Sewage Treatment System Impact Monitoring Program

Hawkesbury-Nepean River Interpretive Report 2020 (Volume 2: Appendices)

Trends in WWTP nutrient loads and water quality of the Hawkesbury-Nepean River

Shimsco Consulting Pty Ltd

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Appendix A : Monitoring sites and methods of measurements

Table A-1 List of WWTPs operating in the Hawkesbury-Nepean River catchment since 1995

WWTP	Discharge location	Operating and upgrade history	Data availability
Picton[1]	Stonequarry Creek and then to Nepean River	• Operating since November 2000 • More precautionary discharges in recent years • Emergency Operations Protocol discharges (2019-2020)	No missing data, but discharges were made infrequently
West Camden	Matahil Creek and then to Nepean River	• Nitrogen upgrade complete by October 2008. Phosphorus upgrade complete by February 2009 (reduced from 1 mg/L to 0.2 mg/L) • Increased nitrogen licence exceedances plus infrequent phosphorus licence exceedances since 2015 in relation to EPLs	Consistent, no data gaps
Wallacia	Warragamba River and then to Nepean River	• Operating since September 2006	Consistent, no data gaps
Penrith	Boundary Creek and then to Nepean River. Wastewater is also transferred to St Marys AWTP for advance treatment and discharged into Boundary Creek (from mid-2010)	• Phosphorus upgrade in 2001 • Nitrogen and phosphorus upgrade in 2010 • A portion of wastewater transferred to the St Marys AWTP for high level treatment from June 2010 • St Marys AWTP commissioned in June 2010 • Increasing nitrogen licence exceedances since 2015	Consistent, no data gaps
Winmalee	Unnamed Creek and then to Nepean River	• North Katoomba and Wentworth Falls WWTPs decommissioned and transferred to Winmalee in June 1996 • Winmalee phosphorus treatment upgrade in December 1999 • Blackheath WWTP decommissioned and transferred to Winmalee in June 2008	Consistent, no data gaps
North Richmond	Redbank Creek and then to Hawkesbury River	• Phosphorus upgrade in 1999 • Both nitrogen and phosphorus upgrade in 2010 after AWTP commissioning	Consistent, no data gaps
Richmond[2]	Rickabys Creek and then to Hawkesbury River	• Increased recycled water production from July 2002 • Both nitrogen and phosphorus upgrade in March 2005	Consistent, no data gaps
St Marys	Tributary of South Creek and then to Hawkesbury River. Advanced treated wastewater also discharged to Boundary Creek via Penrith (from mid-2010)	• Nitrogen and phosphorus upgrade in December 1999 • A portion of wastewater transferred to the St Marys AWTP for high level treatment from June 2010 • St Marys AWTP commissioned in June 2010	Consistent, no data gaps
Quakers Hill	Breakfast Creek to South Creek and then to Hawkesbury River. Wastewater is also transferred to St Marys AWTP for advance treatment and discharged into Boundary Creek (from mid-2010)	• Phosphorus upgrade in December 1998 • A portion of wastewater transferred to the St Marys AWTP for high level treatment from June 2010 • St Marys AWTP commissioned in June 2010	Consistent, no data gaps

WWTP	Discharge location	Operating and upgrade history	Data availability
Riverstone	Eastern Creek to South Creek and then to Hawkesbury River	• Treatment upgrade to reduce nitrogen and phosphorus in December 1999 • WWTP reaching the design capacity, June 2010 • Treatment upgrade to reduce the nutrient load in 2019	Consistent, no data gaps
Castle Hill	Cattai Creek and then to Hawkesbury River	• Phosphorus upgrade in 1994 • Round Corner WWTP decommissioned and transferred to Castle Hill WWTP in December 2000	Consistent, no data gaps
Rouse Hill	Second Ponds Creek to Cattai Creek and then to Hawkesbury River	• Operating since July 1994 • Nitrogen upgrade in December 2009 • Phosphorus upgrade in June 2006	Consistent, no data gaps
West Hornsby	Waitara Creek to Berowra Creek and then to Hawkesbury River	• Operating since 1994 • Upgrade in 2003-05 (mostly nitrogen)	Consistent, no data gaps
Hornsby Heights	Calna Creek to Berowra Creek and then to Hawkesbury River	• Phosphorus upgrade in 1993 • Upgrade in 2003-05 (mostly nitrogen)	Consistent, no data gaps
Brooklyn	Hawkesbury River at 14m depth at old road bridge adjacent to Kangaroo Point	• Operating since 2007	Consistent, no data gaps

[1] Mainly reused for onsite agricultural irrigation, wet weather discharges only

[2] Mostly reused since 2002 at University of Western Sydney Richmond campus and Richmond Golf Club; excess overflows to Rickabys Creek

Table A-2 List of decommissioned WWTPs between 1996 and 2008 in the Hawkesbury-Nepean River

WWTP	Discharge location	Operating and upgrade history	Data availability
Warragamba	Meggaritys Creek to Warragamba River and then to Nepean River	Phosphorus upgrade in 2002 Decommissioned and transferred to Wallacia WWTP in August 2006	Consistent, no data gaps
Glenbrook	Lapstone Creek and then to Nepean River	Decommissioned and transferred to Penrith WWTP in August 2005	Consistent, no data gaps
Blackheath	Hat Hill Creek and then to Grose River	Phosphorus upgrade in 2001 Decommissioned and transferred to Winmalee WWTP in June 2008	Consistent, no data gaps
North Katoomba	Katoomba Creek and then to Grose River	Decommissioned and transferred to Winmalee WWTP in June 1996	Consistent, but very limited data
Wentworth Falls	Tributary of Blue Mountains Creek and then to Grose River	Decommissioned and transferred to Winmalee WWTP in June 1996	Consistent, but very limited data
Round Corner	O'Hares Creek to Cattai Creek and then to Hawkesbury River	Decommissioned and transferred to Castle Hill WWTP in December 2000	Consistent, no data gaps

Note: This list excludes two other inland decommissioned WWTPs (Mount Victoria and South Katoomba) which were operating in upstream Lake Burragorang catchment

Table A-3 List of key receiving water quality monitoring sites (Hawkesbury-Nepean River and tributaries) with monitoring history

Site code	Description	Latitude	Longitude	Data collection history
N92	Nepean River at Maldon Weir, upstream of Stonequarry Creek and Picton WWTP	-34.20373	150.63018	Consistent: 1995-2020
N91#	Nepean River at Maldon Bridge, downstream of Stonequarry Creek and Picton WWTP	-34.20221	150.63219	Consistent: 1995-2020
N78#	Nepean River at Macquarie Grove Rd, upstream of Matahil Creek and West Camden WWTP	-34.0413	150.695	2003-2011 and 2018-2019
N75	Nepean River at Sharpes Weir, downstream of Matahil Creek and West Camden WWTP	-34.0415	150.677	Consistent: 1995-2020
N67	Nepean River at Wallacia Bridge, upstream of Warragamba River	-33.8670	150.636	2008-2020
N57	Nepean River at Penrith Rowing Club ramp, upstream of Penrith Weir and Penrith WWTP	-33.7432	150.684	Consistent: 1992-2020
N53#	Nepean River at BMG Causeway, downstream of Penrith WWTP	-33.7333	150.6798	Up to 2013
N51	Nepean River opposite Fitzeralds Creek	-33.7150	150.657	2008-2020
N48/N48A*	Nepean River at Smith Road, Princes farm, upstream of Winmalee WWTP	-33.6701	150.663	Consistent: 1994-2020
N464#	Lagoon on Unnamed Creek downstream of Winmalee WWTP before Nepean River confluence	-33.6623	150.6646	1992, 2015-2020
N44	Nepean River at Yarramundi Bridge, downstream of Winmalee WWTP	-33.6146	150.698	1994-2001, 2008-2020
N42	Hawkesbury River at North Richmond Water Filtration Plant, downstream of Grose River	-33.5868	150.723	Consistent: 1996-2020
N39	Hawkesbury River at Freemans Reach, downstream of North Richmond WWTP	-33.5700	150.747	Consistent: 1996-2020
NS04/NS04A*	Lower South Creek at Fitzroy pedestrian bridge, Windsor	-33.6088	150.824	2008-2020
N35	Hawkesbury River at Wilberforce, Butterfly farm, downstream of South Creek	-33.5730	150.838	Consistent: 1995-2020
NC11/NC11A*	Lower Cattai Creek at Cattai Road Bridge, 100m downstream of bridge	-33.5591	150.907	2008-2020
N3001	Hawkesbury River Off Cattai State Recreation Area (SRA), downstream of Cattai Creek	-33.5583	150.889	Consistent: 1995-2020
N26	Hawkesbury River at Sackville Ferry, downstream of Cattai Creek	-33.5007	150.876	Consistent: 1995-2020

Site code	Description	Latitude	Longitude	Data collection history
N2202	Lower Colo River at Putty Road Bridge, Reference site	-33.4325	150.829	2008-2020
N18	Hawkesbury River at Leets Vale, opposite Leets Vale Caravan Park, downstream of Colo River	-33.4280	150.948	Consistent: 1996-2020
NB13	Berowra Creek at Calabash Bay (Cunio Point)	-33.5869	151.118	2002-2020
NB11	Berowra Creek, Off Square Bay (Oaky Point)	-33.5667	151.148	Consistent: 1995-2020

* Use latest site code N48A, N04A, NC11A in all plots and tables

Not a STSIMP (2010) monitoring site, but monitored routinely or infrequently for many years for Sydney Water's operational purpose

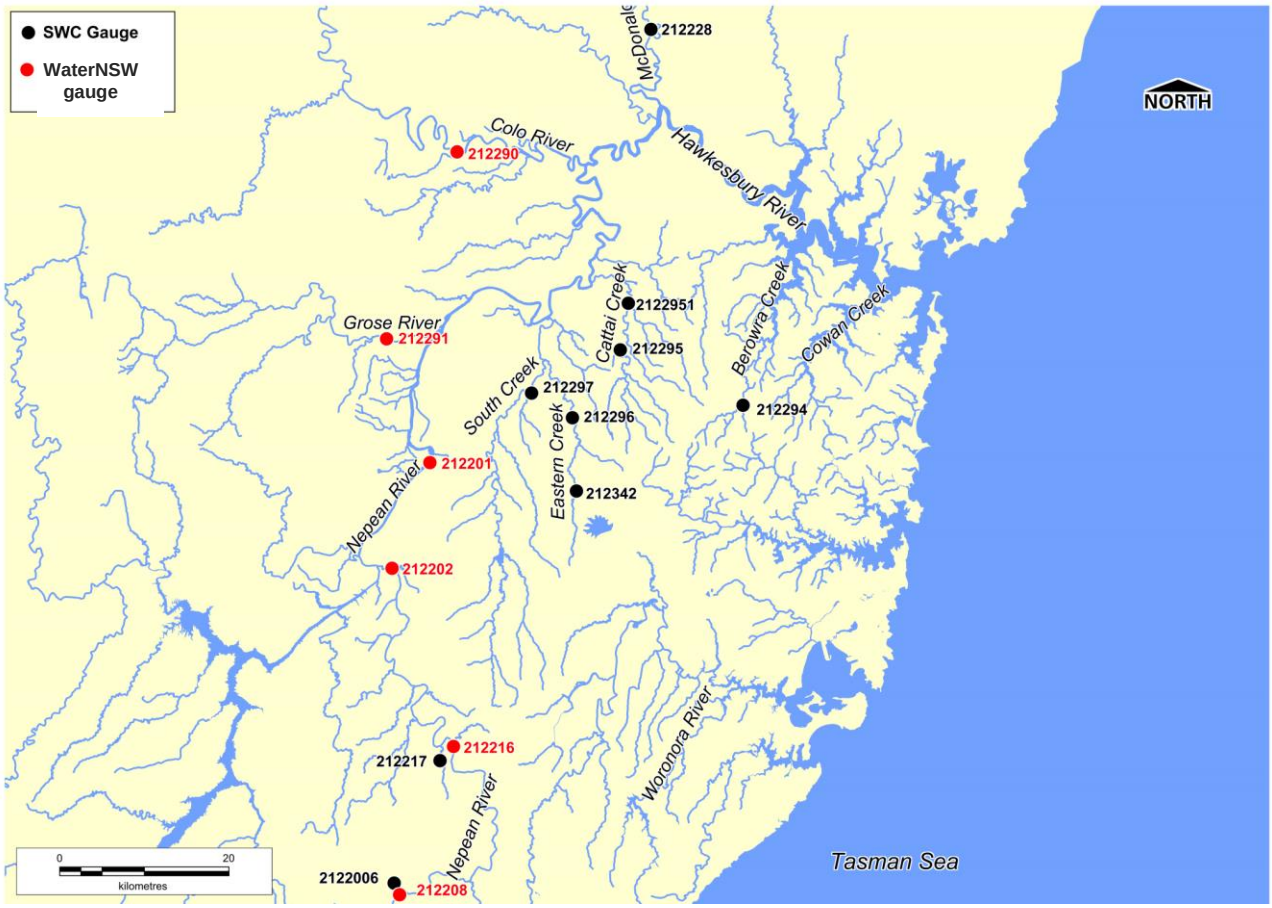


Figure A-1 Flow monitoring locations in Hawkesbury-Nepean River catchment

Table A-4 List of hydrometric monitoring sites

Site codes	Name	Description	Owner
212208	Maldon Weir	Nepean River at Maldon Weir	WaterNSW
2122006	Stonequarry Creek	Stonequarry Creek, downstream of Picton WWTP discharge point	Sydney Water
212216	Camden Weir	Nepean River at Camden Weir	WaterNSW
212217	Matahil Creek	Matahil Creek, downstream of West Camden WWTP discharges	Sydney Water
212202	Wallacia	Nepean River at Wallacia	WaterNSW
212201	Penrith Weir	Nepean River at Penrith Weir	WaterNSW
212291	Grose River	Grose River at Burralow	WaterNSW
212297	South Creek RR	South Creek at Richmond Road	Sydney Water
212296	Eastern Creek GR	Eastern Creek at Garfield Road	Sydney Water
212342	Eastern Creek RR	Eastern Creek at Richmond Road	Sydney Water
212295	Cattai Creek M	Cattai Creek at Maralaya	Sydney Water
2122951	Cattai Creek CRR	Cattai Creek at Cattai Ridge Rd	Sydney Water
212290	Colo River	Colo River at Upper Colo	WaterNSW
212228	Mcdonald River	Mcdonald River at St Albans	Sydney Water
212294	Berowra Creek	Berowra Creek at Galston Gorge	Sydney Water

Table A-5 List of wastewater discharge volume and quality analytes and method of measurements

Analytes	Detection limit	Unit of measurement	Methods
Treated wastewater discharge or bypass volume		KL/day	*In-situ* data logger
Total nitrogen	0.05	mg/L	APHA (2017) 4500- N_{org}/NO_3^- I/J
Ammonia (low level)	0.01	mg/L	APHA (2017) 4500-NH_3 H
Ammonia (high level)	0.1	mg/L	As above
Oxidised nitrogen (low level)	0.01	mg/L	APHA (2005) 4500-NO3 I
Oxidised nitrogen (high level)	0.1	mg/L	As above
Total phosphorus	0.01	mg/L	APHA (2017) 4500-P – H/J
Soluble Reactive Phosphorus (SRP)	0.01	mg/L	APHA (2017) 4500-P – H/J

Table A-6 List of water quality analytes and method of measurements

Analytes	Detection limit	Unit of measurement	Method/Reference	Place of measurement
Ammonia nitrogen	0.01	mg/L	APHA (2017) 4500-NH3 H	Laboratory
Oxidised nitrogen	0.01	mg/L	APHA (2017) 4500 NO3 I	Laboratory
Total nitrogen	0.05	mg/L	APHA (2017) 4500- Norg/NO3-	Laboratory
Total filterable phosphorus	0.002	mg/L	APHA (2005) 4500-P – H	Laboratory
Total phosphorus	0.002	mg/L	APHA (2017) 4500-P H	Laboratory
Chlorophyll-*a*	0.2	µg/L	APHA (2017) 10200-H ½	Laboratory
Algal biovolume and cell count *	-	mm^3/L and cells/mL	APHA (2005) 10200-F	Laboratory
Conductivity	-	µS/cm	WTW Meter	Field
Dissolved oxygen	-	% sat	WTW Meter	Field
pH	-	pH unit	WTW Meter	Field
Turbidity	-	NTU	Hach Turbidity Meter (White light)	Field
Water temperature	-	ºC	Yeo-Kal Meter or WTW	Field

* when chlorophyll-*a* exceeds 7 µg/L

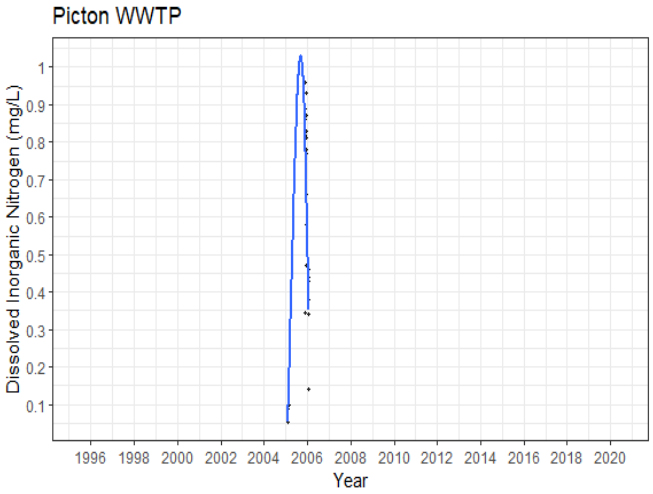
Appendix B : Temporal trends in WWTP nutrient concentrations and loads

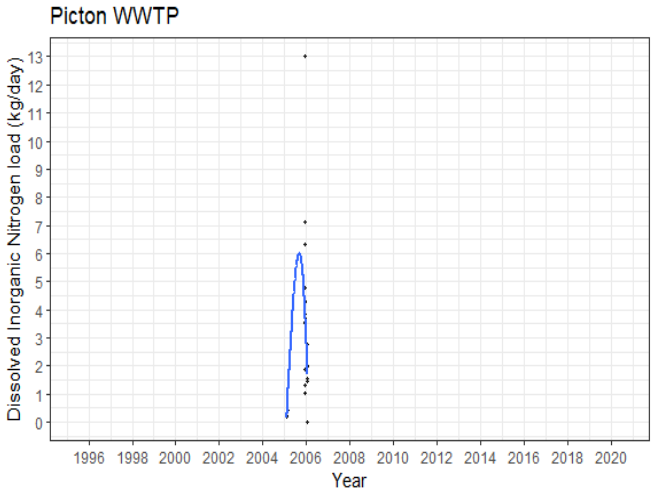
Plots for the inland WWTPs are presented following upstream to downstream locations of the Hawkesbury-Nepean River:

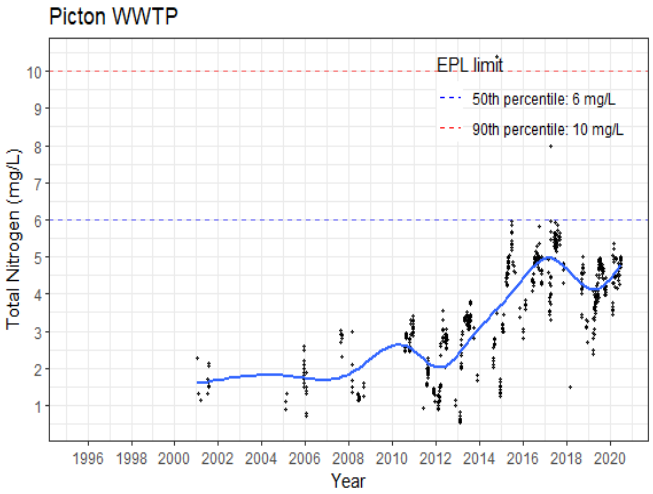
- Picton WWTP
- West Camden WWTP
- Wallacia WWTP
- Penrith WWTP
- St Marys AWTP
- Winmalee WWTP
- North Richmond WWTP
- Richmond WWTP
- St Marys WWTP
- Quakers Hill WWTP
- Riverstone WWTP
- Rouse Hill WWTP
- Castle Hill WWTP
- West Hornsby WWTP
- Hornsby Heights WWTP
- Brooklyn WWTP

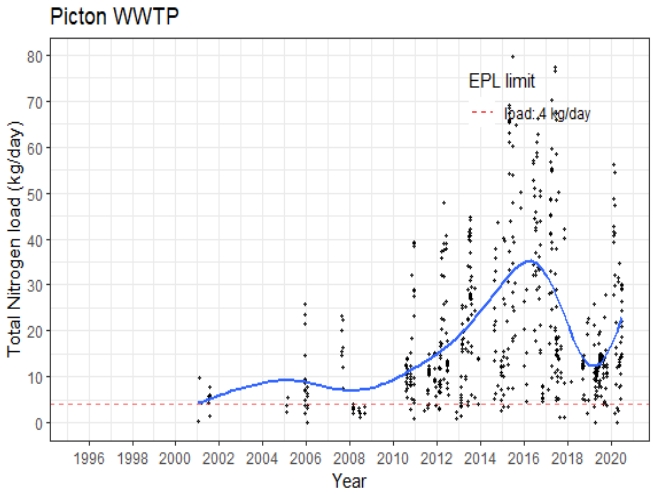
Nutrient concentration and load variables are presented in following order:

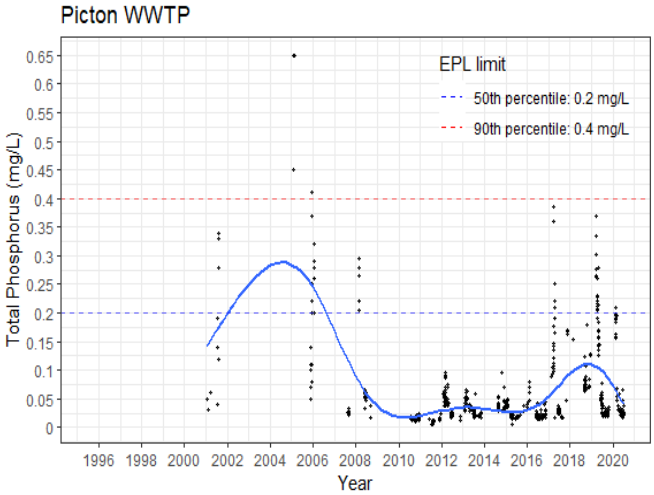
- Dissolved inorganic nitrogen
- Total nitrogen
- Total phosphorus

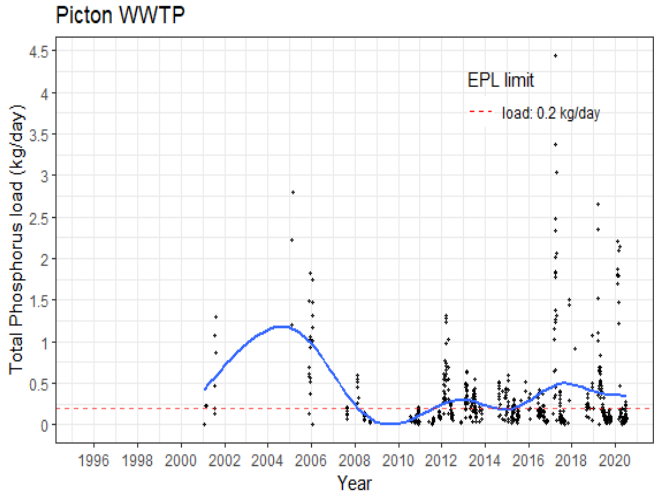

Picton WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

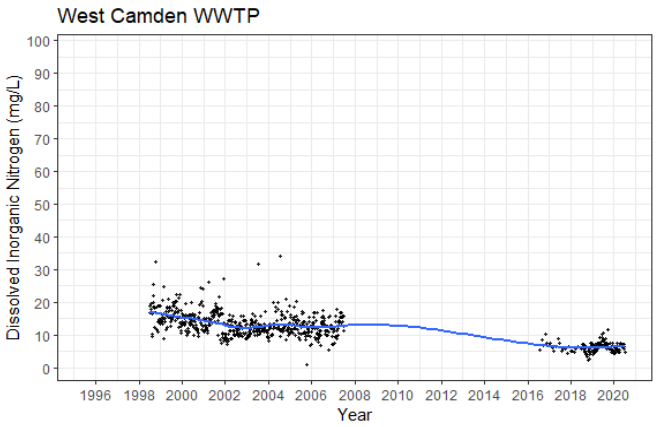

Picton WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

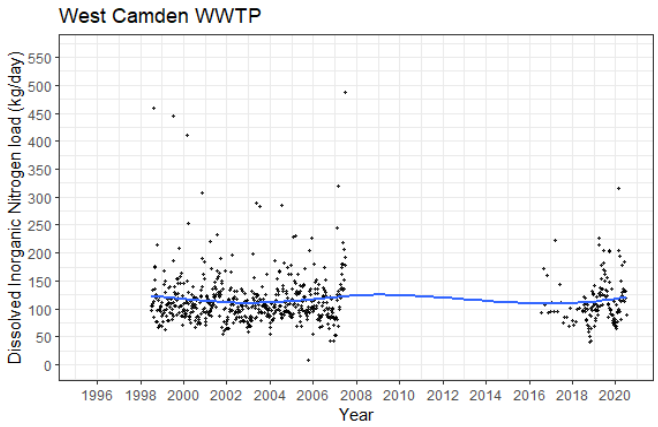

Picton WWTP
EPL limit
50th percentile: 6 mg/L
90th percentile: 10 mg/L
Total Nitrogen (mg/L)
Year

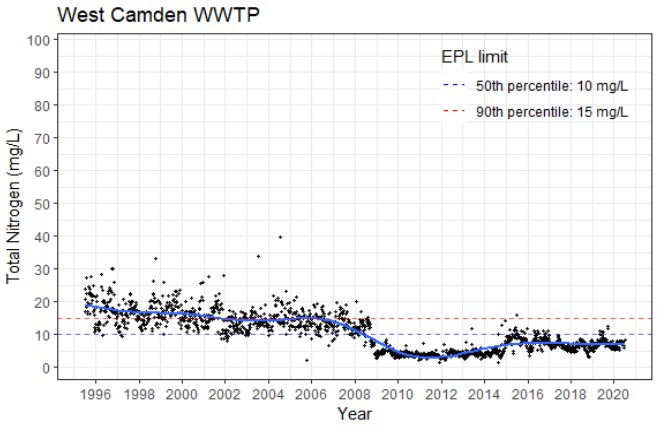

Picton WWTP
EPL limit
load: 4 kg/day
Total Nitrogen load (kg/day)
Year

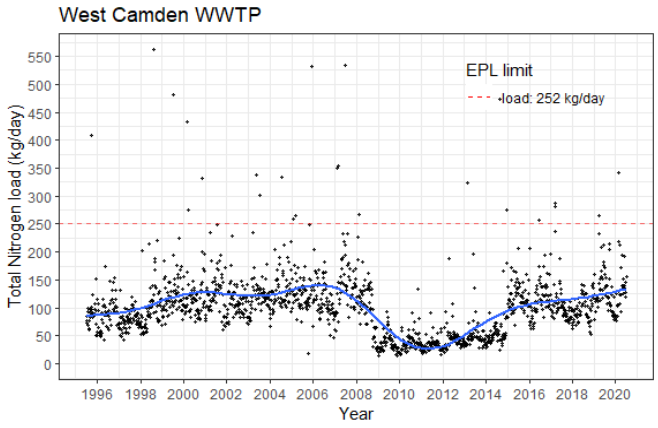

Picton WWTP
EPL limit
50th percentile: 0.2 mg/L
90th percentile: 0.4 mg/L
Total Phosphorus (mg/L)
Year

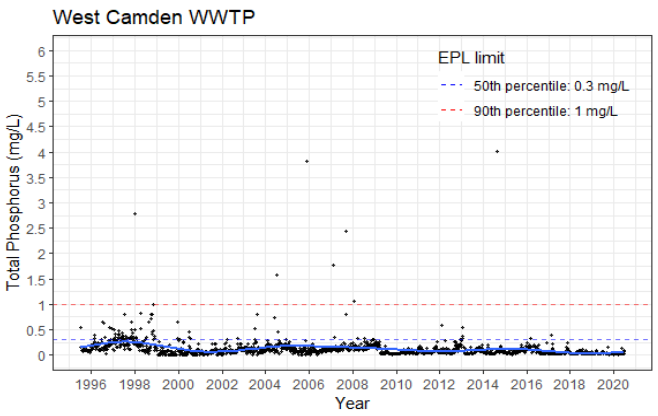

Picton WWTP
EPL limit
load: 0.2 kg/day
Total Phosphorus load (kg/day)
Year

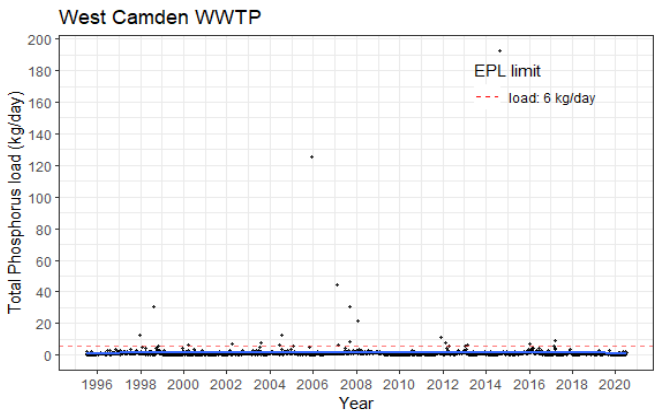

West Camden WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

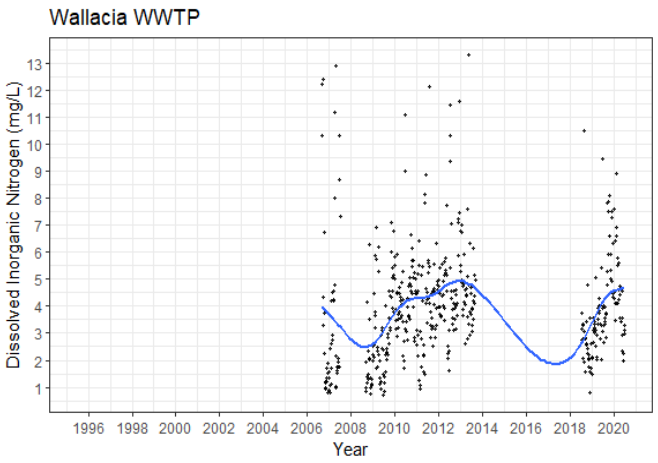

West Camden WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

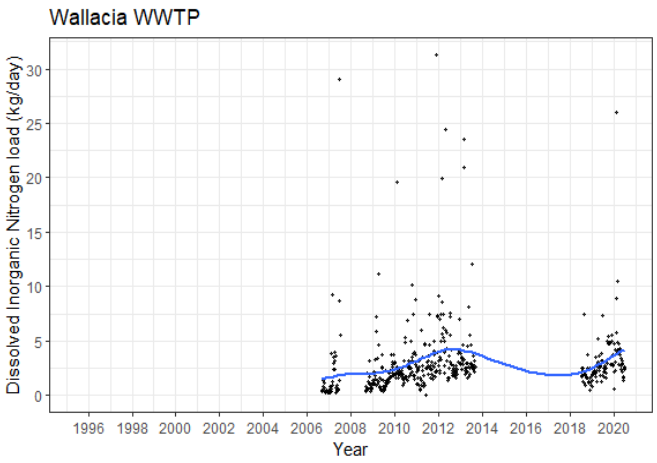

West Camden WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

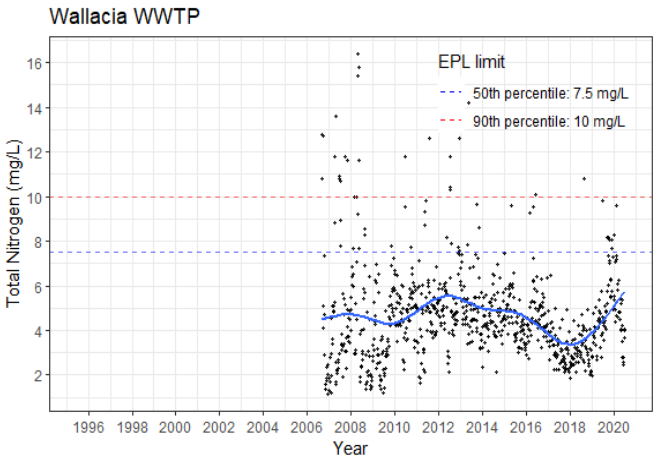

West Camden WWTP
EPL limit
load: 252 kg/day
Total Nitrogen load (kg/day)
Year

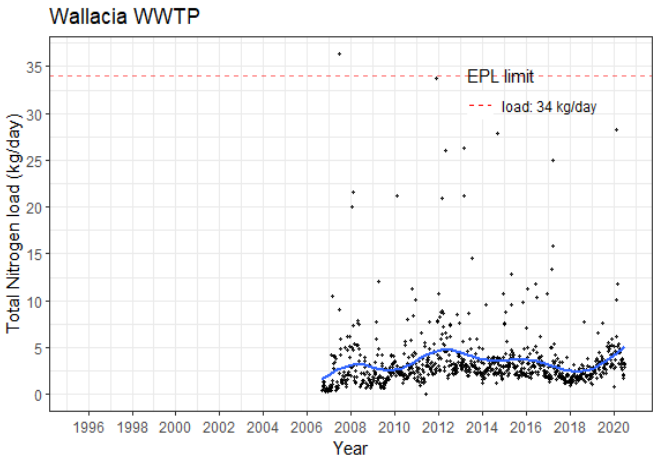

West Camden WWTP
EPL limit
50th percentile: 0.3 mg/L
90th percentile: 1 mg/L
Total Phosphorus (mg/L)
Year

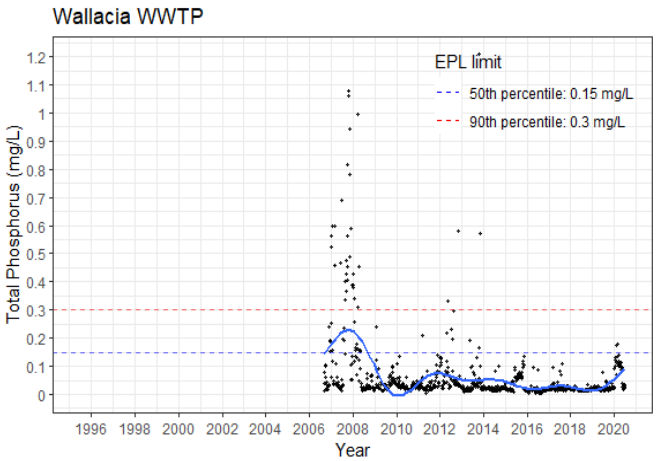

West Camden WWTP
EPL limit
load: 6 kg/day
Total Phosphorus load (kg/day)
Year

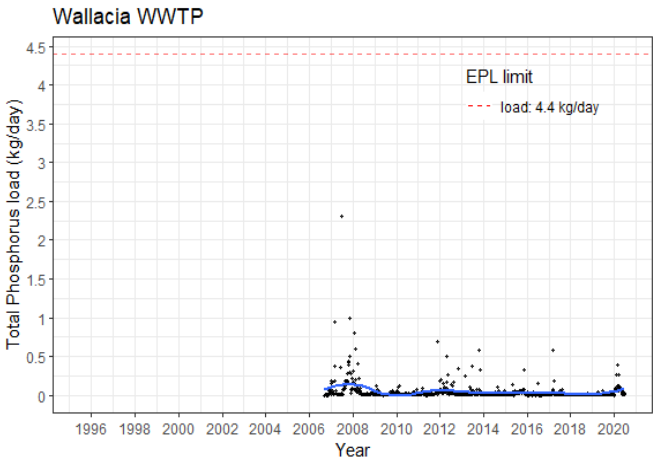

Wallacia WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

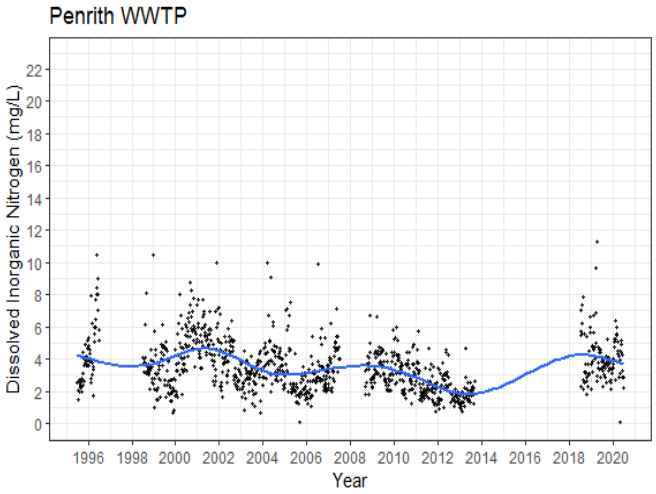

Wallacia WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

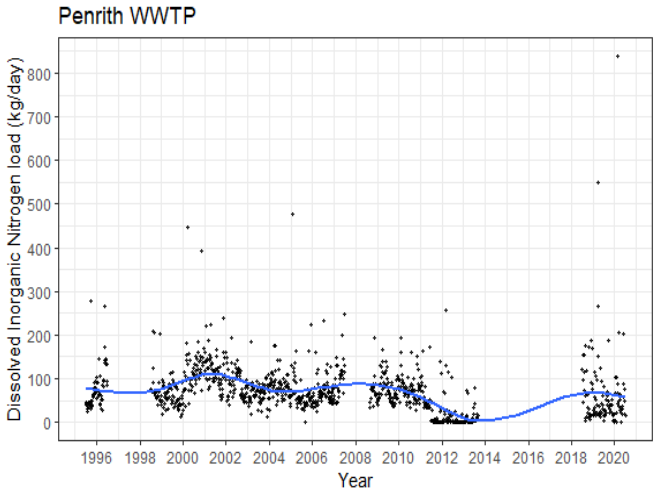

Wallacia WWTP
EPL limit
50th percentile: 7.5 mg/L
90th percentile: 10 mg/L
Total Nitrogen (mg/L)
Year

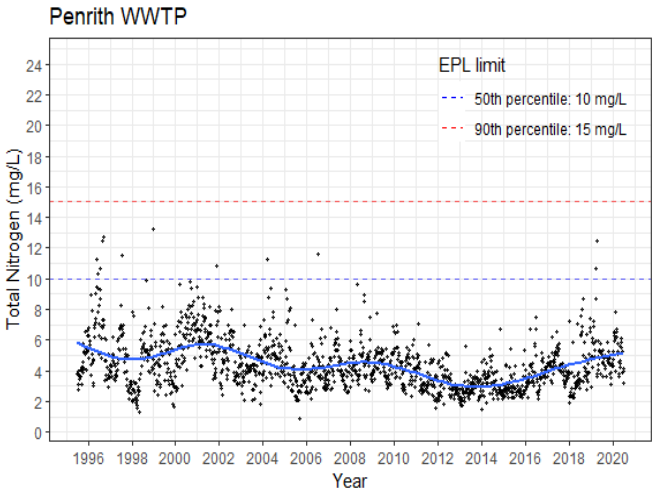

Wallacia WWTP
EPL limit
load: 34 kg/day
Total Nitrogen load (kg/day)
Year

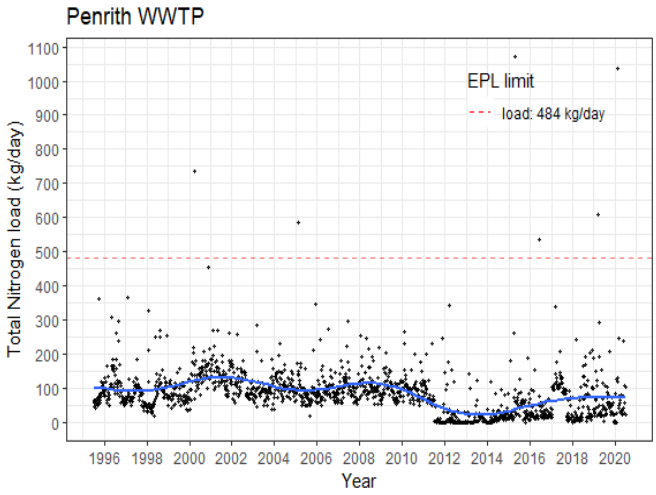

Wallacia WWTP
EPL limit
50th percentile: 0.15 mg/L
90th percentile: 0.3 mg/L
Total Phosphorus (mg/L)
Year

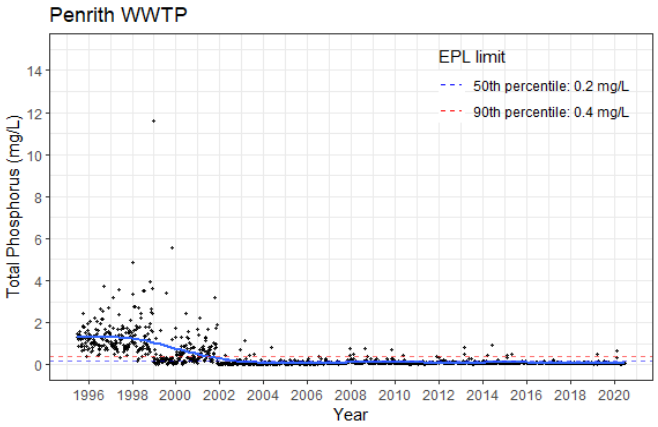

Wallacia WWTP
EPL limit
load: 4.4 kg/day
Total Phosphorus load (kg/day)
Year

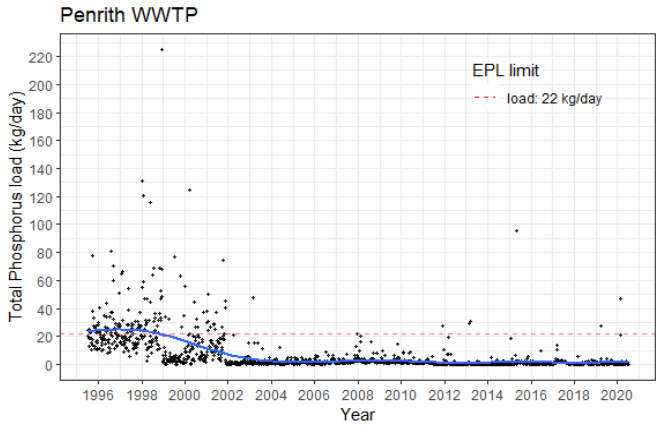

Penrith WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

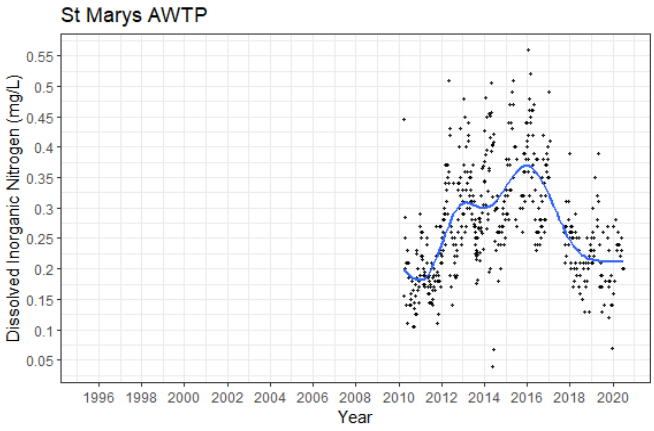

Penrith WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

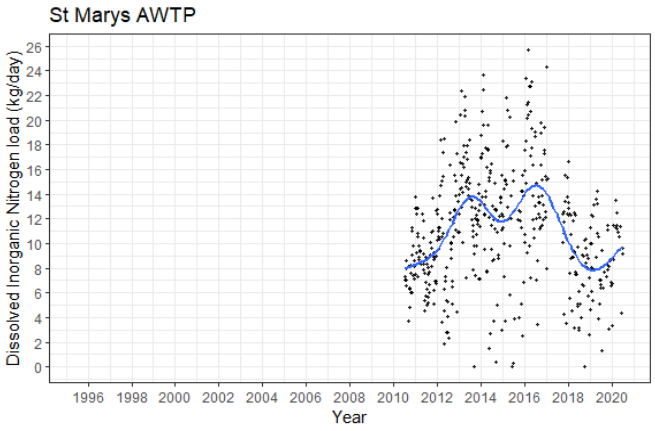

Penrith WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

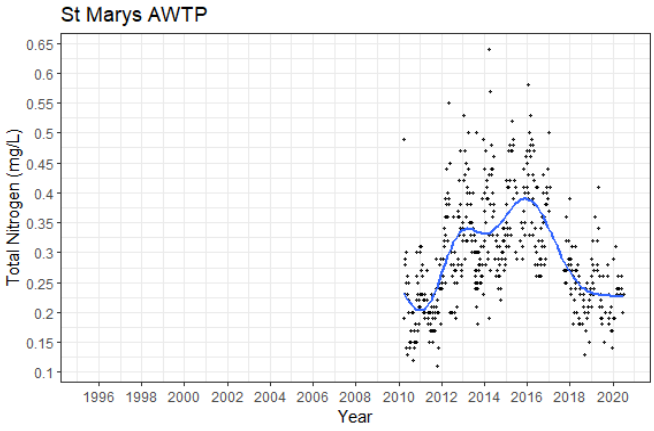

Penrith WWTP
EPL limit
load: 484 kg/day
Total Nitrogen load (kg/day)
Year

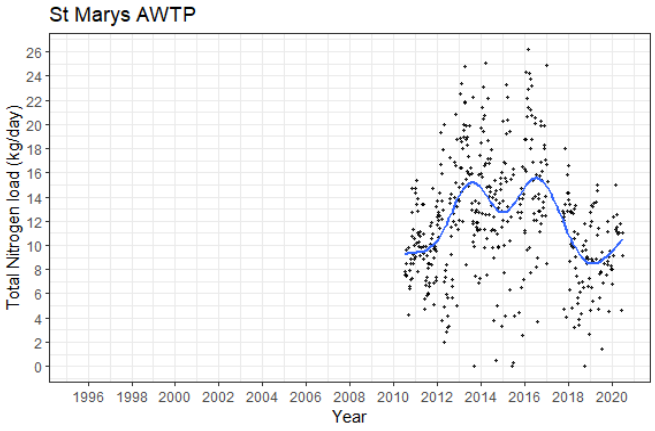

Penrith WWTP
EPL limit
50th percentile: 0.2 mg/L
90th percentile: 0.4 mg/L
Total Phosphorus (mg/L)
Year

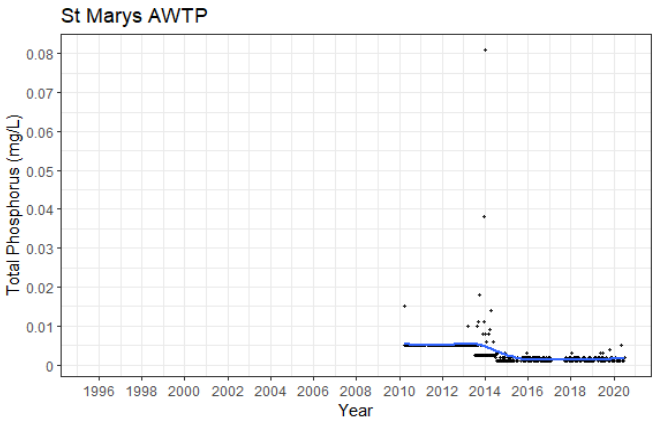

Penrith WWTP
EPL limit
load: 22 kg/day
Total Phosphorus load (kg/day)
Year

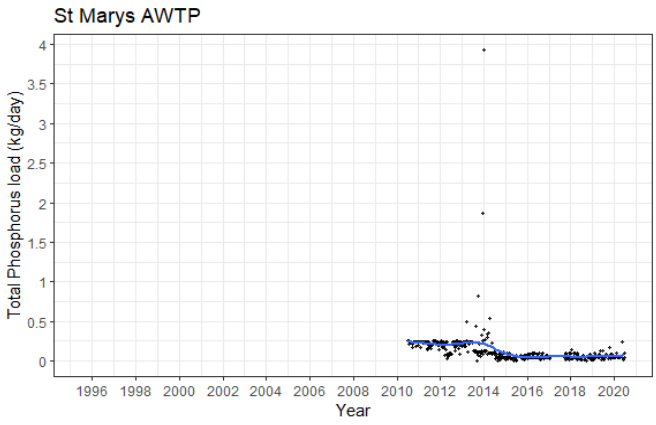

St Marys AWTP
Dissolved Inorganic Nitrogen (mg/L)
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

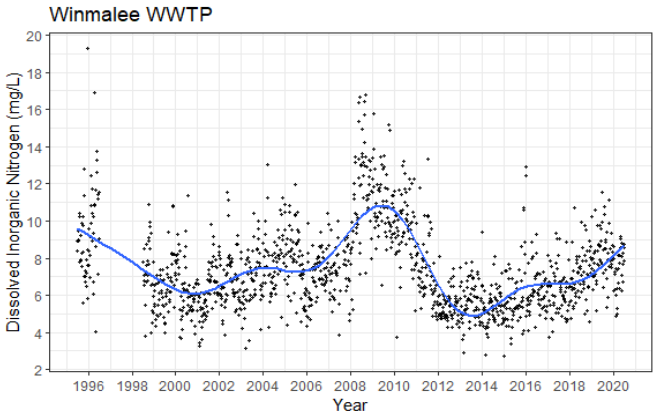

St Marys AWTP
Dissolved Inorganic Nitrogen load (kg/day)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

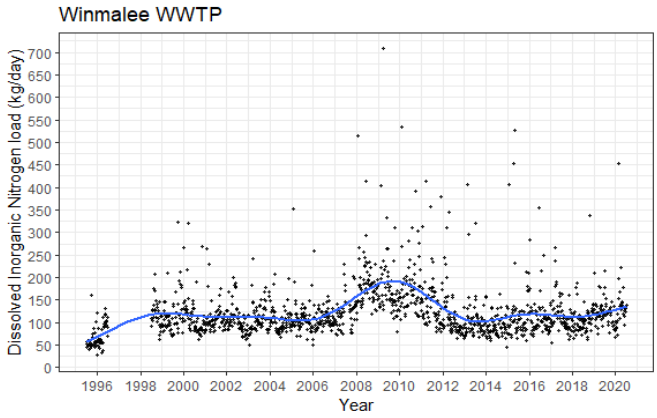

St Marys AWTP
Total Nitrogen (mg/L)
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

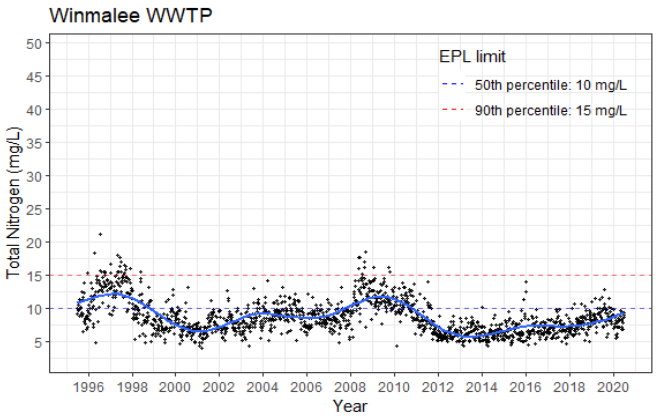

St Marys AWTP
Total Nitrogen load (kg/day)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

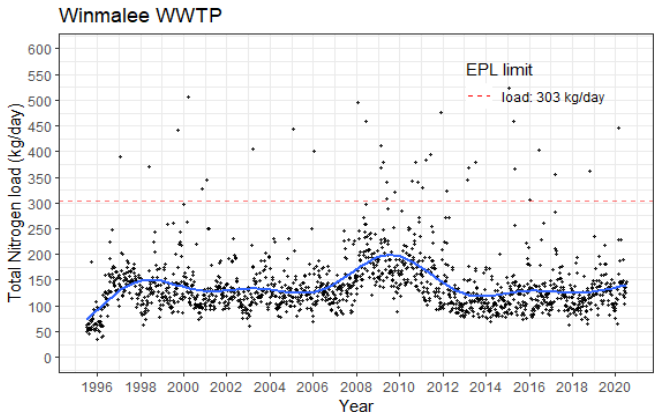

St Marys AWTP
Total Phosphorus (mg/L)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

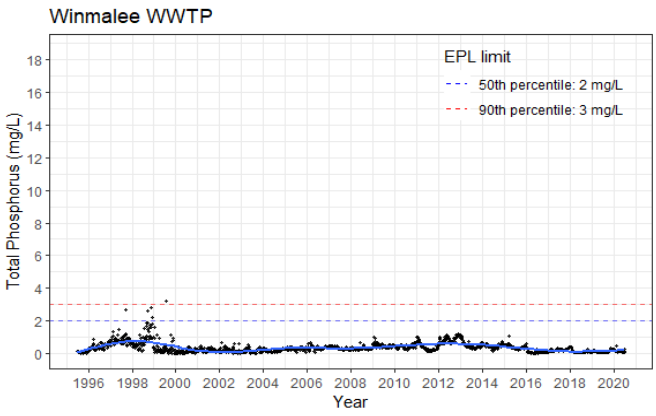

St Marys AWTP
Total Phosphorus load (kg/day)
4
3.5
3
2.5
2
1.5
1
0.5
0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

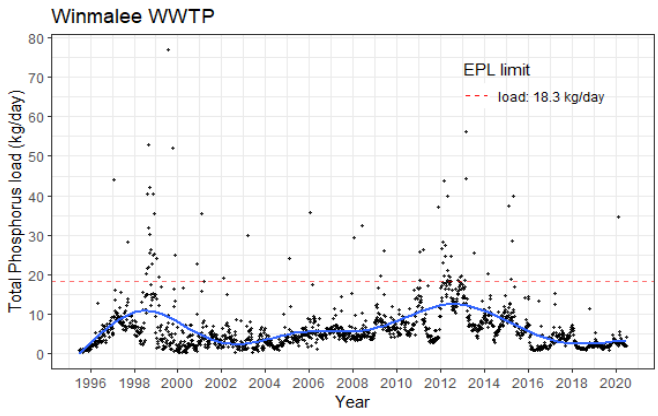

Winmalee WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

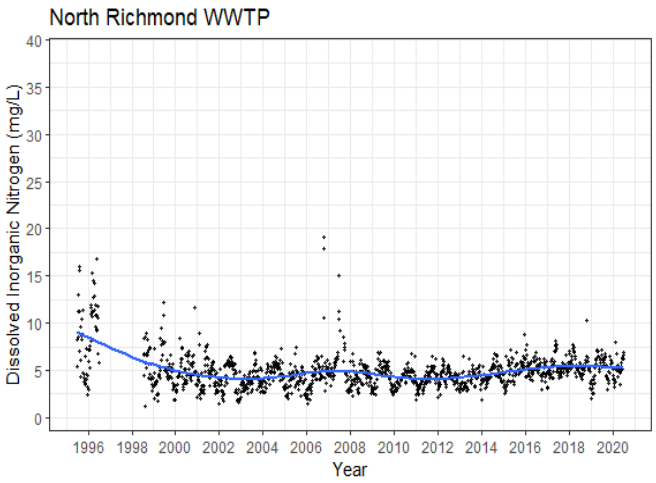

Winmalee WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

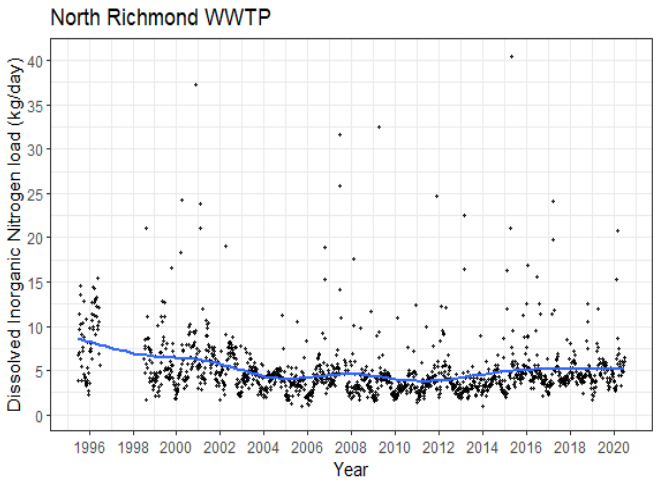

Winmalee WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

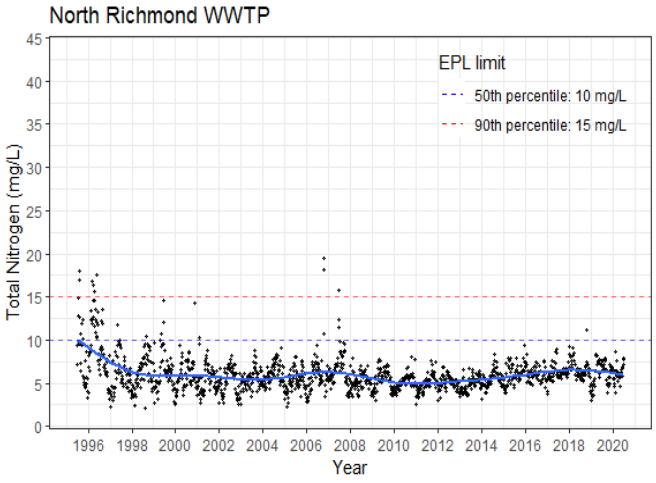

Winmalee WWTP
EPL limit
load: 303 kg/day
Total Nitrogen load (kg/day)
Year

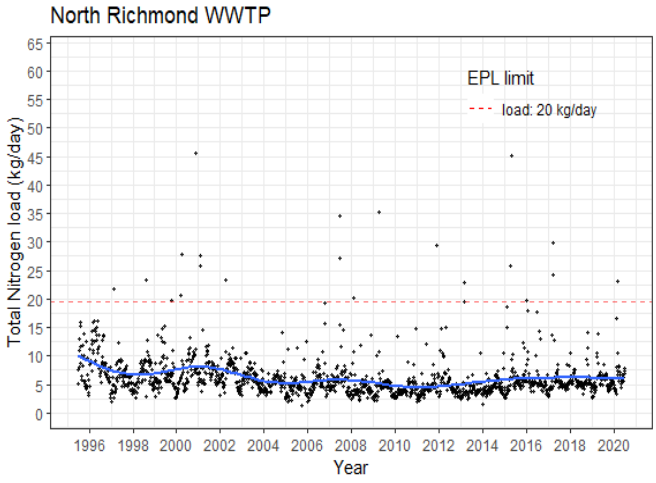

Winmalee WWTP
EPL limit
50th percentile: 2 mg/L
90th percentile: 3 mg/L
Total Phosphorus (mg/L)
Year

