Government of **Western Australia**
Department of **Water**

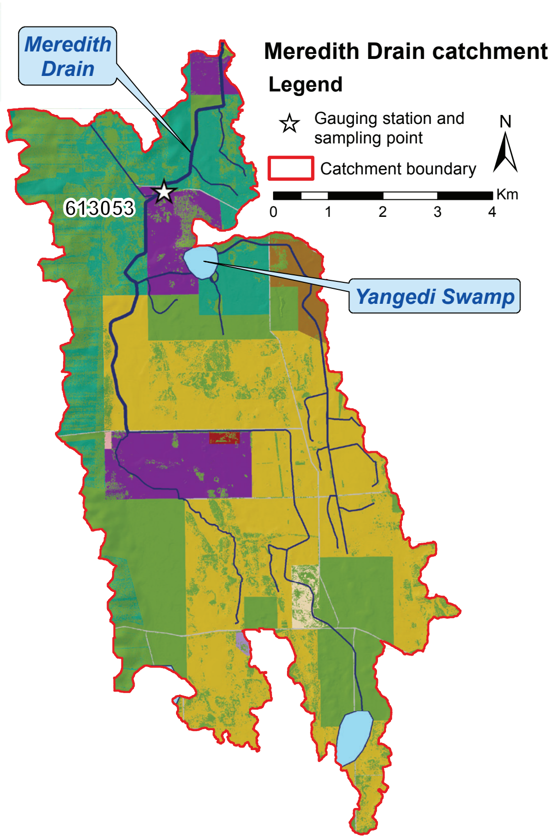
Peel-Harvey catchment
Nutrient report 2010

Meredith Drain

The Meredith Drain catchment is bordered by the Harvey catchment to the east and the Myalup State Forest to the west. It discharges to the Harvey River downstream of Samson South Drain.

The catchment's monitoring site is located at the Johnston Road flow gauging station (613053). The drain has been monitored since 1982 and has a history of very high total nitrogen and phosphorus concentrations. Before 1987 Meredith Drain flowed year-round. Since then it has ceased to flow from around January to June, with the exception of 1993 and 1999 when it flowed year-round.

The Meredith Drain catchment lies on subdued dune-swale terrain, comprising of leached sands. Half of the catchment is subject to seasonal inundation and most of the catchment has a high or very high risk of phosphorus leaching to waterways (90%).



Two thirds of the catchment has been cleared, mostly for agriculture such as stock grazing and plantations. There is also a piggery present.

Meredith Drain, Johnston Road – December 2006

Land use classification (2006)		Area (km²)	Area (%)
Cattle for beef (predominantly)		20	36
Cattle for dairy		1.1	2.1
Conservation and natural		20	36
Horticulture		0.07	0.13
Industry, manufacturing and transport		0.49	0.88
Intensive animal use		0.11	0.19
Lifestyle block		0.37	0.66
Mixed grazing		5.2	9.2
Plantation		8.5	15
Viticulture		0.04	0.07
Total		**56**	**100**

In 2009 Meredith Drain had the third-highest median TN concentration and second-highest median TP concentration of the 13 sites sampled in the Peel-Harvey catchment.

Nutrient summary: median concentrations, loads and status classification at 613053

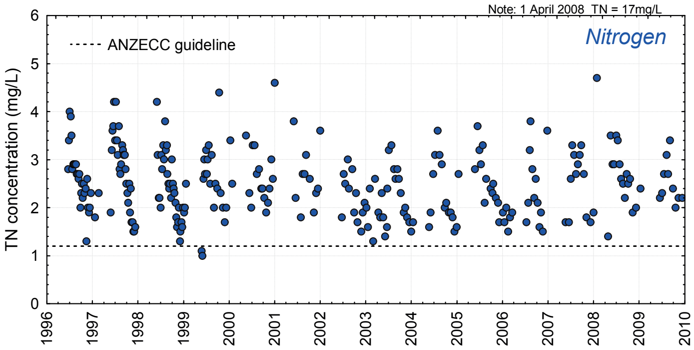
Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual flow (GL)	6.3	4.1	2.8	5.1	4.0	0.64	2.1	0.90	3.5	6.2	0.75	2.2	3.5	1.4
TN median (mg/L)	2.7	2.8	2.4	2.5	2.5	2.7	2.3	2.3	2.0	2.6	1.9	2.7	2.7	2.4
TP median (mg/L)	0.58	0.55	0.56	0.50	0.32	0.58	0.32	0.34	0.42	0.70	0.25	0.50	0.44	0.51
TN load (t/year)	20	13	8.2	15	11	1.6	5.8	2.3	10	18	2.1	6.2	10	3.9
TP load (t/year)	5.1	2.9	2.0	3.6	2.8	0.31	1.2	0.58	2.4	4.4	0.37	1.4	2.3	0.81

