

Water quality snapshot: Yeerup (Torbay Inlet) 2023

Through Healthy Estuaries WA, the Department of Water and Environmental Regulation monitors water quality monthly in Lake Powell, Yeerup (Torbay Inlet) and the surrounding Torbay catchment. This snapshot provides some insights from our monitoring during 2022 and 2023, with comparison to previous years.

Understanding estuary condition and monitoring for change helps to guide how we manage our estuaries

Torbay Inlet, Lake Powell and the rivers and drains that flow into them tend to have high nutrient concentrations and are prone to algal blooms.

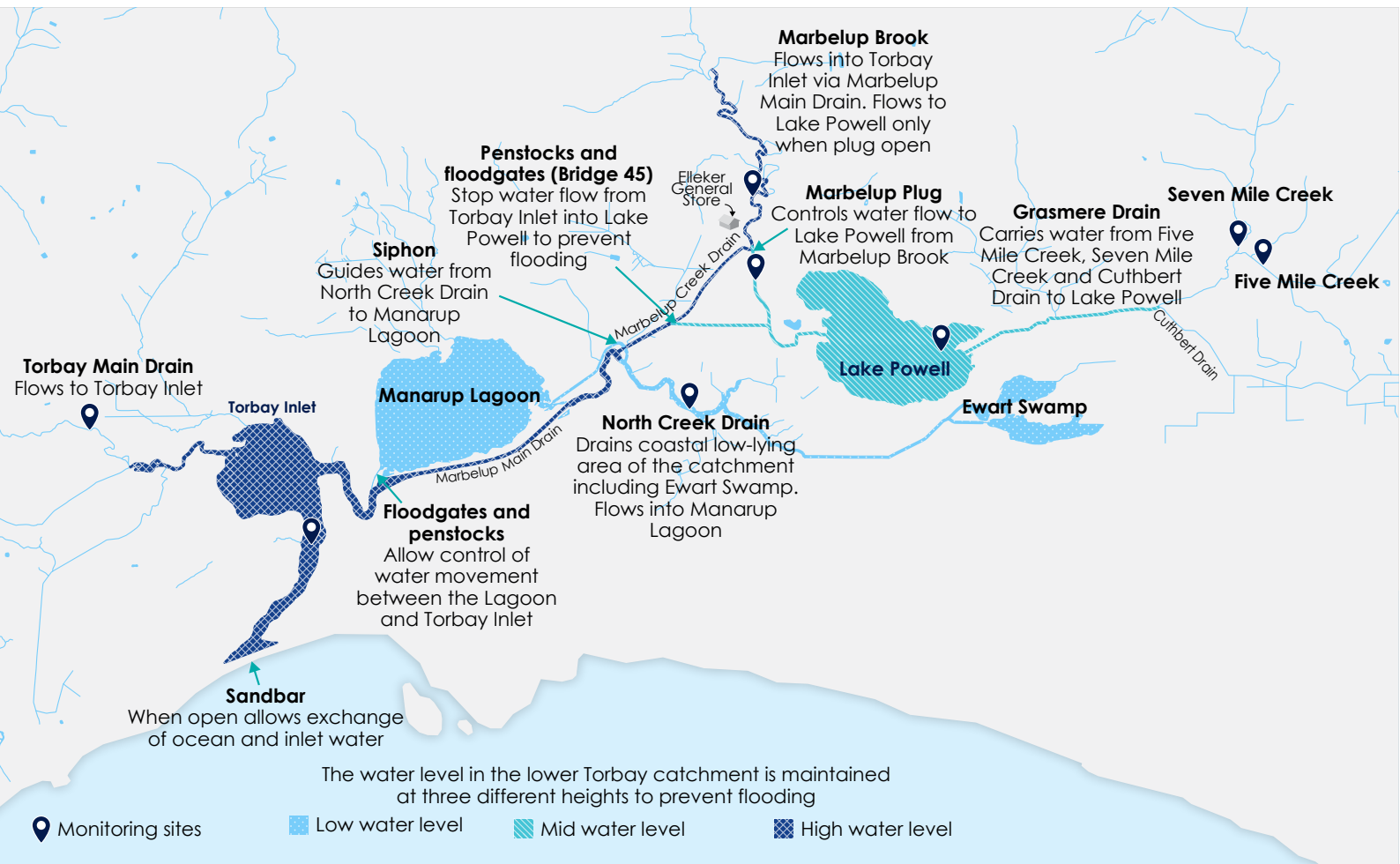
Rainfall washes nutrients (nitrogen and phosphorus), and organic matter from the surrounding area (catchment) into the rivers and drains, and then to Torbay Inlet and Lake Powell. Nutrients applied in the catchment, for example as fertiliser or livestock waste, wash into the waterways when it rains. This is especially the case in areas of the catchment that have soils that are naturally poor at retaining phosphorus. Excessive nutrient availability in waterways can fuel algal growth, some of which can be harmful.

