

Managing water from the Ord River

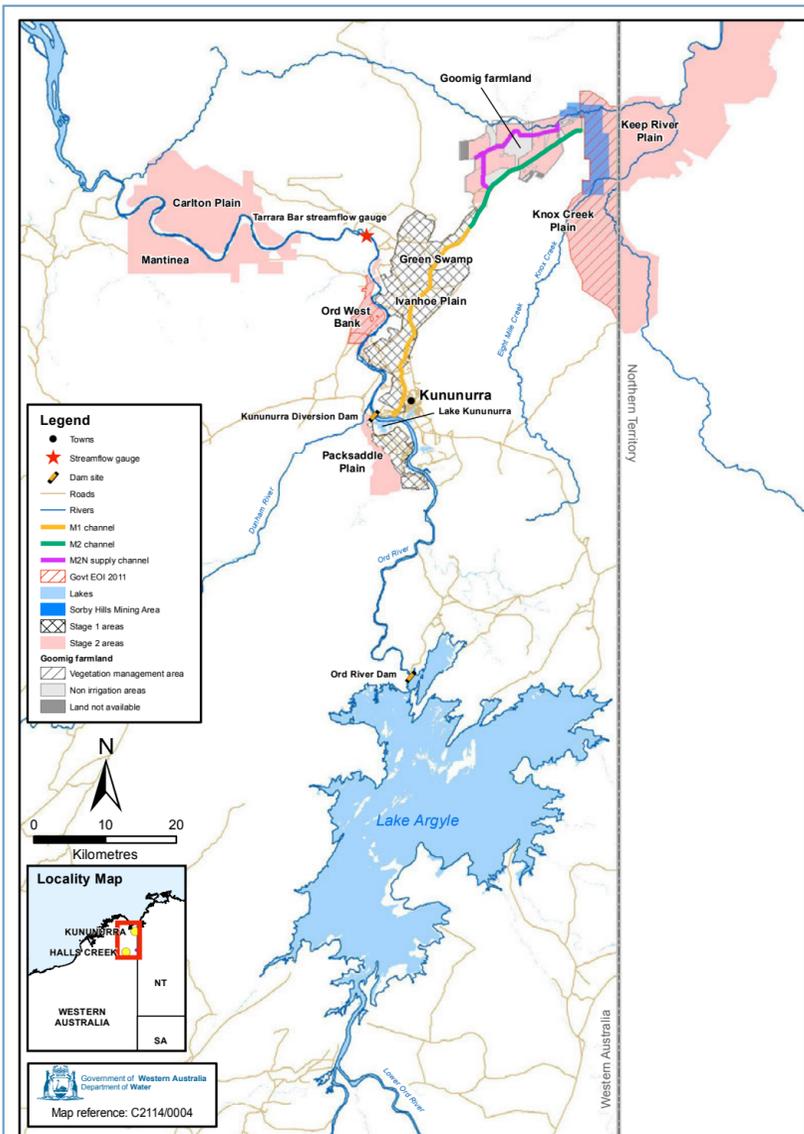
The Ord River is one of the most significant waterways in Australia. It provides for water to an iconic agricultural project, supports local tourism and sustains a unique Kimberley environment.

We are seeing the largest development of irrigated land in the Ord River area since the 1960s. The Ord-East Kimberley Irrigation Expansion Project plans to increase the size of the Ord irrigation area by 15,400 hectares in the short term with potential for further expansion beyond this in Western Australia and into the Northern Territory.

The WA Government signed an agreement with Kimberley Agricultural Investment (KAI) for development of the Goomig (7,400 ha) and Knox Plain (6,000 ha) expansion areas. An additional 2,000 ha will be developed within existing agricultural areas at the Ord West Bank, Packsaddle Plain and Ord East Bank.

There is potential to develop a further 9,000 ha in the medium term in the Carlton Plain and Mantinea areas.

Two additional areas totalling 5,000 ha known as Cockatoo sands have been identified for possible development. Up to 14,000 ha of land has also been identified for possible development in the Northern Territory.