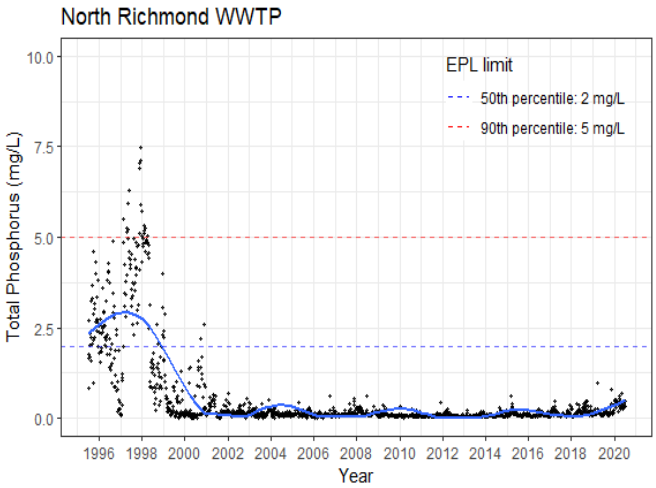

Winmalee WWTP
EPL limit
load: 18.3 kg/day
Total Phosphorus load (kg/day)
Year

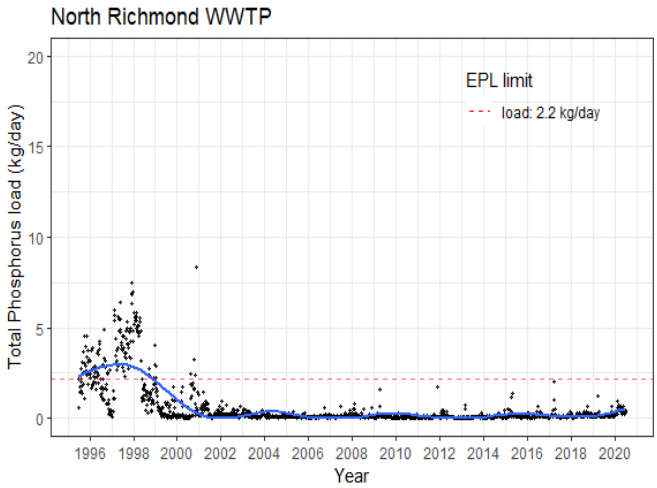

North Richmond WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

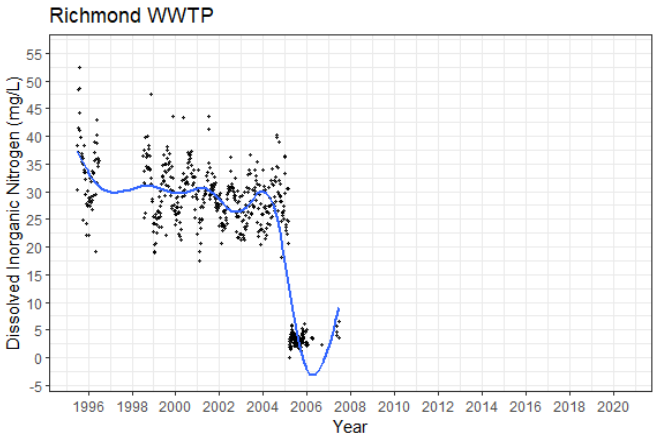

North Richmond WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

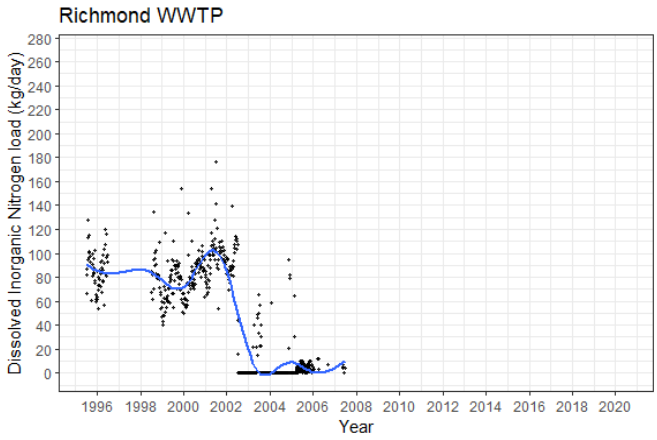

North Richmond WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

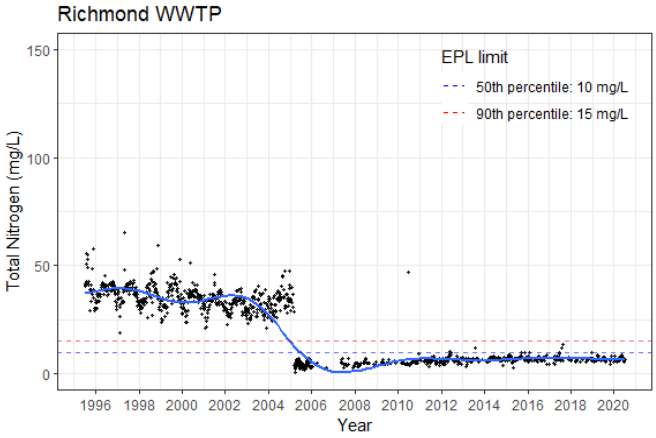

North Richmond WWTP
EPL limit
load: 20 kg/day
Total Nitrogen load (kg/day)
Year

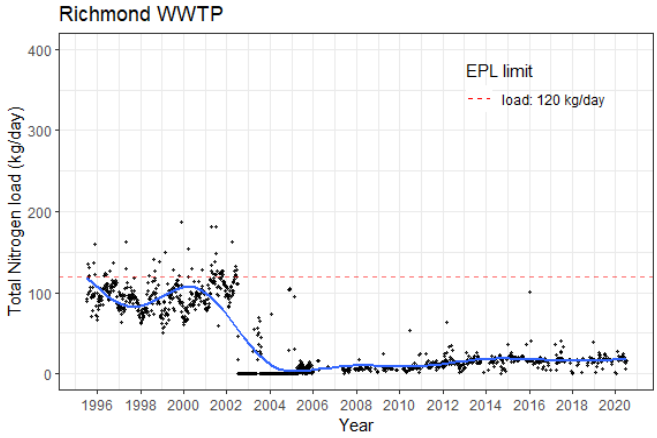

North Richmond WWTP
EPL limit
50th percentile: 2 mg/L
90th percentile: 5 mg/L
Total Phosphorus (mg/L)
Year

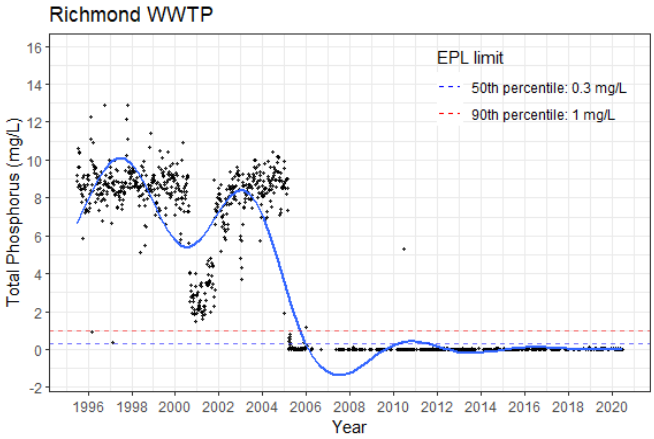

North Richmond WWTP
EPL limit
load: 2.2 kg/day
Total Phosphorus load (kg/day)
Year

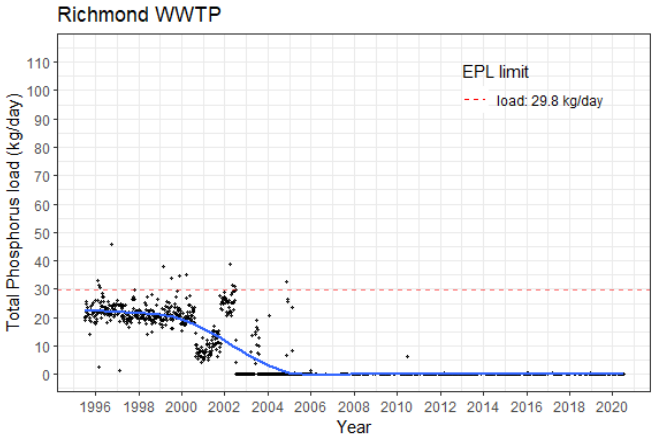

Richmond WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

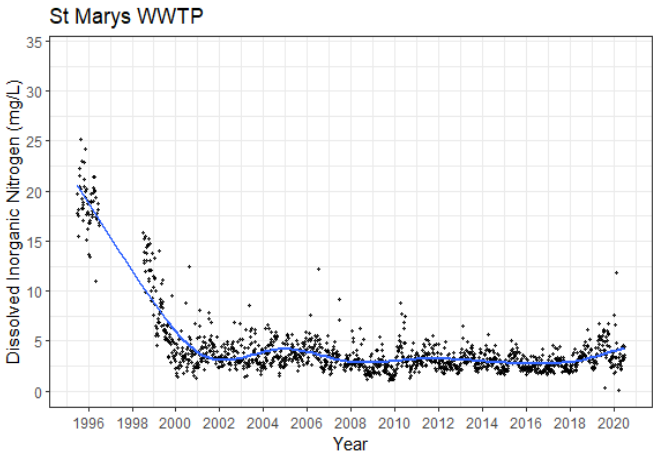

Richmond WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

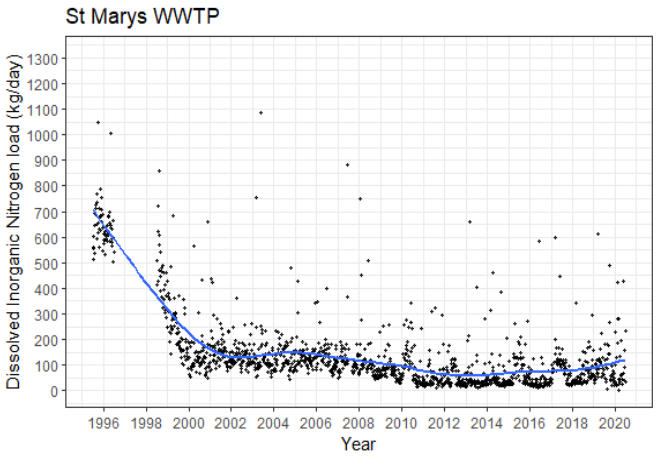

Richmond WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

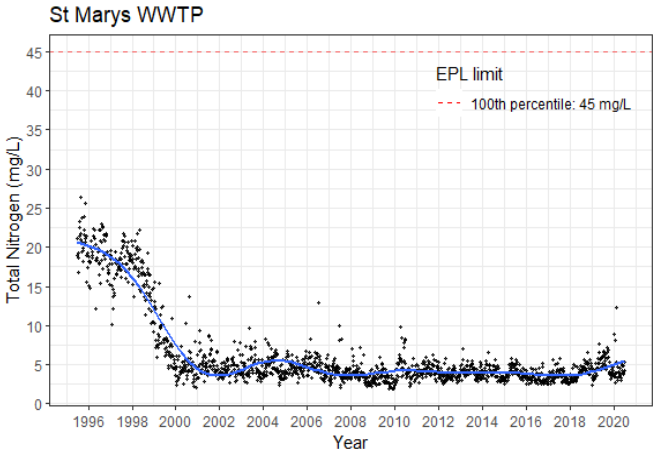

Richmond WWTP
EPL limit
load: 120 kg/day
Total Nitrogen load (kg/day)
Year

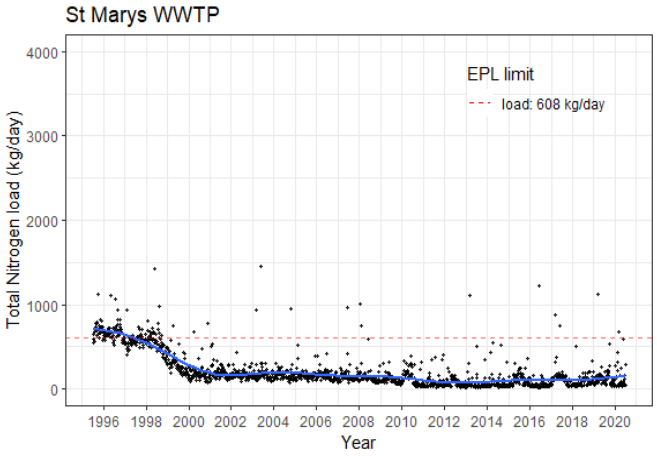

Richmond WWTP
EPL limit
50th percentile: 0.3 mg/L
90th percentile: 1 mg/L
Total Phosphorus (mg/L)
Year

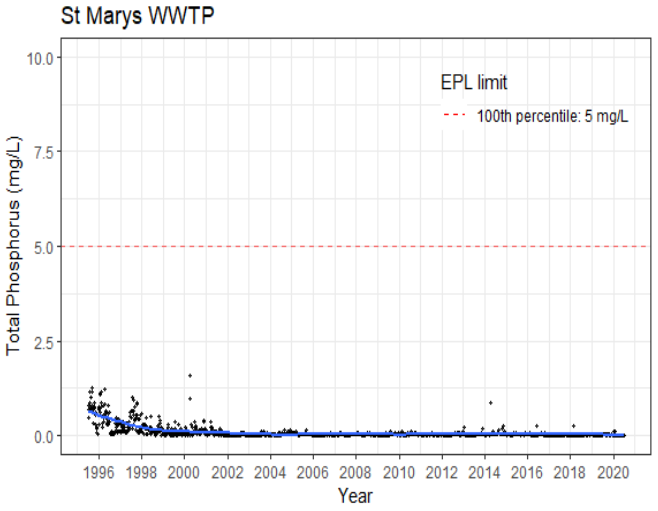

Richmond WWTP
EPL limit
load: 29.8 kg/day
Total Phosphorus load (kg/day)
Year

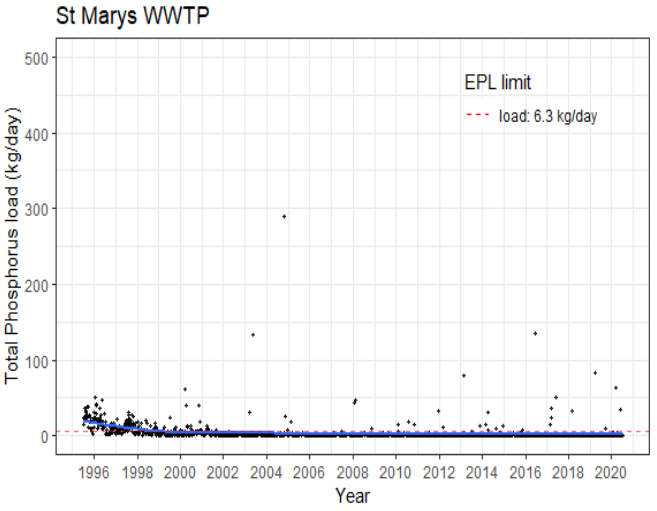

St Marys WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

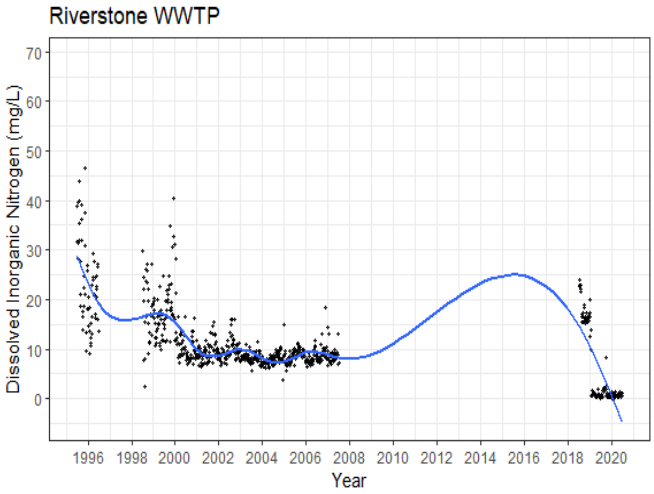

St Marys WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

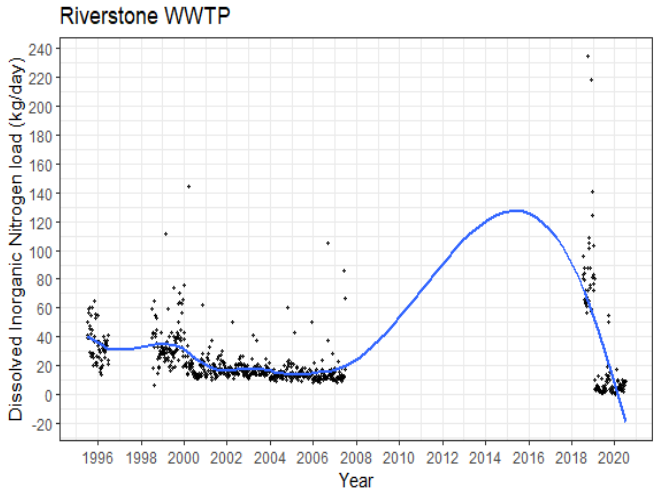

St Marys WWTP
EPL limit
100th percentile: 45 mg/L
Total Nitrogen (mg/L)
Year

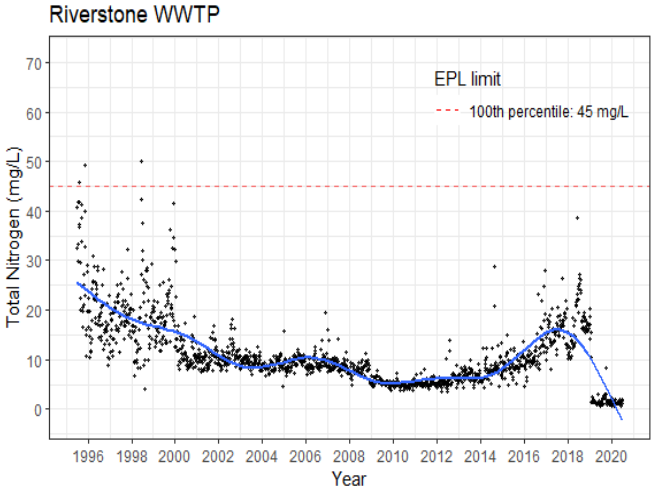

St Marys WWTP
EPL limit
load: 608 kg/day
Total Nitrogen load (kg/day)
Year

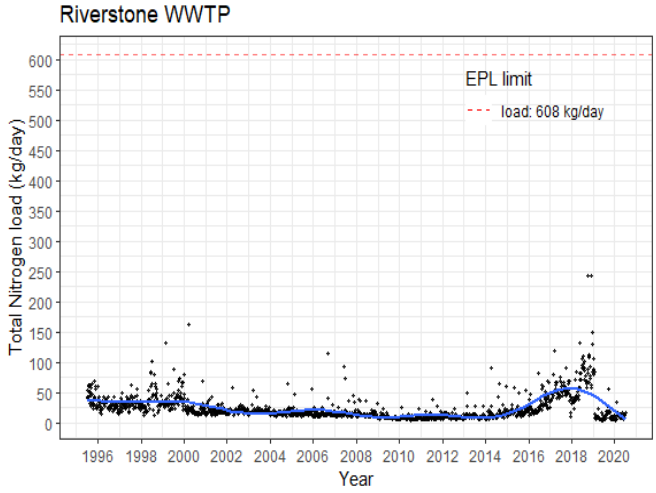

St Marys WWTP
EPL limit
100th percentile: 5 mg/L
Total Phosphorus (mg/L)
Year

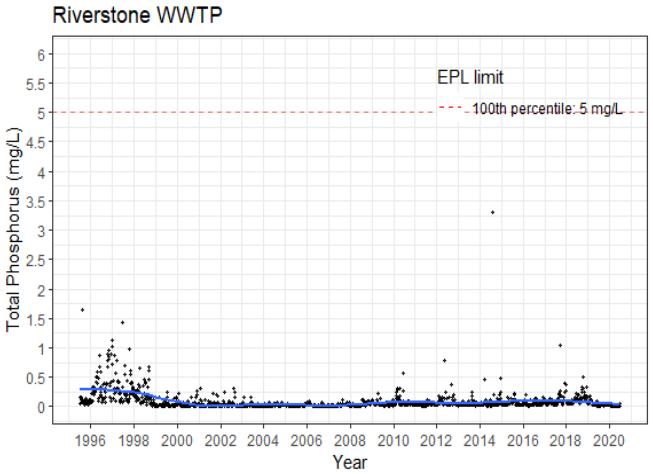

St Marys WWTP
EPL limit
load: 6.3 kg/day
Total Phosphorus load (kg/day)
Year

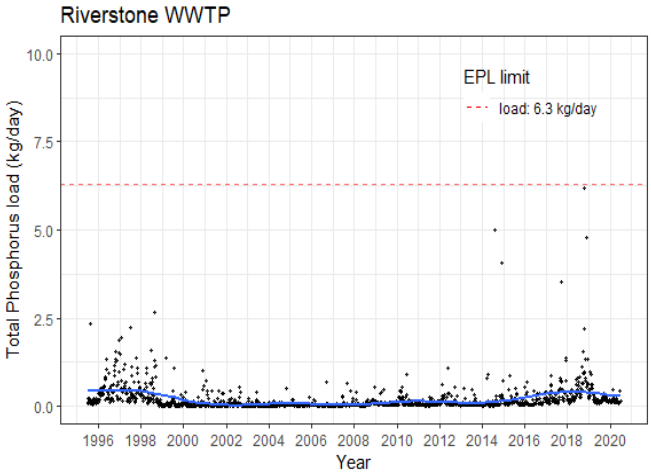

Riverstone WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

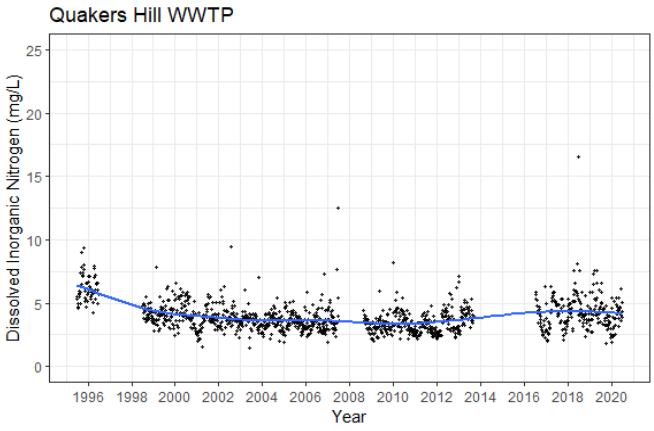

Riverstone WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

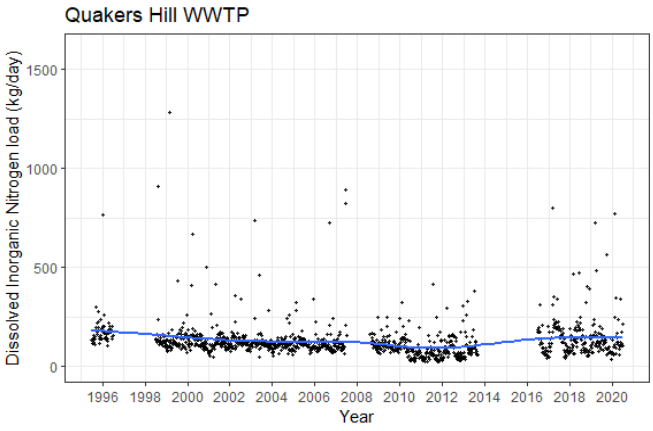

Riverstone WWTP
EPL limit
100th percentile: 45 mg/L
Total Nitrogen (mg/L)
Year

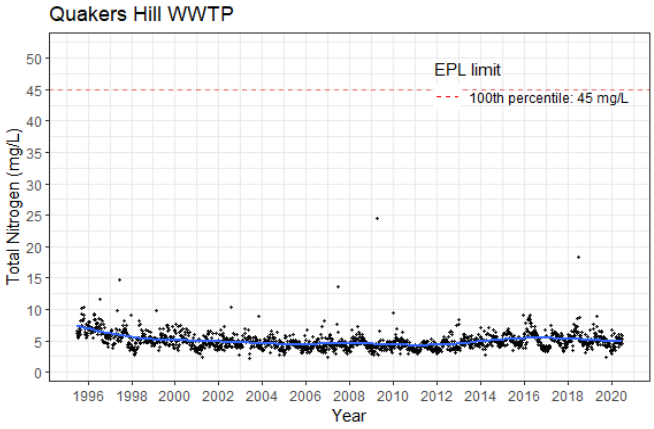

Riverstone WWTP
EPL limit
load: 608 kg/day
Total Nitrogen load (kg/day)
Year

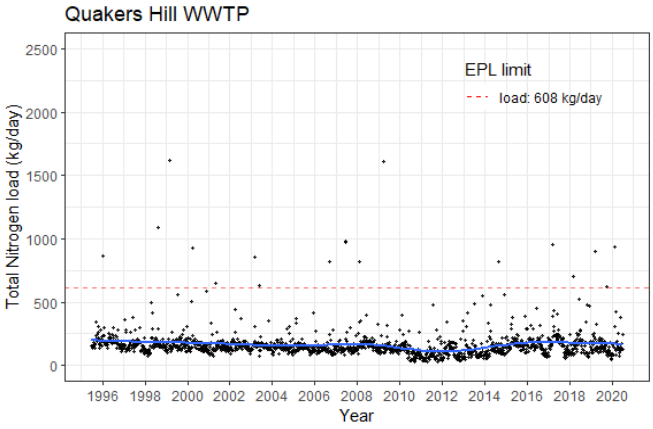

Riverstone WWTP
EPL limit
100th percentile: 5 mg/L
Total Phosphorus (mg/L)
Year

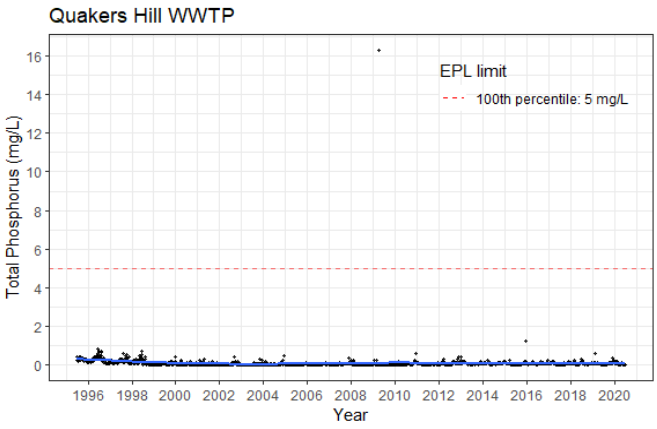

Riverstone WWTP
EPL limit
load: 6.3 kg/day
Total Phosphorus load (kg/day)
Year

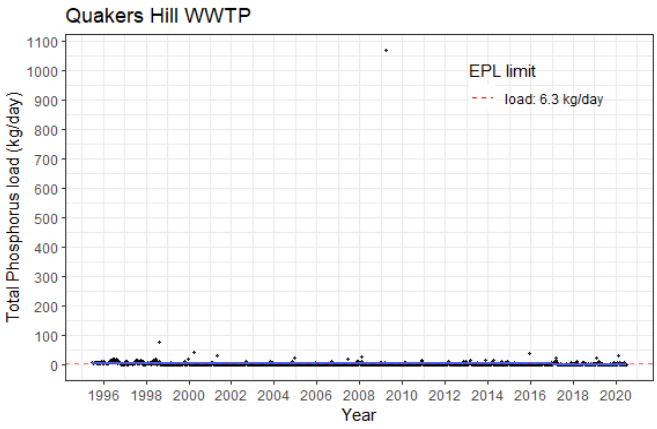

Quakers Hill WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

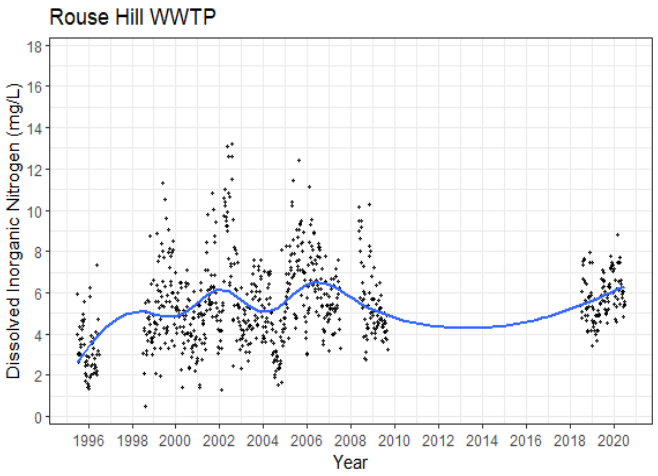

Quakers Hill WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

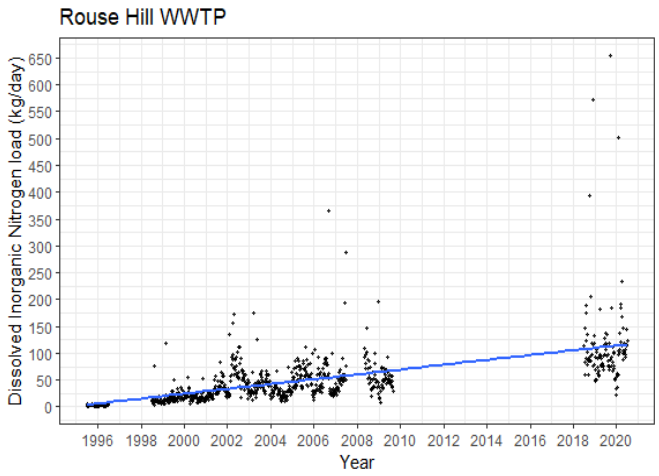

Quakers Hill WWTP
EPL limit
100th percentile: 45 mg/L
Total Nitrogen (mg/L)
Year

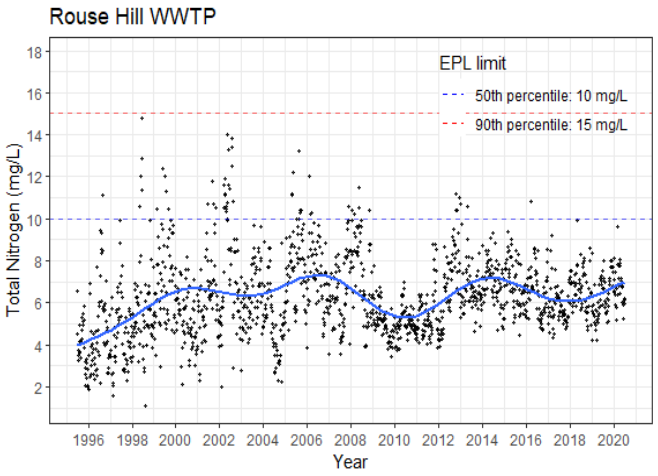

Quakers Hill WWTP
EPL limit
load: 608 kg/day
Total Nitrogen load (kg/day)
Year

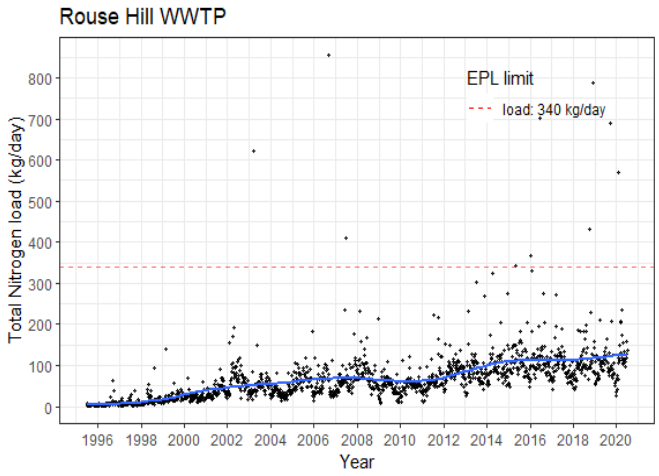

Quakers Hill WWTP
EPL limit
100th percentile: 5 mg/L
Total Phosphorus (mg/L)
Year

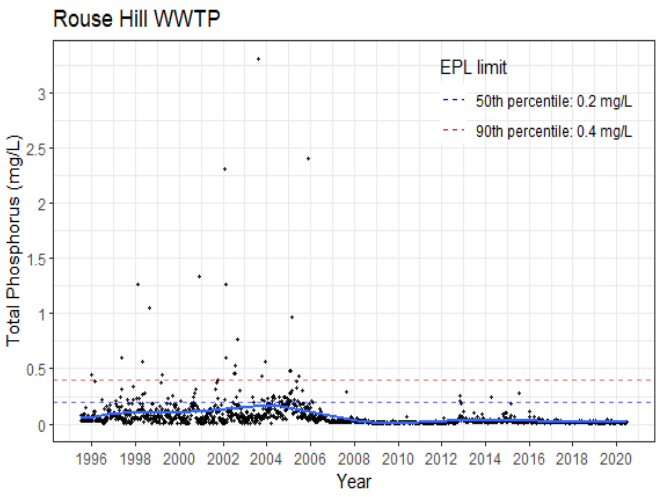

Quakers Hill WWTP
EPL limit
load: 6.3 kg/day
Total Phosphorus load (kg/day)
Year

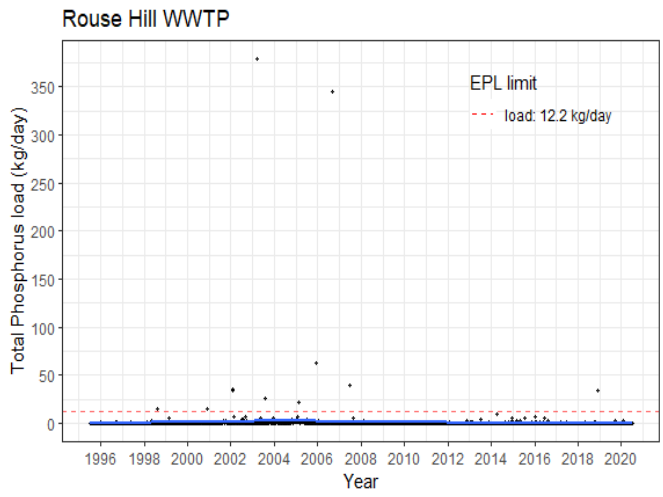

Rouse Hill WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

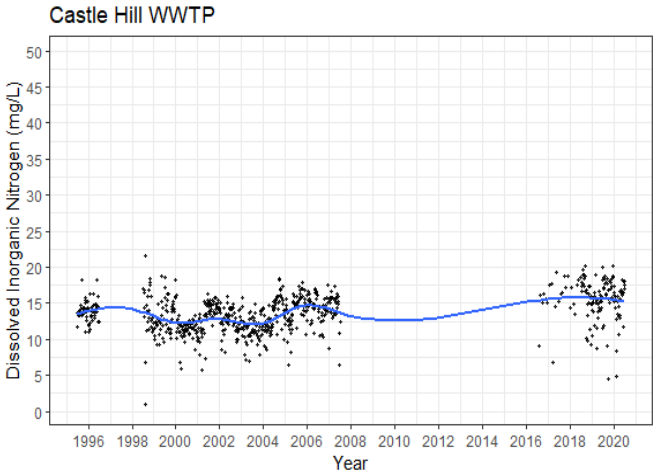

Rouse Hill WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

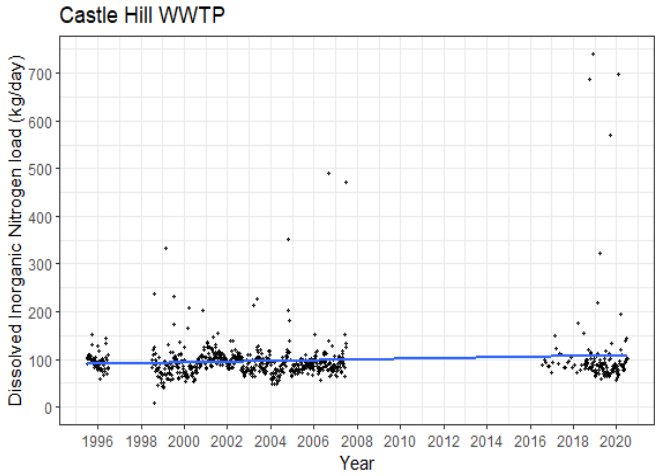

Rouse Hill WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

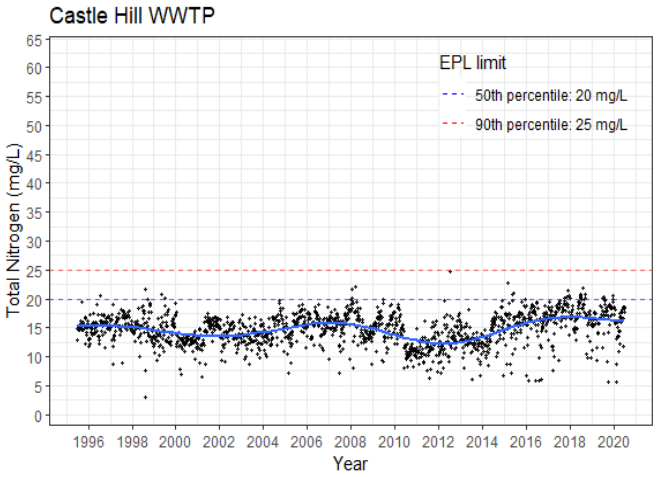

Rouse Hill WWTP
EPL limit
load: 340 kg/day
Total Nitrogen load (kg/day)
Year

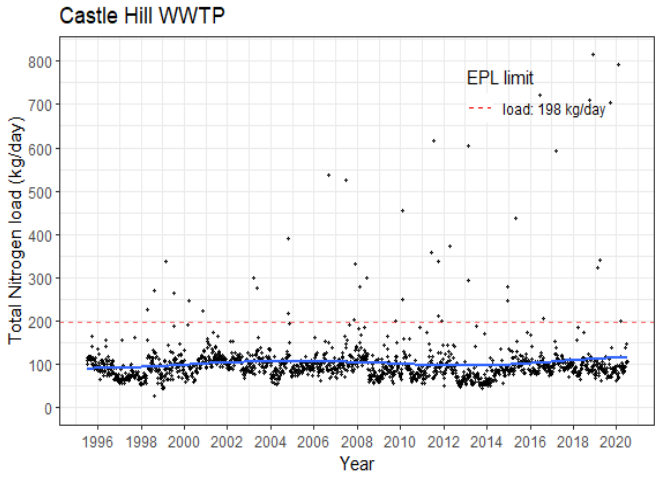

Rouse Hill WWTP
EPL limit
50th percentile: 0.2 mg/L
90th percentile: 0.4 mg/L
Total Phosphorus (mg/L)
Year

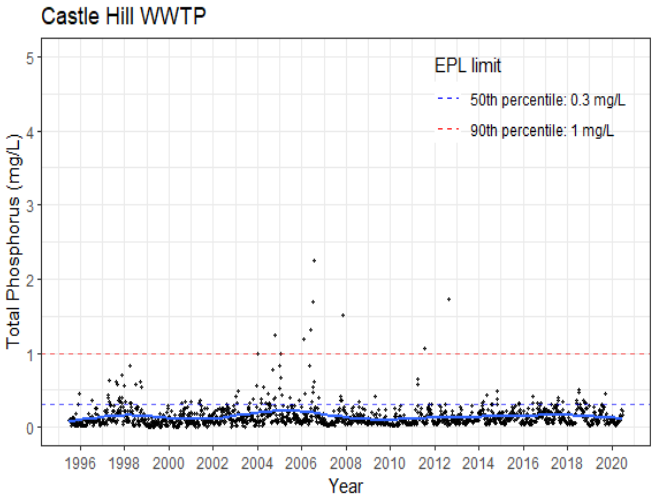

Rouse Hill WWTP
EPL limit
load: 12.2 kg/day
Total Phosphorus load (kg/day)
Year

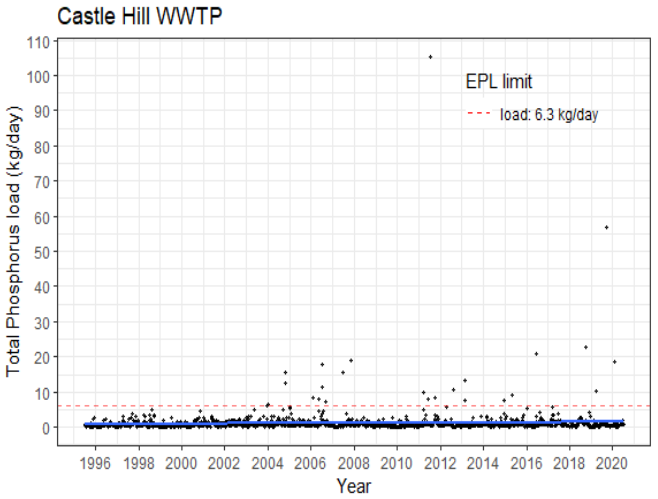

Castle Hill WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

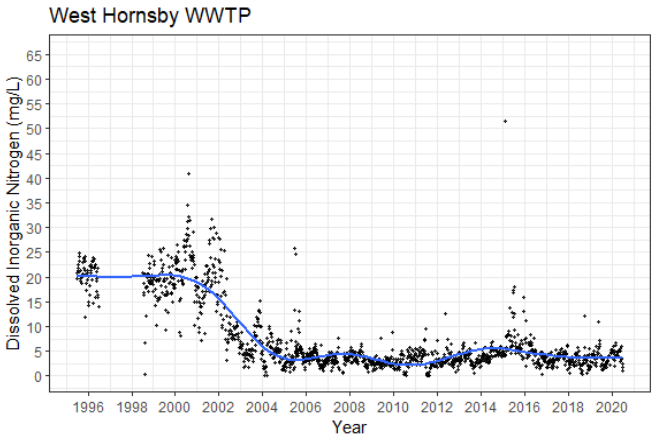

Castle Hill WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

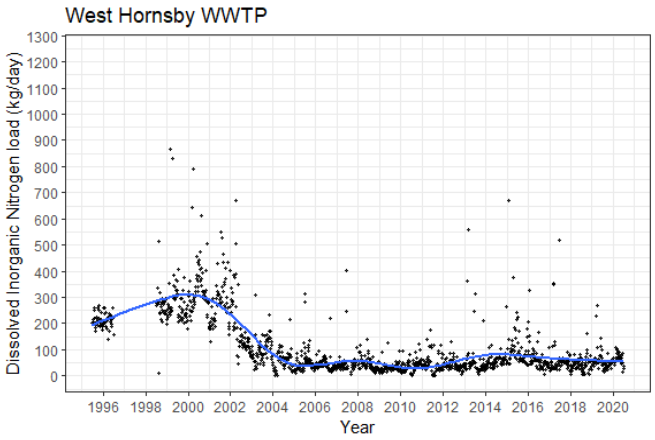

Castle Hill WWTP
EPL limit
50th percentile: 20 mg/L
90th percentile: 25 mg/L
Total Nitrogen (mg/L)
Year

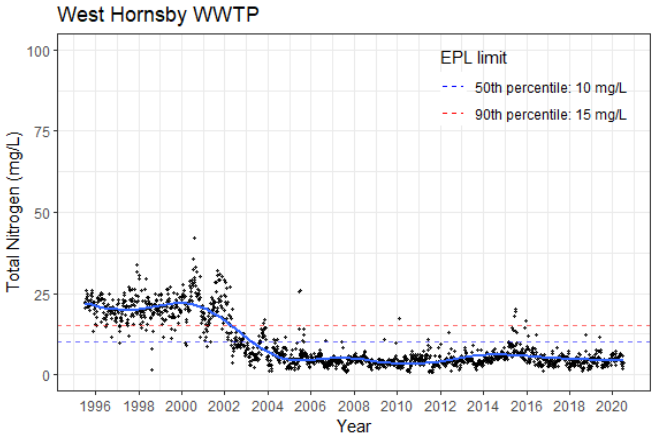

Castle Hill WWTP
EPL limit
load: 198 kg/day
Total Nitrogen load (kg/day)
Year

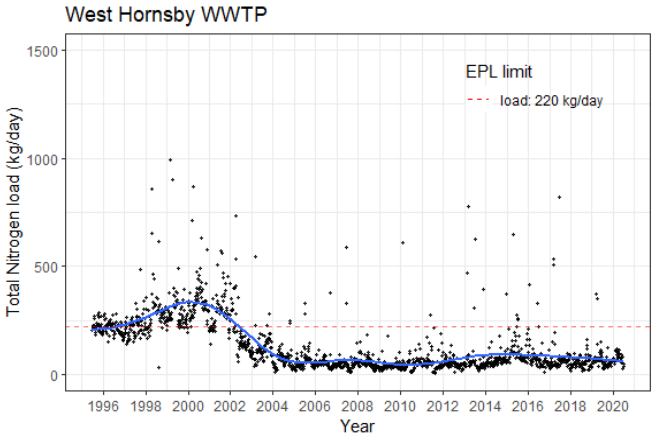

Castle Hill WWTP
EPL limit
50th percentile: 0.3 mg/L
90th percentile: 1 mg/L
Total Phosphorus (mg/L)
Year

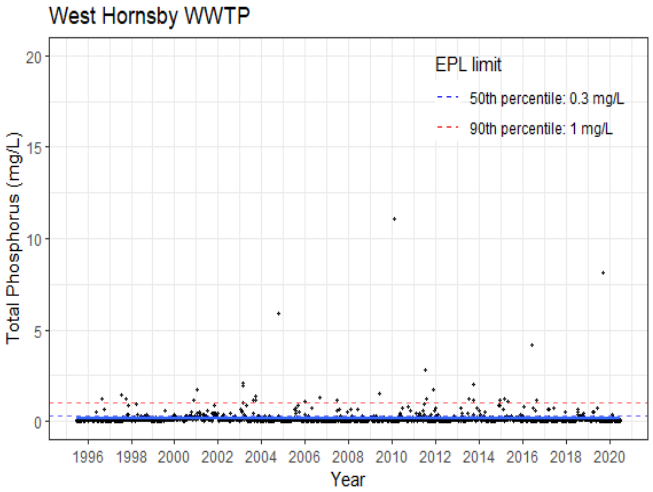

Castle Hill WWTP
EPL limit
load: 6.3 kg/day
Total Phosphorus load (kg/day)
Year

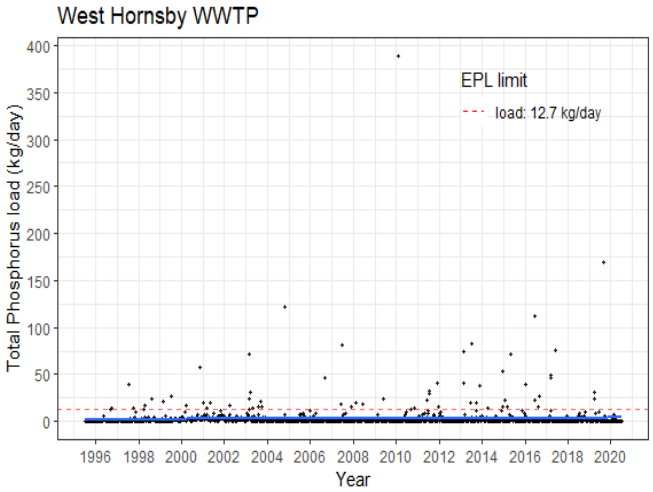

West Hornsby WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

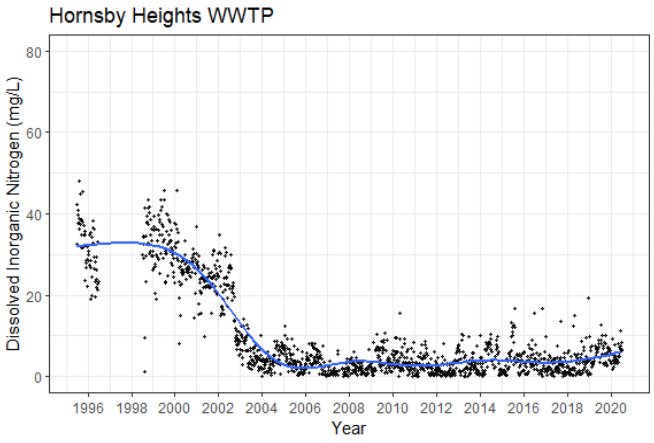

West Hornsby WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

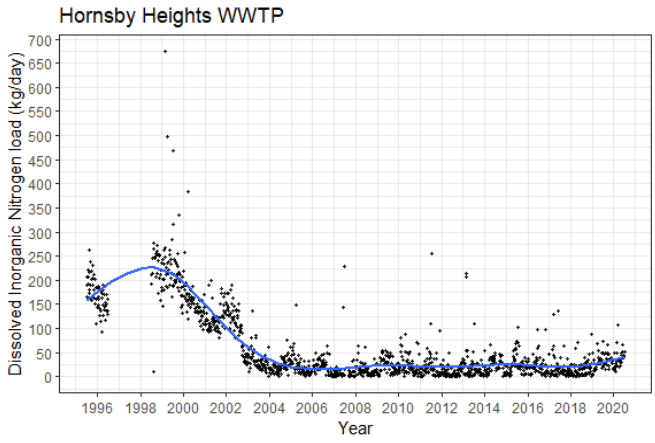

West Hornsby WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

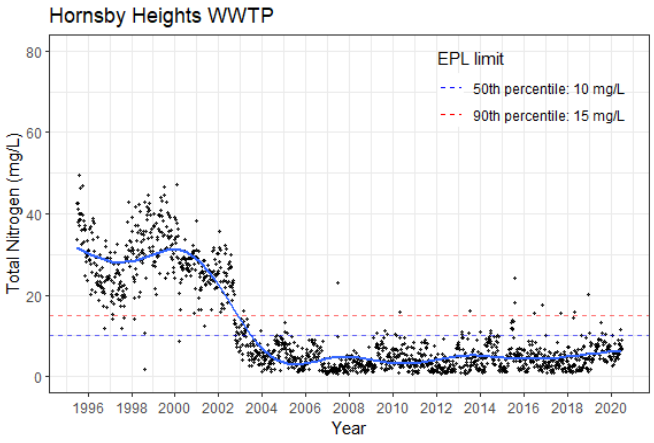

West Hornsby WWTP
EPL limit
load: 220 kg/day
Total Nitrogen load (kg/day)
Year

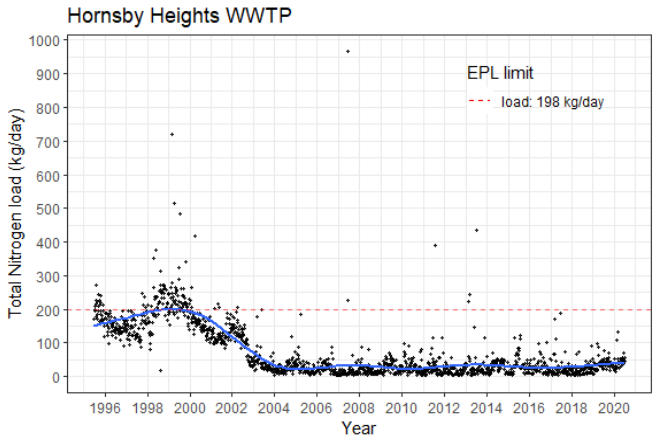

West Hornsby WWTP
EPL limit
50th percentile: 0.3 mg/L
90th percentile: 1 mg/L
Total Phosphorus (mg/L)
Year

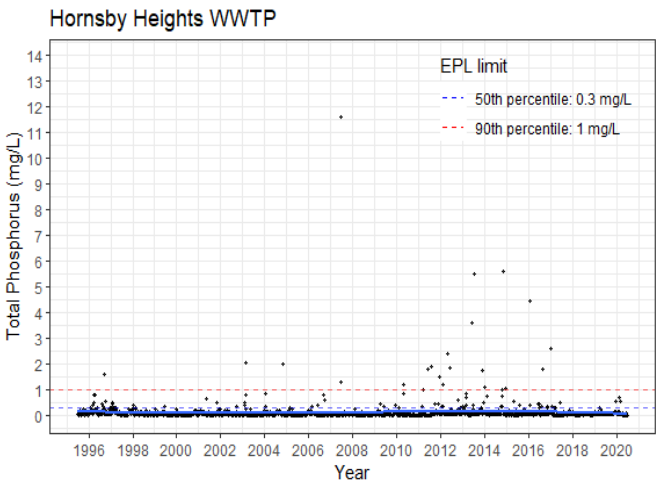

West Hornsby WWTP
EPL limit
load: 12.7 kg/day
Total Phosphorus load (kg/day)
Year

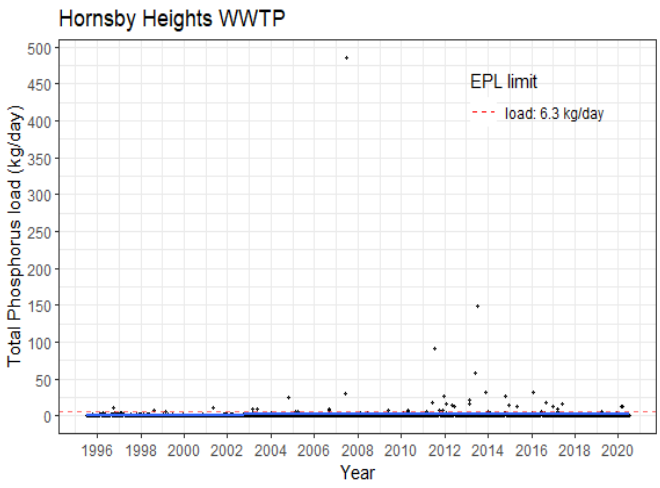

Hornsby Heights WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

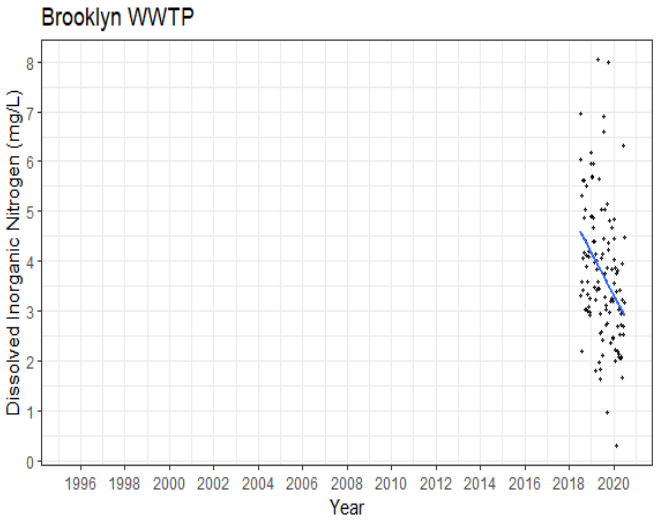

Hornsby Heights WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year

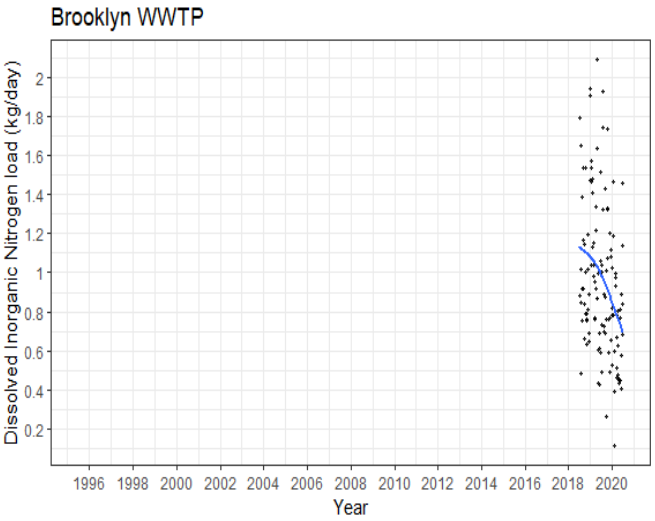

Hornsby Heights WWTP
EPL limit
50th percentile: 10 mg/L
90th percentile: 15 mg/L
Total Nitrogen (mg/L)
Year

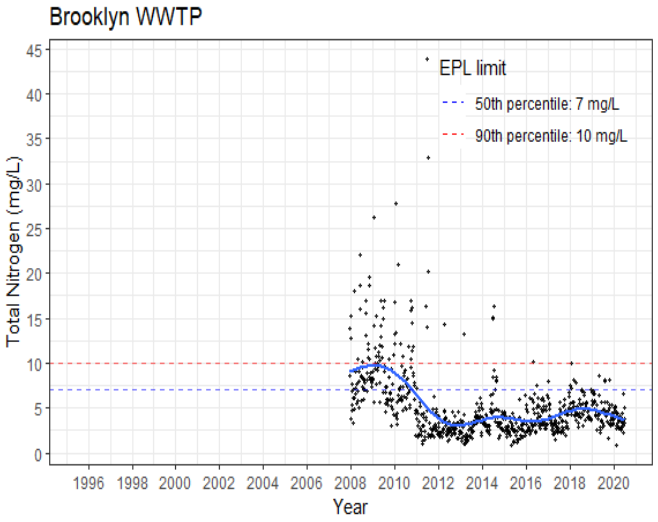

Hornsby Heights WWTP
EPL limit
load: 198 kg/day
Total Nitrogen load (kg/day)
Year

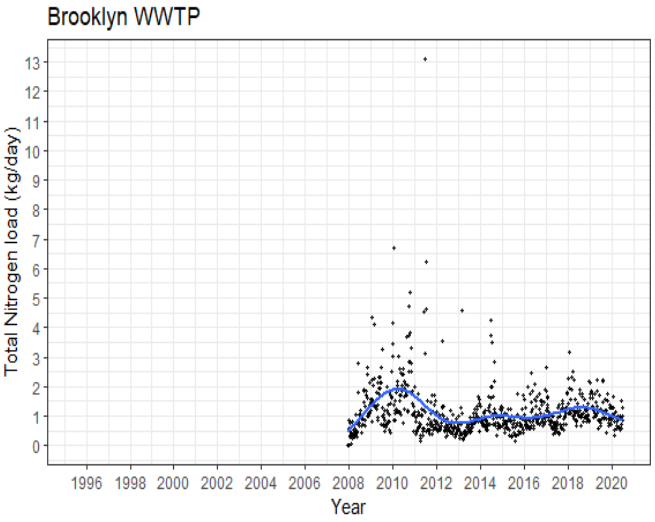

Hornsby Heights WWTP
EPL limit
50th percentile: 0.3 mg/L
90th percentile: 1 mg/L
Total Phosphorus (mg/L)
Year

