

Upper Swan

The Upper Swan catchment consists of a number of creeks and drains which discharge into the Swan River and Upper Swan Estuary at various points. Drainage is highly modified in the southern and central portions of the catchment but remains more natural in the northern section.

Archaeological evidence shows that the Upper Swan River and surrounding areas were important to the local Nyungar people. After the foundation of the Swan River Colony the fertile alluvial flats along both sides of the river were used as agricultural land. Over time, landuse has changed in the southern portion of the catchment to urban and industrial uses while the northern section retains many vineyards. Caversham Airbase is located in the upper part of the Wandoo Creek subcatchment.

The western edge of the catchment is characterised by leached, highly permeable, Bassendean sands which have

poor nutrient-retention capabilities. The remainder of the catchment has neutral red and yellow earths which tend to be more fertile and viticulture is the dominant landuse here.

Two sites are monitored fortnightly for water quality. One, on Wandoo Creek (WNDCK), West Swan and one on Chapman Street Drain (CSMDREID), Ashfield. These two waterways have very different landuses in their catchments. The sampling sites give an indication of the nutrient concentrations leaving the two subcatchments and entering the Swan River and Upper Swan Estuary. They do not represent nutrient concentrations in upstream areas, nor do they give an indication of the water quality in the remaining subcatchments. In 2015, the Wandoo Creek site (WNDCK) was not flowing on any of the sampling occasions.

Upper Swan – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	39 km ²
Per cent cleared area (2005)	83% (total catchment)
River flow	CSMDREID flows year round whilst WNDCK dries for at least six months every year
Main land uses (2005)	Viticulture, farms, residential and lifestyle blocks/hobby farms (total catchment)



Photo: Water Science Branch

Looking downstream from Chapman Street Drain sampling site (CSMDREID), April 2015.