Current and proposed irrigation development areas

Quick water facts

Lake Argyle – storage volumes

- To the full supply level (92.23 m AHD) 10 760 GL
- Flood storage between full supply level (92.23 m) and the first auxiliary spillway (105.8 m) 18 660 GL

At Ord River Dam / Lake Argyle

- Mean annual stream inflow 4278 GL/yr

Lake Argyle – net evaporation

- Currently licensed (350 GL/yr, high power demand) 1132 GL/yr
- Currently licensed (350 GL/yr, enhanced rules, high power demand) 1106 GL/yr
- Fully licensed (750 GL/yr, high power demand) 1151 GL/yr

Electricity generated (financial year average)

- Currently licensed (350 GL/yr, high power demand) 243.1 GWh/yr
- Fully licensed (750 GL/yr, high power demand) 238.4 GWh/yr

Water allocations

Annual water entitlement limits (dependent on Lake Argyle)

- The Ord River between the Ord River Dam and Tarrara Bar, 33 km downstream of the Kununurra Diversion Dam 750 GL/yr
- The lower Ord River, 56 km downstream of the Kununurra Diversion Dam to the tidal limit 115 GL/yr

Reliability of entitlements (% of years fully supplied)

95%

Lower Ord River flows – post dam

Annual average flow at Tarrara Bar

- Recent years (350 GL/yr, moderate power demand) 3480 GL/yr
- Currently licensed (350 GL/yr, high power demand) 3545 GL/yr
- Fully licensed (750 GL/yr, high power demand) 3135 GL/yr

Typical dry season flow rate

- In recent years (350 GL/yr, moderate power demand) 65 m³/s
- When fully licensed (750 GL/yr, high power demand) 42 m³/s

Further information

The *Ord surface water allocation plan* is available on our website www.water.wa.gov.au

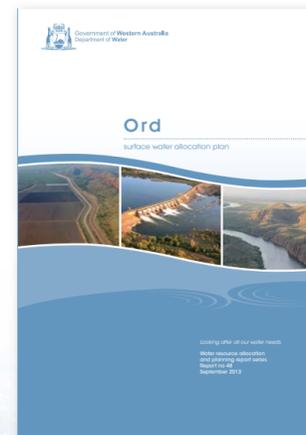
The Department of Water is assessing and advising government on water supply options should additional water be needed for irrigation expansion. If major infrastructure or supply system changes are agreed, then water management arrangements will be updated accordingly.

How is water allocation decided?

The priority set by government is for secure and reliable water supplies to maximise the irrigation potential of the region, while at the same time supporting hydro-electricity generation and sustaining a healthy downstream river environment.

The Department of Water is responsible for managing and licensing water from the Ord River under the *Rights in Water and Irrigation Act 1914 (WA)*. Its *Ord surface water allocation plan* supports the government priorities through water allocation limits which control the total volume of entitlements that can be issued, and water release rules and water sharing rules which are managed through licences.

The water release rules are particularly important during times of below-average storage and dry periods, and ensure the most effective water sharing. The rules were set using a water balance model that weighs up hydrology, water demands, reliability, releases to meet the different needs, and operational constraints. As irrigation expands, the water release rules will be adjusted slightly to maintain a 95 per cent reliability of supply for each phase of irrigation development.



Government of Western Australia
Department of Water

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How the system works

Water flows from south to north along the Ord River and is stored in Lake Argyle by the Ord River Dam, and Lake Kununurra by the Kununurra Diversion Dam.

The Department of Water licenses the Water Corporation to store water in the lakes and to operate the dams in accordance with licence conditions. The Ord Irrigation Cooperative (OIC) and self-supply irrigators hold licences to take water from the Ord River downstream of the Ord River Dam.

Since 1996 a hydropower plant has operated on the Ord River Dam. Water is released through turbines to generate electricity for local towns and the Argyle Diamond mine. Water releases for hydropower generation are the largest releases from Lake Argyle.

Irrigation is the primary consumptive use of water from Lake Argyle. The other main water benefit is for the lower Ord River, below the Kununurra Diversion Dam. Flows in the lower part of the river come from Lake Argyle and the Dunham River, and support water dependent ecosystems as well as community values.