The Torbay catchment is highly modified. The lakes and lagoon are linked with a network of creeks and

drains managed by Water Corporation to prevent flooding of the surrounding low-lying areas. Marbelup Brook and Torbay Main Drain flow directly into Torbay Inlet; while Seven Mile Creek and Five Mile Creek join up, before flowing into Lake Powell.¹ Torbay Inlet exchanges water with the ocean at times when the sandbar is open.

Marbelup Brook, Seven Mile Creek and Five Mile Creek flow all year round, whereas Torbay Main Drain stops flowing in dry summers. In early 2023, Torbay Main Drain was dry for about two months, marking a very dry start to the year.

¹ For more detail, see the [Torbay catchment water quality snapshot 2021](#) on wa.gov.au.



Nutrients

We monitor nutrient concentrations because excess phosphorus and nitrogen can promote algal growth. While algae are a natural part of aquatic ecosystems, excessive algal growth (algal blooms) can harm fish and pose risks to human health, as well as making waterways unsightly and smelly.

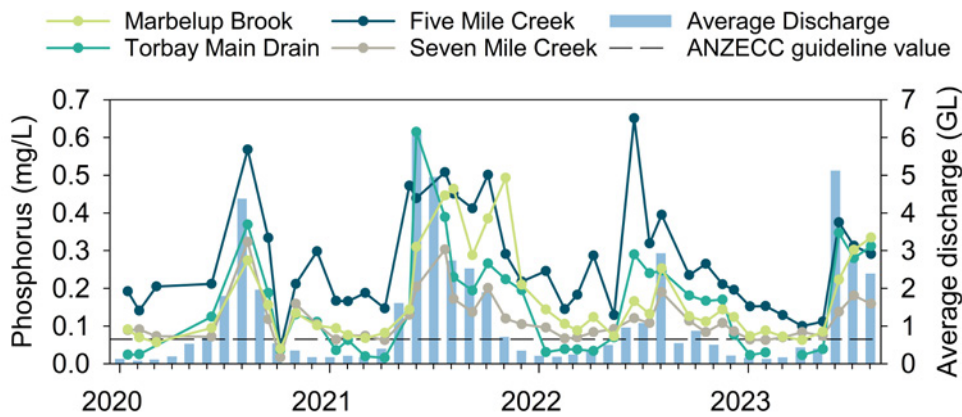
Nutrients in the Torbay catchment

Concentrations of phosphorus and nitrogen in the tributaries (creeks and drains) of the Torbay catchment are often high compared with water quality guidelines, an indication of poor water quality.²

Five Mile Creek usually has the highest nutrient concentrations, particularly of phosphorus, typically exceeding water quality guidelines year round. Torbay Main Drain is the only tributary that seasonally has healthy phosphorus concentrations which occur during low flow periods in summer and autumn.

Key takeaways

- Discharge (or flow) of water through the tributaries is higher in winter because of rainfall. Rainfall and flow bring with it nutrients from the catchment, so phosphorus (and nitrogen; not shown here) concentrations increase when discharge increases.
- Water quality tends to be poor in all the tributaries to Lake Powell and Torbay Inlet throughout most of the year.
- Torbay Main Drain tends to have lower phosphorus concentrations in low flow periods (summer and autumn). This is the only tributary that sometimes has concentrations below guideline levels, representing good water quality.



Phosphorus concentrations and average discharge into Torbay Inlet and Lake Powell, 2020–23

In 2022–23, we conducted additional monitoring to explore what forms of phosphorus make up the total phosphorus (TP) measured in each of the tributaries, to help us understand why some have high concentrations all year round. In the Torbay Main Drain, we found that the proportion of phosphate (a form of phosphorus that is highly bioavailable) was typical for waterways on the south coast. However, we found a higher proportion of phosphate in Marbelup Brook, Seven Mile Creek and Five Mile Creek.

