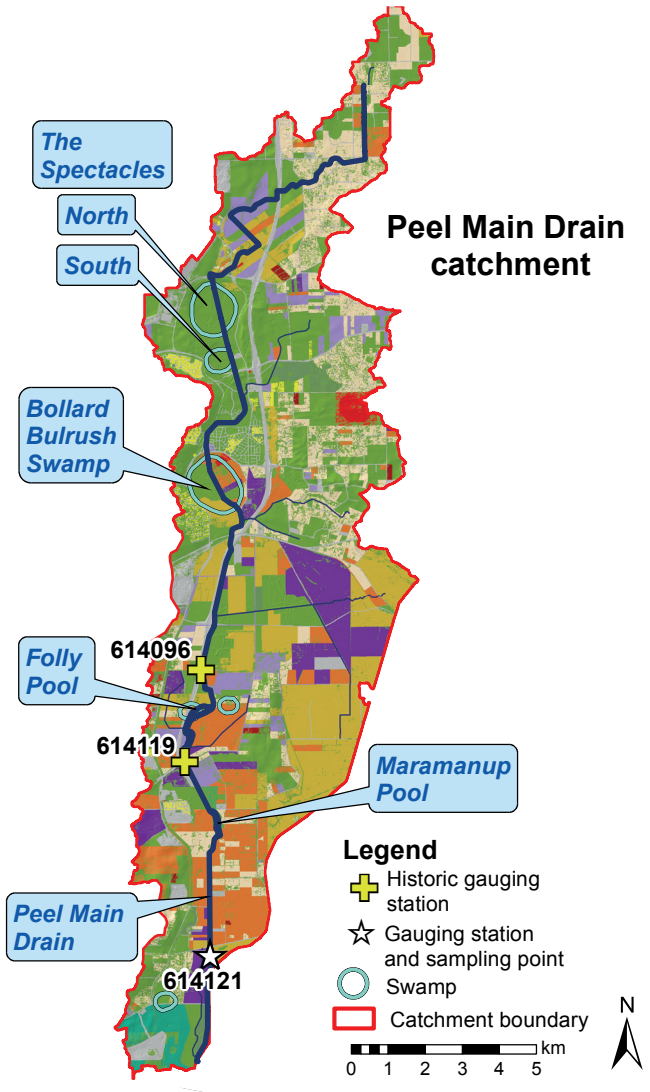
Peel Main Drain

Peel Main Drain flows in a southerly direction and passes through several pools or wetlands (swamps) before discharging to the Serpentine River at Kerulup Pool.

Since July 2006, water quality has been monitored on a regular basis near the bottom of the catchment at the gauging station on Karnup Road (614121). Before this, samples were collected approximately 250 m upstream at Karnup Road Bridge (1990–93).



There have been several gauging stations located along Peel Main Drain:

- 1994–98 at Folly Road (614096)
- 2000–05 at Zig Zag Road (614119)
- 2005 onwards at Karnup Road (614121)

In wet years Peel Main Drain flows all year, however in dry years it can cease to flow between the months of November and May inclusive. In 2006 it also ceased to flow for two days in July.

Nearly half the Peel Main Drain catchment (mostly north of Bollard Bulrush Swamp) has leached sands and a high or very high risk of phosphorus loss to waterways. Land use in this area is dominated by bushland and residential and lifestyle blocks. To the south the land has been cleared, mostly for agriculture such as stock grazing.

In addition to a piggery and several poultry farms, the catchment also has two sheep feedlots and an aquaculture facility that have licence conditions governing discharge and report to the National Polution Inventory (Department of Environment Regulation).

Land use classification (2006)	Area (km²)	Area (%)
Animal keeping – non-farming (horses)	12	10
Cattle for beef (predominantly)	16	13
Conservation and natural	47	39
Horticulture	5.6	4.6
Industry, manufacturing and transport	11	9.1
Intensive animal use	0.35	0.29
Lifestyle block	15	13
Mixed grazing	7.5	6.2
Offices, commercial and education	0.83	0.69
Plantation	1.9	1.6
Recreation	1.4	1.2
Residential	1.2	0.98
Total	**120**	**100**

Nutrient summary: median concentrations, loads and status classification at 614121