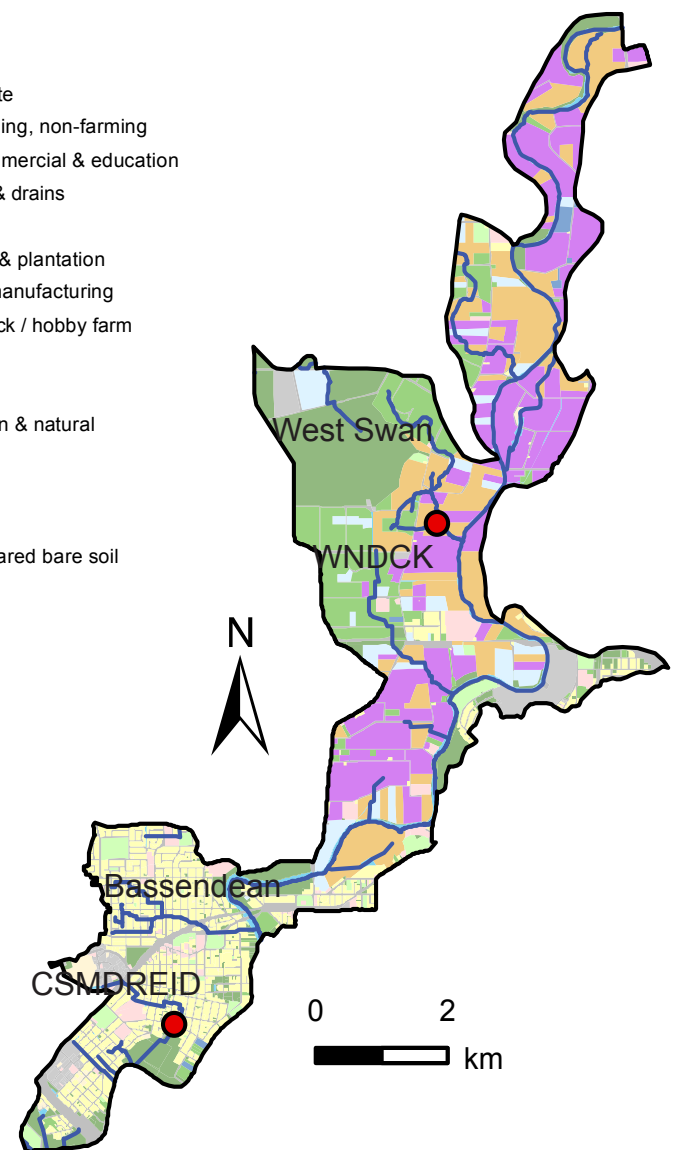


Photo: Frances Miller

Looking downstream from Wandoo Creek sampling site (WNDCK), August 2016.

Legend

- Monitored site
- Animal keeping, non-farming
- Offices, commercial & education
- Waterways & drains
- Farm
- Horticulture & plantation
- Industry & manufacturing
- Lifestyle block / hobby farm
- Quarry
- Recreation
- Conservation & natural
- Residential
- Sewerage
- Transport
- Unused, cleared bare soil
- Viticulture



Nutrient Summary: concentrations, rainfall and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual rainfall (mm)	009225	466.8	703.0	807.8	607.2	503.8	860.8	608.2	782.4	674.4	617.8	715.8
TN median (mg/L)	CSMDREID		1.40			1.40	1.20	1.20	1.10	1.30	1.60	1.35
TP median (mg/L)	CSMDREID		0.066			0.110	0.120	0.120	0.150	0.160	0.160	0.165
TN median (mg/L)	WNDCK							2.80	3.00	2.55		3.05
TP median (mg/L)	WNDCK							0.340	0.440	0.335		0.370

