Gull Road Drain

This data report provides a summary of the nutrients at the Gull Road Drain sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the drain enters the Lower Serpentine River and, from there, discharges to the Peel Inlet.

About the catchment

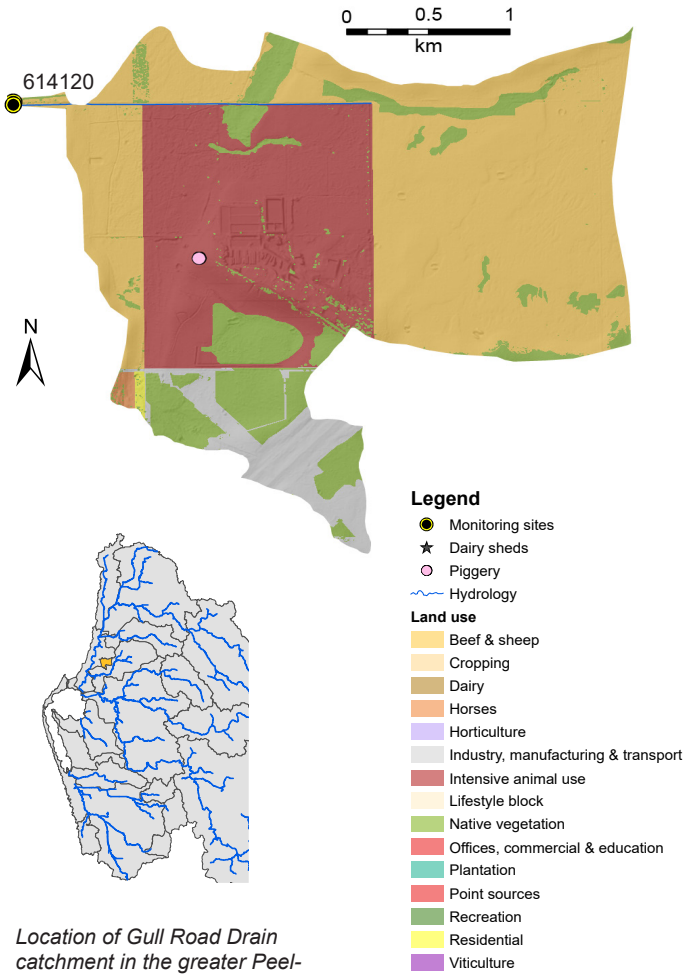
Gull Road Drain has a catchment area of about 8 km^2. Upstream and to the south of the sampling site is a piggery and composting facility. More than 80 per cent of the catchment has been cleared for agriculture, predominantly beef cattle grazing and intensive animal use.

Most of the catchment has soils with a low capacity to bind phosphorus. This is often so poor that any phosphorus applied to them can be quickly washed or leached into drains and other waterways.

Water quality is measured at site 614120, Gull Road, where Gull Road Drain passes under Gull Road in Keralup.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Gull Road Drain sampling site were classified as very high, with the median concentrations substantially higher than the other catchment sites. Nutrient loads were small because of the very small flow volumes at this site. The highly modified nature of the drainage system, including the number of drains constructed to reduce surface water ponding, along with the lack of fringing vegetation means nutrients can be washed from soils into waterways and transported downstream quickly rather than being assimilated.



Location of Gull Road Drain catchment in the greater Peel-Harvey catchment.

Facts and figures

Sampling site code	614120
Catchment area	8 km^2
Per cent cleared area (2015)	85 per cent
River flow	Ephemeral, dries over summer
Main land use (2015)	Beef cattle grazing and intensive animal use

Estimated loads and flow at Gull Road Drain

614120	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	0.9		0.3											0.3	0.1
TN load (t)	3.5		1.3											1.3	0.3
TP load (t)	1.28		0.41											0.42	0.10

Gull Road Drain

Nitrogen over time (2005–19)

