Bennett Brook

Bennett Brook was once a natural creek system but its tributaries to the west have been modified to become deeply incised drains. It discharges into the Swan Estuary upstream of Success Hill in Bassendean.

The Gnangara pine plantation and Whiteman Park cover just over half the catchment. Some native vegetation remains in Whiteman Park but it is very degraded. The remainder of the catchment has been cleared for residential, rural and industrial uses.

Soils in the Bennett Brook catchment consist of leached Bassendean sands in the northern section, Southern River sands in the central portion and a small band of Karrakatta sands on the western edge. Increased groundwater pumping in the catchment's north for metropolitan water supply has lowered groundwater levels and reduced flow into the brook. Conversely, the catchment's south has higher-than-natural flow due to the construction of drainage networks and the increase in runoff from hard surfaces such as roads and roofs.

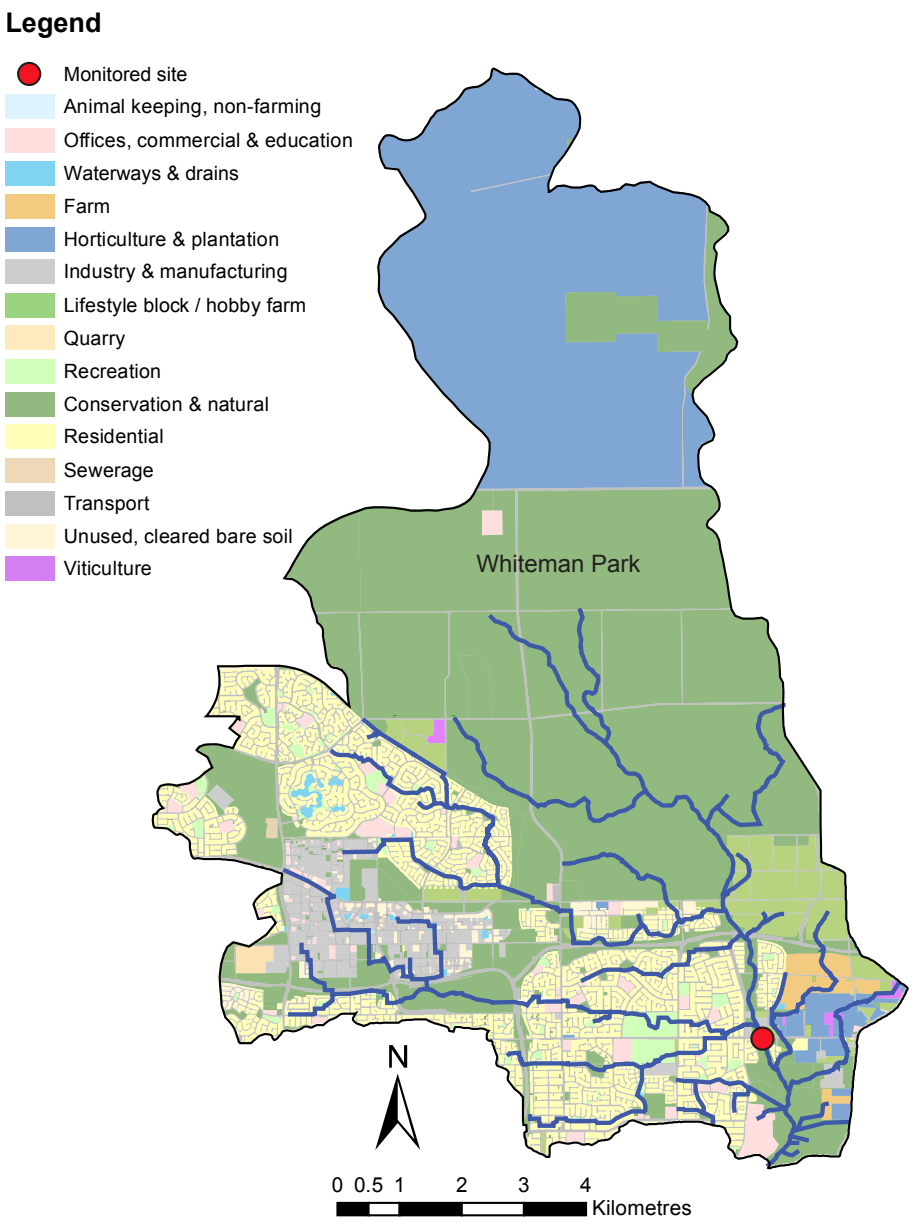
Water quality is monitored fortnightly at a site close to where the brook flows into the Swan Estuary. This site is positioned to indicate what nutrients are leaving the catchment, so the data may not represent nutrient concentrations in upstream or downstream tributaries. Flow was measured from 1988 to 1992 and then again from 2001 to present at the Department of Water and Environmental Regulation gauging station near Benara Road.