TN short term target = 2.0 mg/L

TN long term target = 1.0 mg/L

TP short term target = 0.2 mg/L

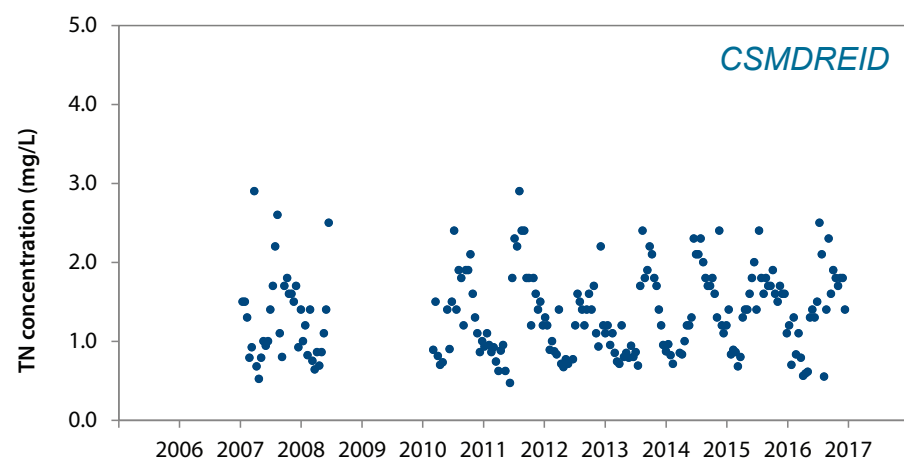
TP long term target = 0.1 mg/L

■ 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 the Upper Swan

Total nitrogen concentrations over the 2006 to 2016 monitoring period



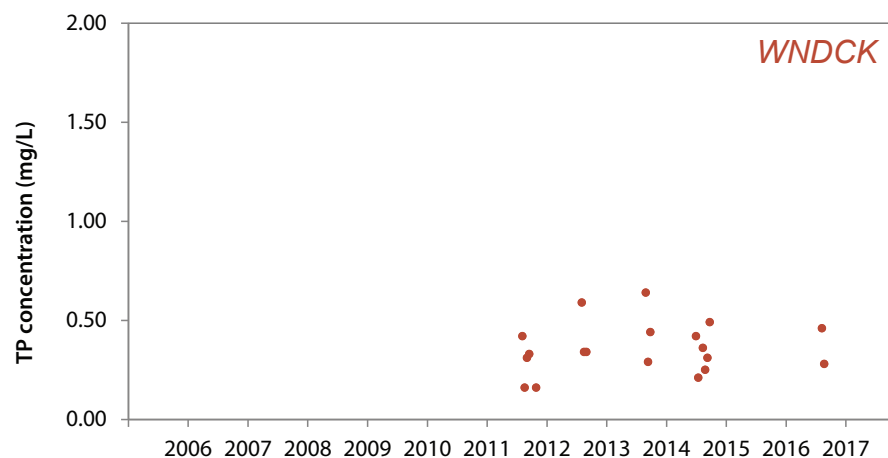
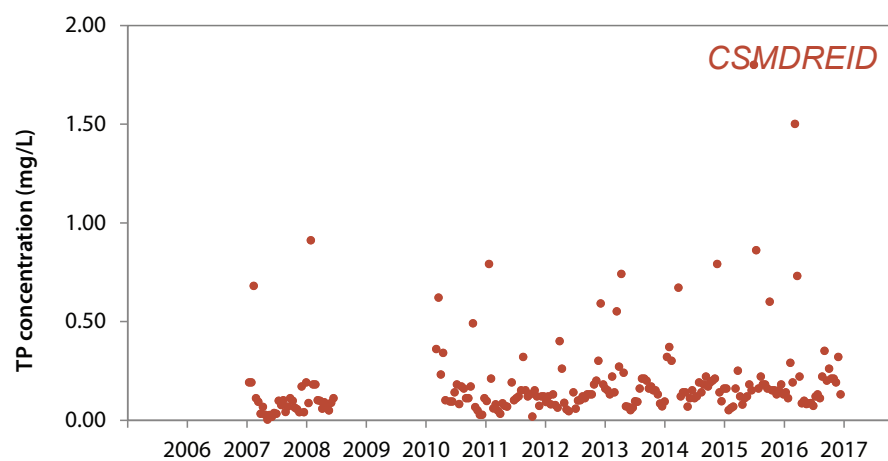
Trend

While total nitrogen (TN) concentrations appear stable at CSMDREID, an emerging increasing trend of 0.05 mg/L/yr over 2012–16 was detected. The data were too scattered to analyse for trends at WNDCK.

Target

CSMDREID is passing the short- but failing the long-term target. WNDCK, with its higher TN concentrations, was failing both the short- and long-term TN targets, however due to the site not flowing in 2015 it was not possible to test against the targets in 2016.

Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

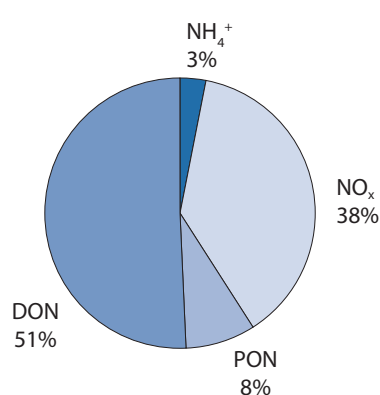
Total phosphorus (TP) concentrations appear stable at WNDCK but were increasing at CSMDREID. There were insufficient data to test for trends at WNDCK. CSMDREID had small emerging increasing trends of 0.009 mg/L/yr (2007–16 and 2012–16).

Target

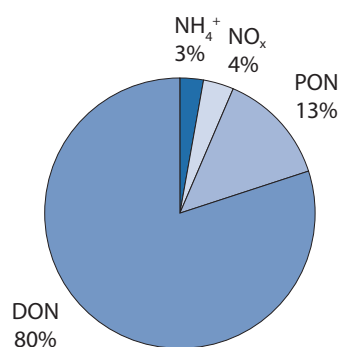
CSMDREID is passing the short- but failing the long-term target. WNDCK, with its higher TP concentrations, was currently failing both the short- and the long-term TP targets however it was not possible to test against the targets in 2016 (see N).

