Susannah Brook

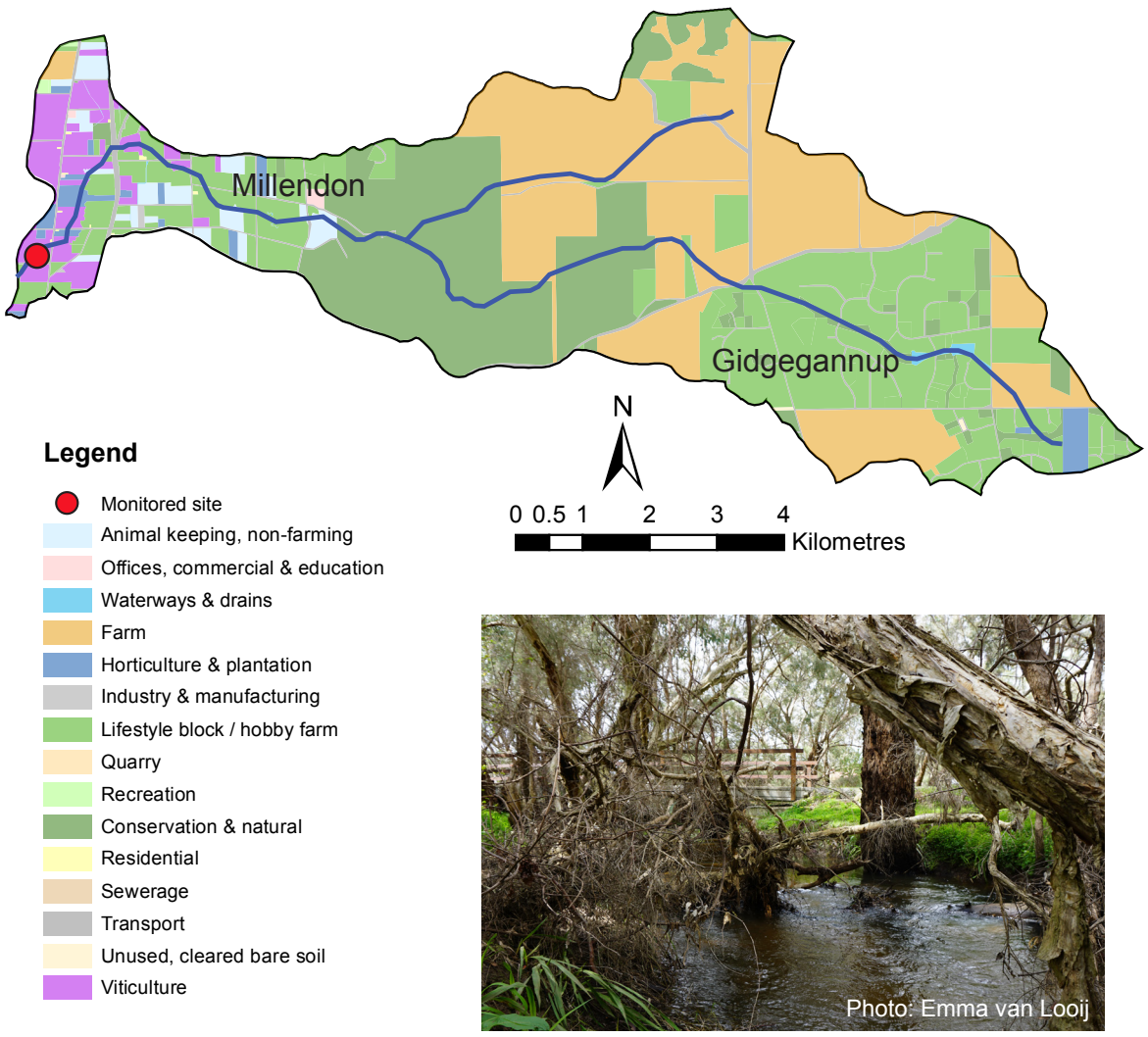
Susannah Brook is an ephemeral stream that drains the Darling Scarp, it has several small dams in its upper reaches but is otherwise relatively unmodified. The brook flows into the Swan River just west of the Swan Valley Sports Ground in Herne Hill.

Agriculture is the dominant land use in the Susannah Brook catchment. The brook's lower reaches are flanked by horticulture such as orchards and vineyards, while the upper catchment is dominated by pasture. There is an area of remnant vegetation (approximately 20% of the catchment) situated near the middle catchment, but it is mostly in poor condition. The upper catchment has been extensively cleared and very little natural vegetation remains on the lower, coastal plain, section of the catchment.

Soils in the catchment range from lateritic and ironstone gravels in the upper reaches to the east, through to shallow red and yellow earths and rock outcrops on the slopes of the Darling Scarp, to gravelly and sandy Forrestfield and Guildford soils on the western plains. A small area of more fertile alluvial soils is located close to the Swan River and is used for intensive horticulture and orchards.