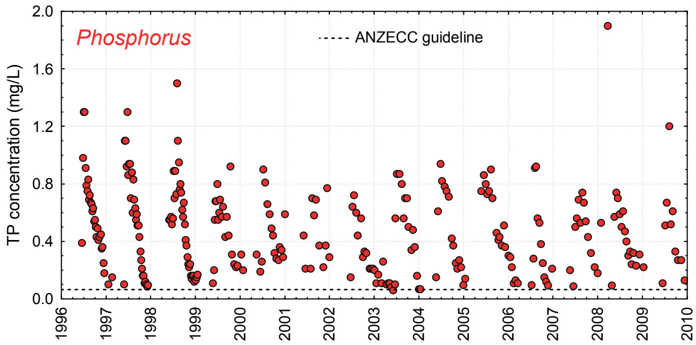
Status classification: Low, Moderate, High, Very high

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

TN = total nitrogen TP = total phosphorus

Total nitrogen (TN) and total phosphorus (TP) concentrations (1996–2009)





TN concentration:

Between 1996 and 2009 all but two TN samples (1999) exceeded the ANZECC[1] guideline for the protection of lowland rivers (1.2 mg/L).

On average 5.7% of samples exceeded 3.6 mg/L, three times the guideline. The percentage of samples exceeding 3.6 mg/L (three times the ANZECC guideline) was similar between 1996 and 2004 (5.8%) and 2005 and 2009 (5.4%).

TN trend:

Trend analysis was undertaken using data from 2005 to 2009 inclusive.

Once the data were adjusted for flow an emerging increasing trend (0.08 mg/L/year) was detected.

TP concentration:

Between 1996 and 2009, all but one TP sample (2003) exceeded the ANZECC[1] guideline for the protection of lowland rivers (0.065 mg/L).

On average 27% of samples exceeded ten times the guideline (0.65 mg/L). The annual percentage of samples greater than 0.65 mg/L ranged between 7.7% (2002) and 47% (2005).

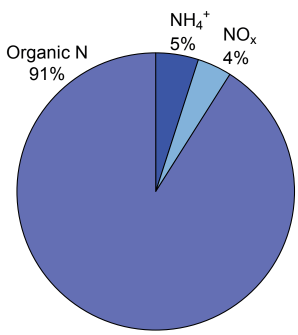
Between 1996 and 2004, 29% of samples exceeded 0.65 mg/L; this decreased slightly to 23% of samples between 2005 and 2009.

TP trend:

Trend analysis was undertaken using data from 2005 to 2009 inclusive.

Once the data were adjusted for flow and seasonality no trend was detected.

Nutrient fractions (2005–2009)



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).

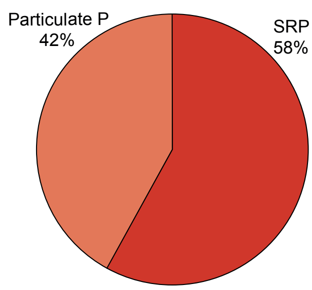
DIN is also derived from animal wastes and fertilisers but is readily available to plants and algae.

Meredith Drain, along with Coolup South Main Drain, had the equal-highest percentage of organic N of the catchments draining to the Harvey Estuary.

Phosphorus:

Over half of the phosphorus (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.

The remaining P was present as particulate P which consists of sediment bound forms of P and organic waste materials.

