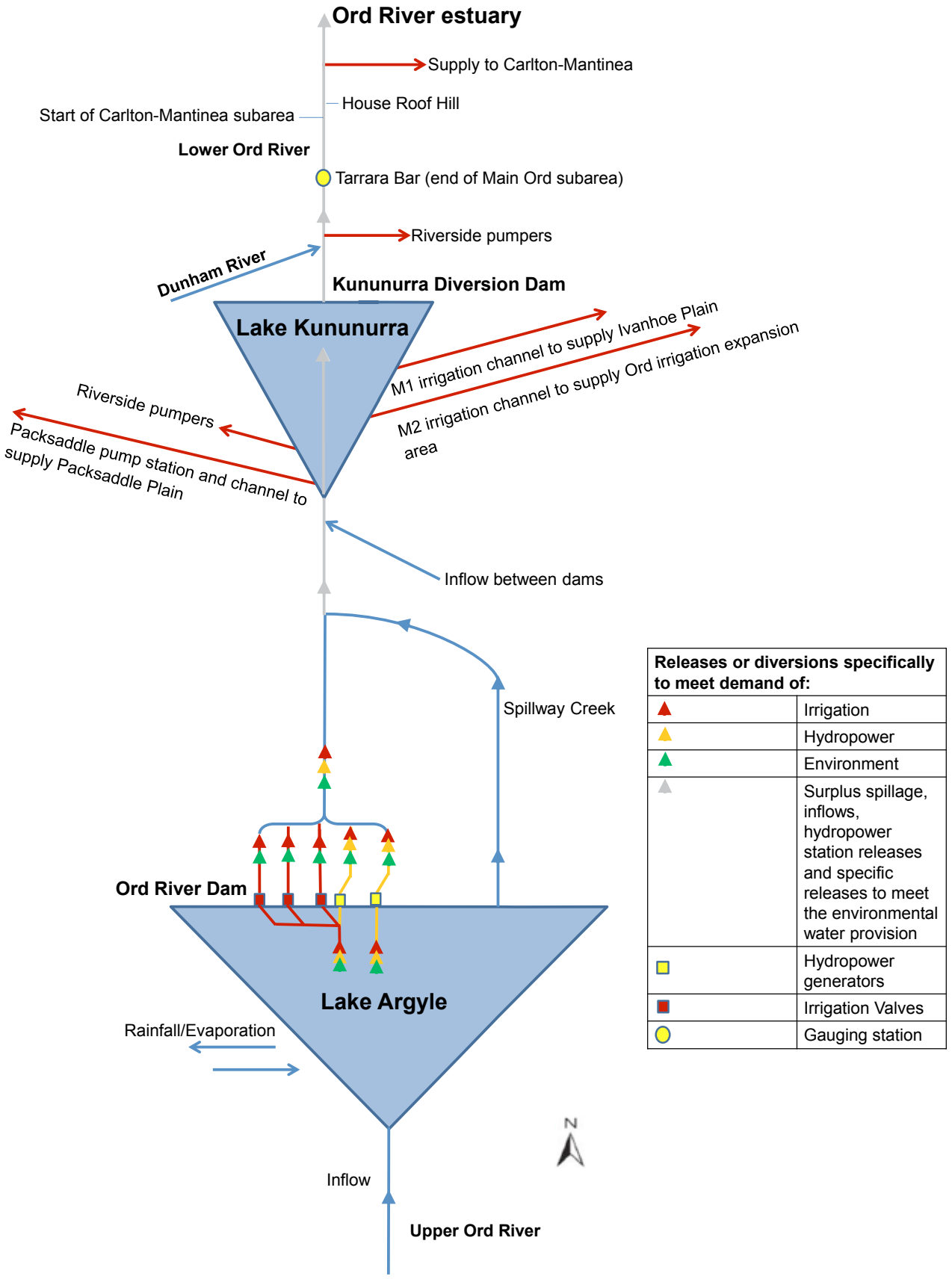

Figure 3

How water is distributed from the Ord River and Kununurra Diversion dams

Ord surface water allocation plan

3 Current and projected water demands

Water from the upper Ord catchment is stored in Lake Argyle and released through the Ord River Dam to Lake Kununurra. Above the Kununurra Diversion Dam, water is diverted to the Stage 1 irrigation area and the new M2 supply area (Figure 4, Section 3.2). Self-supply pumpers take water directly from the river above and below the diversion dam. Further downstream, past House Roof Hill, more water may be directly pumped from the river for irrigation. The release of water from Lake Argyle and Lake Kununurra serves multiple purposes, but the volume and timing of releases needed for hydropower are not always the same as those needed for irrigation, the river environment or other demands.

Releases from Ord River Dam for hydropower and irrigation

Most of the water used in the Ord area is stored in and released from Lake Argyle by the Water Corporation. The Water Corporation owns, operates and maintains the Ord River Dam and is licensed by the Department of Water to store and release (but not divert) the water in the reservoir. Pacific Hydro owns and operates a 30 MW power station constructed on the outlet works of the Ord River Dam.

Through contract arrangements with the Water Corporation, Pacific Hydro releases water through the power station to generate electricity. The Water Corporation can also release water from Lake Argyle through the irrigation valves that bypass the power station (Figure 3). Water is released through the power station whenever possible. Releases via the irrigation valves usually only occur when the hydropower station is undergoing maintenance.

The water released through the power station or irrigation valves flows down the Ord River and into Lake Kununurra. Riverside pumpers (self-suppliers) abstract water directly from Lake Kununurra, as well as from the lower Ord River downstream of the Kununurra Diversion Dam.

Diversions from Lake Kununurra for irrigation

Above the diversion dam, the OIC takes water from Lake Kununurra for irrigation by either:

- diverting it under gravity into the M1 supply channel (Figure 3) to supply members on the Ivanhoe Plain
- pumping it into the Packsaddle supply channel (Figure 3) to supply members on the Packsaddle Plain.

By 2014 additional water is expected to be diverted into the M1 channel to supply the new Goomig farmland area (Figure 4). This is the first phase of the Ord irrigation expansion project to develop the larger M2 channel supply area, including land on Knox Creek and Keep River plains in the Northern Territory (Figure 4).

The M1 supply channel's capacity has been increased to enable delivery of the additional water for the first 17 km towards the Goomig farmland. The new M2 channel will carry water for the remaining distance and will be extended further when subsequent development phases proceed. When complete, the M2 channel will transport water from Lake Kununurra to supply 30 000 ha of the M2 supply area.

Releases from Lake Kununurra to maintain the lower Ord River

The Water Corporation releases water from Lake Kununurra into the lower Ord River by raising some of the 20 gates of the Kununurra Diversion Dam. The releases are made up of:

- surplus spillage from Lake Argyle
- surplus inflows from the Lake Kununurra catchment
- surplus hydropower releases
- when necessary, releases specifically to meet the environmental water provision for the lower Ord River.

3.2 Irrigation demands

Irrigation is the dominant consumptive use of water from Lake Argyle. Water for irrigation is either self-supplied by individual users or scheme-supplied by the OIC.

Current demand for irrigation

More than 80 licensed self-supply irrigators abstract a total of 9.3 GL/yr of water from the Main Ord subarea, mainly from Lake Kununurra and between the Kununurra Diversion Dam and Tarrara Bar (Figure 3).

In addition, the Water Corporation is licensed to abstract 3.1 GL/yr from the M1 offtake to supply some irrigation customers (within the first 12.8 km of the M1 channel) in the Stage 1 area, and to flush and dilute treated wastewater that discharges into the M1 channel.

Ord Irrigation Cooperative's supply for Stage 1 irrigation

The Stage 1 area includes the Ivanhoe and Packsaddle plains (Figure 4). The OIC supplies water to 15 363 ha of farmland on 111 separate properties (as at June 2012) on the Ivanhoe and Packsaddle plains (Figure 5). The OIC holds a licence to take 335 GL/yr (in force until 2014).

Most water for the Stage 1 areas is diverted at the M1 offtake into the M1 supply channel for the Ivanhoe Plain and about 10 to 12 per cent is diverted at the Packsaddle pump station to Packsaddle Plain. In recent years, the OIC has taken less than 200 GL/yr from Lake Kununurra, largely due to changed cropping and the closure of the sugar mill since the licence was first issued in 2004.

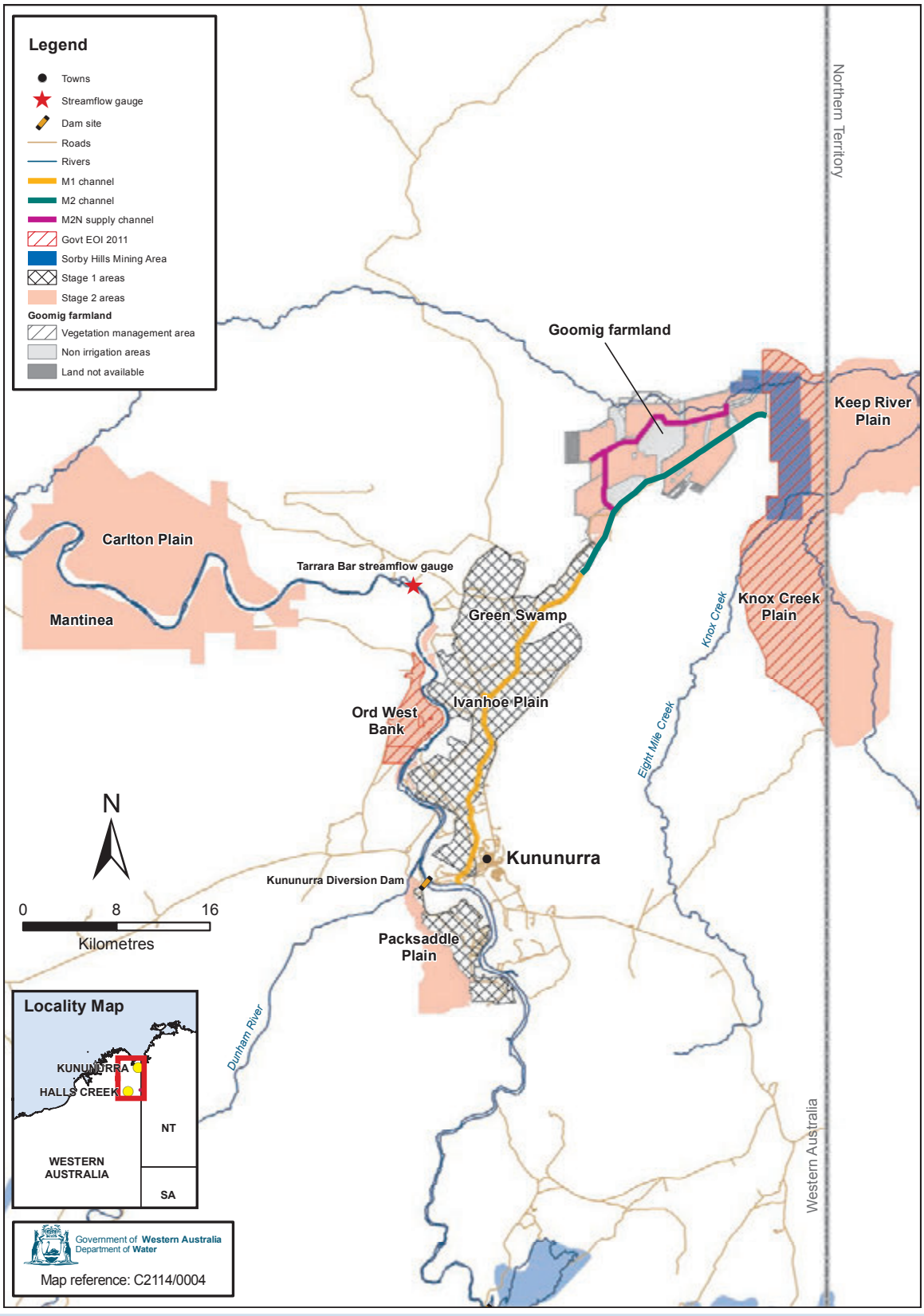

Figure 4

Current (Stage 1) and proposed irrigation development areas in the plan area

Ord surface water allocation plan

Irrigation expansion

Since the 1950s the vision for the Ord irrigation project has been to develop all the irrigable soils on the greater Ord and Keep River floodplains. Expansion beyond the Stage 1 areas was promoted in the mid 1990s, culminating in a proposal to develop more than 30 000 ha of irrigated agriculture to the north of the Stage 1 area, in what became known as the M2 channel supply area.

The M2 channel supply area was thoroughly investigated and granted conditional environmental approval by the state and Northern Territory governments in early 2002. Although the project lapsed, the approvals remained and the Western Australian Government committed financial resources to develop the first phase of the M2 supply area.

The Goomig farmlands – first phase of the M2 supply area

In 2008 the state government committed to developing 7400 ha of serviced irrigated farmland, now known as the Goomig farmlands (Figure 4). The Goomig farmlands form the first phase of the greater (30 000 ha) M2 channel supply area development. Construction of the off-farm infrastructure began in 2010 and is scheduled to be completed by the end of 2013.

In November 2012, the state government announced that Kimberley Agricultural Investment Pty Ltd (KAI) had been selected to develop the Goomig farmlands[2].

Subject to contract negotiations of KAI to obtain relevant (federal government) approvals, KAI intends to develop subsequent phases of the M2 supply area (see below) and construct a sugar refinery to process sugarcane. The first water is to be supplied in 2014, with demand growing over the subsequent four years as more sugarcane is grown.

The Knox Plain area in Western Australia – second phase of M2 supply area

KAI has also been appointed the preferred developer for approximately 5000 ha of the Knox Creek Plain in Western Australia. This involves completing final designs for irrigation infrastructure, seeking the remaining environmental approvals and constructing the infrastructure within the next five years.

Extension into the Northern Territory – third phase of M2 supply area

The Northern Territory, Western Australian and federal governments recently signed a Memorandum of Understanding on the proposed expansion of the Ord River Agricultural Area over the remaining 14 000 ha of the M2 supply channel area in the Northern Territory. Development of the area will require further approvals from the Northern Territory and federal governments. More detail on the approvals required under different legislation and the status of those approvals is provided in Section 1.2.8 of the *Ord surface water allocation plan methods report* (DoW 2012b).

[2] The Miriuwung Gajerrong Corporation has been offered two lots (675 ha) in the Goomig farmlands – in accordance with the Ord Final Agreement and the Aboriginal Development Package negotiated for the Goomig development.

Infill areas in the Sorby Hills mining tenement – final phase of the M2 supply area

In the longer term there is scope to irrigate up to 3000 ha of land, undisturbed by mining in the Sorby Hills mining tenement, after mining and rehabilitation is complete.

Ord West Bank

In November 2012, the state government announced it would develop the Ord West Bank area (Figure 4). It expects to bring approximately 1000 ha of irrigable freehold land to the market during the next several years. A mix of horticultural and broadacre crops is expected to be grown across this area in the next three to five years.

The Carlton Plain and the Mantinea areas – the downriver developments

Downstream in the Carlton-Mantinea subarea, there are proposals to develop more than 8000 ha on the river's north side (Carlton Plain). There is also the potential to develop 4000 ha on the south side (Mantinea area). Development of these areas could take place in five to 10 years. Given recent changes in planned areas and crop types, demand could be up to 155 GL/yr.

New areas on the Packsaddle Plain, Ord East Bank and Stage 1 infill areas

Variable soils on new areas of Packsaddle Plain are likely to limit development to about 200 ha. A further 1000 to 1100 ha of land could be developed on land known as the Ord East Bank area and other areas adjacent to existing Stage 1 lots.

While subject to native title and other approvals, together the demand from these areas could be up to 25 GL/yr (Table 2).

Cockatoo Sands

DAFWA is investigating whether the soils of Cockatoo Sands are suitable for irrigation. Between 4000 and 6000 ha of Cockatoo Sands is sufficiently close to the Ord River to warrant assessment of whether it can be economically supplied with water from the river. The development is a longer-term proposal and possible demand is likely to be about 40 to 60 GL/yr.

Water demand for irrigation expansion and supply options

A range of irrigation demands are possible in the Main Ord subarea (Table 2). If each of the development areas proceed, and water demand in these areas is consistent with the range of demand listed, then water demand will be greater than the allocation limit set by this plan. Should a decision be made to meet all of these demands into the future, with consequent changes to the current dam infrastructure or supply system, then a new water allocation plan will be needed.

Table 2
Water demand for irrigation developments in the Main Ord subarea

Development area	Gross development area (ha)	Nominal farmland area (ha)	Range of possible water demand* (GL/yr)
Ord Stage 1 irrigation area			
Ivanhoe and Packsaddle plains, riverside pumpers	19 000	16 000	230–350
Ord expansion area supplied by the M2 channel			
Goomig farmlands	9500	7400	80–170
Knox Plain (in WA)	6000	5000	60–110
Sorby Hills area (post mining)	4000	3000	30–60
Northern Territory	~16 000	14 000	140–270
Ord expansion area not supplied by the M2 channel			
Ord West Bank	1700	1000	16–25
East Bank and other miscellaneous	1200	1100	8–20
New Packsaddle Plain area	1700	200	4–5
Cockatoo Sands	Not defined	4000–6000	40–60
Total	**>59 100**	**51 700–53 700**	**608–1070**

* At the point of diversion from the Ord River

Once the system reaches full allocation, and there are no further management improvements to effectively distribute reliable water supply across competing demands, a market may develop for water for consumptive use.