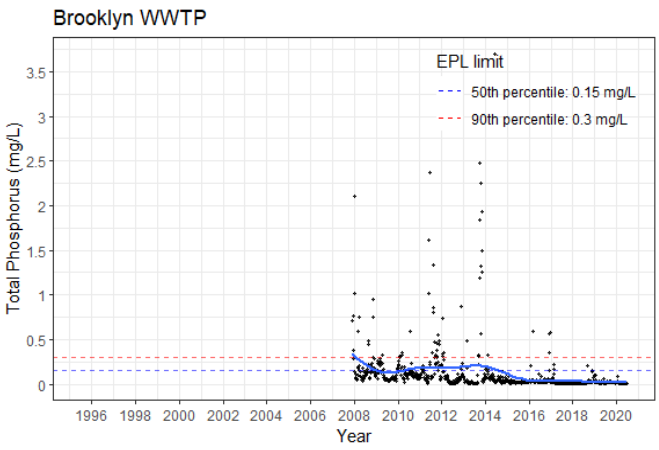

Hornsby Heights WWTP
EPL limit
load: 6.3 kg/day
Total Phosphorus load (kg/day)
Year

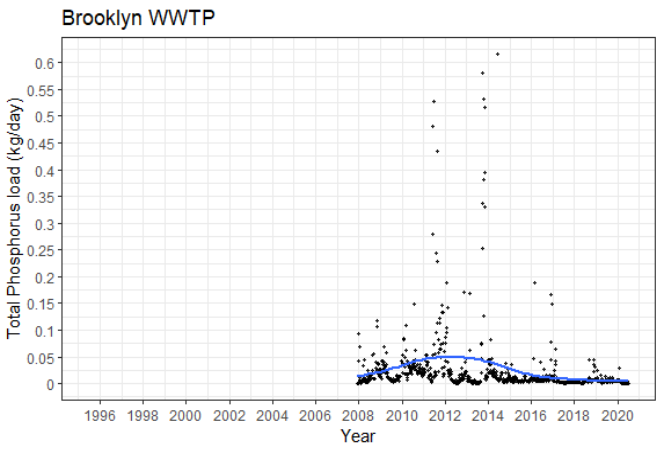

Brooklyn WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year


Brooklyn WWTP
Dissolved Inorganic Nitrogen load (kg/day)
Year


Brooklyn WWTP
EPL limit
50th percentile: 7 mg/L
90th percentile: 10 mg/L
Total Nitrogen (mg/L)
Year


Brooklyn WWTP
Total Nitrogen load (kg/day)
Year


Brooklyn WWTP
EPL limit
50th percentile: 0.15 mg/L
90th percentile: 0.3 mg/L
Total Phosphorus (mg/L)
Year


Brooklyn WWTP
Total Phosphorus load (kg/day)
Year

Appendix C : Temporal trends in water quality of key routine monitoring sites

The plots for the key routine monitoring sites of the Hawkesbury-Nepean River sites are presented in the following order from upstream to downstream:

- N92: Nepean River at Maldon Weir
- N91: Nepean River at Maldon Bridge
- N78: Nepean River at Macquarie Grove Road
- N75: Nepean River at Sharpes Weir
- N67: Nepean River at Wallacia Bridge
- N57: Nepean River at Penrith Rowing Club Ramp
- N53: Nepean River at BMG Causeway
- N51: Nepean River opposite Fitzgerald Creek
- N48A: Nepean River at Smith Road
- N464: Lagoon on unnamed Creek downstream of Winmalee WWTP
- N44: Nepean River at Yarramundi Bridge
- N42: Hawkesbury River at North Richmond Water Filtration Plant
- N39: Hawkesbury River at Freemans Reach
- NS04A: Lower South Creek at Fitzroy Bridge
- N35: Hawkesbury River at Wilberforce
- NC11A: Lower Cattai Creek at Cattai Ridge Road
- N3001: Hawkesbury River off Cattai SRA
- N26: Hawkesbury River at Sackville Ferry
- N2202: Lower Colo River at Putty Road
- N18: Hawkesbury River at Leets Vale
- NB13: Berowra Creek at Calabash Bay
- NB11: Berowra Creek off Square Bay

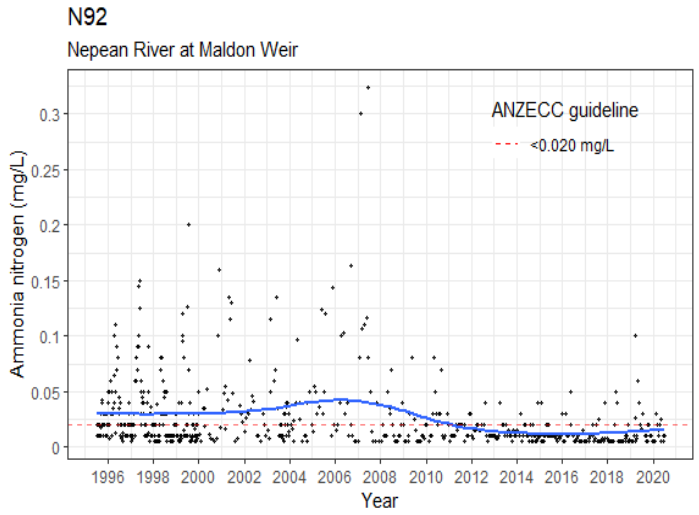
The water quality plots are presented in the following groups and order of analytes:

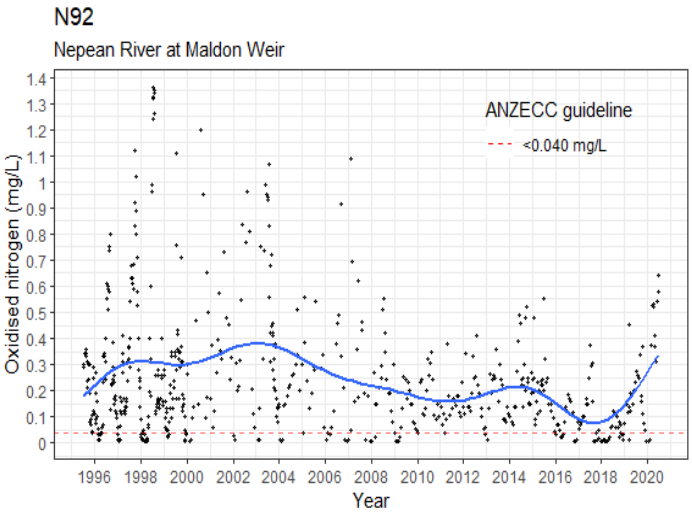
Nutrients and chlorophyll-*a*

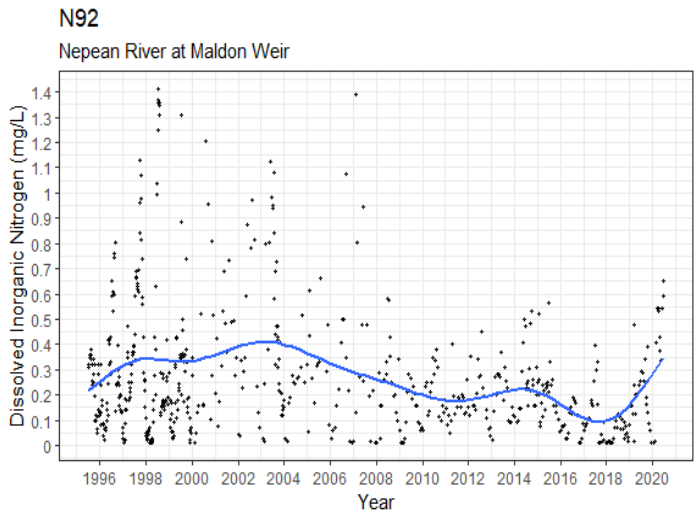
- Ammonia nitrogen
- Oxidised nitrogen
- Dissolved inorganic nitrogen
- Total nitrogen
- Total phosphorus
- Chlorophyll-*a*

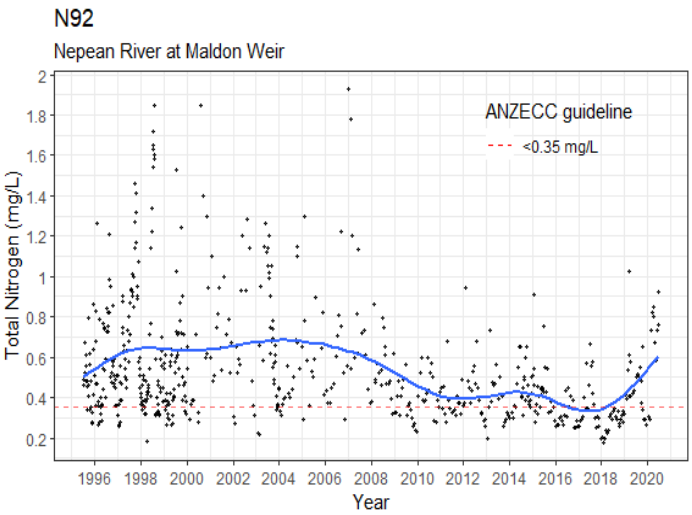
Other physico-chemical analytes

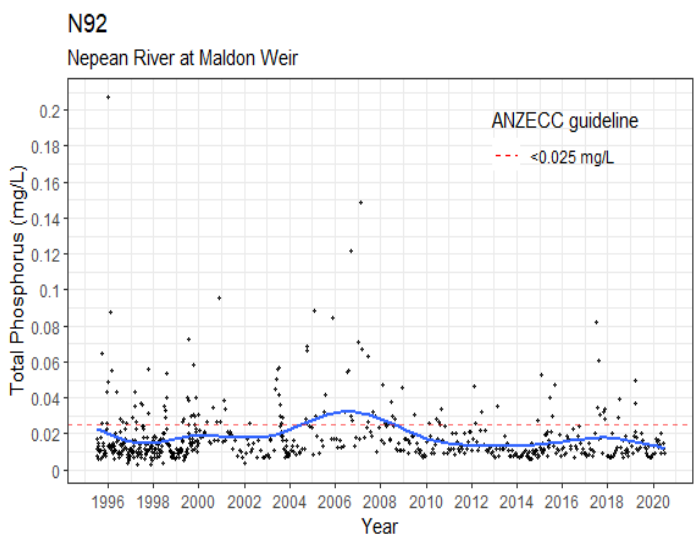
- Conductivity
- Dissolved oxygen saturation
- pH
- Turbidity

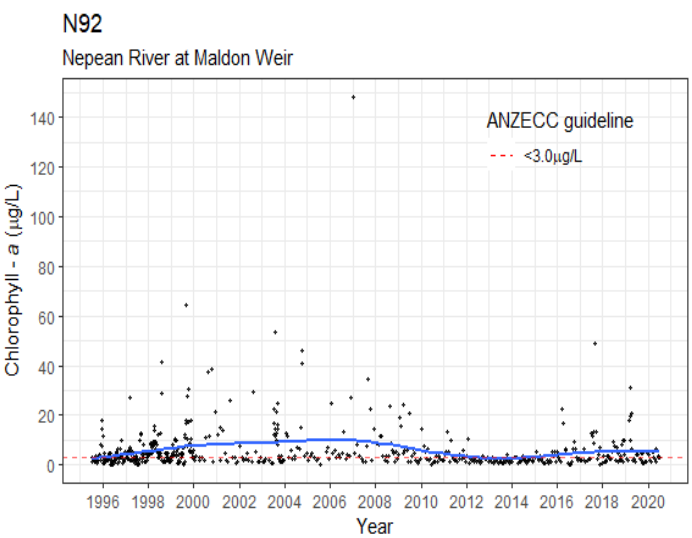

N92
Nepean River at Maldon Weir
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

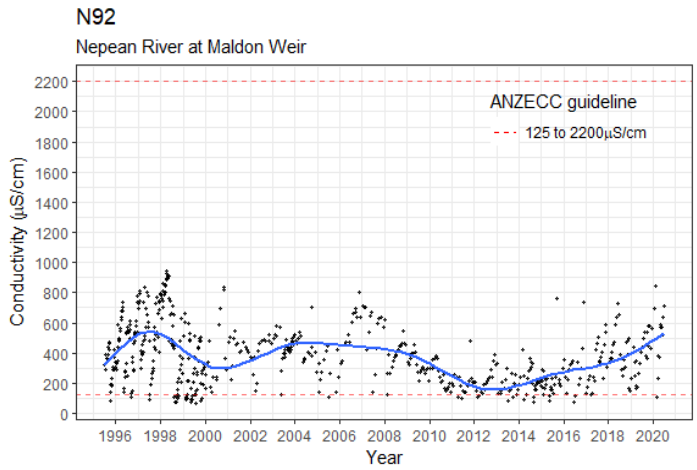

N92
Nepean River at Maldon Weir
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

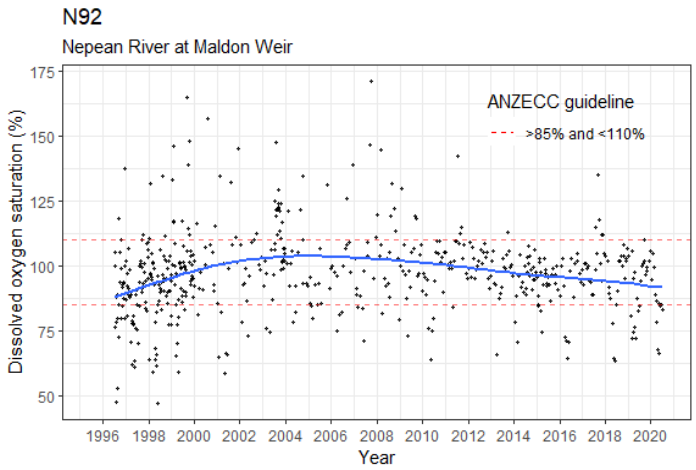

N92
Nepean River at Maldon Weir
Dissolved Inorganic Nitrogen (mg/L)
Year

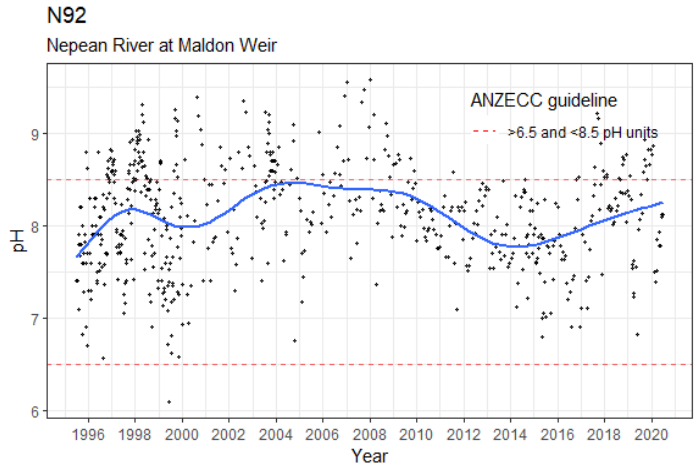

N92
Nepean River at Maldon Weir
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

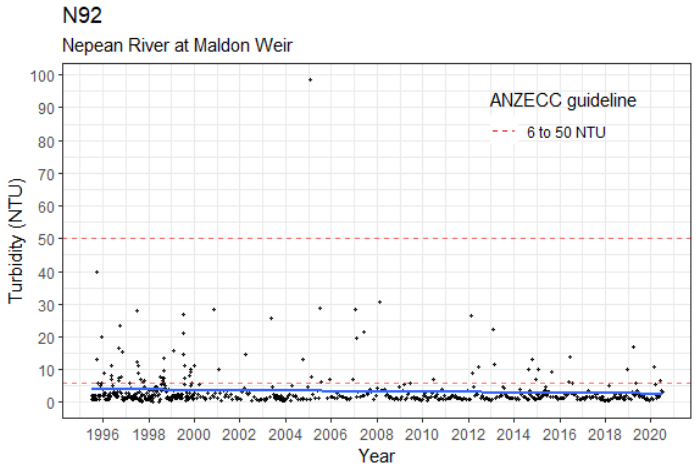

N92
Nepean River at Maldon Weir
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

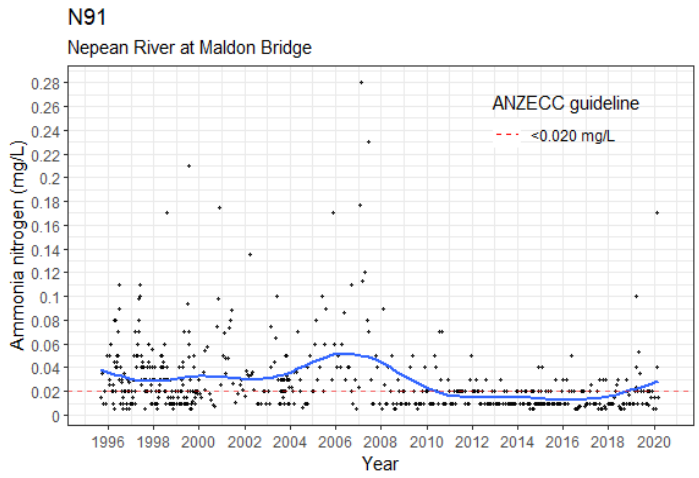

N92
Nepean River at Maldon Weir
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

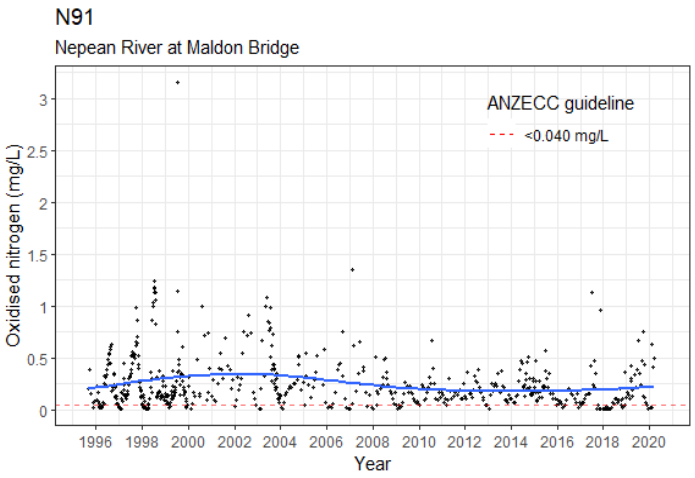

N92
Nepean River at Maldon Weir
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

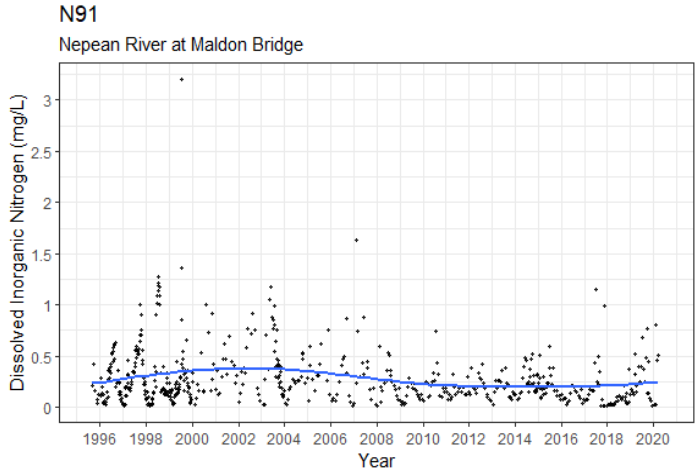

N92
Nepean River at Maldon Weir
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

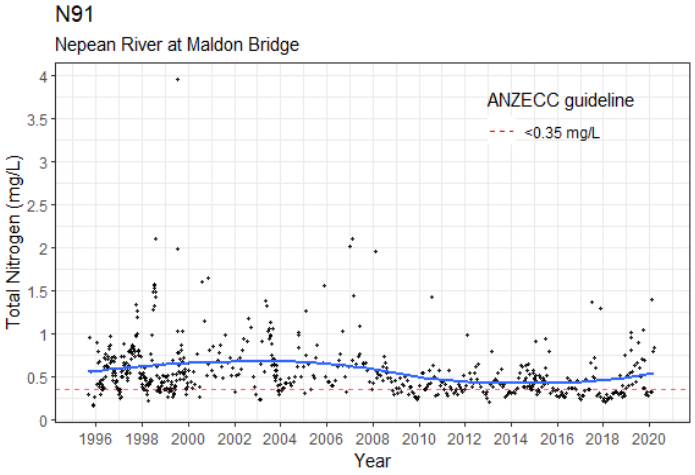

N92
Nepean River at Maldon Weir
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

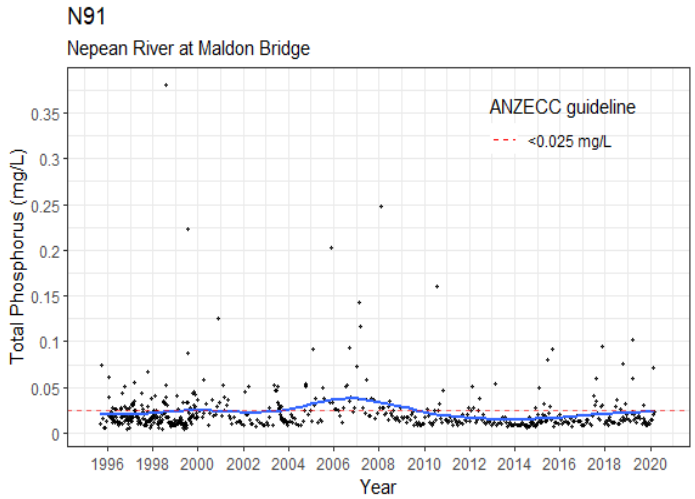

N92
Nepean River at Maldon Weir
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

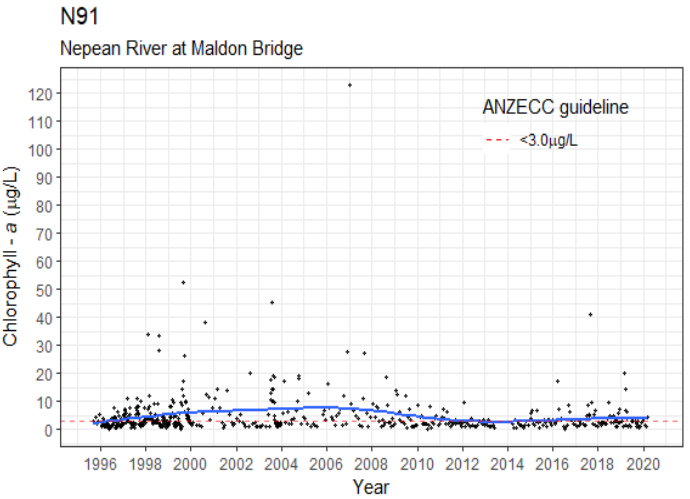

N91
Nepean River at Maldon Bridge
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

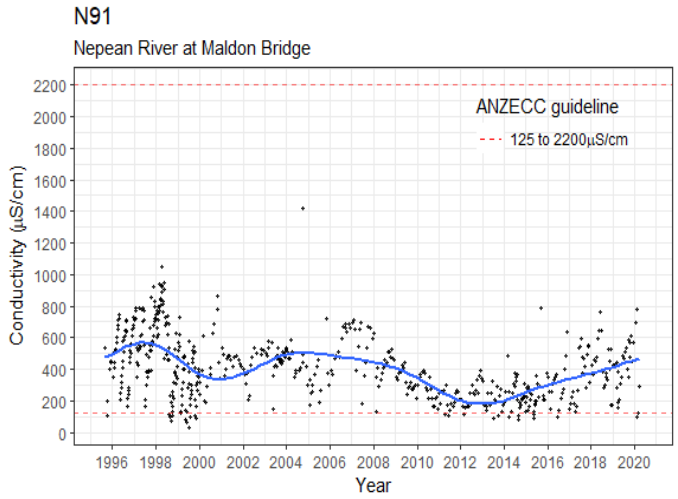

N91
Nepean River at Maldon Bridge
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

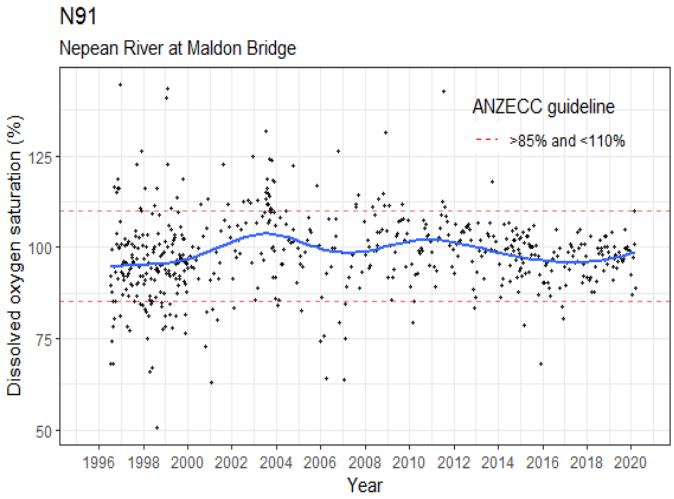

N91
Nepean River at Maldon Bridge
Dissolved Inorganic Nitrogen (mg/L)
Year

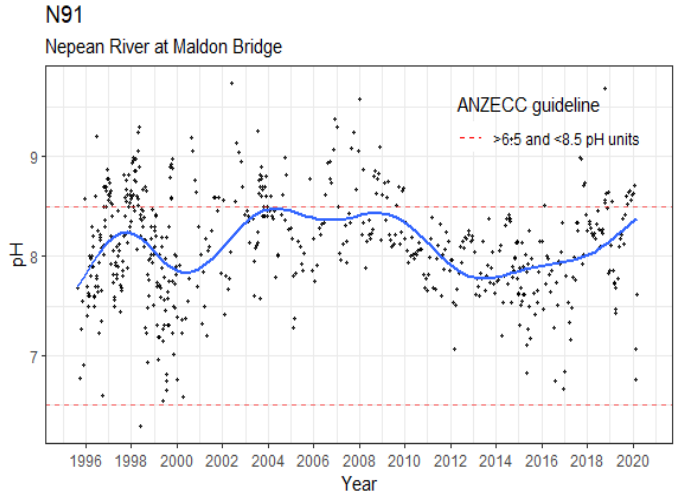

N91
Nepean River at Maldon Bridge
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

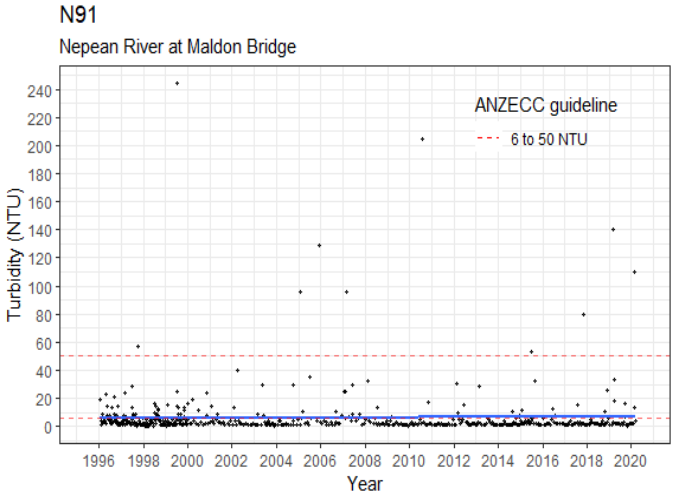

N91
Nepean River at Maldon Bridge
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

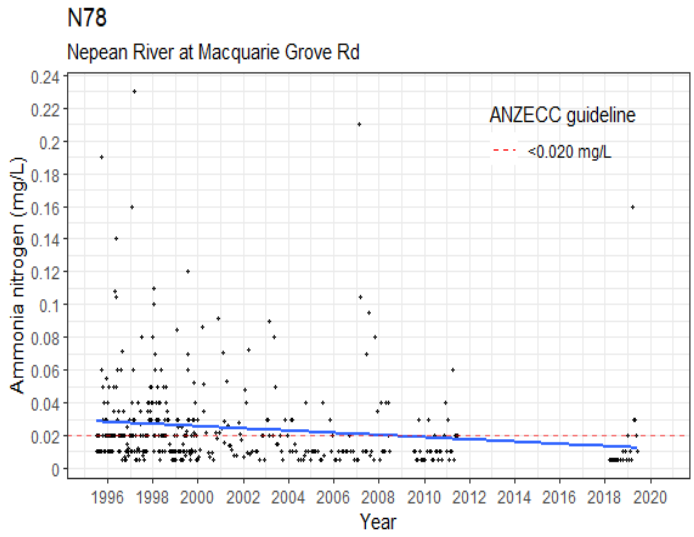

N91
Nepean River at Maldon Bridge
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

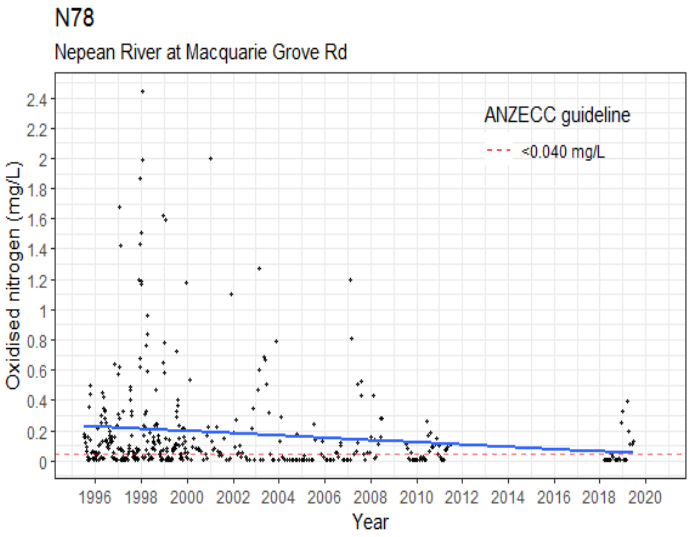

N91
Nepean River at Maldon Bridge
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

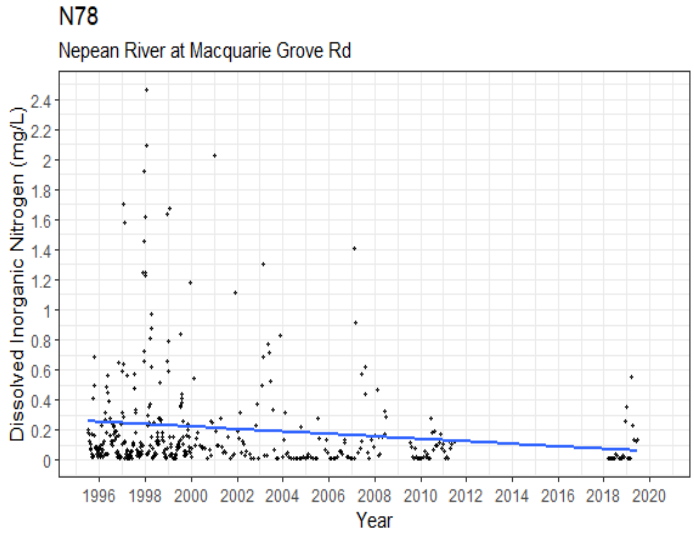

N91
Nepean River at Maldon Bridge
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

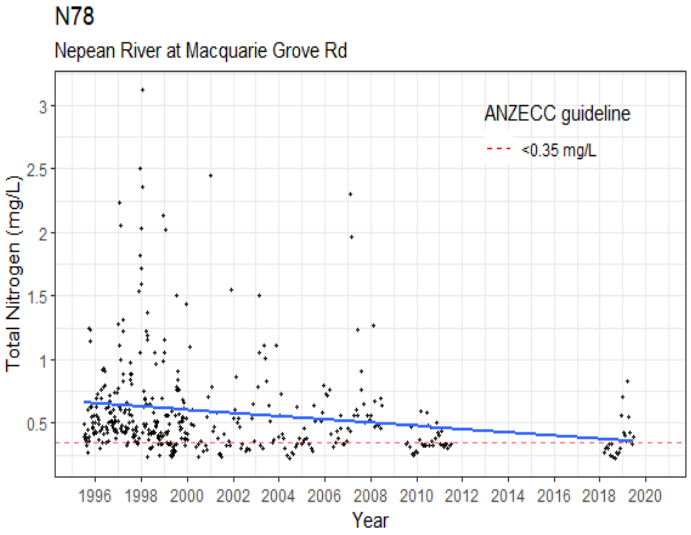

N91
Nepean River at Maldon Bridge
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

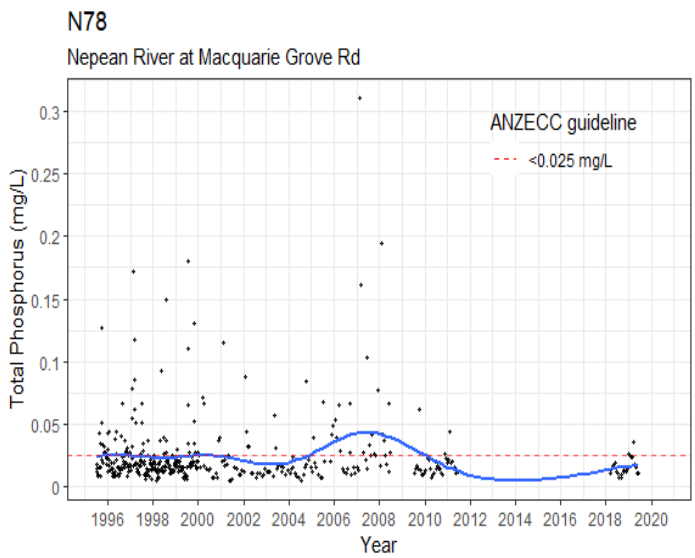

N91
Nepean River at Maldon Bridge
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

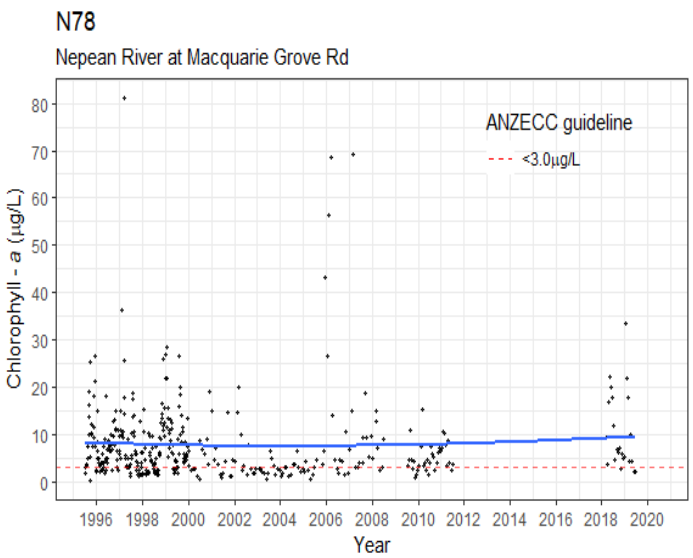

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

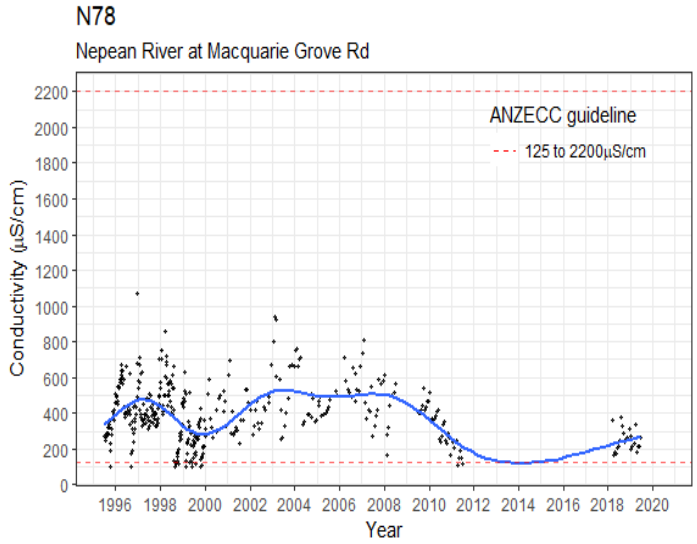

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

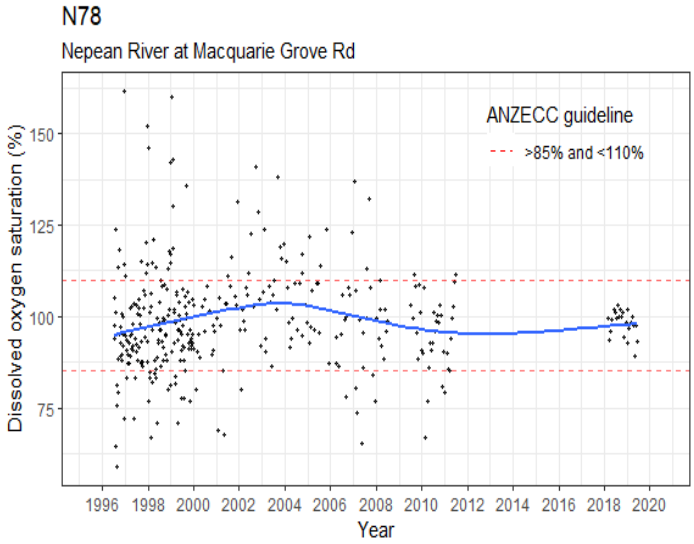

N78
Nepean River at Macquarie Grove Rd
Dissolved Inorganic Nitrogen (mg/L)
Year

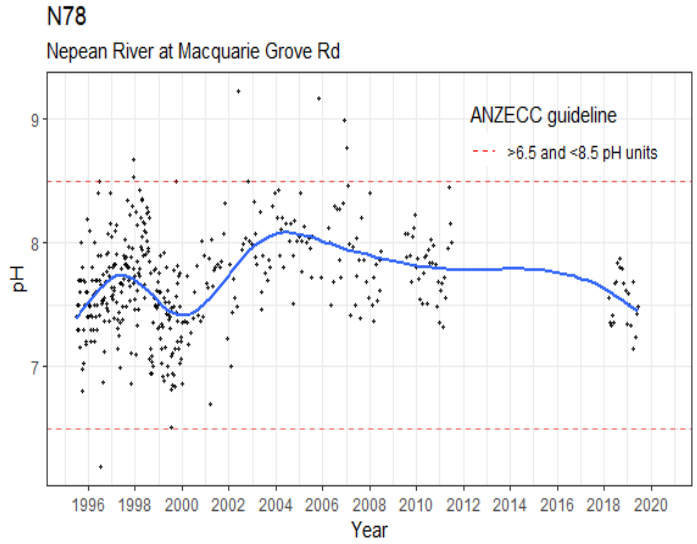

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

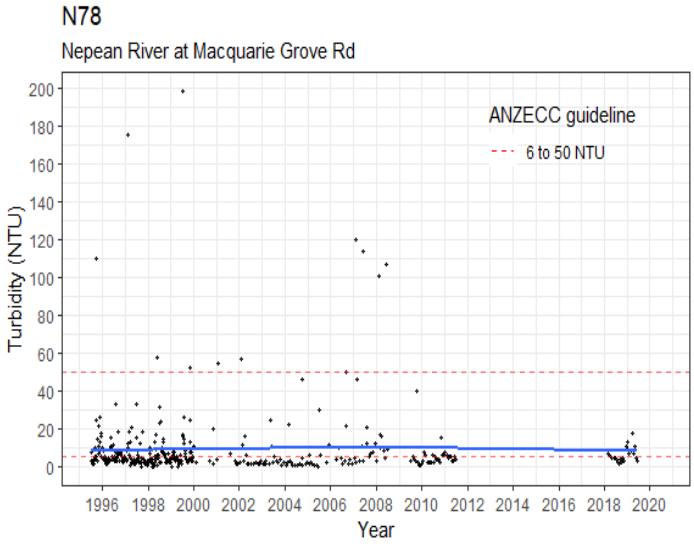

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

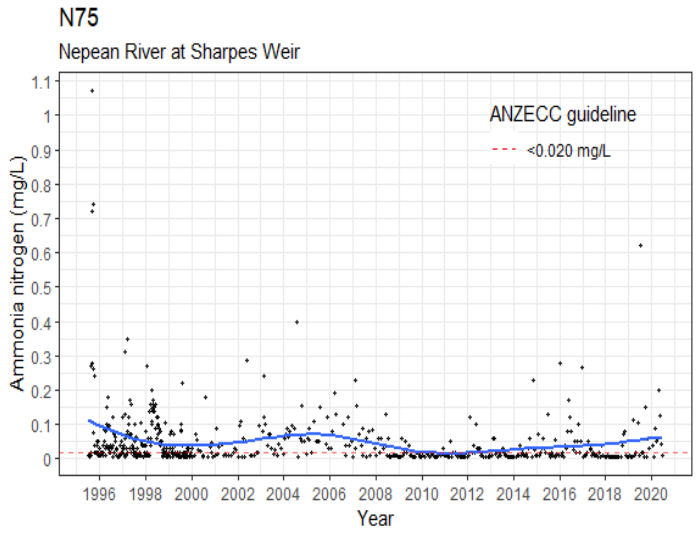

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

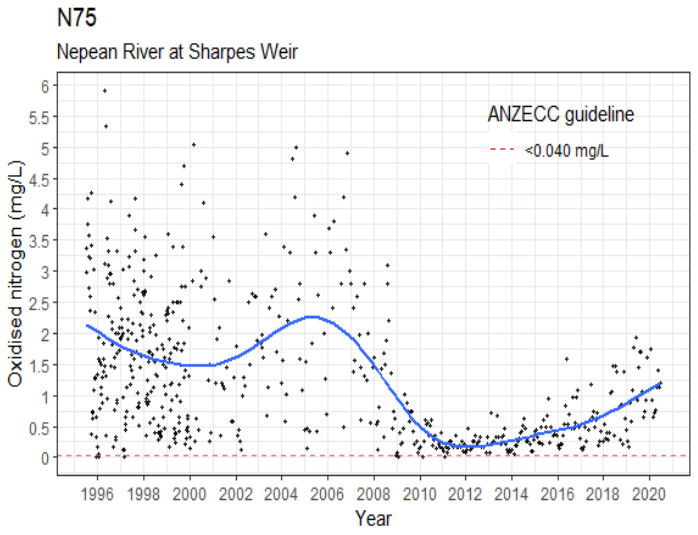

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

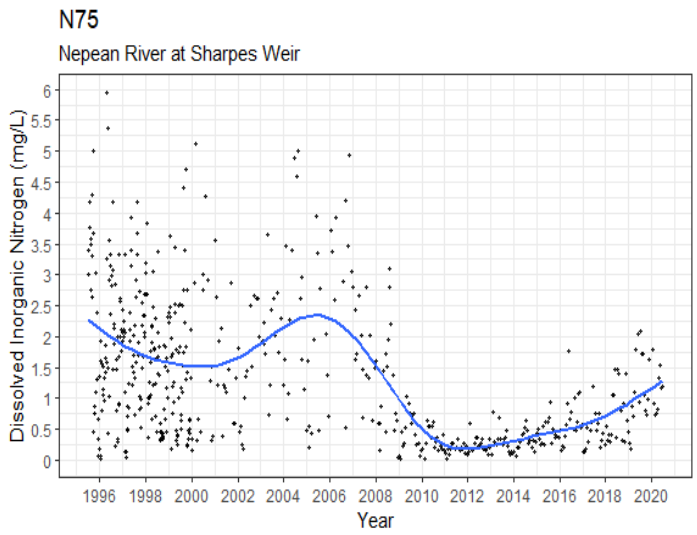

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

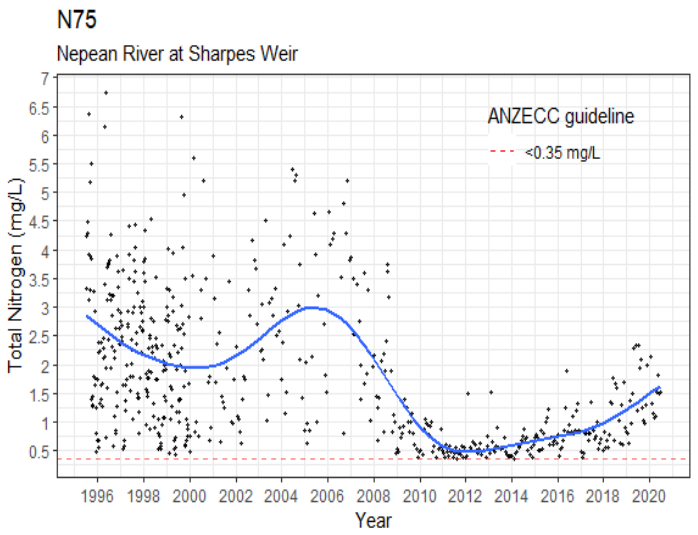

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

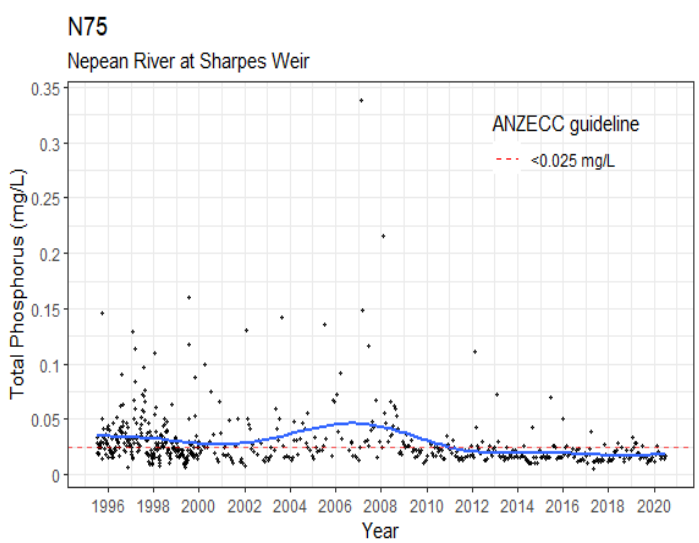

N78
Nepean River at Macquarie Grove Rd
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

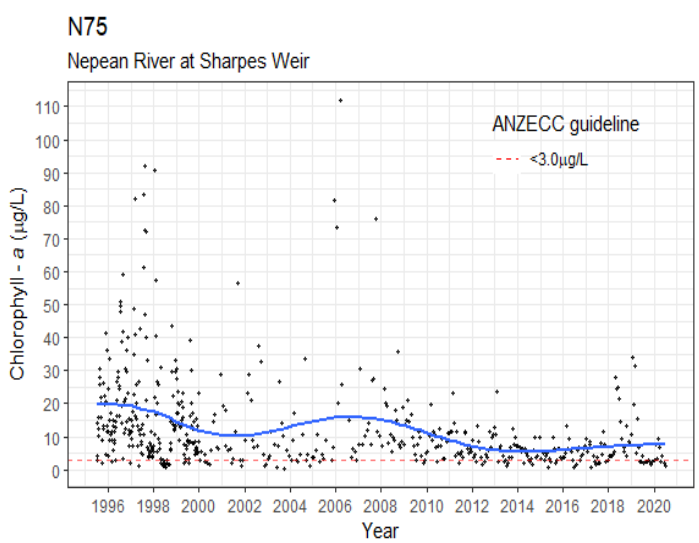

N75
Nepean River at Sharpes Weir
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

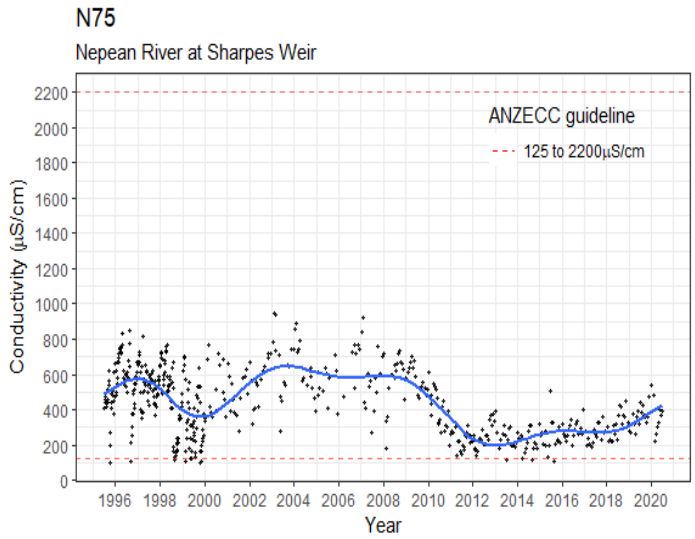

N75
Nepean River at Sharpes Weir
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

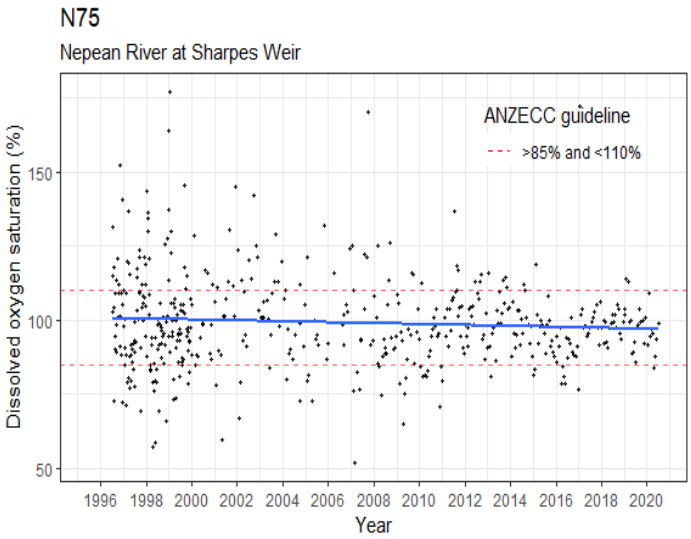

N75
Nepean River at Sharpes Weir
Dissolved Inorganic Nitrogen (mg/L)
Year

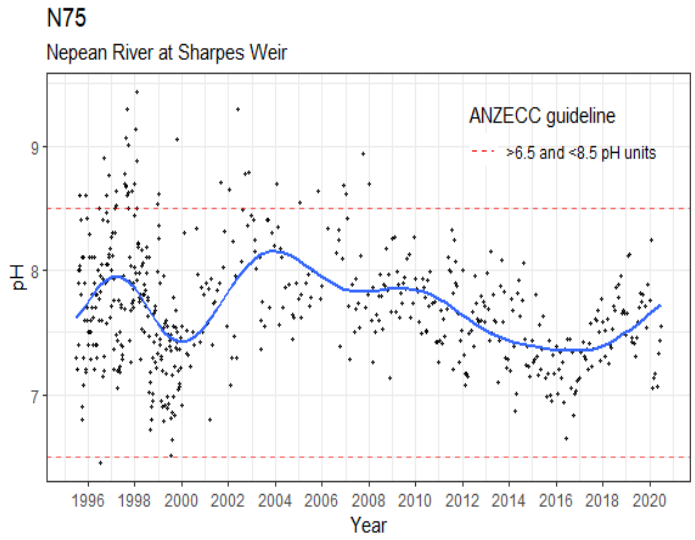

N75
Nepean River at Sharpes Weir
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

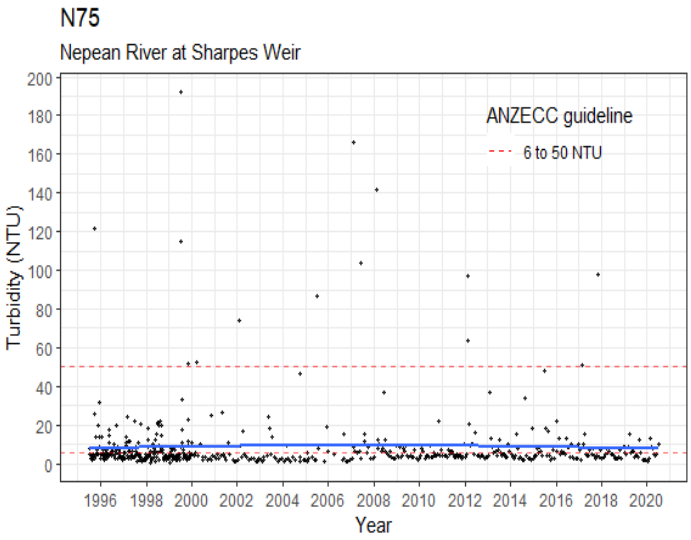

N75
Nepean River at Sharpes Weir
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

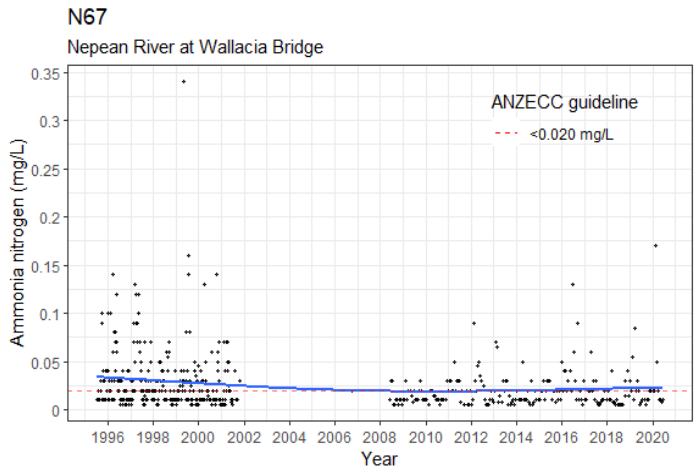

N75
Nepean River at Sharpes Weir
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

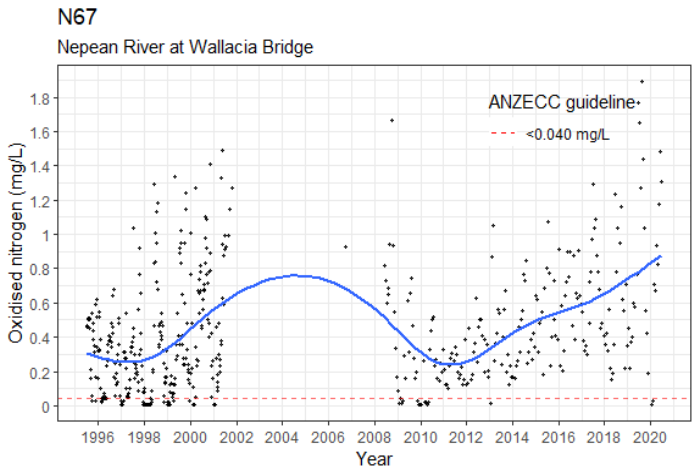

N75
Nepean River at Sharpes Weir
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

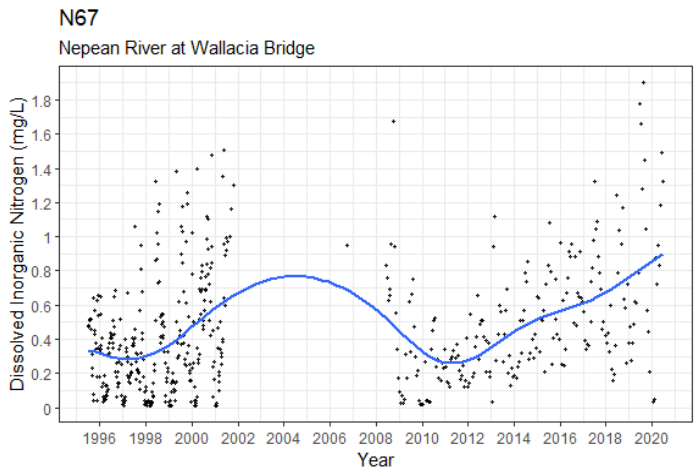

N75
Nepean River at Sharpes Weir
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

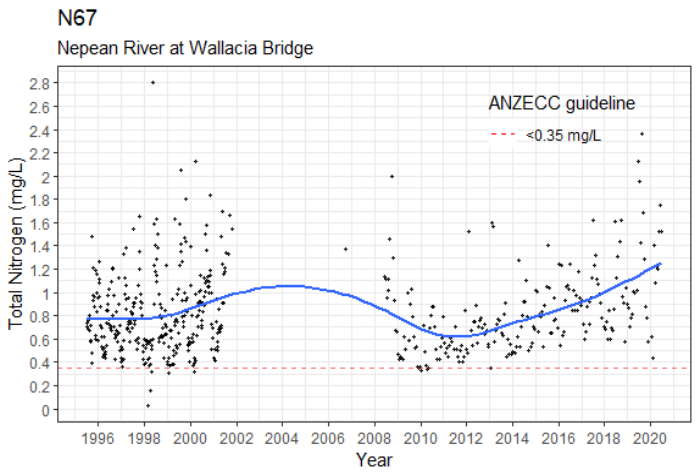

N75
Nepean River at Sharpes Weir
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

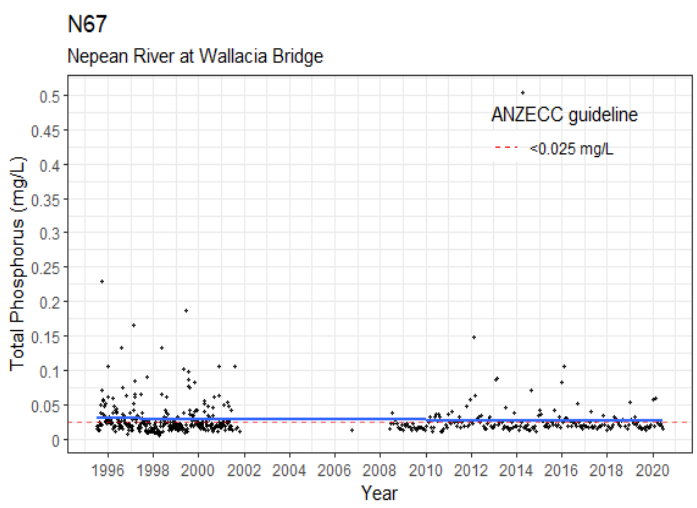

N75
Nepean River at Sharpes Weir
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