Contact Information

For more information, contact the Kununurra Regional Office on 08 9166 4116 or at 27 Victoria Highway, Kununurra Western Australia 6743.



The Ord River Dam

The Ord River Dam was built in the early 1970s to form Lake Argyle and provide a reliable water supply to the Ord River Irrigation Area. The dam captures highly variable runoff from the catchment each wet season and stores it in Lake Argyle for later use. The storage enables water to be released year-round to generate hydro-electricity, supply downstream irrigators in the irrigation season and sustain the lower Ord River environment in dry periods.

Lake Argyle's capacity (to the full supply level) is 10 760 GL or 2.5 times the mean annual inflow. Carefully managed, it is sufficient to provide a highly reliable water supply, even if inflows to the lake over three wet seasons are well below average.

The dam wall is high enough to capture the large volumes of flood waters of the very wet seasons, and temporarily store them above the full supply level (see Ord River Dam schematic below). The spillway, a deep narrow channel cut through a rock saddle, is about seven kilometres from the dam wall. The spillway gradually discharges any flood water over the following dry season. As little or no flood water remains in storage by the next wet season, it does not contribute to the water that can be reliably supplied from Lake Argyle over extended drought periods.

Water for irrigation

Water for irrigation is either scheme-supplied by the OIC or self-supplied by individual users. Up to 905 GL/year of water entitlements can be granted from the existing infrastructure in the Ord area. Of particular importance to agricultural development is 750 GL/year from the Main Ord subarea (using water from Lake Argyle), which is simulated to be available in 95 out of 100 years under the Department of Water Reservoir modelling. In July 2013, 400 GL/year of the 750 GL/year was available for new or increased entitlements to support irrigation expansion. Subject to finalisation of intergovernmental agreements, there are also opportunities for irrigation expansion in the Northern Territory.

As agricultural developments expand, water must be managed and shared responsibly to allow for dry years. There have been several years of severe drought during the past 100 years, and once water is fully allocated future dry periods could severely affect productivity and livelihoods. Given that climate models do not indicate a clear wetting or drying trend for the Kimberley area, the past 100 years' climate was used as a basis to predict future climate and set water allocation limits and water release rules which provide a 95 per cent reliability for irrigation.

During periods of low inflows water sharing is essential. Hydropower restrictions are applied to reduce the total demand on Lake Argyle before storage levels become very low (See Ord River Dam schematic) – Minimum operating level). If storage levels do become very low, irrigation and environmental restrictions also apply.

Water releases for hydropower

Pacific Hydro Ltd own and operate the Ord River Dam Power Station under a water supply agreement with the Water Corporation. The Department of Water sets power station release rules so that water released for power each month does not reduce the reliability of water for irrigation in future years.

Since operation began, most of the water released from the dam has been for hydropower. The volumes released have been sufficient to meet Stage 1 irrigation demands, and are well in excess of the needs of the lower Ord River environment.

As lake levels decline due to low inflows or high power demand, monthly hydropower releases need to be reduced to maintain reliability of supply for irrigation. Power generation is restricted when storage levels in the lake are below-average, and some of the demand at the Argyle mine will be met through greater use of diesel generators.

As more water entitlements are granted for irrigation, the release rules will be adjusted to ensure enough water is retained in storage to provide water for reliable irrigation supplies, hydropower demand and environmental demands. Water released for irrigation and the environment can also be used to generate hydropower, and releases solely for hydropower partly meet the lower Ord environment requirements.

Boating and navigation

Damming of the Ord River and all year-round releases for power have significantly enhanced boating and navigation on the river, with both lakes and the lower Ord River now being popular boating and tourism locations.

Even when flows are in excess of minimum required environmental flows or natural dry season levels, the need to store water for longer periods to reliably provide for increases in water allocations will affect the ease of navigational access.

Boating on Lake Argyle will not be affected by increased demands but boating access on Lake Kununurra, especially close to the Ord River Dam, may change. Below the Kununurra Diversion Dam already parts of the river are not navigable.