Irrigation demand may exceed the reliable allocation limit in this plan in the medium to long term. While beyond the scope of this plan, the Department of Water is leading a cross-government approach to investigate additional water supply options to meet this larger demand.

3.3 Water demands for power

Pacific Hydro supplies hydropower to Horizon Power for towns and the Argyle Diamond Mine. When hydropower is not available, backup diesel generators are used.

3

Current and projected water demands

The 1994 Water Supply Agreement

The 1994 Water Supply Agreement for the power station was originally a contract between Pacific Hydro and the former Water Authority of Western Australia that defined the power station's water release rules. It gave Pacific Hydro the right to generate at least 210 GWh/yr of electricity when water levels in Lake Argyle were greater than 78 mAHD. The agreement is now between Pacific Hydro and the Water Corporation, with the Department of Water defining the water release rules as conditions of the Water Corporation's licence to store water behind the Ord River Dam. The department has considered the agreement in setting licence conditions to date and in developing this plan's new approaches to the water release rules.

To generate the 210 GWh/yr commitment at mid lake levels, about 2100 GL/yr must be released through the power station. At low lake levels more than 2500 GL/yr must be released because at these levels the station needs more water to produce the same amount of electricity.

Provisions of the agreement also allow Pacific Hydro to:

- generate electricity from any Water Corporation releases
- consider revised water release rules (with the Water Corporation and Department of Water) that may increase the amount of electricity able to be generated.

Future electricity demand

The demand for electricity to meet town needs in the Ord area is growing rapidly (Figure 5). Horizon Power expects higher demand associated with the irrigation expansion, while the Argyle Diamond Mine (Rio Tinto) has projected higher demand to support underground mining. Demand associated with underground mining is likely to be high for at least until 2018.

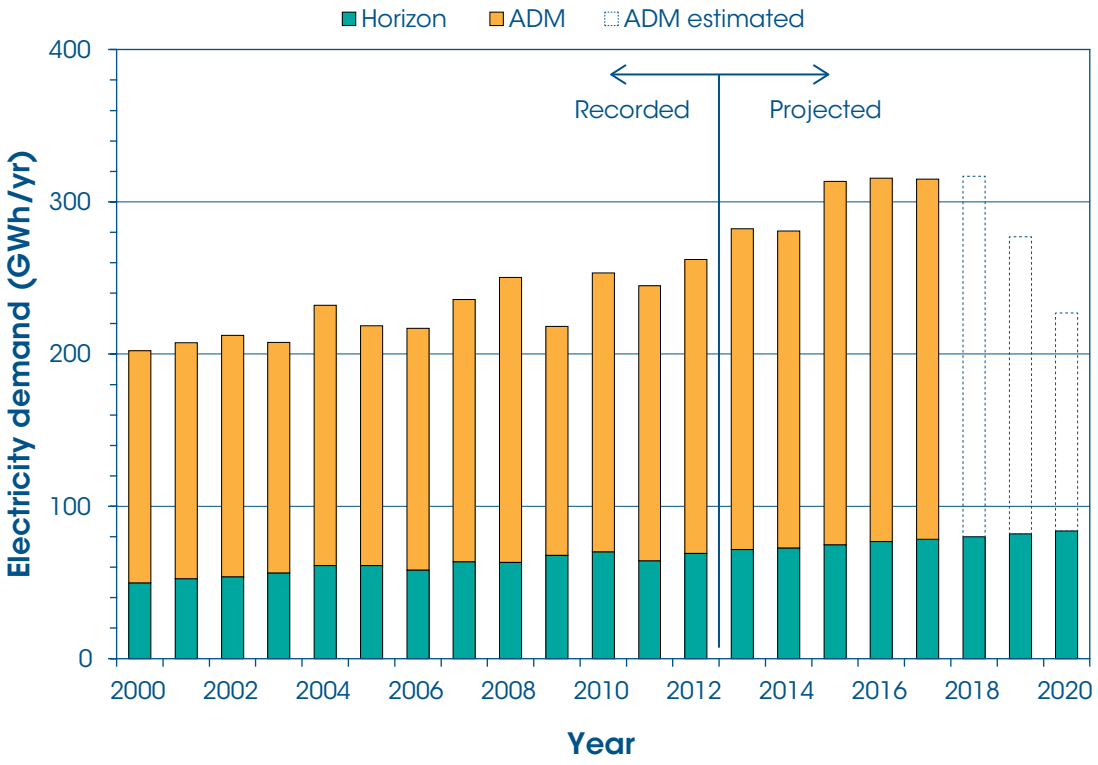

Figure 5
Recorded and projected demands on the East Kimberley electricity grid

By 2015, we expect demand to be 150 per cent or greater than the 210 GWh/yr minimum guaranteed by the 1994 agreement. The electricity demand on the East Kimberley electricity grid beyond 2017 is highly uncertain, but is likely to decrease after 2018 (as advised by Argyle Diamonds). The hydropower station on the Ord River Dam cannot meet the full projected electricity demand (Figure 5). However, the power station will remain the main and cheapest source of electricity in the region.

A new source of electricity generation or greater reliance on the existing diesel power stations at Argyle Diamond Mine and Kununurra will be required to meet the bulk of the growing electricity demand. A possible source of extra power would be to construct a 10 MW capacity hydropower station at the Kununurra Diversion Dam. The station would generate electricity from water released from Lake Kununurra to the lower Ord River. Appendix D shows the average electricity that could be generated if two hydropower stations (at both the Ord River and Kununurra Diversion dams) supplied to the East Kimberley electricity grid.

With a 10 MW station at the Kununurra Diversion Dam, the average additional electricity generated would be more than 60 GWh/yr under the current water licences (350 GL/yr) and 50 GWh/yr if all water for allocation from the Main Ord subarea were licensed (750 GL/yr). With this additional power option, less water would need to be released from Lake Argyle, and the severity of irrigation restrictions would reduce – especially as full allocation for irrigation expansion approaches.

3.4 Environmental, social and cultural water demands

Water that remains in the Ord River provides for environmental, social and some cultural needs as well as for tourism.

Environmental water

The Ord River Dam's construction in the early 1970s greatly changed the flow regime of the lower Ord River. These hydrological changes in turn dramatically altered the river's environment.

Before the dam, the lower Ord River flooded regularly in the wet season, inundating large areas of the river's floodplain. In the dry season the river dried out to a series of isolated pools. After the dam was built, average wet season flows in the lower Ord River reduced by 67 per cent, and average dry season flows increased by 430 per cent (based on data from 1974–75 to 2003–04).

In 1999 the EPA, in line with the COAG Water Reform Framework of 1994, recognised the importance of the post-dam environmental values that had developed in the lower Ord River and required that these be protected. In response to this, the Department of Water has established the environmental water regime required to maintain the post-dam riverine environment of the lower Ord River (Braimbridge & Malseed 2007). This process is consistent with the changes made in 2000 to the *Rights in Water and Irrigation Act 1914* and with contemporary water management policy.

Determining water for the environment

To meet the legislative requirements and the EPA's requirements, we took into account the post-dam ecological, social, cultural and economic factors in providing water for the downstream environment.

To determine the ecological flow requirements of the lower Ord River we considered the water regimes needed to maintain:

- populations of fish and macroinvertebrates
- vegetation community structure and composition
- water quality
- ecosystem processes
- channel morphology.

The method used to determine the required ecological flow regime (Flow Events Methodology) recognises that different parts of the flow regime – low, high, bankfull and overbank flows – are important to river health and have different ecological functions. These flow components reflect the seasonality of the flow regime which, although altered, remains important to the ecology of the lower Ord River. In recent years, the baseflows have been well above what the riverine ecology needs. Flows in the lower Ord will decrease noticeably as diversions for irrigation increase towards the full allocation limit.

For more information on environmental values and the ecological water requirements, see *Environmental values, flow related issues and objectives for the lower Ord River* (DoW 2006a) and *Ecological water requirements for the lower Ord River* (Braimbridge & Malseed 2007).

Water to support traditional Aboriginal laws and customs

Native title consent determinations of the Federal Court of Australia in 2003 and 2006 determined the cultural and spiritual importance of the lower Ord River to the Miriuwung Gajerrong people in law. For details of the Miriuwung Gajerrong determinations (Number 1 on 9 December 2003 and Number 4 on 24 November 2006) see the *Ord surface water allocation plan methods report* (DoW 2012b).

The views of the Miriuwung Gajerrong in relation to flows in the lower Ord River are reported in the *Ord River water management plan* (DoW 2006b):

> At the community workshop in 2000, representatives of traditional owners indicated that access to the river for fishing and ceremonial activities were important to Miriuwung and Gajerrong people, and suggested short periods of 'dry out' and 'wash out'. Subsequent discussions with traditional owners confirmed that having access to the river so they can pursue their traditional activities associated with the river, was important to the Miriuwung and Gajerrong people.

Short periods of low ('dry out') flows are important to (pre-dam) Dreaming stories of the Miriuwung Gajerrong. Such low flows are now very rare in the lower Ord River and usually only occur during periods of dam or power station maintenance.

The Department of Water and Water Corporation recognise the importance of low-flow periods to the Miriuwung Gajerrong and will ensure they are made aware of maintenance likely to cause such low flows so that customary practices can be undertaken.

Water for recreation and tourism

Water-based recreation on Lake Argyle, Lake Kununurra and the lower Ord River is important to the local economy and community. Most fishing and boating activity is only possible because the river is now regulated through the Ord River Dam so the river flows during the dry season (when it would previously have dried out). High releases and relatively low irrigation diversions have allowed boats to navigate between the Kununurra Diversion Dam and the Ord River Dam, and below the diversion dam along much of the lower Ord River.

Impacts of changes to flows in the lower Ord River

The decrease in dry season flows in the lower Ord River as more water is diverted to supply new irrigation areas will affect the water available to meet tourism and recreational needs. However, previous community engagement has shown acceptance of reduced flows given the economic benefits of diverting water for agriculture and as long as some flow is maintained (DoW 2006a).

Dry season flows in the lower Ord were typically around 50 m^3/sec after Lake Argyle first filled in 1974, and increased to 60 to 70 m^3/sec after 1996 when the spillway was raised and the Ord River Dam power station became fully operational. The average dry season flow rate is expected to be about 55 m^3/s once the irrigation allocation (750 GL/yr) is fully utilised. However, in more than a third of dry seasons, flows will be around 42 m^3/s, which is the minimum dry season environmeqntal flow when restrictions are not in force.

Releasing water from Lake Argyle to raise water levels in the lower reaches of the lower Ord River is not feasible given water levels fluctuate considerably based on river bed and bank conditions, changes in channel form due to floods, and tidal influences closer to the estuary. Modelling shows a considerable amount of water would need to be released to have any impact on water levels in the lower Ord River – to the detriment of storing water for agriculture. As such, we do not support releases from Lake Argyle specifically for navigational purposes on the lower Ord River (see Section 5.6).

Recreation on Lake Argyle and Lake Kununurra

Most water-based recreation on Lake Kununurra and Lake Argyle takes place during the dry season and involves commercial boat tours and private boating for recreational fishing.

The water needed for boating is provided by lake storage. However, tour boat operations on Lake Kununurra travel upstream, to where the spillway reaches the lake (40–45 km) and normally continue further upstream (another 15 km) to the base of the Ord River Dam. Flow rates of 50 m^3/s are needed for the boats to navigate to the base of the dam.

Hydropower station releases normally exceed this flow rate, except at times of low power demand. In the past, the Water Corporation has made additional releases for navigation via the Ord River Dam irrigation valves when the power station is releasing less than 50 m^3/s.

We support these releases given the benefits for tourism, but only consider it acceptable when water storage in Lake Argyle is high. At times of low storage, especially when other restrictions apply, releases specifically for navigation would compromise other demands and are not supported (see Section 5.6).

3.5 Balancing the demands for water

A major part of managing water in the Ord River is balancing the release of water from Lake Argyle to meet the different seasonal and short-term patterns of water demand. For this plan, the department's approach to meeting demand is to maximise water for irrigation and hydroelectricity, and meet ecological needs given the existing infrastructure.

Our water release rules provide a very reliable and secure water supply for irrigation (see Chapter 5). Through licences issued under the *Rights in Water and Irrigation Act 1914*, we will manage the timing and volume of water releases, restrictions and diversions to optimise water availability for competing demands.

To guide management, we used an iterative modelling approach (using the Ord River-Lake Argyle reservoir model) to examine different water allocation and restriction options. We modelled future scenarios representing the irrigation and hydroelectricity demand likely to develop during the plan's life. Scenarios ranged from 350 GL/yr for irrigation and moderate power demand, to 750 GL/yr for irrigation and high power demands.

We based modelling on recorded and estimated dam inflow for the period 1906–07 to 2003–04. Through the process, we recognised the importance of managing for drought periods – such as those that occurred in the 1930s, 1950s and 1980s – by specifying restricted releases when inflow declines.

We used the modelling to:

- identify the most effective way to release water for irrigation, hydropower and the environment so that consumptive and non-consumptive demands were met in as many years as possible
- specify water release rules from Lake Argyle and develop restriction policies for each demand during droughts
- estimate the number of years that the different demands were likely to be restricted.

To do this, we modelled the scenarios to meet three target criteria:

- the full irrigation supply of 750 GL/yr to be met in 95 per cent of years
- a minimum irrigation supply of 25 per cent of water demand in the driest year
- a minimum operating level for Lake Argyle of 70 mAHD.

Within these constraints, we selected the optimal water releases to maximise power generation and meet the environmental water provision. The modelling was used to confirm allocation limits and establish licensing rules for water releases, and irrigation, hydropower and environmental water restrictions, for each demand scenario.

As irrigation developments proceed, we will revise restrictions using the Ord River-Lake Argyle reservoir model (see Section 5.3). If new developments proceed rapidly and the high demand projections of Table 2 are realised, and there is agreement that the current dam infrastructure will be changed, we will revise our management accordingly (see Section 1.6).

For more information on the Ord River-Lake Argyle reservoir model simulations and demand scenarios for this plan, see the *Ord surface water allocation plan methods report* (DoW 2012b) and *Reservoir simulation in the Ord River catchment* (Smith & Rodgers 2010).

Chapter Four

Water allocation

This chapter sets out the:

- water allocation limits in each subarea
- water allocation approach
- water regime provided to maintain the lower Ord River environment.

The Department of Water has set allocation limits for each of the five subareas in the Ord plan area. For each subarea we will license and manage to the allocation limits, which were set to achieve the outcomes and resource objectives stated in Chapter 2.

Together, allocation limits and licensing guide how we manage water for irrigation purposes and other consumptive uses. The environmental water regime is provided through water releases for hydroelectricity generation and environmental flows, which are managed through the Water Corporation's Ord River Dam licence.

For more information on how we developed the allocation limits, water release rules and environmental flow regime for this plan, see the *Ord surface water allocation plan methods report* (DoW 2012b).

4.1 Water allocation limits

Generally, an allocation limit is the annual volume of water set aside for use from a water resource. In the Ord, allocation limits represent the annual volume of water that can be taken for consumptive use from each subarea.

Water is available for licensing in four out of the five subareas. The department will grant licensed entitlements up to the annual allocation limits at the defined reliability for each of the surface water subareas (Table 3).

The Ord allocation limits are divided into components for accounting purposes, including:

- water available for licensing (the general licensing component)
- water set aside for potential irrigation expansion into the Northern Territory (the Northern Territory component).

Allocation limits do not include water released for hydroelectricity generation or the downstream environment.

The allocation limits for the Main Ord and Carlton-Mantinea subareas were set in the 2006 plan and remain in place. Water allocation limits for the Upper Ord and Dunham River subareas are newly set in this plan (Table 3).

Table 3
Allocation limits for the *Ord surface water allocation plan* area

Subarea	Allocation limit (total entitlements) (GL/yr)	Allocation limit components (GL/yr)		Annual reliability of supply	Water available for licensing in WA (GL/yr) (at January 2013)
		General licensing	Northern Territory		
Upper Ord	15	15	0	variable	6
Main Ord	750	590	160*	95%	242
Tarrara-Carlton	0	0	0	N/A	0
Carlton-Mantinea	115	115	0	95%	115
Dunham River	25	25	0	variable	5
Total	**905**	**745**	**160**		**368**

* The Northern Territory component may be used in Western Australia if demands in this state grow rapidly before extra supply options are approved.

