Government of **Western Australia**
Department of **Water and Environmental Regulation**

Nullaki (Wilson Inlet) – Overview of the sandbar opening decision framework

Nullaki / Marjit / Wilson Inlet is an estuary in Western Australia's south coast, located at the heart of the town of Denmark. The estuary has significant ecological, cultural and social values. Traditional Owners the Menang and Pibbulmun Wadandi Noongar peoples have a deep and continuing connection to the land and waters.

We have developed a new framework and tool to guide decisions about when to open the sandbar of Nullaki / Wilson Inlet in lower rainfall years. The new framework aims to protect the inlet's environmental and social values in a changing climate.

The modified approach to sandbar openings

The 2009 sandbar opening protocol remains in place and the sandbar will still be opened to prevent flooding when necessary. In addition, it will now be possible to open the sandbar at water levels between 0.5 and 0.7 m and at any time of the year. This will only be recommended in situations where opening the sandbar is necessary to minimise risks to the inlet's ecology.

About the sandbar

The sandbar is a seasonal barrier between the inlet and the ocean, which usually forms in the middle of summer. Rainfall in the wetter months increases river flows and when the sandbar is closed the inlet's water level gradually rises, becoming higher than sea level. When the inlet's water level reaches above 0.7m[1], this can cause flooding in the surrounding low-lying areas of Denmark.

For more than 100 years, the sandbar has been opened most years to prevent flooding, usually during winter. Opening the sandbar involves excavating a channel to release inlet water to the ocean. This results in a drop in the inlet's water level and allows water exchange between the inlet and the ocean. The sandbar usually reforms naturally each summer.

Sandbar openings are guided by the current sandbar opening protocol (2009). The Water Corporation opens the sandbar to prevent flooding (in compliance with the *Water Services Act 2012*) once the water level exceeds 0.7m, usually at a level of about 1m and before the end of the first week in September. The Department of Water and Environmental Regulation (the department) collaborates with the City of Albany, Shire of Denmark and the Water Corporation on the sandbar openings. This activity is regulated by a licence to dredge the waterway under the *Waterways Conservation Act 1976* and Regulations 1981 which is assessed and issued by the department.

[1] Water levels referred to in this document are in metres Australian Height Datum, which is the standard measurement for water level in Australia.