Navigational releases for Lake Kununurra are allowed if Lake Argyle storage levels are high and releases are consistent with the licence for dam operations. The practical arrangements for releases are negotiated with and managed by the Water Corporation.

When water levels in Lake Argyle are low or fall below the trigger levels for hydropower restrictions, specific navigational releases from Lake Argyle are not permitted. Releases made specifically for enhancing boat navigation on the lower Ord River are not feasible at these levels because they compromise hydropower generation and irrigation supply.



Water for the lower Ord River

The Ord River Dam has significantly changed the river environment. There are now year-round flows in the lower Ord River from the diversion dam to Mambi Island (66 km downstream), where tidal effects commence. This is in contrast with the drying-out periods that occurred naturally before the dam was built.

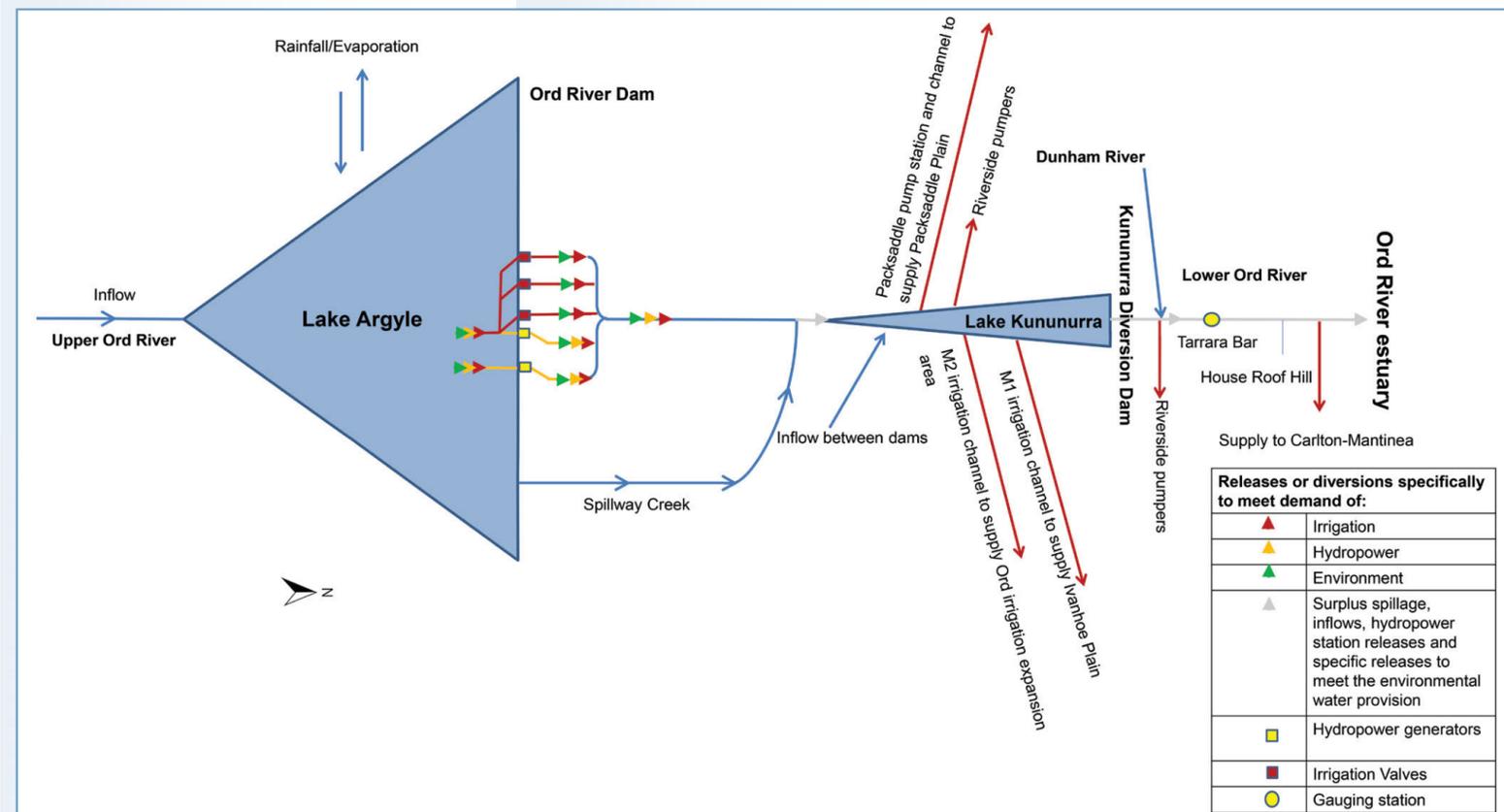
The permanent flows over the dry season have altered the river environment and new water-dependent values have been established.