Bennett Brook – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	112 km^2
Per cent cleared area (2005)	66%
River flow	Permanent No major water supply dams in catchment
Average annual flow	~ 2.3 GL per year (2012–16 average)
Main land uses (2005)	Conservation and natural, pine plantations, residential.

Fountain Park, located on a tributary of Bennett Brook, November 2005.

Bennett Brook, riparian zone is reduced and dominated by exotics, November 2005.



Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616084	2.2*	4.4*	7.8*	4.4*	2.2	6.5*	3.2	1.6	1.4*	1.0*	4.4*
TN median (mg/L)	SWN12	0.88#	0.98#	1.15	1.10	1.05	0.99#	0.93#	1.00#	1.05	0.96#	1.10
TP median (mg/L)	SWN12	0.048	0.044	0.064	0.057	0.060	0.046	0.054	0.065	0.056	0.059	0.053
TN load (t/yr)	SWN12	2.22*	5.30*	10.10*	5.41*	2.49	8.16*	3.52	1.66	1.45*	0.96*	5.31*
TP load (t/yr)	SWN12	0.12*	0.23*	0.46*	0.24*	0.13	0.34*	0.18	0.09	0.08*	0.06*	0.24*

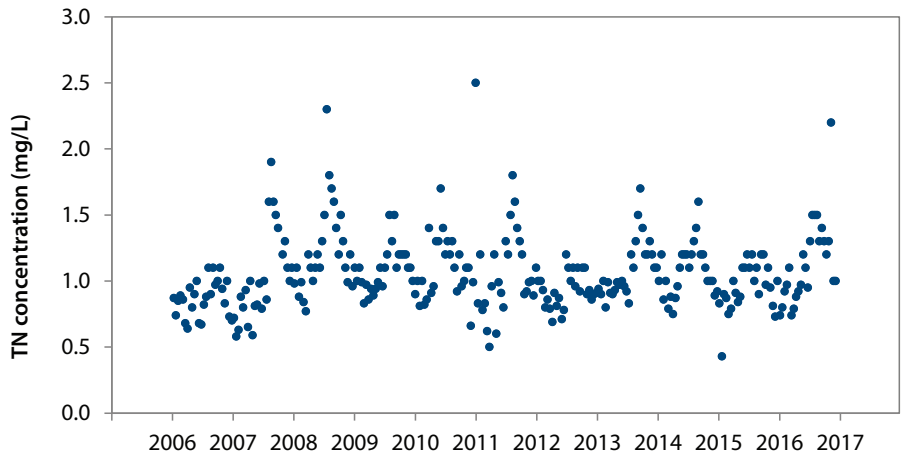
TN short term target = 2.0 mg/L TN long term target = 1.0 mg/L TP short term target = 0.2 mg/L TP long term target = 0.1 mg/L

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 Bennett Brook

Total nitrogen concentrations over the 2006 to 2016 monitoring period



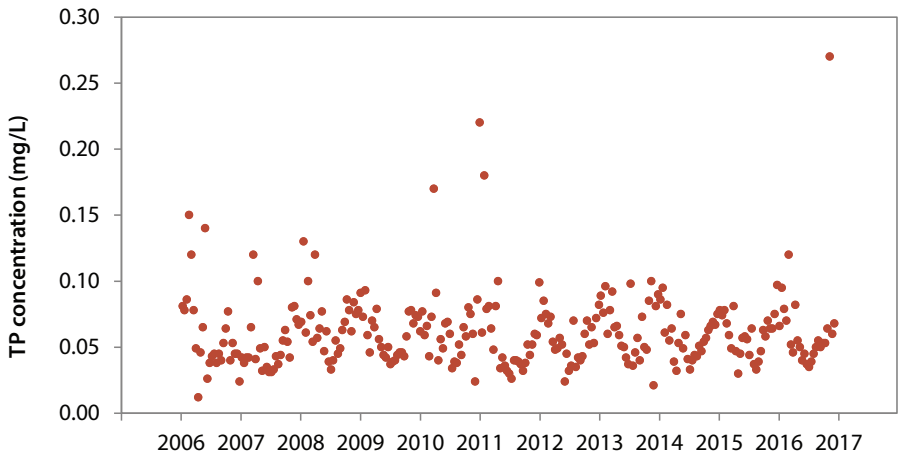
Trend

With the exception of 2006 where total nitrogen (TN) concentrations appeared lower, TN was fairly stable throughout the reporting period. No trends were detected over either the long- or short-term (2007–16 and 2012–16 respectively).