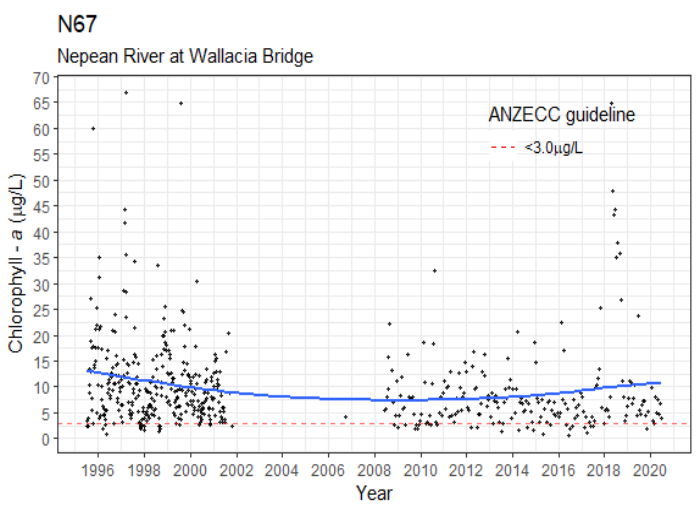

N67
Nepean River at Wallacia Bridge
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

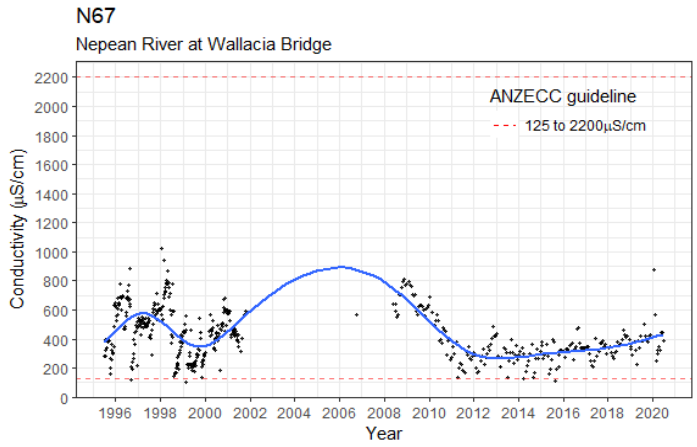

N67
Nepean River at Wallacia Bridge
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

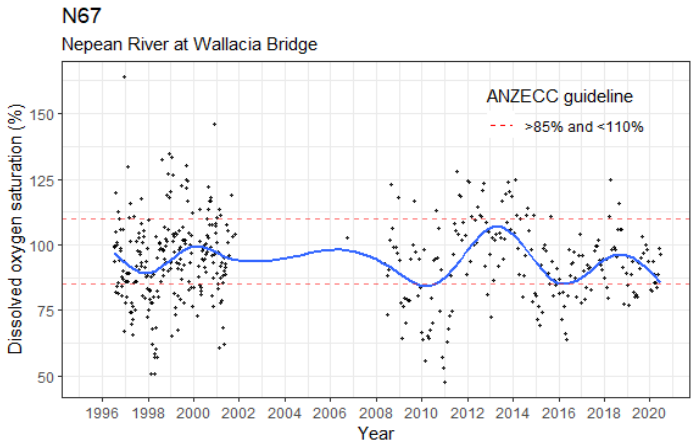

N67
Nepean River at Wallacia Bridge
Dissolved Inorganic Nitrogen (mg/L)
Year

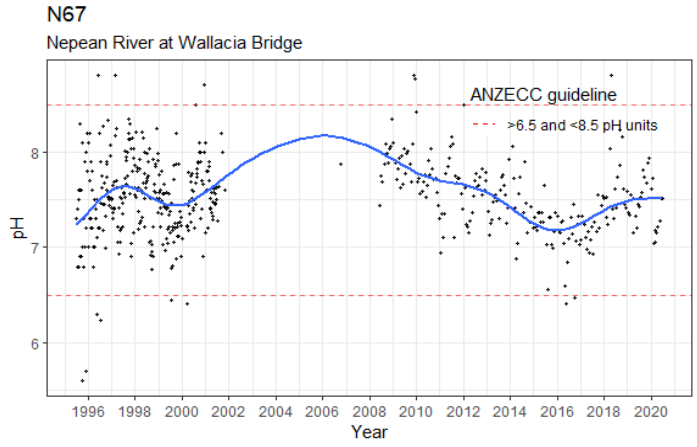

N67
Nepean River at Wallacia Bridge
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

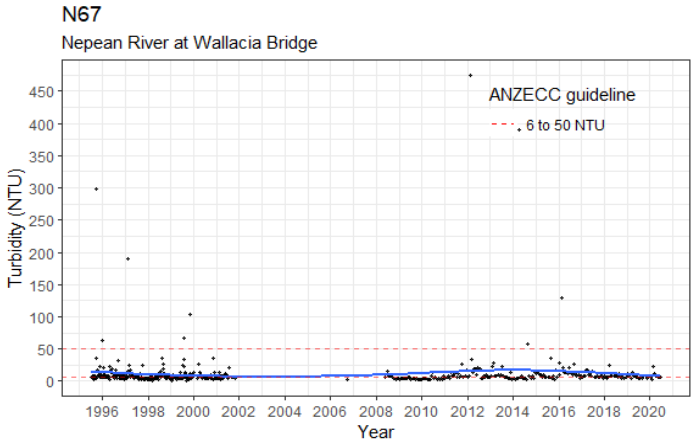

N67
Nepean River at Wallacia Bridge
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

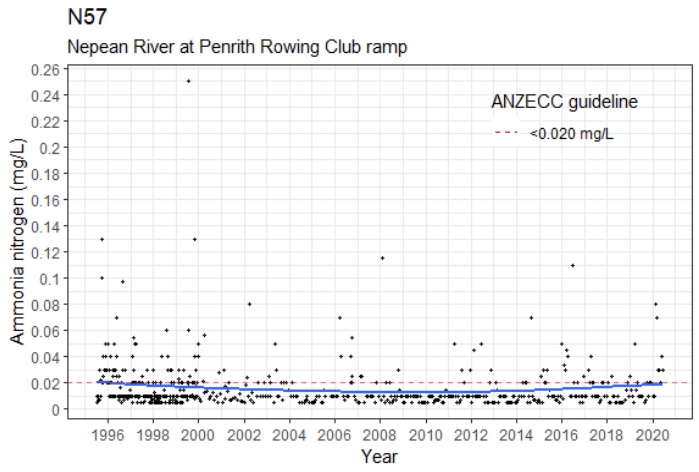

N67
Nepean River at Wallacia Bridge
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

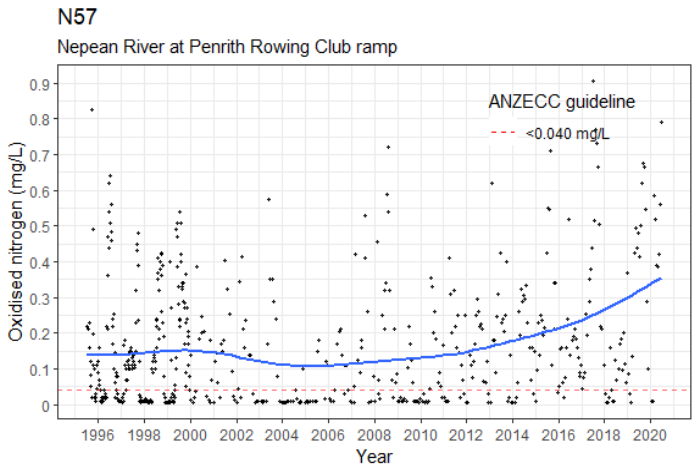

N67
Nepean River at Wallacia Bridge
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

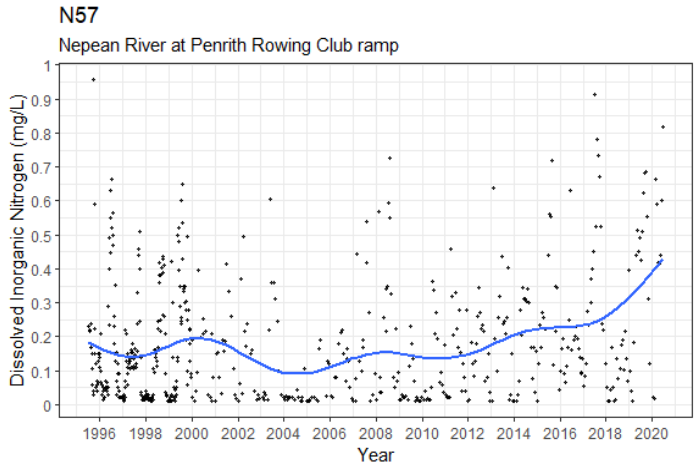

N67
Nepean River at Wallacia Bridge
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

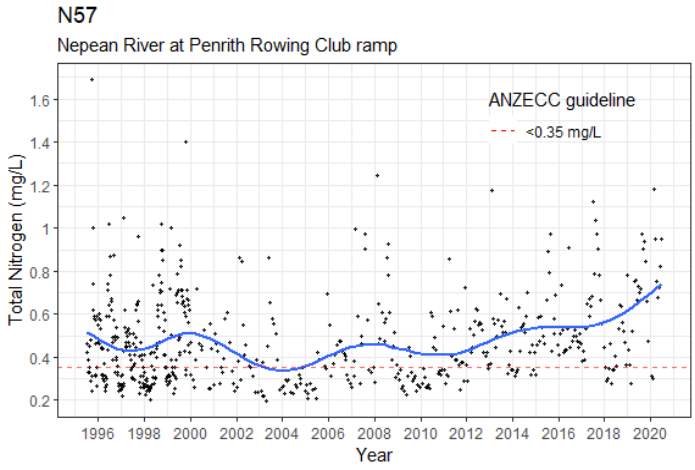

N67
Nepean River at Wallacia Bridge
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

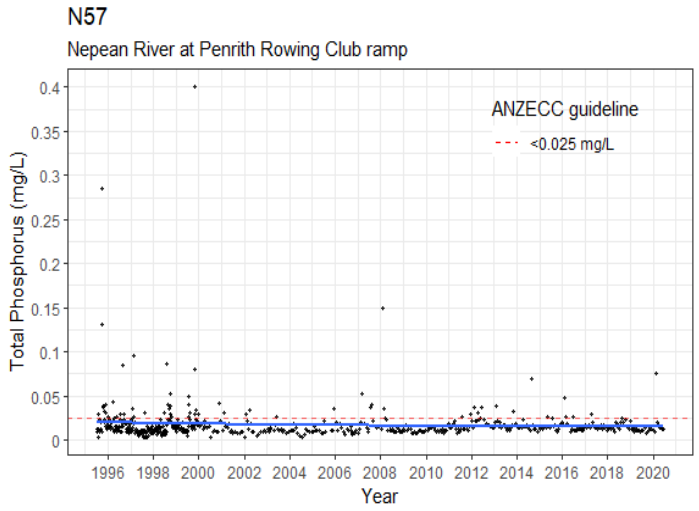

N67
Nepean River at Wallacia Bridge
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

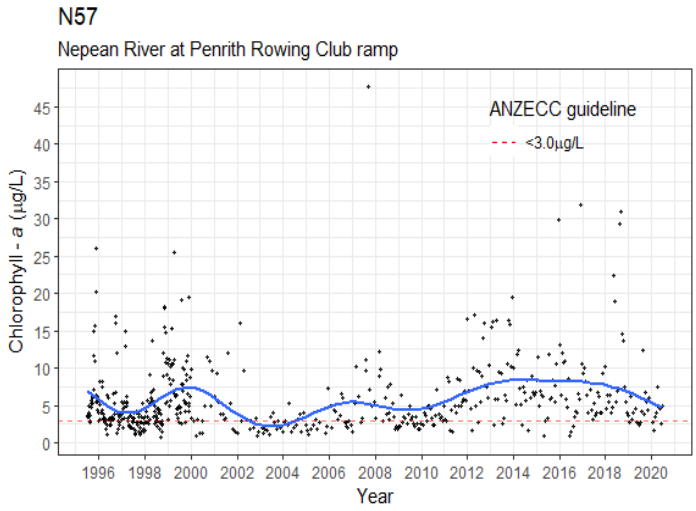

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

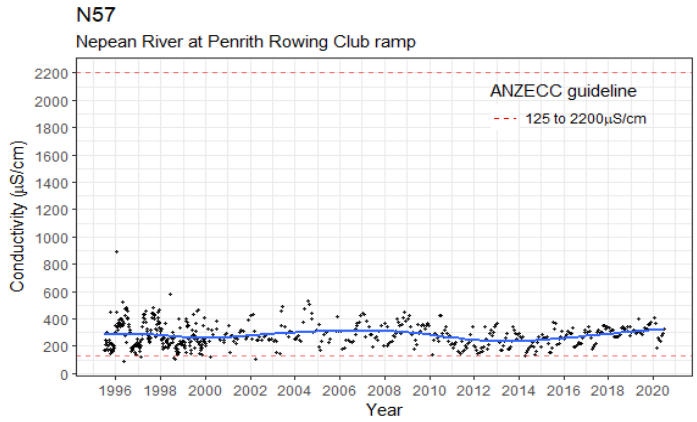

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

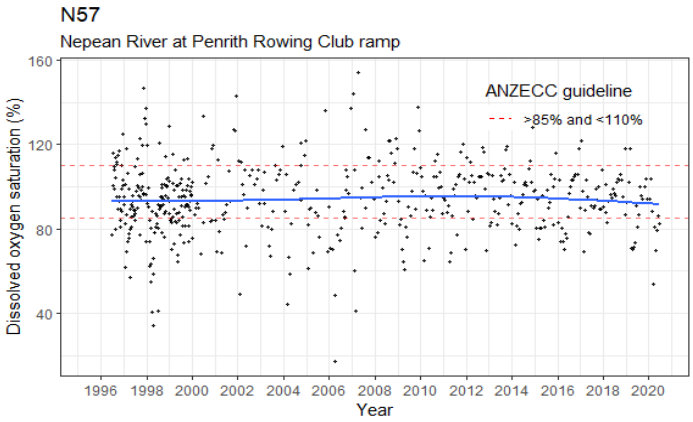

N57
Nepean River at Penrith Rowing Club ramp
Dissolved Inorganic Nitrogen (mg/L)
Year

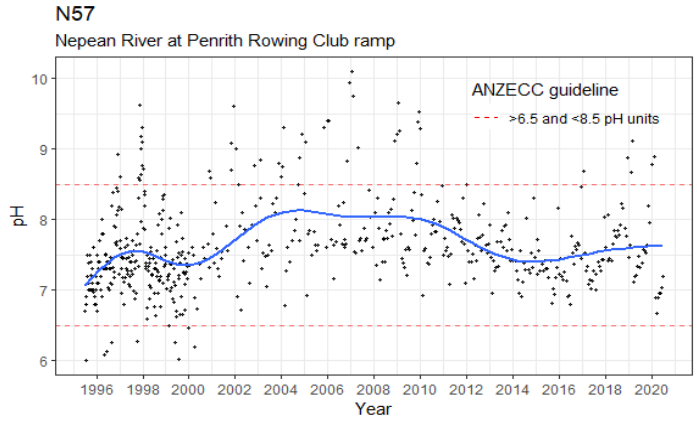

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

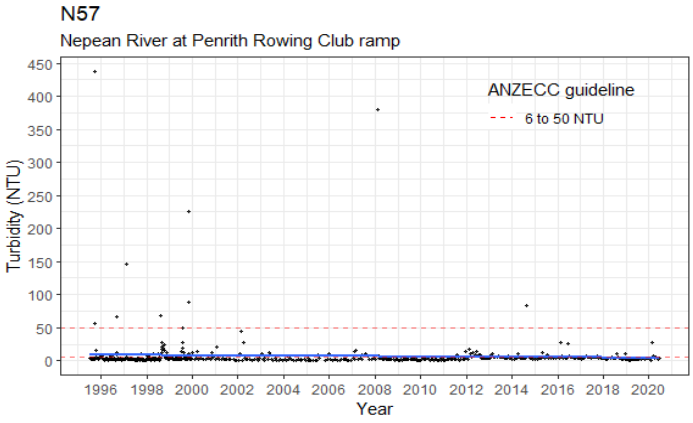

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

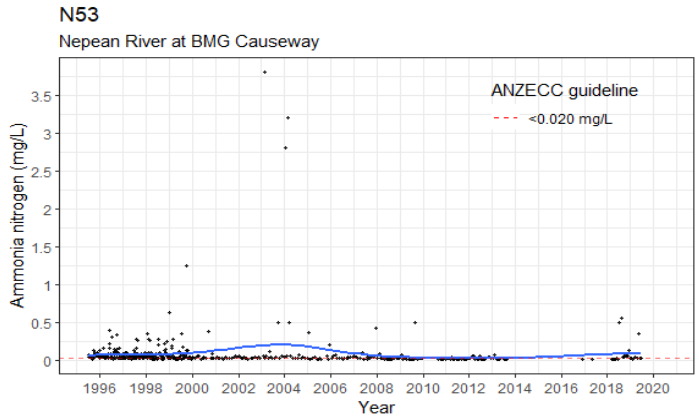

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

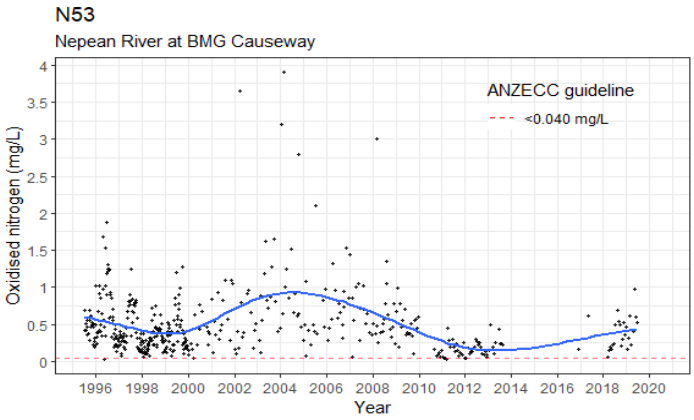

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

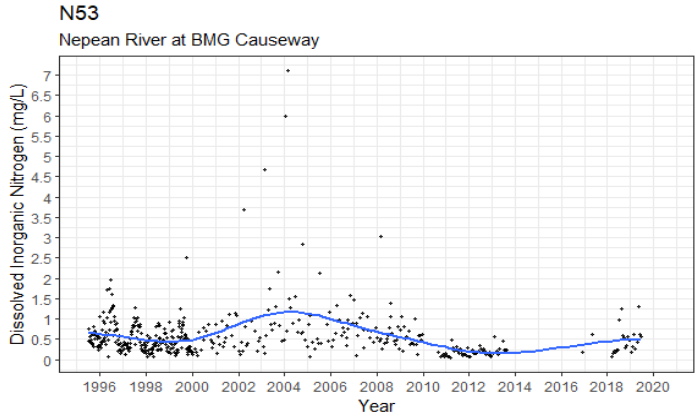

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

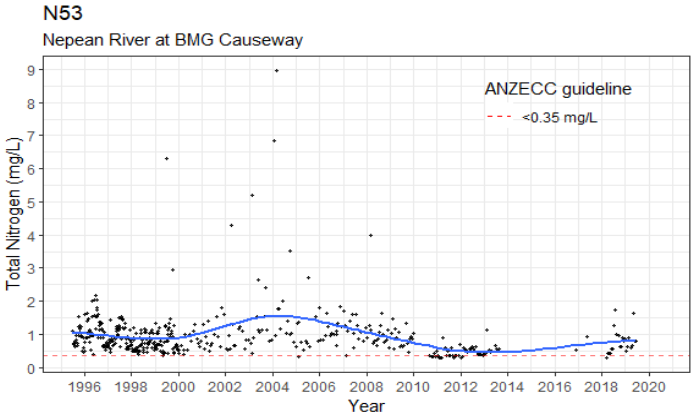

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

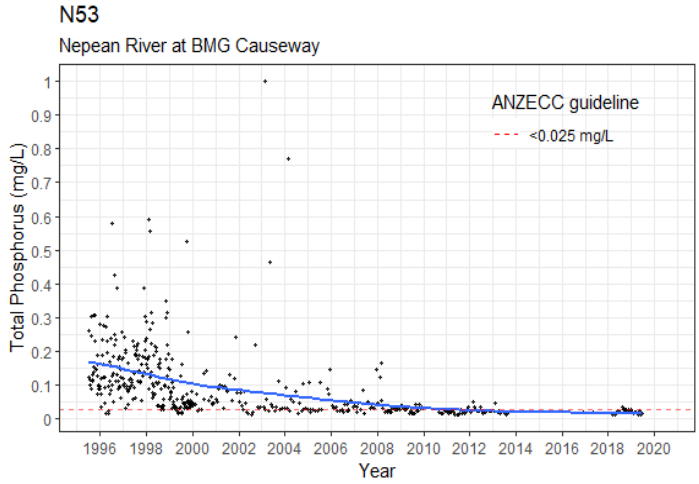

N57
Nepean River at Penrith Rowing Club ramp
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

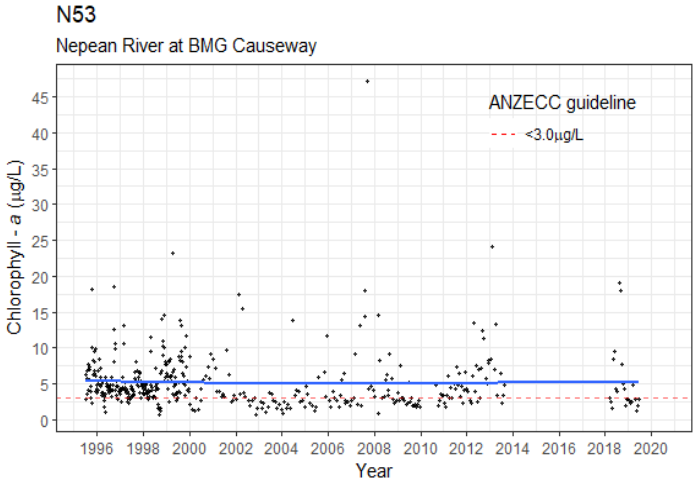

N53
Nepean River at BMG Causeway
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

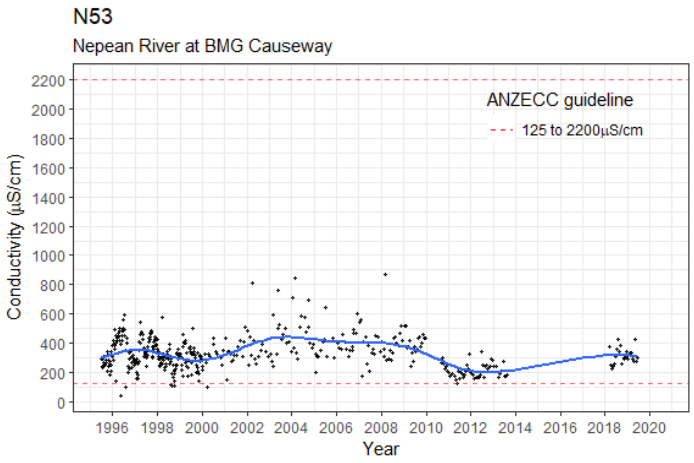

N53
Nepean River at BMG Causeway
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

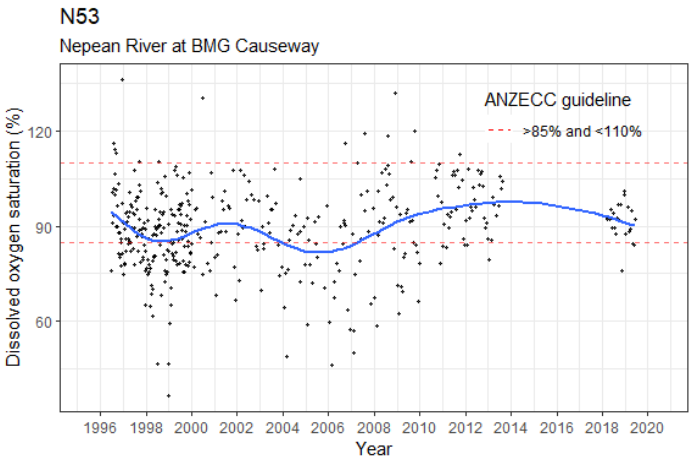

N53
Nepean River at BMG Causeway
Dissolved Inorganic Nitrogen (mg/L)
Year

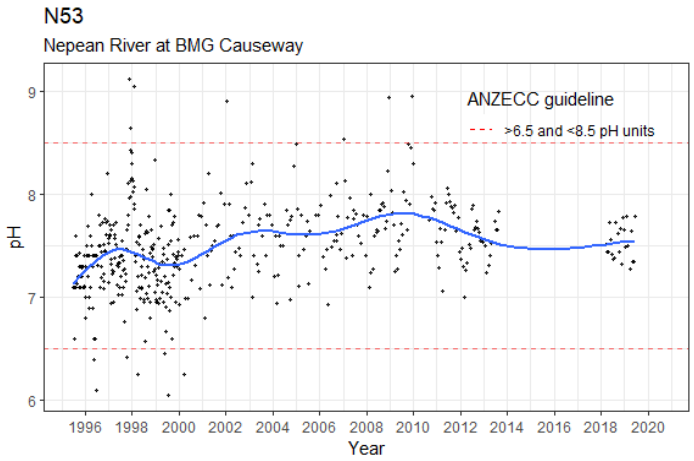

N53
Nepean River at BMG Causeway
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

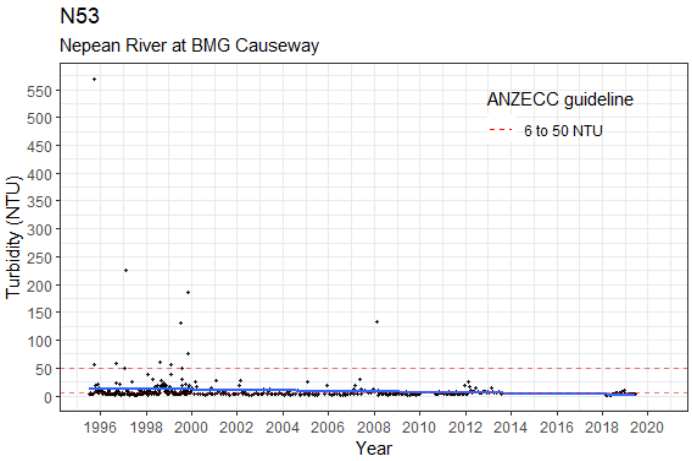

N53
Nepean River at BMG Causeway
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

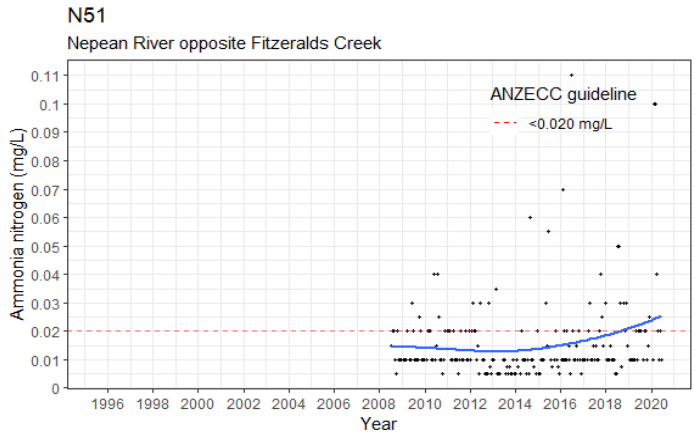

N53
Nepean River at BMG Causeway
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

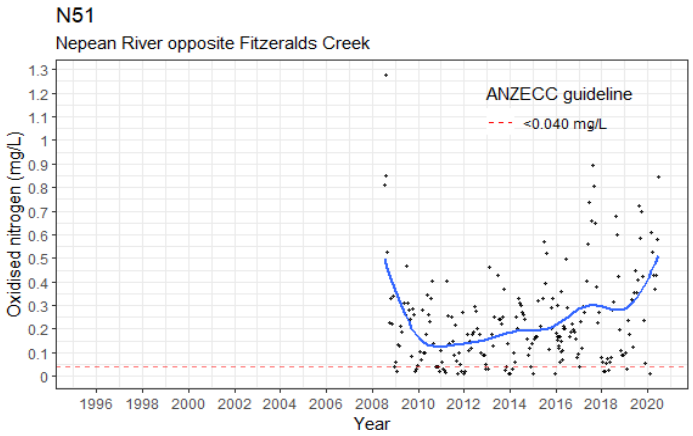

N53
Nepean River at BMG Causeway
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

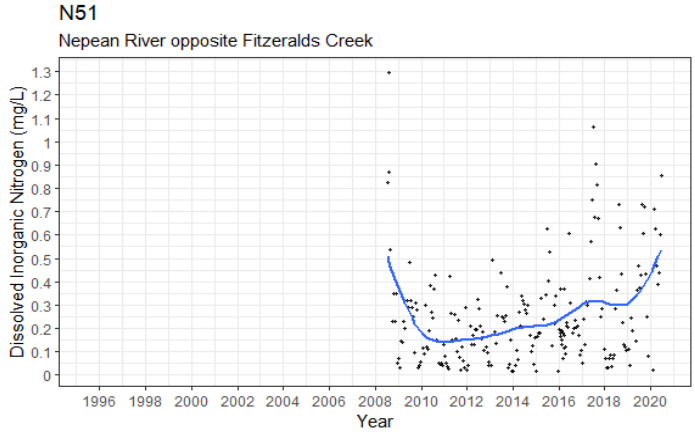

N53
Nepean River at BMG Causeway
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

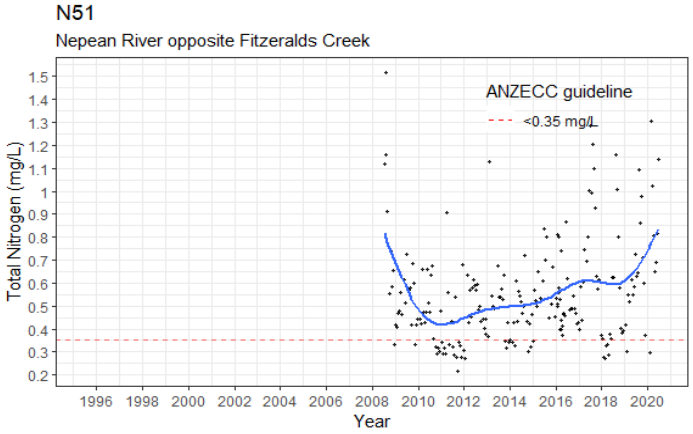

N53
Nepean River at BMG Causeway
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

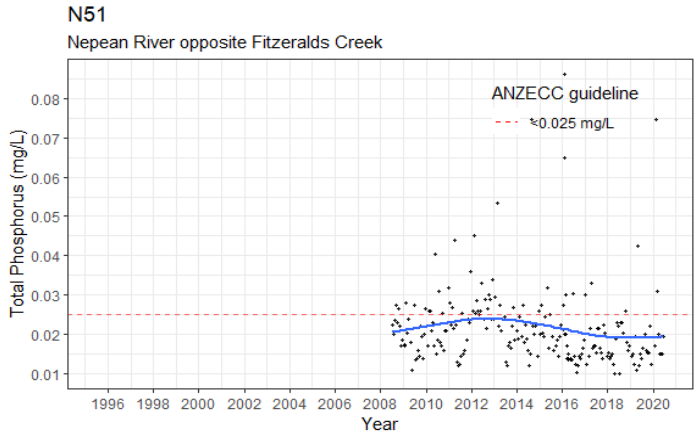

N53
Nepean River at BMG Causeway
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

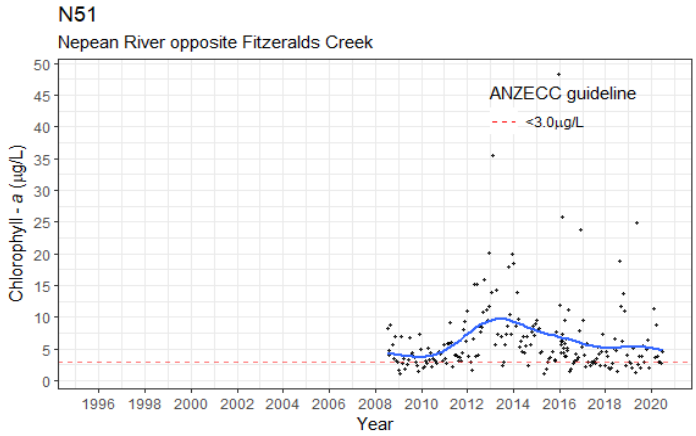

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

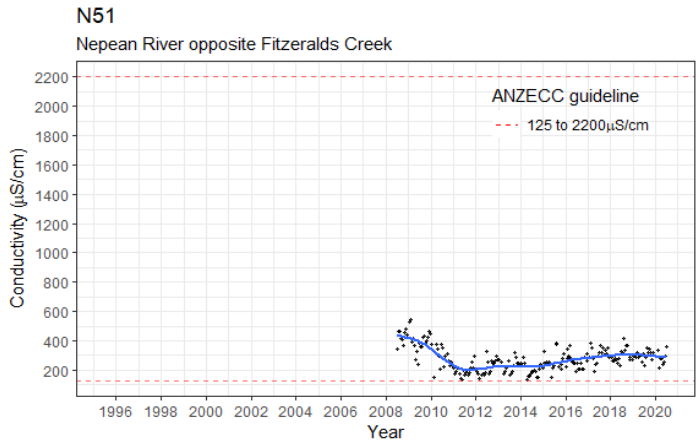

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

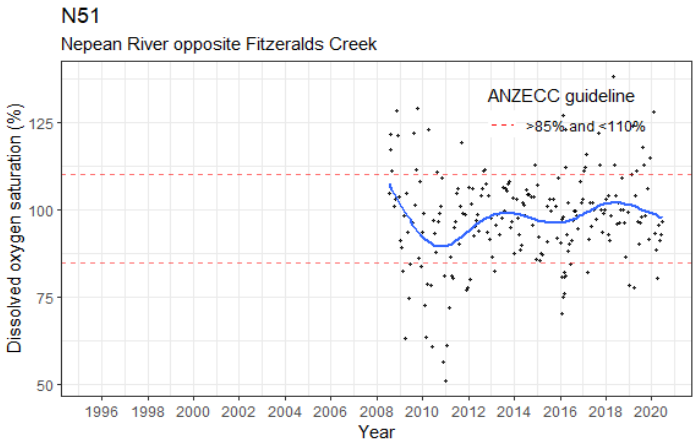

N51
Nepean River opposite Fitzeralds Creek
Dissolved Inorganic Nitrogen (mg/L)
Year

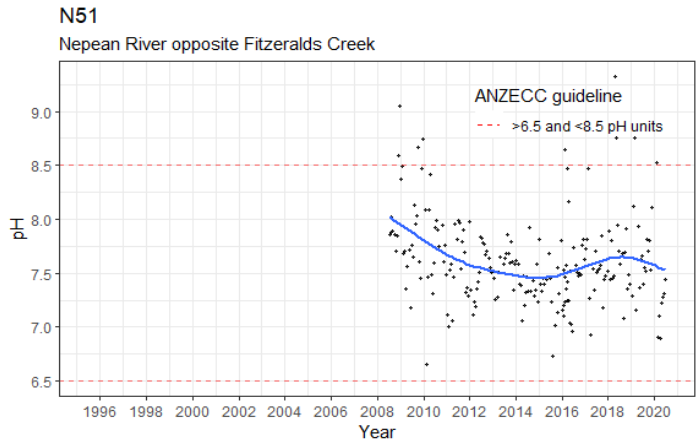

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

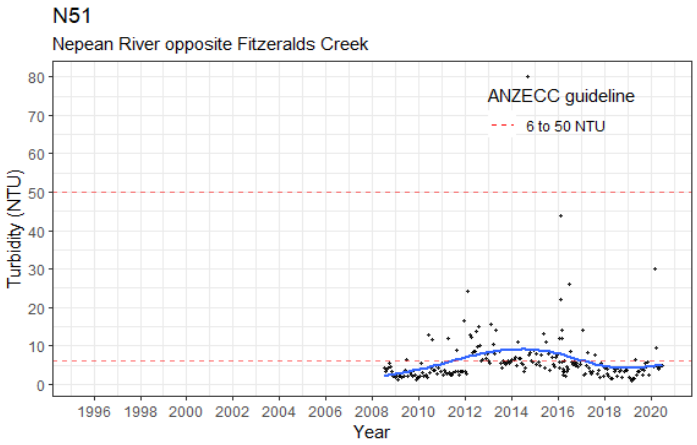

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

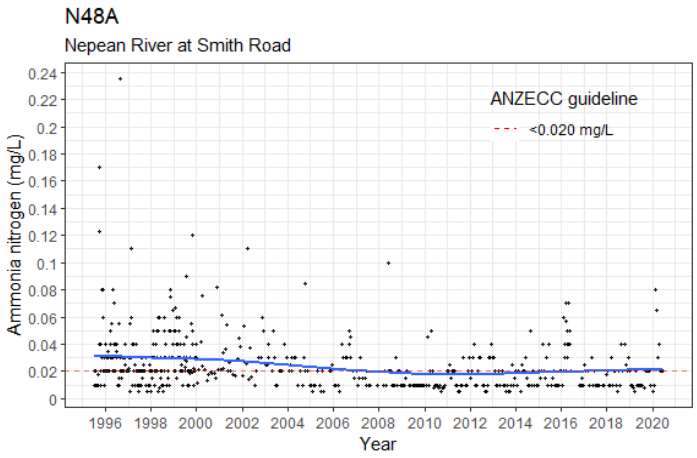

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

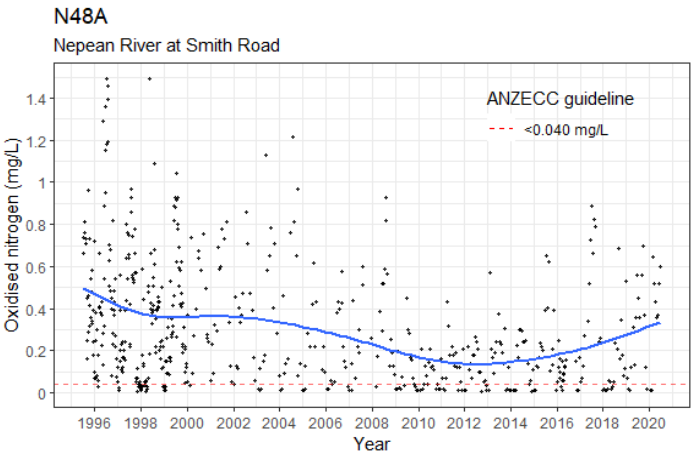

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

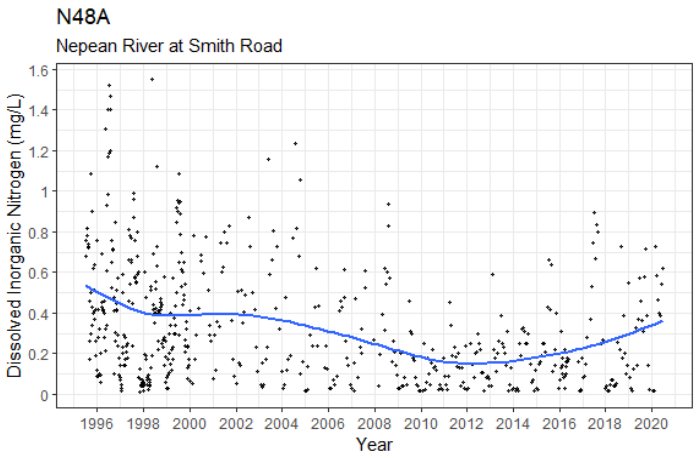

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

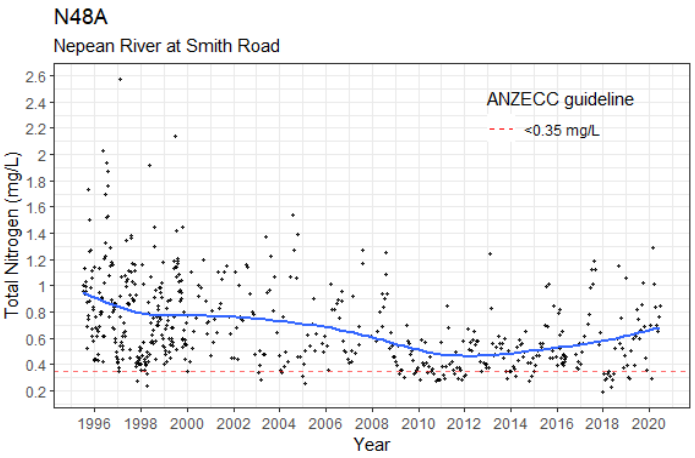

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

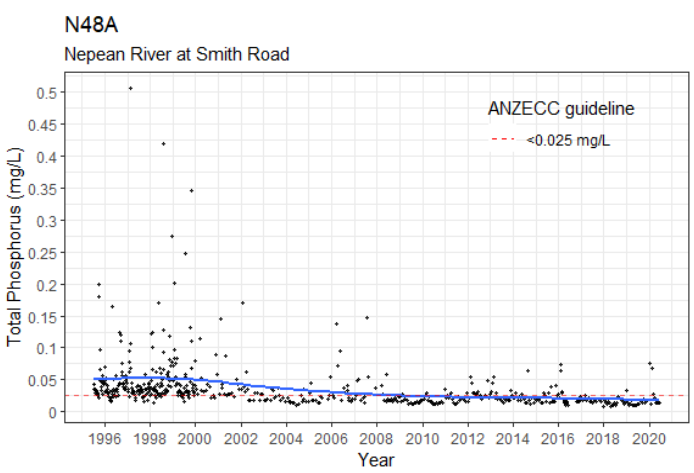

N51
Nepean River opposite Fitzeralds Creek
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

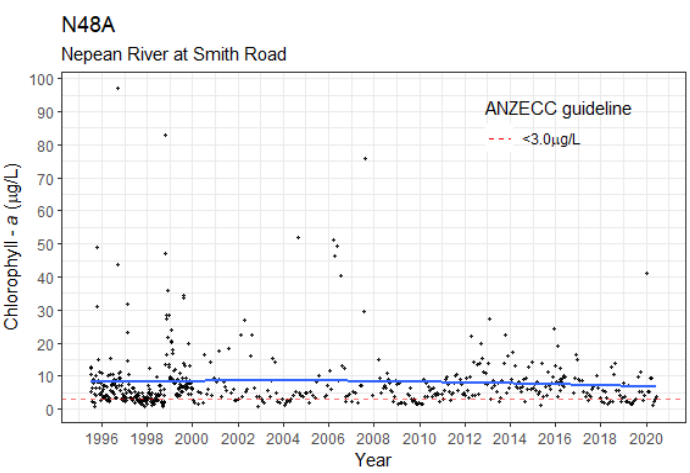

N48A
Nepean River at Smith Road
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

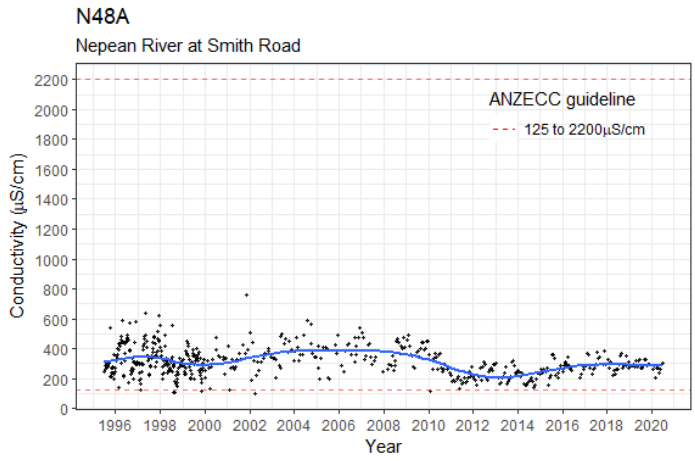

N48A
Nepean River at Smith Road
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

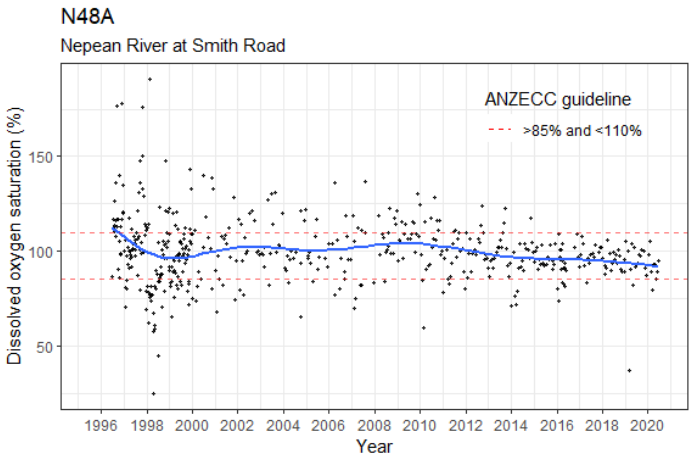

N48A
Nepean River at Smith Road
Dissolved Inorganic Nitrogen (mg/L)
Year

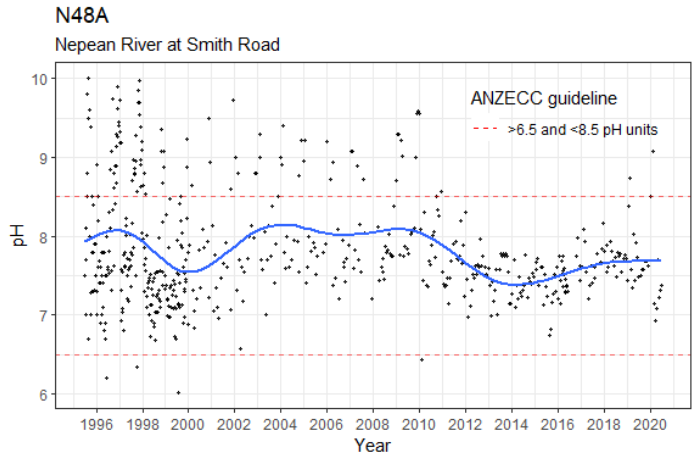

N48A
Nepean River at Smith Road
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

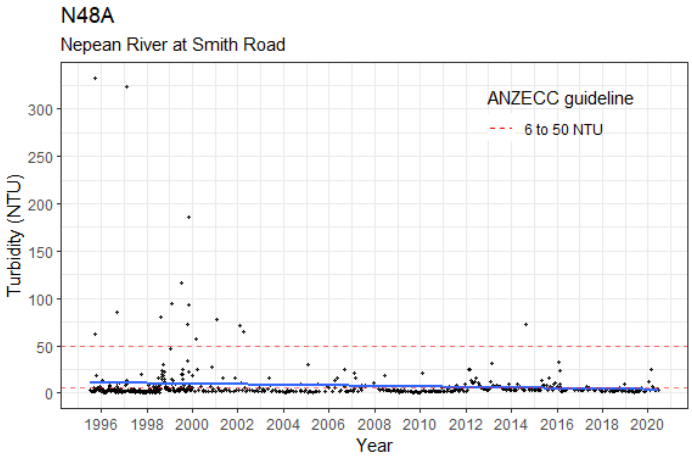

N48A
Nepean River at Smith Road
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

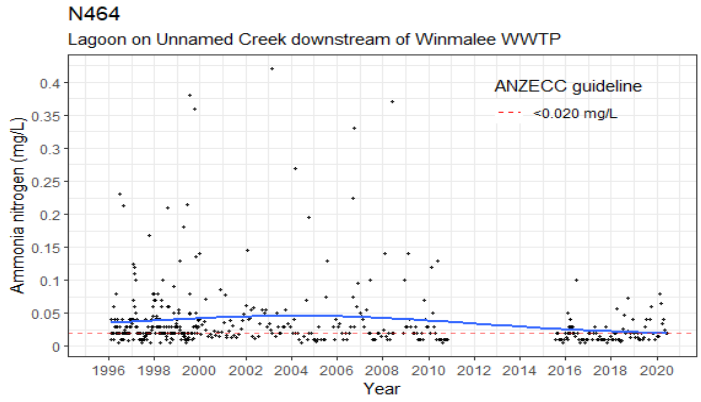

N48A
Nepean River at Smith Road
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

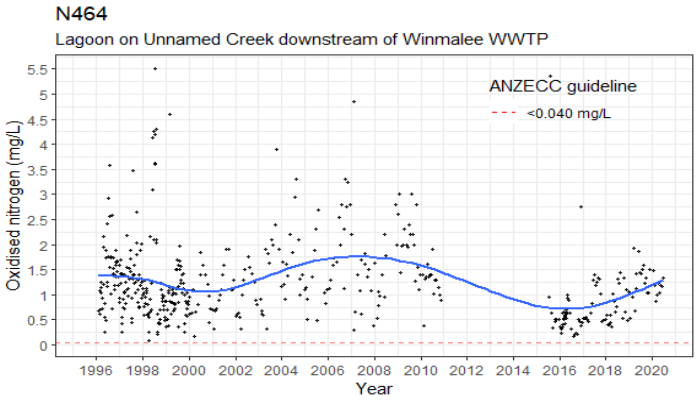

N48A
Nepean River at Smith Road
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

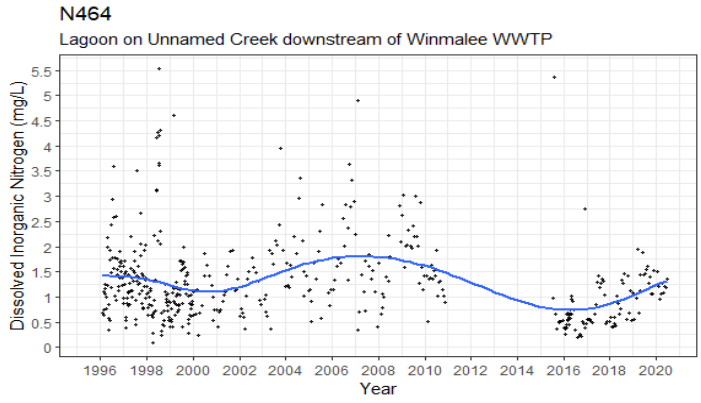

N48A
Nepean River at Smith Road
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

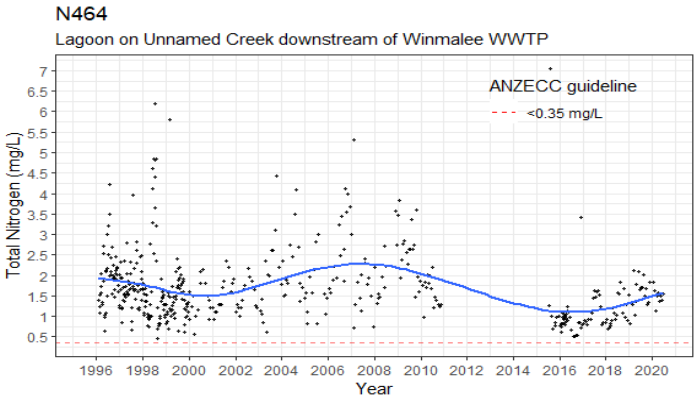

N48A
Nepean River at Smith Road
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

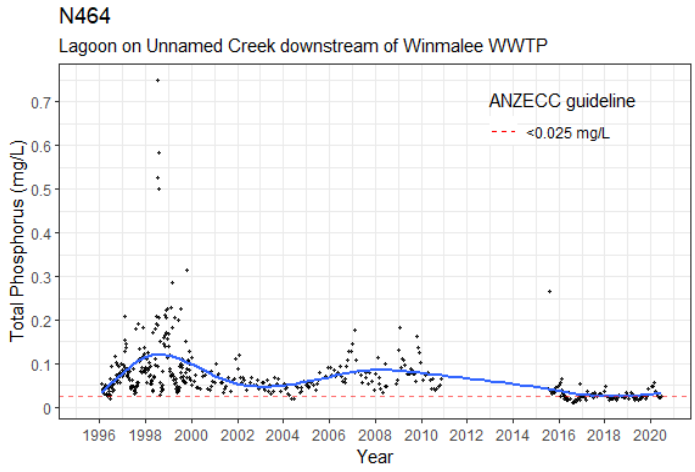

N48A
Nepean River at Smith Road
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

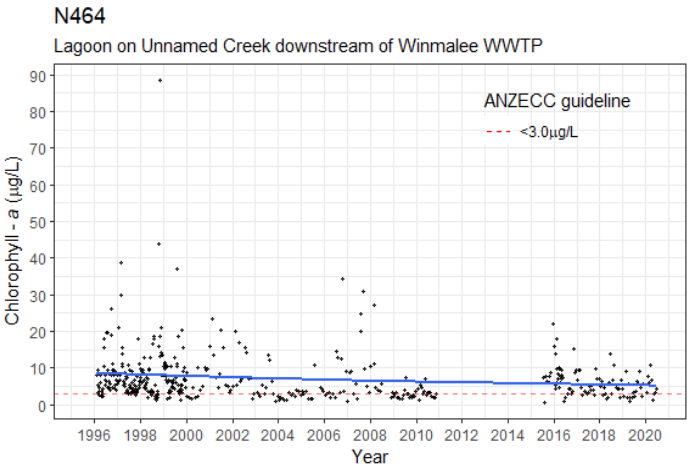

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

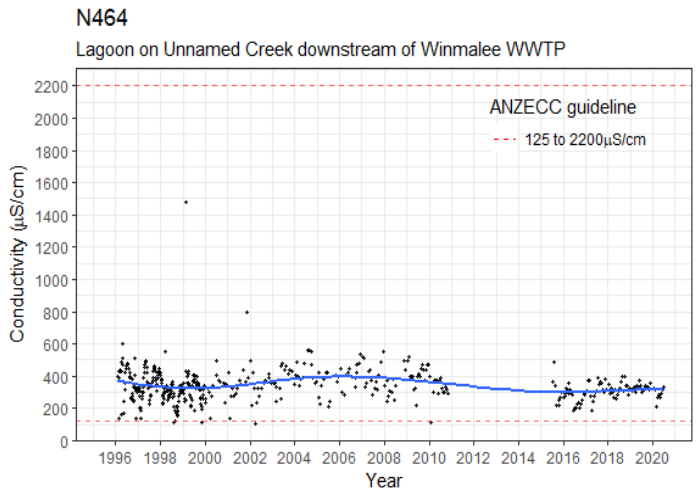

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

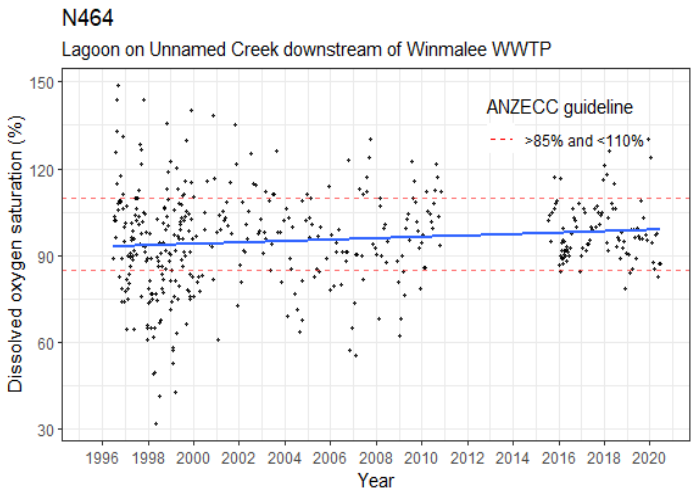

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
Dissolved Inorganic Nitrogen (mg/L)
Year