Nutrient fractions in the Upper Swan

Average composition of nitrogen (N) in Upper Swan over the 2012 to 2016 monitoring period



CSMDREID



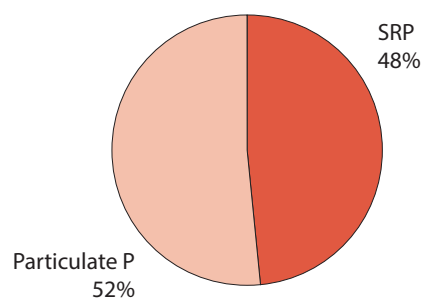
WNDCK

Nitrogen (N) composition varied between the sites, especially NO_x and DON. Organic N consists of dissolved (DON) and particulate (PON) fractions. DON consists of organic compounds leached from peaty subsoils and degrading plant and animal matter and is bioavailable. PON is composed of plant and animal debris and needs to be further broken

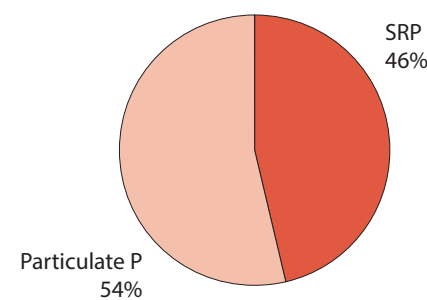
down to become available. Dissolved inorganic N (DIN, consisting of ammonium – NH₄⁺ and N oxides – NO_x) is derived from fertilisers, animal wastes, septic tank leachate and possibly industrial landuse and is readily bioavailable.

There were no flow data for these sites so loads have not been calculated.

Average composition of phosphorus (P) in Upper Swan over the 2012 to 2016 monitoring period



CSMDREID



WNDCK

Phosphorus (P) composition was similar at both sites with about half of the P present as particulate P which consists of sediment-bound forms of P and organic material. Particulate P is not readily available for plant and algal uptake, but may become available over time as particles decompose or release bound phosphate. Soluble reactive phosphorus

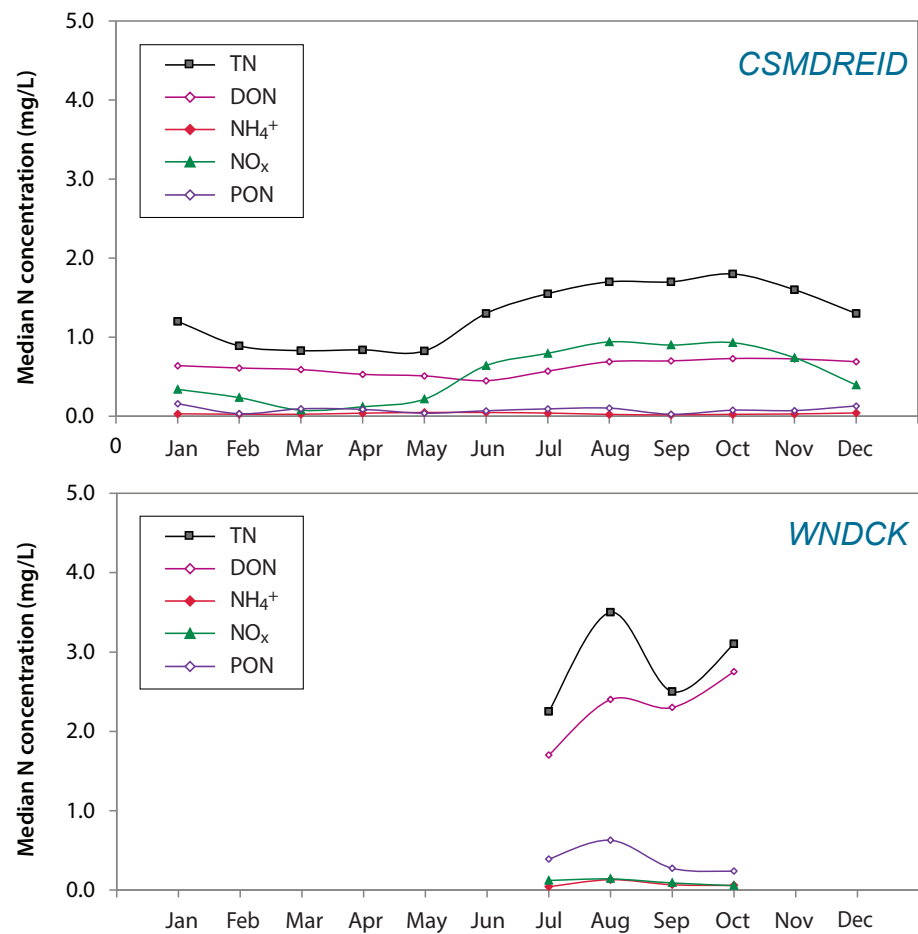
(SRP) is derived from fertilisers and animal waste and is readily available for plant and algal uptake. It made up the remaining P.