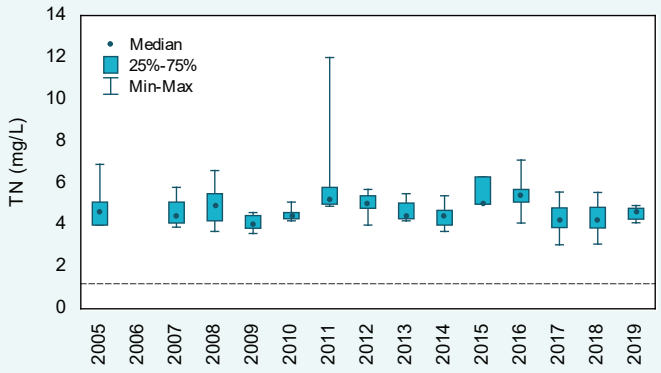
Concentrations

Annual total nitrogen (TN) concentrations were classified as very high using the State Wide River Water Quality Assessment (SWRWQA) methodology at the Gull Road Drain sampling site. Further, they were much higher than at the other 12 sites sampled in the Peel-Harvey catchment. Concentrations fluctuated over the reporting period but all samples collected were consistently much higher than the Bindjareb Djilba (Peel-Harvey estuary) Protection Plan water quality target for TN concentrations.

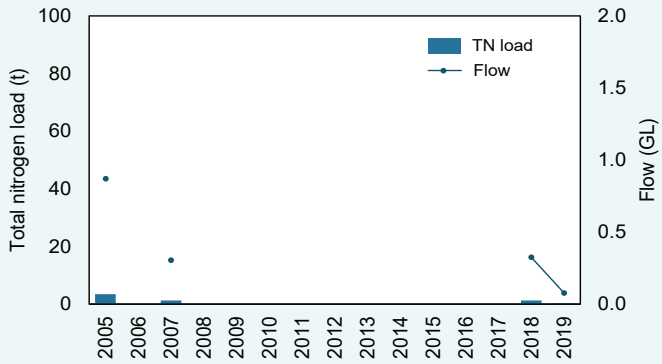
Estimated loads

Estimated TN loads at the Gull Road Drain sampling site were small compared with the other sites in the Peel-Harvey catchment. In 2019, Gull Road Drain had an estimated TN load of 0.3 t, the smallest of the 10 sites where it was possible to calculate loads. The 2019 load per square kilometre was also small at 42 kg/km^2. The reason for the small load at this site was the small flow volumes because TN concentrations were very high. Gull Road had by far the smallest annual flow in 2019, 0.1 GL (the next smallest annual flow was at Meredith Drain which had 1.4 GL). Only four years had sufficient flow data to be able to calculate loads. TN loads were closely related to flow volume; years with large annual flow volumes had large TN loads and vice versa.

Gull Road Drain



Total nitrogen concentrations, 2005–19 at site 614120. The dashed line is the protection plan TN target.



Total nitrogen loads and annual flow, 2005–19 at site 614120.

The weir at the Gull Road Drain sampling site, July 2018.

Gull Road Drain

Nitrogen (2019)

Types of nitrogen

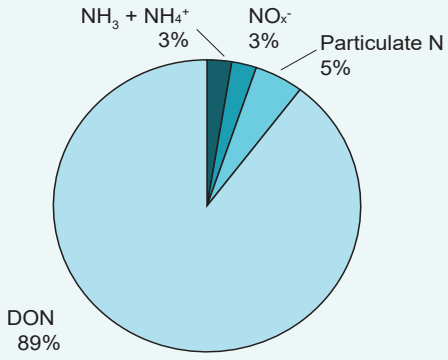
Total N is made up of different types of N. In Gull Road Drain, nearly 90 per cent of the N was present as dissolved organic N (DON). This type of N consists of degrading plant and animal matter as well as other types. DON varies in its bioavailability; plant and animal matter usually needs to be further broken down before becoming available whereas other types of DON are readily bioavailable. The proportion of N present as dissolved inorganic N (DIN – consisting of nitrate, NO_x^- and total ammonia, $NH_3 + NH_4^+$) was small. These types of N are readily bioavailable and are sourced from animal waste and fertilisers.

