

Yule Brook

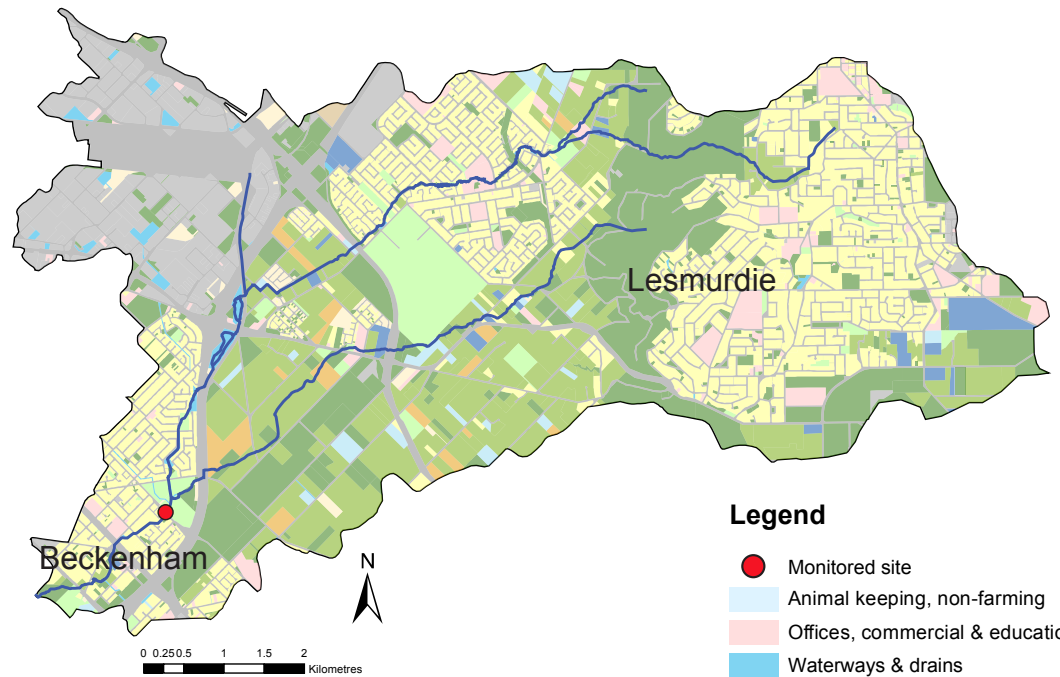
Yule Brook is a natural watercourse at its headwaters but turns into a network of deeply incised drains in its lower reaches that combine to form the Yule Brook Main Drain. Woodlupine Brook is a major tributary of Yule Brook. The drain discharges into the Canning River upstream of Kent Street Weir, opposite Hester Park in Beckenham.

Most of the Yule Brook catchment is highly modified. It has a diversity of urban uses such as light to medium industry and high-density residential developments, as well as agricultural uses such as horticulture and poultry. The hills suburb of Lesmurdie is located in the upper catchment.

The steep section in the middle catchment on the Darling Scarp retains areas of heath vegetation, with pockets of wandoo, marri and jarrah forest, and includes Lesmurdie Falls National Park. Apart from this small area, little remnant vegetation remains in the catchment.

The soils in the lower Yule Brook catchment are a combination of permeable Southern River sands and Guildford yellow, duplex soils. The upper catchment to the east consists of the sandy gravels, shallow red and yellow earths and rocky outcrops common on the Darling Scarp. In low-lying areas, the drains of the Yule Brook catchment intercept the groundwater.

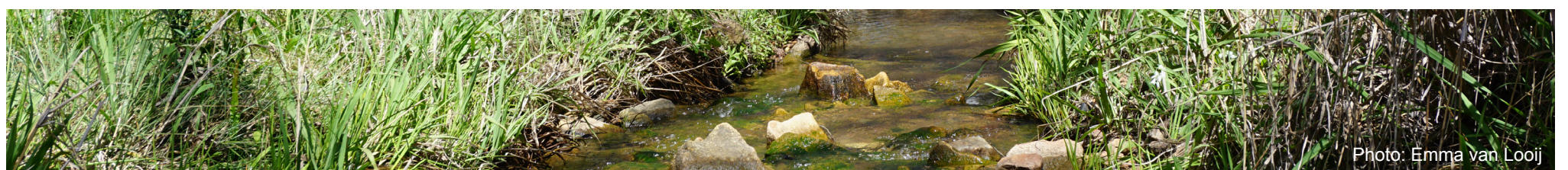
Water quality is monitored fortnightly at a site near Mills Park, at the lower end of the catchment. This site is positioned to indicate the nutrients leaving the catchment and flowing into the Canning River, so the data do not accurately represent nutrient concentrations in upstream areas. The Water Corporation also operates a flow gauging station at this site.



