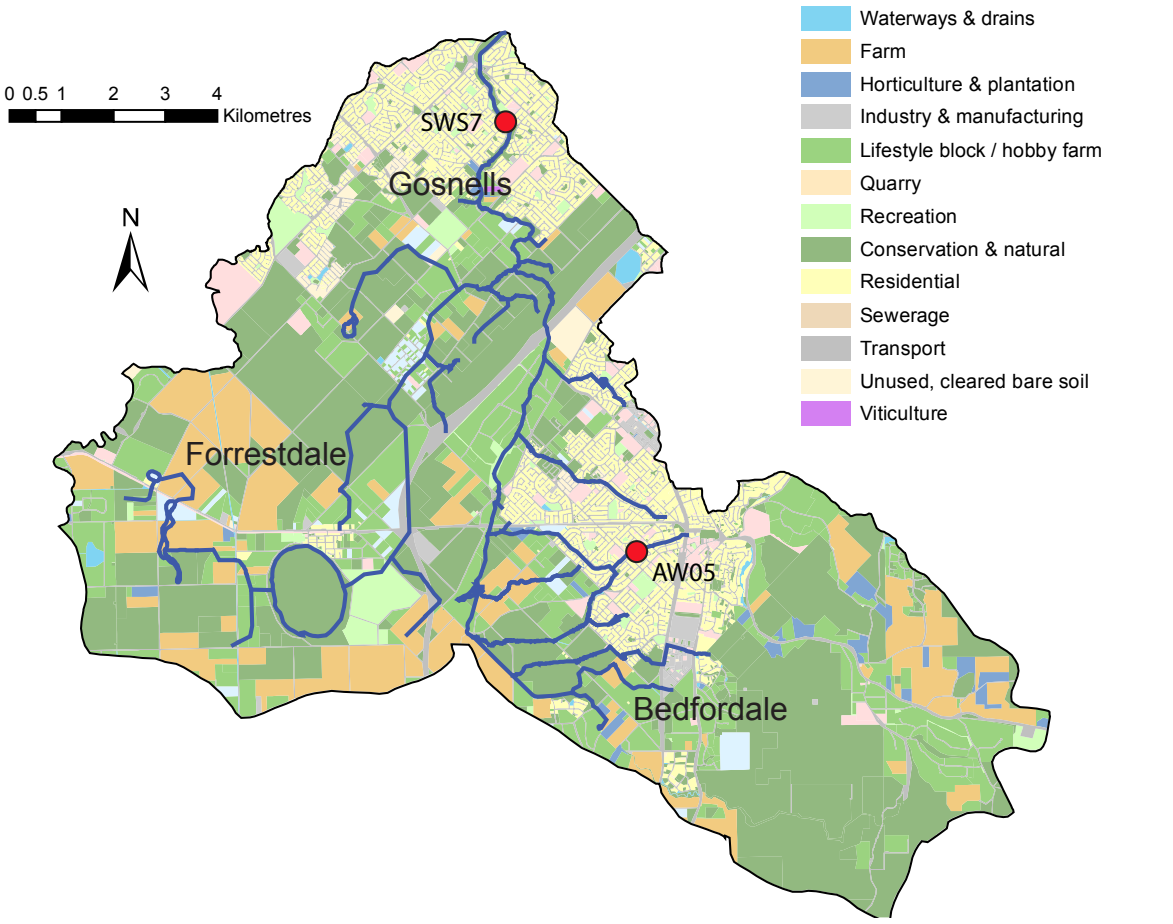
Southern River

Southern River is a natural river system that begins at the confluence of Wungong Brook and Neerigen Brook (North Drain) and flows into the Canning River near the Burslem Drive Bridge in Gosnells. It is fed by several drains and natural waterways and contributes the greatest volume of water (about 36%) of the Canning Estuary tributaries for which there is flow data. Although Southern River is not dammed, one of its major tributaries, Wungong Brook, has a dam on it.

Semi-rural activities dominate the Southern River catchment. Some bushland, such as Bungendore Park, remains in the upper catchment while the lower catchment is highly urbanised. Many wetlands are found in the catchment, most of which are surface expressions of the groundwater. Much of the rural land in the catchment has been earmarked for urban development, which is rapidly progressing.