The Tarrara-Carlton subarea allocation limit is zero, because the Ord Final Agreement makes no provision for any developments and the soils and topography are not favourable for irrigation. While no water entitlements will be granted directly from the Tarrara-Carlton subarea, water entitlements can be committed from the entitlements available in the Main Ord subarea. This can be achieved by releasing the additional water from Lake Kununurra and diverting it downstream in the Tarrara-Carlton river reach.

For irrigation, we have allocated 750 GL/yr from the Main Ord subarea and 115 GL/yr from the Carlton-Mantinea subarea (Table 3). That is, up to 865 GL/yr of licence entitlements can be granted at 95 per cent reliability from the Ord River downstream of Lake Argyle.

As at February 2013, there is an application seeking an annual water entitlement of 98 GL from the Carlton-Mantinea subarea. If it is approved, it will significantly reduce the remaining water available in that subarea.

4.2 Allocation approach

Allocating water for irrigation expansion

The irrigation demands dependent on Lake Argyle will change over time as new irrigation expansion areas are approved and the demand for hydroelectricity increases. We will stage the issuing of licensed entitlements for irrigation water by not issuing more entitlements than are needed for efficient irrigation of planned crop types. This will allow irrigation developers to access secure, reliable water without unnecessarily constraining hydroelectricity generation before additional water is needed for irrigation.

Of the 750 GL/yr allocation limit for the Main Ord subarea, 350 GL of annual water entitlements have been granted in WA (mainly for irrigation). Much of the remaining 400 GL/yr is expected to be granted for irrigation expansion in WA and a portion will be needed should irrigation expansion proceed in the Northern Territory. Allocation of the remaining water will be based on how developments proceed, any intergovernmental agreements and whether new water is available through water supply planning.

Northern Territory irrigation expansion

Conditional environmental approval for the Northern Territory portion of the M2 supply area was granted in 2002, shortly after conditional approval was granted by the WA Minister for the Environment. The department made an indicative provision of 160 GL/yr assuming a nominal 10 ML/ha of irrigation development over 14 000 ha, plus an allowance of 20 GL/yr for distribution losses.

If sugarcane is grown throughout the Goomig farmlands and Knox Creek Plain area in Western Australia, water entitlements of up to 275 GL/yr will be required. Under these circumstances, and unless additional water supply options are developed to make more water entitlements available, we would need to review the water set aside for expansion into the Northern Territory.

We will review the Northern Territory provision in 2017 or sooner if it is constraining the development of viable irrigation areas in Western Australia and/or there is no progress in developing irrigation areas in the Northern Territory.

Licence applications for water to be used in the Northern Territory will be considered once intergovernmental arrangements are made.

Allocating water to irrigation developers and water service providers

Water for developers and water service providers is assessed through the department's water licensing process and granted under the *Rights in Water and Irrigation Act 1914* based on the intended crop types, their water demands and related requirements.

The Western Australian Government selects developers for new irrigation areas in the Ord area as part of its land release program. In the case of the Goomig farmlands project, the government is providing the infrastructure to secure private sector interest and has recently announced it will do likewise for the Ord West Bank. In future, private sector investors are expected to develop the remaining areas.

The approach to water service provision may vary depending on the nature of the development. Where multiple irrigators/landowners are to take up land in a new area, a water service provider will be needed for the new area. A water service provider is subject to licensing by the Department of Water (rights to water) and the Economic Regulation Authority (ERA) (water service regulation).

When the developer selects the new landowners/irrigators, the new irrigators submit their intended crop types and water demand to the new water service provider.

To meet the needs of its customers, the new water service provider then applies to the department for a water licence.

In addition to our usual licence assessment process (see Section 5.1), when we assess large licence applications we will consider the current and future needs for water in WA and the Northern Territory, including the provisions of any inter-government agreement with the Northern Territory, and any agreements made between the Western Australian Government and developer(s).

Allocating water for Traditional Owners' farmland

The Miriuwung Gajerrong people have agreed to surrender native title rights in development areas defined in the Ord Final Agreement, in exchange for a suite of benefits. One of the benefits requires the proponent or developer to make serviced farmland available in most development areas. This benefit may be taken as a direct transfer of land, options to purchase extra land, and/or equity in the development.

In the case of the Goomig farmlands, where the state government is the developer, the Miriuwung Gajerrong (MG) Corporation has agreed to receive five per cent of the land by direct transfer (free of charge) and has the option to purchase a further 7.5 per cent.

To obtain water for the farmland, the MG Corporation (or its agent) can become a customer of the water service provider for the development or, if its land has direct access to the Ord River, it can apply directly to the department for a licence under Section 5C of the *Rights in Water and Irrigation Act 1914*.

Proposals to develop land where native title has been determined, but is not covered by the Ord Final Agreement, cannot proceed until an agreement with the MG Corporation has been negotiated.

Trading water

Trading of water (permanent and temporary) can occur among licensees or within cooperatives, but not between licensees and cooperative members. Also, water entitlements cannot be traded with water for power or the environment.

Trading of water entitlements between licensees in the Ord irrigation area can occur at any time, but is most likely to occur once water entitlements equal the allocation limits. This is not expected to happen during the life of this plan. To assess applications to trade we are guided by statewide policy and Division 7 of Schedule 1 of the *Rights in Water and Irrigation Act 1914.*

Trading of cooperative shares can occur consistent with the cooperative's articles of association. For new water service providers, trading between customers would occur as defined in the customer contracts.

Allocating water in dry periods

To maintain a high reliability of supply, some water is normally kept in storage. This means that demands on water from Lake Argyle for irrigation, hydroelectricity and the environment will be fully met in most years. However in longer dry periods (e.g. those experienced in the Ord area in the 1930s, 1950s and 1980s) a shortfall would occur, so water restrictions are applied.

We have defined the water levels in Lake Argyle that will trigger restrictions to water for irrigation, hydropower and the environment in these circumstances. Because of the seasonal nature of inflows and lake levels, we defined restriction-level triggers for each month of the year. These levels are detailed in Table A1.

Town water supply

Kununurra's town water supply is sourced from an unconfined groundwater aquifer located on the northern bank of Lake Kununurra just above the diversion dam. The town's drinking water source is protected by a Priority 1 (P1) Drinking Water Source Protection Area (DWSPA). Because the groundwater is primarily recharged from the river, any activity along the foreshore should comply with the requirements of the DWSPA plan. Management arrangements for the P1 area are specified in the Kununurra DWSPA plan available at <www.water.wa.gov.au>.

Water supply options for new rural residential areas should be discussed with the department early in the development process and must consider impacts on proposed water supplies for irrigated agriculture.

4.3 Environmental water provision

The environmental water provision is the flow regime the department has set to maintain the existing (post-dam) environmental values of the lower Ord River, consistent with the EPA's recommendations, while accounting for competing demands. It delivers a range of flows important for maintaining river health and ecological functions associated with environmental values in the lower Ord River (see Figure 6 and Section 3.4).

The environmental water provision comprises:

- a baseflow component that varies in the wet and dry seasons
- a series of annual and inter-annual wet season flow events
- infrequent wet season flood events.

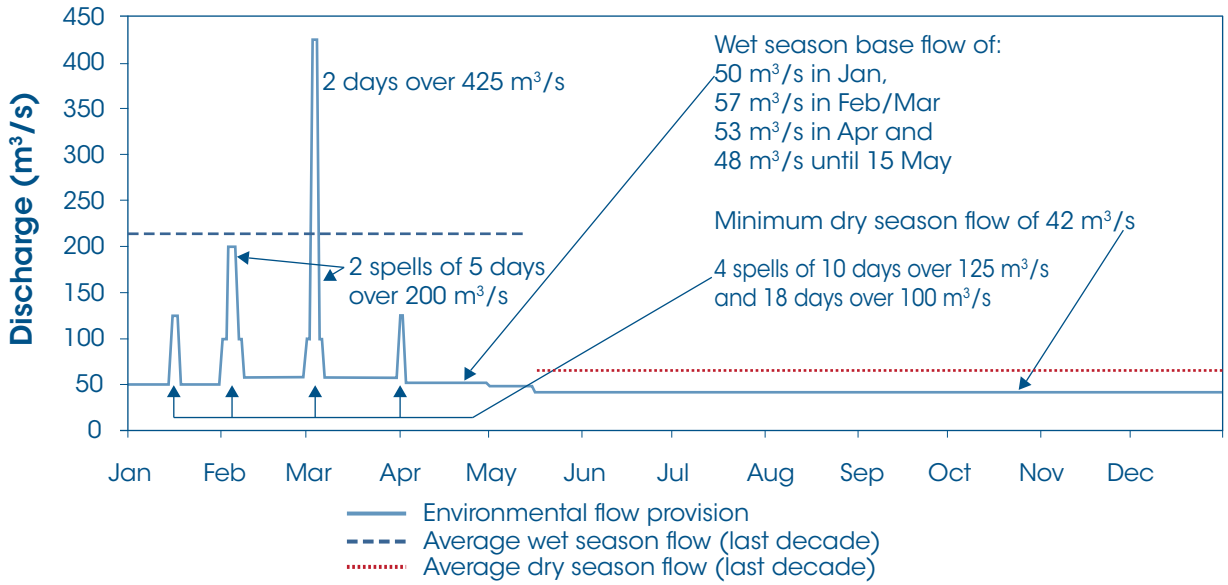

Figure 6
An example of the expected flow regime (environmental water provision) for the lower Ord from Lake Kununurra to Tarrara Bar

Baseflow (Table 4) and wet season peak flow (Table 5) are needed in the lower Ord River to maintain healthy habitat and potential spawning sites for large fish. These components of the environmental water provision are achieved through a combination of releases from lakes Argyle and Kununurra and unregulated catchment inflow.

The required environmental flows will be fully met by releases for hydropower and inflow from the catchment downstream of the Kununurra Diversion Dam (particularly from the Dunham River) in 93 per cent of years.

Restrictions to the environmental flows required in the lower Ord River apply when storage levels in Lake Argyle are low, similar to the restriction policies on hydroelectricity generation and irrigation. Taken together the restriction policies establish how the competing demands for water are balanced during drought periods.

The required baseflow rates are a function of the month of the year and the class of restrictions that apply at the time (Table 4).

Table 4
Baseflow requirements to be measured at Tarrara Bar gauging station

	No restrictions		Class 1 restrictions		Class 2 restrictions	
Month	Minimum Lake Argyle water levels (mAHD)	Full EWP baseflow (m^3/s)	Water levels in Lake Argyle (mAHD)	Restricted EWP (m^3/s)	Water levels in Lake Argyle (mAHD)	Restricted EWP (m^3/s)
January	79.2	50.0	–	–	79.2	39
February	82.0	57.0	–	–	82.0	44
March	83.4	57.0	–	–	83.4	44
April	83.7	53.0	–	–	81.0	41
May	83.2	48.0*	83.2 to 79.4	37	79.4	32
June	82.8	42.0	82.8 to 76.8	37	76.8	32
July	82.3	42.0	82.3 to 76.2	37	76.2	32
August	81.7	42.0	81.7 to 75.3	37	75.3	32
September	81.1	42.0	81.1 to 74.3	37	74.3	32
October	80.5	42.0	80.5 to 73.1	37	73.1	32
November	80.0	42.0	80.0 to 75.7	37	75.7	32
December	79.5	42.0	79.5 to 75.3	37	75.3	32

* On 15 May the environmental water provision flow requirement drops from 48 m^3/s to 42 m^3/s

Table 5
Wet season peak flow requirements to be measured at Tarrara Bar gauging station

No. of events	Total target duration (days)	Duration remaining (higher) flow targets have been met (days)	Average daily discharge (m^3/sec)	
			Unrestricted conditions	Class 2 restriction conditions
			Lake Argyle levels > 82.0 mAHD (Feb) > 83.4 mAHD (Mar) > 83.7 mAHD (Apr)	Lake Argyle levels < 82.0 mAHD (Feb) < 83.4 mAHD (Mar) < 83.7 mAHD (Apr)
1	2	_	≥ 425	_
2	5	3	≥ 200	≥ 154
4	10	5	≥ 125	≥ 96
N/A	18	8	≥ 100	≥ 77

Runoff from the Dunham River catchment makes up the greatest proportion of inflow downstream of the Kununurra Diversion Dam and is particularly important to meeting the wet season peak flows. If the wet season targets have not been met in the current wet and were not achieved in one or more of the preceding four wet seasons, the Water Corporation will be required to release additional 'top up' flows from the Ord River Dam (see Action 3, Table 12). This would require more frequent flow monitoring at Tarrara Bar and in the Dunham River.

Infrequent wet season flood events (Table 6) are also required for fish passage, to scour sediments and to flood riparian vegetation. These flood events, while large and outside of the control of releases from the Ord River Dam, are much less frequent now compared with the period before the dam was built. They occur as a result of runoff from the catchment downstream of the dam and cannot be managed through control of dam releases.

Table 6
Infrequent wet season flood events to be measured at Tarrara Bar gauging station

Flood event	Average daily discharge (m^3/sec)
One event every two years	≥ 750
One event every four years	≥ 1400
One event every 27 to 35 years	≥ 3700

Chapter Five

Water licensing

Water licences are the regulatory instrument the Department of Water uses under the *Rights in Water and Irrigation Act 1914* to manage surface water and groundwater. We will assess and grant licences in line with legislation, statewide licensing policies and procedures, and the approach described in this plan.

We regulate the release of water from the Ord River and Kununurra Diversion dams through conditions set in the Water Corporation's storage licence. The Water Corporation is required to operate the current dam infrastructure, including the release of water, in accordance with its licence conditions. Water releases for hydroelectricity generation are also managed through conditions in the Water Corporation's licence. Water for irrigation purposes and other consumptive uses, such as mining or industrial water supply, is managed through licences issued to the water user.

Water for the lower Ord River environment is provided by releases from the Kununurra Diversion Dam in combination with flows from the Dunham River and the lower Ord catchment. At times when catchment-derived flows are not sufficient to meet the environmental water provision, additional water is released at the Ord River and Kununurra Diversion dams in accordance with conditions in the Water Corporation's storage licence.

This chapter includes:

- the legislative basis for surface water licensing in the Ord
- our approach to using licences and licence conditions to manage Ord surface water for irrigation, power generation and the downstream river environment
- our approach to managing water for irrigation, power generation and the downstream river environment in drought years
- local policies for assessing and managing current licences and new licence applications
- specific conditions that apply to licences and licence operating strategies, particularly for licences from the Main Ord subarea
- an integrated approach to managing different water interests including water availability for opportunistic users.

For more information on how we developed the licensing approach for this plan, see the *Ord surface water allocation plan methods report* (DoW 2012b).

5.1 Legislative requirements

The department regulates and manages water on behalf of the state under the *Rights in Water and Irrigation Act 1914* (the Act). The Act establishes the legislative framework for managing and allocating water in Western Australia. All of the surface water resources in the Ord plan area are covered by the Ord surface water area, which is proclaimed under the Act. In areas proclaimed under the Act, including the Ord plan area, a licence is required to legally take water.

In administering the Act, we also consider other state and Commonwealth agreements and legislation, including:

- *Ord River Hydro Energy Project Agreement Act 1994* (WA)
- *Water Agencies (Powers) Act 1984* (WA)
- *Water Services Act 2012* (WA)
- *Land Administration Act 1997* (WA)
- *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
- *Native Title Act 1993* (Commonwealth).

This plan is consistent with or meets the intent of the National Water Initiative (NWI) as far as possible under the Act. Terms used in the NWI are not used in the Act and this plan uses terms and definitions that are appropriate under Western Australian legislation. The definition of terms used under the Act and in this plan can be found in the Glossary.

Water licences

In the area covered by the *Ord surface water allocation plan*, organisations and individual self-supply users require a water licence issued under Section 5C of the Act to lawfully take or modify the flow of surface water. The licence defines the legal right to take water and specifies the annual water entitlement, as well as where and for what purposes the water may be taken. A permit is also required to interfere with the beds and banks of watercourses under sections 11, 17 and 21 of the Act. This includes, but is not limited to, installing pumps or constructing dams.

In granting a water licence for surface water from the Ord River, the department primarily considers this allocation plan, clause 7 (2) of Schedule 1 of the Act and statewide policies. To meet the objects of the Act we may apply terms, conditions and restrictions to licences under clause 7 (1) of Schedule 1 of the Act. To achieve this, for large or more complex licences we usually require an operating strategy, which is a set of operating rules and actions that the licensee is required to implement as a condition of the licence.

Licences are issued for a fixed term and applications for renewal are again considered under clause 7(2) of the Act. Licences are normally renewed, consistent with the plan, if licence conditions have been met. Powers to alter any licence condition are specified under clause 24 (1) of Schedule 1 of the Act. The rights of licensees are covered under clause 26.

Under the Rights in Water and Irrigation Exemption and Repeal (Section 26C) Order 2011 there are some exemptions from licensing for small-scale or emergency water use.

Similarly, there are some situations where bed and bank activities that do not involve taking water on a mining tenement may not require a permit.