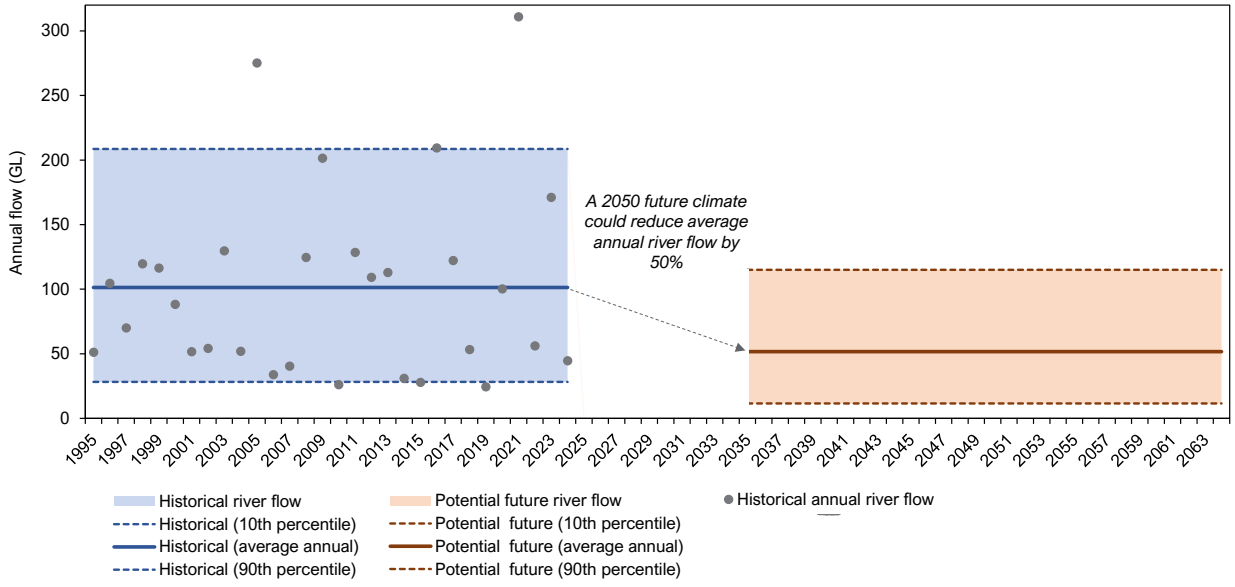
Adapting to our changing climate

Rainfall and river flows are declining in the south west of WA. The timing of rainfall is also changing on the south coast, for example with peak winter rains often occurring later in the year than they were in the past. Extreme weather events may also become more common.

As a result of declining river flows, the minimum inlet water level for opening the sandbar has no longer been reached by September every year. This happened in 2007, 2010, 2014 and 2019 – so the sandbar was not opened in these years.

Analysis using climate models predicts that river flows will continue to decline, by about 50 per cent over the next 30 years. We project that by 2050 this would result in the inlet reaching the water level to be opened under the 2009 protocol only once every three years on average.

In previous years when the sandbar was not opened because the water level did not reach 0.7m by September, community members reported that aspects of the inlet's ecology like vegetation, fish and shorebirds were affected. If years with non-openings happen more often in the future, this may be problematic for the inlet's health.



Examples of ecological and social risks of not opening the sandbar based on observations and analysis of the inlet's ecology include:

Higher than usual water level in summer (compared to when the sandbar is opened which reduces summer water levels) would reduce habitat availability for migratory shorebird species, many of which are threatened species.

Flooding of foreshore vegetation for long periods, particularly in summer months, can result in the loss of vegetation and regrowth.

If the sandbar remained closed for multiple years in a row, seagrass meadows may die off or be unable to reproduce.

The timing of sandbar openings affects seagrass meadows because of impacts on water levels, so requires careful consideration.

There would be more years with no new recruitment of marine/estuarine opportunist fish into the inlet. This may reduce fish populations and therefore the catch available for recreational fishers.

Without the input of ocean water, the water in the inlet would become less salty than usual for longer periods, potentially going beyond the salinity tolerance range of some species like blue mussels.

Without the influx of ocean water in spring and early summer, Prawn Rock Channel would be less appealing for swimming in summer. However, having the sandbar open can reduce the amenity and swimming conditions at Ocean Beach.

The modified approach to sandbar management

The department has engaged with stakeholders and completed data analysis and scientific modelling to inform a modified approach to managing the sandbar. The purpose of the approach is to minimise risks to the inlet's ecological values in a drying climate.

Under this approach, the 2009 sandbar opening protocol remains in place and the sandbar will still be opened to prevent flooding when necessary. In addition, it will now be possible to open the sandbar at water levels between 0.5 and 0.7 m and at any time of the year. This will only be recommended in situations where opening the sandbar is necessary to minimise risks to the inlet's ecology. A specially developed risk scoring matrix and modelling tool will help us decide whether a sandbar opening will help minimise these risks.

The table below shows when we will use the modified approach based on the inlet's water level:

Inlet water level	Sandbar management
Above 0.7m	The sandbar should be opened to prevent flooding, as per the 2009 sandbar-opening protocol.
Between 0.5m and 0.7m	A sandbar opening may be recommended if the risk analysis shows that this would be the better outcome for the inlet's ecology and forecasts show it is unlikely the water level will exceed 0.7m that year. The sandbar management working group will use the decision framework and tool to inform whether (and when) to open the sandbar.
Less than 0.5m	Opening the sandbar is generally not recommended. The sandbar management working group will continue monitoring the water level and applying the decision framework and tool. Opening the sandbar should only be considered as a last resort option to prevent the sandbar staying closed for multiple years in a row.