Soils in the catchment consist of permeable Bassendean and Southern River sands, while further east the soils are primarily Guildford duplex soils and red earths. The hills soils in the catchment's far east are mainly Dwellingup sands and gravels. The Southern River receives discharge from large regional groundwater systems in the west through an extensive seasonally waterlogged plain and system of drains. This groundwater maintains streamflow during summer and it is only during successive low-flow years that the river ceases to flow. On the sand plain, groundwater bores are used extensively as public and private water supplies for irrigation, industrial and domestic purposes.

Water quality is monitored fortnightly at two sites; the Department of Water and Environmental Regulation gauging station, located just above the confluence with the Canning River and, on Neerigen Brook on Seventh Avenue in Armadale. The first site is positioned to indicate the nutrients leaving the catchment and entering the estuary, whereas the second gives an indication of nutrients in upstream areas.



Southern River – facts and figures

Average rainfall (2012–16)	~ 680 mm per year (Perth metro)
Catchment area	149 km^2
Per cent cleared area (2005)	60%
River flow	Permanent, only dries after a series of low rainfall years. Wungong Reservoir is situated on Wungong Brook, one of the major tributaries
Average annual flow	~ 11.6 GL per year (2012–16 average)
Main land uses (2005)	Conservation and natural, farms, unused cleared grassed areas and residential.

Nutrient Summary: concentrations, estimated loads and targets

Year	Site	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual flow (GL)	616092	5.7*	14.9*	19.0*	17.4*	5.9*	20.4*	9.5*	12.6*	12.6*	7.8*	15.5*
TN median (mg/L)	SWS7	0.86#	0.99#	1.15	1.20	1.25	1.20	1.10	1.30	1.30	1.10	1.40
TP median (mg/L)	SWS7	0.115	0.115	0.150	0.140	0.150	0.140	0.125	0.170	0.160	0.135	0.140
TN load (t/yr)	SWS7	7.02*	21.81*	28.57*	26.17*	7.86*	31.15*	11.92*	18.71*	18.63*	11.09*	23.64*
TP load (t/yr)	SWS7	0.89*	2.66*	3.66*	3.25*	0.97*	3.92*	1.49*	2.37*	2.25*	1.32*	2.62*
TN median (mg/L)	AW05		0.60			0.37	0.59	0.48	0.41	0.45	0.42	0.44
TP median (mg/L)	AW05		0.014			0.012	0.016	0.013	0.016	0.015	0.021	0.014

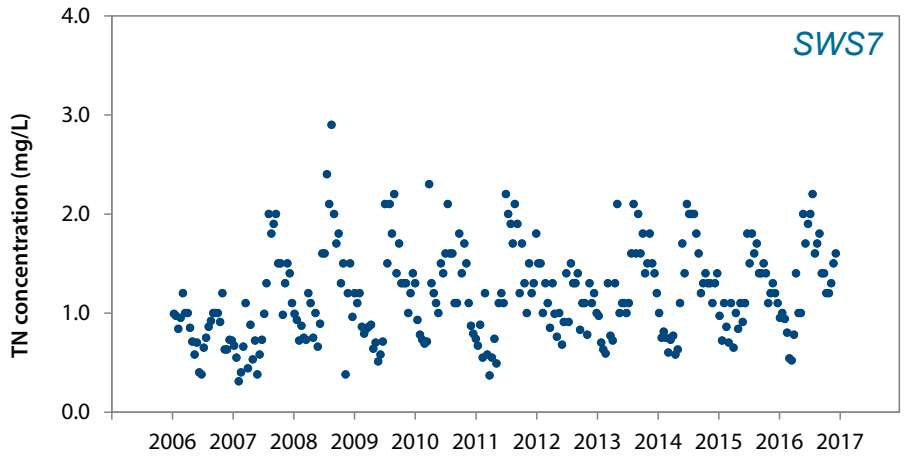
TN short term target = 2.0 mg/L TN long term target = 1.0 mg/L TP short term target = 0.2 mg/L TP long term target = 0.1 mg/L