Year	1990	1991	1992	1993		2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual flow (GL)						2.5	5.5	12	6.8	10*	2.7	6.0	12	7.3*
TN median (mg/L)	1.6	2.2	2.0	2.0							1.6	1.9	2.0	2.3
TP median (mg/L)	0.29	0.27	0.31	0.19							0.08	0.28	0.37	0.32
TN load (t/year)											4.5	12	22	14*
TP load (t/year)											0.69	1.7	3.1	1.9*

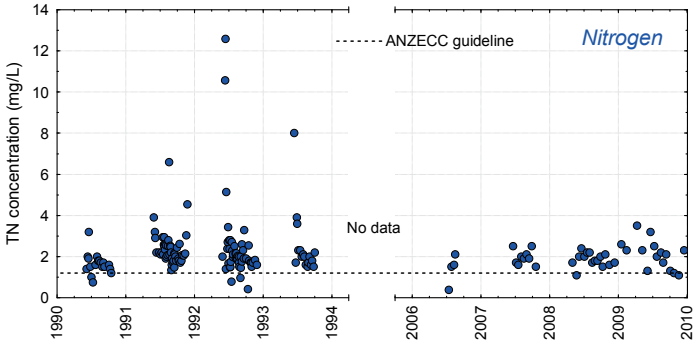
Status classification — Low — Moderate — High — Very high

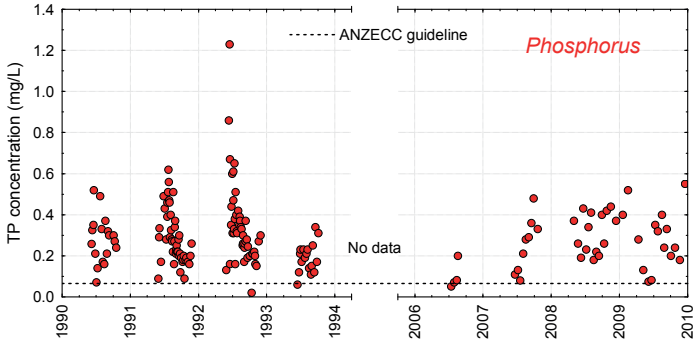
Status reported for three-year period end (i.e. 1996–98 reported in 1998)

* best estimate using available data

TN = total nitrogen TP = total phosphorus

Total nitrogen (TN) and total phosphorus (TP) concentrations (1990–93 and 2006–09)





TN concentration:

The annual percentage of TN samples that exceeded the ANZECC[1] guideline for lowland rivers (1.2 mg/L) ranged between 75% (2006) and 100% (1991, 1994 and 2007).

Between 1990 and 1993, 27% of samples exceeded twice the guideline (2.4 mg/L). Between 2006 and 2009 only 14% of samples exceeded 2.4 mg/L.

TN trend:

Trend analysis was undertaken using data from 2006 to 2009 inclusive.

No trend was detected.

TP concentration:

Between 1990 and 2009, all but three samples (1992, 1993 and 2006) exceeded the ANZECC[1] guideline for lowland rivers (0.065 mg/L).

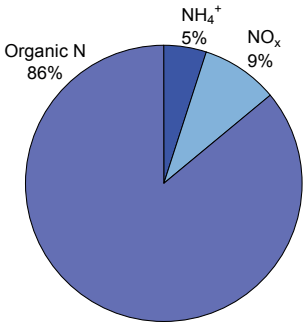
During this time more than 70% of samples also exceeded three times the guideline (0.195 mg/L). The annual percentage of samples that exceeded 0.195 mg/L ranged between 25% in 2006 to 87% in 2008.

TP trend:

Trend analysis was undertaken using data from 2006 to 2009 inclusive.

An emerging increasing trend (0.054 mg/L/year) was detected.

Nutrient fractions (2006–09)



Nitrogen:

Most of the nitrogen (N) was organic in nature. Organic N consists of both dissolved organic and particulate nitrogen. It is derived from degrading plant and animal matter and fertilisers. It often needs to be further broken down before it can be used by plants and algae.

The remaining N was dissolved inorganic N (DIN) such as ammonium (NH_4^+) and N oxides (NO_x).