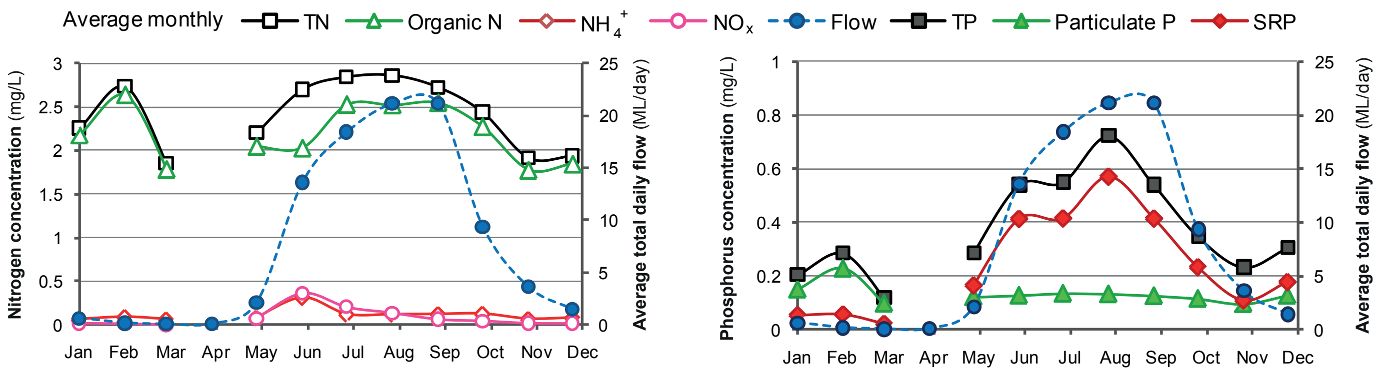


Particulate P is not readily available for uptake by plants and algae, but may become available over time as particles decompose or release bound phosphate.

Meredith Drain had the highest percentage of SRP of the catchments draining to the Harvey Estuary. It was one of four catchments with SRP greater than 50%; the other three drain to the Serpentine River (Gull Road - 87%, Nambeelup Brook - 59% and Dirk Brook – Punrak Drain - 58%).

Knot weed growth in Meredith Drain, downstream of Johnston Road, looking upstream to the gauging station – March 2009

Seasonal variation in nutrient concentrations and riverine flow (2005–2009)



Nitrogen:

Average monthly nitrogen concentrations were dominated by organic N throughout the year. Increases in average organic N occurred both in winter with high flows and during summer due to algal growth.

Winter flows also increased the average monthly DIN concentration.

Average monthly concentrations of TN exceeded the ANZECC[1] guideline throughout the year, while average monthly NH_4^+ concentrations only fell below the guideline during late spring/summer. NO_x briefly exceeded guidelines after the onset of winter flows.

	ANZECC 2000	Months exceeded
TN	1.2 mg/L	All*
NH_4^+	0.08 mg/L	Feb, Jun – Oct
NO_x	0.15 mg/L	Jun – Jul
TP	0.065 mg/L	All*
SRP	0.04 mg/L	May – Feb
*Mar – April (< 3 samples / month)		

Phosphorus:

Average monthly total phosphorus concentrations were greatest during winter. Concentrations also increased in summer possibly due to algal blooms.

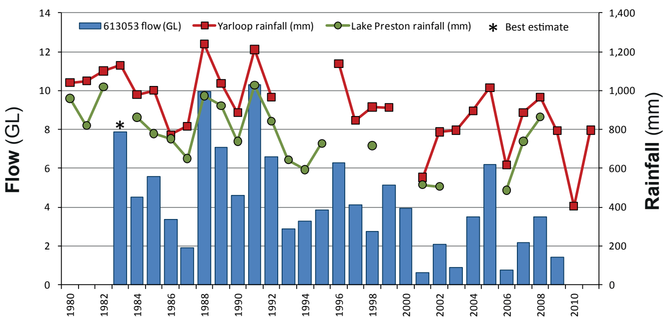
Average monthly SRP concentrations were greater than particulate P concentrations with the exception of summer.

All average monthly TP concentrations exceeded the ANZECC[1] guideline. Average monthly SRP concentrations also exceeded the guideline for most of the year except during March.

Meredith Drain at Johnston Road – March 2005

Long term flow and rainfall (1980 – 2011)

Flow has been measured at Meredith Drain since April 1982, with a brief cessation between December 1982 and March 1983. The Bureau of Meteorology records daily rainfall at Yarloop (9624), to the east of the Johnston Road gauging station. Ongoing records are available from 1947, however data from 1993 and 1994 are unavailable and intermittent thereafter. Rainfall data was also collected to the west at lake Preston between 1982 and 2008 (except 2003 and 2004).



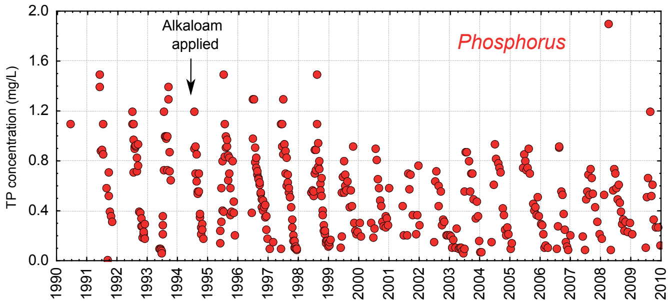
Both total annual flow and rainfall appear to be declining. Before 1987 Meredith drain flowed year-round, since then it ceases to flow from around January to June. Total annual flow ranged from 0.64 GL in 2001 to 10 GL in 1991 and appears to be closely correlated to rainfall.