People proposing to or currently using water, or undertaking activities that will affect the beds and banks of rivers, should contact the department to ensure they have the correct authorisation for their water use.

Compliance and enforcement

The Act requires people or organisations to have appropriate authorisation to take surface water or groundwater, to modify flow or to interfere with the beds or banks of a watercourse proclaimed under the Act. If authorisations are not demonstrated, or the conditions of an authorisation are breached, we will take appropriate enforcement action.

5.2 Licensing large-scale irrigation

Current situation

Water for large-scale irrigation is presently supplied primarily by the OIC: the key water service provider in the Main Ord subarea.

The OIC supplies water to 15 363 ha of farmland, with most of the water diverted at the M1 offtake into the M1 supply channel for the Ivanhoe Plain and about 10 to 12 per cent diverted at the Packsaddle pump station to Packsaddle Plain. The OIC is licensed to supply water for irrigation use and non-potable commercial use in areas serviced by the Stage 1 channel systems of the irrigation district. It also manages the 'on-farm entitlements' of its members.

Large-scale self-supply licensees in the neighbouring Dunham and Carlton-Mantinea subareas are subject to specific conditions and do not affect the management arrangements for the Main Ord subarea.

To date, the supply of water for irrigation diversion in the Main Ord subarea has largely been met by water released for hydroelectricity production. To ensure the reliability of this supply, as well as optimise water for irrigation, hydroelectricity and the downstream river environment, we apply an integrated management approach to licensing. The department ensures that the licences and licence conditions for water entitlements within the Main Ord subarea and the licence conditions governing dam operations are aligned and consistent.

Changes to licensing as irrigation developments proceed

New irrigation developments around the current Stage 1 area and in the new M2 area will be drawing on the 750 GL/yr allocation limit for the Main Ord subarea. The department will assess and grant new licence entitlements in stages, as each new irrigation area proceeds. This will maximise access to water for further irrigation expansion within the allocation limit, and ensure power generation is not unnecessarily restricted before water is fully utilised for irrigation expansion.

For each new licence entitlement we will:

- grant annual water entitlements to match justified crop needs and efficient water use for the area under irrigation

- recoup unused water from existing licensees at times of their licence renewal, or if necessary when we grant new licences for new developments
- adjust water release rules and restrictions to maintain reliability.

Unused water entitlements will be recouped because maintaining reliability for unused entitlements would mean the storage level that triggers restrictions on electricity generation would be higher than it needs to be. We will make provision for reasonable changes in crop types from year to year, such as a move to higher-water-use crops. Also, savings made from efficiency gains above expected efficiency targets will not be recouped and can either be used to expand production or be traded.

When we grant new water entitlements of 30 GL/yr or more from the Main Ord subarea, we will adjust the Ord River Dam releases and restriction trigger levels in the Water Corporation's licence. This will ensure that all irrigation entitlements (on average) are fully supplied in 95 per cent of years.

To maintain the precision of the water release rules and restrictions we will use the Ord River-Lake Argyle reservoir model to define the new levels in the reservoir that will trigger restrictions.

This approach will optimise the 750 GL/yr allocation from the Main Ord subarea. In other subareas, similar crop demand and efficiency assessments will be applied before new licences are issued, but the Water Corporation licence to operate the dams will not need to be changed.

Managing in drought years

Annual inflows to Lake Argyle are highly variable and several years of severe drought have occurred during the past 100 years. Through this plan the department is managing to 95 per cent reliability for irrigation. During periods of low inflows, restrictions for hydropower are applied to reduce the total demand on Lake Argyle before storage levels become very low. If storage levels do get very low, restrictions to irrigation and the environment will also apply.

We will apply restrictions as a percentage of annual water entitlements if water levels:

- in Lake Argyle are less than 79 mAHD on 1 April
- are predicted to fall below monthly trigger levels before 31 December (without applying restrictions).

The monthly trigger levels for current entitlements are listed in Appendix A. We will confirm the likelihood and announce the severity of restrictions to irrigation entitlements two weeks after the annual Ord River stakeholders meeting (see Section 5.6). We will lift restrictions over that particular year if subsequent wet season inflows are large enough to raise storage levels in Lake Argyle above the monthly trigger levels.

To maintain irrigation supply in 95 per cent of years, we will adjust the water levels that trigger restrictions as new entitlements are issued. However, as Figure 7 shows, the changes in Lake Argyle storage levels at which irrigation restrictions are first triggered will not differ significantly. The restriction approach is specified as a condition of the Water Corporation's licence.

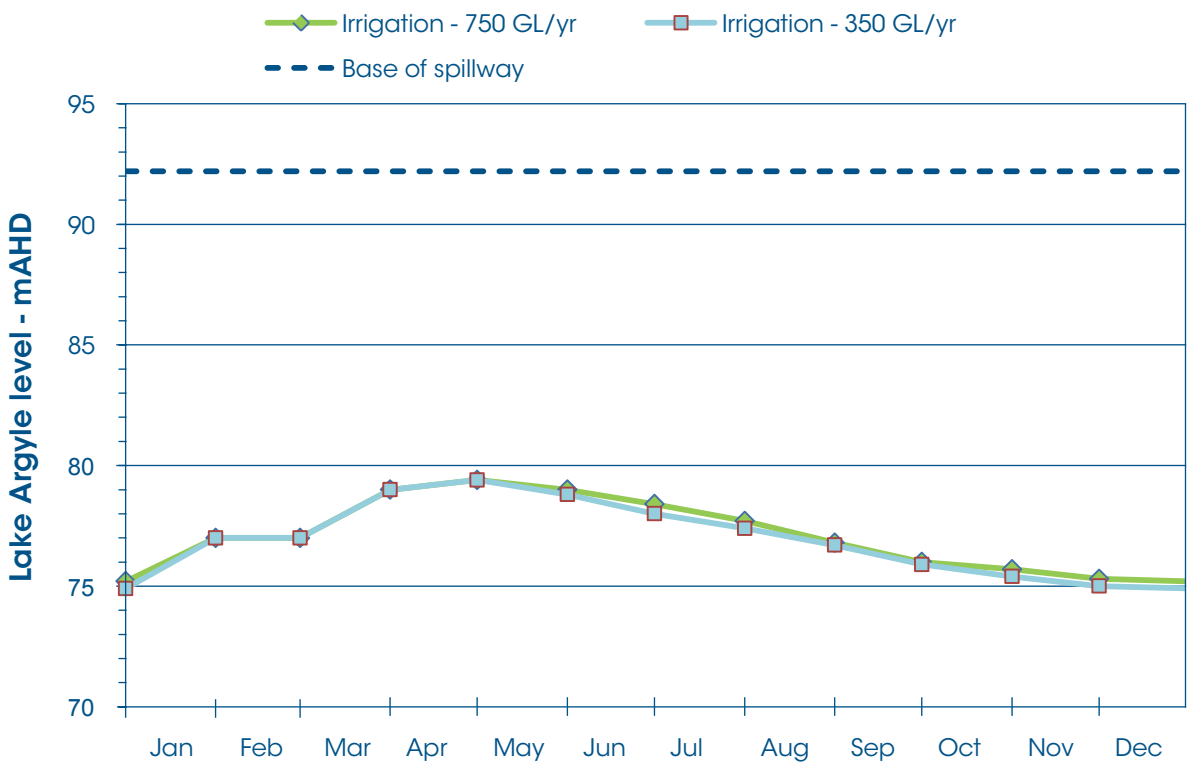

Figure 7
Irrigation restriction trigger levels for current and full allocation

5.3 Licence conditions for hydroelectricity

Current situation

The department has established water release rules to manage the projected high electricity demand coinciding with irrigation expansion and the possibility of drought periods. The current water release rules apply as a condition of the Water Corporation's licence.

The current rules are based on meeting the provisions of the 1994 Water Supply Agreement for the power station (Section 3.3). A more effective approach is possible with some changes to the agreement. This is explained under 'Enhanced rules approach' on page 39.

Current water release rules

The current water release rules:

- establish the monthly water levels at which electricity can be generated at Pacific Hydro's discretion (unrestricted) (Table A1 and Figure 8)
- establish water levels at which electricity generation at Pacific Hydro's discretion would be limited:
  - to a 210 GWh/yr rate (Class 1 restrictions)
  - to a 89.4 GWh/yr rate (Class 2 restrictions)
  - to no independent hydropower releases (Class 3 restrictions).

- set a monthly limit on power generation when Class 1 restrictions are triggered, based on the annual rates of 210 GWh/yr (these include a banking and borrowing provision that gives operational flexibility around each monthly limit, but limits the total power generated to 210 GWh in a financial year)
- set daily limits on power generation when Class 2 restrictions are triggered, based on the annual rate of 89.4 GWh/yr
- allow no independent releases for power when Class 3 restrictions are triggered, and limit daily electricity generation to that which can be generated from the Water Corporation's required releases for irrigation and the environment
- require the Water Corporation to identify whether water levels trigger hydropower restrictions and to apply restrictions as required.

Figure 8 illustrates the current water release rules for 350 GL/yr of irrigation.

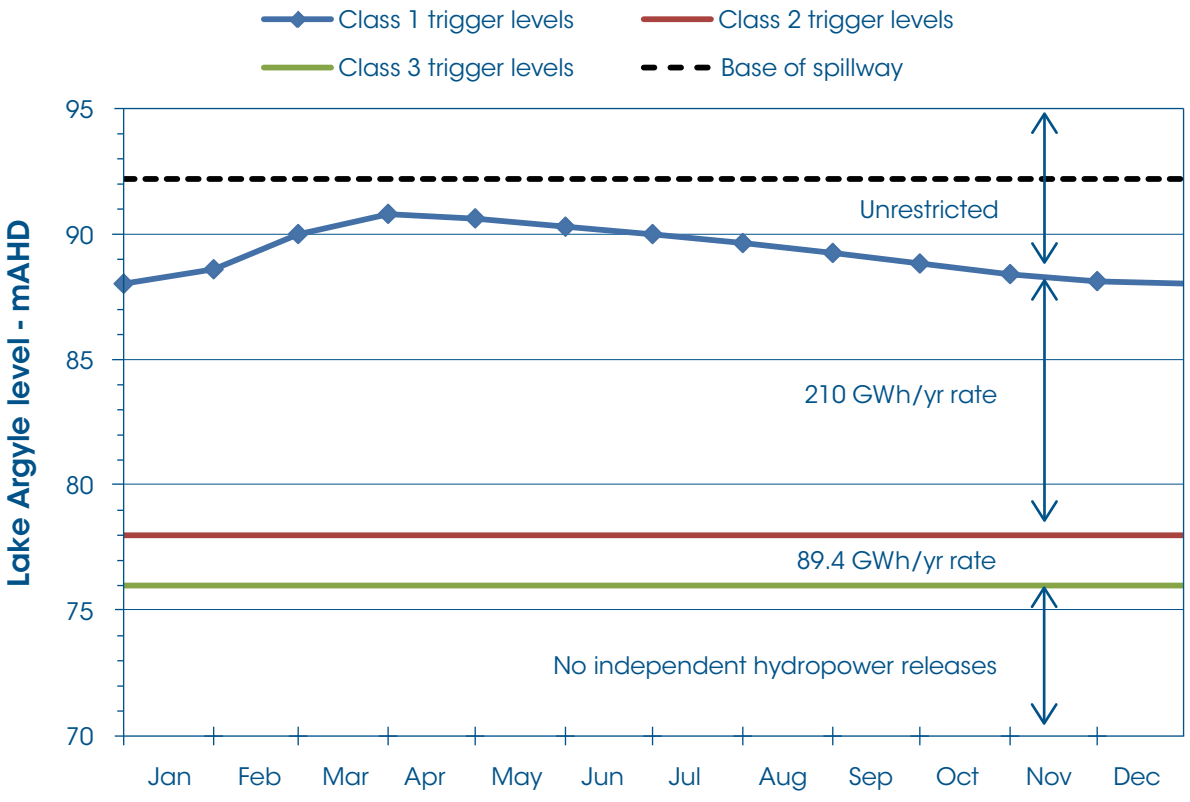

Figure 8
Current hydropower restrictions for 350 GL/yr of irrigation (as at July 2013)

Table 7 sets out the monthly limits on electricity that Pacific Hydro may generate when Class 1 and Class 2 restrictions apply (independent of the electricity that could be generated from the Water Corporation's releases for irrigation and/or the lower Ord River). The monthly limits are based on recent seasonal patterns of demand on the East Kimberley electricity grid.

Table 7
Limits on Pacific Hydro's electricity generation

Month	Restriction Class 1*	Restriction Class 2	
	GWh	GWh	MWh/day
January	18.23	7.54	243
February	15.61	7.55	270
March	18.16	7.86	254
April	16.95	7.67	256
May	16.71	6.52	210
June	16.13	5.86	195
July	17.15	5.96	192
August	18.00	6.25	202
September	17.97	7.91	264
October	18.08	9.40	303
November	19.33	9.29	310
December	17.74	7.58	245
Total	**210.0**	**89.4**	**-**

* Nominal limit adjusted by the banking and borrowing approach

Class 1 restrictions are triggered by the water level in Lake Argyle at the start of the month and continue for the full month unless levels reach the Class 2 trigger during that time. For Class 2 restrictions, we are currently replacing weekly limits with daily limits, which are expected to be in place by late 2013.

The daily limits on power generation for Class 2 restrictions will be based on whether the electricity able to be generated from the Water Corporation's required releases on the day, is larger than Pacific Hydro's Class 2 discretionary daily allowance each month (Table 7).

Compliance with Class 1 and Class 2 generation limits will be assessed over periods of four, six and 12 months.

Class 3 restrictions will apply when lake levels fall below 76 mAHD. At this level Pacific Hydro will have no discretion to generate electricity independent of the Water Corporation's required releases. Class 3 electricity limits are therefore based on the electricity that can be generated from the Water Corporation's required releases for irrigation and the environment.

Changes to hydropower releases as irrigation developments proceed

The department will modify the release rules specified in Water Corporation's licence:

- by adjusting the levels at which Class 1 and Class 2 restrictions are triggered as extra water entitlements are granted
- by increasing the level at which Class 2 restrictions are triggered, and the allowable amount of electricity generation, if Horizon Power's demand exceeds 89.4 GWh/yr
- if the 1994 Water Supply Agreement is renegotiated in line with the enhanced rules approach outlined below.

The department will update the water release rules in the Water Corporation's licence each time we grant new water entitlements of 30 GL/yr or more from the Main Ord subarea. When water entitlements are equal to or less than 450 GL/yr in the Main Ord subarea, each water entitlement increase of 30 GL/yr will require an increase of about 0.2 m to the trigger levels for each class of hydropower restrictions. Once water entitlements are above 450 GL/yr, smaller increments will trigger a revision of the water release rules.

The magnitude of changes will also depend on demand and the hydropower release rules. Changes to the trigger levels for hydropower restrictions are therefore likely to occur each time a new irrigation area of greater than 2500 ha proceeds.

If the electricity demand for local towns to 2015 increases beyond that projected under the 1994 Water Supply Agreement, the trigger levels for Class 2 restrictions will be adjusted to ensure the town demand can be met.

Enhanced rules approach

While the current water release rules share water to best meet all demands under the 1994 Water Supply Agreement, a more effective water sharing arrangement can be achieved.

The enhanced rules approach enables more electricity to be generated on average under any given water demand and can supply up to 750 GL/yr at 95 per cent reliability (Figure 10). The enhanced rules approach will also reduce the severity of irrigation restrictions, especially as the granted entitlements approach the allocation limit. Before the enhanced rules can be implemented, however, the 1994 Water Supply Agreement needs to be changed (see 'Implementing the enhanced rules' below).

The enhanced rules approach varies from the current rules in two ways, by:

- lowering the trigger level at which Class 1 restrictions begin so that the power station can run unrestricted more frequently when storage levels are moderate to high

- increasing the trigger level at which Class 2 restrictions begin so that less water is released, independent of Water Corporation needs, when lake levels are low and restrictions on irrigation are imminent.

The enhanced rules approach at the current 350 GL/yr of licensed entitlements is shown in Figure 9. Comparison with Figure 8 illustrates the benefits on average of the enhanced rules approach. The restriction levels under current entitlements for the enhanced rules approach are shown in Table A2.