Concentrations

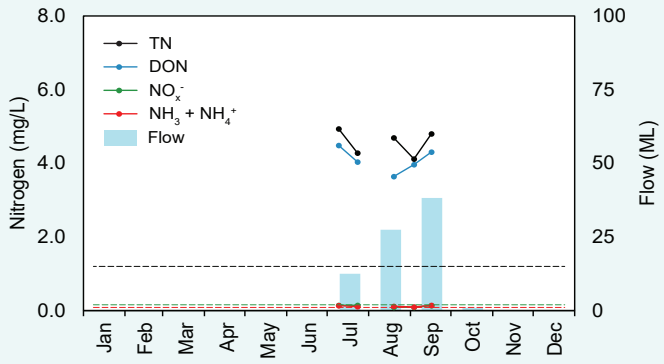
In 2019, there was no clear seasonal pattern in N concentrations at the Gull Road Drain sampling site. The lack of a distinct seasonal pattern suggests that most types of N were entering the drain via both surface and groundwater flows as well as from in-stream sources.

Where there are no data shown on the graph, the drain was not flowing. It is unusual for the drain to stop flowing in the middle of the year but 2019 was a very dry year.

Gull Road Drain



2019 average nitrogen fractions at site 614120.



2019 nitrogen concentrations and monthly flow at 614120. The black dashed line is the protection plan TN target, the red and green lines are the ANZECC trigger values for total ammonia and nitrate.

Algal growth in the upper part of Gull Road Drain. High nutrient concentrations contribute to excess algal growth such as this, November 2017.

Gull Road Drain

Phosphorus over time (2005–19)

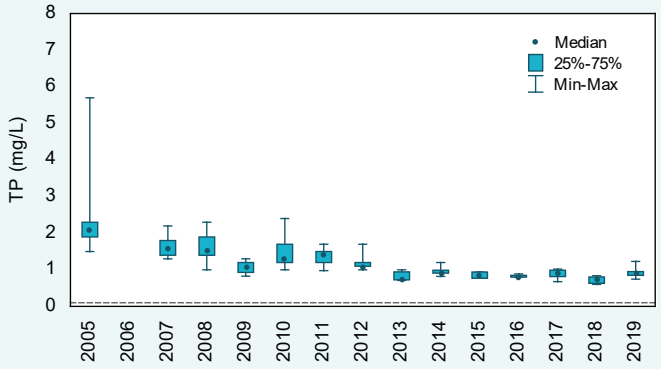
Concentrations

Total phosphorus (TP) concentrations have declined significantly over the reporting period at the Gull Road Drain sampling site. They are, however, still very high with all years classified as very high using the SWRWQA methodology. The Gull Road Drain site also had the highest median TP concentration of the 13 sites in the Peel-Harvey catchment. In 2019, the median TP concentration was 0.917 mg/L, much higher than the next highest median at Nambeelup Brook of 0.476 mg/L. All samples were well over the protection plan water quality target for TP concentrations.

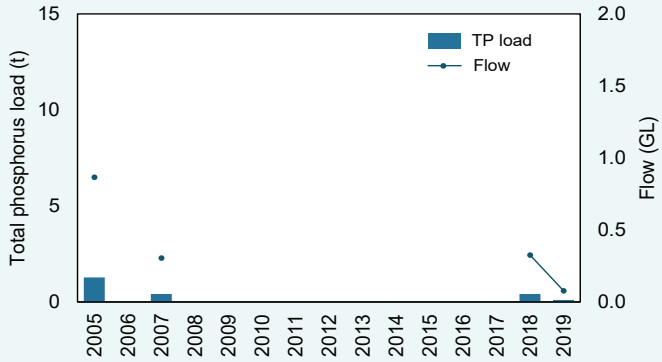
Estimated loads

Estimated TP loads at the Gull Road Drain sampling site were small compared with the other sites in the Peel-Harvey catchment. In 2019, the site had an estimated TP load of 0.10 t, the smallest TP load of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The load per square kilometre of 11.9 kg/km^2 was moderate. As with TN, the reason for the small TP loads is the small flow volumes as TP concentrations were very high. Only four years had sufficient flow data to be able to calculate loads. TP loads were closely related to flow volume; years with large annual flow volumes had large TP loads and vice versa.