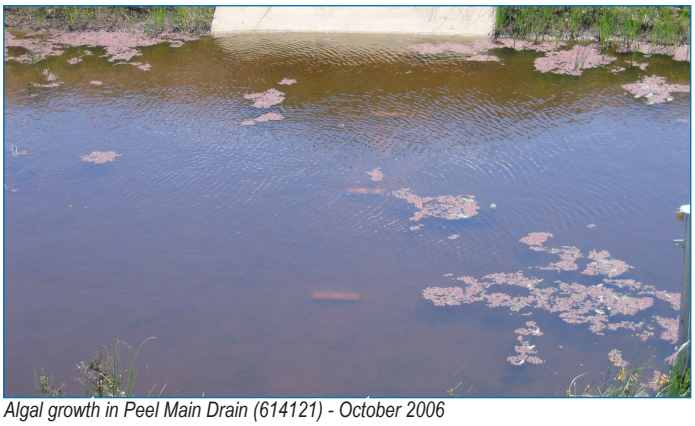
DIN is also derived from animal wastes and fertilisers but is readily available to plants and algae.

Of the five catchments that drain into the Serpentine River, Peel Main Drain had the second-highest percentage of DIN (14%).

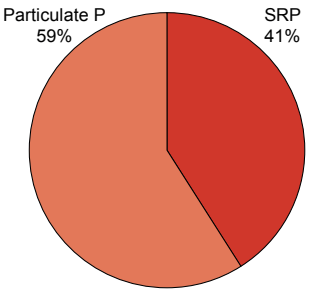
Phosphorus:

More than half the phosphorus (P) was present as particulate P, which consists of sediment-bound forms of P and organic waste materials.

Particulate P is not readily available for uptake by plants and algae, but may become available over time as organic matter decomposes or soil particles release bound phosphorus.



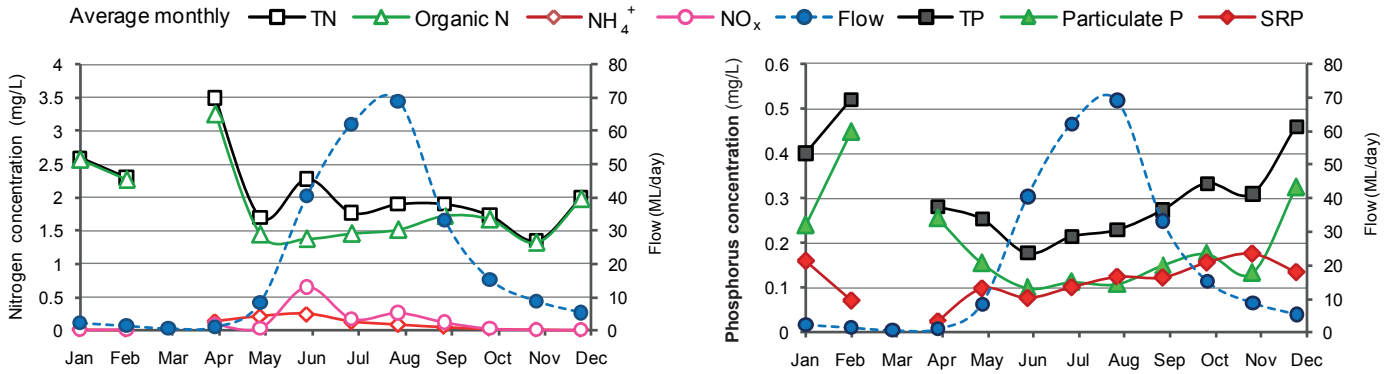
Algal growth in Peel Main Drain (614121) - October 2006



The remaining P was present as soluble reactive phosphorus (SRP). SRP is derived from fertilisers and animal wastes and is readily available for uptake by plants and algae.

Peel Main Drain had the lowest percentage of SRP of the catchments draining to the Serpentine River.

Seasonal variation in nutrient concentrations and riverine flow (2006–09)



Nitrogen:

TN and organic N concentrations were greatest during low flows. The high concentrations during the summer may have been caused by decaying plant matter or nutrient-rich groundwater seepage.

During winter increased flows diluted the organic N concentration, however average monthly NH_4^+ and NO_x concentrations increased, possibly due to excess fertilisers and animal wastes being flushed into the system.