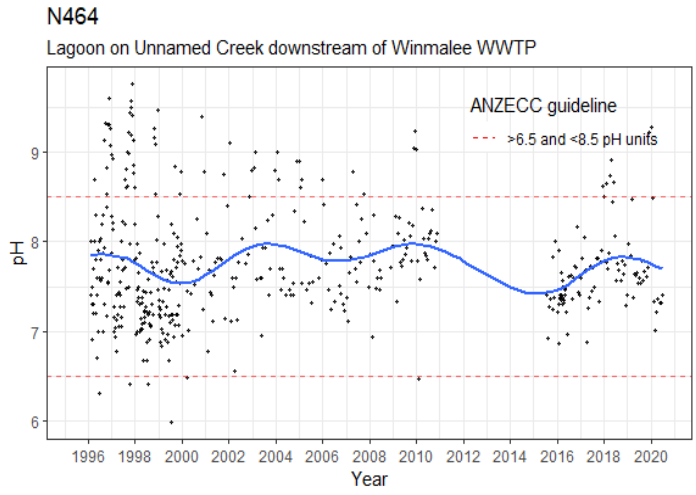

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

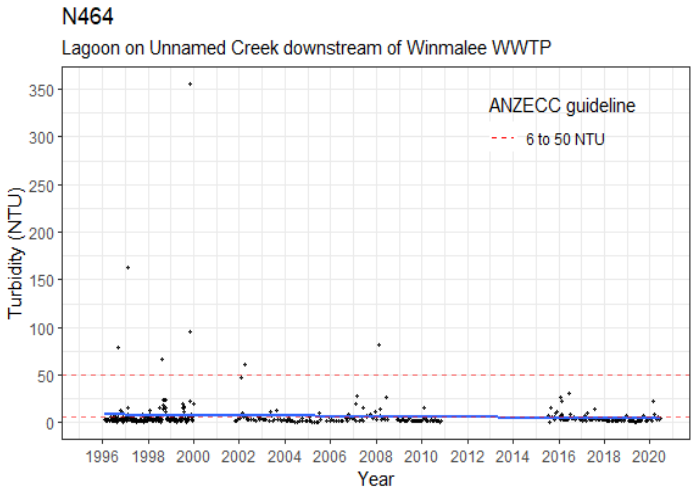

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

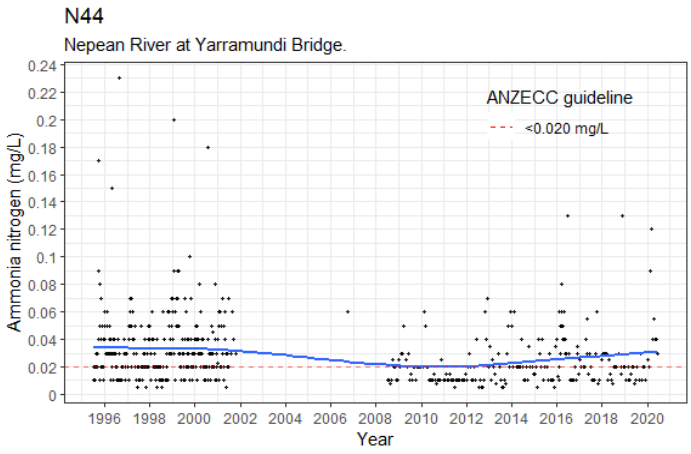

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

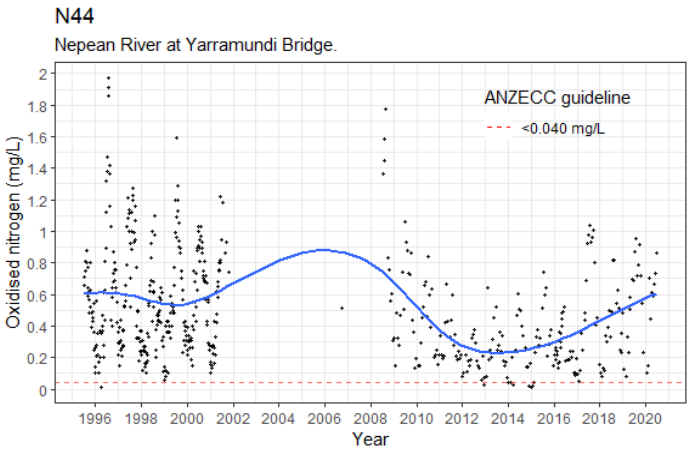

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

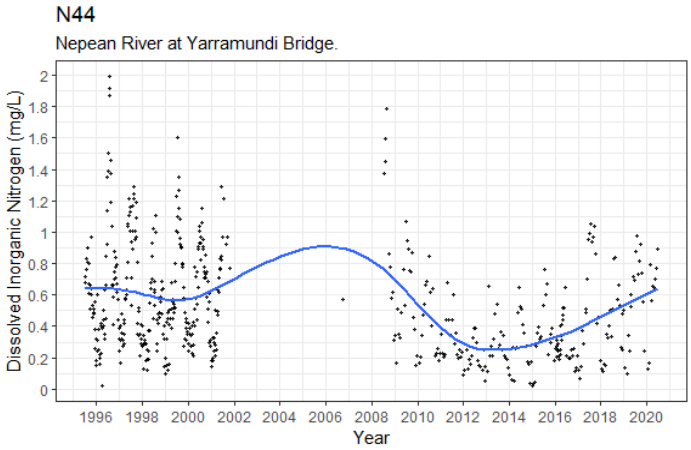

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

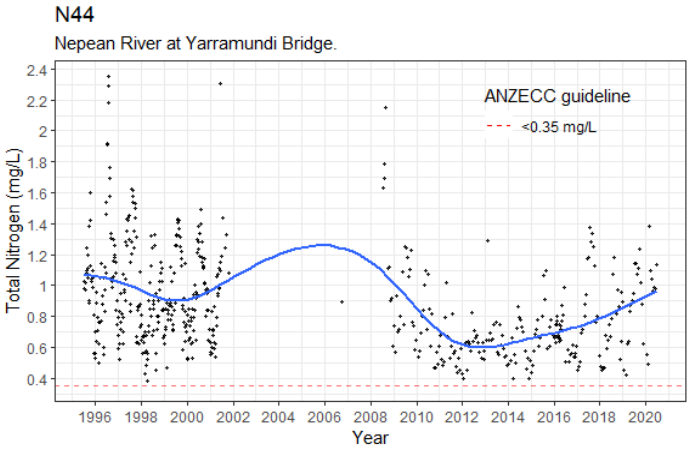

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

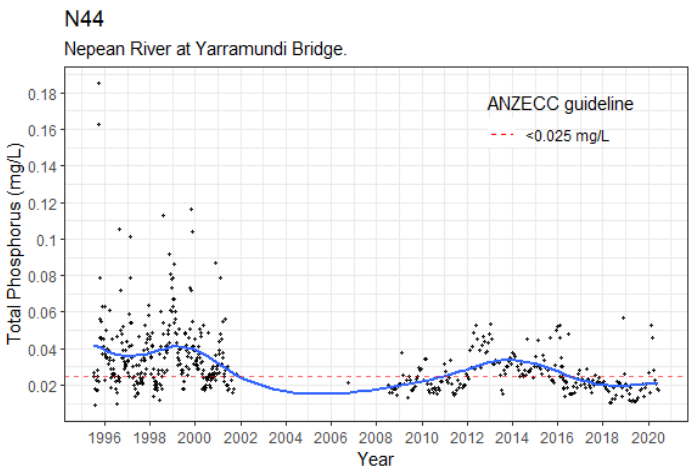

N464
Lagoon on Unnamed Creek downstream of Winmalee WWTP
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

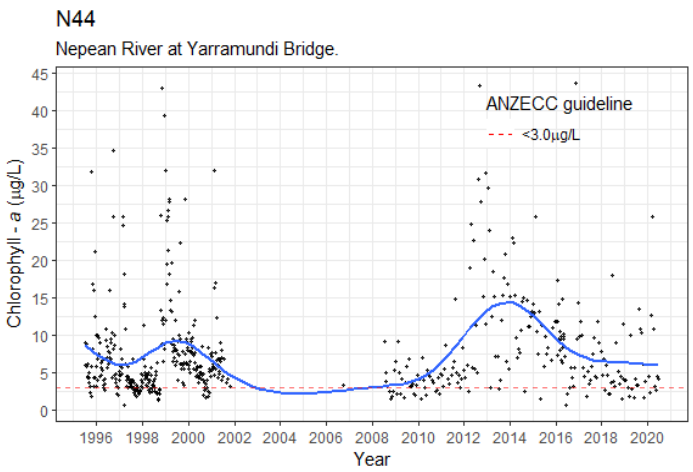

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

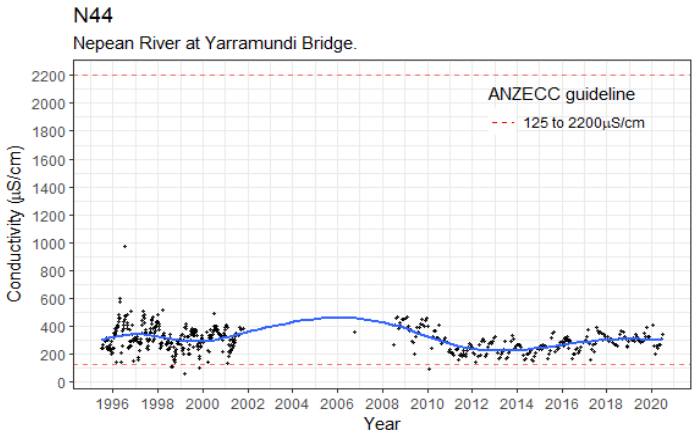

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

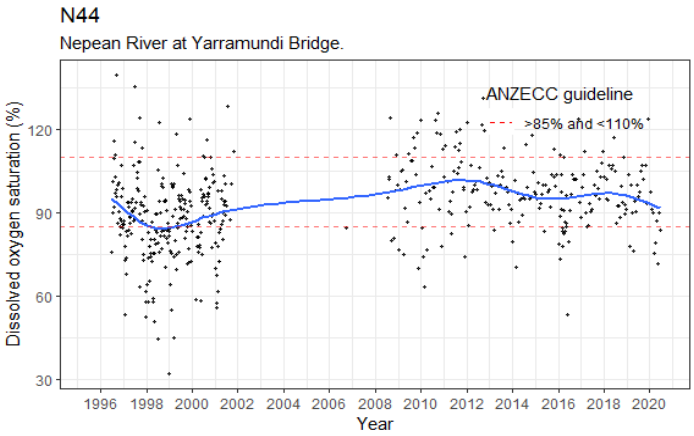

N44
Nepean River at Yarramundi Bridge.
Dissolved Inorganic Nitrogen (mg/L)
Year

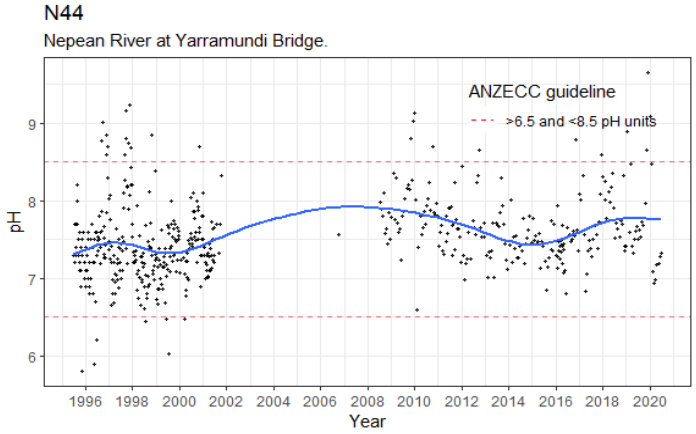

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

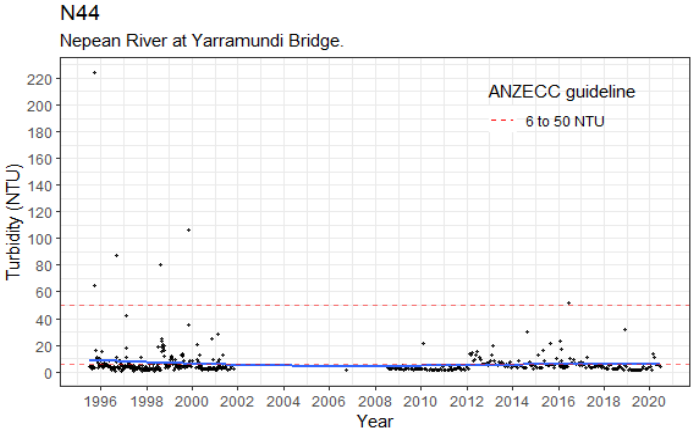

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

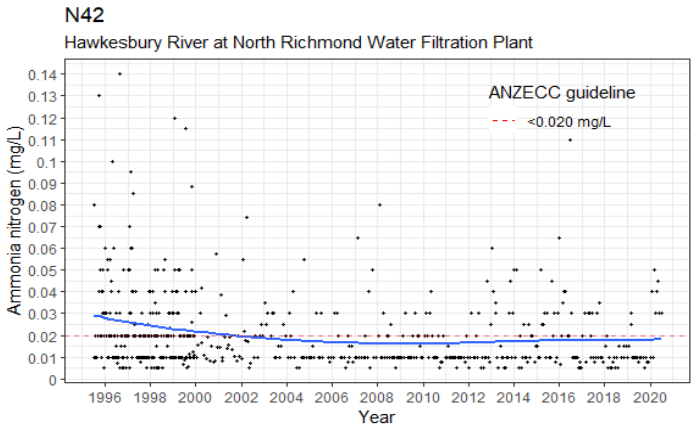

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

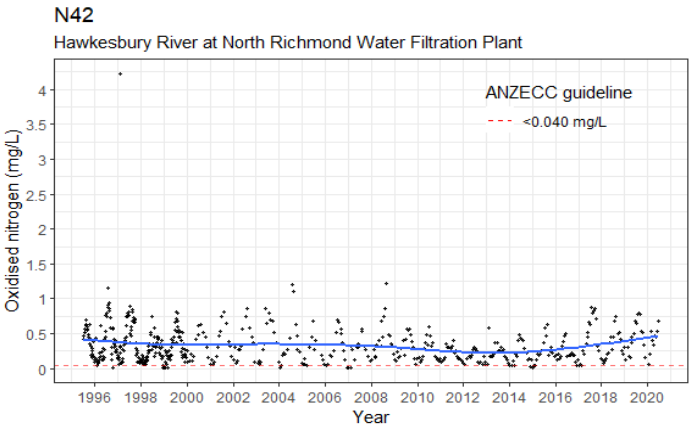

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

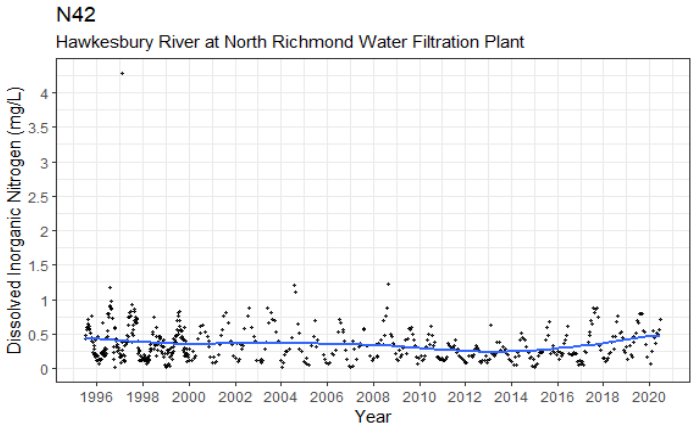

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

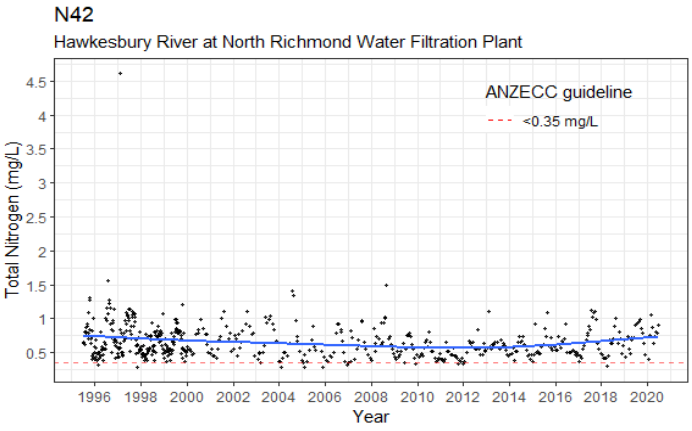

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

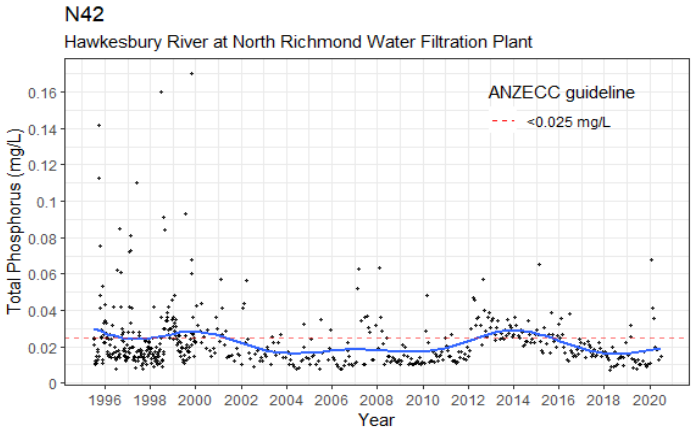

N44
Nepean River at Yarramundi Bridge.
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

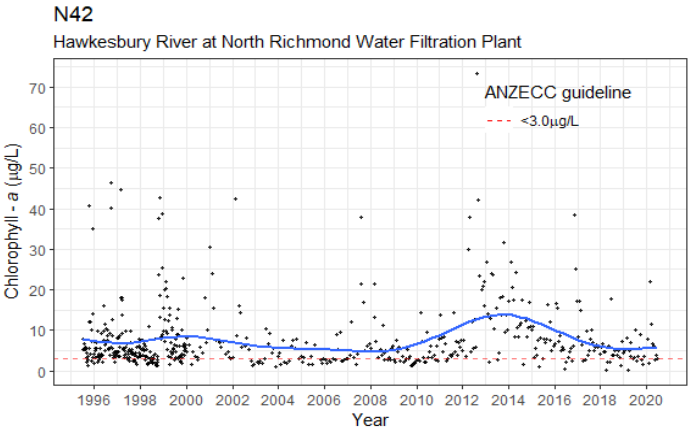

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

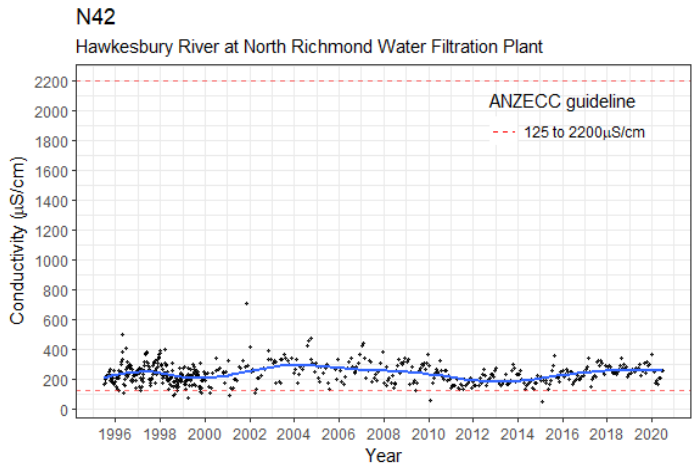

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

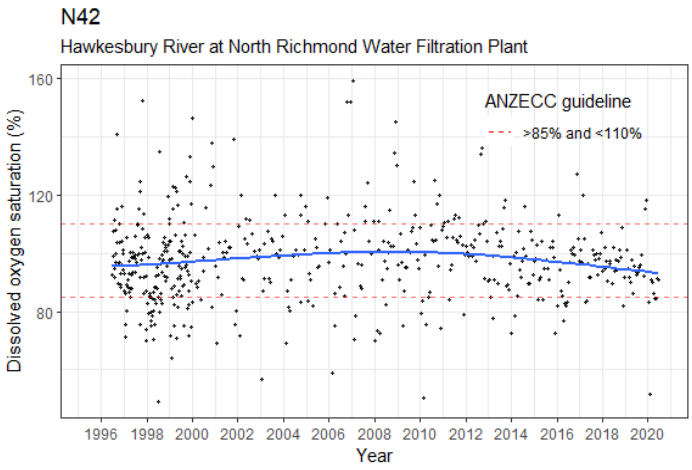

N42
Hawkesbury River at North Richmond Water Filtration Plant
Dissolved Inorganic Nitrogen (mg/L)
Year

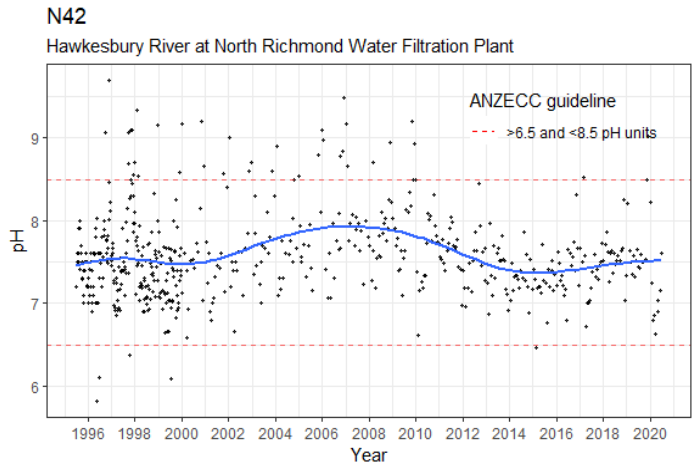

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

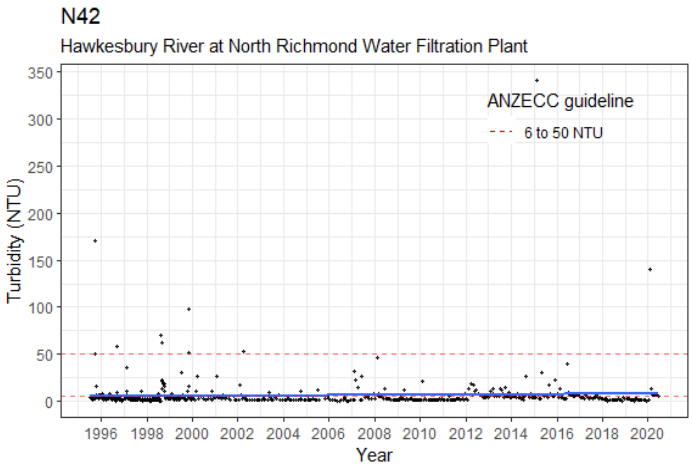

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

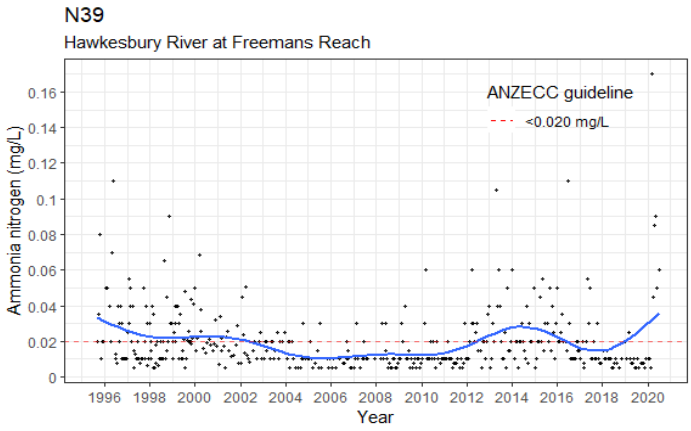

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

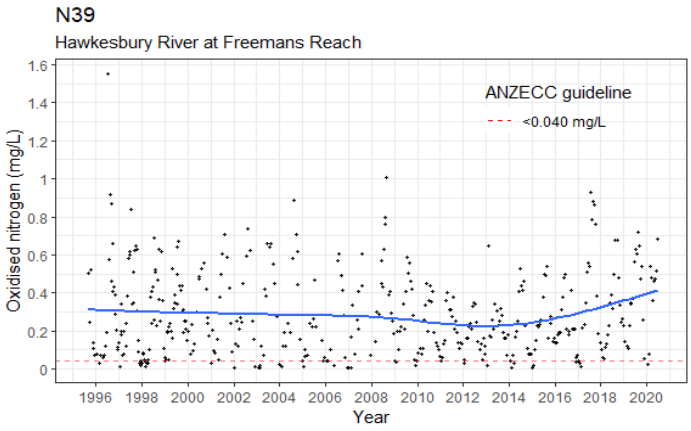

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

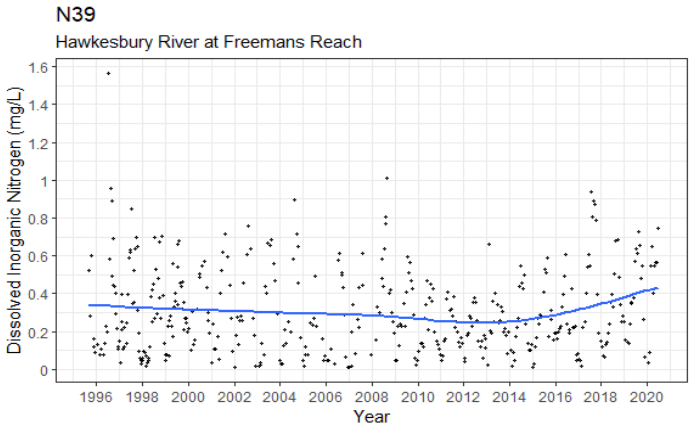

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

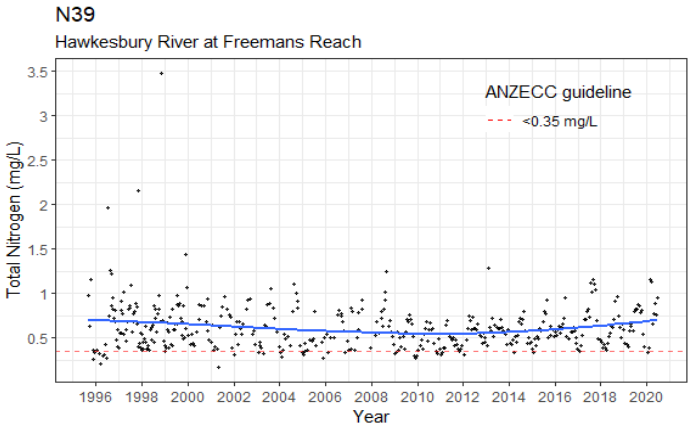

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

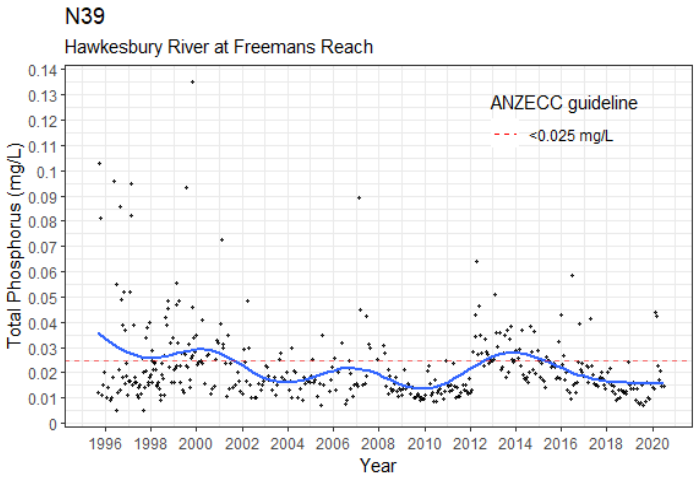

N42
Hawkesbury River at North Richmond Water Filtration Plant
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

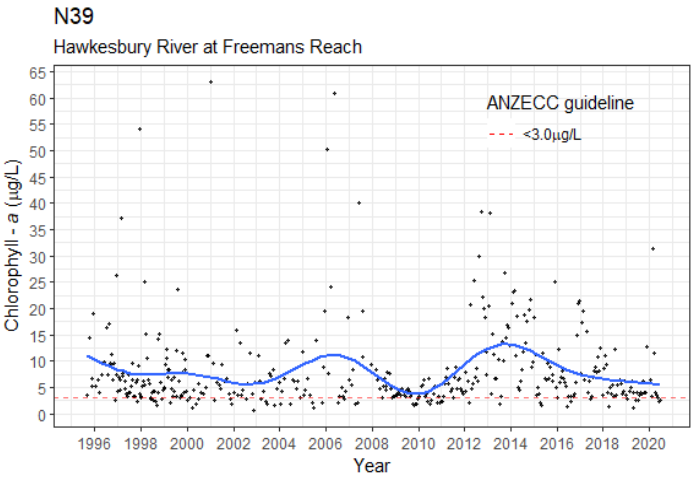

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

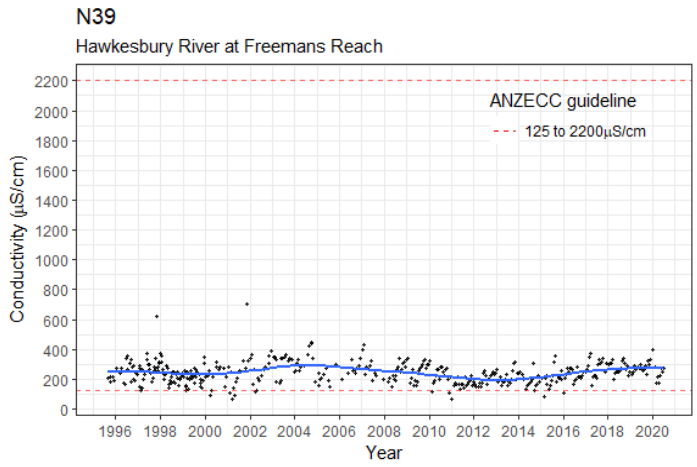

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

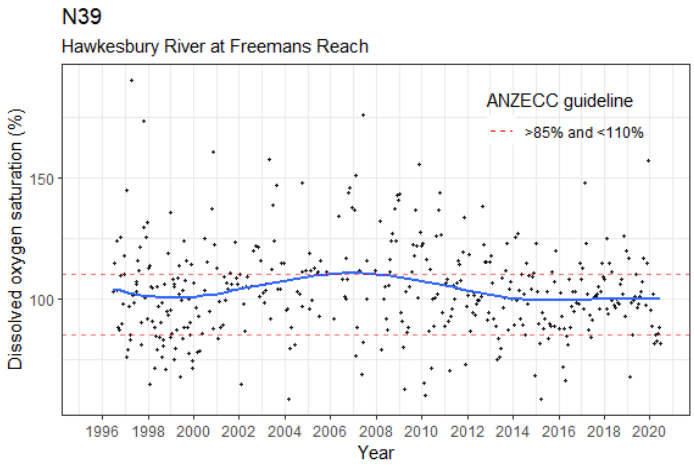

N39
Hawkesbury River at Freemans Reach
Dissolved Inorganic Nitrogen (mg/L)
Year

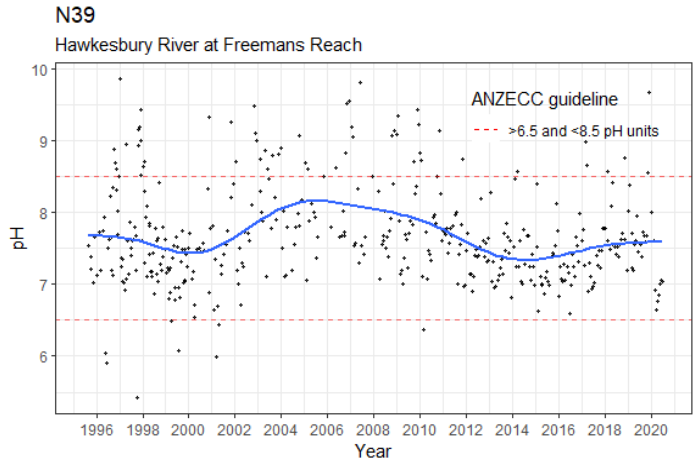

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

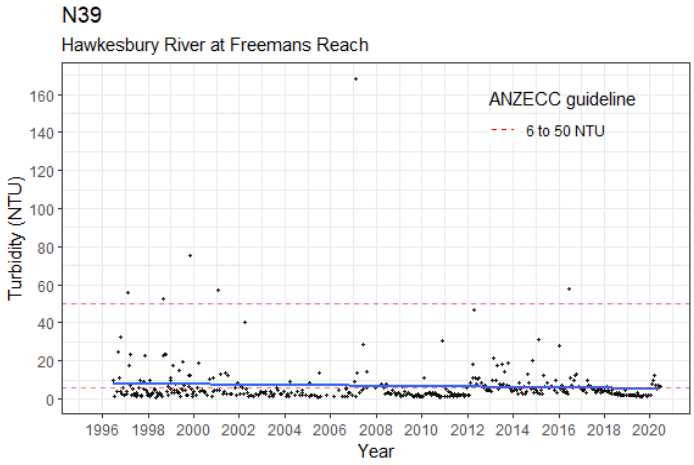

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

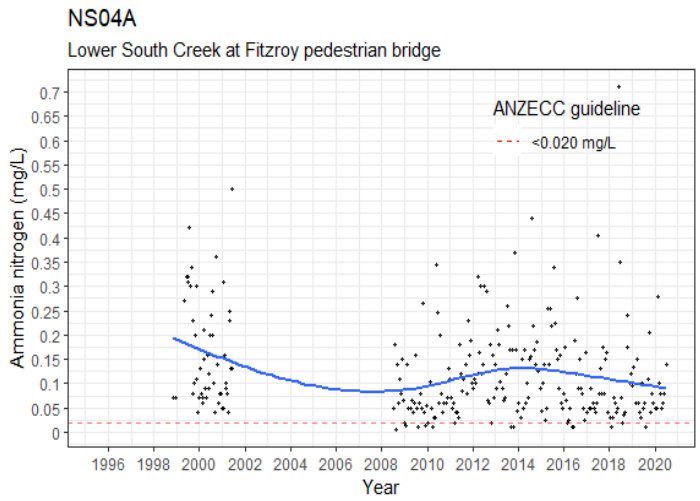

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

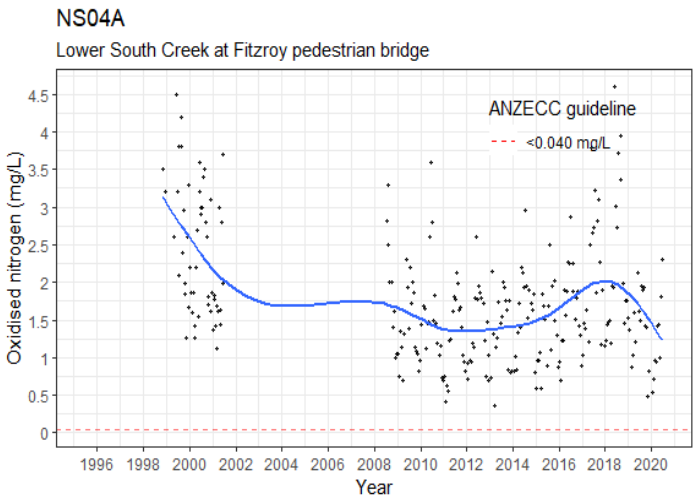

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

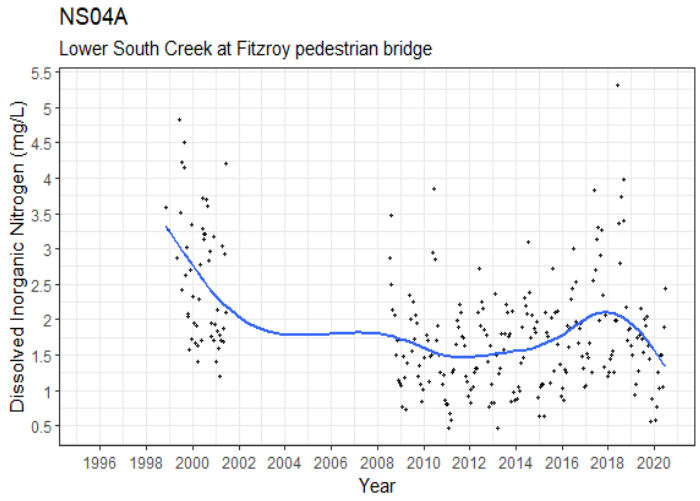

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

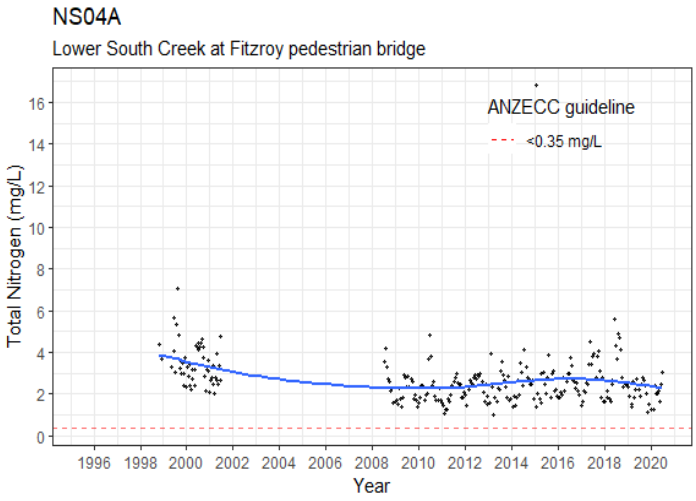

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

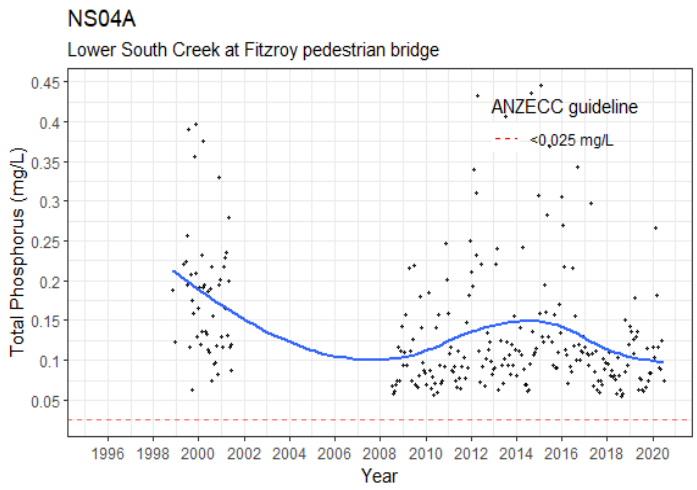

N39
Hawkesbury River at Freemans Reach
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

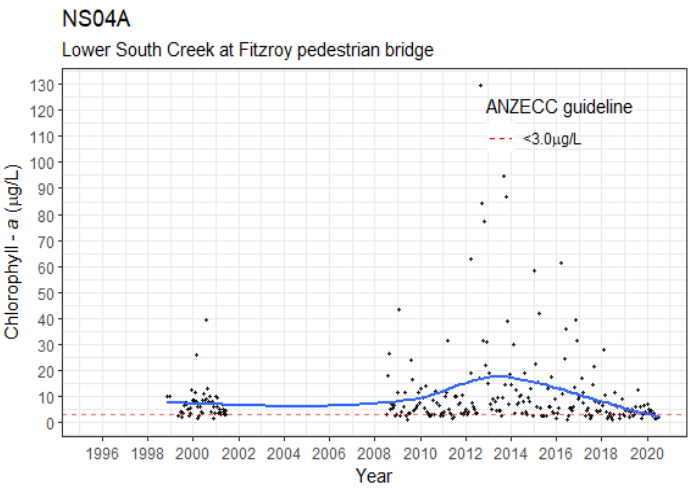

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

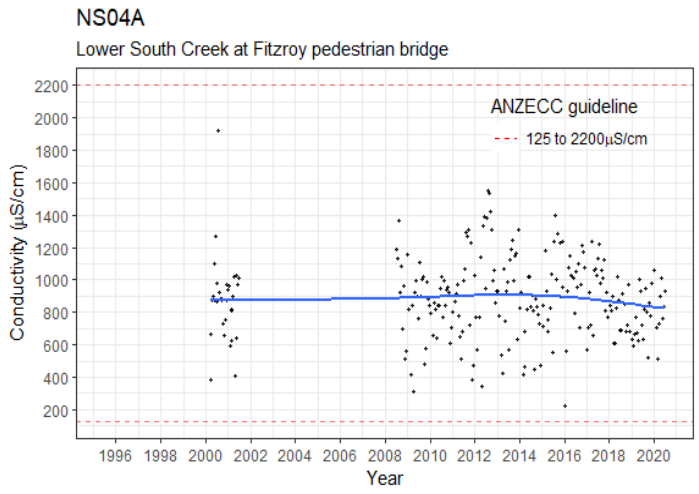

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

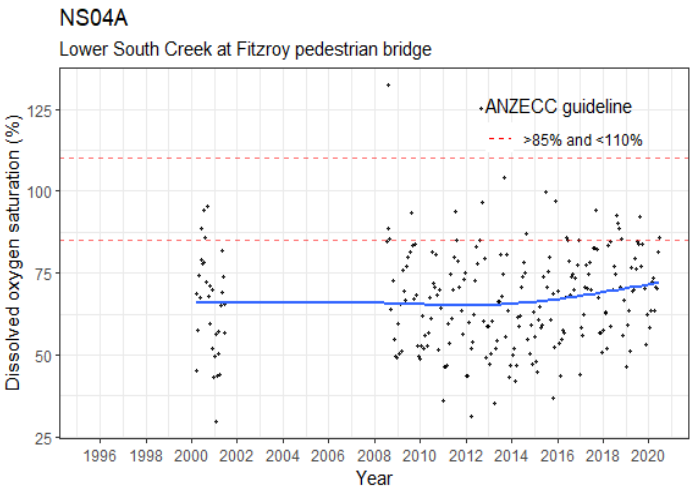

NS04A
Lower South Creek at Fitzroy pedestrian bridge
Dissolved Inorganic Nitrogen (mg/L)
Year

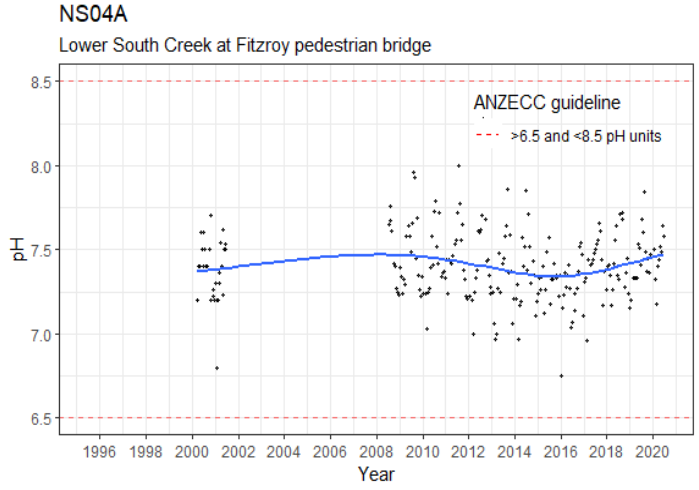

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

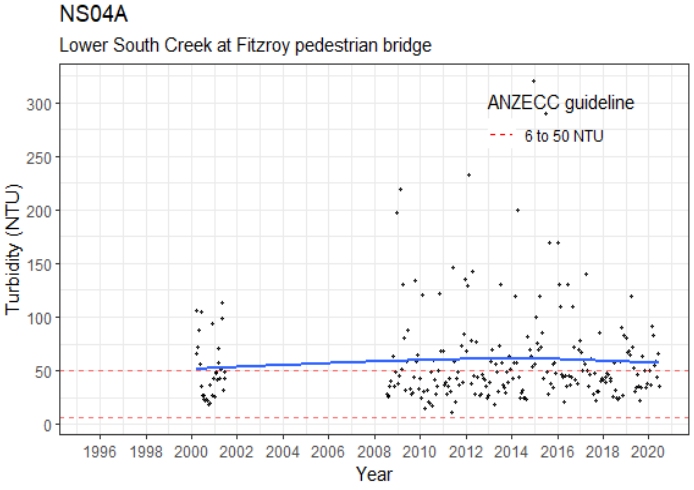

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

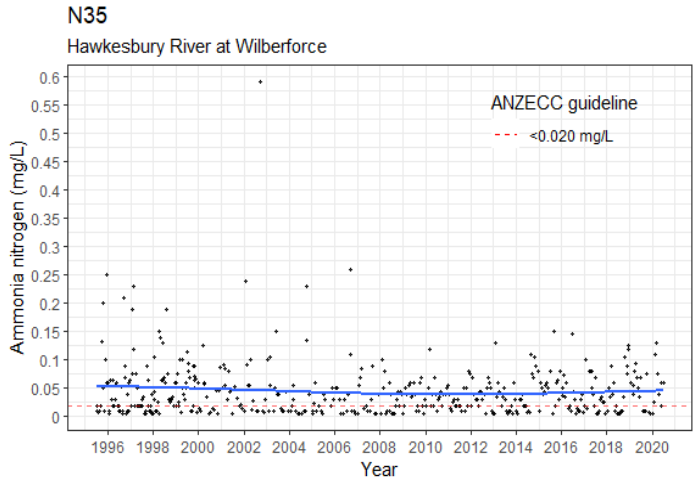

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

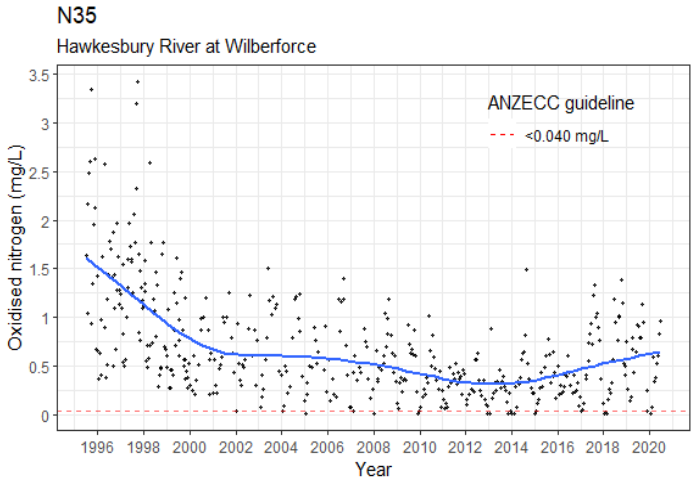

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

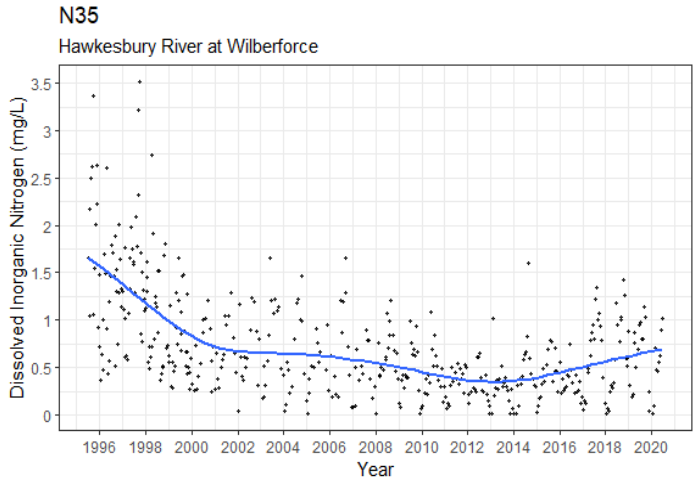

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

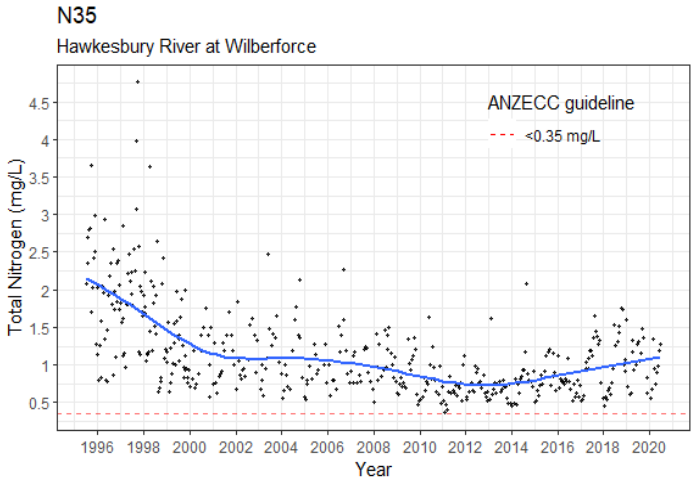

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

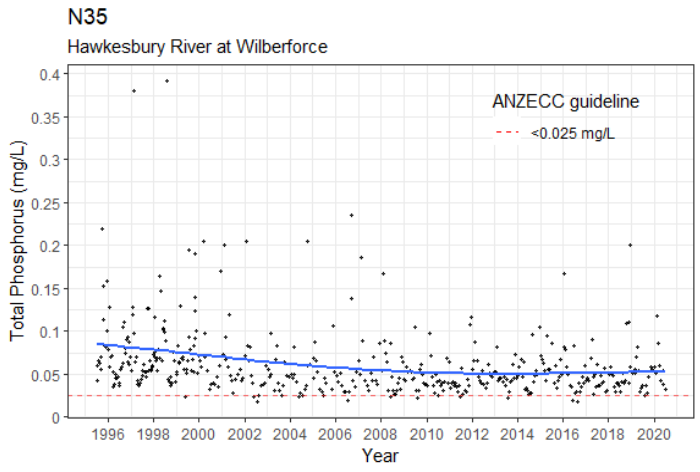

NS04A
Lower South Creek at Fitzroy pedestrian bridge
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

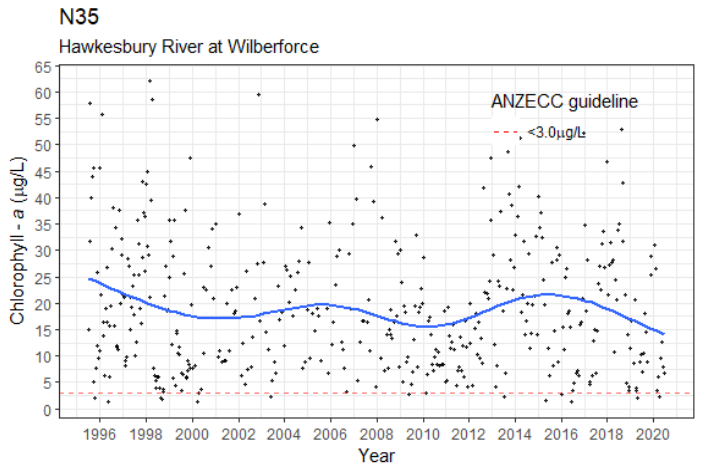

N35
Hawkesbury River at Wilberforce
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

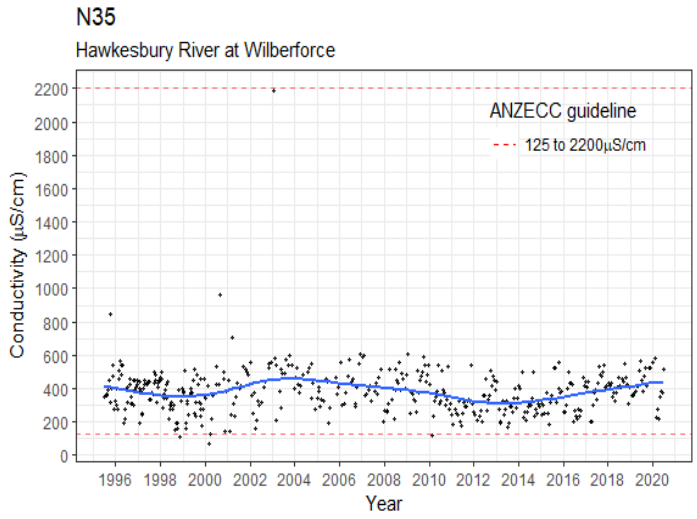

N35
Hawkesbury River at Wilberforce
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

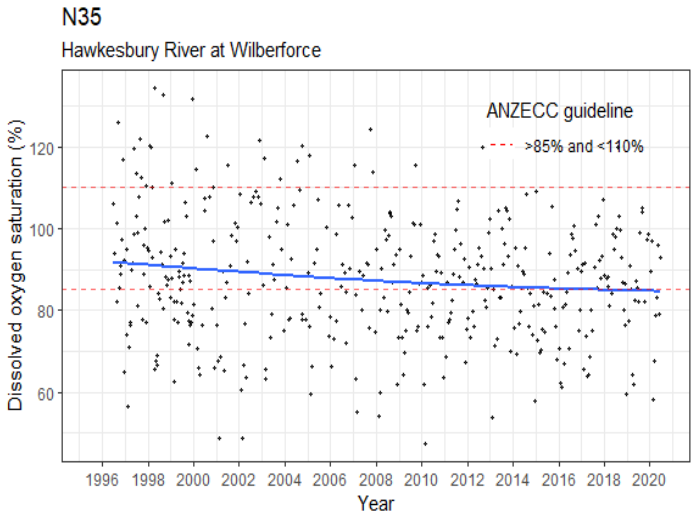

N35
Hawkesbury River at Wilberforce
Dissolved Inorganic Nitrogen (mg/L)
Year

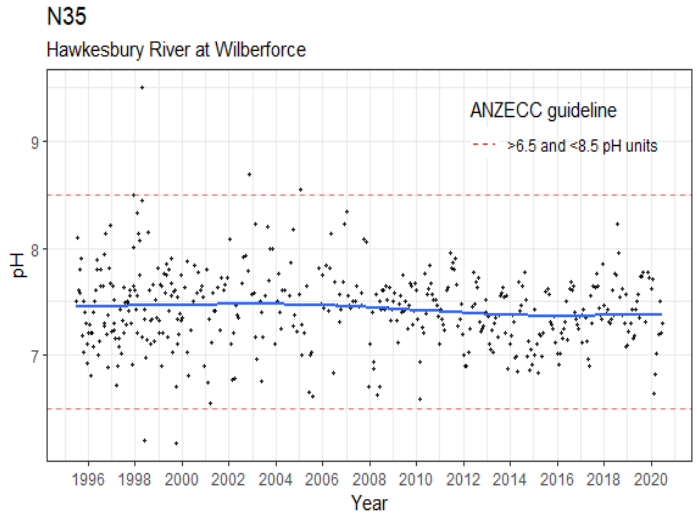

N35
Hawkesbury River at Wilberforce
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

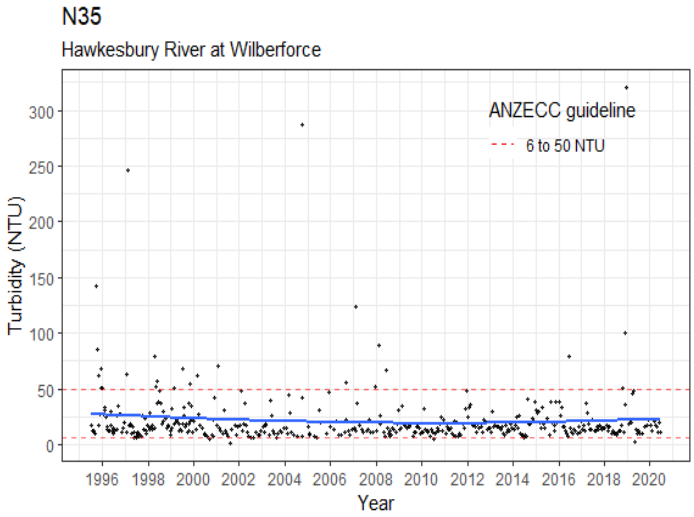

N35
Hawkesbury River at Wilberforce
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

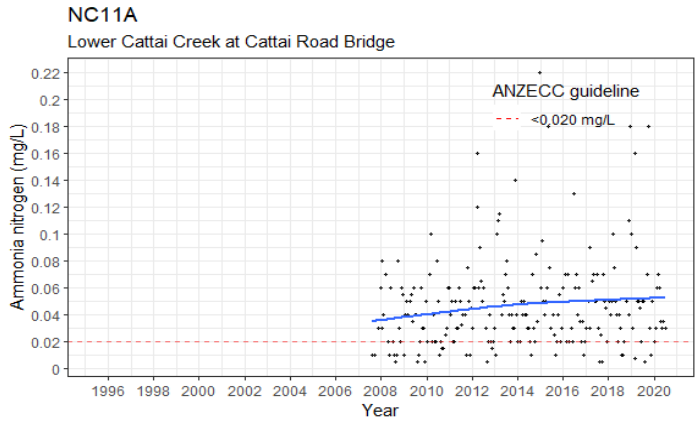

N35
Hawkesbury River at Wilberforce
ANZECC guideline
Chlorophyll - a (µg/L)
Year

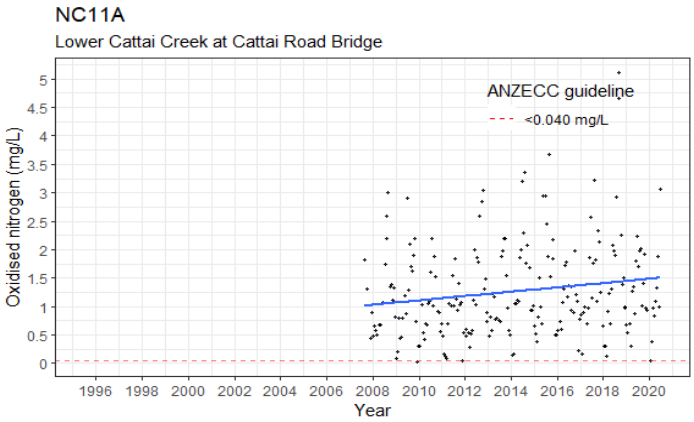

N35
Hawkesbury River at Wilberforce
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

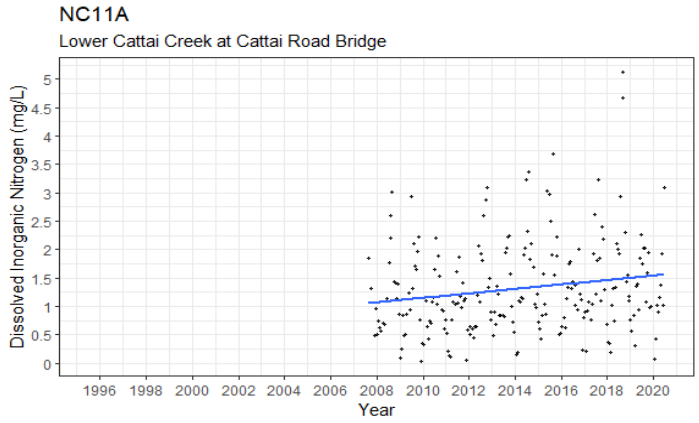

N35
Hawkesbury River at Wilberforce
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

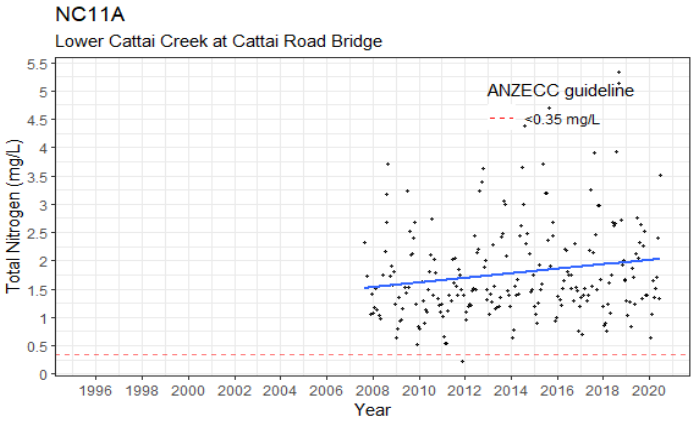

N35
Hawkesbury River at Wilberforce
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

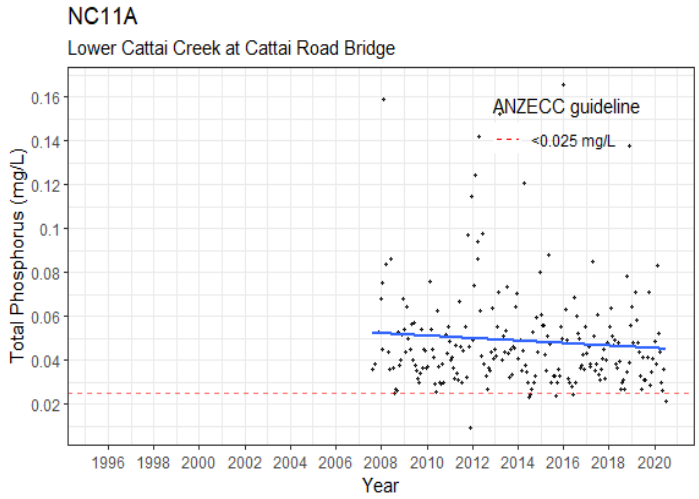

N35
Hawkesbury River at Wilberforce
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