Gull Road Drain



Total phosphorus concentrations, 2005–19 at site 614120. The dashed line is the protection plan TP target.



Total phosphorus loads and annual flow, 2005–19 at site 614120.

Installing treatment beds in Gull Road Drain that use a high phosphorus-adsorbing material to remove some of the phosphorus from the water, August 2017.

Phosphorus (2019)

Types of phosphorus

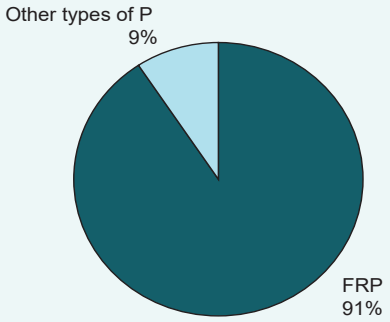
Total P is made up of different types of P. At Gull Road Drain, 91 per cent of the P was present as phosphate, the highest proportion of the 13 sites sampled in the Peel-Harvey catchment (Peel Main Drain had the next highest percentage of 61 per cent). Phosphate is measured as filterable reactive phosphorus (FRP) which in surface waters is mainly present as phosphate (PO_4^{3-}) species. Phosphate is readily bioavailable and was probably derived from animal waste and fertilisers with a small amount coming from natural sources. The remainder of the P was present as either particulate P or dissolved organic P (DOP) or both (shown as 'Other types of P' in the chart below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

Concentrations

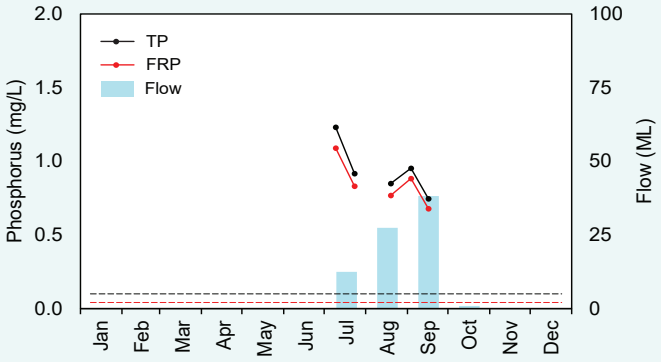
Both TP and phosphate concentrations were highest in June, when the drain first started to flow for the year. This peak may have been because of a first flush effect where heavy rainfall flushed P into the drain from surrounding land use as well as mobilising any that was left in the drain after it dried the previous summer. All samples were well over their trigger values (protection plan water quality target for TP and Australian and New Zealand Environment and Conservation Council [ANZECC] trigger value for phosphate).

Where there are no data shown on the graph, the drain was not flowing. It is unusual for the drain to stop flowing in the middle of the year but 2019 was a very dry year.

Gull Road Drain



2019 average phosphorus fractions at site 614120.



2019 phosphorus concentrations and monthly flow at 614120. The dashed black line is the protection plan TP target, the red is the ANZECC trigger value for phosphate.

A drain upstream of the Gull Road Drain sampling site. Note the waterlogging and surface runoff from the paddock in the background, August 2017.

Gull Road Drain

Dissolved organic carbon over time (2005–19)

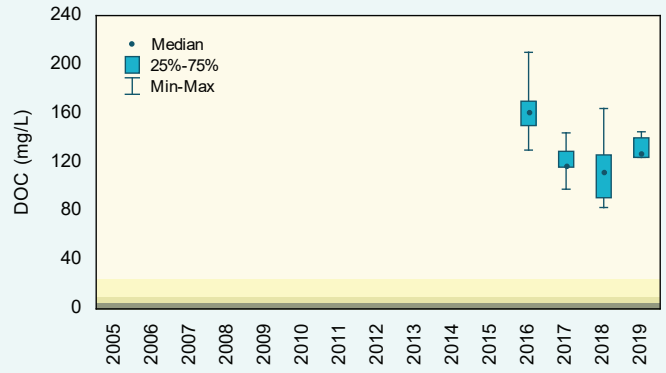
Concentrations

There were only four years with sufficient dissolved organic carbon (DOC) data to graph at the Gull Road Drain sampling site. All years were classified as having very high DOC concentrations using the SWRWQA methodology. Compared with the other sites in the Peel-Harvey catchment, DOC concentrations were very high with Gull Road Drain having the largest median in 2019 (127 mg/L, the Nambeelup Brook site had the next largest median of 61 mg/L). The annual range in concentrations was also generally large.