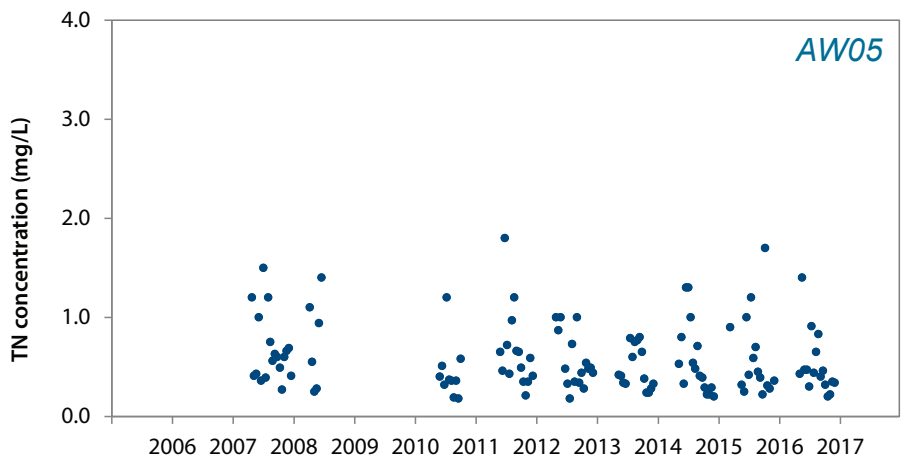
insufficient data to test target | failing both short and long-term target | passing short but failing long-term target | passing both short and long-term target

* 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).

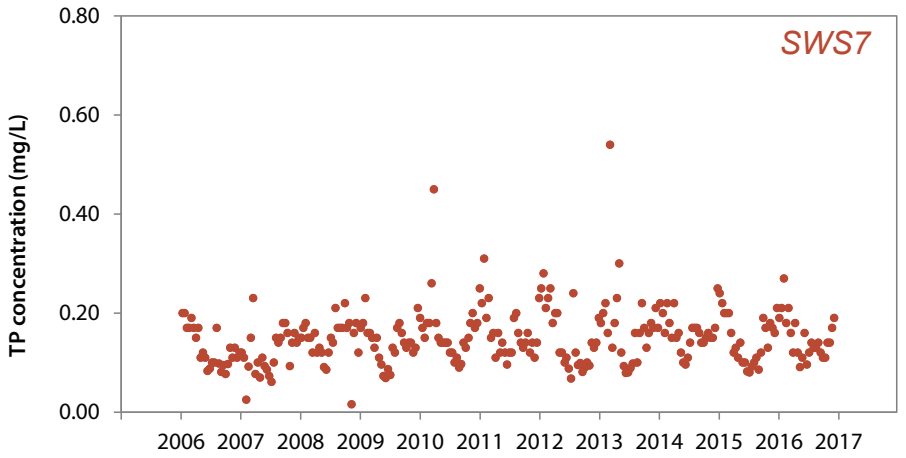
Changes in nutrient concentrations over time in Southern River

Total nitrogen concentrations over the 2006 to 2016 monitoring period





Total phosphorus concentrations over the 2006 to 2016 monitoring period



Trend

Total nitrogen (TN) concentrations appeared relatively stable at both sites. Concentrations appeared lower in 2006–07 at site SWS7, the reason for this is unclear. There were no trends detected at either site

Target

Site SWS7 near the base of the catchment, is passing the short- but failing the long-term TN target. AW05, which is higher in the catchment is passing both the short- and long-term targets.

Trend

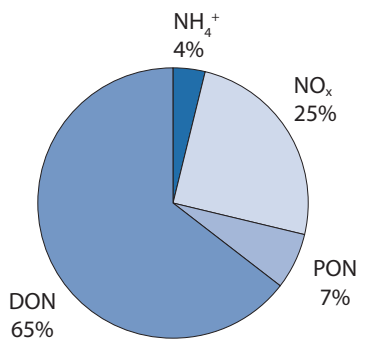
Total phosphorus (TP) concentrations appeared relatively stable at both sites. Like with TN, TP concentrations appeared lower at the start of the reporting period at SWS7. There were no trends at either site.