In this approach, the sandbar management working group will determine the optimal opening location to maximise the success and duration of the opening. The group also considers the prevailing and forecast weather and ocean conditions, such as inlet and ocean water levels and currents.

The risk scoring matrix

The **risk scoring matrix** outlines risks associated with different sandbar management scenarios to water quality, seagrass, foreshore vegetation, fish and shellfish, birds and the amenity of Prawn Rock Channel and Ocean Beach.

The expected risks for each of these criteria have been rated for six different scenarios. The scenarios consider whether the sandbar is opened or not, the timing of the opening (before or after 7 September) and whether the sandbar is likely to stay open for a short or long period of time.

In scenarios one and two, the sandbar will be opened as usual to prevent flooding. The modified approach will involve comparing risk scores for either scenario three or four (depending on the date and water level at the time) with scenario five where the sandbar is not opened. Scenario six would be used instead of scenario five if the sandbar had not been opened the year before.

The modified approach involves applying the risk scoring matrix to determine the better management option – open the sandbar or leave it closed. This is completed repeatedly from about August onwards, until the sandbar is either opened or an opening is unlikely to be feasible.

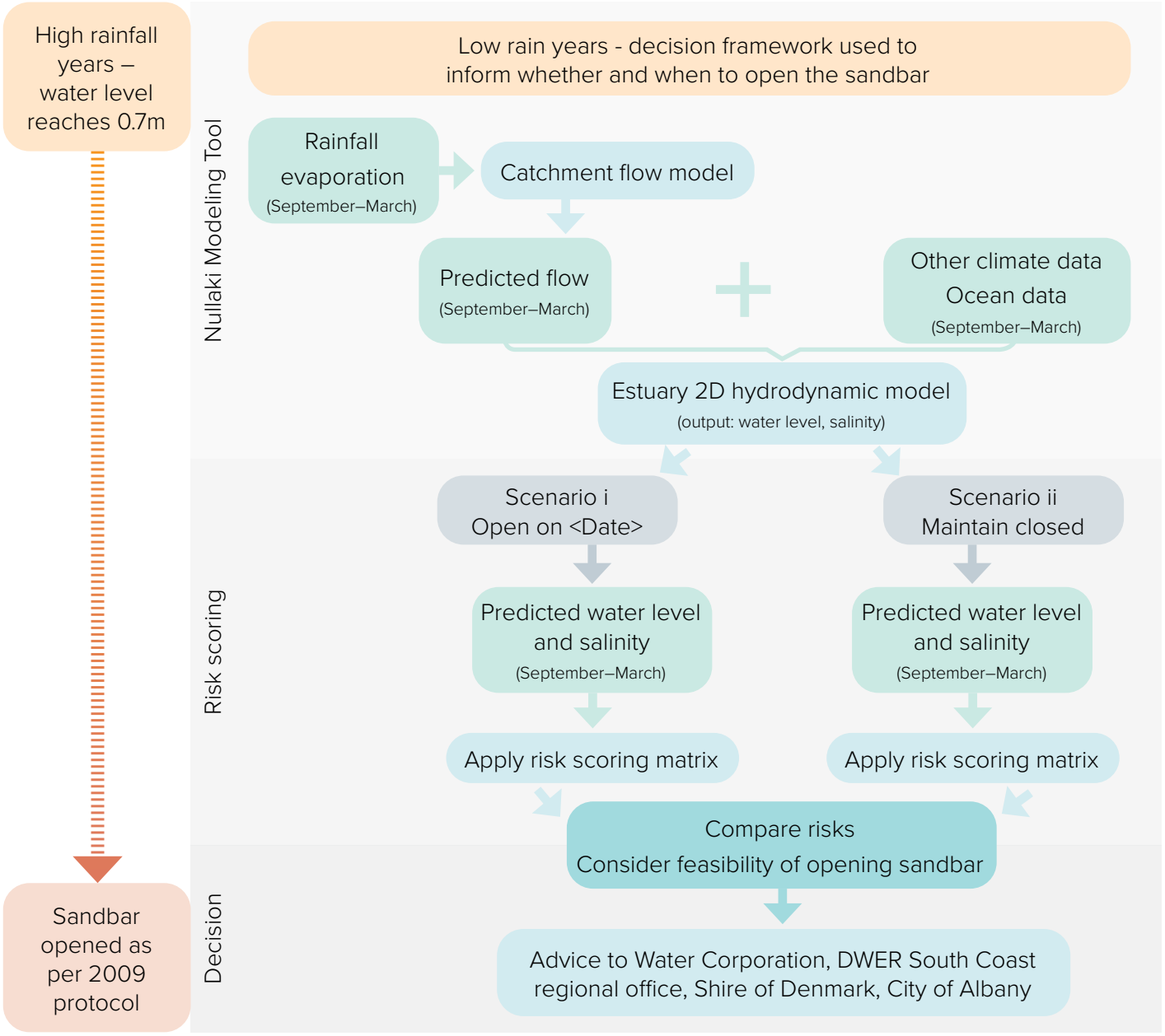
Legend

The risk scoring matrix

	Scenario	1. Open **before** 7 Sept; water level **above** 0.7m, **long** opening	2. Open **before** 7 Sept; water level **above** 0.7m, **short** opening	3. Open **before** 7 Sept; water level **less than** 0.7m, **short** opening	4. Open **after** 7 Sept; **any water level, short** opening duration	5. Sandbar is not opened	6. Sandbar not opened multiple years in a row
Water quality	Nutrient availability						
	Phytoplankton activity						
	Harmful algal blooms						