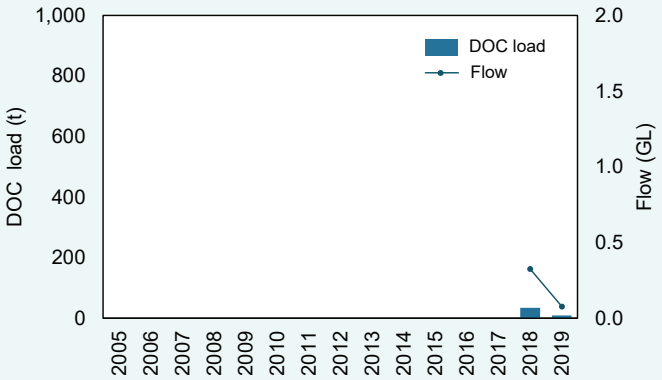
Estimated loads

Estimated DOC loads at the Gull Road Drain sampling site were very small compared with the other sites in the Peel-Harvey catchment. In 2019, the estimated DOC load was 9 t, much smaller than the other 10 sites in the Peel-Harvey catchment where it was possible to calculate loads (the next smallest load of 51 t was recorded at Coolup South Main Drain). The load per square kilometre of 1,133 kg/km^2 was moderate to large compared with the other Peel-Harvey sites. As for TN and TP, the reason for the small DOC loads was the small flow volume; DOC concentrations were very high. DOC loads were closely related to flow volume; years with large annual flow volumes had large DOC loads and vice versa.

Gull Road Drain



Dissolved organic carbon concentrations, 2005–19 at site 614120. The shading refers to the SWRWQA classification bands.



Dissolved organic carbon loads and annual flow, 2005–19 at site 614120.

low moderate high very high

The Lower Serpentine River at one of the river health assessment sampling sites. Gull Road Drain discharges into the Lower Serpentine River downstream of this location, December 2017.

Gull Road Drain

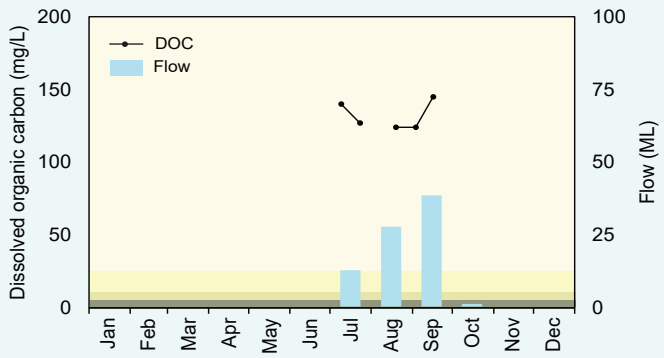
Dissolved organic carbon (2019)

Concentrations

In 2019, all DOC samples collected fell into the very high band of the SWRWQA. Most of the DOC at this site was entering the drain via groundwater. DOC is sourced mainly from degrading plant and animal matter, including from agricultural land and natural organic matter in soils and wetlands. It varies widely in its bioavailability.

Where there are no data shown on the graph, the drain was not flowing. It is unusual for the drain to stop flowing in the middle of the year but 2019 was a very dry year.

Gull Road Drain



2019 Dissolved organic carbon concentrations and monthly flow at 614120. The shading refers to the SWRWQA classification bands.

low moderate high very high

A drain running through a paddock in the Gull Road Drain catchment. This kind of drain will rapidly transport water, April 2002.