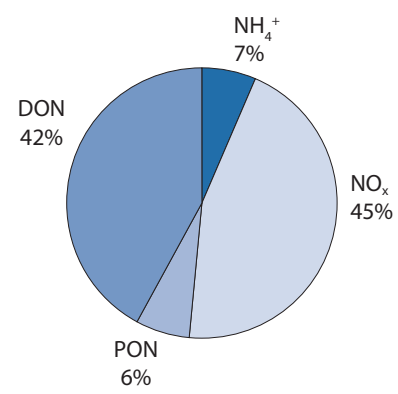
Target

Site SWS7 near the base of the catchment, is passing the short- but failing the long-term TP target. AW05, which is higher in the catchment is passing both the short- and long-term TP targets.

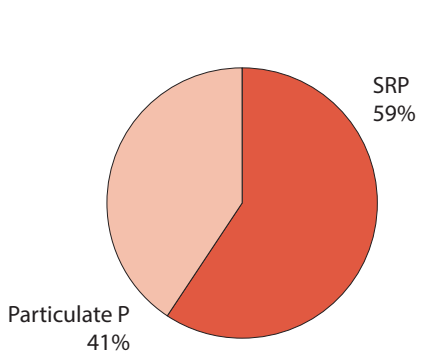
Nutrient fractions and estimated loads in Southern River

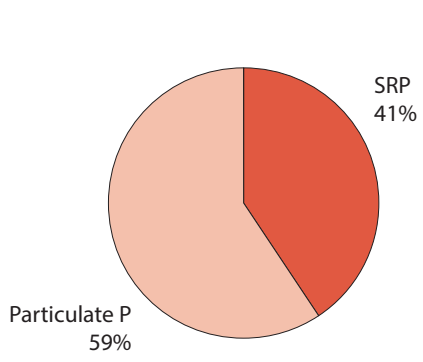
Average composition of nitrogen (N) in Southern River over the 2012 to 2016 monitoring period





Average composition of phosphorus (P) in Southern River over the 2012 to 2016 monitoring period





SWS7

Nitrogen (N) composition varied at the two sites. SWS7 was dominated by dissolved organic N (DON), and to a lesser extent oxides of N (NO_x), whereas AW05 was dominated by DON and NO_x in similar proportions. DON is mostly organic compounds leached from peaty subsoils and degrading plant and animal matter. Particulate organic N (PON) is composed

AW05

of plant and animal debris. Likely sources of dissolved inorganic N (consisting of ammonium – NH_4^+ and NO_x) include fertilisers and septic tank leachate.

Site SWS7 had the third-largest average TN load (2012–16) and the fourth-largest load per unit area (0.11 t/km^2/yr) of the nine subcatchments with flow data.

SWS7

Phosphorus (P) composition differed at the two sites. SWS7 was dominated by soluble reactive P (SRP), which is readily available for plant and algal growth. Animal waste and fertilisers are common sources of SRP in semi-rural catchments. Particulate P was the dominant form at AW05 and is commonly associated with suspended sediments derived