Algal growth on bedrock in Whistlepipe Gully, October 2016.

Yule Brook – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	55 km ²
Per cent cleared area (2005)	78%
River flow	Ephemeral No major water supply dams in catchment
Average annual flow	No flow data available
Main land uses (2005)	Residential, conservation and natural, lifestyle blocks/hobby farms and transport (roads)



Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616042	3.8	7.9	10.4	8.9	3.4	9.3					
TN median (mg/L)	SWS3	0.88	1.05 [#]	0.90	0.83	0.76	0.99	0.66	1.10 [#]	1.00	0.94	1.10 [#]
TP median (mg/L)	SWS3	0.155 [#]	0.115 [#]	0.070	0.100	0.093	0.087	0.072	0.096	0.094	0.120 [#]	0.099
TN load (t/yr)	SWS3	3.68	8.40	11.31	9.57	3.39	10.07					
TP load (t/yr)	SWS3	0.33	0.67	0.94	0.76	0.29	0.81					

TN short term target = 2.0 mg/L

TN long term target = 1.0 mg/L

TP short term target = 0.2 mg/L

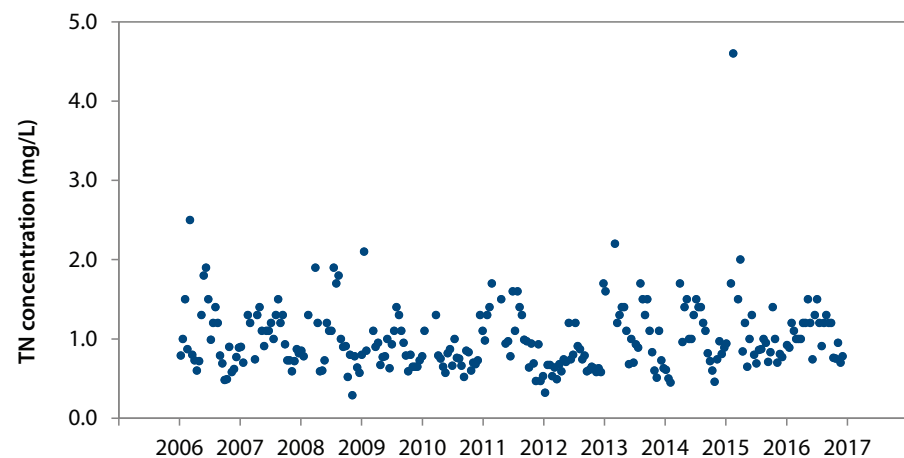
TP long term target = 0.1 mg/L

insufficient data to test target
 failing both short and long-term target
 passing short but failing long-term target
 passing both short and long-term target

* Best estimate using available data. # Statistical tests that account for the number of samples and large data variability are used for testing against targets on three years of winter data. Thus the annual median value can be above the target even when the site passes the target (or below the target when the site fails).

Changes in nutrient concentrations over time in Yule Brook

Total nitrogen concentrations over the 2006 to 2016 monitoring period



Trend

Total nitrogen (TN) concentrations appear to fluctuate over the monitoring period. There was a short-term emerging increasing trend of 0.06 mg/L/yr (2012–16). The reason for the high TN concentration in 2015 is unclear though it was collected in February, during a short time period when the brook was flowing in Summer.

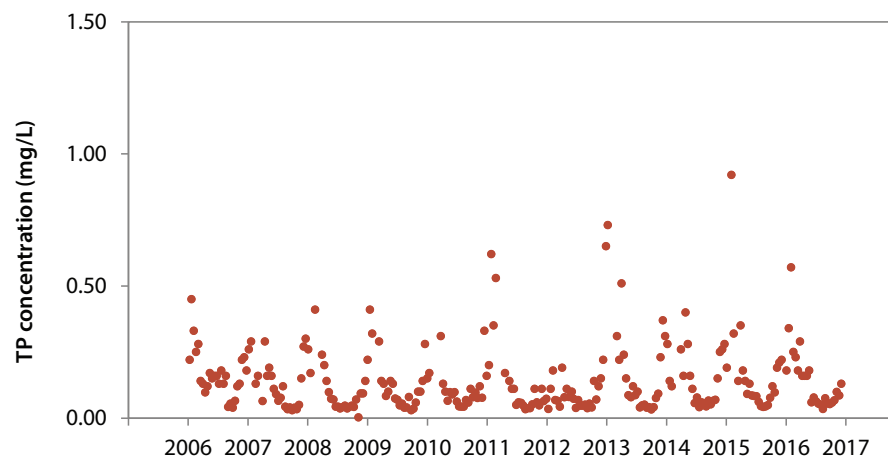
Target

Yule Brook has been passing the short- and long-term TN targets for the reporting period.