There were no flow data for these sites so loads have not been calculated.

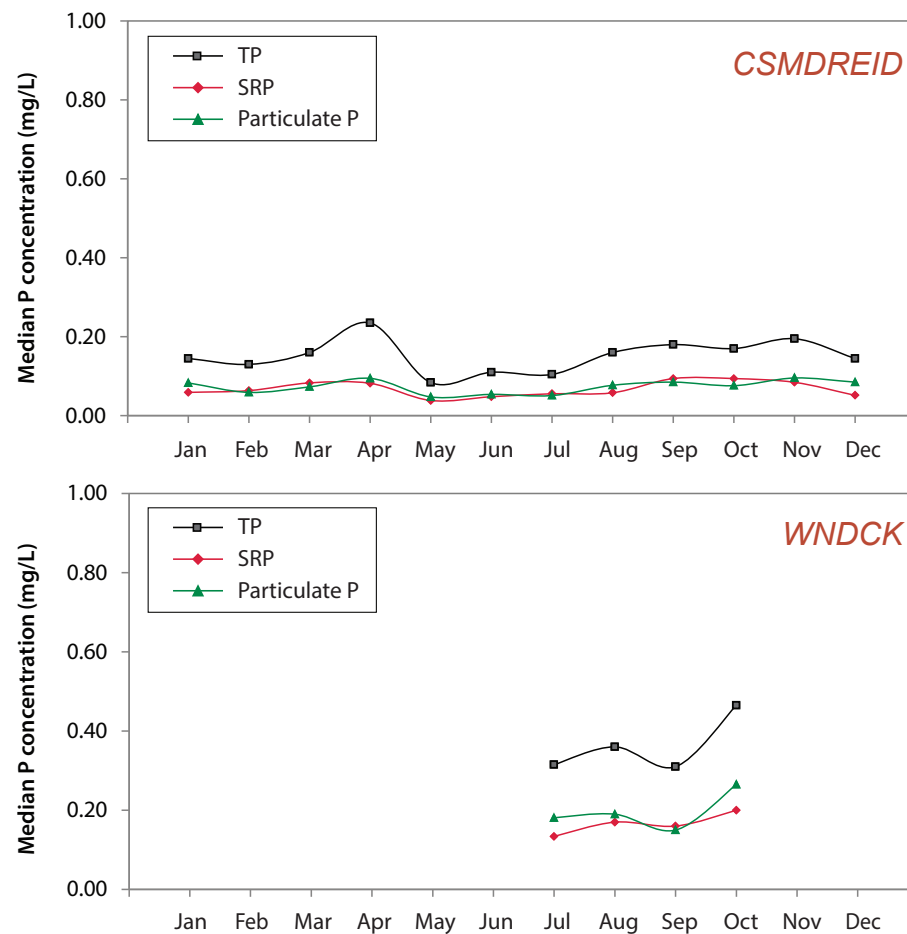


Seasonal variation in nutrient concentrations in the Upper Swan

Nitrogen seasonal variation over the 2012 to 2016 monitoring period



Phosphorus seasonal variation over the 2012 to 2016 monitoring period



Nitrogen

Nitrogen concentrations showed a seasonal pattern, particularly NO_x at CSM DREID and DON and PON at WNDCK. Surface and subsurface flows were the dominant transport mechanism for these forms

of N. DON at WNDCK was probably entering the creek via groundwater, hence the increase in October when the relative contribution from groundwater was large.

Phosphorus

P did not show a strong seasonal response at CSM DREID. The spike in particulate P concentrations in April was most likely due to the first flush washing P into the creek. It is likely that P was entering the

waterways via surface and subsurface runoff as well as groundwater. Particulate P at WNDCK was likely also sourced from instream algae, especially in October when flows were lower and temperatures higher.



Photo: Water Science Branch



Photo: Water Science Branch



Photo: Emma van Looij

Photographs of the Upper Swan Catchment: (Top left) Brook Street Main Drain in Bassendean, January 2003. (Bottom left) Brook St Main Drain in Bassendean, January 2003. (Right) Submerged vineyards in Herne Hill after the Swan River flooded following heavy rainfall in February 2017.

Local nutrient reduction strategies for Upper Swan

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

- The Riverwise Sustainable Gardening Workshops Spring series was held in 2016.
- Horse industry workshops which have been run by Perth NRM and the WA Horse Council to improve management practices on horse properties to reduce nutrients entering the Swan Canning river systems.
- New requirements for residents with aerobic treatment units to submit three, six or 12 monthly reports depending on the unit type.
- The Town of Bassendean is implementing works to improve the water quality in the catchment including applying soil amendments, replacing exotic and largely deciduous vegetation with indigenous species, conducting community education and restoring Pickering Park Foreshore and Drainage Outflow.
