

Paradise Dam

Fact Sheet: Climate change impact considerations

March 2022

Introduction

The Queensland Government has announced that Paradise Dam will be returned to its original height. A range of technical studies were undertaken to ensure the best information was available in developing a recommendation for the long-term future of Paradise Dam.

An important aspect of the project hydrology studies was to understand how climate change might impact on reliability and the dam's yield for customers, over the long term. Definitions of reliability and yield are provided on page 3 and 4 of this Fact Sheet.

How was the impact of climate change assessed?

- OD Hydrology, a Brisbane-based consultancy with experience in all aspects of hydrology, water supply, water management and water resource planning throughout Australia, was engaged to assess the potential impact of climate change on both:
 - Reliability - the impact of climate change on the average reliability of medium priority (MP) allocations (with existing yields held constant) was assessed using the outputs from 11 different climate change models (known as General Circulation Models or GCMs), and by using a defined greenhouse gas scenario (known as Representative Concentration Pathway 8.5). These terms are explained in Table 1, below.
 - Yield - the impact of climate change on yield (with current average medium priority [MP] reliability held constant) was then assessed across six of the eleven GCMs.
- This information considered potential changes to rainfall, evaporation and inflows out to 2050 in the Burnett River Sub-scheme under different dam height scenarios.

Table 1- Understanding climate change impact assessment terms

General Circulation Models (GCMs)	Representative Concentration Pathway (RCP)
GCMs are computational models that represent inter-related physical processes in the atmosphere, ocean, land surface, and frozen regions across the earth.	A Representative Concentration Pathway (RCP) is a greenhouse gas concentration trajectory adopted by the Intergovernmental Panel on Climate Change.
These models are the most advanced tools currently available for simulating the response of the global climate system to increasing greenhouse gas concentrations.	Pathways describe different climate futures, all of which are considered possible depending on the volume of greenhouse gases emitted in years to come.

General Circulation Models (GCMs)	Representative Concentration Pathway (RCP)
They depict the climate using a three-dimensional grid over the globe and provide estimates of regional climate change.	For planning purposes, the Queensland Government adopts the “RCP 8.5” emission scenario.
Eleven different worldwide GCMs have been considered for the Paradise Dam Options Evaluation as most relevant to Queensland. A sample of six of the eleven models (excluding the lowest and highest results) was then selected for further analysis of the potential impact on water supply yield from the Burnett catchment.	The RCP 8.5 scenario is referred to as “business as usual”, as it is a likely outcome if society does not make concerted efforts to cut greenhouse gas emissions globally.

How might climate change impact the Burnett River sub-scheme?

- While advances continue to be made across the scientific community’s collective understanding of climate change, the fact remains that many uncertainties persist. The rate of change will depend upon multiple variables.
- As a result, there is a significant variability in results across the GCMs.
- In general, however, the outlook is more negative, with eight of the eleven global models predicting a reduction in average annual inflows compared to current inflows. And correspondingly a reduction in monthly water supply reliability if yield is held constant (i.e., if the system is to supply all allocations as allowed for in the Water Plan).
- Further analysis was undertaken assuming the existing historical performance was maintained (i.e., to ensure average reliability as achieved with Paradise Dam was not made worse), and to assess the impact on yield (for example, a reduction in total MP water allocations that may be available for customers in the future, attributed to climate change). This was assessed across a sample of six of the eleven models (excluding the highest and lowest data), for the following dam options:
 - In a scenario where Paradise Dam is returned to the original full supply level, the total yield (supply) available from the Burnett River sub-scheme would likely be reduced by 2050 (due to climate change) but is likely to still meet demand projections at this time. The sample of six of the eleven models show the impact on yield ranging from negative 160,000 ML to positive 50,000 ML a year by 2050, though more likely negative.
 - In a scenario where Paradise Dam is permanently reduced by five metres, the Burnett River sub-scheme yield would be reduced by 2050 (due to reduction in Paradise Dam storage capacity, and considering climate change), to the extent that additional storages are likely to be required to meet projected demand. The modelling identified the extent to which these additional storages may likely be required sooner, and larger, than would otherwise be required if climate change didn’t occur.