Rainfall was greater at Yarloop where it ranged from 405 mm (2000) to 1241 mm (1988); to the west at Lake Preston rainfall ranged from 63 mm (2000) to 1019 mm (1982).

Alkaloam[2]

Phosphorus export from Meredith Drain has been an ongoing concern for many years. In 1994 Alkaloam (also known as Bauxite residue or red mud) was applied to the majority of farmed land within the catchment. This product binds phosphorus to prevent it leaching to waterways

A decline in TP concentrations was observed after the Alkaloam was applied. Trend analysis confirmed the observation with a decreasing trend (0.02 mg/L) in the flow adjusted seasonal data (1995 to 2000).



Weed growth downstream of Meredith Drain – January 2009

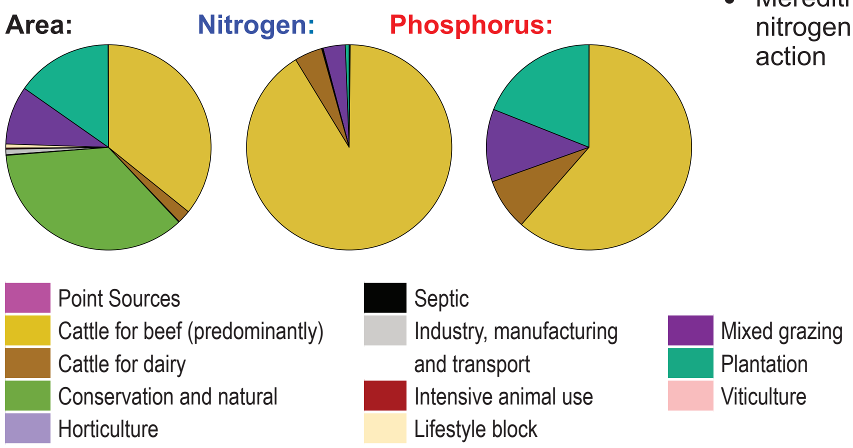
Modelled results (1997–2007)[3]

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

Nutrient sources

The main source of nitrogen load within the catchment was ‘cattle for beef’ (91%). ‘Cattle for dairy’ and ‘mixed grazing’ contributed a further 8%.

While ‘cattle for beef’ was also the main source of phosphorus load (61%), ‘plantations’, ‘mixed grazing’ and ‘cattle for dairy’ were also substantial (19%, 11.5% and 8% respectively).



Annual exports to Peel Inlet

The Meredith Drain catchment is 5.6% of the area that drains to the Harvey Estuary. On average it contributed to the Harvey Estuary:

- 6% of the flow (11 GL/year)
- 5% of the nitrogen load (16 tonnes/year)
- 12% of the phosphorus load (8 tonnes/year).

Values may differ to those on the front page due to different analysis techniques.

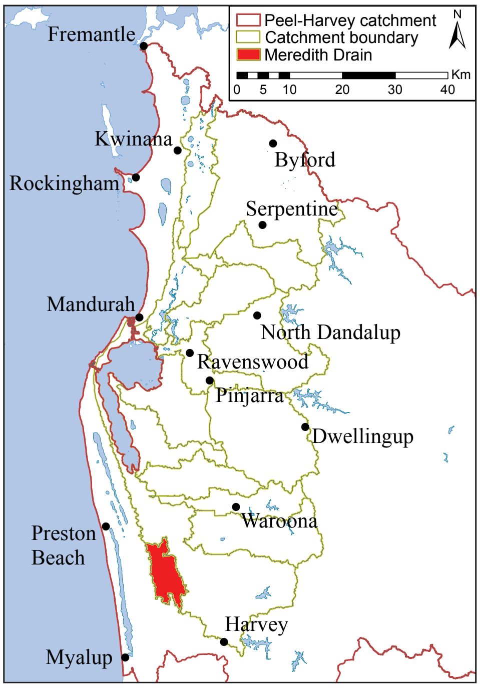
Remediation priority

The SQUARE-modelled data indicated that based on nutrient loads per cleared area (kg/ha/year)[1]:

- Meredith Drain catchment requires medium-priority nitrogen and high-priority phosphorus remediation action

Meredith Drain catchment had the highest phosphorus load per cleared area of all the Peel-Harvey catchments.

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



Catchment draining to estuary	Area (km^2)	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] Water and Rivers Commission 2000, *Nutrients in tributary inflows to the Peel-Harvey estuarine system, Western Australia: Status and Trend,* Water Resource Technical Series, Report no. 23, Water and Rivers Commission, 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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