Gull Road Drain

Total suspended solids over time (2005–19)

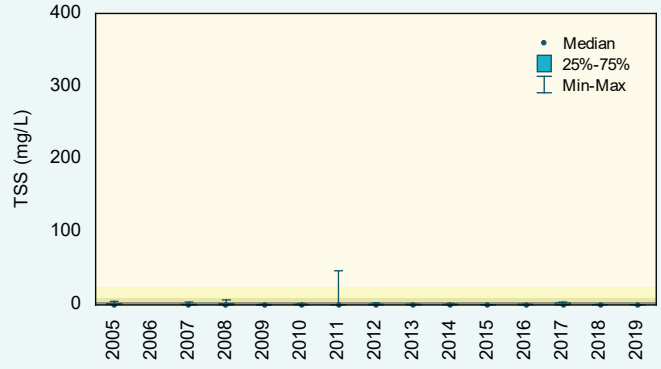
Concentrations

Total suspended solids (TSS) concentrations at the Gull Road Drain sampling site were low, with all years classified as low using the SWRWQA methodology. In 2019, the site also had the lowest median TSS concentration of the 13 sites sampled in the Peel-Harvey catchment, with all samples below the laboratory limit of reporting (LOR) of 1 mg/L.

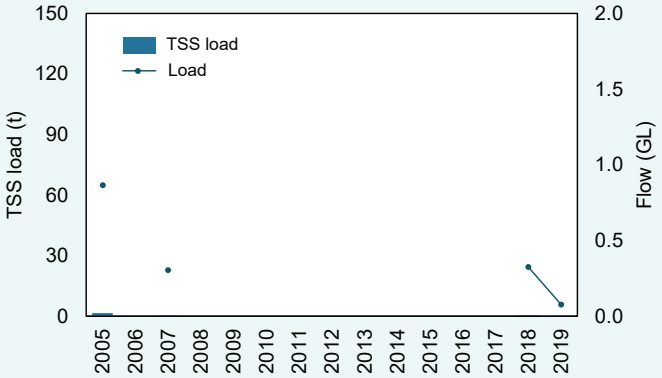
Estimated loads

Estimated TSS loads at the Gull Road Drain sampling site were very small compared with the other sites in the Peel-Harvey catchment. In 2019, the estimated TSS load at this site was 0.1 t, the smallest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The load per square kilometre of 8 kg/km^2 was also small compared with the other Peel-Harvey catchment sites and much smaller than Mayfield Drain, which had the next smallest load per square kilometre of 68 kg/km^2. TSS loads were closely related to flow volume; years with large annual flow volumes had large TSS loads and vice versa.

Gull Road Drain



Total suspended solids concentrations, 2005–19 at site 614120. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 614120.

low moderate high very high

A drain in the Gull Road Drain catchment with revegetation along its left bank. The drain itself is choked with exotic grasses which thrive in high nutrient conditions, September 2004.

Gull Road Drain

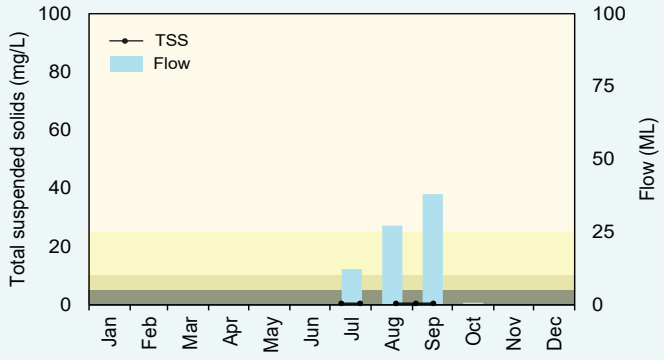
Total suspended solids (2019)

Concentrations

In 2019 TSS concentrations were consistently very low at the Gull Road Drain sampling site. All samples collected were below the LOR for TSS (1 mg/L).

Where there are no data shown on the graph, the drain was not flowing. It is unusual for the drain to stop flowing in the middle of the year but 2019 was a very dry year.

Gull Road Drain



2019 total suspended solids concentrations and monthly flow at 614120. The shading refers to the SWRWQA classification bands.

low moderate high very high

A drain in the Gull Road Drain catchment. Note the sandy banks which will easily erode if stock walk along it or water levels are high, April 2002.