Seagrass	Self-shading Month of opening				Sept / Oct-Nov / Dec-Apr		
	Seagrass reproduction		unknown	unknown	unknown	unknown	
	Seagrass desiccation Water level (m)		>-0.4 m	between -0.4 and -0.5 m	<-0.5 m		
	Seagrass health						
Vegetation	Foreshore vegetation Water level (m)		>0.3 m for ≥110 days	>0.3 m for ≥21 days in Dec to Apr	otherwise		
Fish & shellfish	Commercial fishery						
	Recreational fishery						
	Blue mussels Autumn salinty (ppt)		≥ 24.5 ppt	between 20.5 and 24.5 ppt	<20.5 ppt		
	Lamprey						
Birds	Shorebirds Water level in February (m)		<-0.1 m	between -0.1 and 0.1 m	>0.1 m		
	Prawn Rock Channel Amenity						
	Ocean Beach Amenity						

The Nullaki modelling tool

To assess the risks to different ecological criteria in the risk matrix and determine the best time to open the sandbar, it is important that we can understand and predict the water level and salinity of the inlet into the future. We have developed a **modelling tool** that predicts the inlet's water level and salinity based on catchment and estuary models combined with forecast rainfall and ocean data.



Alongside the *Water Quality Improvement Plan* currently being developed for Nullaki (Wilson Inlet), the *Sandbar Opening Decision Framework* aims to improve the inlet's condition and health, supporting the inlet's Aboriginal heritage and social values. Continued stakeholder input to the management of the inlet is essential and appreciated.

Thanks to:

- Wilson Inlet Catchment Committee
- Pibulmun and Menang-Noongar Elders and leaders
- Wilson Inlet Restoration Group
- Denmark Bird Group
- Denmark Environment Centre
- Green Skills
- Estuarine fishers
- Wilson Inlet Seafood/Aquaculture
- Denmark Chamber of Commerce
- Denmark Surf Life Saving Club
- South Coast Bushcare Services (SCBS)
- Denmark Riverside Club Inc.
- Denmark Dragon Boat Club
- Denmark Residents & Ratepayers Association
- The broader community.

Nullaki sandbar management working group:

Government of **Western Australia**
Department of **Water and Environmental Regulation**

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