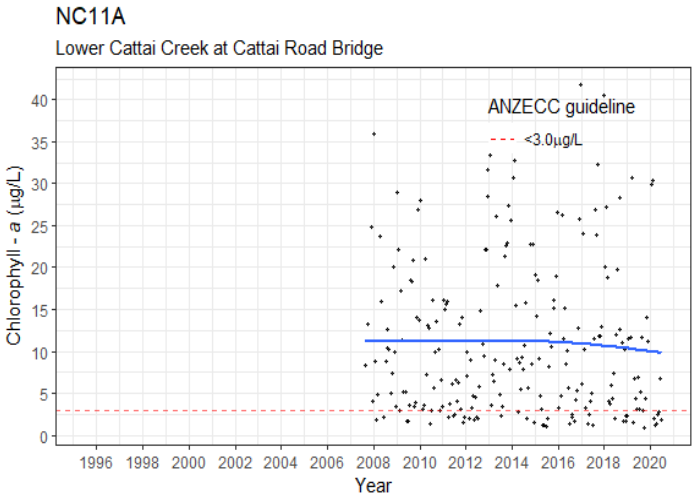

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

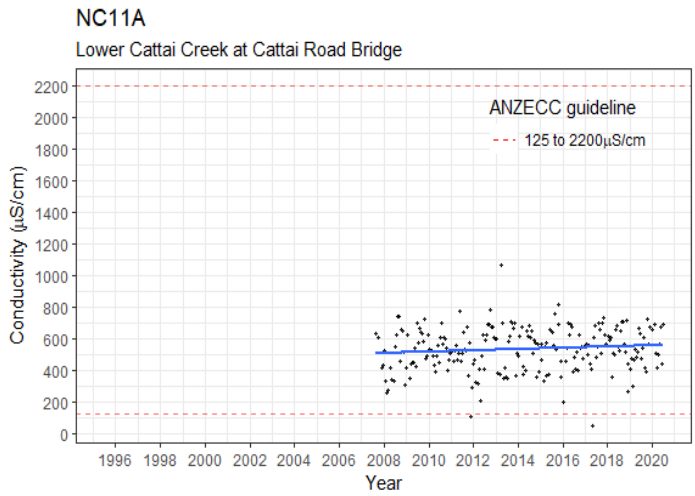

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

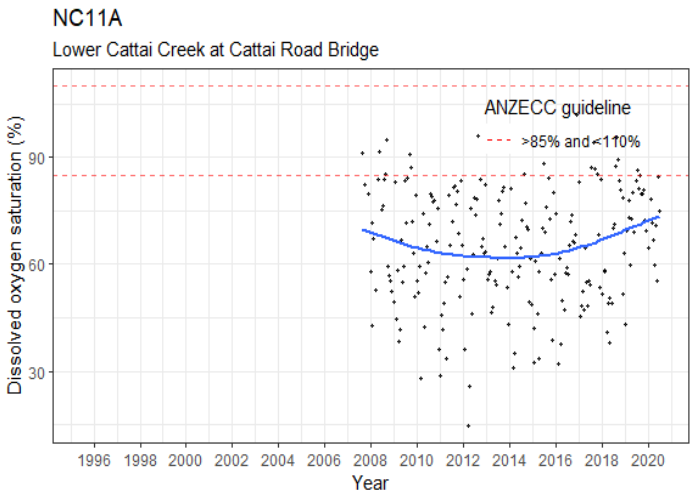

NC11A
Lower Cattai Creek at Cattai Road Bridge
Dissolved Inorganic Nitrogen (mg/L)
Year

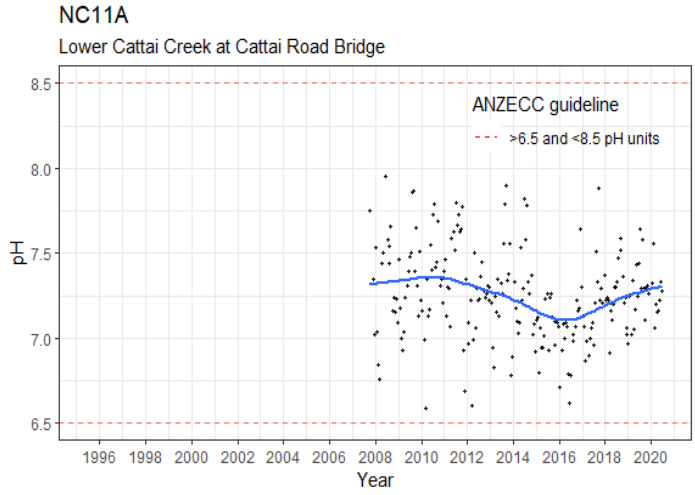

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

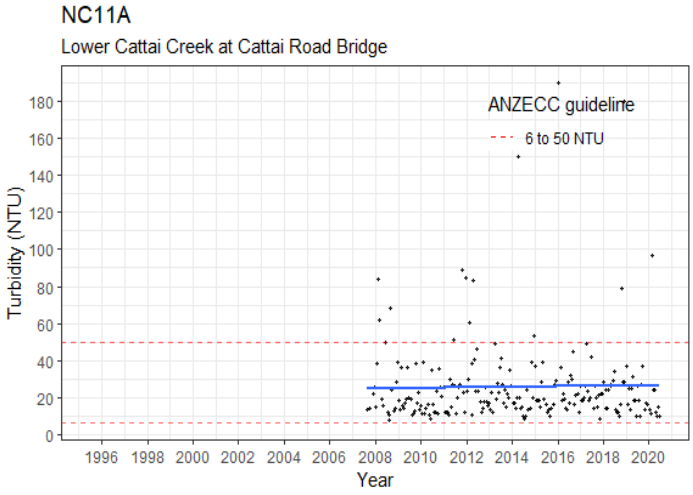

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

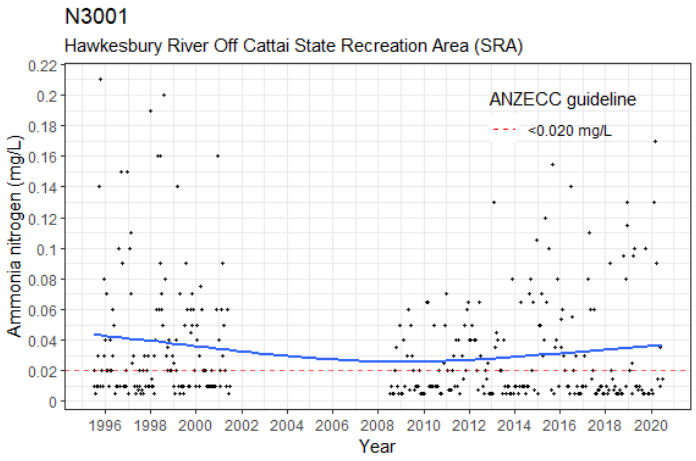

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

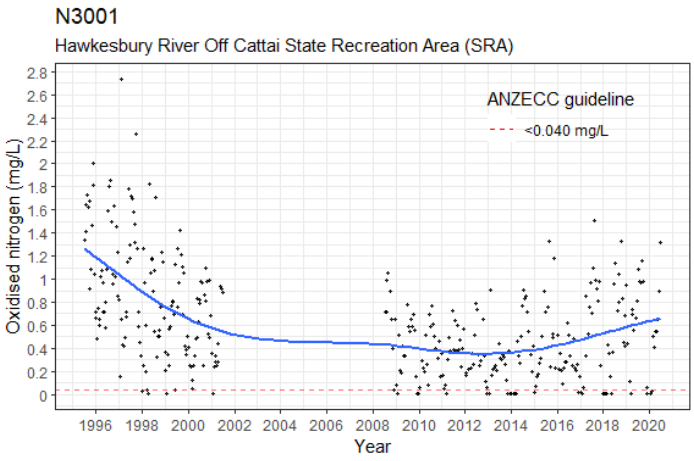

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

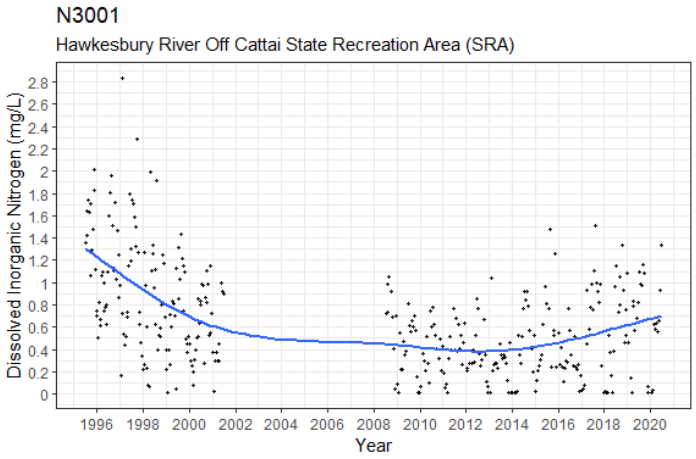

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

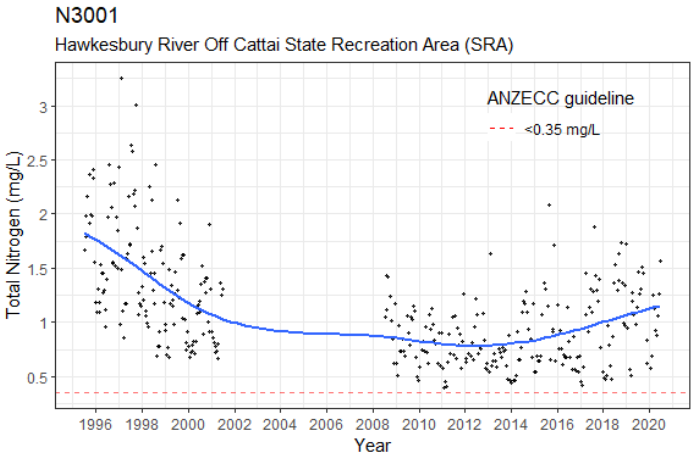

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

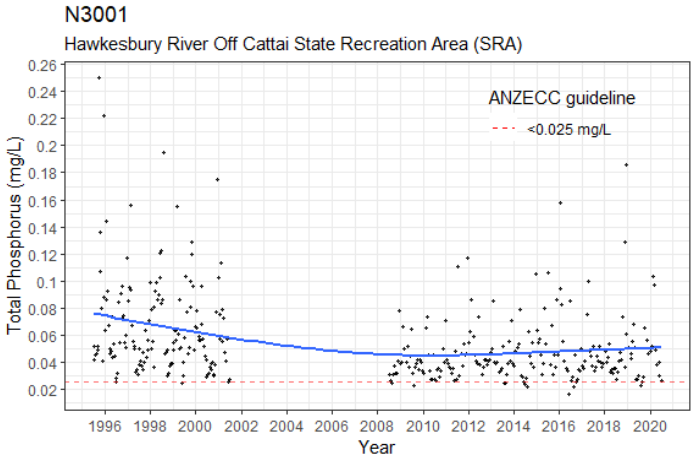

NC11A
Lower Cattai Creek at Cattai Road Bridge
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

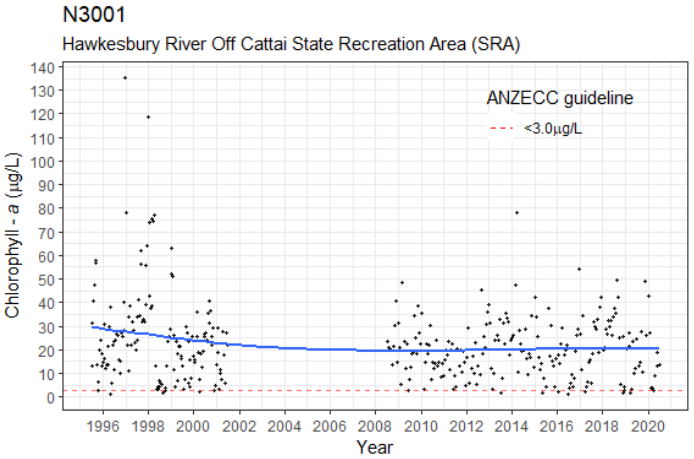

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

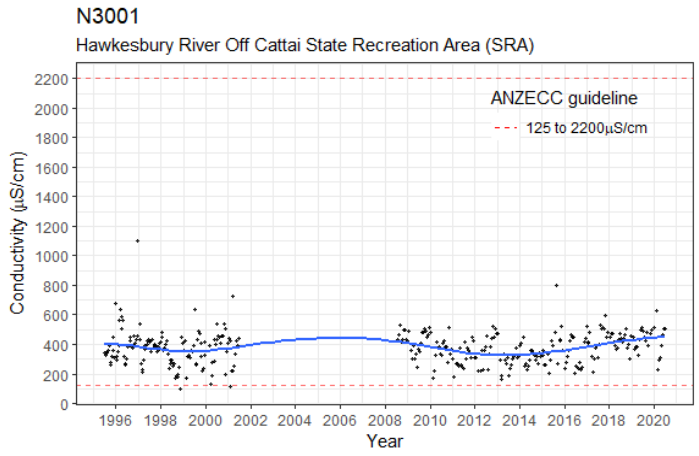

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

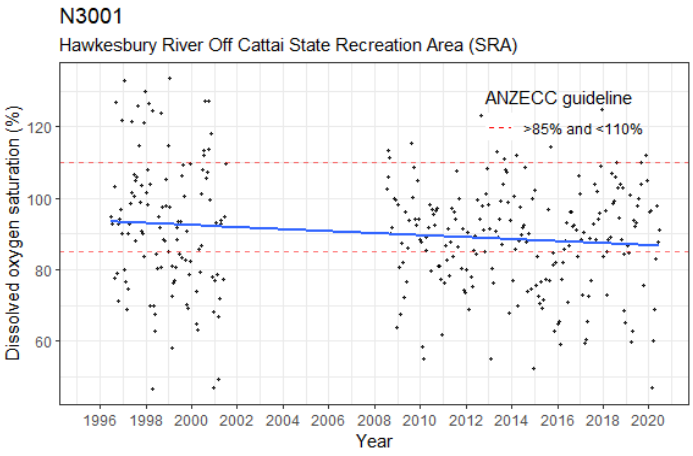

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
Dissolved Inorganic Nitrogen (mg/L)
Year

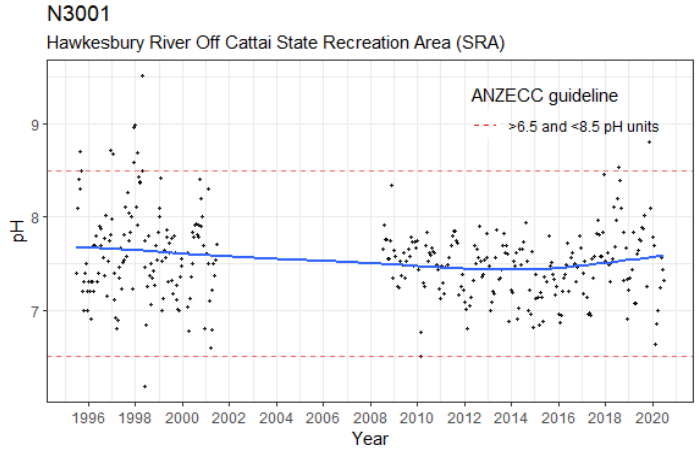

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

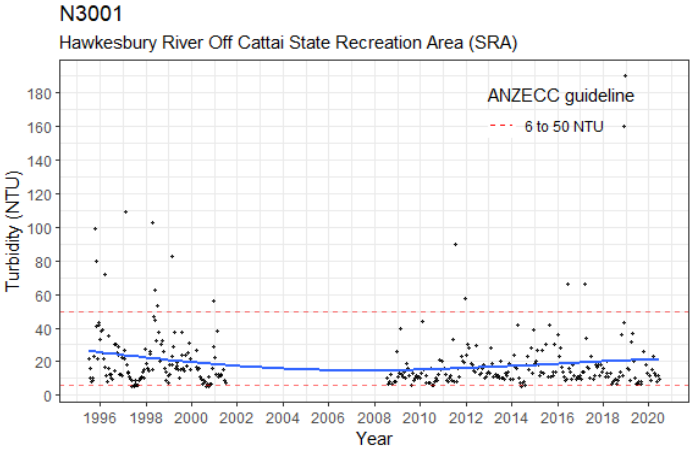

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

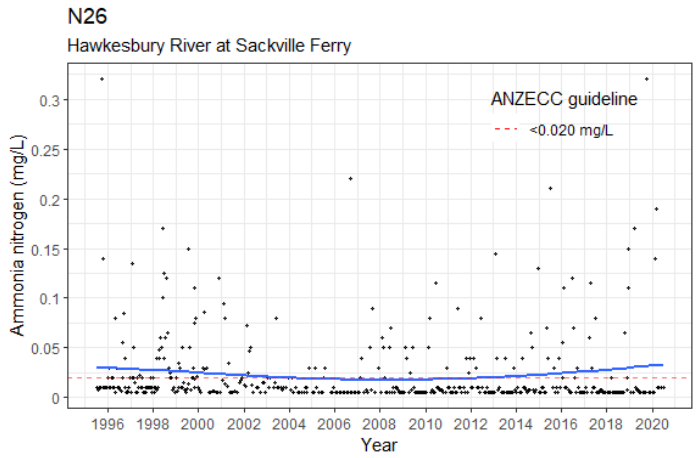

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

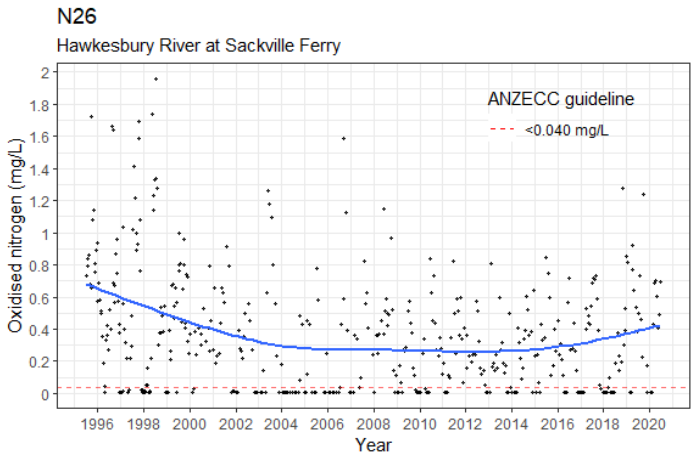

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

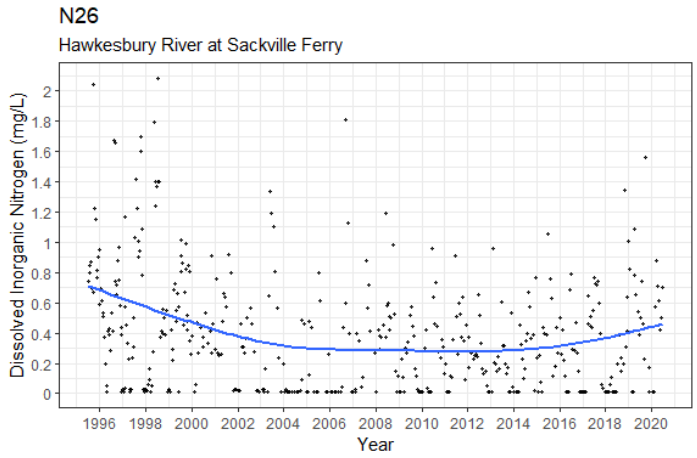

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

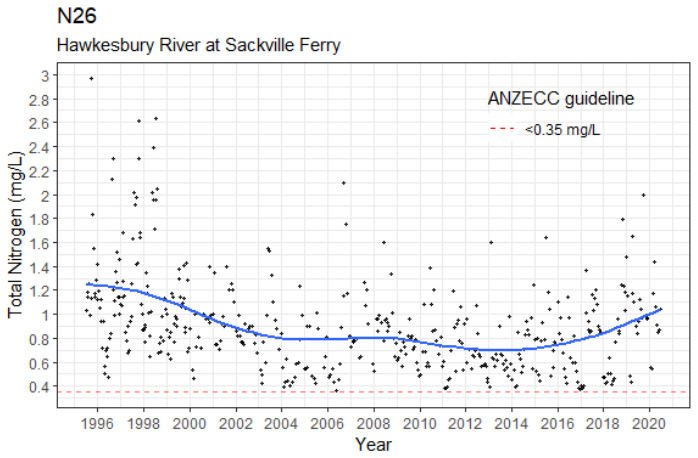

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

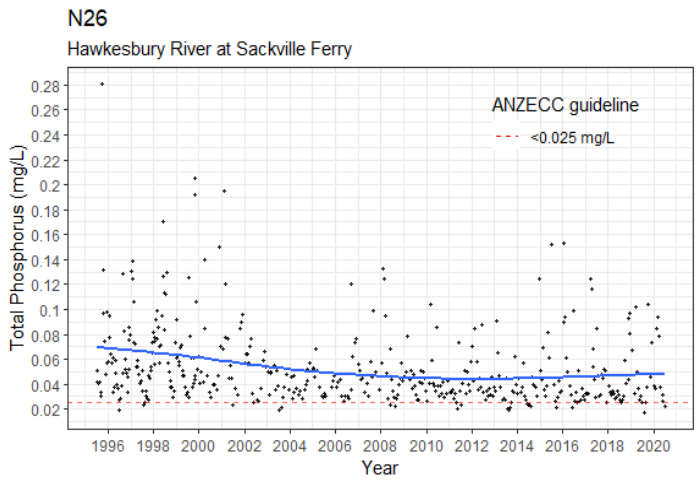

N3001
Hawkesbury River Off Cattai State Recreation Area (SRA)
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

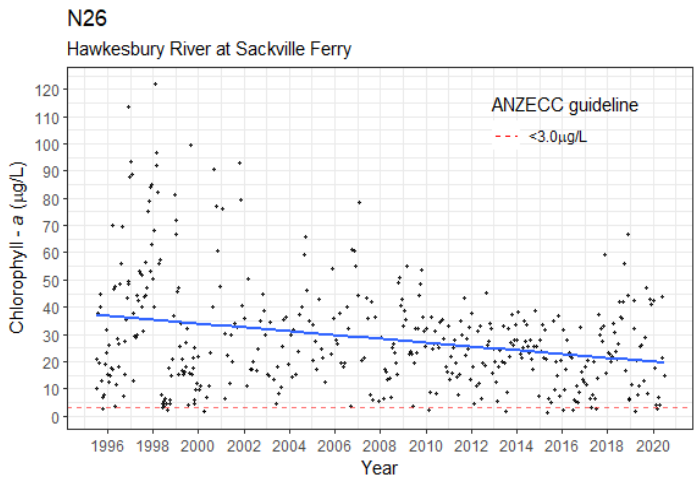

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

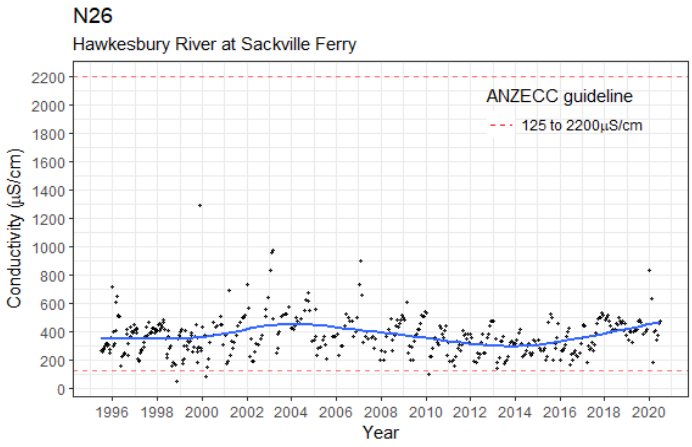

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

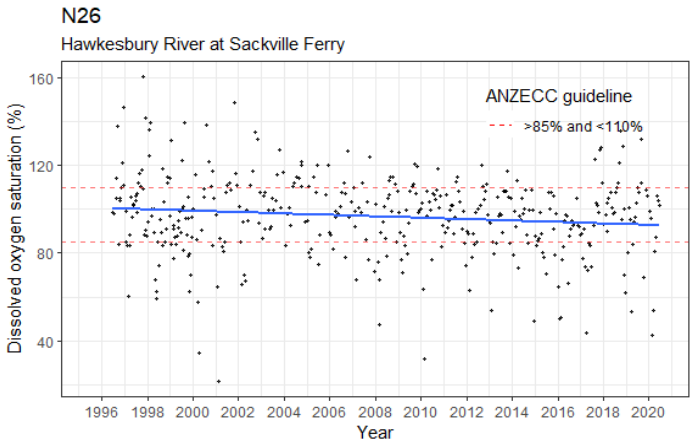

N26
Hawkesbury River at Sackville Ferry
Dissolved Inorganic Nitrogen (mg/L)
Year

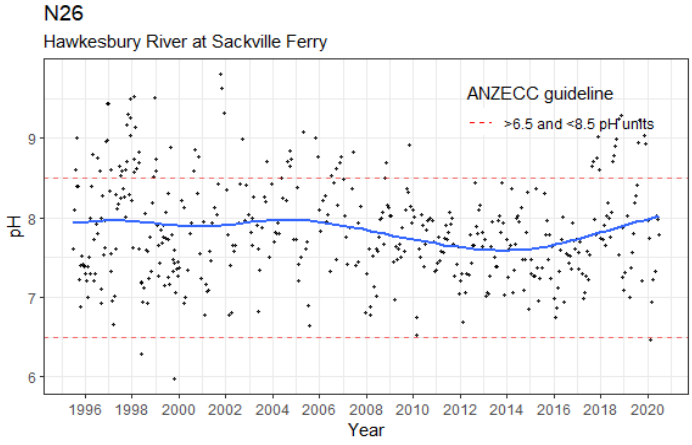

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

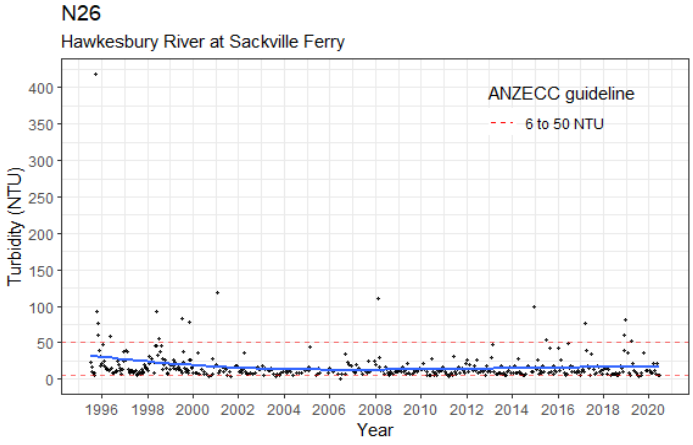

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

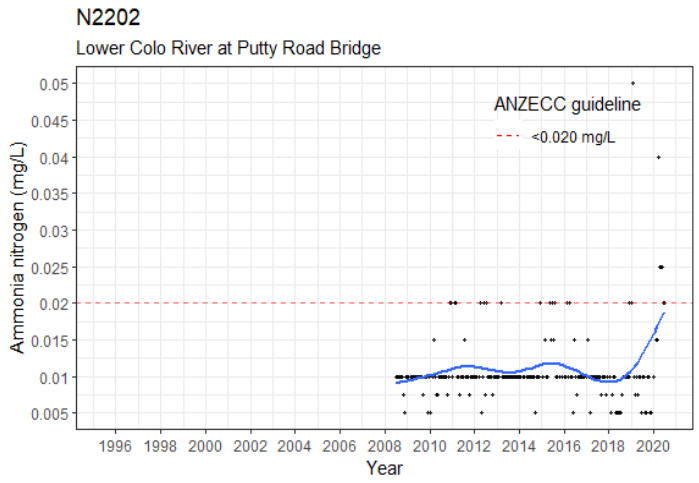

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

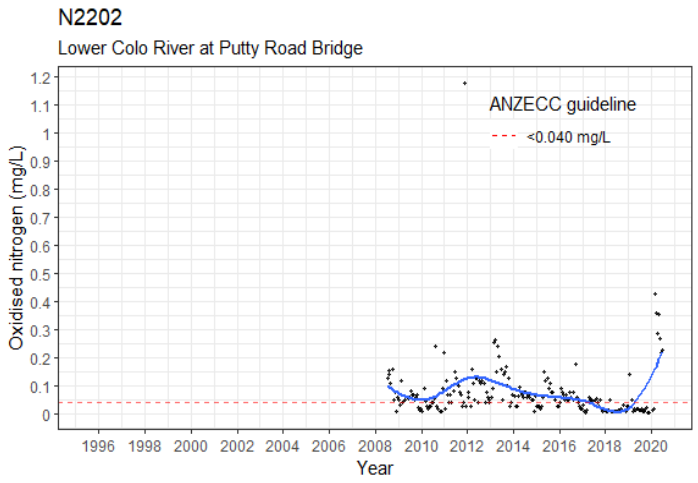

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

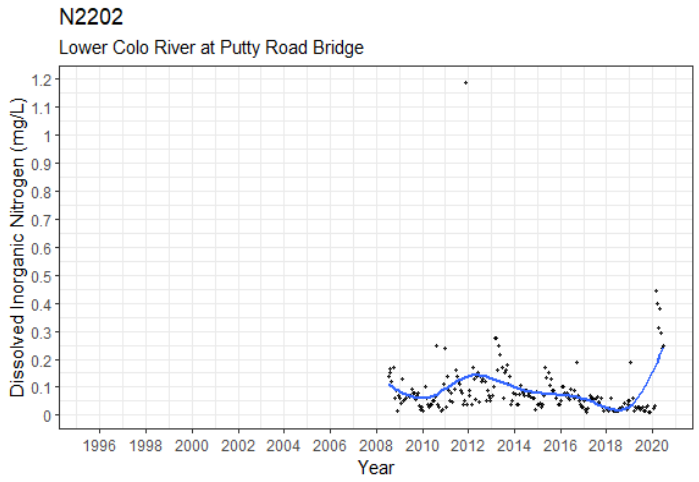

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

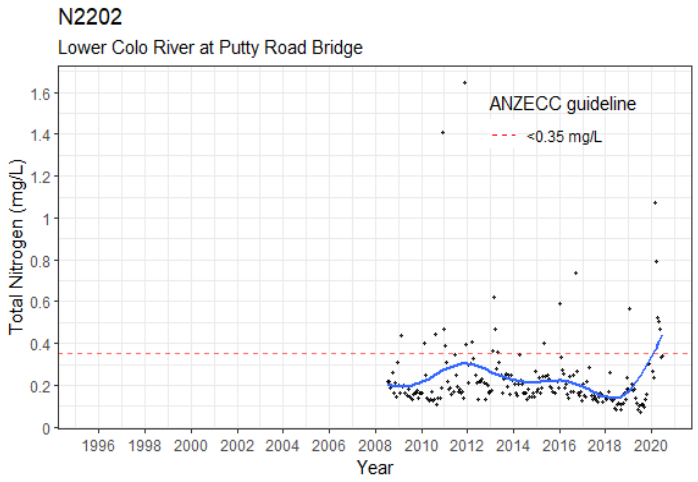

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

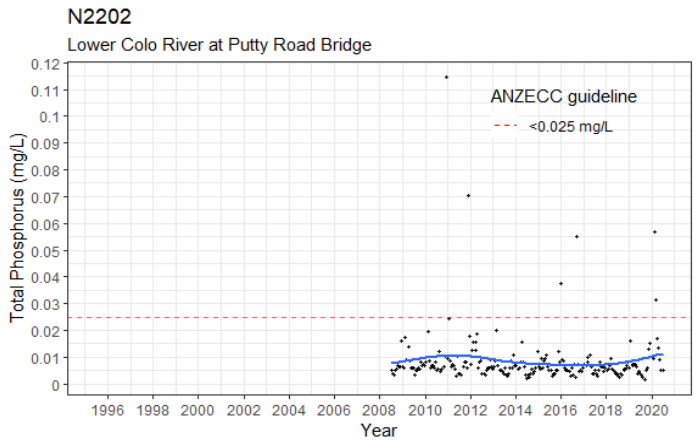

N26
Hawkesbury River at Sackville Ferry
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

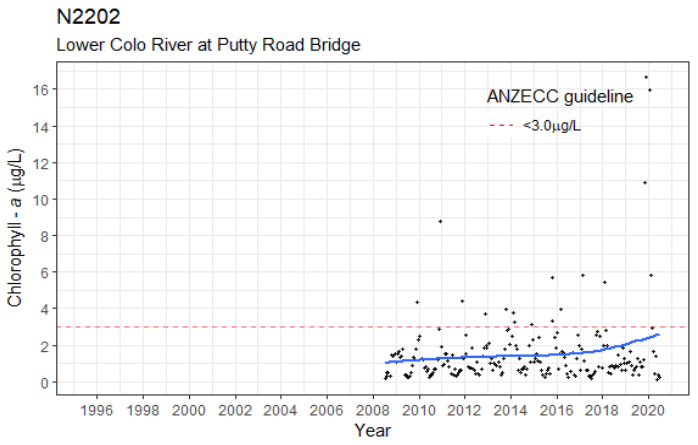

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

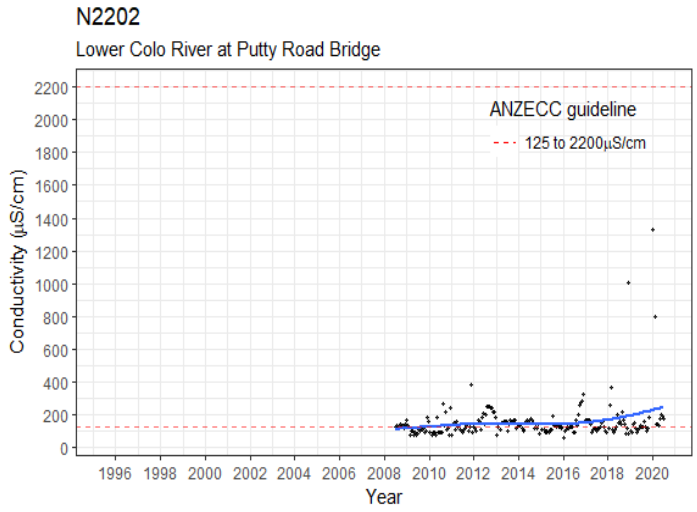

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

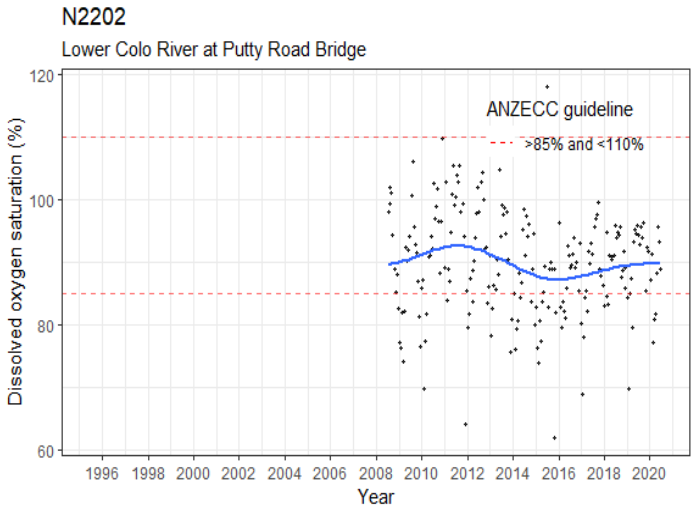

N2202
Lower Colo River at Putty Road Bridge
Dissolved Inorganic Nitrogen (mg/L)
Year

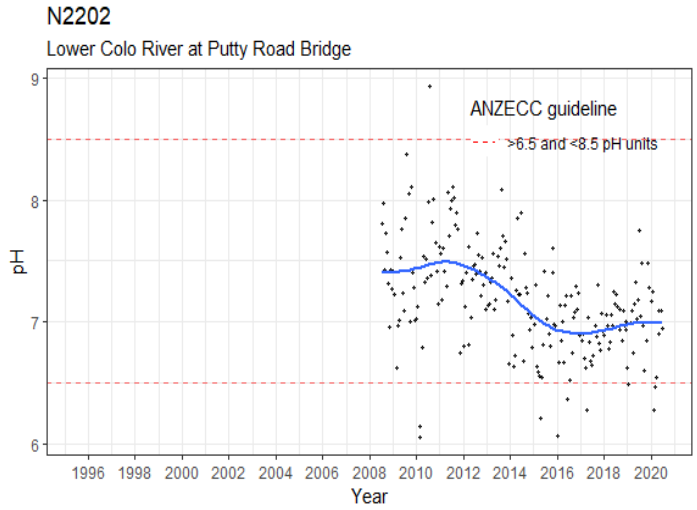

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

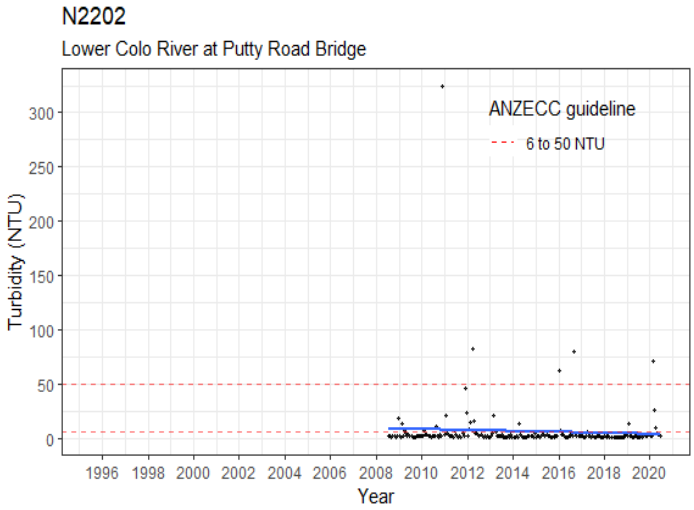

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

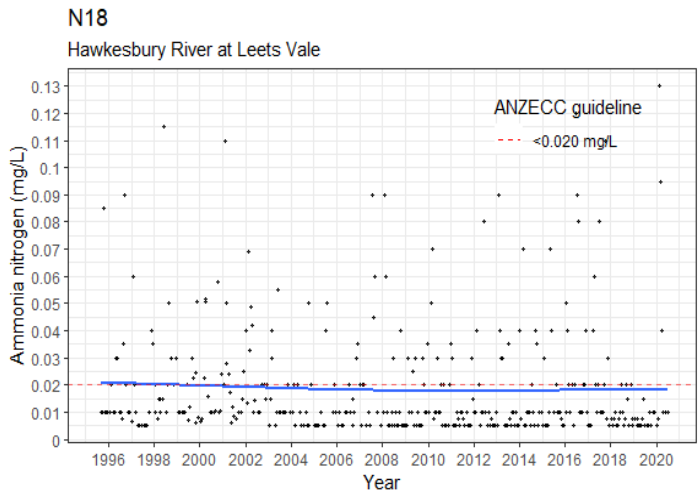

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

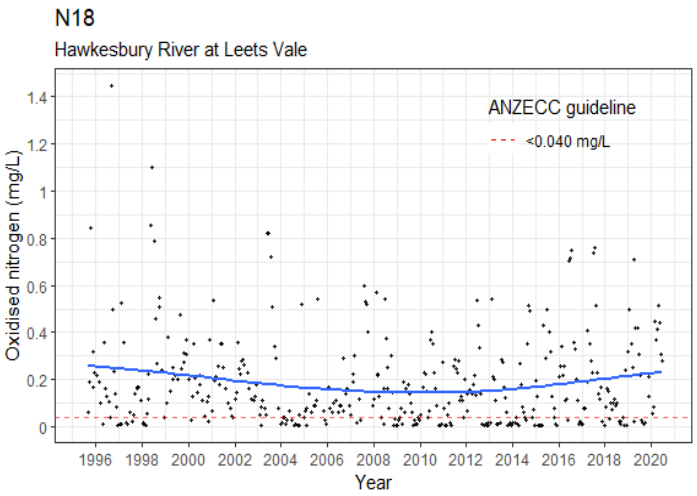

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

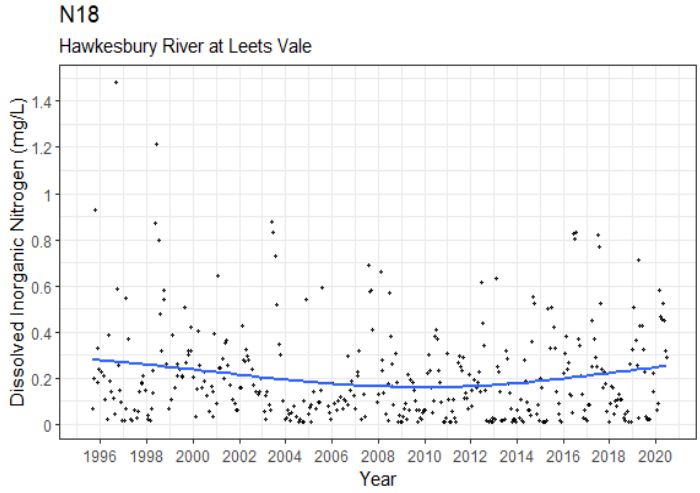

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

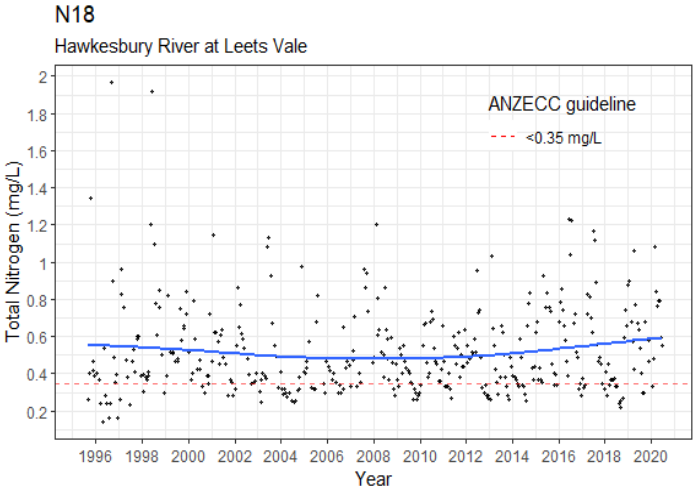

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

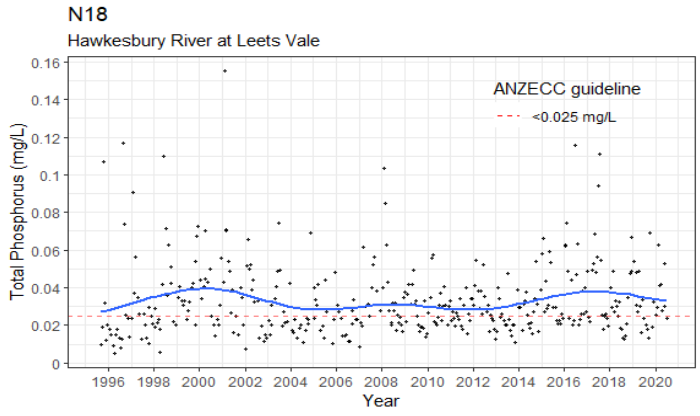

N2202
Lower Colo River at Putty Road Bridge
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

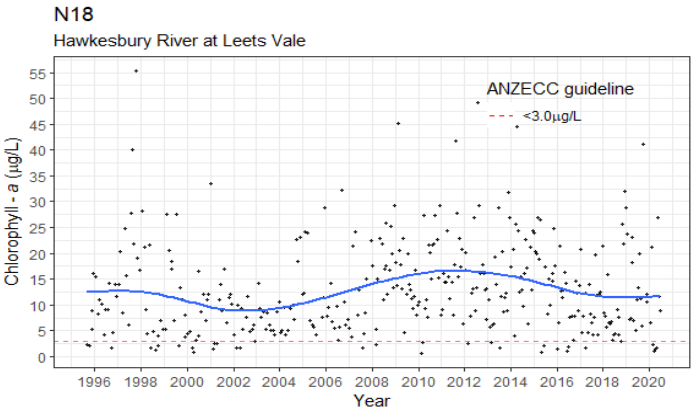

N18
Hawkesbury River at Leets Vale
ANZECC guideline
<0.020 mg/L
Ammonia nitrogen (mg/L)
Year

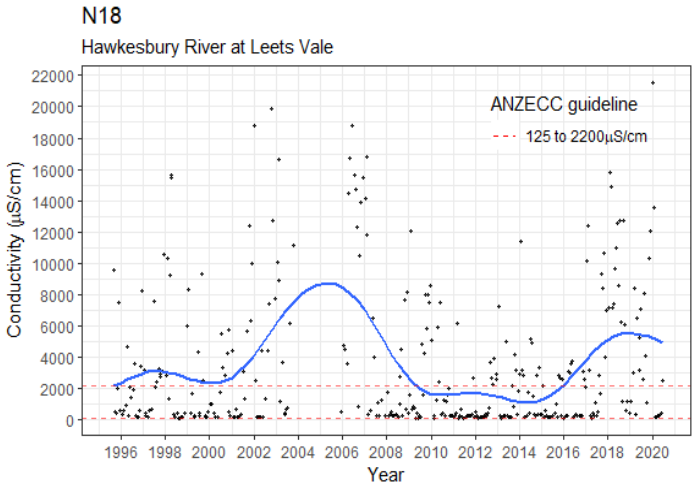

N18
Hawkesbury River at Leets Vale
ANZECC guideline
<0.040 mg/L
Oxidised nitrogen (mg/L)
Year

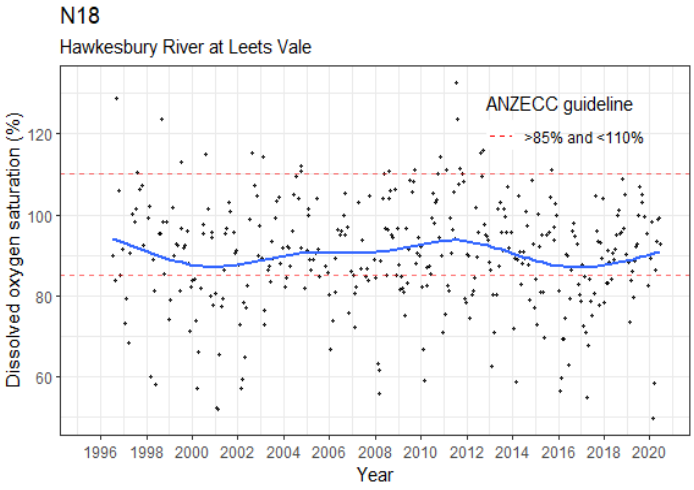

N18
Hawkesbury River at Leets Vale
Dissolved Inorganic Nitrogen (mg/L)
Year

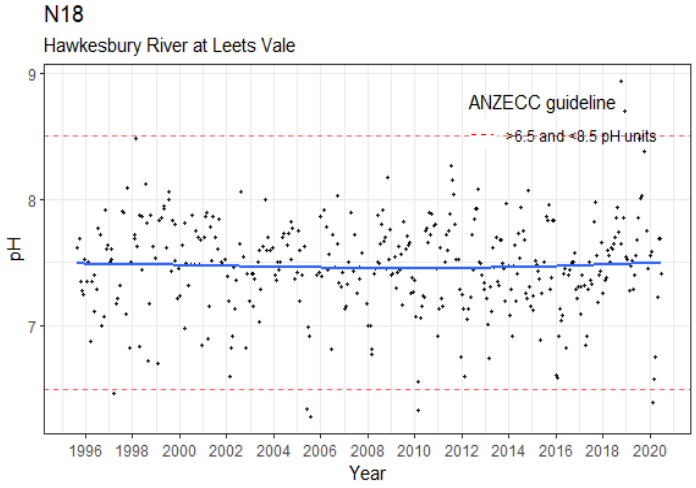

N18
Hawkesbury River at Leets Vale
ANZECC guideline
<0.35 mg/L
Total Nitrogen (mg/L)
Year

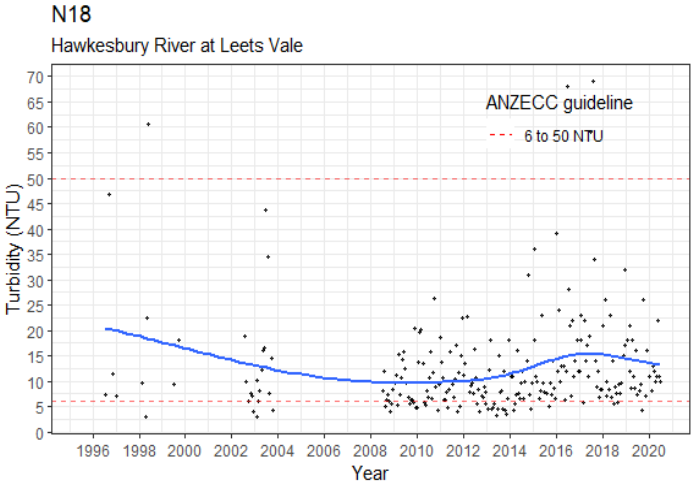

N18
Hawkesbury River at Leets Vale
ANZECC guideline
<0.025 mg/L
Total Phosphorus (mg/L)
Year

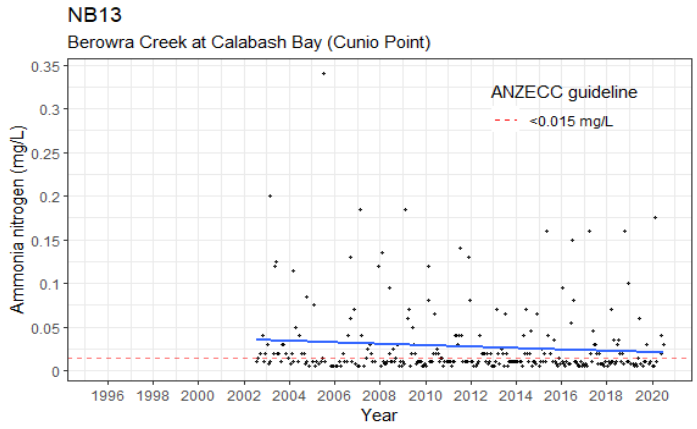

N18
Hawkesbury River at Leets Vale
ANZECC guideline
<3.0µg/L
Chlorophyll - a (µg/L)
Year

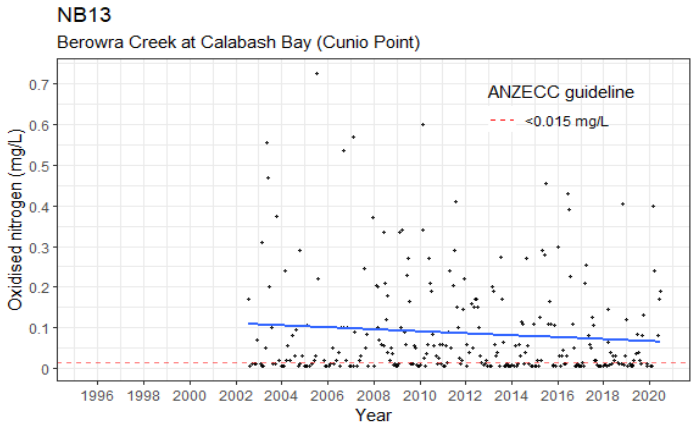

N18
Hawkesbury River at Leets Vale
ANZECC guideline
125 to 2200µS/cm
Conductivity (µS/cm)
Year

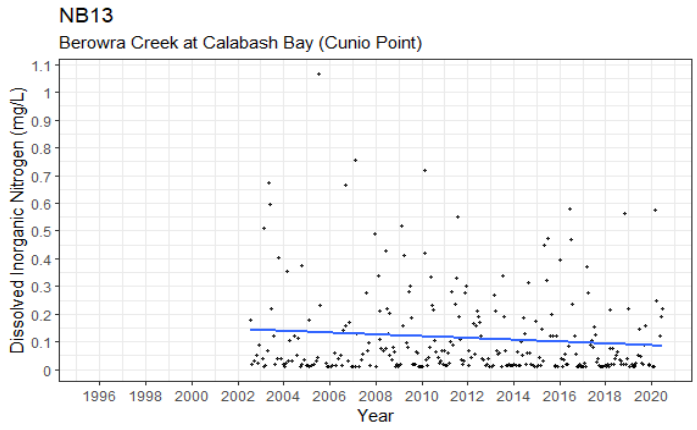

N18
Hawkesbury River at Leets Vale
ANZECC guideline
>85% and <110%
Dissolved oxygen saturation (%)
Year

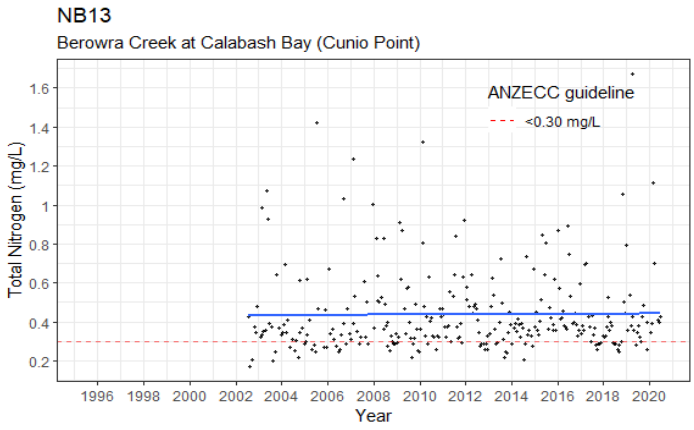

N18
Hawkesbury River at Leets Vale
ANZECC guideline
>6.5 and <8.5 pH units
pH
Year

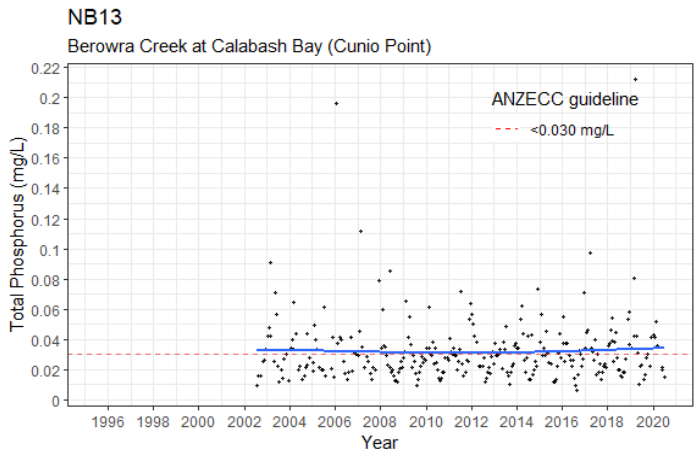

N18
Hawkesbury River at Leets Vale
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
Year

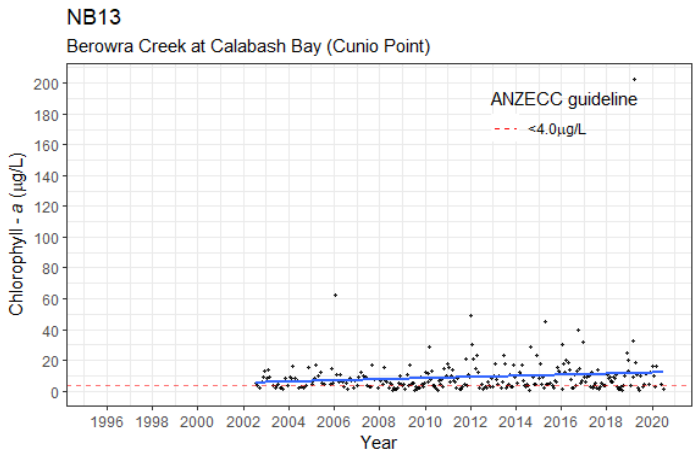

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
<0.015 mg/L
Ammonia nitrogen (mg/L)
Year

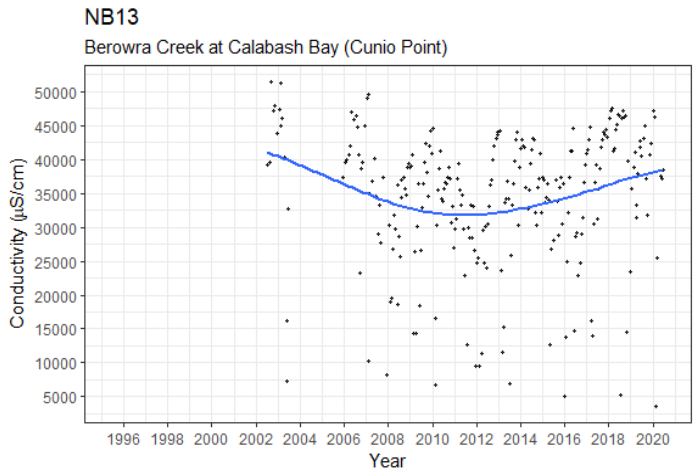

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
<0.015 mg/L
Oxidised nitrogen (mg/L)
Year

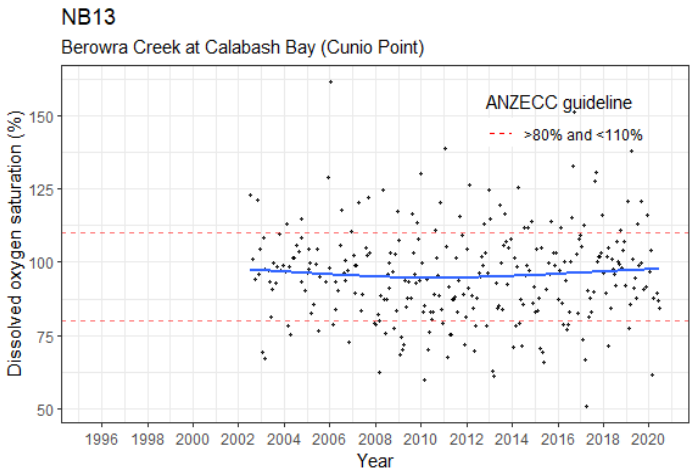

NB13
Berowra Creek at Calabash Bay (Cunio Point)
Dissolved Inorganic Nitrogen (mg/L)
Year