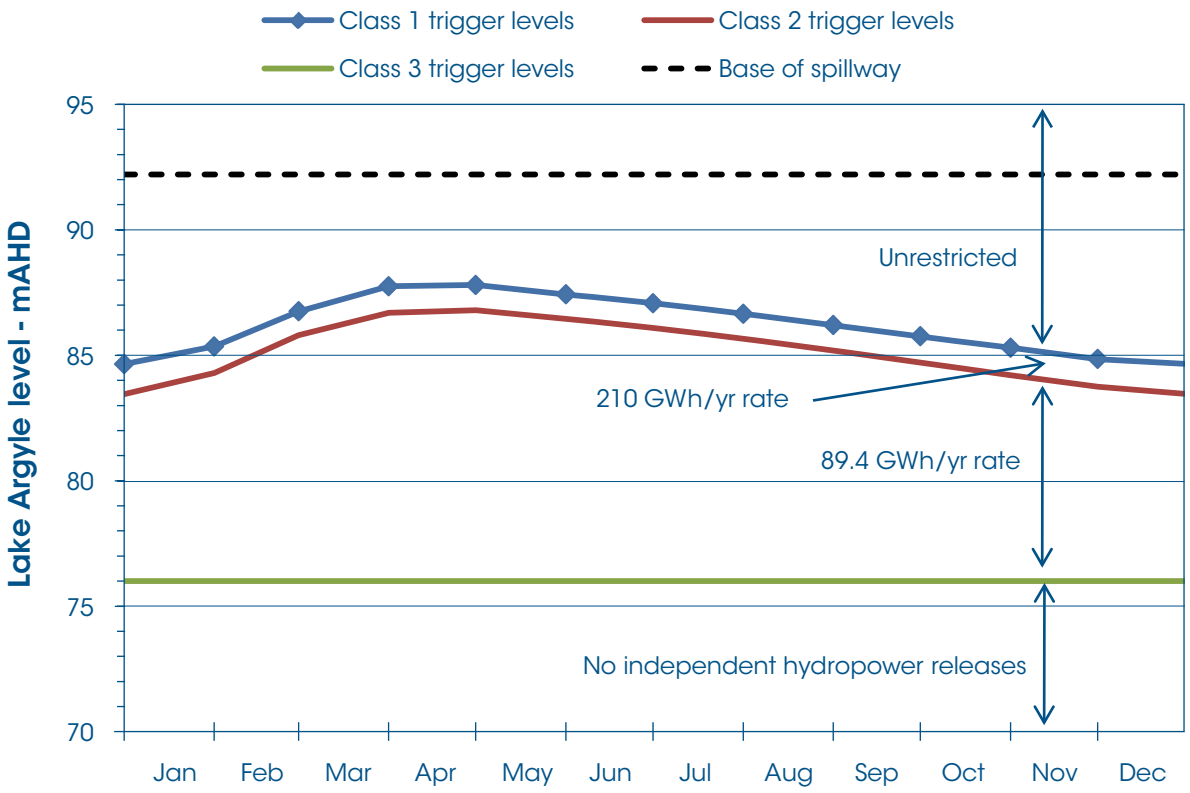

Figure 9
Enhanced rules approach for hydropower restrictions for 350 GL/yr of irrigation

The enhanced rules optimise water for electricity and irrigation. As irrigation demand increases, the average electricity able to be generated will decrease for both the current and enhanced rules approach. The current rules approach enables Pacific Hydro to generate at least 210 GWh/yr while water levels in Lake Argyle are above 78 mAHD and therefore maintain the minimum guaranteed in the 1994 Water Supply Agreement. However, the current agreement significantly affects water for irrigation. Only 520 GL/yr can be reliably supplied in 95 per cent of years if the minimum guarantee of the water supply agreement is maintained (see current rules approach in Figure 10). With the enhanced rules, more hydroelectricity can be generated on average and more water can be supplied for irrigation expansion (see enhanced rules approach in Figure 10).

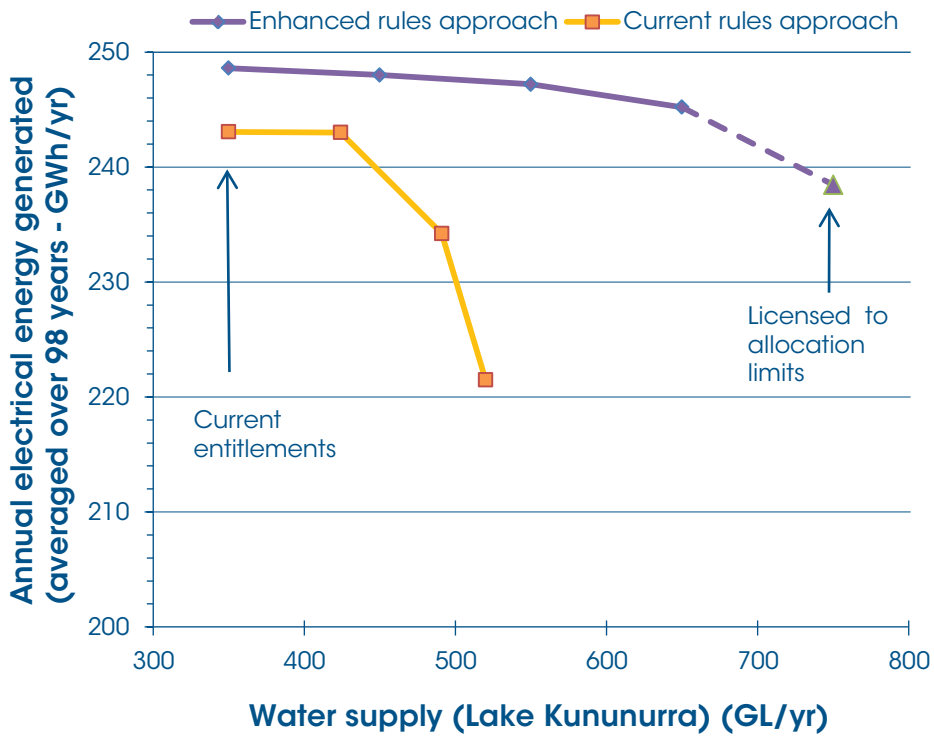

Figure 10
Comparison of electricity generated under current and enhanced rules with increasing water supply

For more detail on the enhanced rules approach and how it was developed, see the *Ord surface water allocation plan methods report* (DoW 2012b).

Implementing the enhanced water release rules

The water licence issued by the Department of Water to the Water Corporation is the legal instrument that defines the hydropower release rules. The Water Corporation will apply the release rules, as specified in its licence, with the trigger levels defined by either the current rules or the enhanced rules (whatever is current at the time) to determine restrictions to hydropower.

The Water Corporation and Pacific Hydro 'support in principle' a move to the enhanced rules, and intend to update their water supply agreement. Ideally, the updated water supply agreement would reflect the enhanced rules. The department will implement the enhanced rules approach as soon as the Water Corporation applies to change its licence to introduce them.

The department is, however, prepared to issue annual water entitlements up to 750 GL/yr in the Main Ord subarea, to support irrigation expansion, whether or not the enhanced rules have been agreed between the Water Corporation and Pacific Hydro.

This would mean – when more than 520 GL/yr of entitlements were granted – that power generation would:

- be limited to less than 210 GWh/yr in approximately 10 per cent of years in which water levels were above 78 mAHD
- still average more than 238.4 GWh/yr over the long term.

Managing in drought years

The current or enhanced rules, whichever apply at the time, include the approach to managing in drought years by specifying the lake levels at which electricity generation is restricted. The restrictions on hydropower are not solely a drought measure, but limit the demand on Lake Argyle before storage levels become very low. The following classes of restrictions have been adopted:

- Class 1 restrictions – 210 GWh/yr (based on the water supply agreement)
- Class 2 restrictions – 89.4 GWh/yr (based on town power demand)
- Class 3 restrictions – no independent hydropower releases.

Figure 8 and Figure 9 illustrate the restrictions on hydroelectricity generation for the water entitlements currently granted (~ 350 GL/yr) given the current and enhanced rules approach.

5.4 Licence conditions for environmental water

The environmental water provision is measured at the Tarrara Bar gauging station (Figure 12). It is made up of three components:

- dry season and wet season baseflow (Table 4)
- wet season flow targets (Table 5)
- infrequent wet season flood events (Table 6).

Current situation

It is a condition of the Water Corporation's storage licence that the environmental water provision for baseflow and wet season flow targets be met. The Water Corporation is therefore responsible for releasing enough water through the Ord River and Kununurra Diversion dams to meet these flow targets.

A dry season baseflow of 42 m^3/s is required from the Kununurra Diversion Dam to House Roof Hill. Downstream of House Roof Hill (to the tidal limit) the shape of the main channel changes and the required baseflow is 37 m^3/s (5 m^3/s lower than the upstream reach). The wet season baseflow ranges from 48 m^3/s to 57 m^3/s.

Depending on the demand for hydroelectricity and irrigation, additional releases from storage may be needed to meet the dry season minimum flows – see Chapter 6 and Table 15 of the methods report (DoW 2012b).

Inflows from the Dunham River into the Ord River, below the diversion dam, provide most of the flow needed to meet the wet season flow targets. The department requires the wet season flow event targets to be met in four out of five years. If the targets are not met in one of the previous four years, the Water Corporation will need to release additional water from storage to 'top up' catchment inflow to meet the targets in the fifth year.

The infrequent wet season flood events are generated from runoff, primarily from the Dunham River catchment and only need to be reported on (not delivered) as a condition of the Water Corporation's licence.

Changes to environmental water as irrigation developments proceed

Recent high flows in the lower Ord River greatly exceed those required to meet the environmental water provision. As more water is diverted for irrigation, especially as diversion approaches 750 GL/yr, downstream flows will decrease but will be sufficient to meet the full environmental water provision in most years (tables 4 and 5).

Restrictions to environmental flows will apply in years when storage levels in Lake Argyle are low, similar to restrictions on irrigation and hydroelectricity generation.

Managing in drought years

The Lake Argyle levels that trigger restrictions on environmental flows for the lower Ord River during drought periods is shown in Figure 11. In the dry season months (May to December) the water available to the environment will reduce by 12 per cent under Class 1 restrictions and 23 per cent under Class 2 restrictions. In the wet season months (January to April), only Class 2 restrictions apply.

Based on the season and restriction class, different components of the environmental water provision will be restricted in different ways:

- in the dry season, the Class 1 and Class 2 restrictions apply to the baseflow component (Table 4)
- in the wet season, Class 2 restrictions apply to the baseflow (Table 4) and peak flow components (Table 5).

The flow rates needed to provide the required baseflow component (Table 4) are related to the month and restriction class (Figure 11). The restricted flows and levels in Lake Argyle that trigger environmental water restrictions under current entitlements are shown in Table A1.

The wet season flow requirements are expected to be achieved by 30 April each year. During the wet season, environmental flow targets change if Lake Argyle water levels change (from drought to non-drought or vice versa).

Table 4 summarises the minimum flow rate targets for each month under normal and restricted conditions. For more information on how the environmental restrictions were developed and assessed, see the *Ord surface water allocation methods report* (DoW 2012b).

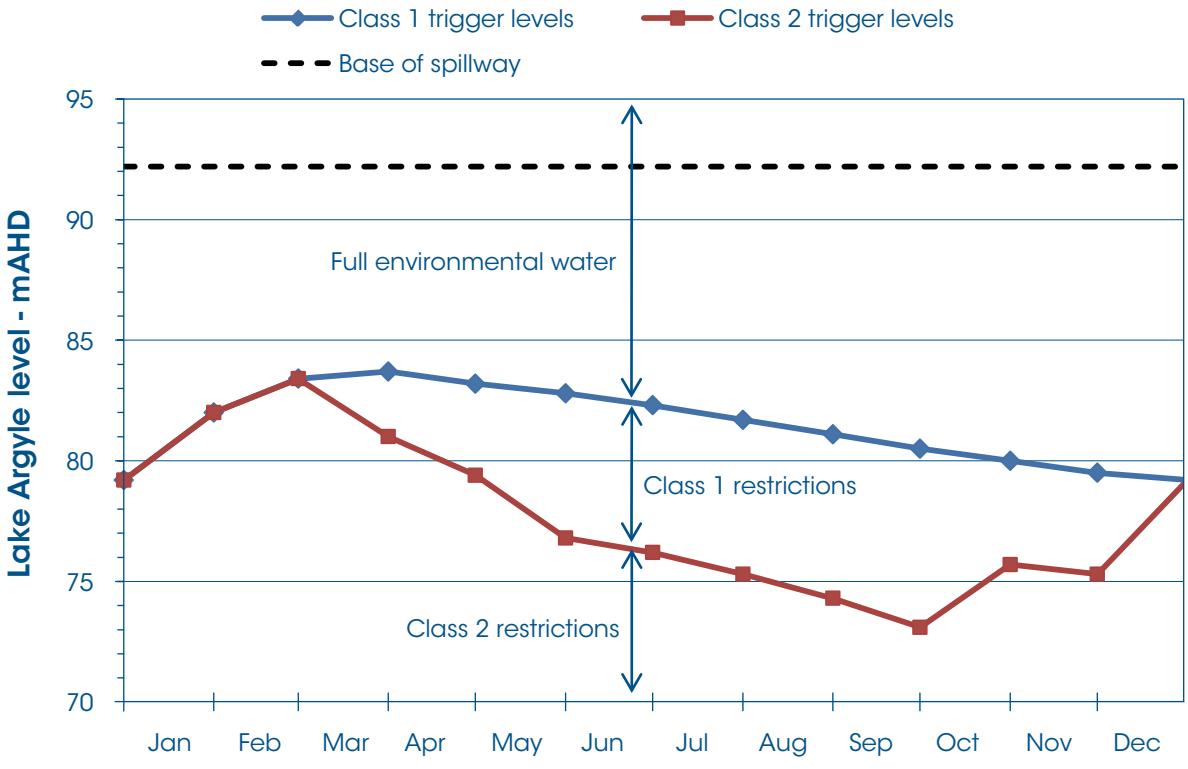

Figure 11
Environmental water restrictions for current and full allocation

5.5 Licensing small-scale irrigation and other self-supply users

More than 80 individually licensed self-supply water users abstract directly from Lake Kununurra and the Ord River downstream of the Kununurra Diversion Dam. These are largely on Packsaddle Plain and along River Farm Road. Self-supply water use is mostly for small-scale agricultural properties and rural residential properties. Self-supply pumpers from the Ord River and Lake Kununurra must have authorisation under a water licence from the Department of Water. A demand of around 15 GL/yr from the 750 GL/yr allocation limit for the Main Ord subarea is expected for the riverside pumpers.

The Argyle Diamond Mine (Rio Tinto) has a licence from Lake Argyle (Upper Ord subarea) to abstract water from Lake Argyle for camp and processing purposes. Rio Tinto has two licences to divert a total of 8.9 GL of surface water a year.

Aquaculture is also a potential growth industry. For land based aquaculture, a licence will be required.

We will assess any proposal for self-supply use using the statewide licensing policies and in the context of this plan. Several local licensing policies apply to self-supply water users (see Section 5.7).

5.6 Integrating water management

The department regulates water releases, restrictions and diversions in the Main Ord subarea in an integrated way to best meet all needs.

Water releases from Lake Argyle used to generate hydroelectricity are in turn used to supply agriculture or environmental flows, as well as water for opportunistic uses such as tourism and cultural activities.

Integration of objectives and management is guided by this allocation plan, and is outlined in the previous sections. The specific water levels that trigger restrictions, and the severity of restrictions, will vary depending on relative demands, seasonal inflows, and whether current or enhanced water release rules are in place.

Support to integrate and manage the resource effectively is provided through:

- operations software to guide power station releases
- the annual Ord River stakeholder meeting
- considering other users of the Ord River.

Operations software

The Department of Water has provided the Water Corporation and Pacific Hydro with improved software to help them:

- coordinate power station operations in accordance with the water release rules in force at any time
- report the electricity generated and releases made through the power station.

This coordination is essential – particularly when limits on electricity generation apply.

The Water Corporation is responsible for ensuring Pacific Hydro's power station releases are consistent with the water release rules established under the Water Corporation's licence. The software is designed to help operators of the dam and power station meet these obligations. The software can readily accommodate changes to the Water Corporation's operating strategy.

The Water Corporation also uses output from the software to prepare its annual report and assess compliance with power generation restrictions as they applied that year. The Water Corporation is responsible for maintaining the software and will require approval from the department to make changes.

Appendix C provides more information on how this software is used.

Annual Ord River stakeholder meeting

At the end of each wet season, when Lake Argyle is near its maximum level for the year, the department will organise and facilitate an annual Ord River stakeholder meeting (Appendix B). This will normally be in April of each year and all relevant stakeholders will be invited.

The meeting will provide an overview of scheme performance (inputs and outputs for lakes Argyle and Kununurra) through the previous 12 months and expectations for the next 12 months.

We will use the information provided by stakeholders at this meeting to determine whether restrictions will apply in the coming dry seasons. The decision on restrictions will be made following the meeting and announced within two weeks.

The meeting will also provide an opportunity to discuss any new issues that have arisen.

Supporting other users of the Ord River

Recreation, tourism and cultural activities are affected by releases, especially in the dry season. The Department of Water recognises the importance of these activities being considered as part of release management and supports them where feasible.

Releases for navigation purposes

Navigational use of the Ord River has been significantly enhanced with the damming of lakes Argyle and Kununurra. Both lakes are now popular boating and tourism locations. On the lower Ord River this has been supported by the year-round flows that the dam releases maintain (in contrast with the drying out periods that naturally occurred before the Ord River Dam was built).