Surface flow is the dominant transport pathway of nutrients, with groundwater tending to make a relatively minor contribution to flow in Susannah Brook.

Water quality is monitored fortnightly at the Department of Water and Environmental Regulation gauging station near the catchment's lower end, shortly before the brook flows into the Swan River in Herne Hill. This site is positioned to indicate the nutrients leaving the catchment and entering the Swan River, so the data do not accurately represent nutrient concentrations in upstream areas.



Susannah Brook in Millendon, September 2017.

Susannah Brook – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	55 km^2
Per cent cleared area (2005)	66%
River flow	Ephemeral (June to November) No major water supply dams in catchment
Average annual flow	~ 3.2 GL per year (2012–16 average)
Main land uses (2005)	Farms, lifestyle blocks/hobby farms and conservation and natural

Downstream of Susannah Brook sampling site, November 2005

Susannah Brook in Millendon, September 2017.

Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616099	3.0	7.2*	4.0*	5.5*	0.4	3.4*	3.2*	4.9	4.0*	0.7*	3.1*
TN median (mg/L)	SWN11	0.85	0.55	0.50	0.76	0.73	1.50#	1.03#	0.74	0.64	0.44	0.58
TP median (mg/L)	SWN11	0.013	0.012	0.016	0.020	0.012	0.022	0.014	0.015	0.012	0.012	0.015
TN load (t/yr)	SWN11	2.95	7.55*	4.05*	5.50*	0.25	3.43*	2.93*	4.93	3.46*	0.46*	2.43*
TP load (t/yr)	SWN11	0.07	0.20*	0.11*	0.15*	0.01	0.07*	0.06*	0.13	0.07*	0.01*	0.05*

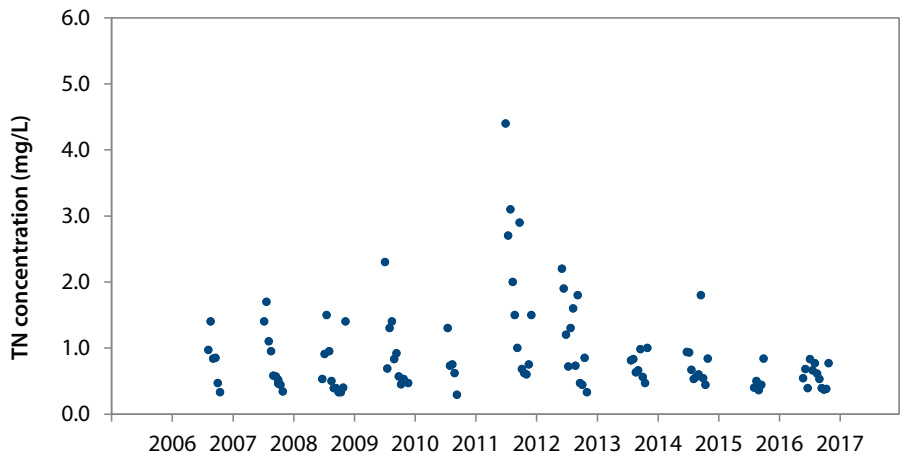
TN short term target = 2.0 mg/L TN long term target = 1.0 mg/L TP short term target = 0.2 mg/L TP long term target = 0.1 mg/L

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

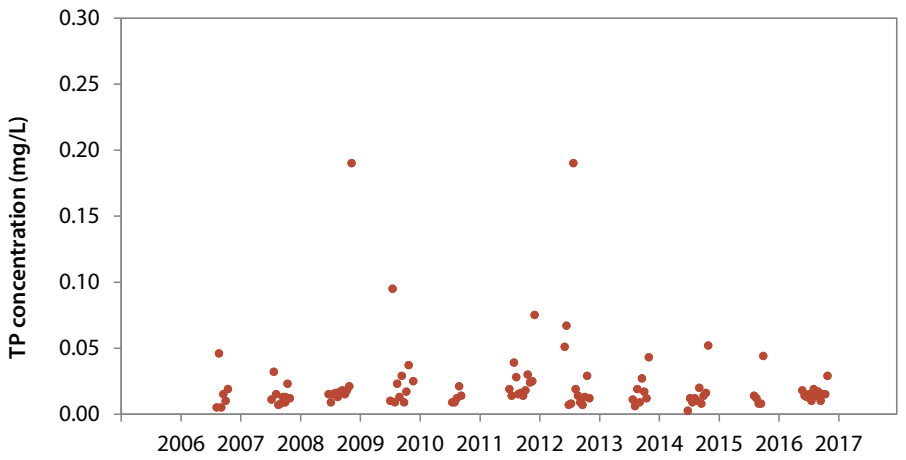
* Best estimate using available data. # Statistical tests that account for the number of samples and large data variability are used for testing against targets on three years of winter data. Thus the annual median value can be above the target even when the site passes the target (or below the target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

Changes in nutrient concentrations over time in Susannah Brook

Total nitrogen concentrations over the 2006 to 2016 monitoring period



Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

From the plot above, it appears that total nitrogen (TN) concentrations have decreased since 2011. This was verified by statistical testing with an emerging decreasing trend of 0.10 mg/L/yr being detected over the 2012–16 period. The increase in the number of samples with high concentrations in 2011 may have been caused by a point source of pollution in the catchment.