Average monthly concentrations of TN exceeded ANZECC[1] guidelines throughout the year

ANZECC[1] guidelines were also exceeded in autumn and winter by average monthly NH_4^+ concentrations and in winter by average NO_x concentrations.

Phosphorus:

Average monthly particulate phosphorus concentrations were greatest during summer, possibly due to algal growth.

Average monthly SRP concentrations increased slightly with winter flows and were greater than particulate phosphorus concentrations in August and November.

All average monthly TP concentrations exceeded ANZECC[1] guideline values. Average monthly SRP concentrations also exceeded guidelines for all months except April.

	ANZECC 2000	Months exceeded
TN	1.2 mg/L	All*
NH_4^+	0.08 mg/L	Apr* – Aug
NO_x	0.15 mg/L	Jun – Aug
TP	0.065 mg/L	All*
SRP	0.04 mg/L	May – Feb*
*Nov – Apr (< 3 samples / month), no sample collected in March		

Related studies[2]

In 1994 and 1995 Peel Main Drain was investigated to determine possible ways to improve the assimilation of nitrogen and phosphorus within the catchment, and hence reduce their export into the Serpentine River. Several sites along the drain were sampled along with a detailed investigation of the northern eye of the Spectacles Wetland and a tributary draining one sheep feedlot.

The study calculated an annual export of 16.5 tonnes of nitrogen and 3 tonnes of phosphorus from the drain. The feedlot was identified as a major point source, with untreated effluent representing approximately a quarter of the nitrogen and a third of the phosphorus load being discharged from the drain. The wetland was found to be effective in reducing nutrients (inorganic forms more than particulate/organic forms).

Given the high flows during the winter months, it was deemed impractical to modify the drain – although the establishment of riparian vegetation along the minor headwater drains and wastewater management from point sources were recommended.

Peel Main Drain at Karnup Road (614121)

May 2007

September 2008

Downstream to culverts and Karnup Road Bridge - July 2002

Peel Main Drain at Zig Zag Road (614119)

Algal growth and reeds at Zig Zag Road - October 2006

Modelled results (1997–2007)[3]

This page reports results from the Streamflow Quality Affecting Rivers and Estuaries (SQUARE) model. It estimated flow, nitrogen and phosphorus loads from the 13 subcatchments of the Peel-Harvey estuary.

Nutrient sources

There were many diffuse sources of nutrient loads in the catchment. 'Horticulture' contributed 19% of the nitrogen and 53% of the phosphorus load despite accounting for less than 5% of the area. 'Intensive animal use' included one piggery and 10 poultry farms and although these only represented 0.3% of the area, they contributed 11% of the nitrogen and 13% of the phosphorus loads.

Septic tanks contributed a further 11% of the nitrogen and 4.5% of the phosphorus loads.

Annual exports to Peel Inlet

The Peel Main Drain catchment covers 1.4% of the area that drains to the Peel Inlet. On average it contributed to the Peel Inlet:

- 2% of the flow (11 GL/year)
- 4% of the nitrogen load (26 tonnes/year)
- 6% of the phosphorus load (4.5 tonnes/year).

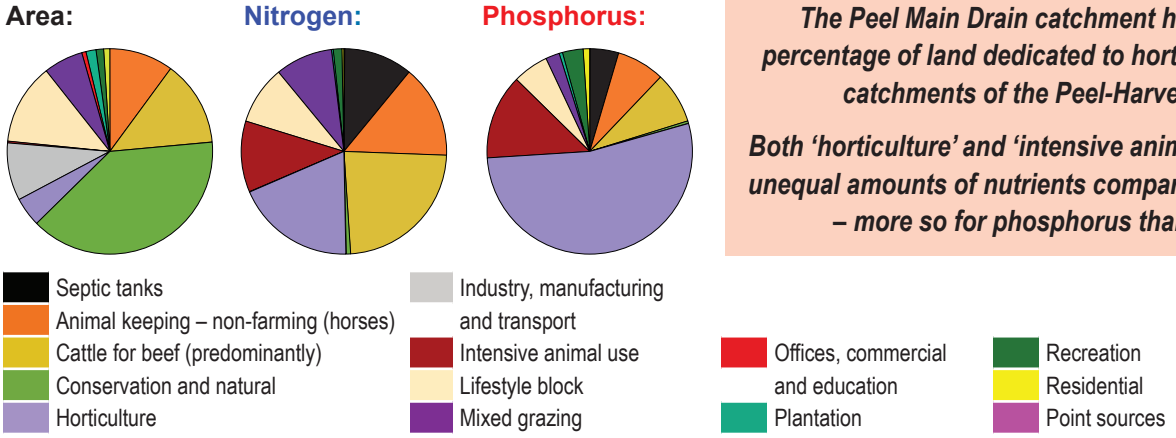
Remediation priority

The SQUARE-modelled data indicated that based on nutrient loads per cleared area (kg/ha/year):