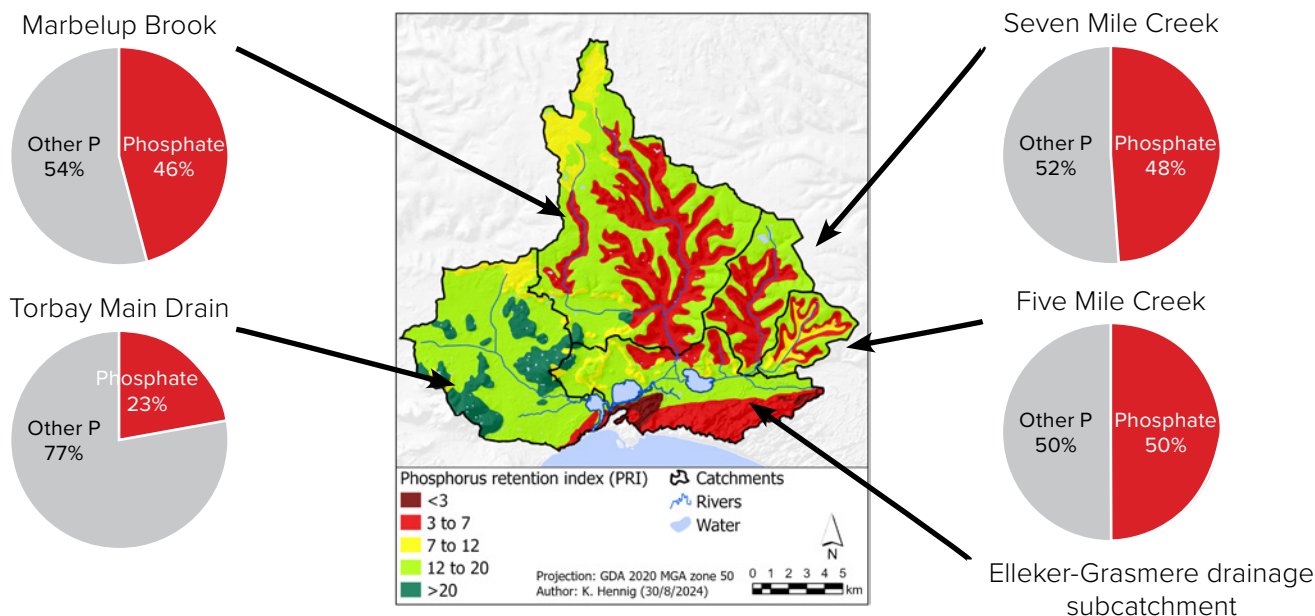
The soils in the Marbelup Brook, Seven Mile Creek and Five Mile Creek subcatchments tend to have a poorer phosphorus retention capacity compared with the Torbay Main Drain subcatchment. This suggests that the high year-round phosphorus concentrations in Marbelup Brook, Seven Mile Creek and Five Mile Creek are mainly due to inputs from catchment land uses such as agriculture, because the soils are particularly prone to losing phosphorus through leaching and run-off.

Key takeaways

- Soils with a poor ability to retain phosphorus (PRI<7) are common in the Marbelup Brook, Seven Mile Creek and Five Mile Creek subcatchments. The Torbay Main Drain subcatchment tends to have soils with a better phosphorus-retention capacity than the other areas.
- In the three subcatchments with poorer phosphorus-retention capacity, the total phosphorus is made up of a higher proportion of phosphate than we would usually see in waterways on the south coast. A higher proportion of phosphate is an indicator that tells us the phosphorus in the water is mainly coming from fertiliser applied to the catchment's soils.

² Nutrient concentrations are compared with [ANZECC and ARM CANZ \(2000\) water quality guidelines for lowland rivers in south-west Australia](#). Guidelines are used to assess risk of adverse effects on water quality.

Drains usually have higher nutrient concentrations than rivers due to the lack of natural features, so the comparison with lowland river guideline values here is only as a reference and to enable an easier comparison with other adjacent catchments.



Average percentage of phosphate and other types of phosphorus for the tributaries in the Torbay catchment (March 2022 to February 2023). The map shows the location of the subcatchments and the phosphorus retention index of the soils

Nutrients in Lake Powell and Torbay Inlet

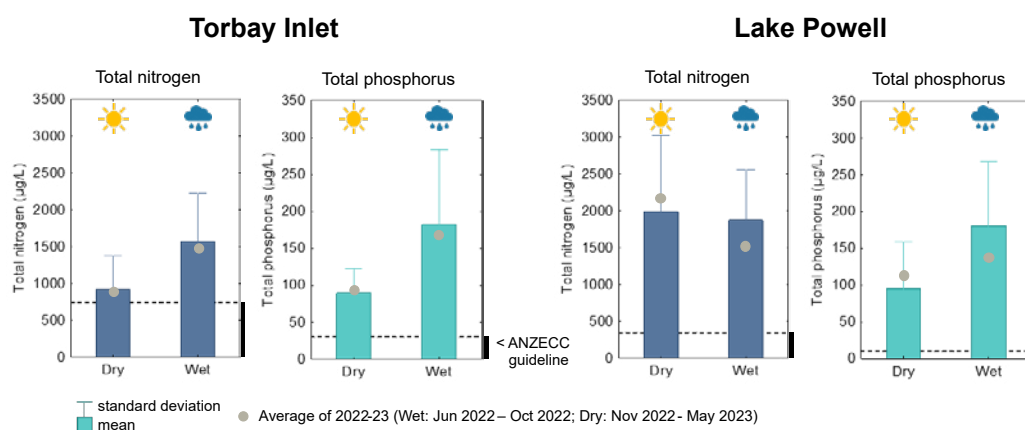
Both Lake Powell and Torbay Inlet tend to have very high nutrient concentrations and poor water quality all year round.³ Nutrient concentrations are particularly high in the wet months of the year (June to October) when excessive amounts of nitrogen and phosphorus from catchment land uses flow in from the rivers, creeks and drains.