As increased amounts of water are diverted for agriculture, water flows in the lower Ord River will reduce (see Section 3.4). Although flows will still be in excess of minimum required environmental flows or natural dry season levels, this will affect the ease of navigational access. Modelling has shown that releasing water specifically for improving boating access on the lower Ord is not feasible (see Section 3.4).

Given this context, we will not permit water releases from lakes Argyle and Kununurra specifically for enhancing boating navigation on the lower Ord River. However, recognising the importance of boating and tourism, we will work with other agencies to retain

boating and tourism use on the lower Ord River consistent with the expected lower flows.

We recognise that some tourism boating operations can be affected by occasional low water levels in Lake Kununurra. Navigational releases may occur if Lake Argyle levels are high and they are consistent with the licence for dam operations. The practicality of such releases (given the timing, limitations of infrastructure and amount of water) are negotiated with and managed by the Water Corporation.

When lake levels fall below the Class 2 trigger levels for hydropower restrictions under the enhanced rules approach, navigational releases from Lake Argyle will not be permitted. Table A2 (Appendix A) lists the trigger levels given current irrigation entitlements.

Water to support traditional Aboriginal laws and customs

The Department of Water and Water Corporation recognise the importance of low-flow periods to the Miriuwung Gajerrong. We will ensure the MG Corporation is made aware of any periods of low flow on the lower Ord – resulting from planned maintenance of the dams or foreshore areas by the Water Corporation – so that customary practices can be undertaken. Representatives from the MG Corporation will be invited to the annual Ord River stakeholder meeting, where likely river flows for the forthcoming 12 to 18 months are discussed.

5.7 Licensing policies

The department uses policies to guide water licensing assessment and decisions. We develop strategic and operational policies that apply across the state as well as local licensing policies. Local licensing policies apply either because statewide policies do not address the local issues, or because an alternative approach is needed to better manage the local issue.

Local licensing policies

We have developed local licensing policies for the *Ord surface water allocation plan* (Table 8). These local policies provide additional specific guidance for managing licences in the Ord area and summarise the positions already discussed in this chapter. Where a local policy differs from a statewide policy, the local policy in this allocation plan is applied.

Table 8
Local licensing policy specific to the Ord plan area

Policy group		Policy detail	
1	**Licence applications**		
1.1	Applications for non-agricultural uses	For applicants requesting water for non-agricultural uses in the Main Ord and Carlton-Mantinea subareas, the department will require they show their use will not detrimentally affect planned agricultural expansion.	
1.2	Native title notification	1.2.1	Section 24HA (7) of the *Native Title Act 1993* (Cwlth) requires the department to notify native title groups, potentially affected by the grant of a licence, about any new licence applications and to provide them with an opportunity to comment. The department may also apply for applications to renew or amend existing licences if native title notification has not previously been completed.
		1.2.2	The department will have regard to the following when deciding whether to notify native title groups: • if a registered native title determination or claim exists over an area of land or water • if land tenure extinguishes native title • if the Ord Final Agreement or any of the Miriuwung Gajerrong determinations extinguish or partly extinguish native title rights.
		1.2.3	If notification is required, the department will notify the native title group in writing. Native title groups will need to provide any comments within the specified timeframe, usually 30 days.
		1.2.4	The department will consider any comments received from native title groups in assessing applications in accordance with Section 7(2) of the *Rights in Water and Irrigation Act 1914*. If no comments are received within the 30-day timeframe, the assessment will proceed.
2	**Licence assessment**		
2.1	Setting water entitlements and distribution efficiency targets for water service providers	The department grants water entitlements to irrigation water service providers on the basis that overall water use will be efficient. The current water service provider has an 80 per cent distribution efficiency target. For new areas, an 85 per cent distribution efficiency target is appropriate given that Total Channel Control systems are being used in new areas. This will increase to 90 per cent once a balancing storage connected to the M2 channel is built.	

Table 8 (continued)
Local licensing policy specific to the Ord plan area

Policy group		Policy detail	
2.2	Licence duration	2.2.1	Licences issued in the Main Ord subarea for new developments will be for no longer than five years in the first instance. This will enable the department to review entitlements at the time of renewal when the licensee has constructed the development, knows the take-up in demand over the five years and has clearer future demand projections.
		2.2.2	The duration of licences for small self-supplied use will be extended to 10 years on renewal, provided that past water use can be confirmed.
2.3	On-farm water use efficiency and recycling	2.3.1	New developments must use best-practice water use efficiency and be consistent with approval requirements under the *Environmental Protection Act 1986 (WA) and Environmental Protection and Biodiversity Conservation Act 1999* (Cwlth) to minimise potential off-site impacts. The department will consider these requirements when assessing applications for new developments and apply appropriate conditions on the water licence/s, including a water conservation and efficiency plan. New developments must achieve zero discharge of tail water during dry season months. Where furrow irrigation is to be the dominant means of on-farm watering, on-farm recycling systems will be required. Water entitlements will be assessed on the basis of achieving an on-farm water efficiency of at least 80 per cent.
		2.3.2	Existing farm developments that are discharging tail water off-site must continually improve their operations to better manage volumes and water quality, so far as is reasonable with current infrastructure. The department may require licensees to develop a water conservation and efficiency plan with appropriate targets, drainage management and a monitoring program, to limit impacts on off-site environmental values or on other users. At times of licence renewal, water entitlements will be reviewed on the basis of achieving an on-farm water efficiency of at least 70 per cent, depending on the type of irrigation.
3	Licence conditions		
3.1	Staged development	Water entitlements are likely to be granted in stages for developments that require time to achieve full operating capacity. The staged approach will be set out in the licence conditions.	
3.2	Adjusting water entitlements over time	The department will adjust the water release rules and restriction policies in the Water Corporation's storage licence (in the operating strategy for the Ord dams) each time that the net increase in entitlements granted from Lake Argyle is 30 GL/yr or more (see Section 5.3). As demand is expected to grow rapidly during the next five years, these adjustments may be required each year.	

Table 8 (continued)
Local licensing policy specific to the Ord plan area

Policy group		Policy detail	
4	Maximising water for use		
4.1	Water release rules	4.1.1	Water release rules are set out in the operating strategy, which is a condition of the Water Corporation's storage licence. The Water Corporation must release water from the Ord River Dam and Kununurra Diversion Dam in accordance with its operating strategy.
		4.1.2	To coordinate dam and power station operations, the Water Corporation will use software developed by the department to: • collate operational data from the dams, power station and flows in the Ord and Dunham rivers • guide operations, especially when restrictions on hydroelectricity generation apply • report on the power generated and compliance with the water release rules currently in force.
4.2	Hydropower restrictions	The levels that trigger Class 1, Class 2 and Class 3 restrictions for hydropower are to be based on the approach outlined in Section 5.3 and the levels detailed in Appendix A. The department will use the results of future reservoir simulations to define trigger levels when more than an extra 30 GL/yr of entitlements are granted.	
4.3	Navigational release restrictions	Specific releases from Lake Argyle for navigational purposes on Lake Kununurra will not be permitted when water levels in Lake Argyle fall below those for Class 2 hydropower restrictions, under the enhanced rules approach (see Table A2 for current irrigation demand). Specific water releases from Lake Argyle for navigational purposes on the Lower Ord will not be permitted.	
4.4	Environmental water restrictions	The department and the Water Corporation will use the levels shown in Figure 11 and listed in Appendix A to assess the trigger levels for Class 1 (12 per cent reduction) and Class 2 (23 per cent reduction) restrictions to the environmental water provision.	
4.5	Irrigation restriction rules	The levels that trigger restrictions to irrigation are shown in Figure 7 and listed in Appendix A. The Water Corporation assesses and proposes the possible severity of restrictions required, for discussion at the annual Ord River stakeholder meeting. If applicable, the department will announce the severity of restrictions two weeks after the meeting.	
4.6	Trading water entitlements	4.6.1	Self-supply licensees and water service providers can only trade their *Rights in Water and Irrigation Act 1914* entitlements with other licensees.
		4.6.2	Licensees cannot trade their water entitlements with cooperative members or water service provider customers and vice versa.
		4.6.3	Water entitlements cannot be traded with water for hydropower or the environment.

Table 8 (continued)
Local licensing policy specific to the Ord plan area

Policy group		Policy detail	
4.7	Water use, entitlements and recouping unused entitlements	To ensure full and efficient use of the resource, maximise development and reduce hydropower restrictions, the department: • aims to grant water entitlements to match justified crop needs and efficient water use for the area under irrigation • will recoup water entitlements (part or full) that have never been used or have not been used for more than two consecutive years.	
5	Managing impacts		
5.1	Monitoring and reporting for water service providers	5.1.1	Water service providers will be required to monitor water quality impacts on the Ord River and tributaries through licence conditions.
		5.1.2	Water service providers must provide the following in their annual report to the department: • annual water diverted and delivered on-farm • distribution efficiency • surface water and groundwater quality monitoring results (required in Stage 1 areas, where no EP Act or EPBC Act conditions apply) • drainage discharge figures and estimates of irrigation return flows.
5.2	Monitoring and reporting for self-supplied use	Irrigation methods and disposal of tail water must not affect the Ord River's water quality. The department's preference is for no tail water discharge as required for the Ord Stage 2 development.	
5.3	Monitoring information	The department may use monitoring information submitted by licensees to improve our understanding of the water resource, as well as our reporting on resource condition in the plan area. Data that may be used include water level, water chemistry, abstraction (metered use) and hydrological work (including any local models).	
5.4	Compliance	The department will conduct on-ground licence compliance inspections in accordance with its statewide compliance plan.	

Statewide licensing policies

The department has statewide strategic and operational policies that guide our licensing processes and decisions. These policies can be accessed on our website at <www.water.wa.gov.au>. The main strategic and operational policies that apply in the Ord surface water area relate to metering, use of operating strategies, water trading/transactions, staged development, recouping of unused entitlements and compliance and enforcement.

Chapter Six

Monitoring for the Ord River

This chapter sets out how the Department of Water will monitor water resources in the plan area. We use the monitoring information that we collect, as well as that obtained from licensees, to:

- evaluate whether resource objectives are achieved
- assess and implement trigger and response mechanisms
- evaluate whether meeting resource objectives is achieving environmental outcomes
- inform future planning.

Monitoring supports our plan evaluations and helps us to adapt management, while improving our understanding of the water resource over time.

This chapter does not include the specific monitoring that the Water Corporation uses to manage the release of water from the Ord River and Kununurra Diversion dams. These are included in the licence operating strategies for these dams.

6.1 Evaluating resource objectives

To evaluate our performance against the plan's resource objectives, the department will annually assess flows in the Ord River and lake levels in Lake Argyle using the performance indicators in Table 9.

If the indicators are not being met we will investigate the reasons why and take the necessary actions. This could include compliance and enforcement action, further investigative or technical work, or a change in our management approach.

As the performance indicators have been set using long-term trends in rainfall and inflows, we will need to consider if they are being met over a number of years before being able to make meaningful conclusions about how well our resource management is working.

Table 9
Monitoring in the plan area

Resource objective	Site (see Figure 8)	Performance indicator	Monitoring frequency
a) Flows measured at Tarrara Bar meet: i) the base flow component for wet and dry seasons ii) annual and inter-annual wet season peak flows iii) infrequent wet season flood events.	Ord River – Tarrara Bar	Monthly base flow requirements in Table 3, Chapter 4 Wet season peak flow requirements in Table 4, Chapter 4 Infrequent wet season flood flow requirements in Table 5, Chapter 4	Daily
b) Water levels in Lake Argyle are maintained above irrigation restriction levels in 95% of years	Lake Argyle (Ord River Dam)	The relevant restriction levels are outlined in Appendix A	Daily

6.2 Trigger and response mechanisms

We have set up a trigger and response framework to prevent damage to significant ecological values when flows in the Ord River are low (Table 10). The triggers will be assessed daily during low-flow periods so that immediate action can be taken.

Table 10
Trigger and responses in the plan area

Trigger	Site	Frequency	Response
Daily flow of less than 35 m^3/sec (this may be triggered in dry periods or as a result of dam maintenance)	Ord River – Tarrara Bar	Daily	The department will set up dissolved oxygen probes – one upstream of Tarrara Bar and one at Carlton Crossing.
Dissolved oxygen equal to or less than 2 mg/L at more than 4 m depth in selected deep pools	Sites to be determined within reaches 1, 2 or 3 (Figure 12)	Hourly, once flow is below 35 m^3/sec	The Water Corporation will release water from the Ord River and Kununurra Diversion dams. The volume and pattern of releases will be determined in consultation with the department.

6.3 Environmental monitoring

The department has developed a monitoring program specifically for the environmental water provision of the lower Ord River. The details of the program are documented in *Lower Ord River environmental water provisions monitoring program and management framework* (DoW 2011a).

We will use this program to check that the water regime, made up of water released from the dams and flows from the Dunham River, is sufficient to maintain the lower Ord River's ecological condition.

The program will monitor and assess water quality, fish, macroinvertebrates and vegetation in reaches 1 and 2 of the Ord River (Figure 12). It will be complemented by water quality data from the OIC's monitoring of irrigation drains in the Ord irrigation area.

We will review this data every three years using the triggers documented in Appendix E. We have also identified how the Department of Water, Water Corporation or the OIC will be required to respond should any of these triggers be breached (Table 11). The trigger levels will be reviewed after each round of environmental monitoring to ensure they remain appropriate. We will also assess the role of any new licensees.

Table 11
Management responses required by Department of Water, Water Corporation and Ord Irrigation Cooperative

Do flows meet the environmental water provision?	Has a trigger been breached*?	Department of Water actions	Water Corporation actions	Ord Irrigation Cooperative actions
Yes	Yes	✓ Short-term review (<6 months) of ecological flow model – this may require input from expert panel Response based on: • severity of impacts • certainty of cause • reference site response • revise operational strategy and amend if required	✓ Provide monitoring data as requested ✓ Implement revised operating strategy if required	✓ Provide water quality data if requested ✓ If a breach is detected investigate source, rectify issue and monitor impact
	No	No action required	No action required	No action required
No	Yes	✓ Analysis of ecological trigger and EWP component not met ✓ Consider action on non-compliance	✓ Show cause of EWP flowbreach ✓ Provide monitoring data as requested ✓ Meet operating strategy and revised operating strategy if required	✓ Provide water quality data if requested ✓ If a breach is detected investigate source, rectify issue and monitor impact
	No	Longer-term review of: ✓ ecological trigger ✓ EWRs/EWPs ✓ operating strategy ✓ allocation plan	✓ Show cause of EWP flow breach ✓ Provide monitoring data as requested ✓ Meet operating strategy or meet revised strategy if environmental provision is revised	No action required

* Trigger levels for different environmental parameters are listed in Appendix E.

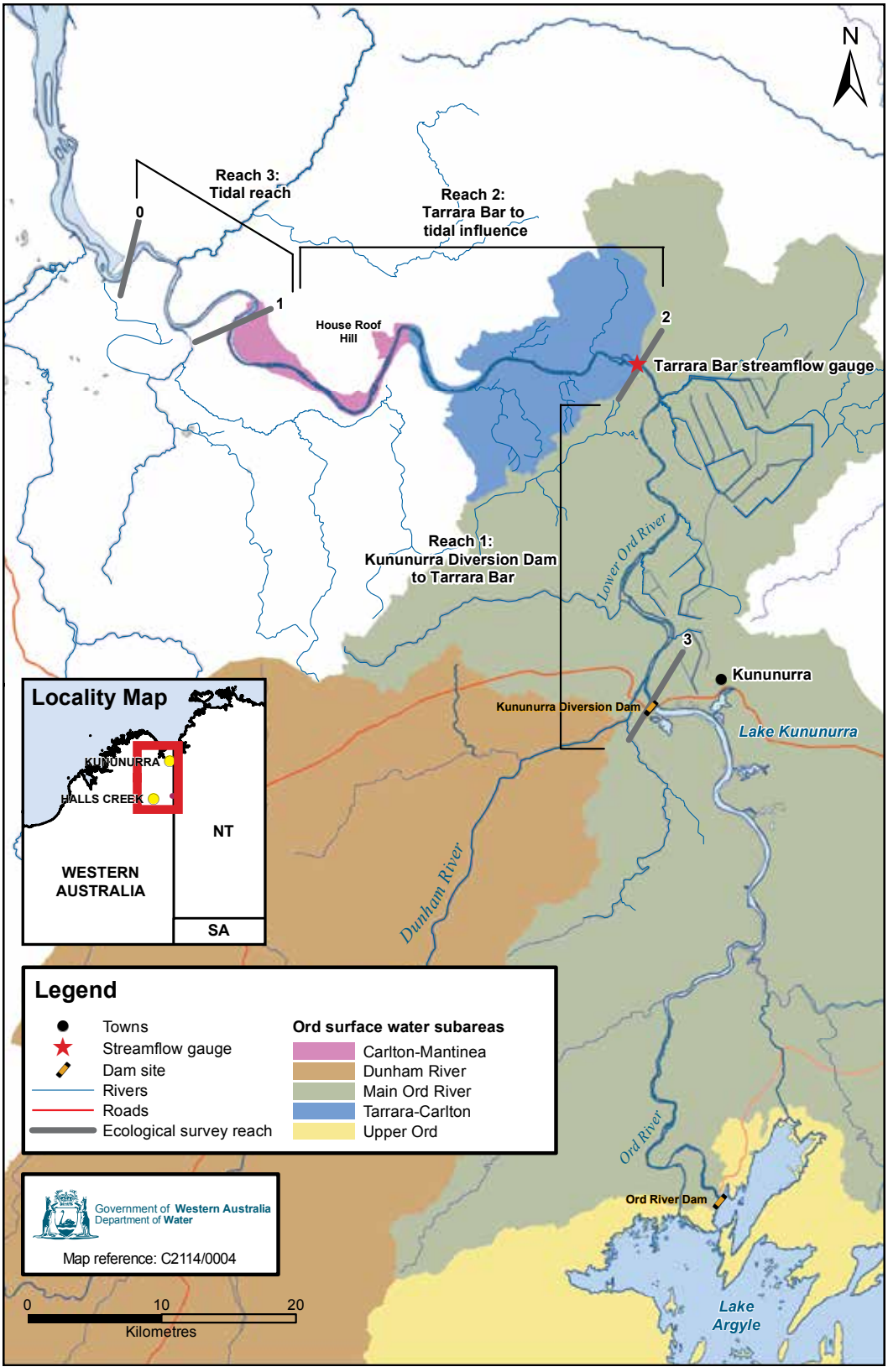

Figure 12

Streamflow monitoring sites and ecological monitoring reaches in the lower Ord River

6.4 Monitoring for future planning needs

In addition to the monitoring identified above, there is a network of measurement sites in the Ord River catchment (maintained by the department and licensees) that ensures we are informed on how the resource is performing over time. The monitoring network is made up of river level and rainfall sites. See Appendix F for a full list of these sites.