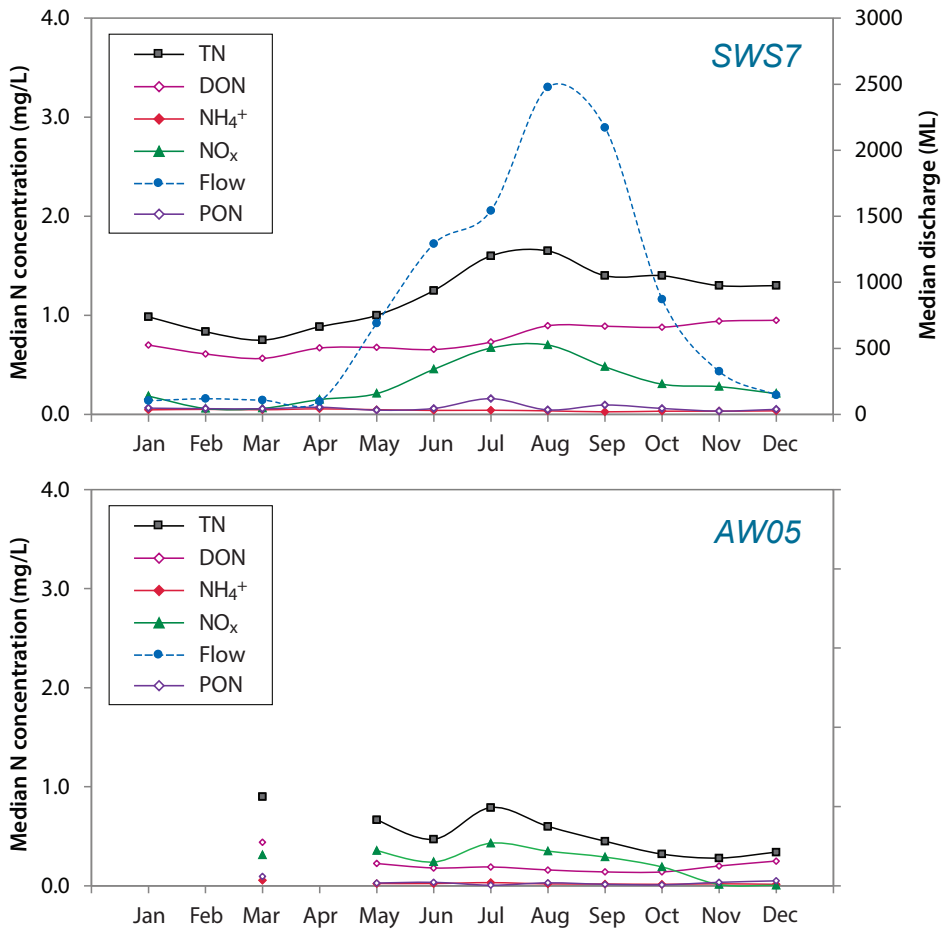
AW05

from soil erosion, particularly from the foothills of the Darling Scarp. Particulate P is not immediately available to plants and algae.

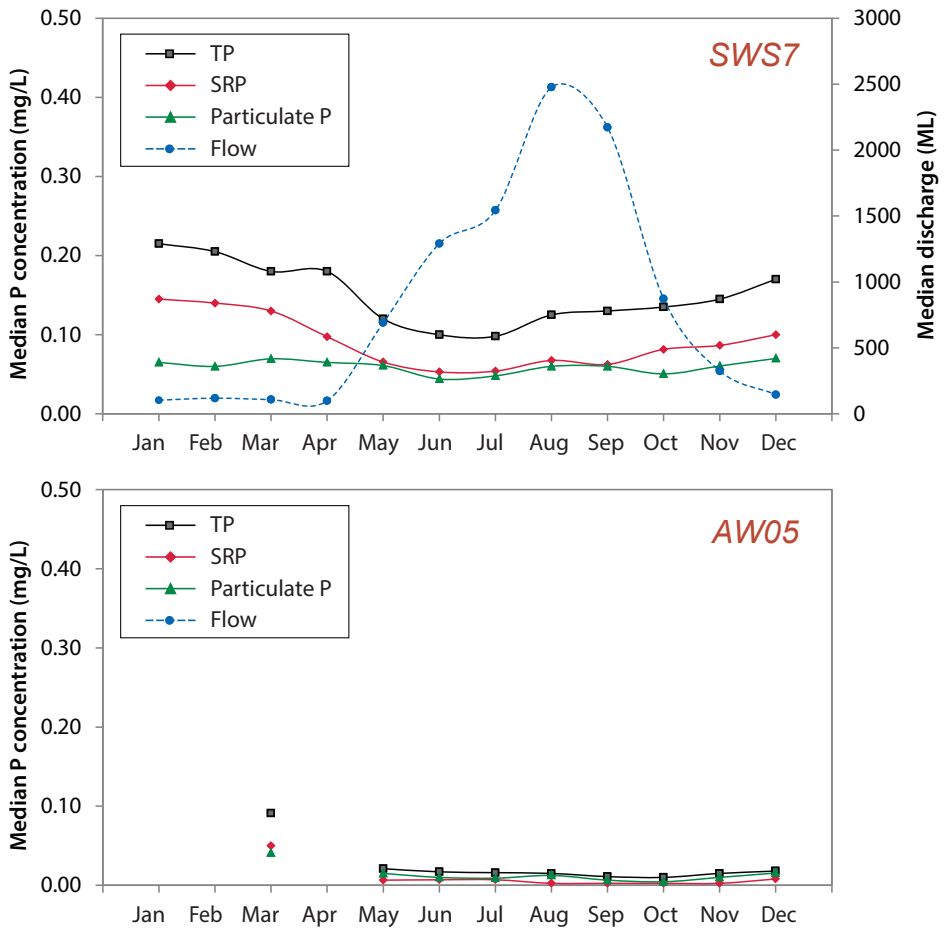
Site SWS7 had the third-largest average TP load (2012–16) and the fourth-largest load per unit area (0.013 t/km^2/yr) of the nine subcatchments with flow data.