Gull Road Drain

pH over time (2005–19)

pH values

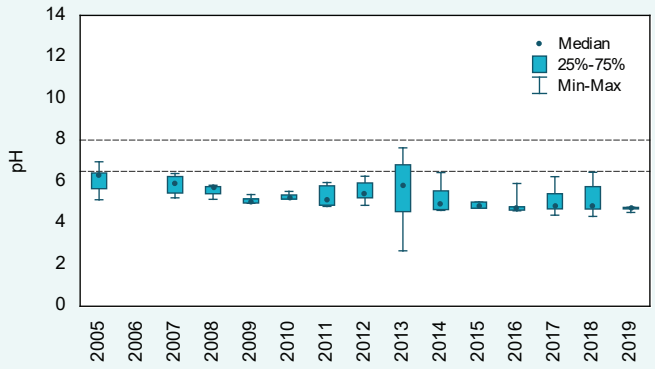
In Gull Road Drain, the pH was low, with most samples collected below the lower ANZECC trigger value. pH reduced over the reporting period, being higher at the start of the period. In 2019, the median pH (4.7) was lower in Gull Road Drain than the other 12 sampling sites in the Peel-Harvey catchment. The catchment with the next lowest median was Nambeelup Brook (6.7).

pH (2019)

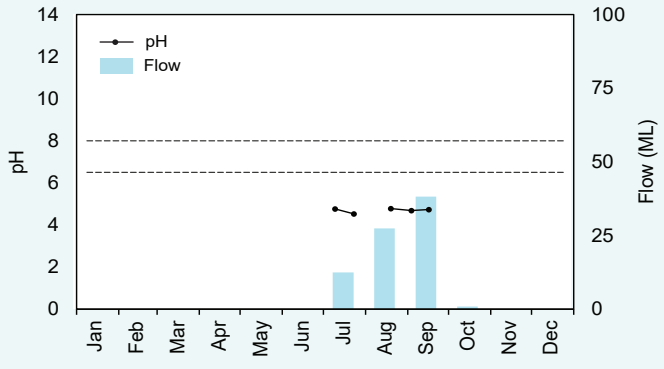
pH values

In 2019, pH was fairly steady through the year, with all samples well below the lower ANZECC trigger value. It is unclear why the pH at this site is so low, much lower than the other sites in the Peel-Harvey catchment.

Gull Road Drain



pH levels, 2005–19 at site 614120. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 614120. The dashed lines are the upper and lower ANZECC trigger values.

Looking downstream at the weir at the Gull Road Drain sampling site when it is dry, March 2019.

Gull Road Drain

Salinity over time (2005–19)

Concentrations

Salinity fluctuated over the reporting period at the Gull Road Drain sampling site. All years were classified as fresh using the Water Resources Inventory 2014 salinity ranges (note, the 2018 report used the SWRWQA bands).

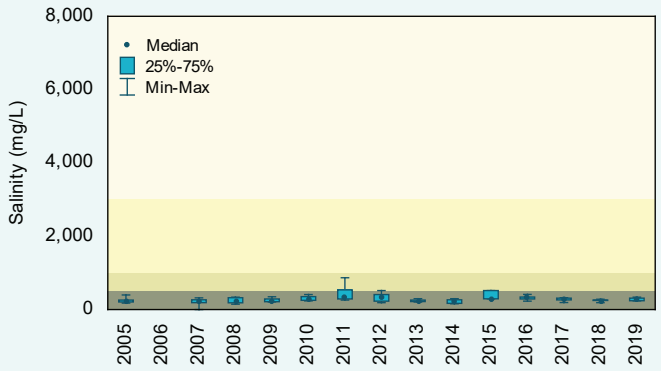
Salinity (2019)

Concentrations

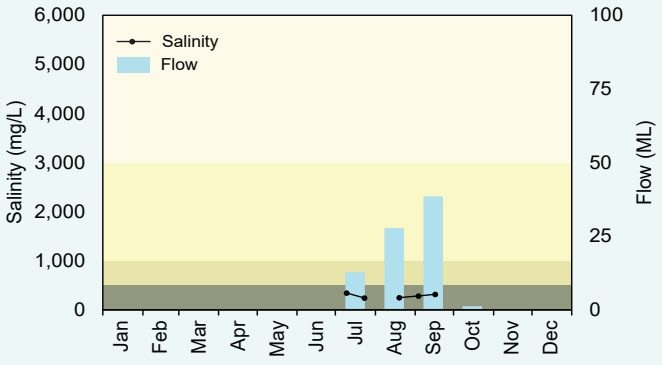
Salinity at Gull Road Drain in 2019 was consistently low and there was no evidence of a seasonal pattern, with very little variation in salinity during the year.