This monitoring will be critical for future planning and will allow us to optimise both water for use and in-situ values, as demand changes.

Chapter Seven

Implementing and evaluating the plan

The Department of Water will implement the *Ord surface water allocation plan* through:

- licensing to the allocation limits for each subarea in Chapter 4
- adjusting existing licences and issuing new licences according to the allocation and licensing approach in Chapter 5
- undertaking the Ord River monitoring program in Chapter 6
- implementing the actions in Table 12.

7.1 Implementing the plan

To successfully implement the *Ord surface water allocation plan* we identified a number of actions to carry out over the next seven years (Table 12). They complement the licensing and allocation approach for the Ord area outlined in Chapter 5. The actions were identified during the plan's development and stakeholder consultation.

Table 12
Actions to implement the *Ord surface water allocation plan*

No.	Action	Responsible branch of Department of Water	Timeline
Licensing			
1	Adjust conditions of the Water Corporation's licence for the Ord River and Kununurra Diversion dams (primarily the trigger levels for hydropower restrictions) to ensure that the resource is not over-committed as new water entitlements are granted	Kimberley Region	As required (when 30 GL or more of new annual water entitlements are granted since the last adjustment)
2	Announce restrictions for the coming year	Kimberley Region	Two weeks after annual meeting
3	Include a requirement in the Water Corporation's operating strategy to 'top up' wet season peak flow events if they have not been met in one of the four preceding wet seasons	Water Allocation Planning	2014
4	Conduct on-ground licence compliance inspections on at least 10% of licensees in the Main Ord subarea	Kimberley Region	Annually
5	Conduct on-ground compliance inspections in other Ord subareas based on risk	Kimberley Region	As required

Table 12 (continued)
Actions to implement the *Ord surface water allocation plan*

No.	Action	Responsible branch of Department of Water	Timeline
Resource assessment			
6	Update the flow series in reservoir modelling from 1906–07 to 2003–04 to 1906–07 to 2014–15	Water Resource Assessment	2015
7	Run the reservoir model to redefine water release rules for Ord River and Kununurra Diversion dams each time a significant amount of water entitlement is granted for irrigation expansion (~30 GL/yr while water entitlements are less than 450 GL/yr)	Water Resource Assessment	Late 2013 when we know on-farm water demand for the new Goomig farmland and Knox Plain development
8	Review the Northern Territory component	Water Allocation Planning, Water Supply Planning and Water Resource Assessment	2017 or sooner if hindering development or there is no progress
Monitoring and adaptive management			
9	Review implementation of ongoing flow monitoring	Water Resource Assessment	Annually
10	Review implementation of the ecological monitoring program	Water Allocation Planning and Water Resource Assessment	Every three years
11	Publish an evaluation statement	Water Allocation Planning and Kimberley Region	At least every three years
Stakeholder engagement			
12	Hold the Ord River stakeholders meeting to discuss the likelihood and severity of restrictions and to discuss operation of the dams in the previous and coming year	Kimberley Region	Annually around April
13	Liaise with the Miriuwung Gajerrong to maximise opportunities for Indigenous people during 'dry out' periods	Kimberley Region (and Water Corporation)	Ongoing

7.2 Evaluating the plan

Each year we will evaluate whether the plan's outcomes and resource objectives are being met. This will coincide with the annual Ord River stakeholder meeting, normally held each April. We will publish an evaluation statement at least every three years.
The evaluation statement will include information on:

- the allocation status for each resource including any changes in licensed entitlements
- whether irrigation demand or other demands have changed
- performance against the outcomes and resource objectives
- whether restrictions have been triggered in previous years, and the severity of restrictions to irrigation, hydropower and the environment
- the status of plan actions
- how we are adapting our water resource management (if necessary).

Appendices

Ord surface water allocation plan

A

Appendix A
Restrictions and water release rules

How the restriction policies and release rules were developed

The restriction policies and release rules were developed using a computer simulation model of the operations of the dams and power station (Smith & Rodgers 2010). As detailed in the *Ord surface water allocation methods report* (DoW 2012b), simulations were run iteratively to establish the restriction and release rules needed to manage the Ord River water resource during times of water shortage.

For practical licensing reasons, the power station release rules are not identical to the rules used in the simulation model. In the model, water balance calculations were undertaken daily to determine the releases required from Lake Argyle each day. This involved checking the (simulated) lake level each day to determine if any or all of the daily hydroelectricity, irrigation and downstream environmental demands were on restrictions on that day.

How we will implement the water release rules and restriction policies

Table A1 summarises the release rules and related restriction policies as currently licensed. Table A2 summarises the enhanced release rules and related restriction policies that will apply if the enhanced rules were introduced now (i.e. given the current water entitlements).

As indicated in Chapter 5, new reservoir simulations will be undertaken to establish new restriction levels to apply each time more than an additional 30 GL/yr of water entitlements are to be granted.

Power station release rules

The power station operational software uses the trigger levels for hydropower restrictions (see tables A1 and A2 as examples) to guide station operations in accordance with the release rules in force at the time.

The water release rules are implemented on a day-to-day basis in the following way:

- Class 1 limits on hydropower are determined based on water levels at the start of the month, and apply for the whole month unless Class 2 restrictions are triggered. Class 1 limits are checked again at the start of the next month.
- Class 2 trigger levels are determined each day of the month by linearly interpolating between the trigger level for the first day of the month and the first day of the following month.
- Under Class 3 restrictions, daily limits on generation are set by the Water Corporation's required releases.

Irrigation restrictions

Irrigation restrictions will be determined for a 12-month period based on the storage in Lake Argyle at the end of the wet season and projections of likely lake levels over the coming dry season. This will be one of the outcomes of the annual Ord River stakeholder meeting (see Appendix B). The Water Corporation is to obtain expected power station and irrigation demands for the next 12 months and estimate projected lake levels to the end of the year.

If these projected levels fall below the trigger levels for irrigation restrictions (see tables A1 or A2), the department will implement restrictions and specify their severity for the current irrigation season.

The severity will be set having regard for the irrigation and power demands at the time and by adopting a minimum acceptable storage target for Lake Argyle at the end of the year. The percentage of annual water entitlements allowed to be diverted would be set so that the storage level at the end of the year did not fall below the target minimum.

To indicate the likely severity of restrictions for an irrigation year, see the reservoir simulation results for irrigation supply under current entitlements and the current rules (Figure A1) and under the full allocation limit and enhanced rules (Figure A2). The percentage of irrigation demand supplied is shown on the right axis, with restrictions only occurring in five out of 98 years.

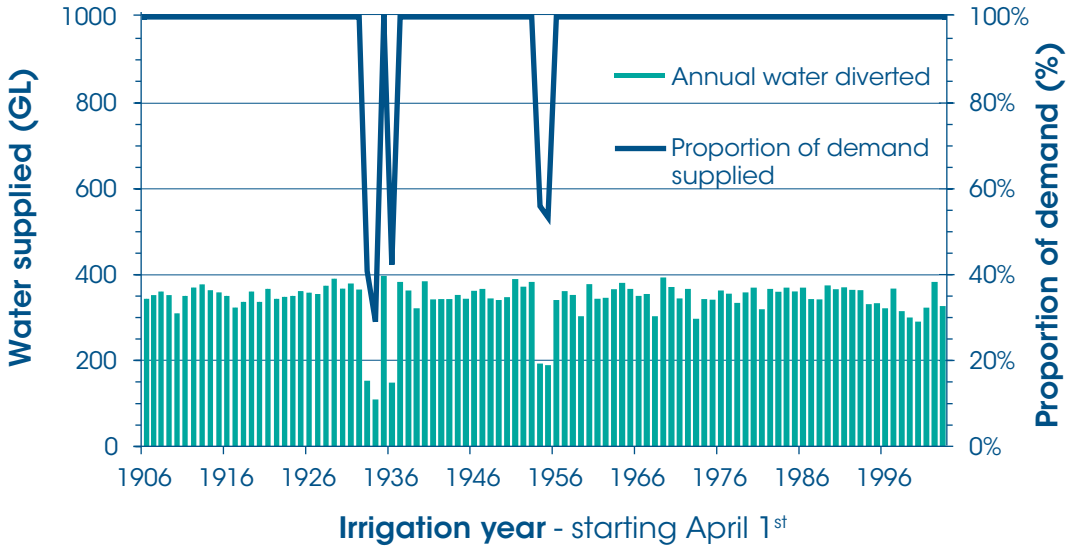

Figure A1
Irrigation water supply and reliability as currently licensed – current irrigation (350 GL/yr), high power demand and current release rules

A

Appendix A
Restrictions and water release rules

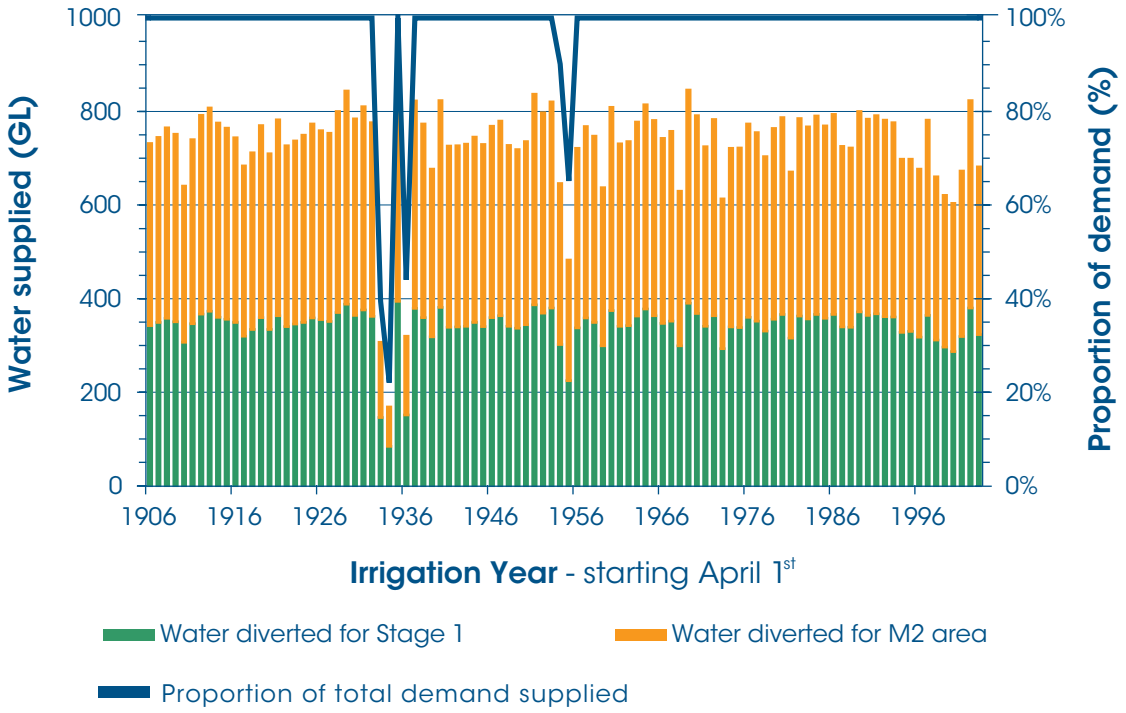

Figure A2
Irrigation water supply and reliability with full entitlements and the enhanced rules – irrigation licensed to limits (750 GL/yr), high power demand

Environmental water restrictions

The Water Corporation uses flows monitored by the department at Tarrara Bar to ensure releases at the Kununurra Diversion Dam are sufficient to meet the environmental water provision for the lower Ord River. In drought years, environmental flows at Tarrara are restricted to the minimum environmental water provision. The restricted flows and levels in Lake Argyle that trigger environmental water restrictions under current entitlements are shown in Table A1.

Table A1

Restriction policies – as currently licensed (as at July 2013) *

Month	Power						Irrigation	EWP			
	Class 1		Class 2		Class 3			Class 1		Class 2	
	Water level – 1st of month	Restricted target	Water level – 1st of month	Restricted target	Water level – in the month	Restricted target	Water levels below which irrigation restrictions will apply	Water level – in the month	Restricted flow	Water level – in the month	Restricted flow
	mAHD	MW	mAHD	MW	mAHD	MW	mAHD	mAHD	m^3/s	mAHD	m^3/s
Jan	88.05	24.51	78.00	10.12	76.00	0.00	74.90	79.20	44.0	79.20	38.5
Feb	88.60	23.22	78.00	11.23	76.00	0.00	77.00	82.00	50.2	82.00	43.9
Mar	90.00	24.41	78.00	10.56	76.00	0.00	77.00	83.40	50.2	83.40	43.9
Apr	90.80	23.54	78.00	10.64	76.00	0.00	79.00	83.70	46.6	81.00	40.8
May	90.65	22.46	78.00	8.76	76.00	0.00	79.40	83.20	42.2	79.40	37.0
Jun	90.35	22.40	78.00	8.13	76.00	0.00	78.80	82.80	37.0	76.80	32.0
Jul	90.05	23.05	78.00	8.00	76.00	0.00	78.00	82.30	37.0	76.20	32.0
Aug	89.70	24.19	78.00	8.39	76.00	0.00	77.40	81.70	37.0	75.30	32.0
Sep	89.30	24.96	78.00	10.98	76.00	0.00	76.70	81.10	37.0	74.30	32.0
Oct	88.85	24.30	78.00	12.62	76.00	0.00	75.90	80.50	37.0	73.10	32.0
Nov	88.40	26.85	78.00	12.89	76.00	0.00	75.40	80.00	37.0	75.70	32.0
Dec	88.15	23.85	78.00	10.18	76.00	0.00	75.00	79.50	37.0	75.30	32.0

* Irrigation demand (Lake Kununurra) – 350 GL/yr, electricity demand – 327 GWh/yr, 210 GWh/yr guaranteed down to lake levels of 78 mAHD. Note that restriction levels are changed over time as water and power demands change.