Yule Brook in Beckenham, the brook has been converted to a drain here, November 2012.

Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

While total phosphorus (TP) concentrations appeared stable over the reporting period, trend analysis detected a small emerging increasing trend of 0.003 mg/L/yr over the 2007–16 period.

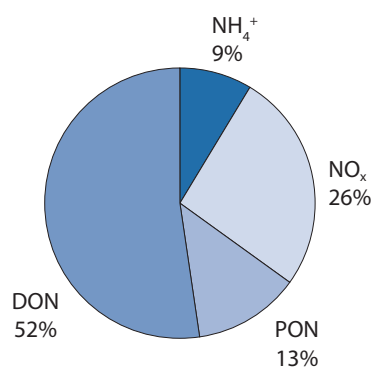
Target

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Nutrient fractions and estimated loads in Yule Brook

Average composition of nitrogen (N) in Yule Brook over the 2012 to 2016 monitoring period



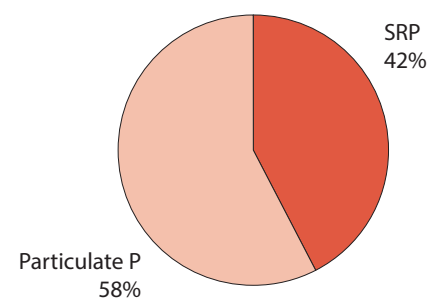
Nitrogen

Organic nitrogen (N) made up approximately two-thirds of the N present in Yule Brook. This type of N is made up of both dissolved (DON) and particulate (PON) fractions. DON largely comprises organic compounds leached from peaty subsoils and degrading plant and animal matter. It is available for uptake by plants, algae and bacteria. PON is composed of

plant and animal debris which needs to be further broken down to become available to plants and algae. Dissolved inorganic N (DIN, consisting of ammonium – NH_4^+ and N oxides – NO_x) made up the remainder of the N present in Yule Brook. This form of N is readily available for plant and algal uptake. It is likely to have come from fertilisers used on home gardens and agriculture, industry discharge, animal waste and septic tank leachate.

As Yule Brook did not have flow (and therefore load) information available for the last five years (2012–16) it was not possible to compare its loads with the other subcatchments.

Average composition of phosphorus (P) in Yule Brook over the 2012 to 2016 monitoring period



Phosphorus

Particulate phosphorus (P) made up over half of the P present in Yule Brook. This form of P is commonly associated with soil erosion, suspended sediments, or algae and bacteria in the water. It is not readily absorbed by plants and algae, though some may become available as particles break down, or bound phosphate is released. Soluble reactive phosphorus (SRP) is readily available for plant and algal growth and made up the remainder of the P present. It is probably derived from fertilisers, animal waste, septic tank leachate and industrial discharge.

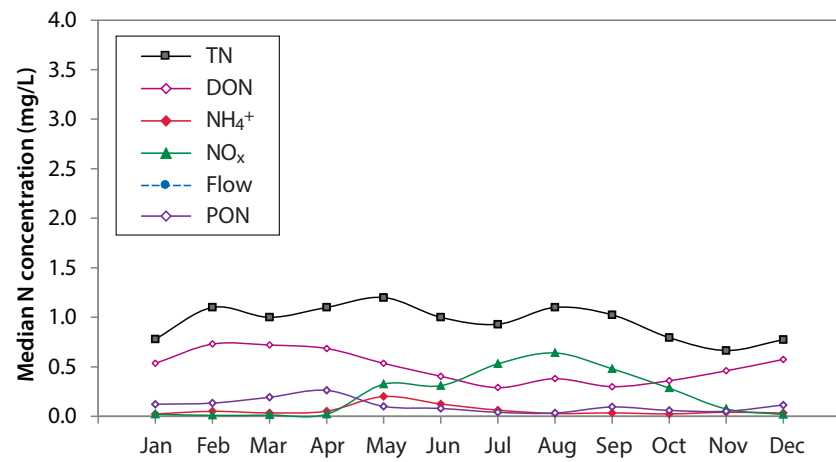
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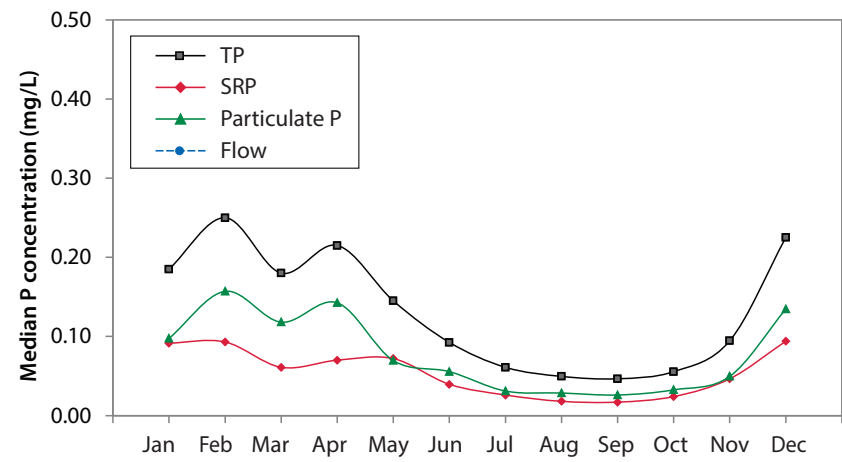