Seasonal variation in nutrient concentrations in Southern River

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 similar pattern at both sites. NO_x concentrations were greatest in winter suggesting it is being transported to the river via surface and subsurface flows following rainfall. The other forms of N did not show a strong seasonal response suggesting that a range of transport mechanisms are delivering them to the river including surface and subsurface flows as well as groundwater.

Phosphorus

Phosphorus concentrations were relatively stable at AW05. At SWS7, SRP showed a seasonal response, being lowest in winter during high flows and highest in summer. This suggests that SRP is being transported to the river predominantly via groundwater at this site. Particulate P stayed steady year-round suggesting it is being delivered by a mix of surface and subsurface flows as well as groundwater.

Department of Biodiversity, Conservation and Attractions.

Photo: Katherine Bennett.

Photo: Department of Biodiversity, Conservation and Attractions.

Photographs of Southern River: (Top left) Work underway to create a vegetated swale near Ranford Road, February 2013. (Bottom left) The AW05 sampling site, August 2017. (Right) The completed vegetated swale (same location as the photo at top left), April 2015.

Local nutrient reduction strategies for Southern River

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

- The Southern River Urban Waterways Renewal Project (2010–12) involved the construction and/or restoration of living streams and basins. An example of these projects is the Riverside Lane Foreshore and Floodplain Restoration Project along the foreshore of the Wungong River. A biofiltration basin was constructed to receive and treat urban stormwater from a local drain before it enters the river. The accompanying revegetation of a large foreshore area helped restore natural diversity and provide habitat for native fauna.
- The City of Armadale plans to restore the foreshore of a 2.7 km stretch of the Wungong River, a tributary of Southern River.
- The RiverWise-Waterwise behaviour change project funded by the Department of Biodiversity, Conservation and Attractions (DBCA) aims to reduce fertiliser use and water consumption through a personalised coaching approach to individual households.
- The Sediment and Erosion Control Project. This was a detailed investigation into the planning, statutory and policy mechanisms for controlling and enforcing the management of erosion and sedimentation within the cities of Armadale and Gosnells. This investigation now informs the Sediment Task Force.
- A subsoil amendment trial in the Abingdon Development commenced in 2014. The Department of Water and Environmental Regulation through the SCWQIP trialled the addition of IronMan Gypsum to 185 m of subsoil drains in a new development. Evaluation of the trial is ongoing.
- Ongoing sub-regional partnership projects whereby the South East Regional Centre for Urban Landcare is working together with DBCA, local governments and community groups to deliver water quality and community capacity-building outcomes.
- The Phosphorus Awareness Project which assists the community in reducing their nutrient outputs through education, promotion and behaviour change programs.
- The DBCA's Health 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 Swan Canning river systems. It uses sophisticated modelling to identify nutrient sources and provides nutrient-reduction targets for each of the subcatchments.

The Southern River 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 Southern River

	Max. load (t/yr)	Conc. target (mg/L)	% reduction
TN	11.4	0.75	46%
TP	1.15	0.075	48%

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


Photo: Dominic Heald

Summary: Southern River

- SWS7 is passing the short- but failing the long-term TN and TP targets.
- AW05 is passing both the short- and long-term TP targets.
- Of the nine sites with flow data, SWS7 has the third-largest median TN and TP loads.
- Of the 33 sites sampled, AW05 has the second-lowest median TN and the lowest median TP concentrations.
- Of the 33 sites sampled, SWS7 has one of the highest proportions of P present as bioavailable SRP and AW05 has one of the highest proportions of N present as bioavailable DIN.
- Overall, a 46% reduction in TN and a 48% reduction in TP is required for this catchment to meet its SCWQIP targets.

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