Where there are no data shown on the graph, the drain was not flowing. It is unusual for the drain to stop flowing in the middle of the year but 2019 was a very dry year.

Gull Road Drain



Salinity concentrations, 2005–19 at site 614120. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations and monthly flow at 614120. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

Beef cattle grazing is one of the main land uses in the Gull Road Drain catchment, May 2018.

Gull Road Drain

Background

Healthy Estuaries WA is a State Government program launched in 2020 and builds on the work of the Regional Estuaries Initiative. Collecting and reporting water quality data, such as in this report, helps build understanding of the whole system. By understanding the whole system, we can direct investment towards the most effective actions in the catchments to protect and restore the health of our waterways.

Nutrients (nitrogen and phosphorus) are compounds that are important for plants to grow. Excess nutrients entering waterways from effluent, fertilisers and other sources can fuel algal growth, decrease oxygen levels in the water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as these help us better understand the processes occurring in the catchment.

You can find information on the condition of Peel-Harvey estuary at estuaries.dwer.wa.gov.au/estuary/peel-harvey-estuary/

Healthy Estuaries WA partners with the Peel-Harvey Catchment Council to fund best-practice management of fertiliser, dairy effluent and watercourses on farms.

- To find out how you can be involved visit estuaries.dwer.wa.gov.au/participate
- To find out more about the Peel-Harvey Catchment Council go to peel-harvey.org.au
- To find out more about the health of the rivers in the Peel-Harvey Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Variables were compared with the Bindjareb Djilba (Peel-Harvey estuary) Protection Plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 2014 Water Resources Inventory ranges. They were classified using the SWRWQA methodology. Standard statistical tests were used to calculate trends and loads. For further information on the methods visit estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

Glossary

Bioavailable: bioavailable nutrients refers to those nutrients which plants and algae can take up from the water and use straight away for growth.

Concentration: the amount of a substance present per volume of water.

Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

First flush: material washed into a waterway by the first rainfall after an extended dry period. The first flush is often associated with high concentrations of nutrients and particulate matter.

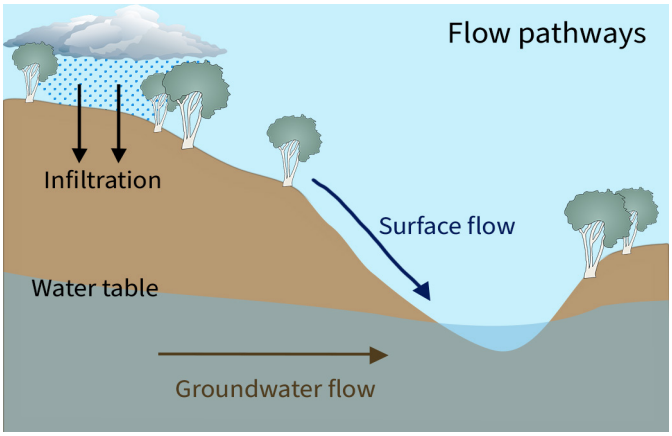
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

Load: the total mass of a substance passing a certain point.

Load per square kilometre: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

Nitrate: The measurement for the nutrient nitrate actually measures both nitrate (NO_3^-) and nitrite (NO_2^-), which is reported as NO_x^-. We still refer to this as nitrate as in most surface waters nitrite is present in very low concentrations.

The schematic below shows the main flow pathways which may contribute nutrients, particulates and salts to the waterways. Connection between surface water and groundwater depends on the location in the catchment, geology and the time of year.



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