Seasonal variation in nutrient concentrations in Yule Brook

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

There was a seasonal pattern evident in NO_x concentrations. The maximum concentrations occurred in winter, coinciding with winter rains and increased flow. The brook's catchment has areas of duplex soils with sands or loams above relatively impermeable subsurface horizons. Consequently, only relatively small amounts of rainfall may be needed to saturate the perched aquifer and induce subsurface run-

off containing N. Such subsurface run-off may be the dominant pathway for NO_x entering Yule Brook in winter. The NH₄⁺ concentrations were not seasonal, remaining relatively constant throughout the year. DON appears to be entering the brook via groundwater, shown by decreasing concentrations over winter when flow is at its highest.

Phosphorus

P concentrations were seasonal, with concentrations highest in summer and lowest in winter. This suggests that SRP is predominantly entering the brook via groundwater which is being diluted in winter when flows are at their highest. Particulate P is likely to be sourced predominantly from instream sources such as algae, especially in summer when algal growth is favoured in the brook.



Photographs of Yule Brook: (Top left) The Yule Brook sampling site with high flow following heavy winter rains, August 2017. (Bottom left) Lesmurdie Falls, September 2016. (Right) Whistlepipe Gully, October 2016.

Local nutrient reduction strategies for Yule Brook

Nutrient reduction strategies being undertaken or recently completed in the Yule Brook catchment include but are not limited to:

- Riverwise Sustainable Gardening Workshops Autumn series held in 2017.
- The Yule Brook Revegetation Project which involved the revegetation of designated areas of Yule Brook and established effective partnerships that will contribute to achieving long-term improvements in river health. It also provided technical advice to local government and community groups implementing the restoration works.
- Beckenham Open Space was once agricultural land and productive orchards. Since the South East Regional Centre for Urban Landcare (SERCUL) gained residence in 2003 it has been restoring the catchment and wetland systems surrounding its offices located in Beckenham.
- The Woodlupine Living Stream Project which involves the Department of Biodiversity, Conservation and Attractions (DBCA), Shire of Kalamunda, SERCUL, Two Rivers Catchment Group and other community groups, is planning to deliver water quality and community capacity building outcomes.
- Ongoing sub-regional partnership projects whereby SERCUL is working together with DBCA, local governments and community groups to deliver water quality and community capacity building outcomes.

- The Phosphorus Awareness Project which aims to assist the community in reducing their nutrient outputs through education, promotion and behaviour change programs.
- The DBCA's Healthy Catchments Program aims to protect the environmental health and community benefit of the Swan Canning river system by improving water quality in the catchments. This is achieved through engaging partners and focusing the effort of local governments, sub-regional groups, the community and other organisations in water quality improvement activities.

Swan Canning water quality improvement plan

The Swan Canning water quality improvement plan (SCWQIP) complements the River Protection Strategy (RPS) and presents a roadmap for reducing nutrient inputs into the river systems. It uses sophisticated modelling to identify nutrient sources and provides nutrient-reduction targets for each of the subcatchments.

SCWQIP load and concentration targets for Yule Brook

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	5.6	0.75	25%
TP	0.43	0.075	0%

For further information on the RPS and the SCWQIP contact rivers.info@dbca.wa.gov.au



Photo: Water Science Branch



Photo: Water Science Branch

Summary: Yule Brook

- Yule Brook is currently passing both the short- and long-term TN and TP targets.
- There was an emerging increasing long-term trend in TP concentrations and an emerging increasing short-term trend in TN concentrations
- Overall, a 25% reduction in TN is required for this catchment to meet its SCWQIP targets.