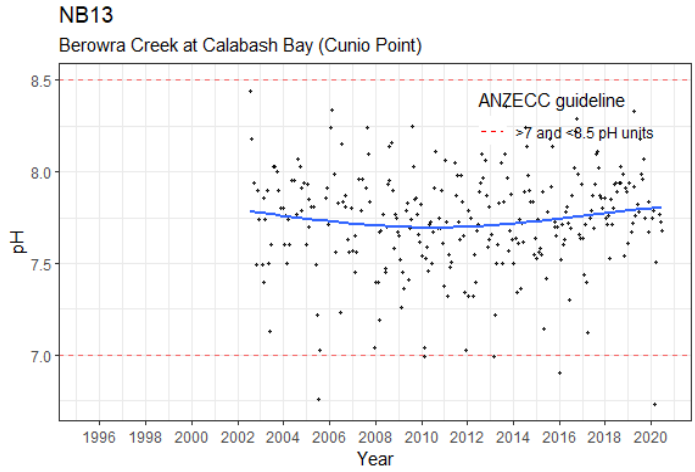

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
<0.30 mg/L
Total Nitrogen (mg/L)
Year

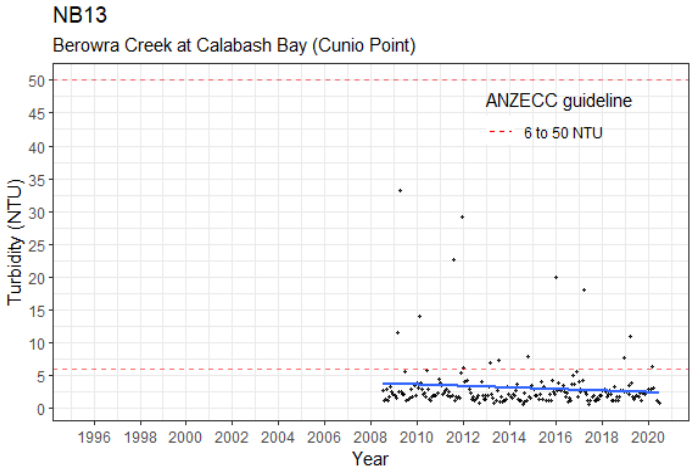

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
<0.030 mg/L
Total Phosphorus (mg/L)
Year

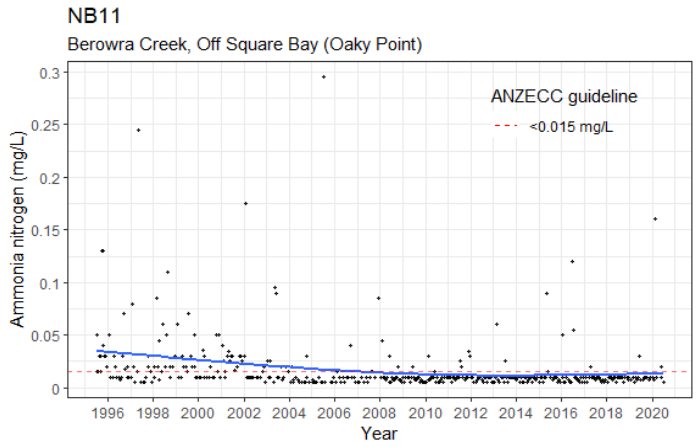

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
<4.0µg/L
Chlorophyll - a (µg/L)
Year

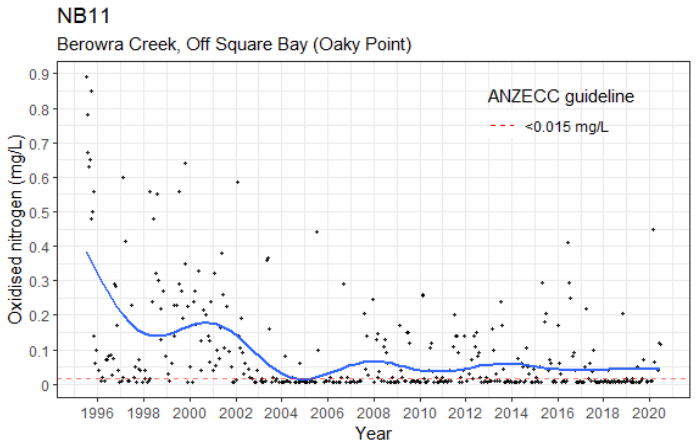

NB13
Berowra Creek at Calabash Bay (Cunio Point)
Conductivity (µS/cm)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

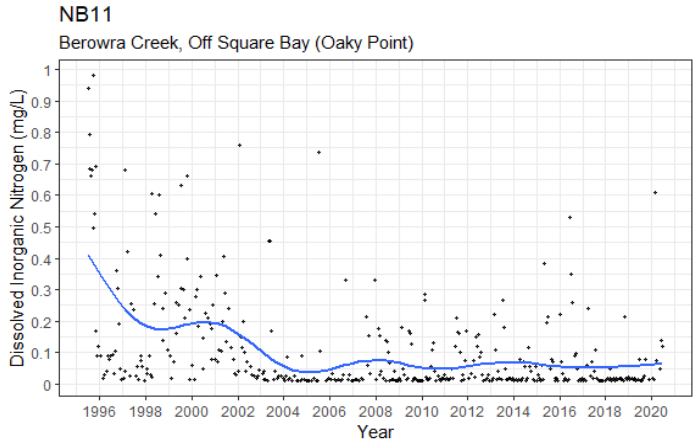

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
>80% and <110%
Dissolved oxygen saturation (%)
150
125
100
75
50
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

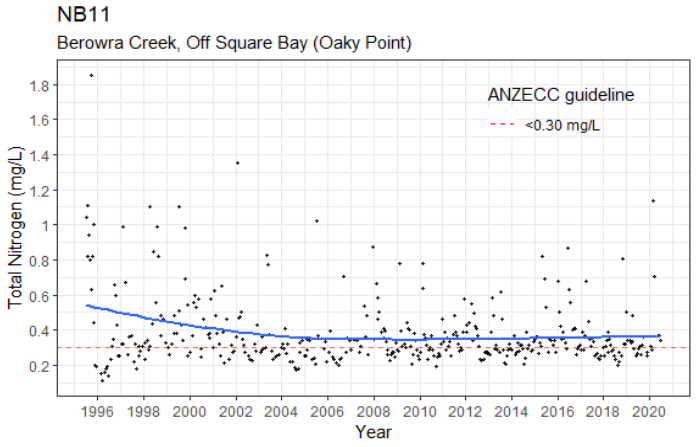

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
>7 and <8.5 pH units
pH
8.5
8.0
7.5
7.0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

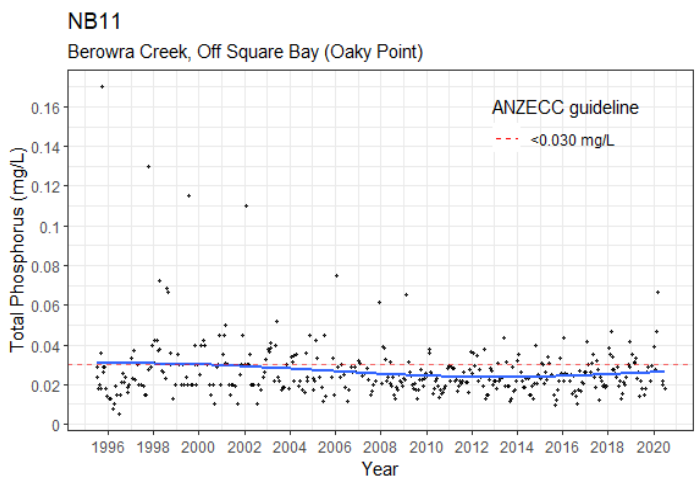

NB13
Berowra Creek at Calabash Bay (Cunio Point)
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
50
45
40
35
30
25
20
15
10
5
0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

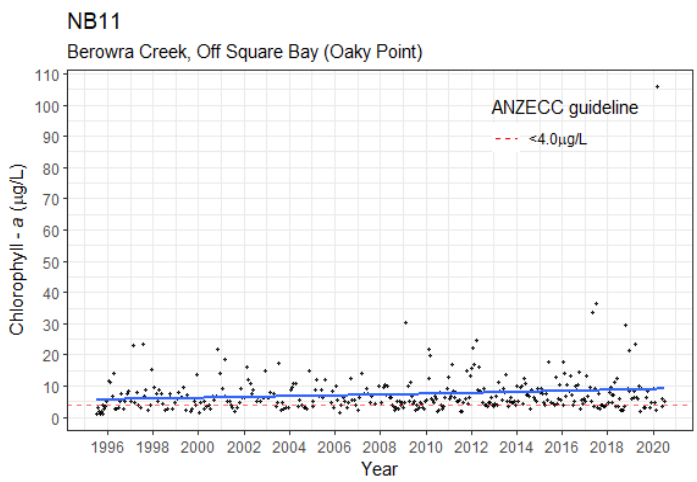

NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
<0.015 mg/L
Ammonia nitrogen (mg/L)
Year

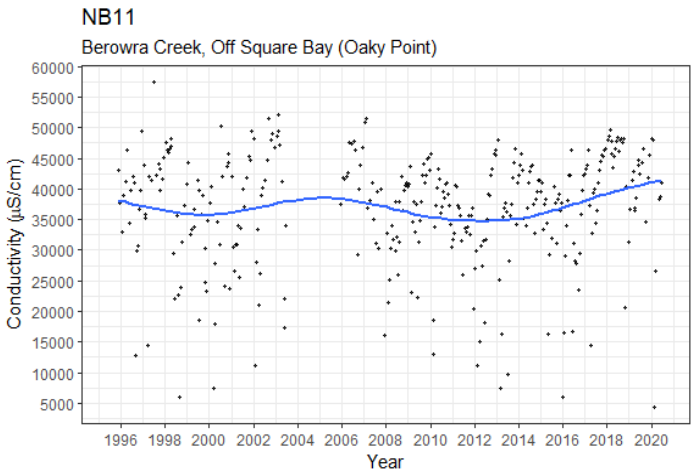

NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
<0.015 mg/L
Oxidised nitrogen (mg/L)
Year

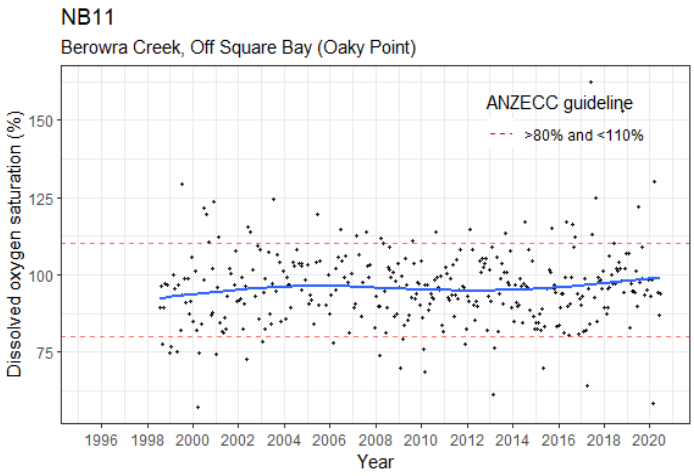

NB11
Berowra Creek, Off Square Bay (Oaky Point)
Dissolved Inorganic Nitrogen (mg/L)
Year

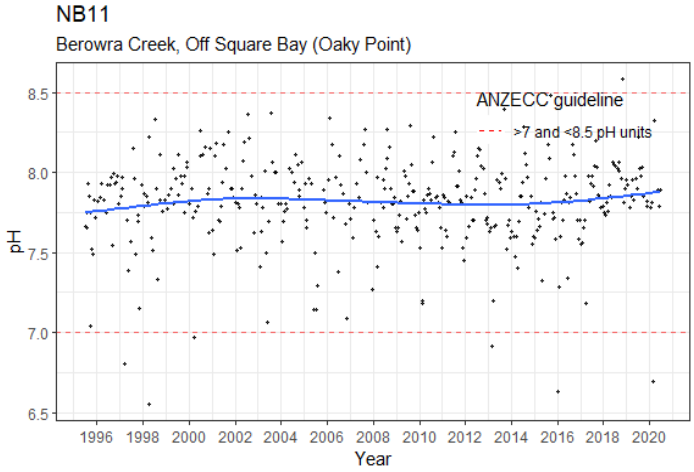

NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
<0.30 mg/L
Total Nitrogen (mg/L)
Year

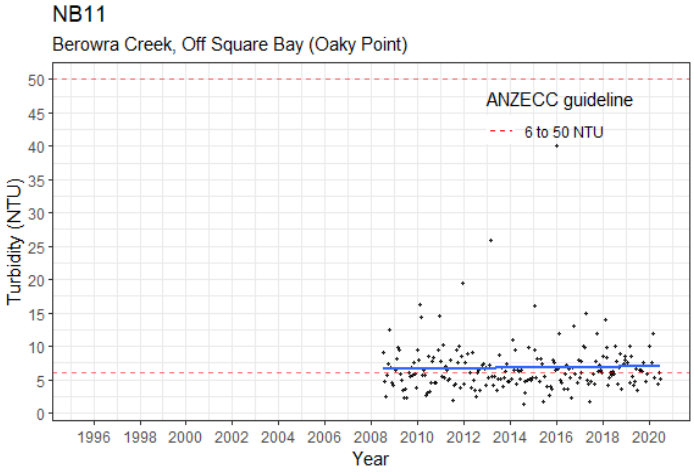

NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
<0.030 mg/L
Total Phosphorus (mg/L)
Year


NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
<4.0µg/L
Chlorophyll - a (µg/L)
Year


NB11
Berowra Creek, Off Square Bay (Oaky Point)
Conductivity (µS/cm)
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year


NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
>80% and <110%
Dissolved oxygen saturation (%)
150
125
100
75
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year


NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
>7 and <8.5 pH units
pH
8.5
8.0
7.5
7.0
6.5
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year


NB11
Berowra Creek, Off Square Bay (Oaky Point)
ANZECC guideline
6 to 50 NTU
Turbidity (NTU)
50
45
40
35
30
25
20
15
10
5
0
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020
Year

Appendix D : Priority WWTPs and water quality sites

EPL limits and water quality guidelines

Table D-1 EPL limits and compliance (2019-2020)

WWTP	Licence no./ Year	Ammonia (mg/L)		Total nitrogen (mg/L)				Total phosphorus (mg/L)			
		50%ile	90%ile	50%ile	90%ile	100%ile	Load (kg)	50%ile	90%ile	100%ile	Load (kg)
Picton	10555	0.5	1	6	10	NA	1,460	0.2	0.4	NA	73
	2019-2020	<0.1	0.4	4.67	4.97	-	2,286	0.026	0.164	-	39.4
West Camden	1675	1	5	10	15	NA	91,980	0.3	1	NA	2,190
	2019-2020	0.11	1.72	6.84	8.34	-	47,874	0.024	0.042	-	214.8
Wallacia	12235	0.5	1	7.5	10	NA	12,410	0.15	0.3	NA	1,606
	2019-2020	0.02	0.16	5.07	7.67	-	1,672	0.026	0.12	-	19.9
Penrith	1409	1	5	10	15	NA	176,660	0.2	0.4	NA	8,030
	2019-2020	0.02	0.7	4.68	6.22	-	23,468	0.063	0.092	-	474.5
North Richmond	190	2	5	10	15	NA	7,118	2	5	NA	803
	2019-2020	0.85	1.24	6.3	7.66	-	2,407	0.279	0.49	-	116.6
Richmond	1726	1	5	10	15	NA	43,800	0.3	1	NA	10,877
	2019-2020	<0.1	<0.1	6.45	8.2	-	3,777	0.027	0.034	-	15.5
Winmalee	1963	2	5	10	15	NA	110,595	2	3	NA	6,687

WWTP	Licence no./ Year	Ammonia (mg/L)		Total nitrogen (mg/L)				Total phosphorus (mg/L)			
		50%ile	90%ile	50%ile	90%ile	100%ile	Load (kg)	50%ile	90%ile	100%ile	Load (kg)
	2019-2020	0.19	2.8	8.47	9.9	-	58,250	0.144	0.261	-	1,995.1
St Marys	1729	1	5	NA	NA	45	222,000*	NA	NA	5	2,300*
	2019-2020	0.07	1.64	-	-	12.3	50,843	-	-	0.132	1,371.0
Quakers Hill	1724	1	5	NA	NA	45	222,000*	NA	NA	5	2,300*
	2019-2020	0.07	0.66	-	-	6.69	54,712	-	-	0.38	917.4
Riverstone	1796	1	5	NA	NA	45	222,000*	NA	NA	5	2,300*
	2019-2020	0.01	0.02	-	-	8.25	4,459	-	-	0.047	60.2
Castle Hill	1725	1	5	20	25	NA	72,270	0.3	1	NA	2,300
	2019-2020	0.06	0.22	17.3	19.1	-	34,694	0.106	0.264	-	673.8
Rouse Hill	4965	1	2	10	15	NA	124,100	0.2	0.4	NA	4,453
	2019-2020	0.07	0.39	6.79	7.89	-	44,121	0.014	0.018	-	539.7
Hornsby Heights	750	1	5	10	15	NA	72,270	0.3	1	NA	2,300
	2019-2020	0.02	0.07	6.31	9	-	16,599	0.072	0.134	-	355.8
West Hornsby	1695	1	5	10	15	NA	80,300	0.3	1	NA	4,643
	2019-2020	0.02	0.33	4.55	6.08	-	25,955	0.043	0.095	-	1,490.8
Brooklyn	12438	0.5	1	7	10	NA	NA	0.15	0.3	NA	NA
	2019-2020	0.01	0.07	3.85	5.4	-	-	0.015	0.03	-	-

NA	Not applicable
*	Also applicable as a combined load limit for the South Creek WWTPs (St Marys, Quakers Hill and Riverstone)
	Non-compliance, EPL limit exceedance

Table D-2 Water quality guidelines (ANZG 2018) and 50th percentile value, 2019-2020

Site code		Ammonia nitrogen (mg/L)	Oxidised Nitrogen (mg/L)	TN (mg/L)	TP (mg/L)	Chl-*a* (µg/L)	Conductivity (µS/cm)	DO Sat (%)	pH	Turbidity (NTU)
	Freshwater guideline	0.020[d]	0.04[d]	0.35[b]	0.025[b]	3.0[b]	125-2200[d]	85-110[d]	6.5-8.5[e]	50.0[d]
	Estuarine guideline[a]	0.015[c]	0.04[c]	0.30[c]	0.030[c]	4.0[c]		80-110[c]	7.0 - 8.5[c]	
	Associated WWTP									
N92	u/s Picton	0.01	0.30	0.53	0.012	2.8	532.5	96.5	8.2	1.6
N91	d/s Picton	0.02	0.32	0.58	0.014	2.0	529.0	97.0	8.3	2.2
N78	u/s West Camden	-	-	-	-	-	-	-	-	-
N75	d/s West Camden	0.05	1.12	1.50	0.015	2.4	371.0	97.2	7.6	4.4
N67	u/s Wallacia	0.01	0.93	1.29	0.019	5.1	392.0	93.5	7.5	6.5
N57	u/s Penrith	0.02	0.50	0.76	0.013	4.4	322.0	88.1	7.4	3.3
N53	d/s Penrith	-	-	-	-	-	-	-	-	-
N51	d/s Penrith	0.02	0.43	0.76	0.016	3.8	290.0	96.5	7.5	4.6
N48A	u/s Winmalee	0.02	0.37	0.70	0.015	5.3	288.0	93.2	7.6	3.2
N464	d/s Winmalee (lagoon)	0.03	1.23	1.56	0.026	4.8	317.0	96.0	7.6	4.1
N44	d/s Winmalee, u/s North Richmond	0.03	0.70	1.05	0.019	4.6	299.0	93.6	7.5	4.2
N42	d/s North Richmond	0.01	0.52	0.81	0.013	3.9	257.0	91.3	7.4	3.5
N39	u/s South Creek catchment	0.01	0.48	0.81	0.015	4.0	268.0	97.2	7.6	1.9
NS04A	South Creek lower tributary	0.06	1.42	2.03	0.089	4.0	821.0	72.4	7.5	47.0
N35	d/s South Creek catchment, u/s Cattai Creek catchment	0.03	0.60	1.03	0.049	10.0	434.5	91.2	7.4	16.0
NC11A	Cattai Creek lower tributary	0.04	1.09	1.65	0.039	3.1	565.0	74.9	7.3	16.0
N3001	d/s Cattai Creek catchment	0.01	0.60	1.19	0.043	14.3	470.5	96.4	7.6	12.0
N26	d/s Cattai Creek catchment	0.01	0.48	0.98	0.038	19.7	431.0	103.0	8.0	8.6
N2202	Lower Colo River	0.01	0.02	0.31	0.009	1.2	156.0	91.9	7.1	2.7
N18	d/s Colo River	0.01	0.22	0.57	0.029	10.9	2575.0	96.8	7.6	10.5
NB13	Berowra estuary	0.01	0.06	0.40	0.026	7.3	39450.0	94.1	7.8	2.3
NB11	Berowra estuary	0.01	0.01	0.31	0.024	5.0	41500.0	96.3	7.9	6.1

a	Estuarine sites: NB11, NB13	b	Default trigger values for NSW and VIC east flowing coastal river
c	Default trigger values for Estuaries (South East Australia)	d	Default trigger value for lowland river (South East Australia)
e	Default trigger values for NSW lowland river		50th percentile value exceeded default levels (2019-2020)

Appendix E : Supplementary information on method of data analysis

Data categorisation

Table E-1 Definition of intervention period for each WWTP by each nutrient load estimates (TN, DIN and TP)

WWTPs	River zones	Total nitrogen/ DIN			Total phosphorus	
	Data categorisation periods	From	To		From	To
West Camden	**Upper Nepean – West Camden**					
	Period 1: Pre-upgrade	1-Jul-95	29-Oct-08	Period 1: Pre-upgrade	1-Jul-95	28-Feb-09
	Period 2: Post TN upgrade to TN process deterioration	30-Oct-08	28-Feb-15	Period 2: Post TP upgrade	1-Mar-09	30-Jun-20
	Period 3: Post TN process deterioration	1-Mar-15	30-Jun-20			
Winmalee	**Lower Nepean River – Yarramundi**					
	Period 1: Pre-North Katoomba and Wentworth Falls WWTPs decommissioning	1-Jul-95	13-Jun-96	Period 1: Pre-North Katoomba and Wentworth Falls WWTPs decommissioning	1-Jul-95	13-Jun-96
	Period 2: Post North Katoomba and Wentworth Falls WWTPs decommissioned to Blackheath WWTP decommissioned	14-Jun-96	24-Jun-08	Period 2: Post North Katoomba and Wentworth Falls WWTPs decommissioned to Winmalee WWTP TP upgrade	14-Jun-96	31-Dec-99
	Period 3: Post Blackheath WWTP decommissioned	25-Jun-08	30-Jun-20	Period 3: Winmalee WWTP TP upgrade to Blackheath WWTP decommissioned	1-Jan-00	24-Jun-08
				Period 4: Post Blackheath WWTP decommissioned	25-Jun-08	30-Jun-20
	Hawkesbury River – South Creek					
St Marys	Period 1: Pre-TN upgrade	1-Jul-95	31-Dec-99	Period 1: Pre-TP upgrade	1-Jul-95	31-Dec-99
	Period 2: Post TN upgrade to St Marys AWTP commissioned	1-Jan-00	30-Jun-10	Period 2: Post TP upgrade to St Marys AWTP commissioned	1-Jan-00	30-Jun-10
	Period 3: Post St Marys AWTP commissioned	1-Jul-10	30-Jun-20	Period 3: Post St Marys AWTP commissioned	1-Jul-10	30-Jun-20
Quakers Hill	Period 1: Pre-St Marys AWTP commissioned	01-Jul-95	30-Jun-10	Period 1: Pre-TP upgrade	1-Jul-95	31-Dec-98
	Period 2: Post St Marys AWTP commissioned	01-Jul-10	30-Jun-20	Period 2: Post TP upgrade to St Marys AWTP commissioned	1-Jan-99	30-Jun-10
				Period 3: Post St Marys AWTP commissioned	1-Jul-10	30-Jun-20
Riverstone	Period 1: Pre-TN upgrade	1-Jul-95	31-Dec-99	Period 1: Pre-TP upgrade	1-Jul-95	31-Dec-99
	Period 2: Post TN upgrade to reaching design capacity and increased discharge	1-Jan-00	30-Jun-10	Period 2: Post TP upgrade to reaching design capacity and increased discharge	1-Jan-00	30-Jun-10

WWTPs	River zones	Total nitrogen/ DIN			Total phosphorus	
	Data categorisation periods	From	To		From	To
	Period 3: Post reaching design capacity and increased discharge process change to TN upgrade	1-Jul-10	21-Jan-19	Period 3: Post reaching design capacity and increased discharge process change to TP upgrade	01-Jul-10	04-Mar-19
	Period 4: Post TN upgrade	22-Jan-19	30-Jun-20	Period 4 Post TP upgrade	05-Mar-19	30-Jun-20
Richmond	Period 1: Pre-increased recycled water use	1-Jul-95	19-Jul-02	Period 1: Pre-increased use of recycled water	1-Jul-95	19-Jul-02
	Period 2: Increased recycled water uses to TN upgrade	20-Jul-02	15-Mar-05	Period 2: Increased recycled water uses to TP upgrade	20-Jul-02	15-Mar-05
	Period 3: Post TN upgrade	16-Mar-05	30-Jun-20	Period 3: Post TP upgrade	16-Mar-05	30-Jun-20
	Hawkesbury River – Cattai Creek					
Castle Hill	Period 1:-Pre-up to Round Corner WWTP decommissioned	1-Jul-95	19-Dec-00	Period 1: Pre-up to Round Corner WWTP decommissioned	1-Jul-95	19-Dec-00
	Period 2: Post Round Corner WWTP decommissioned	20-Dec-00	30-Jun-20	Period 2: Post Round Corner WWTP decommissioned	20-Dec-00	30-Jun-20
Rouse Hill	Period 1: Pre-TN upgrade	1-Jul-95	26-Dec-09	Period 1: Pre-TP upgrade	1-Jul-95	16-Jun-06
	Period 2: Post TN upgrade	27-Dec-09	30-Jun-20	Period 2: Post TP upgrade	17-Jun-06	30-Jun-20

Table E-2 Water quality data categorisation, reference lines and intervention periods for each WWTP by each nutrient load estimates (TN, DIN and TP)

Site	Reference line/ Period	River zones	Total nitrogen/ DIN			Total phosphorus/ Chl-*a*	
		Data categorisation periods	From	To		From	To
Upper Nepean River – West Camden							
N75	Reference line 1	Upgrade	29-Oct-08		TP upgrade	28-Feb-09	
	Reference line 2	TN process deterioration	28-Feb-15				
	Period 1	Pre-upgrade	01-Jul-95	29-Oct-08	Period 1: Pre-upgrade	01-Jul-95	28-Feb-09
	Period 2	Post TN upgrade to TN process deterioration	30-Oct-08	28-Feb-15	Period 2: Post TP upgrade	01-Mar-09	30-Jun-20
	Period 3	Post TN process deterioration	01-Mar-15	30-Jun-20			
Lower Nepean River – Yarramundi							
N44#	Reference line 1	North Katoomba and Wentworth Falls WWTPs decommissioned	13-Jun-96		North Katoomba and Wentworth Falls WWTPs decommissioned	13-Jun-96	
	Reference line 2	Blackheath WWTP decommissioned	24-Jun-08		Winmalee WWTP TP upgrade	31-Dec-99	
	Reference line 3	St Mary's AWTP commissioned	30-Jun-10		Penrith WWTP TP upgrade	1-Feb-01	
	Reference line 4				Blackheath WWTP decommissioned	24-Jun-08	
	Reference line 5				St Marys AWTP commissioned	30-Jun-10	
	Period 1	Pre-St Marys AWTP commissioned	01-Jul-08	30-Jun-10	Pre-St Marys AWTP commissioned	1-Jul-08	30-Jun-10
	Period 2	Post St Marys AWTP commissioned	01-Jul-10	30-Jun-20	Post St Marys AWTP commissioned	1-Jul-10	30-Jun-20
Hawkesbury River – South Creek							
N35	Reference line 1	St Marys and Riverstone WWTPs TN upgrade	31-Dec-99		Quakers Hill WWTP TP upgrade	31-Dec-98	
	Reference line 2	Richmond WWTP increased recycled water use	19-Jul-02		St Marys and Riverstone WWTPs TP upgrade	31-Dec-99	
	Reference line 3	Richmond WWTP TN upgrade	15-Mar-05		Richmond WWTP increased recycled water use	19-Jul-02	
	Reference line 4	St Marys AWTP commissioned/ Riverstone WWTP reaching design capacity and increased discharge	30-Jun-10		Richmond TP upgrade	15-Mar-05	

Site	Reference line/ Period	River zones	Total nitrogen/ DIN			Total phosphorus/ Chl-*a*	
		Data categorisation periods	From	To		From	To
	Reference line 5	Riverstone WWTP TN upgrade	01-Jan-19		St Marys AWTP commissioned/ Riverstone WWTP reaching design capacity and increased discharge	30-Jun-10	
	Reference line 6				Riverstone WWTP TP upgrade	04-Mar-19	
	Period 1	Pre-St Marys and Riverstone WWTPs TN upgrade	01-Jul-95	31-Dec-99	Pre-St Marys and Riverstone WWTPs TP upgrade	1-Jul-95	31-Dec-99
	Period 2	Post St Marys and Riverstone WWTP TN upgrade to Richmond WWTP TN upgrade	01-Jan-00	15-Mar-05	Post St Marys and Riverstone WWTPs TP upgrade to Richmond WWTP TP upgrade	1-Jan-00	15-Mar-05
	Period 3	Post Richmond WWTP TN upgrade to St Marys AWTP commissioned/ Riverstone WWTP process change	16-Mar-05	30-Jun-10	Post Richmond WWTP TP upgrade to St Marys AWTP commissioned/ Riverstone WWTP process change	16-Mar-05	30-Jun-10
	Period 4	Post St Marys AWTP commissioned/ Riverstone WWTP Riverstone WWTP reaching design capacity and increased discharge to Riverstone WWTP TN upgrade	01-Jul-10	21-Jan-19	Post St Marys AWTP commissioned to Riverstone WWTP TP upgrade	1-Jul-10	4-Mar-19
	Period 5	Post Riverstone WWTP TN upgrade	22-Jan-19	30-Jun-20	Post Riverstone WWTP TP upgrade	5-Mar-19	30-Jun-20
Hawkesbury River – Cattai Creek							
N3001*	Reference line 1	Round Corner WWTP decommissioned	19-Dec-00		Round Corner WWTP decommissioned	19-Dec-00	
	Reference line 2	Rouse Hill WWTP TN upgrade	26-Dec-09		Rouse Hill WWTP TP upgrade	16-Jun-06	

the fitted model only includes use data from July 2008, the other interventions are presented on the figures for general information

* the fitted model only includes data from the most recent set of observations, ie from 2008 onwards. Hence no periods are fitted.

WWTP nutrient loads

Table E-3 Details on WWTP nutrient load variables

Wastewater Treatment Plant	Load equation
Upper Nepean River – West Camden	
West Camden WWTP	nutrient concentration x (discharge volume + bypass volume)/ 1000
Lower Nepean River - Yarramundi	
Winmalee WWTP	[(Blackheath nutrient concentration x discharge volume) + (North Katoomba nutrient concentration x discharge volume) + (Wentworth Falls nutrient concentration x discharge volume) + (Winmalee discharge nutrient concentration x discharge volume) + (Winmalee bypass nutrient concentration x bypass volume] / 1000
Hawkesbury River – South Creek	
Quaker's Hill WWTP	nutrient concentration x discharge volume / 1000
St Marys WWTP	[(Discharge nutrient concentration x discharge volume) + (bypass nutrient concentration x bypass volume)] / 1000
Riverstone WWTP	nutrient concentration x discharge volume / 1000
Richmond WWTP	nutrient concentration x discharge volume / 1000
Hawkesbury River – Cattai Creek	
Rouse Hill WWTP	[(Rouse Hill nutrient concentration x discharge volume) + (Round Corner nutrient concentration x discharge volume)] / 1000
Castle Hill WWTP	nutrient concentration x discharge volume / 1000

Table E-4 Details on site-specific nutrient loads

Site	WWTP load
Nepean River at Sharpes Weir (N75)	West Camden (lag 0)
Nepean River at Yarramundi (N44)	Winmalee (lag 0)
Hawkesbury River at Wilberforce (N35)	Quakers Hill (lag 1), St Marys (lag 1), Riverstone (lag 1), Richmond (lag 1)
Hawkesbury River at Cattai SRA (N3001)	Rouse Hill (lag 1), Castle Hill (lag 1)

River and Creek flow

Table E-5 Details on site-specific river flow calculation for all receiving water sites

Site/ tributary	Formula for deriving site-specific flow
Nepean River at Macquarie Grove Rd (N78):	Camden Weir flow (log 0)
Nepean River at Sharpes Weir (N75)	Camden Weir flow (lag 0) + Matahill Creek flow (lag 0)
Nepean River at Smith Road (N48A)	Penrith Weir flow (lag 0) + St Marys AWTP discharge flow (lag 0) + Penrith WWTP discharge flow (lag 0)
Nepean River at Yarramundi (N44)	Penrith Weir flow (lag 0) + St Marys AWTP discharge flow (lag 0) + Penrith WWTP discharge flow (lag 0) + Winmalee discharge flow (lag 0)
Hawkesbury River at Freemans Reach (N39)	Penrith Weir flow (lag 1) + St Marys AWTP discharge flow (lag 1) + Penrith WWTP discharge flow (lag 1) + Winmalee WWTP discharge flow (lag 1) + Grose River (lag 0) + North Richmond WWTP discharge flow (lag 0)
South Creek base flow	(South Creek RR (lag 1) minus St Marys WWTP (lag 1)) + ((Eastern Creek GR (lag 1) minus Quakers Hill WWTP (lag 1)) Note: no flow from Riverstone WWTP is included as it is included in the Riverstone WWTP load calculation.
South Creek at NS04A	South Creek RR
Hawkesbury River at Wilberforce (N35)	Penrith Weir flow (lag 1) + St Marys AWTP discharge flow (lag 1) + Penrith WWTP discharge flow (lag 1) + Winmalee WWTP discharge flow (lag 1) + Grose River (lag 1) + North Richmond WWTP discharge flow (lag 1) + Richmond WWTP discharge flow (lag 1) + South Creek RR (lag 1) + Eastern Creek GR (lag 1) + Riverstone WWTP discharge flow (lag 1)
Cattai Creek base flow	Cattai Creek (lag 0) minus Rouse Hill WWTP discharge (lag 1) minus Castle hill WWTP discharge (lag 1)
Cattai Creek at NC11A	Cattai Creek RR
Hawkesbury River at Cattai SRA (N3001)	Penrith Weir flow (lag 1) + St Marys AWTP discharge flow (lag 1) + Penrith WWTP discharge flow (lag 1) + Winmalee discharge flow (lag 1) + Grose River (lag 1) + North Richmond WWTP discharge flow (lag 1) + Richmond WWTP discharge flow (lag 1) + South Creek RR (lag 1) + Eastern Creek GR (lag 1) + Riverstone WWTP discharge flow (lag 1) + Cattai Creek M (lag 0)

Notes:

South Creek RR	South Creek at Richmond Road
Eastern Creek GR	Eastern Creek at Garfield Road
Cattai Creek M	Cattai Creek at Maralaya

Fourier transforms

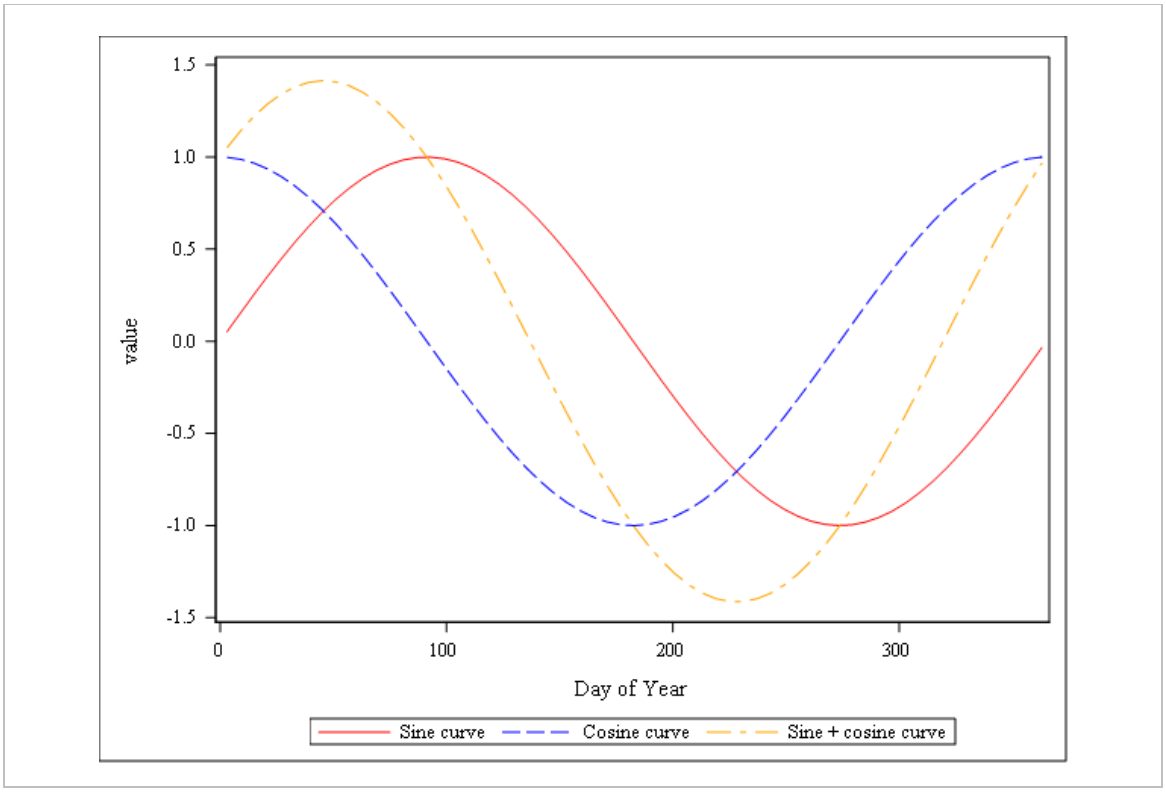
Examples of the transforms are shown in plots below. The first order sine function allows a high value around March and a low value around September; the first order cosine function allows a high around December/January and a low in June/July. When both terms are included in a model, they allow the high to shift to around February and the low to around August.

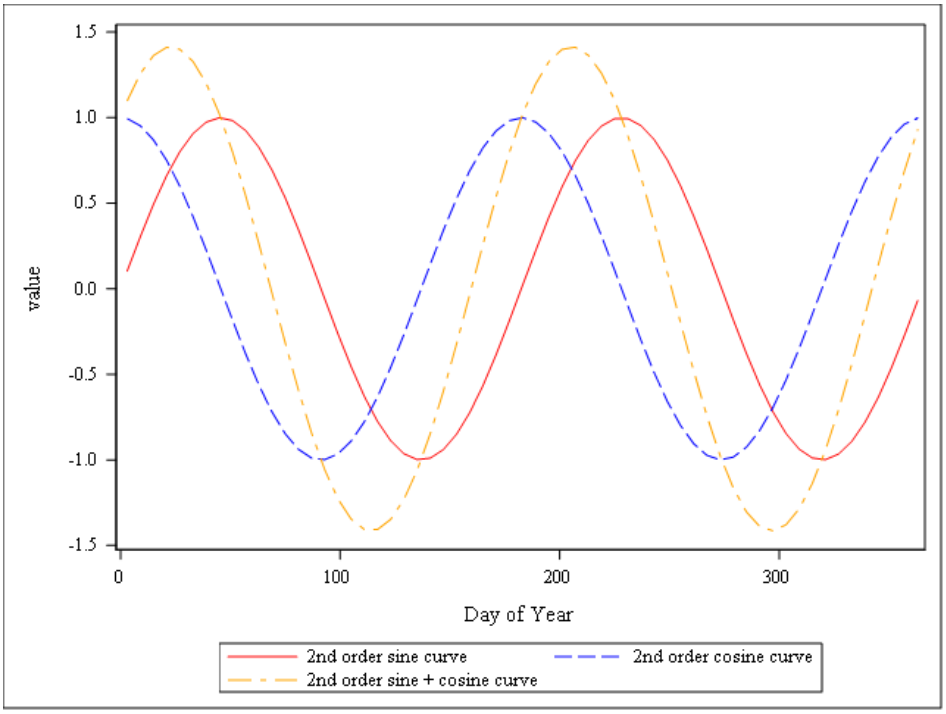
Similarly, for the 2nd, 3rd and 4th order sine and cosine functions: each allows for two or three highs/lows a year and the sum of the terms shifts the timing of these slightly.

When different order sine and cosine terms are summed a more complex seasonal pattern can be modelled.

For example:

- Summing the 1st and 2nd order sine and cosine curves allows a high peak in late January with a second, lower peak in July, a trough in May with a lower trough in October.
- Summing the 1st, 2nd and 3rd order sine and cosine curves allows the highest peak in late January with two lower peaks around end of May, beginning of June and around end of August, beginning of September and three troughs in April, July and the lowest one around end October beginning of November.
- Summing the 1st, 2nd, 3rd and 4th order sine and cosine curves allows the highest peak in late January with three lower peaks in April, July and October and four troughs in March, June, August and the lowest one in November.




1.5
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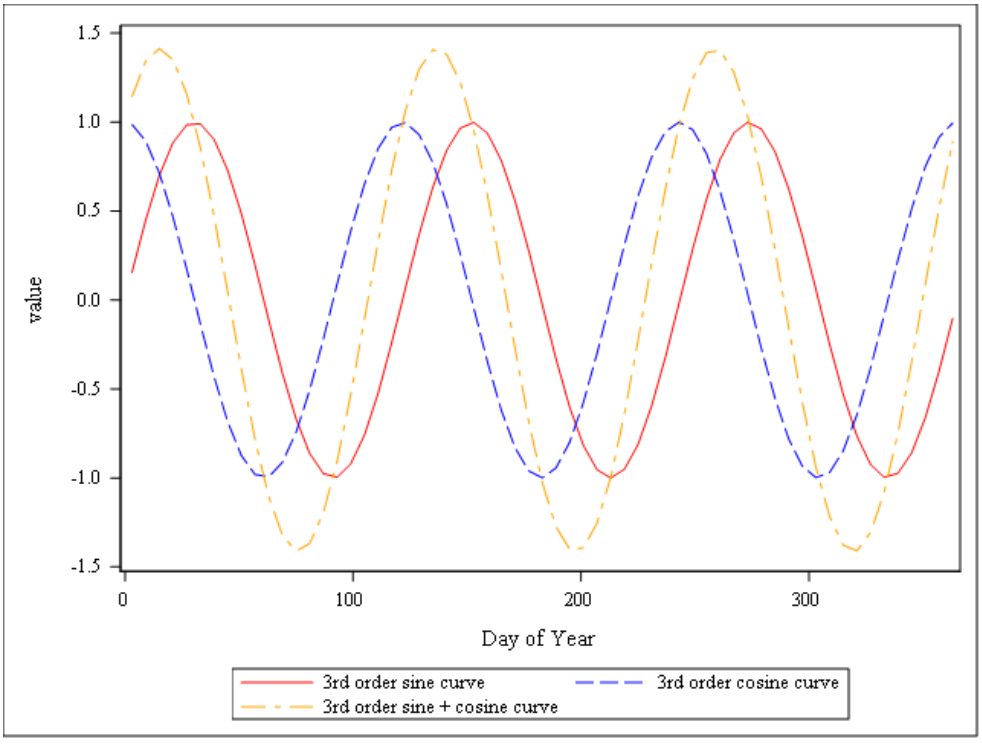
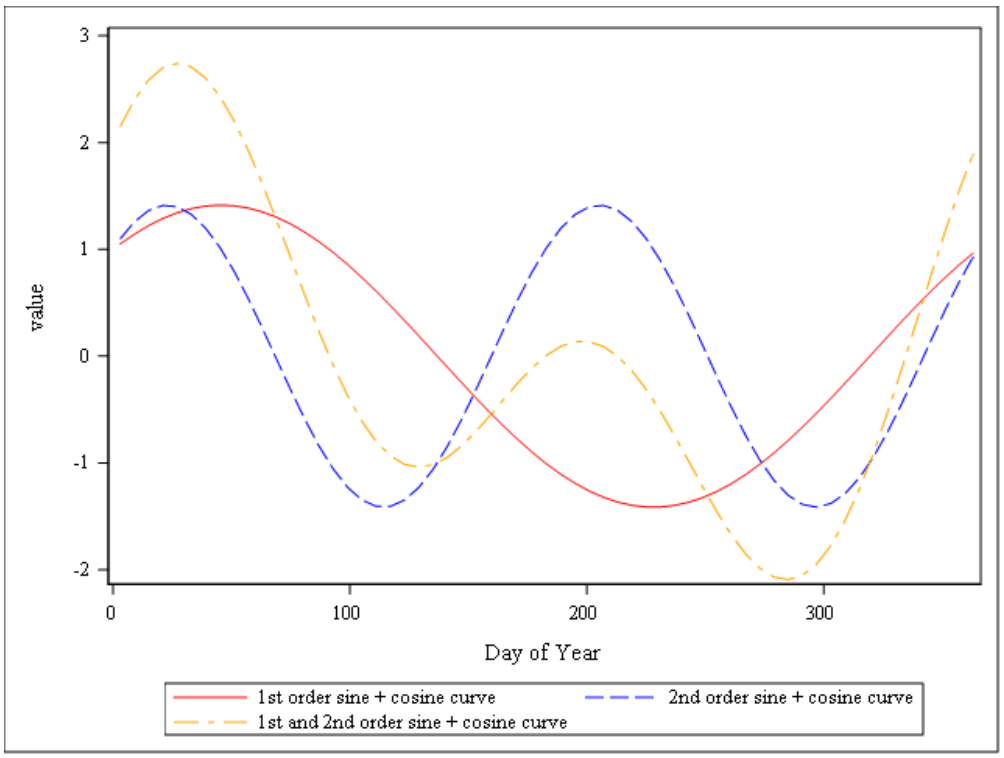
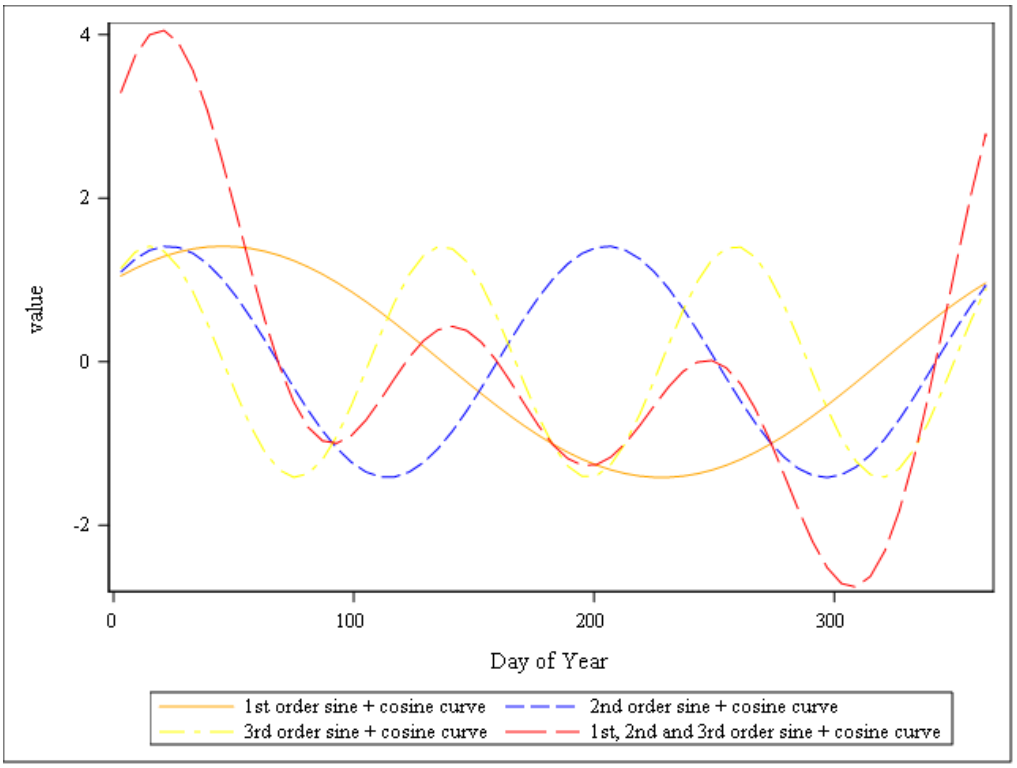
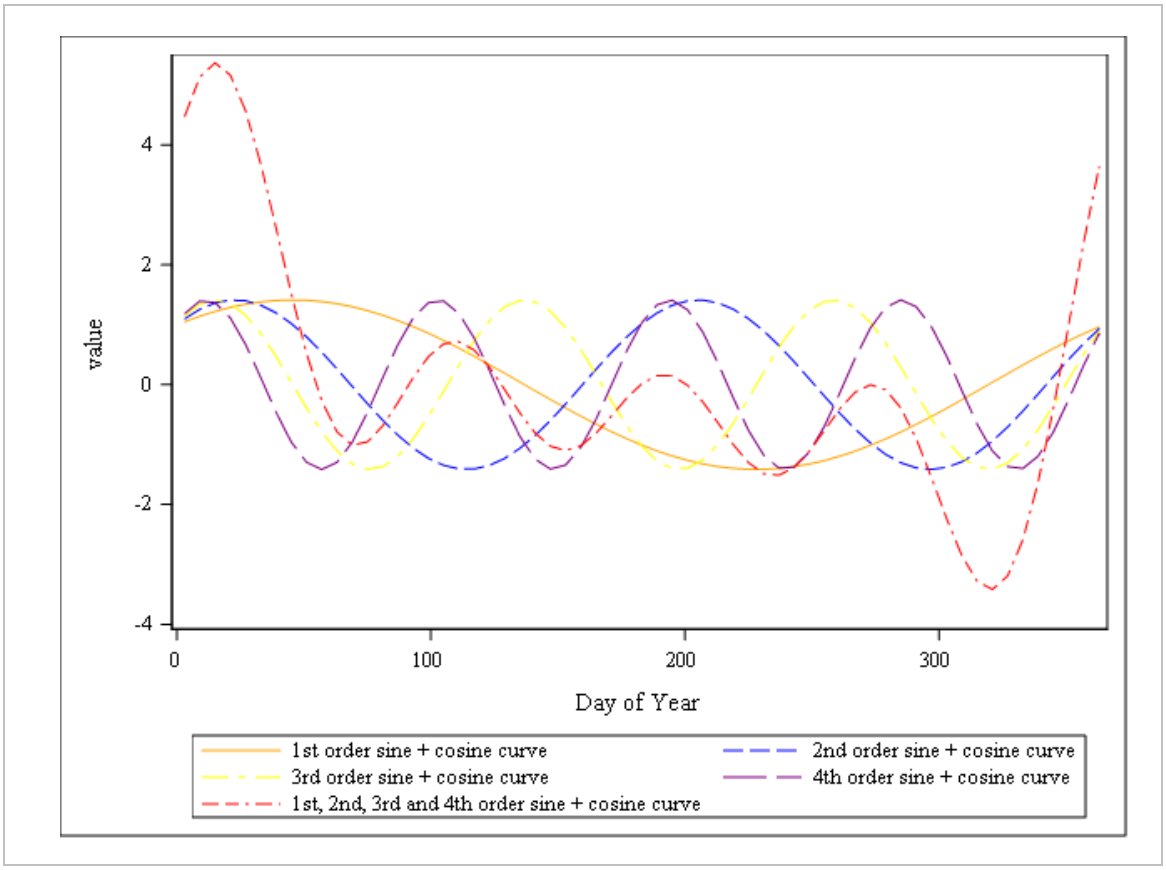
0.5
0.0
-0.5
-1.0
-1.5
value
0
100
200
300
Day of Year
2nd order sine curve
2nd order cosine curve
2nd order sine + cosine curve


1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
value
0
100
200
300
Day of Year
3rd order sine curve
3rd order cosine curve
3rd order sine + cosine curve


3
2
1
0
-1
-2
value
0
100
200
300
Day of Year
1st order sine + cosine curve
2nd order sine + cosine curve
1st and 2nd order sine + cosine curve


4
2
0
-2
value
0
100
200
300
Day of Year
1st order sine + cosine curve
2nd order sine + cosine curve
3rd order sine + cosine curve
1st, 2nd and 3rd order sine + cosine curve



Interpretation of coefficients

When an outcome variable has been analysed on the log scale and some of the explanatory variables are also on the log scale, interpreting the relationship on the original scale is complex and differs based on what the value of the explanatory variable is used.

For example:

Log(Y) = a + b log(X) where a is the estimated intercept and b is the estimated regression coefficient from the model for explanatory variable X.

For a 1 unit increase in X

$$\log(y|x+1) - \log(y|x) = (a + b*\log(x+1)) - (a + b*\log(x))$$

$$= b(\log(x+1) - \log(x))$$

From logarithm rules: $\log(y|x+1) - \log(y|x) = \log[(y|x+a)/(y|x)]$

Hence $(y|x+1)/(y|x) = 10^{b[\log(x+1)-\log(x)]}$

Example 1 – positive coefficient, X on range of 10 to 30:

The model aims to predict, for example, the Chl-*a* concentration at the downstream site.

If the explanatory variable X, e.g. Chl-*a* at the upstream site, is on the range of 10 to 30 say and the regression coefficient b is 0.7 the relationship is shown in the figure below.

$$\log(y|x+1) - \log(y|x) = 0.7[\log(x+1) - \log(x)]$$

If Chl-*a* at the upstream site increases from 10 to 11 µg/L,

$$\log(y|x+1) - \log(y|x) = 0.7[\log(11) - \log(10)]$$
$$= 0.0289$$

Back-transforming log(Y) to get on original scale:

$$(y|x+1)/(y|x) = 10^{0.0289}$$
$$= 1.06$$

Chl-*a* at the downstream site increases by a factor of 1.06 or 6%.

If Chl-*a* at the upstream site increases from 15 to 16 µg/L,

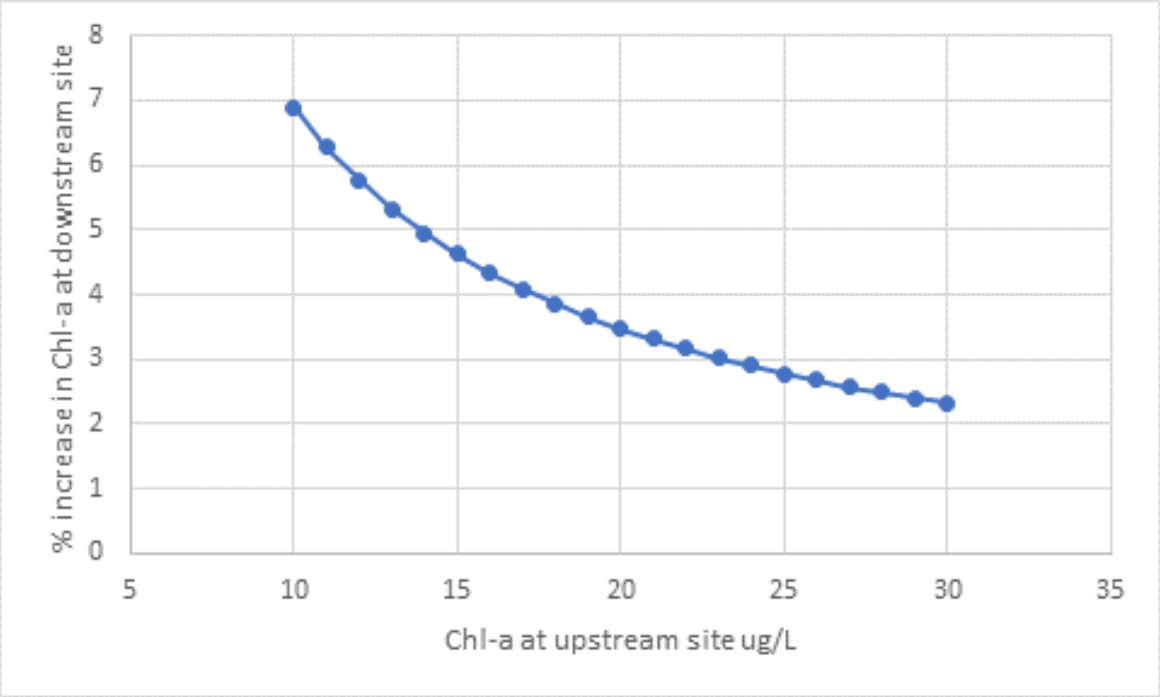
$$\log(y|x+1) - \log(y|x) = 0.7[\log(16) - \log(15)]$$
$$= 0.0196$$

Back-transforming log(Y) to get on original scale:

$$(y|x+1)/(y|x) = 10^{0.0196}$$
$$= 1.05$$

Chl-*a* at the downstream site increases by 5%.

If Chl-*a* at the upstream site increases from 30 to 31 µg/L, then Chl-*a* at the downstream site increases by a factor of 1.02 or 2%. As the Chl-*a* concentration increases at the upstream site, an increase of 1 µg/L at that site increases the Chl-*a* concentration at the downstream site but the percentage of the increase reduces as the Chl-*a* at the upstream site increases. However, because the concentration at the upstream site is increasing the magnitude of Chl-*a* at the downstream site will increase.