How was this information considered when assessing primary spillway height options for Paradise Dam?

- While we don’t have certainty about climate change impacts, planning for the full remediation of Paradise Dam has considered the potential for reduced yields if the current average reliability (since Paradise Dam was constructed) is to be maintained.
- Climate change requires a conservative approach to ensure water security can be provided into the future.
- The larger the capacity of the alternative supply option, the more resilient the infrastructure is to downside climate change impacts on dam inflows. In effect, this indicates that larger supplies provided a buffer against climate change risk and uncertainty.

- If Paradise Dam was to be permanently lowered, it was very likely that additional supply options would have been required to meet demand to 2050.
- Although results are uncertain, additional supply options may still be required to service demand beyond 2050 with Paradise Dam returned to its original full supply level.

More information

Climate change also has the potential to impact on water demand, and this has been considered in the Paradise Dam Demand Study, which you can read about in this Fact Sheet: [NCEconomics Future Water Demand Study April 2021](#).

Information about other hydrology and hydraulic studies is available in this Fact Sheet: [Hydrology and Hydraulic Studies April 2021](#).

Information about alternative supply options is available in this Fact Sheet: [Alternative Storages Findings December 2021](#).

More information is available in the Paradise Dam Improvement Project [Options Evaluation Report](#).

Reliability and yield definitions

The Burnett Basin Water Plan 2014 (the Water Plan) is underpinned by the Department of Regional Development, Manufacturing and Water's (DRDMW) Integrated Quantity and Quality Model (IQQM) with a simulation period based on over 100 years of climatic data (from 1890 to 2008) and extensive stream flow data from the 1950s onwards.

The performance indicator used to test/set the **reliability** of a water allocation is the monthly supplemented water sharing index.

- This is a statistical measure defined as the percentage of months in the IQQM simulation period in which the allocations are fully supplied.
- Allocations fully supplied does not mean 100% announced allocation (AA) but is based on an assumed monthly water use demand pattern.
- In the Bundaberg Water Supply Scheme (BWSS) the demand pattern assumes slightly higher use through the summer months and the reverse during winter months.
- The Burnett Basin Water Plan 2014 defines the water allocation security objectives (WASO) which underpins the reliability of all water allocations in the BWSS:
 - For the high priority (HP) water allocation group, a minimum long-term monthly reliability of 99%.
 - For the medium priority (MP) water allocation group, a minimum long-term monthly reliability of 90%.
 - A 93% reliability means that if we looked back over the water plan simulation period (1 July 1890 – 30 June 2008) the assumed monthly demand would be possible 93% of the time (e.g., of 1404 months in the simulation period, water would be available to medium priority water users for 1,306 of those months).

Yield is the reliable supply of medium priority and high priority water allocations from catchment inflows.

- Yield is the available resource that can be sustainably extracted from a catchment without impacting on other water users or the environment.
- For the BWSS, the water plan specifies the DRDMW IQQM computer program's simulation for a period between 1890 to 2008 is to be used to assess consistency with environmental flow objectives and water allocation security objectives.
- Yield can be described in terms of different water products to meet different customer requirements, including:
 - medium priority (MP) water allocations (lower reliability – typically for irrigation / agricultural use).

- high priority (HP) (highest reliability – typically urban water supply and industrial use).
- Total yield is a combination of maximum allocations (volume) of water that can theoretically be supplied per year for each water product (medium and high priority).
- This is determined by the IQQM program to achieve the minimum reliability required as specified in the water plan.
- These are the maximum allocations (volume of water per year) that can be sold.

Stakeholder engagement

Sunwater is committed to ongoing engagement with the community to ensure transparency during the works at Paradise Dam. We will continue to share updates as the work progresses with a dedicated Community Reference Group and Paradise Dam Industry Forum that include representatives from local government, peak bodies, customers, and downstream residents. Information is also regularly shared on Sunwater's Paradise Dam Facebook page and the project webpages on the Sunwater website.

Questions?

Please contact us on 3120 0270 or paradise.dam@sunwater.com.au with any questions. For general enquiries, please contact customer support by phone on 13 15 89 or live chat via [sunwater.com.au](https://www.sunwater.com.au), Monday-Friday 8.30am-4.30pm.