Target

Bennett Brook was passing the short-term but failing the long-term TN target for the reporting period.

Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

Total phosphorus (TP) concentrations were relatively stable over the reporting period. No trends were detected over either the long- or short-term (2007–16 and 2012–16 respectively).

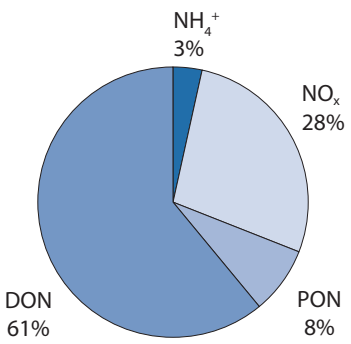
Target

Bennett Brook was passing the short- and long-term TP targets for the reporting period.

Pearl Cichlid (*Geophagus brasiliensis*). These aggresive introduced fish easily outcompete native fish for food and habitat, May 2013. Photo: Kelli O'Neill

Nutrient fractions and estimated loads in Bennett Brook

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

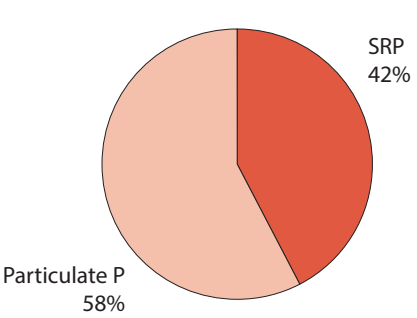


Nitrogen

The largest portion of the nitrogen (N) present was in the form of organic N which comprises both dissolved (DON) and particulate (PON) fractions. DON largely consists of 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 and needs to be further broken down to become available to plants and algae. The remaining N was present as dissolved inorganic N (DIN, consisting of ammonium – NH_4^+ and N oxides – NO_x) which is readily available for plant and algal uptake. These forms of N are commonly derived from septic tank leachate, animal waste and fertilisers used for agriculture, horticulture, viticulture and home gardens.

Bennett Brook had the second-smallest average TN load (2012–16) of the nine subcatchments with flow data. It also had the second-smallest load per unit area (0.023 t/km^2/yr).

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



Phosphorus

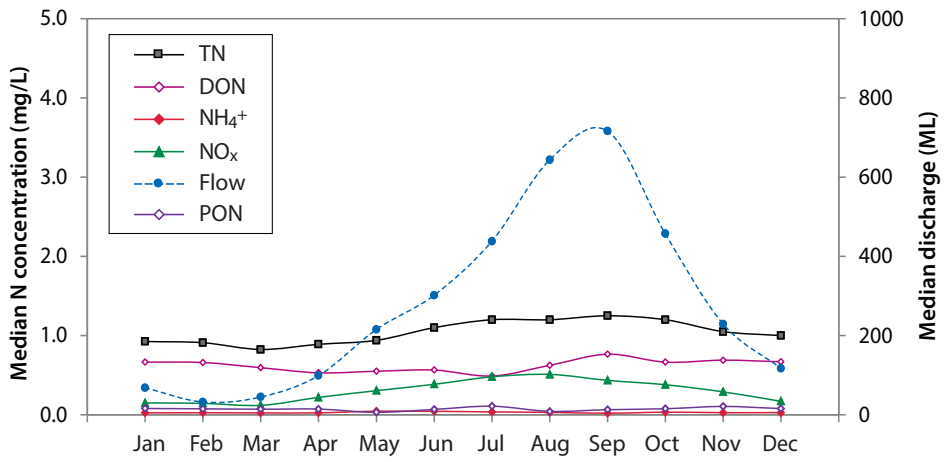
Forty two per cent of the P was present as soluble reactive phosphorus (SRP) – commonly derived from animal wastes and fertilisers used in agriculture, horticulture, viticulture and home gardens. Unlike particulate P, this form of P is readily available for plant and algal uptake. Likely sources for this kind of P include organic waste material and sediment-bound forms of P.