- Annual water quality monitoring has been conducted by the Town of Bassendean since 2010.
- The Department of Biodiversity, Conservation and Attractions (DBCA) Riverbank Program which has funded numerous projects across four key foreshore sites in the Upper Swan catchment. Projects have included significant erosion control treatments such as construction of rock revetments and bioengineering as well as restoration techniques using weed control and revegetation. Examples include projects in Success Hill, Lilac Hill and Claughton Reserve.
- 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.
- Coordination and support of community led projects to reduce nutrient inputs into the Swan River in the north sub-region led by the cities of Swan and Bayswater and funded by the DBCA.
- Phosphorus Awareness Project which aims to assist the community in reducing their nutrient outputs through education, promotion and behaviour change programs.

Swan Canning water quality improvement plan

The *Swan Canning water quality improvement plan* (SCWQIP) complements the delivery of other major programs and presents a roadmap for reducing nutrient inputs into the 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 Upper Swan

	Max. acceptable load (t/yr)	Concentration target (mg/L)	% reduction required
TN	6.7	0.75	23%
TP	2.01	0.075	0%

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

Summary: Upper Swan

- The site on Chapman Street Drain (CSMDREID) is passing the short- but failing the long-term TN and TP targets.
- An emerging increasing short-term trend in TN concentrations was detected at CSMDREID.
- Emerging increasing short- and long-term trends were detected in TP concentrations at CSMDREID.
- Of the 33 sites sampled, the site at WNDCK has the second-highest median TN and TP concentrations.
- Of the 33 sites sampled, WNDCK has the second-lowest percentage of N present as bioavailable DIN.
- Overall, a 23% reduction in TN is required for this catchment to meet its SCWQIP targets.