Nitrogen and phosphorus concentrations in Torbay Inlet and Lake Powell generally follow similar seasonal patterns (November 2017 to June 2023). The exception is that in Lake Powell, average total nitrogen concentrations are nearly as high in the dry months as in the wet months. This is likely because of a combination of ammonium (a form of dissolved nitrogen) release from the sediment and blooms of cyanobacterial microalgae species in the dry months that can access nitrogen from the air to help them grow. Average total nitrogen and total phosphorus concentrations for the wet months of 2022 (June to October) were slightly below the 2017–23 averages, partially because river discharge, and therefore nutrient input from catchment land uses, was also slightly below average in those months.

Key takeaways

- In Torbay Inlet, average nitrogen and phosphorus concentrations are higher in the wet months of the year.
- The period June 2022 to May 2023 was a typical year for Torbay Inlet, as average total nitrogen and total phosphorus concentrations were similar to 2017–23 seasonal averages for both the wet and dry months.
- In Lake Powell, average phosphorus concentrations are higher in the wet months than the dry months, but average nitrogen concentrations are similar in the wet and the dry seasons.

³ Nutrient concentrations are compared with [ANZECC and ARMCANZ \(2000\) water quality guidelines](#). For Torbay Inlet, we use the guideline for estuaries in south-west Australia. For Lake Powell, we use the guideline for freshwater lakes in south-west Australia.



Average nitrogen and phosphorus concentrations (2017 to 2023) in Torbay Inlet and Lake Powell during dry months (November to May) and wet months (June to October)

Algal activity

In Torbay Inlet, algal densities are highest in winter and spring. This is a result of nutrients entering the inlet when the rivers flow strongly and deliver excess nutrients from agricultural land uses in the catchment.

In Lake Powell and North Creek Drain, the algal densities are typically highest during the summer. A high supply of nutrients all year round combined with warmer weather, plenty of sunlight, and mostly stagnant conditions in summer create ideal conditions for excessive algal growth.

North Creek Drain has the highest algal densities among the monitoring sites. During the summer months, the algae thrive in this often stagnant and confined water, with its high nutrient levels. The summer of 2021–22 had a lower than usual algal density in North Creek Drain, following the wet year of 2021. In summer 2023, the drain experienced the typical high algal density again.

Some algae can be potentially harmful because they can produce toxins that can harm or kill aquatic life such as fish. Some species can also affect human health, and can cause skin irritation or illness.

Lake Powell has a history of potentially harmful algal blooms. These tend to be more prevalent in summer months, whereas in the cooler months non-harmful species dominate the algal community. Recently there has been a shift in the types of potentially harmful species that are most dominant in the microalgal communities in Lake Powell. In the past, a cyanobacteria, *Nodularia*, usually contributed to the highest densities among the algal community in summer. These blooms are visually distinct, because *Nodularia* forms long filaments, often leading to a visible algal mat on the water's surface. However, the dominant cyanobacteria changed to *Anabaenopsis* and *Nodularia* in 2021–22 and *Dolichospermum* in 2022–23. These types of cyanobacteria are less visible to the naked eye because they form smaller colonies that float within the water column. It is too early to say if this shift will be long lasting.

The change in the dominant algal groups may be due to the very wet year of 2021, when Lake Powell was much fresher than it has been for a long time. Both cyanobacteria observed recently are more typical within a freshwater environment.

Summary

Water quality in the catchment, Torbay Inlet and Lake Powell remains poor because of the long-lasting legacy of past land management practices, including land clearing, fertiliser application for agriculture and modification of the catchment's drainage. This has led to the accumulation of nutrients in the sediment as well as the continuing nutrient inputs from catchment land uses, especially agriculture. Together these create an environment suitable for potentially harmful algal blooms.

Efforts in the catchment to reduce the nutrient loads entering the inlet, especially through fertiliser management on farms, remain essential to ensure the water quality in Torbay Inlet and its tributaries does not deteriorate further. Work to reduce nutrient inputs from land uses in the subcatchments of Marbelup Brook, Seven Mile Creek and Five Mile Creek is especially important, because these areas have a higher prevalence of soils that are poor at retaining phosphorus.



Learn more: estuaries.dwer.wa.gov.au/estuary/torbay-inlet/torbaycatchment.org.au/the-torbay-lake-system/

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