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

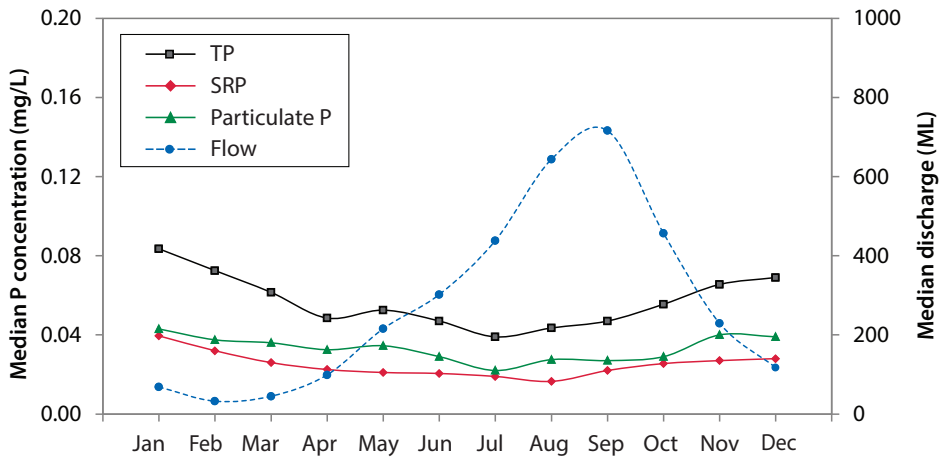
Photo: Water Science Branch

Seasonal variation in nutrient concentrations in Bennett Brook

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

NO_x and to a lesser degree TN and DON concentrations were seasonal, increasing in autumn through winter and falling again in spring and summer. These increases coincided with seasonal rainfall – flushing NO_x from surface soils into the brook. However NH_4^+ was not seasonal given it is likely to undergo oxidation to NO_3^- in the soils before it reaches the brook.

During the summer months groundwater is the major water source and transports N to the brook.

Phosphorus

TP, particulate P and SRP showed a reverse seasonal response; that is, concentrations tended to be higher in the summer when flows were at their lowest. This indicates that most of the P is entering the brook via groundwater and sub-surface flows. The leached sandy soils have a poor capacity to store phosphate from fertilisers so it is likely that any P applied to the soils is leaching into the groundwater and subsequently into the brook. The particulate P may be forming through in-stream processes as well as being washed in from the catchment.

Department of Biodiversity, Conservation and Attractions

Department of Biodiversity, Conservation and Attractions

Photo: Dominic Heald

Photographs of Bennett Brook: (Top left) Section of Bennett Brook, prior to revegetation in Oriole Park, Bennett Springs, October 2014. (Bottom left) Same section of Bennett Brook after revegetation, January 2017. (Right) Looking upstream at the Bennett Brook catchment site, September 2017.

Local nutrient reduction strategies for Bennett Brook

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

- The Department of Biodiversity, Conservation and Attractions (DBCA) secured Australian Government funding for restoration activities in compensation basins in the catchment over the 2013–16 to improve nutrient uptake potential and ecological value, delivered and co-funded by the City of Swan.
- Ongoing restoration of Bennett Brook Reserve, which involves on-ground projects by the Friends of Bennett Brook Reserve to improve water quality and maintain biodiversity.
- An assessment of foreshore condition of the Bennett Brook which is currently being completed.
- Ongoing subregional partnership projects with DBCA to assess the success of past restoration work and help prioritise areas for future restoration work.
- The Phosphorus Awareness Project which aims to assist the community in reducing their nutrient outputs through education, promotion and behaviour change programs.
- In 2016–17 a targeted education program run by SERCUL on behalf of DBCA in the Bennett Brook Catchment provided 50 school presentations, teacher development day, shopping centre displays, Fertilise Wise training for turf managers, and community group presentations.
- The 2015–17 Light Industry Program, a project delivered by the Department of Water and Environmental Regulation in partnership with DBCA and seven local governments in the Swan Canning catchment, including the City of Swan. Businesses in Malaga light industrial area having been audited and provided recommendations or requirements to reduce the risk of releasing nutrient and non-nutrient contaminants into waterways and groundwater systems.
- 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.


Photo: Water Science Branch

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 systems. It uses sophisticated modelling to identify nutrient sources and provides nutrient-reduction targets for each of the subcatchments.

The Bennett Brook catchment has a local WQIP that draws together activities for improving water quality in the catchment and helps to target future investment for better water quality outcomes.

SCWQIP load and concentration targets for Bennett Brook

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	4.8	1.00	32%
TP	0.42	0.100	0%

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

Summary: Bennett Brook

- Bennett Brook is passing both the short- and long-term TP targets.
- It is passing the short- but failing the long-term TN target.
- Of the nine sites with flow data, Bennett Brook has the second-smallest average TN and TP loads.
- Bennett Brook also has the second-smallest TN and the equal second-smallest TP loads per unit area.
- To enable Bennett Brook to meet the SCWQIP TN target, a 32% reduction is required.
- TP loads are currently considered acceptable and no reduction in TP is required to meet the SCWQIP target.

www.dwer.wa.gov.au
www.dbca.wa.gov.au

For further information please contact the
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