Target

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

Susannah Brook, flowing strongly under the River Road bridge, September 2012.
Photo: Water Science Branch

Trend

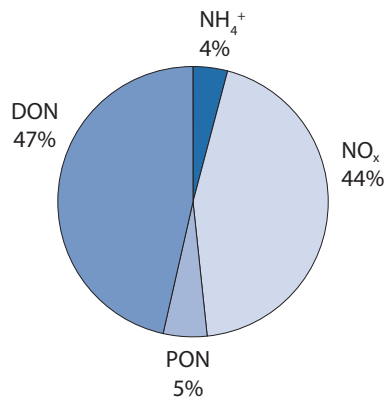
From the plot above, total phosphorus (TP) concentrations appear relatively stable over the reporting period. As for TN, the concentrations in 2011 appear higher than surrounding years though there is also an unusually high data point in 2008. This was taken shortly before the brook stopped flowing so it is possible that this was collected from a barely moving (or stationary) pool. There were no trends detected in TP concentrations.

Target

Susannah Brook has been passing the short- and long-term TP targets for the reporting period.

Nutrient fractions and estimated loads in Susannah Brook

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

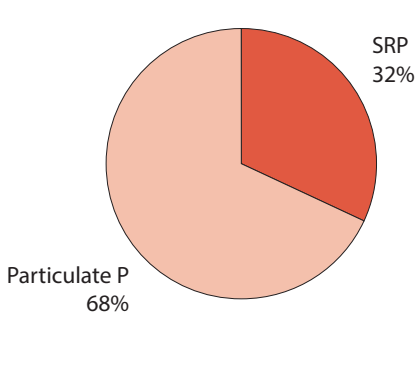


Nitrogen

Dissolved inorganic nitrogen (DIN, consisting of ammonium – NH_4^+ and N oxides – NO_x) made up almost half of the nitrogen (N) in the brook. Likely sources of DIN include fertilisers, septic tank leachate and animal waste. This form of N is readily available for uptake by plants and algae. The remainder was present as organic N which consists of both dissolved (DON) and particulate (PON) fractions. DON largely comprises organic compounds leached from peaty subsoils and degrading plant and animal matter and is available for uptake by plants, algae and bacteria. PON is composed of plant and animal debris and needs to be further broken down to become available to plants and algae.

Susannah Brook had the third-smallest average TN load (2012–16) and the fifth-largest load per unit area (0.05 t/km^2/yr) of the nine subcatchments with flow data.

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



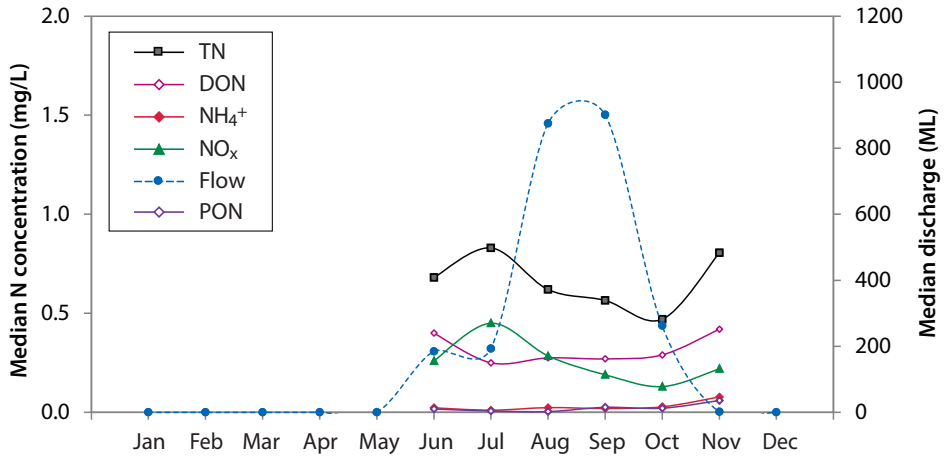
Phosphorus

Just over two-thirds of the phosphorus (P) in Susannah Brook was particulate P, which is commonly associated with soil eroded from agricultural areas and suspended sediments in the water. Plants and algae cannot take up particulate P, though some may become available as particles decompose and bound phosphate is released. The remaining P was present as soluble reactive phosphorus (SRP) which is readily available for plant and algal uptake. Animal waste and fertilisers are common sources of SRP in rural catchments.