While there is a lot of water flowing into the lower Ord now, water flows below the diversion dam will diminish as increased volumes of water are diverted for agriculture.

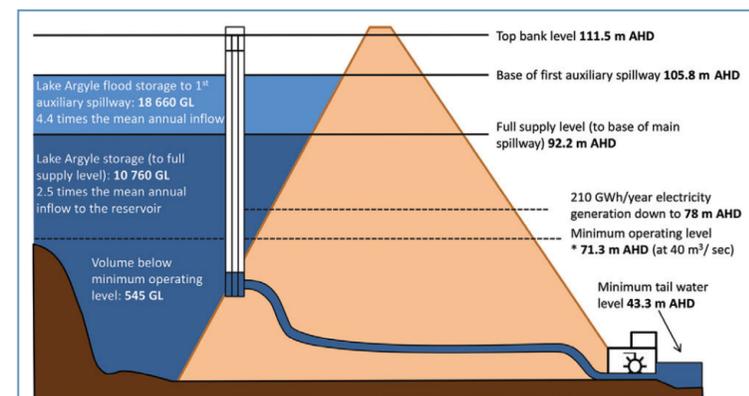
Scientific studies, including a low-flow trial, have been used to work out how much water is needed to provide for habitat, fish movement and breeding, regeneration of vegetation, and dissolved oxygen. The environmental flow regime provides a range of flows important for maintaining these river health and ecological functions (see diagram below).

In most years, the environmental flows will be met by releases for hydropower and inflow from the catchment downstream of the Ord River Dam – particularly from the Dunham River. In some years top-up releases will be needed.

When storage is low, releases for environmental flows will be reduced, through restrictions described on the dam licence, to balance competing demands for water.

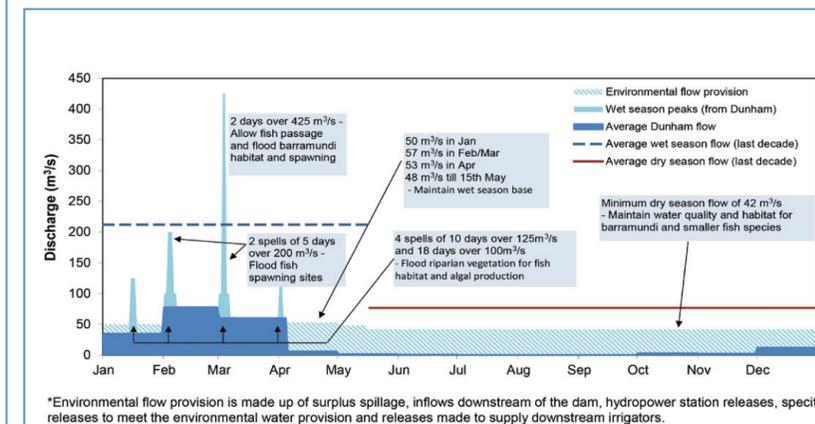


How water is distributed from the Ord River and Kununurra Diversion dams



*The minimum operating level was updated by the Water Corporation using computational fluid dynamics modelling in late 2013.

Ord River Dam schematic



*Environmental flow provision is made up of surplus spillage, inflows downstream of the dam, hydropower station releases, specific releases to meet the environmental water provision and releases made to supply downstream irrigators.

An example of the expected environmental flow regime for the lower Ord from Lake Kununurra to Tarrara Bar