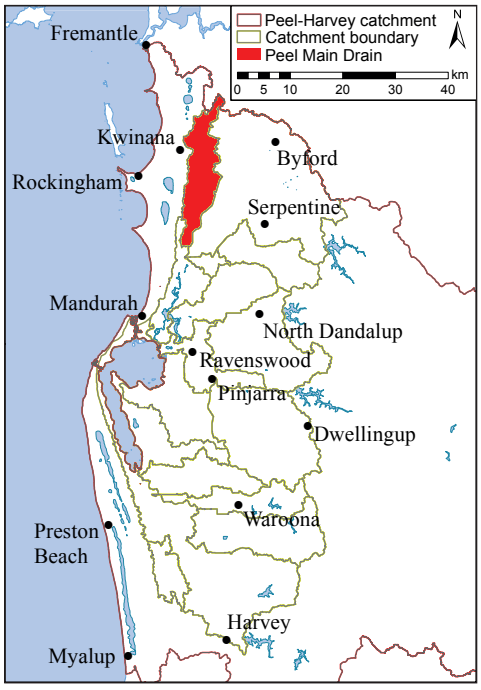
- Peel Main Drain catchment requires medium-priority nitrogen and phosphorus remediation action.

The Peel Main Drain catchment had the largest percentage of land dedicated to horticulture of all the catchments of the Peel-Harvey estuary.

Both 'horticulture' and 'intensive animal use' contribute unequal amounts of nutrients compared with their area, – more so for phosphorus than nitrogen.



How Peel Main Drain fits within the Peel-Harvey catchment: location and statistics



Catchment draining to estuary	Area (km²)	Flow (GL)	TN load (tonnes/ year)	TN load per cleared area (kg/ha)	TP load (tonnes/ year)	TP load per cleared area (kg/ha)
Peel Main Drain	**120**	**11**	**26**	**3.0**	**4.5**	**0.52**
Upper Serpentine	502	55	106	3.8	21	0.75
Dirk Brook – Punrak Drain	134	18	51	7.5	5.6	0.82
Nambeelup	143	19	44	3.6	10.5	0.86
Lower Serpentine	94	6.2	9.7	1.6	2.9	0.49
Mandurah	24	3.0	7.9	5.0	1.3	0.84
Upper Murray	6 752	286	204	0.51	4.9	0.01
Lower Murray, mid Murray and Dandalup	638	74	198	6.4	4.9	0.16
Coolup (Peel)	151	23	42	3.2	15	1.2
Subtotal Peel Inlet	**8 558**	**496**	**701**	**1.4**	**73**	**0.14**
Coolup (Harvey)	113	16	26	3.3	14	1.8
Mayfield Drain	119	19	33	3.1	7.1	0.67
Harvey	710	142	259	6.9	39	1.0
Meredith Drain	56	11	16	4.3	8.3	2.2
Subtotal Harvey Estuary	**998**	**188**	**334**	**5.6**	**69**	**1.2**
Total Peel-Harvey Estuary	**9 556**	**684**	**1 035**	**1.8**	**142**	**0.25**

References

[1] ANZECC & ARMCANZ 2000, *Australian guidelines for water quality monitoring and reporting,* National Water Quality Management Strategy, Paper no. 7, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

[2] Chambers, JM & Hale, JA 1999, *Improving in-stream assimilation of nutrients in the Peel Main Drain*, Western Australia, Environmental Science, Murdoch University, Murdoch, Western Australia.

[3] Kelsey, P, Hall, J, Kretschmer, P, Quinton, B & Shakya D 2010, *Hydrological and nutrient modelling of the Peel-Harvey catchment*, Water Science Technical Series, Report no. 33, Department of Water, Western Australia.

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