Table A2

Restriction policies – Current irrigation, high power demand, enhanced release rules scenario *

Month	Power						Irrigation	EWP			
	Class 1		Class 2		Class 3			Class 1		Class 2	
	Water level – 1st of month	Restricted target	Water level – 1st of month	Restricted target	Water level – in the month	Restricted target	Water levels below which irrigation reestrictions will apply	Water level – in the month	Restricted flow	Water level – in the month	Restricted flow
	mAHD	MW	mAHD	MW	mAHD	MW	mAHD	mAHD	m^3/s	mAHD	m^3/s
Jan	84.65	24.51	83.45	10.12	76.00	0.00	74.90	78.30	44.0	78.30	38.5
Feb	85.35	23.22	84.30	11.23	76.00	0.00	77.00	81.00	50.2	81.00	43.9
Mar	86.75	24.41	85.80	10.56	76.00	0.00	77.00	82.60	50.2	82.60	43.9
Apr	87.75	23.54	86.70	10.64	76.00	0.00	79.00	82.10	46.6	81.00	40.8
May	87.80	22.46	86.80	8.76	76.00	0.00	79.40	81.60	42.2	79.40	37.0
Jun	87.43	22.40	86.45	8.13	76.00	0.00	78.80	81.10	37.0	77.20	32.0
Jul	87.08	23.05	86.10	8.00	76.00	0.00	78.00	80.50	37.0	76.20	32.0
Aug	86.65	24.19	85.65	8.39	76.00	0.00	77.40	79.90	37.0	75.30	32.0
Sep	86.20	24.96	85.20	10.98	76.00	0.00	76.70	79.20	37.0	74.30	32.0
Oct	85.75	24.30	84.70	12.62	76.00	0.00	75.90	78.30	37.0	73.10	32.0
Nov	85.30	26.85	84.20	12.89	76.00	0.00	75.40	77.60	37.0	74.50	32.0
Dec	84.85	23.85	83.75	10.18	76.00	0.00	75.00	77.40	37.0	76.20	32.0

* Irrigation demand (Lake Kununurra) – 350 GL/yr, electricity demand – 327 GWh/yr, 210 GWh/yr not guaranteed down to lake levels of 78 mAHD

Appendix B
Annual Ord River stakeholder meeting

B

Purpose and outcomes of the meeting

The main purpose and outcome of the annual Ord River stakeholder meeting is for the Department of Water and Water Corporation to discuss with stakeholders the likelihood and severity of restrictions in dry years, as well as expected demand and dam operations over the forthcoming 12 months. The meeting also provides an opportunity for stakeholders to discuss any new issues that have arisen.

The department will use the information presented at the meeting to decide whether restrictions will be put in place in the coming year. Restrictions will be announced within two weeks of the annual meetings, which are normally held in April each year.

Attendees of the meeting

The Department of Water will invite the following stakeholders to the annual meeting:

- Water Corporation
- Ord Irrigation Cooperative
- Pacific Hydro
- Miriuwung Gajerrong Corporation
- self-supply irrigators
- the Shire of Wyndham East Kimberley
- tour boat operators
- other government agencies
- any other identified interested parties.

In addition to the annual stakeholder meeting, the department will also meet annually with water service providers and large licensees to discuss operational matters relating to their licences.

Information and discussion

The following information will be presented and discussed at the meeting:

- Dam and power station operations (including maintenance) from the previous 12 months and for the next 12 to 18 months, including expected impacts for other users.
- Future water level targets for Lake Argyle.
- Whether drought restrictions will apply for the upcoming dry season, or are expected to occur for the next dry season and what this means for irrigators, self-supply, power generation, the lower Ord River environment and tour boat operators.
- Any ongoing dam management, planned maintenance and monitoring issues.
- The compliance of flows at Tarrara Bar with the lower Ord environmental water provision (see Section 4.3).
- Issues raised by licensees who hold licences dependent on Lake Argyle.
- Results of ecological monitoring when applicable.

C

Appendix C
Operations software

The Water Corporation enters daily operational data from its dams, as well as irrigation demand and flow data from the Dunham River and Ord River at Tarrara Bar. It projects the likely flow so it can calculate how much water to release from storage.

When levels in Lake Argyle are high and there are no restrictions, the spreadsheet is updated at the end of each month.

When Class 1 restrictions apply there are monthly limits on generating hydroelectricity. As the month progresses, the Water Corporation updates the spreadsheet with the power generated at least weekly. In doing this it tracks progress against the monthly limit, allowing it to adjust operations to minimise the chance of going over the limit.

When Class 2 restrictions apply it must update the spreadsheet daily because the limits on releases are set daily for the next 24-hour period.

Compliance under Class 2 restrictions will be assessed over four-, six- and 12-month periods, if the Class restrictions persist for these periods. The software will compare the electricity generated each day with the daily limit and record the degree of over or under generation for the day. The net over or under generation will be accumulated over the current period of Class 2 restrictions. No over generation is allowed over a 12-month period.

Appendix D

Future 10 MW power station on the Kununurra Diversion Dam

The electricity generated with and without a future 10 MW hydropower station is shown in Table D1. Results are presented for the current Ord River Dam water release rules, with:

- 350 GL/yr of irrigation demand and high power demand
- 750 GL/yr of irrigation demand and high power demand.

Also shown are statistics on the water released and spilled from Lake Argyle, and the severity of irrigation restrictions, with and without the extra power station.

Table D1 indicates that, with a 10 MW station at the Kununurra Diversion Dam, the additional electricity generated averages more than:

- 60 GWh/yr under the current licensed situation (350 GL/yr), and
- 50 GWh/yr if water entitlements were granted up to the allocation limit (750 GL/yr).

With this additional power option, less water would need to be released from Lake Argyle, and the severity of irrigation restrictions would reduce – especially as full allocation for irrigation expansion approaches (see bold numbers in Table D1).

The department would approve the establishment of a 10 MW hydropower station at the Kununurra Diversion Dam provided:

- the station only generated power from water releases the Water Corporation made to meet its existing licensed commitments: no water entitlements would be granted for its operation
- the Water Corporation applied to amend its storage licence for its existing dams to provide for the new power station, in accordance with the licensing provisions of the *Rights in Water and Irrigation Act 1914*
- the necessary environmental and Aboriginal heritage clearances were obtained.

D

Appendix D
Future 10 MW power station on the Kununurra Diversion Dam

Table D1
Electricity generated with and without a 10 MW hydropower station at the Kununurra Diversion Dam – (a) 350 GL/yr of irrigation with current release rules, and (b) 750 GL/yr of irrigation with the enhanced rules approach.

	(a) 350 GL/yr irrigation demand		(b) 750 GL/yr irrigation demand	
Long-term average annual statistics	Existing conditions	With additional hydropower station	Existing conditions	With additional hydropower station
Hydroelectricity generated (GWh/yr)	243.1	306.7	238.4	289.6
Water released at Ord River Dam by PH for power generation (GL/yr)	2387	2188	**1511**	**1457**
Water released at the Ord River Dam for the lower Ord (GL/yr)	54	75	642	575
Spillage from Lake Argyle (GL/yr)	699	839	742	858
Average water supplied to irrigation in the worst 5% of years with restrictions (% of demand)	70%	71%	**54%**	**77%**

Appendix E
Trigger levels for ecological monitoring parameters

E

Table E1
Trigger values for macroinvertebrates, fish and vegetation

Parameter	Trigger
Macroinvertebrates	10% decline from baseline levels* in: • total number of taxa • high-flow taxa • number of sensitive EPT taxa • SIGNAL and SIGNALFLOW scores.
Fish	30% decline from baseline levels* in the following parameters: • total number of species • abundance of each species. A detectable change in frequency of occurrence or size class distribution of: • *Lates calcarifer* (barramundi), *Liza alata* (mullet), *Arius graffei* (blue catfish), *Arius midgleyi* (Midgley's catfish) in deep pools • *Glossigobius giurus* (flathead goby), *Nematalosa erebi* (bony bream) or *Melanotaenia australis* (rainbowfish) in shallow backwaters.
Vegetation	From baseline levels a measurable: • change in distribution, abundance, cover and/or richness of riparian vegetation • change in distribution, abundance and/or richness of in-stream vegetation species • change in distribution, abundance, cover and/or richness of terrestrial and/or exotic species • crown dieback in overstorey. In addition: • greater than 15% reduction in abundance of dominant species • no indication of recent (six years) overstorey recruitment.

* Derived from monitoring by Wetland Research and Management (2000–03, 2010 and 2011)

E

Appendix E
Trigger levels for ecological monitoring parameters

Table E2
Nutrient and physico-chemical trigger values

Parameter	Locally derived reference values*	ANZECC 2000 trigger values
Total nitrogen (TN)	290 µg/L	300 µg/L
Total phosphorus (TP)	18 µg/L	10 µg/L (baseflow)
Filterable reactive phosphorus (FRP)	9 µg/L	5 µg/L
Nitrate (NO_x)	14 µg/L	5 µg/L
Ammonium (NH^{4+})	29 µg/L	10 µg/L (baseflow)
Salinity	1000 mg/L	1000 mg/L
Turbidity	14 NTU	2 NTU (baseflow)
Total suspended solids (TSS)	7 mg/L	2 mg/L (baseflow)
Dissolved oxygen (DO)	≤2 mg/L	≤2 mg/L

* To be reviewed as more data become available

Appendix F
Monitoring sites on rivers in the Ord River plan area

F

Table F1
River level monitoring sites

Station no.	Station name	River
809310	Bedford Downs	Ord
809312	Frog Hollow	Frog Hollow
809315	Mistake Ck H/S	Negri
809316	Old Ord H/S	Ord
809321	Dunham Gorge	Dunham
809322	O'Donnell Range	Wilson
809339	Tarrara Bar	Ord
809340	Flying Fox Hole	Dunham

Table F2
Rainfall monitoring sites

Station no.	Station name	River
502015	Bedford Downs	Ord
502014	Frog Hollow	Frog Hollow
502033	Mistake Ck H/S	Negri
502028	Old Ord H/S	Ord
501029	Moochalabra Dam	Moochalabra Ck
502031	Dunham Gorge	Dunham
501008	Moochalabra No. 1	Moochalabra Ck
502002	Mud Springs	Leopold
502006	Me No Savvy	Margaret
502019	Liamma Bore	Dunham
502020	Elgee Cliffs	Ord/Fitzroy
502027	Durack Range	Wilson
502032	Lake Kununurra	Ord
502046	Mt Rob	King
502048	Eight Mile Mill	Sandy Ck
502049	Knox Ck (Microwave)	Knox Ck
502062	Abney Hill	Weaber Pl Rd

Appendix F
Monitoring sites on rivers in the Ord River plan area

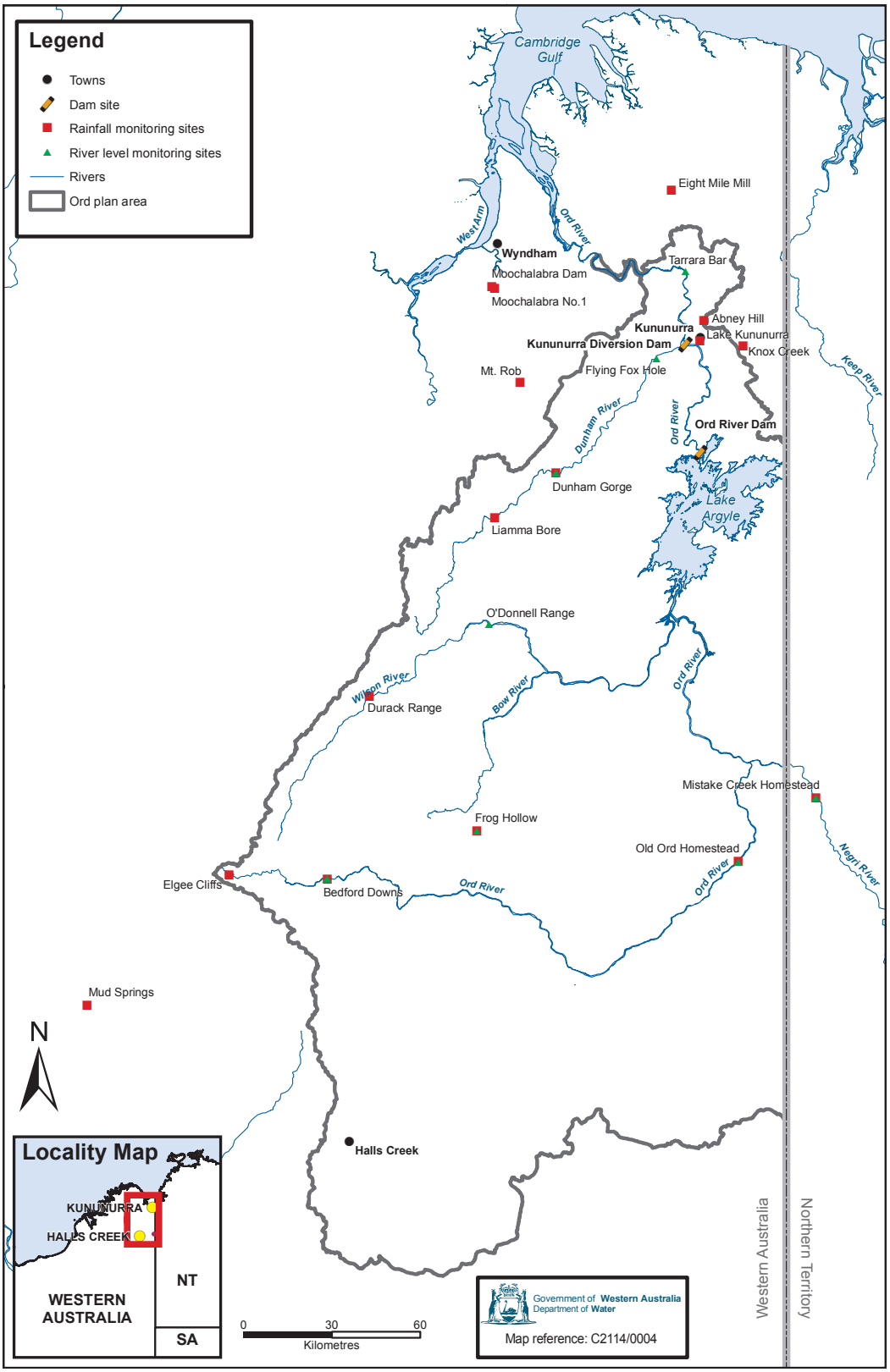

Figure F1
Rainfall and river monitoring sites in the Ord River plan area

Ord surface water allocation plan

Appendix G
Map information and disclaimer

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

Map author: Gary Floyd and Michael Fifield

Filepath: [J:\gisprojects\Project\C_series\C2114...For all]

Filename: [J:\gisprojects\Project\C_series\C2114\0004_2009WAP]

Compilation date: 27 February 2013

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

Dams Register – Water Corporation – 2012

Hydrography, Lakes (medium scale 250K GA) – GeoScience Australia – 2012

WA Coastline, WRC (Poly) – DoW –2006

Hydrography, Linear (Hierarchy) – DoW – 2007

Surface Water Allocation Subareas – DoW – 2007

WIN Sites – DoW – 2012

RIWI Surface Water Areas and Irrigation Districts – DoW – 2012

Shortened forms

List of Shortened forms	
ADM	Argyle Diamond Mine
AHD	Australian Height Datum
DoW	Department of Water
EPA	Environmental Protection Authority
EWP	Environmental water provision
EWR	Environmental water requirement
KDD	Kununurra Diversion Dam
PH	Pacific Hydro

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	Withdrawal of water from any surface water or groundwater source of supply.
Allocation limit	The annual volume of water set aside for use from a water resource. In the Ord area it is the total amount of water that can be licensed from a resource or subarea.
Annual announced allocation	The proportion of an annual water entitlement that is available in a given year.
Annual water entitlement	The amount of water specified on a licence issued under Section 5C of the *Rights in Water and Irrigation Act 1914* that can be taken each year (dates specified on the licence).
Argyle Diamonds	Argyle Diamonds Ltd, operators of the Argyle Diamond Mine – a wholly owned subsidiary of Rio Tinto Ltd.
Consumptive use	Water used for consumptive purposes considered as a private benefit including irrigation, industry, urban and stock and domestic use.
Diversion (of water)	Taking water from a watercourse, usually by gravity.
Ecological 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.
Environmental water provision	The water regime resulting from 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.
Fit-for-purpose water	Water of a quality suitable for the intended end purpose. It implies that the quality is not higher than needed.
Goomig farmlands	New farmland being established by the Western Australian Government under the Ord Irrigation expansion project. The area is located on the Weaber Plain to the north east of Stage 1 areas.
In-situ water	Represents water that needs to be left in the system, including the water needed to maintain the integrity of the resource and ecological, social and cultural values.
Licence (or licensed entitlement)	A formal authorisation that entitles the licence holder to take water from a watercourse, wetland or underground source under the *Rights in Water and Irrigation Act 1914.*
Management area	A defined surface water area or groundwater area proclaimed under the *Rights in Water and Irrigation Act 1914.*
On-farm water efficiency	The percentage of the water entering a farm that reaches the root zone of the crop.
Ord Final Agreement	A deed for the Compulsory Acquisition of Native Title Rights and Interests (Ord) between the State of Western Australia, the Miriuwung and Gajerrong People (MG), and private interests (Grantee Parties).
Over-allocation	Where the total volume of water allocated out of the resource (that could be abstracted at any time) is over the set allocation limit.
Over-use	Where the actual volume of water abstracted from the resource is over the set allocation limit.
Pacific Hydro	Pacific Hydro Limited, owners and operators of the Ord River Dam hydropower station.

Reliability	The frequency with which a water licence holder can access their full annual water entitlement.
Self-supply	Water users (individuals or organisations) who abstract water from a source for their own individual requirements.
Social value	An in-situ quality, attribute or use that is important for public benefit, welfare, state or health.
Social water requirement	The water regime needed to maintain social and cultural values.
Subarea	A subdivision, within a surface or groundwater area, defined to better manage water allocation. Subarea boundaries are not proclaimed and can therefore be amended without being gazetted.

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Legislation

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