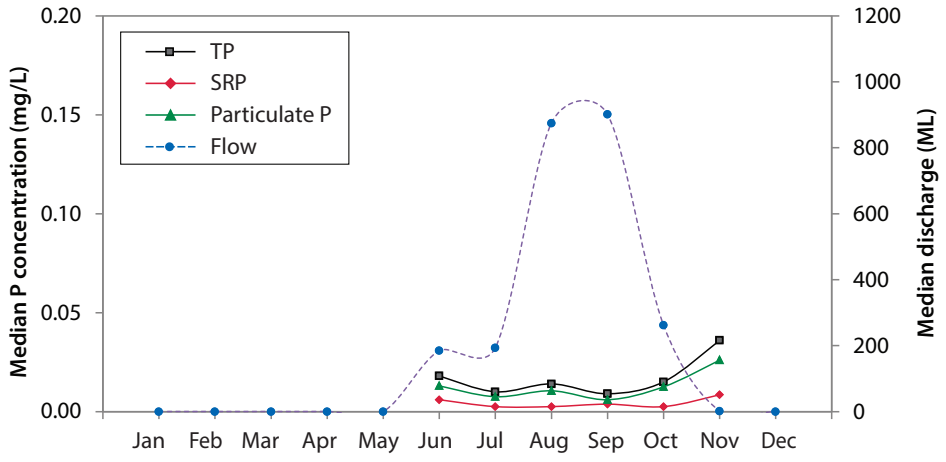
Susannah Brook had the smallest average TP load (2012–16) and the third-smallest load per unit area (0.001 t/km^2/yr) of the nine subcatchments with flow data.

Seasonal variation in nutrient concentrations in Susannah Brook

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

A seasonal pattern in NO_x is evident. The peak concentrations of TN and NO_x occured at the start of winter and are probably due to nutrient-rich surface runoff from the first rainfalls of the season. NH_4^+ concentrations remained relatively constant throughout the monitoring period. All forms of N increased from October through to November. Susannah Brook is often dry in November, so there were less data points available to calculate the median.

Melaleucas lining Susannah Brook in Millendon, September 2017. Photo: Emma van Looij

Phosphorus

Phosphorus concentrations in Susannah Brook were constant throughout the year. The increase at the end of the year coincided with the water levels falling, shortly before the brook ceases to flow. This increase in concentrations is probably due to localised groundwater contributing a relatively large portion of the flow as well as instream sources of particulate P.

Photo: Water Science Branch

Photo: Emma van Looij

Photo: Dominic Heald

Photographs of Susannah Brook: (Top left) Susannah Brook flowing through farmland, note the almost complete absence of riparian vegetation, February 2002. (Bottom left) Watsonia growing along Susannah Brook in Millendon, September 2017. (Right) Susannah Brook sampling site, August 2017.

Local nutrient reduction strategies for Susannah Brook

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

- Eastern Region Catchment Management Program which is a partnership project whereby the Eastern Metropolitan Regional Council is working together with the Department of Biodiversity, Conservation and Attractions (DBCA), local governments and community groups to deliver water quality and community capacity-building outcomes.
- The *Eastern Catchment management plan 2012-2022* was developed to address catchment management including water quality in a coordinated approach.
- Susannah Brook Catchment Group was very active between 2002 and 2012, revegetating areas from the brook's headwaters at Blue Wren Reserve to the eastern and western public open space areas off Strawberry Hill Drive. The Friends of Blue Wren Reserve have also undertaken recent planting in the Blue Wren Reserve.
- Revegetation of the fire-affected areas of Red Hill Nature Reserve which aimed to reduce the erosion and sedimentation risks following the February 2011 fire.
- 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.

Erosion of banks along Susannah Brook, September 2017. Photo: Emma van Looij

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 Swan Canning river system. It uses sophisticated modelling to identify nutrient sources and provides nutrient-reduction targets for each of the subcatchments.

SCWQIP load and concentration targets for Susannah Brook

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	4.8	0.75	0%
TP	0.65	0.075	0%

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

Summary: Susannah Brook

- Susannah Brook is currently passing both the short- and long-term TN and TP targets.
- Of the nine catchments with flow data, Susannah Brook has the third-smallest average TN load and the smallest average TP load.
- An emerging decreasing short-term TN trend was detected.
- Of the 33 sites sampled, it has the fifth-lowest median TN concentration and the second-lowest median TP concentration.
- Of the 33 sites sampled, the proportion of P present as bioavailable SRP is one of the lowest however the proportion of N present as bioavailable DIN is one of the highest.
- Nutrient concentrations are currently acceptable and no reduction is required for Susannah Brook to meet its SCWQIP targets.

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For further information please contact the
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