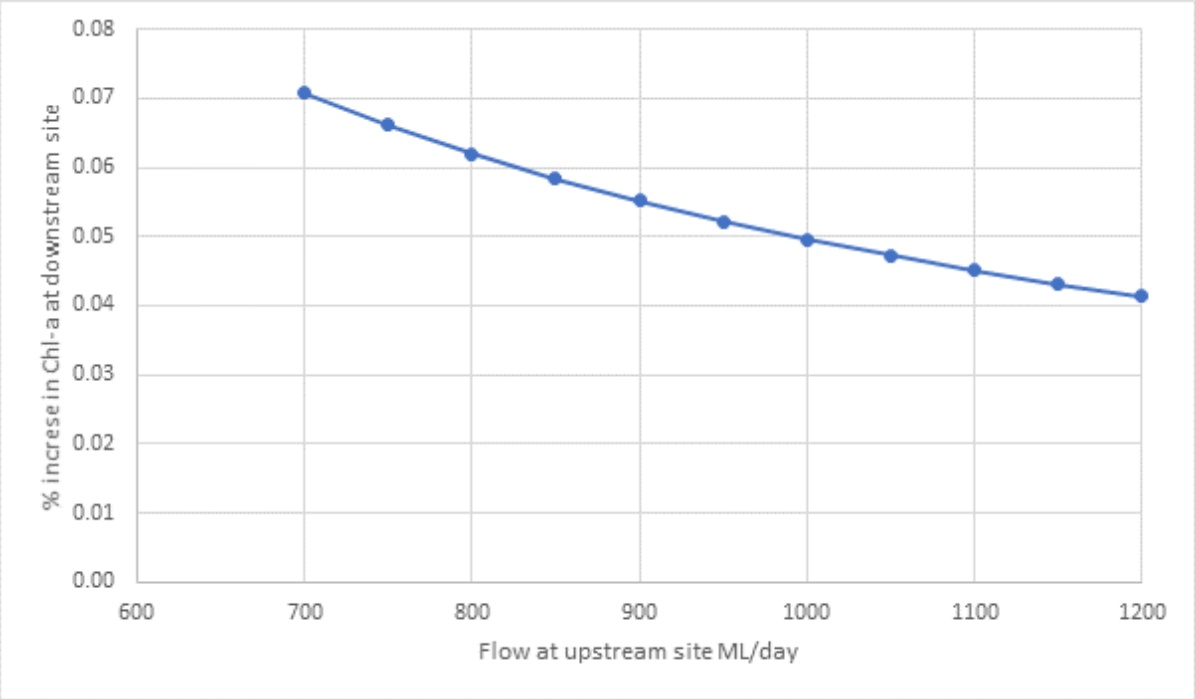


Example 2 – positive coefficient, X on range 700 to 1200:

The model aims to predict, for example, the Chl-*a* concentration at the downstream site as in Example 1.

If the explanatory variable X is on the range of 700 to 1200 say (eg Flow at the upstream site) and the regression coefficient b is 0.05, the relationship is shown in the figure below.

If flow at the upstream site increases from 700 to 710 ML/day, Chl-*a* at the downstream site increases by 0.07%. If Flow at the upstream site increases from 1000 to 1010 ML/day, Chl-*a* at the downstream site increases by 0.05% and if Flow at the upstream site increases from 1200 to 1210 ML/day, then Chl-*a* at the downstream site increases by 0.04%. As Flow increases at the upstream site, an increase of 10 ML/day at that site increases the Chl-*a* concentration at the downstream site but the percentage of the increase reduces as the Flow at the upstream site increases. However, because the Flow at the upstream site is increasing the magnitude of Chl-*a* at the downstream site will increase.

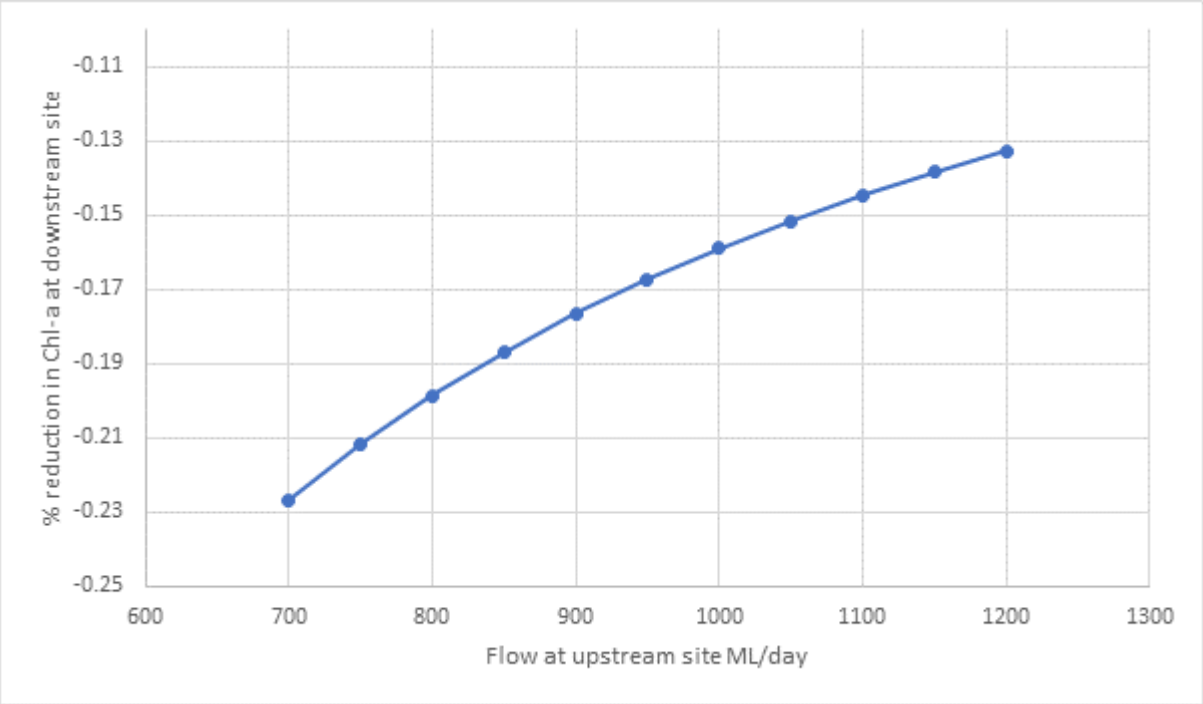


Example 3 – negative coefficient, X on range 700 to 1200:

When the regression coefficient is negative, for example, flow at the upstream site has a coefficient of -0.16, so that as flow increases, Chl-*a* at the downstream site decreases. With flow in the same range as Example 2, the relationship is shown in the figure below.

Now the result on the y-axis is % reduction in Chl-*a* at the downstream site.

If flow at the upstream site increases from 700 to 710 ML/day, Chl-*a* at the downstream site decreases by 0.22%. If Flow at the upstream site increases from 1000 to 1010 ML/day, Chl-*a* at the downstream site decreases by 0.15% and if Flow at the upstream site increases from 1200 to 1210 ML/day, then Chl-*a* at the downstream site decreases by 0.13%. As Flow increases at the upstream site, an increase of 10 ML/day at that site decreases the Chl-*a* concentration at the downstream site but the percentage decrease reduces as the Flow at the upstream site increases.


% reduction in Chl-a at downstream site
-0.11
-0.13
-0.15
-0.17
-0.19
-0.21
-0.23
-0.25
600
700
800
900
1000
1100
1200
1300
Flow at upstream site ML/day

Appendix F : Statistical analysis outcomes of Nepean River at Sharpes Weir – West Camden WWTP

West Camden WWTP total nitrogen load

Table F-1 Final model for West Camden WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	2.12661185432596	0.023487535449847	90.542146	<0.0001
Period 1	-0.24646425795912	0.028809283008368	-8.555029	<0.0001
Period 2	-0.58364224938420	0.032397253152028	-18.015177	<0.0001
Period 1: Linear trend	0.00011952070954	0.000015431150170	7.745418	<0.0001
Period 2: Linear trend	-0.00005822721490	0.000045556171688	-1.278141	0.2014
Period 3: Linear trend	-0.00025933111631	0.000061334516636	-4.228143	<0.0001
Period 1: Quadratic trend	-0.00000001573884	0.000000003022998	-5.206370	<0.0001
Period 2: Quadratic trend	0.00000008097086	0.000000019341485	4.186383	<0.0001
Period 3: Quadratic trend	0.00000014112827	0.000000032747573	4.309579	<0.0001

Table F-2 Final model for West Camden WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Period	53.39264869	2	1,573.434311	<0.0001	5.57658542	2	164.337059	<0.0001
Period 1: Linear trend	2.45753046	1	144.842514	<0.0001	1.01787063	1	59.991501	<0.0001
Period 2: Linear trend	2.21810384	1	130.731131	<0.0001	0.02771791	1	1.633645	0.2014
Period 3: Linear trend	0.02399209	1	1.414052	0.2346	0.30332082	1	17.877194	<0.0001
Period 1: Quadratic trend	0.65695796	1	38.719945	<0.0001	0.45990998	1	27.106284	<0.0001
Period 2: Quadratic trend	0.49744680	1	29.318638	<0.0001	0.29735879	1	17.525803	<0.0001
Period 3: Quadratic trend	0.29819204	1	17.574913	<0.0001	0.31511759	1	18.572475	<0.0001
1st order cosine by year	3.93463090	26	8.919239	<0.0001	4.02407619	26	9.121998	<0.0001
1st order sine by year	2.42796758	26	5.503851	<0.0001	2.31858649	26	5.255900	<0.0001
2nd order cosine by year	0.67007157	26	1.518955	0.0459	0.67687426	26	1.534376	0.0421
2nd order sine by year	0.65973761	26	1.495530	0.0524	0.67507903	26	1.530306	0.0431
3rd order cosine by year	1.18178049	26	2.678925	<0.0001	1.18030721	26	2.675586	<0.0001
3rd order sine by year	0.53584945	26	1.214693	0.2103	0.53584945	26	1.214693	0.2103

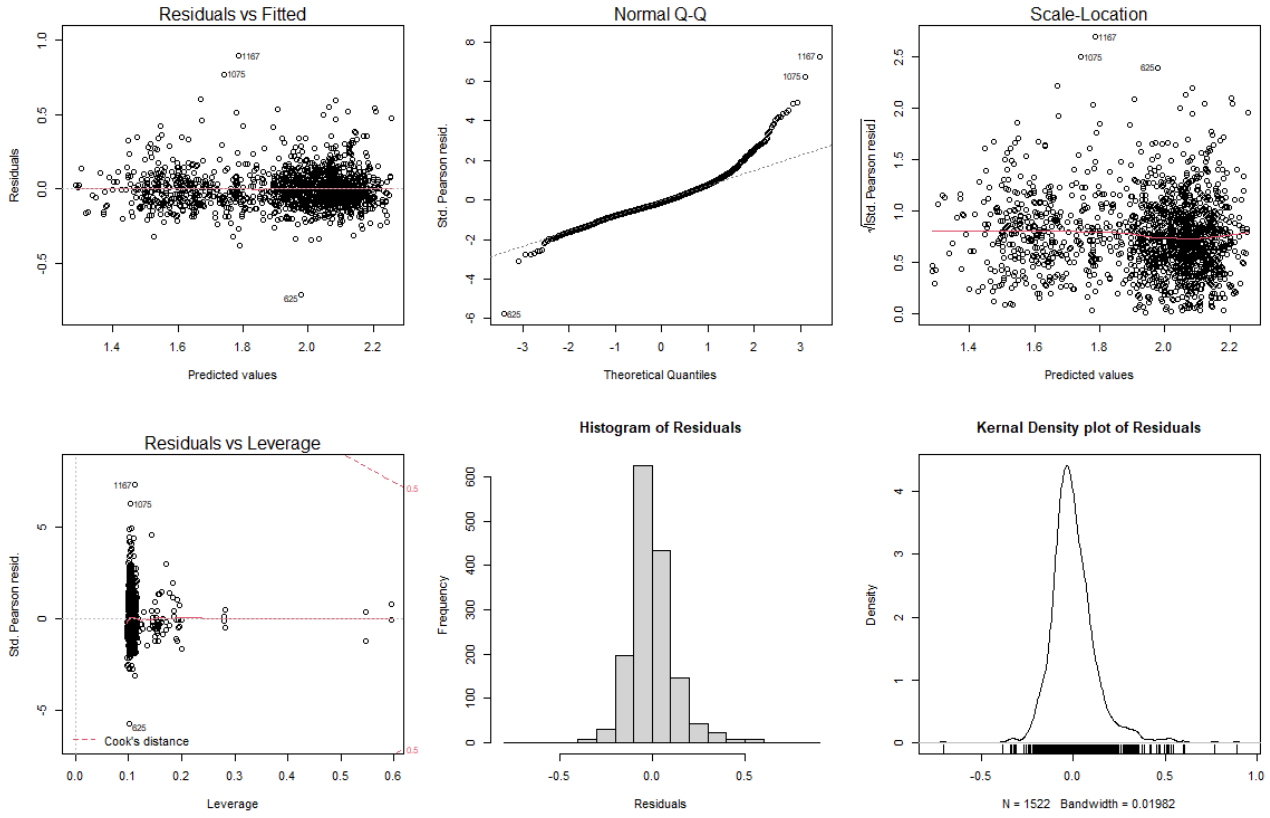


Figure F-1 Final model for West Camden WWTP total nitrogen load: residual plots

N75 total nitrogen concentrations

Table F-3 Final model for site N75 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-0.08044719291112	0.131180248326137	-0.6132569	0.5400
Log_{10}(Camden Weir flow)	-0.24376233679219	0.015871997622620	-15.3580124	<0.0001
Log_{10}(Matahil Creek flow)	0.10058707050211	0.039347649173002	2.5563680	0.0109
Log_{10}(West Camden TN load)	0.21964098299670	0.065594479151559	3.3484675	0.0009
Period 1	0.24580758317175	0.066370260174184	3.7035802	0.0002
Period 2	-0.10379066172282	0.065844205642007	-1.5763067	0.1156
Period 1: Linear trend	-0.00007585372624	0.000031143661821	-2.4356072	0.0152
Period 3: Linear trend	-0.00029021346188	0.000149397238523	-1.9425624	0.0527
Period 1: Quadratic trend	0.00000001823016	0.000000006206381	2.9373251	0.0035
Period 3: Quadratic trend	0.00000019858688	0.000000081185011	2.4461028	0.0148

Table F-4 Final model for site N75 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Log_{10}(Camden Weir flow)	22.94191987	1	814.5155035	<0.0001	6.6435534	1	235.868546	<0.0001
Log_{10}(Matahil Creek flow)	0.01807568	1	0.6417477	0.4235	0.1840675	1	6.535017	0.0109
Log_{10}(West Camden TN load)	12.32027647	1	437.4113522	<0.0001	0.3158076	1	11.212235	0.0009
Period	2.42728044	2	43.0883196	<0.0001	1.9294822	2	34.251561	<0.0001
Period 1: Linear trend	0.03796507	1	1.3478881	0.2462	0.1670879	1	5.932182	0.0152
Period 3: Linear trend	0.29192246	1	10.3642315	0.0014	0.1062871	1	3.773549	0.0527
Period 1: Quadratic trend	0.59733112	1	21.2072688	<0.0001	0.2430158	1	8.627879	0.0035
Period 3: Quadratic trend	0.10414111	1	3.6973605	0.0551	0.1685310	1	5.983419	0.0148
1st order cosine by year	2.93684307	26	4.0103012	<0.0001	2.7121520	26	3.703482	<0.0001
1st order sine by year	1.71705272	26	2.3446600	0.0002	1.6071583	26	2.194598	0.0007
2nd order cosine by year	0.81260444	26	1.1096230	0.3246	0.8405869	26	1.147833	0.2817
2nd order sine by year	1.42548492	26	1.9465200	0.0038	1.4254849	26	1.946520	0.0038

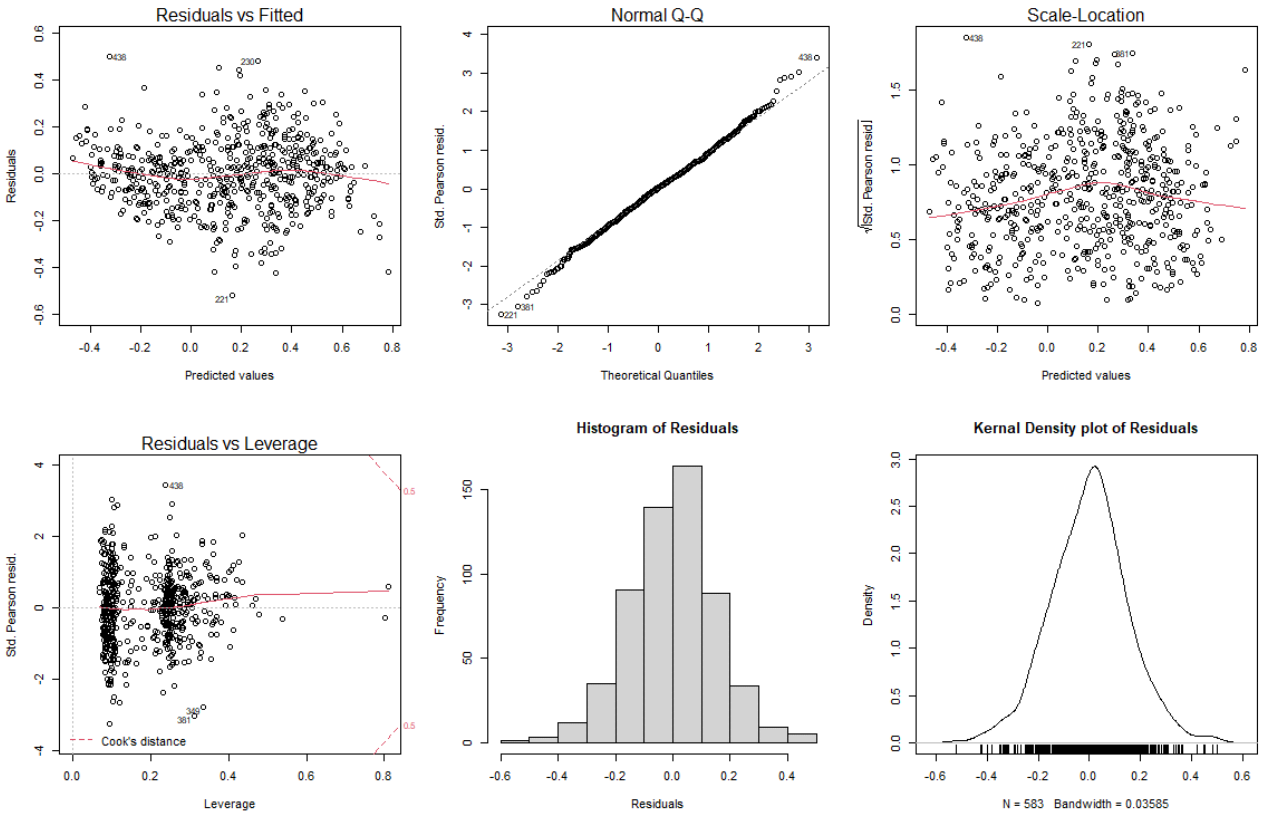


Figure F-2 Final model for site N75 total nitrogen concentrations: residual plots

N78 and N75 total nitrogen concentrations

Table F-5 Final model for upstream/downstream analysis of site N78 and N75 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-1.8629380195773	1.1512215527110	-1.6182272	0.1125
N78	-4.3201803446875	4.9554016826203	-0.8718123	0.3878
Log_{10}(Flow)				
N75	-0.3218850140537	0.0922970305864	-3.4874905	0.0011
N78	0.1287750430714	0.0822986291912	1.5647289	0.1245
Linear trend				
N75	0.0032381505902	0.0017133985356	1.8898992	0.0651
N78	0.0073961516211	0.0070093782112	1.0551794	0.2969
Quadratic trend				
N75	-0.0000009736107	0.0000005939026	-1.6393440	0.1080
N78	-0.0000024744663	0.0000025242906	-0.9802621	0.3321

Table F-6 Final model for upstream/downstream analysis of site N78 and N75 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Site	3.65463359	1	253.428088	<0.0001	0.01096062	1	0.7600568	0.3878
Site by flow	0.41961103	2	14.548821	<0.0001	0.21070170	2	7.3054831	0.0018
Site by Linear trend	0.37797924	2	13.105357	<0.0001	0.06756318	2	2.3425614	0.1074
Site by Quadratic trend	0.08679035	2	3.009209	0.0591	0.05261227	2	1.8241813	0.1728
Site by 1^{st} order cosine	0.11638970	2	4.035483	0.0243	0.08778296	2	3.0436250	0.0574
Site by 1^{st} order sine	0.09090223	2	3.151777	0.0521	0.09090223	2	3.1517769	0.0521

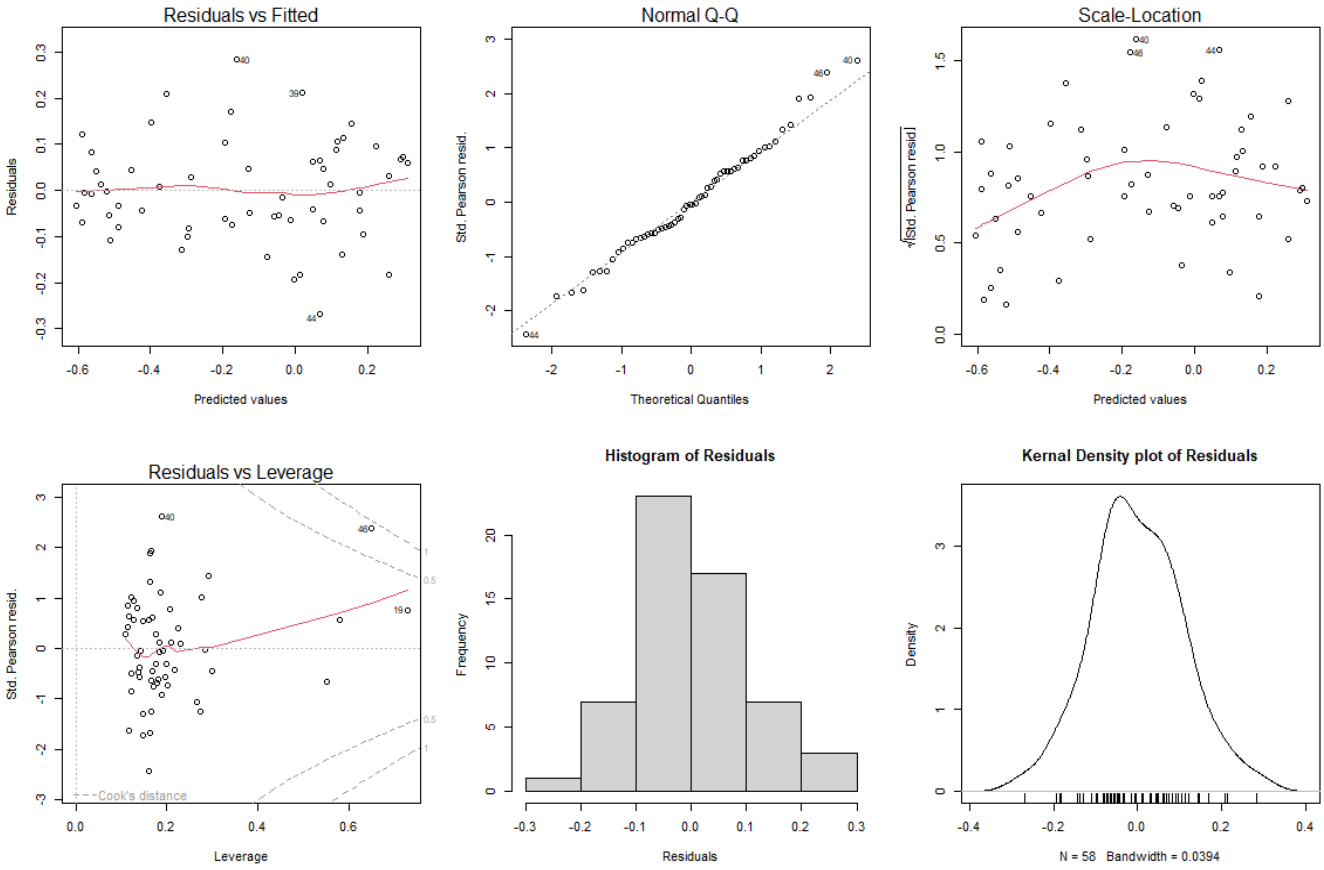


Figure F-3 Final model for upstream/downstream analysis of site N78 and N75 total nitrogen concentrations: residual plots

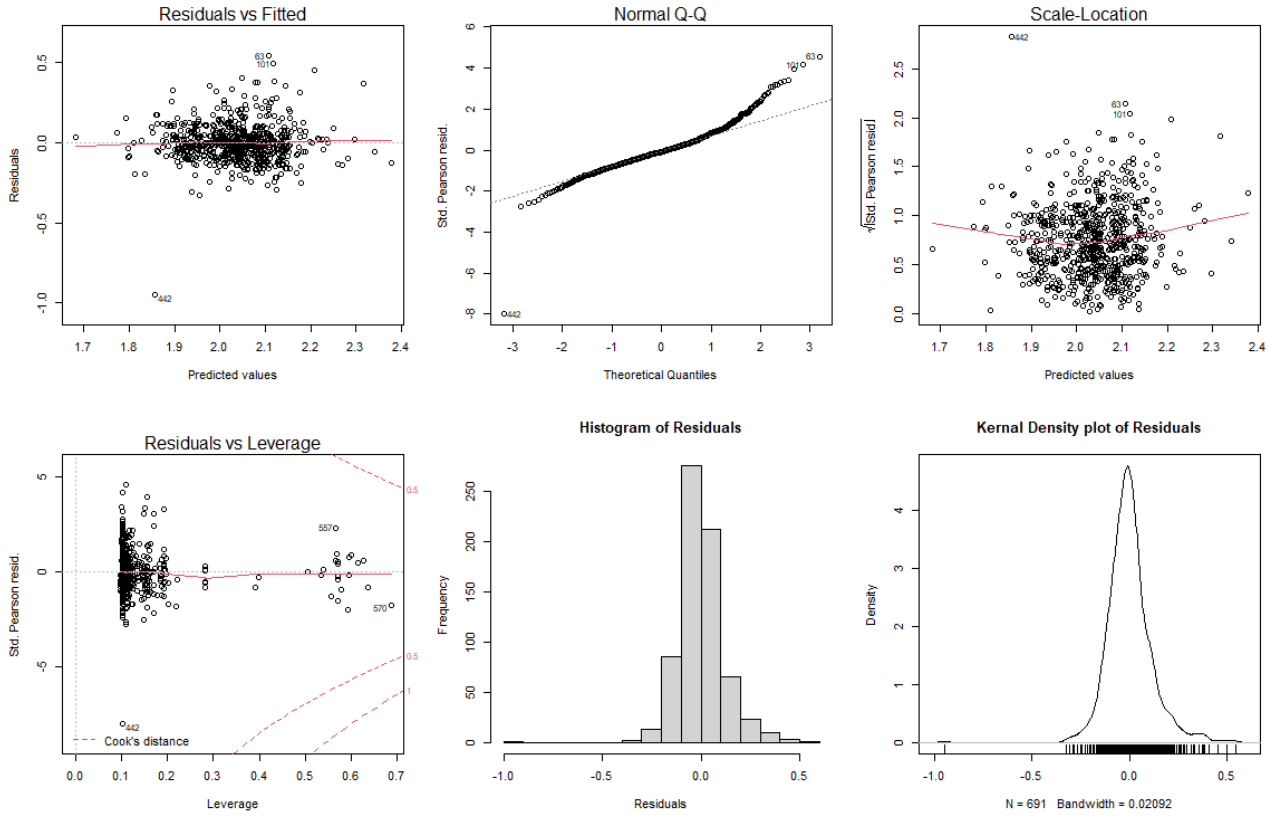
West Camden WWTP dissolved inorganic nitrogen load

Table F-7 Final model for West Camden WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	2.499478043275927	0.398533696724336	6.2716856	<0.0001
Period 1	-0.424453327185665	0.403898844471023	-1.0508902	0.2937
Period 1: Linear trend	-0.000019484599969	0.000050960518728	-0.3823470	0.7023
Period 3: Linear trend	-0.000917610595674	0.000632611401512	-1.4505123	0.1474
Period 1: Quadratic trend	0.000000001081404	0.000000009211561	0.1173964	0.9066
Period 3: Quadratic trend	0.000000395458182	0.000000239045846	1.6543194	0.0986

Table F-8 Final model for West Camden WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Period	0.0009055161	1	0.0573986	0.8107	0.0174224606	1	1.10437016	0.2937
Period 1: Linear trend	0.0005966770	1	0.0378220	0.8459	0.0023062699	1	0.14618921	0.7023
Period 3: Linear trend	0.0814537284	1	5.1631666	0.0234	0.0331923222	1	2.10398583	0.1474
Period 1: Quadratic trend	0.0847199023	1	5.3702020	0.0208	0.0002174224	1	0.01378191	0.9066
Period 3: Quadratic trend	0.1152533103	1	7.3056452	0.0071	0.0431751203	1	2.73677269	0.0986
1st order cosine by year	1.7707991360	15	7.4831287	<0.0001	1.3541950787	15	5.72262310	<0.0001
1st order sine by year	0.9971765711	15	4.2139170	<0.0001	0.8228798541	15	3.47736551	<0.0001
2nd order cosine by year	0.4427700212	15	1.8710790	0.0234	0.5428035530	15	2.29380552	0.0036
2nd order sine by year	0.5623651654	15	2.3764699	0.0025	0.4690212499	15	1.98201270	0.0146
3rd order cosine by year	0.5722719278	15	2.4183344	0.0020	0.5824312228	15	2.46126605	0.0017
3rd order sine by year	0.4785158338	15	2.0221354	0.0123	0.4785158338	15	2.02213537	0.0123



Note: 6 observations are not included in the Residuals by Leverage plot as they have leverage=1

Figure F-4 Final model for West Camden WWTP dissolved inorganic nitrogen load: residual plots

N75 dissolved inorganic nitrogen concentrations

Table F-9 Final model for N75 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	0.43210780449389	0.25399966885867	1.70121405	0.0904
Log_{10}(Camden Weir flow)	-0.43103708475171	0.03200496926155	-13.46781749	<0.0001
Log_{10}(Matahil Creek flow)	0.21748393055538	0.07531233868817	2.88775962	0.0043
Log_{10}(West Camden DIN load)	-0.00210132071896	0.14120674434673	-0.01488116	0.9881
Period 1	0.56307263996295	0.20093364995705	2.80228145	0.0055
Period 1: Linear trend	-0.00039501175451	0.00016276601137	-2.42686880	0.0161
Period 1: Quadratic trend	0.00000008617816	0.00000003144776	2.74035901	0.0067

Table F-10 Final model for N75 total dissolved inorganic nitrogen concentrations: type I and type III sums of squares, mean square and p values

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Log_{10}(Camden Weir flow)	13.8845323	1	252.699120	<0.0001	9.9660249410	1	181.382107914	<0.0001
Log_{10}(Matahil Creek flow)	0.2938840	1	5.348703	0.0217	0.4581942171	1	8.339155623	0.0043
Log_{10}(West Camden DIN load)	0.4589393	1	8.352716	0.0042	0.0000121675	1	0.000221449	0.9881
Period	0.3211544	1	5.845025	0.0165	0.4314704214	1	7.852781325	0.0055
Period 1: Linear trend	0.5232070	1	9.522392	0.0023	0.3236086498	1	5.889692167	0.0161
Period 1: Quadratic trend	0.3727307	1	6.783715	0.0098	0.4126125668	1	7.509567512	0.0067
1st order cosine by year	2.4882787	15	3.019119	0.0002	2.4817681781	15	3.011219593	0.0002
1st order sine by year	1.3131772	15	1.593326	0.0773	1.3131772085	15	1.593325668	0.0773

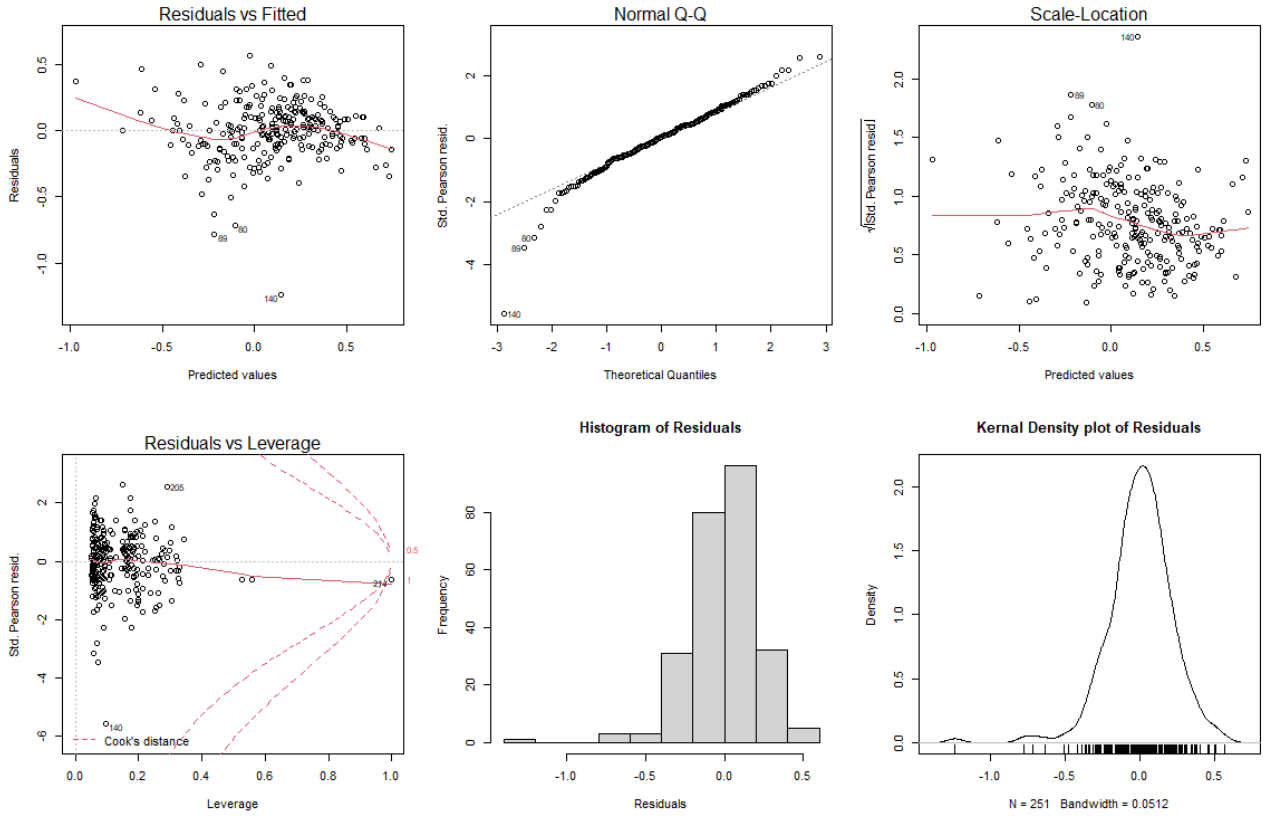


Figure F-5 Final model for N75 dissolved inorganic nitrogen: residual plots

N78 and N75 dissolved inorganic nitrogen concentrations

Table F-11 Final model for upstream/downstream analysis of site N78 and N75 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-0.143282299	0.6597117216	-0.2171893	0.8289
N78	-6.180225431	1.0150818014	-6.0884014	<0.0001
Log_{10}(Flow)				
N75	-0.377336548	0.2234921209	-1.6883662	0.0976
N78	0.562994375	0.2100275119	2.6805744	0.0099
Linear trend				
N75	0.000579348	0.0002881026	2.0109086	0.0497
N78	0.002667294	0.0004918835	5.4226123	<0.0001

Table F-12 Final model for upstream/downstream analysis of site N78 and N75 dissolved inorganic nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Site	25.80045255	1	242.112692	<0.0001	3.95017483	1	37.0686312	<0.0001
1st order cosine	0.36989095	1	3.471074	0.0683	0.59341130	1	5.5686003	0.0222
1st order sine	0.01534412	1	0.143990	0.7060	0.08637921	1	0.8105867	0.3723
Site by Flow	1.45618476	2	6.832454	0.0024	1.14137356	2	5.3553523	0.0078
Site by Linear trend	3.61196429	2	16.947424	<0.0001	3.61196429	2	16.9474236	<0.0001

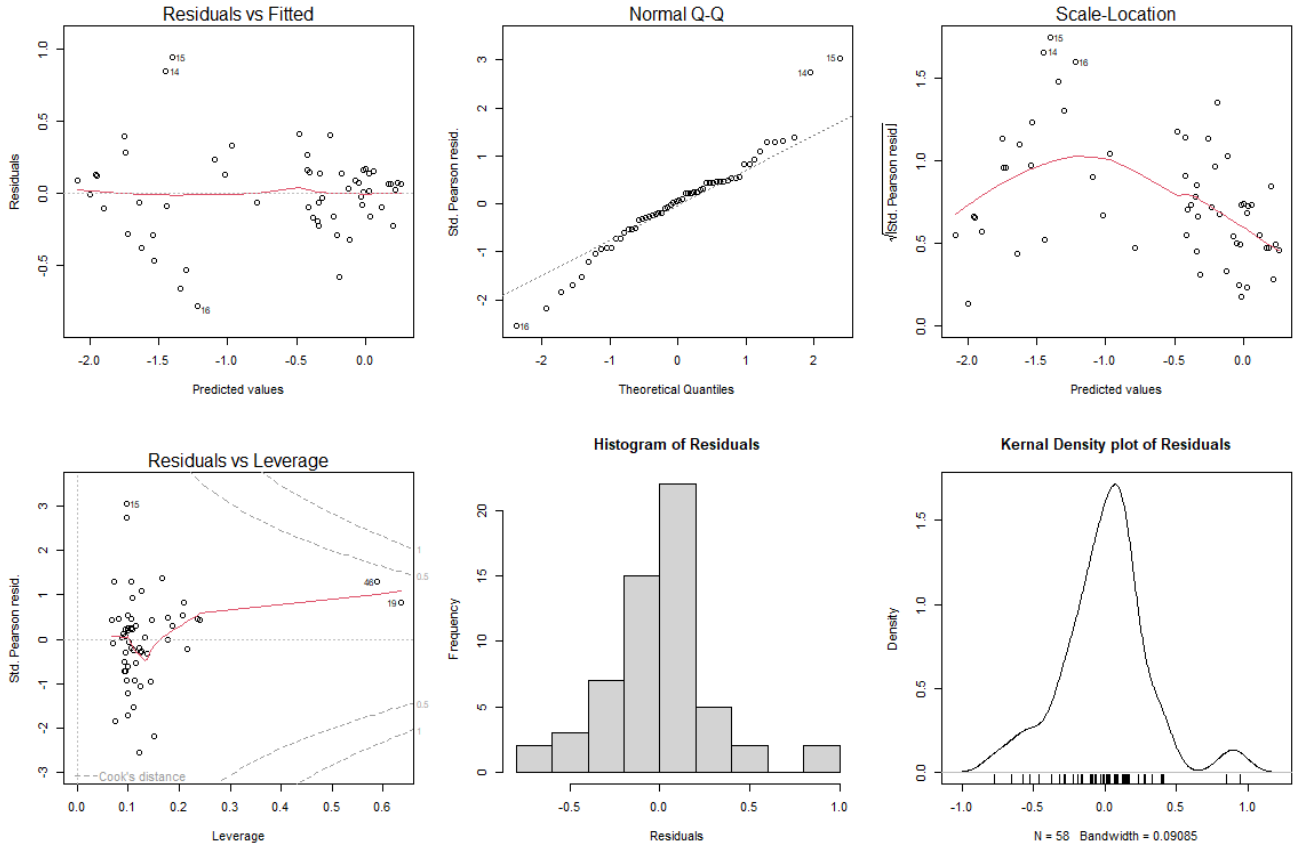


Figure F-6 Final model for upstream/downstream analysis of site N78 and N75 dissolved inorganic nitrogen concentrations: residual plots

West Camden WWTP total phosphorus load

Table F-13 Final model for West Camden WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-0.59660177673631	0.04445132707133	-13.421462	<0.0001
Period 1	0.73936070541725	0.06449975245348	11.463001	<0.0001
Period 1: Linear trend	-0.00040646006021	0.00004073611168	-9.977881	<0.0001
Period 2: Linear trend	0.00050663073665	0.00005145722139	9.845668	<0.0001
Period 1: Quadratic trend	0.00000009095022	0.00000000771782	11.784445	<0.0001
Period 2: Quadratic trend	-0.00000011459009	0.00000001249787	-9.168769	<0.0001

Table F-14 Final model for West Camden WWTP total phosphorus load: type I and type III sums of squares, mean square and p values

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Period	1.416147	1	10.735550	0.0011	17.333275	1	131.400384	<0.0001
Period 1: Linear trend	7.201034	1	54.589716	<0.0001	13.132899	1	99.558102	<0.0001
Period 2: Linear trend	1.348099	1	10.219692	0.0014	12.787169	1	96.937185	<0.0001
Period 1: Quadratic trend	13.652634	1	103.498118	<0.0001	18.319021	1	138.873141	<0.0001
Period 2: Quadratic trend	11.418965	1	86.565080	<0.0001	11.089350	1	84.066331	<0.0001
1st order cosine by year	11.721206	26	3.417550	<0.0001	11.700937	26	3.411641	<0.0001
1st order sine by year	17.607546	26	5.133830	<0.0001	16.834252	26	4.908361	<0.0001
2nd order cosine by year	10.782107	26	3.143738	<0.0001	9.940036	26	2.898215	<0.0001
2nd order sine by year	6.595642	26	1.923091	0.0036	6.639488	26	1.935875	0.0033
3rd order cosine by year	8.764111	26	2.555351	<0.0001	8.790146	26	2.562942	<0.0001
3rd order sine by year	6.519698	26	1.900948	0.0042	6.519698	26	1.900948	0.0042

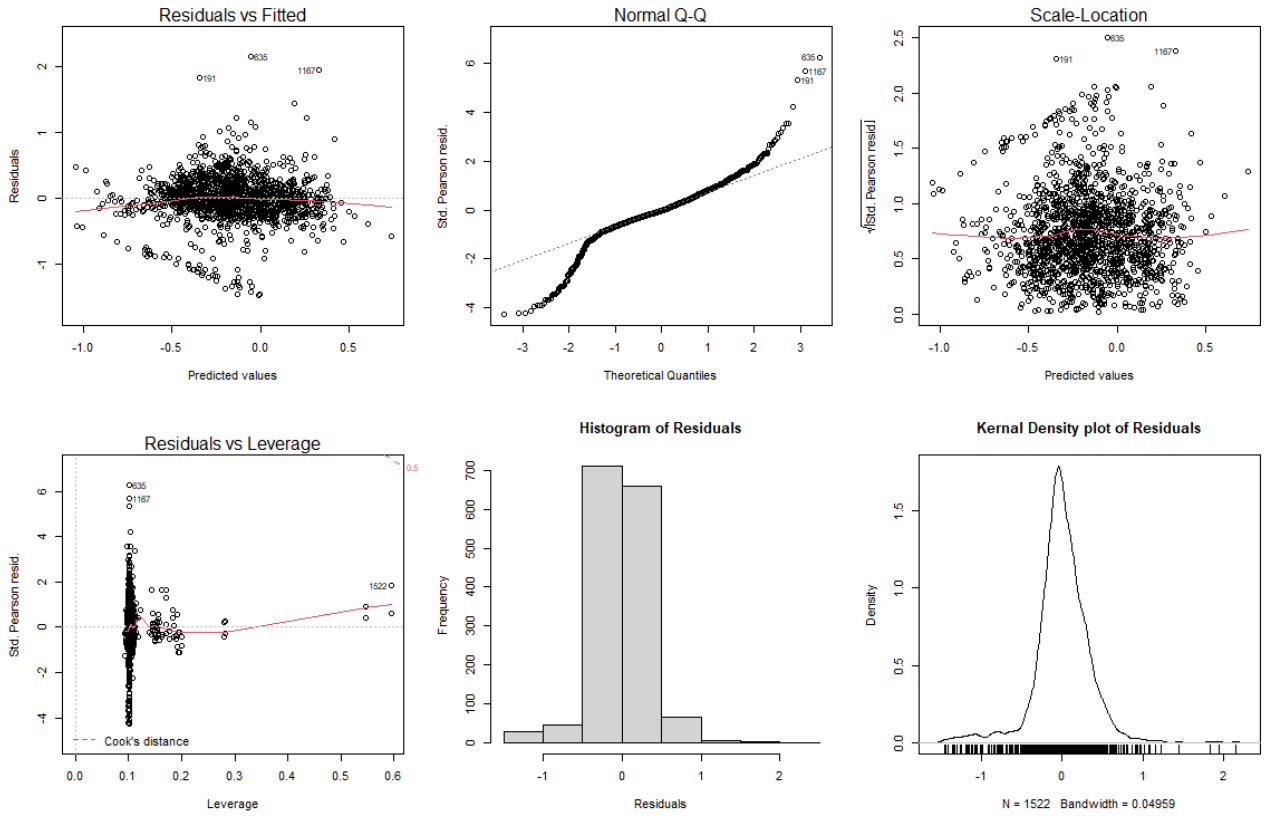


Figure F-7 Final model for West Camden WWTP total phosphorus load: residual plots

N75 total phosphorus concentrations

Table F-15 Final model for site N75 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-2.03595259791490	0.049339789027507	-41.263910	<0.0001
Log_{10}(Camden Weir flow)	0.09762449193434	0.015608245494568	6.254674	<0.0001
Log_{10}(Matahil Creek flow)	0.23275377114507	0.035449722294570	6.565743	<0.0001
Log_{10}(West Camden TP load)	0.06003532563684	0.017454652820270	3.439503	0.0006
Period 1	0.28502994961432	0.047269288033874	6.029918	<0.0001
Period 1: Linear trend	-0.00023564541010	0.000030313686997	-7.773565	<0.0001
Period 2: Linear trend	-0.00018438666590	0.000043800700199	-4.209674	<0.0001
Period 1: Quadratic trend	0.00000004721475	0.000000005988775	7.883875	<0.0001
Period 2: Quadratic trend	0.00000003091226	0.000000010742159	2.877658	0.0042

Table F-16 Final model for site N75 total phosphorus concentrations: type I and type III sums of squares and p values

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Log_{10}(Camden Weir flow)	1.16443361	1	50.019431	<0.0001	0.9107211	1	39.120951	<0.0001
Log_{10}(Matahil Creek flow)	0.23072042	1	9.910831	0.0018	1.0035610	1	43.108983	<0.0001
Log_{10}(West Camden TP load)	1.74366456	1	74.900887	<0.0001	0.2754021	1	11.830179	0.0006
Period	6.26785217	1	269.241972	<0.0001	0.8464452	1	36.359916	<0.0001
Period 1: Linear trend	0.02643972	1	1.135745	0.2872	1.4067484	1	60.428310	<0.0001
Period 2: Linear trend	0.38366896	1	16.480891	<0.0001	0.4125465	1	17.721355	<0.0001
Period 1: Quadratic trend	1.51325951	1	65.003603	<0.0001	1.4469563	1	62.155483	<0.0001
Period 2: Quadratic trend	0.39655396	1	17.034379	<0.0001	0.1927766	1	8.280916	0.0042
1st order cosine by year	2.43422388	26	4.021714	<0.0001	2.7400858	26	4.527045	<0.0001
1st order sine by year	1.65588143	26	2.735772	<0.0001	1.4157536	26	2.339044	0.0003
2nd order cosine by year	1.80682219	26	2.985149	<0.0001	1.7566858	26	2.902316	<0.0001
2nd order sine by year	3.48317180	26	5.754738	<0.0001	3.3237494	26	5.491348	<0.0001
3rd order cosine by year	1.09148047	26	1.803294	0.0099	1.0726842	26	1.772240	0.0119
3rd order sine by year	1.68644724	26	2.786271	<0.0001	1.6864472	26	2.786271	<0.0001

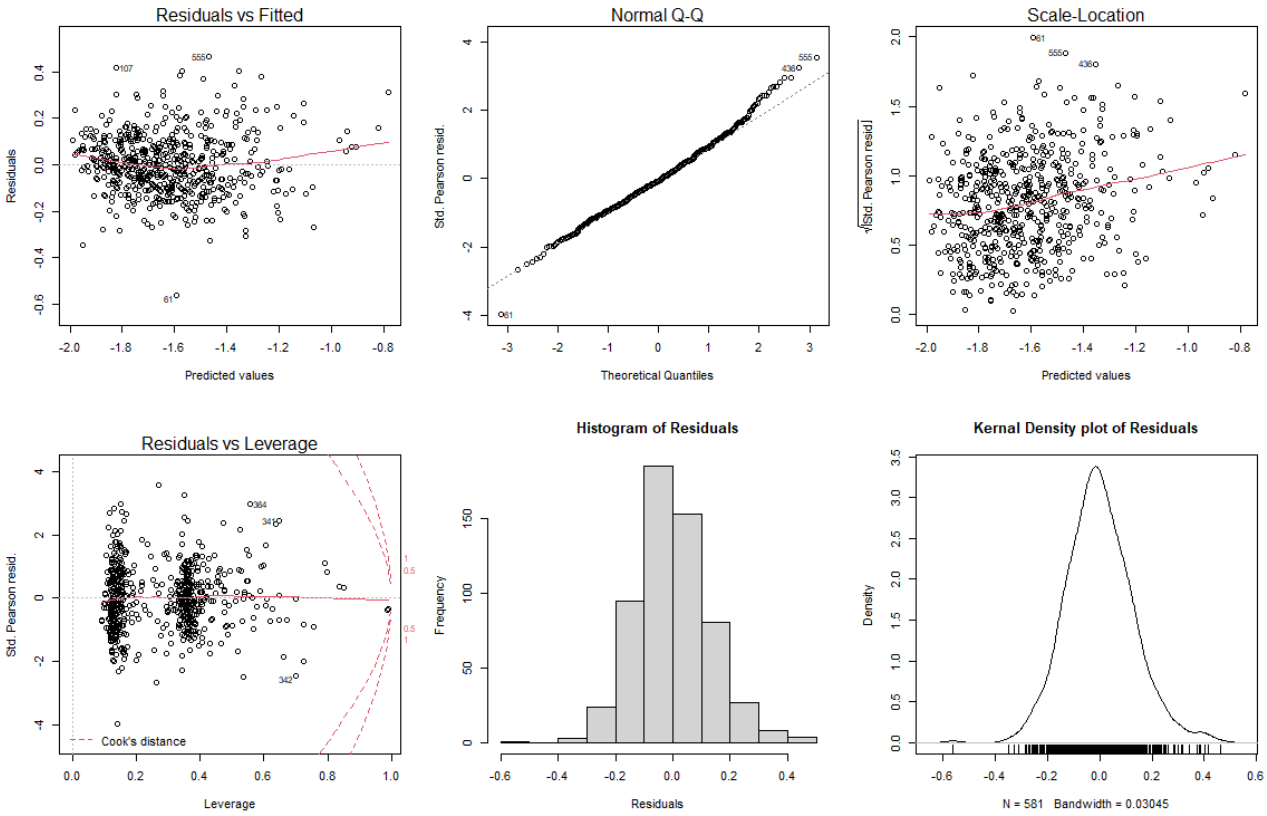


Figure F-8 Final model for site N75 total phosphorus concentrations: residual plots (West Camden WWTP upgrade stage 2, post upgrade linear and quadratic trends, overall quadratic trend)

N78 and N75 total phosphorus concentrations

Table F-17 Final model for upstream/downstream analysis at site N78 and N75 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-27.992778694674	8.5015429395823	-3.292670	0.0019
N78	-57.650571572433	36.4874203943200	-1.580012	0.1210
Log_{10}(Flow)				
N75	0.120984821376	0.1045687617678	1.156988	0.2533
N78	0.079886917489	0.0932409818066	0.856779	0.3960
Linear trend				
N75	0.014555012143	0.0048146656625	3.023058	0.0041
N78	0.047306420111	0.0201629877711	2.346201	0.0233
Quadratic trend				
N75	-0.000002030318	0.0000006728673	-3.017412	0.0041
N78	-0.000006680847	0.0000028599180	-2.336028	0.0239

Table F-18 Final model for upstream/downstream analysis at site N78 and N75 total phosphorus concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Site	0.11867142	1	6.411041	0.0148	0.04621027	1	2.496439	0.1210
Site by Flow	0.27129161	2	7.328056	0.0017	0.03836651	2	1.036346	0.3629
Site by Linear trend	0.05409663	2	1.461244	0.2425	0.27105882	2	7.321768	0.0017
Site by Quadratic trend	0.15804076	2	4.268955	0.0199	0.26954585	2	7.280900	0.0018
Site by 1st order cosine	0.12528632	2	3.384200	0.0425	0.04178457	2	1.128674	0.3323
Site by 1st order sine	0.33255357	2	8.982848	0.0005	0.33255357	2	8.982848	0.0005

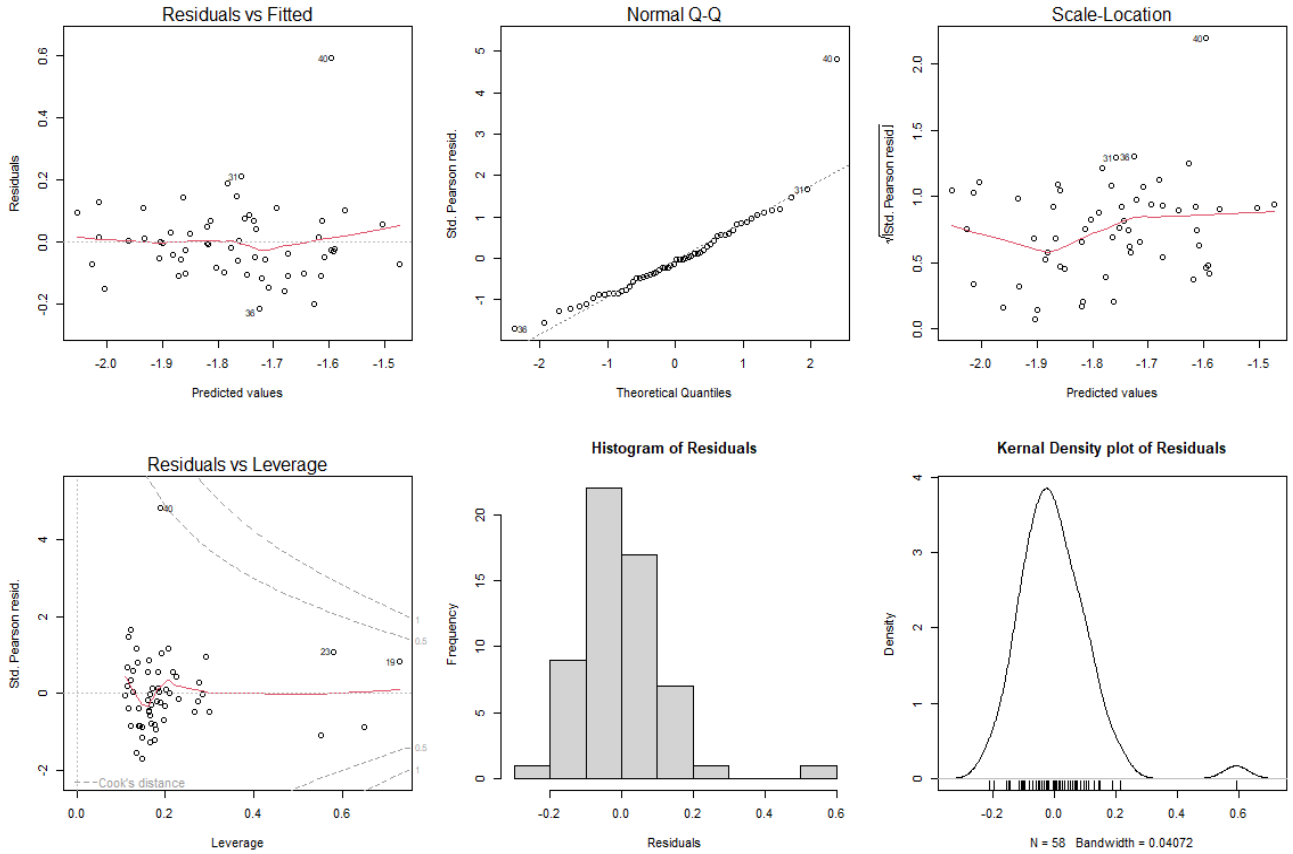


Figure F-9 Final model for upstream/downstream analysis at site N78 and N75 total phosphorus concentrations: residual plots

N75 Chlorophyll-*a*

Table F-19 Final model for site N75 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	1.14720896199041	0.096744055030817	11.8581856	<0.0001
Log_{10}(Camden Weir flow)	-0.13966903228081	0.027533800588825	-5.0726391	<0.0001
Log_{10}(Matahil Creek flow)	-0.06864594653286	0.077919011928874	-0.8809910	0.3788
Log_{10}(West Camden TN load)	-0.00015460124996	0.000337942377926	-0.4574781	0.6476
Log_{10}(West Camden TP load)	-0.00620252485371	0.003320786067200	-1.8677881	0.0625
Period 1	0.41413263336073	0.066189508631213	6.2567715	<0.0001
Period 1: Linear trend	-0.00031425462526	0.000049389787404	-6.3627450	<0.0001
Period 1: Quadratic trend	0.00000005942666	0.000000009729912	6.1076257	<0.0001

Table F-20 Final model for site N75 chlorophyll-*a* concentrations: type I and type III sums of squares and p values

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Log_{10}(Camden Weir flow)	12.249752848	1	168.9824841	<0.0001	1.86532091	1	25.7316670	<0.0001
Log_{10}(Matahil Creek flow)	4.085750072	1	56.3619695	<0.0001	0.05626373	1	0.7761451	0.3788
Log_{10}(West Camden TN load)	0.075025022	1	1.0349527	0.3096	0.01517142	1	0.2092862	0.6476
Log_{10}(West Camden TP load)	0.003273683	1	0.0451597	0.8318	0.25289536	1	3.4886326	0.0625
Period	0.186042686	1	2.5664155	0.1099	2.83782905	1	39.1471900	<0.0001
Period 1: Linear trend	0.049859651	1	0.6878023	0.4074	2.93477411	1	40.4845246	<0.0001
Period 1: Quadratic trend	1.579920708	1	21.7946378	<0.0001	2.70414809	1	37.3030923	<0.0001
1st order cosine by year	15.936203162	26	8.4552387	<0.0001	14.53601007	26	7.7123411	<0.0001
1st order sine by year	6.426240578	26	3.4095573	<0.0001	5.91087456	26	3.1361206	<0.0001
2nd order cosine by year	4.965411617	26	2.6344883	<0.0001	5.17338688	26	2.7448333	<0.0001
2nd order sine by year	10.993954513	26	5.8330400	<0.0001	11.10485114	26	5.8918782	<0.0001
3rd order cosine by year	1.345095551	26	0.7136646	0.8500	1.21855866	26	0.6465282	0.9106
3rd order sine by year	6.429464427	26	3.4112678	<0.0001	6.42946443	26	3.4112678	<0.0001

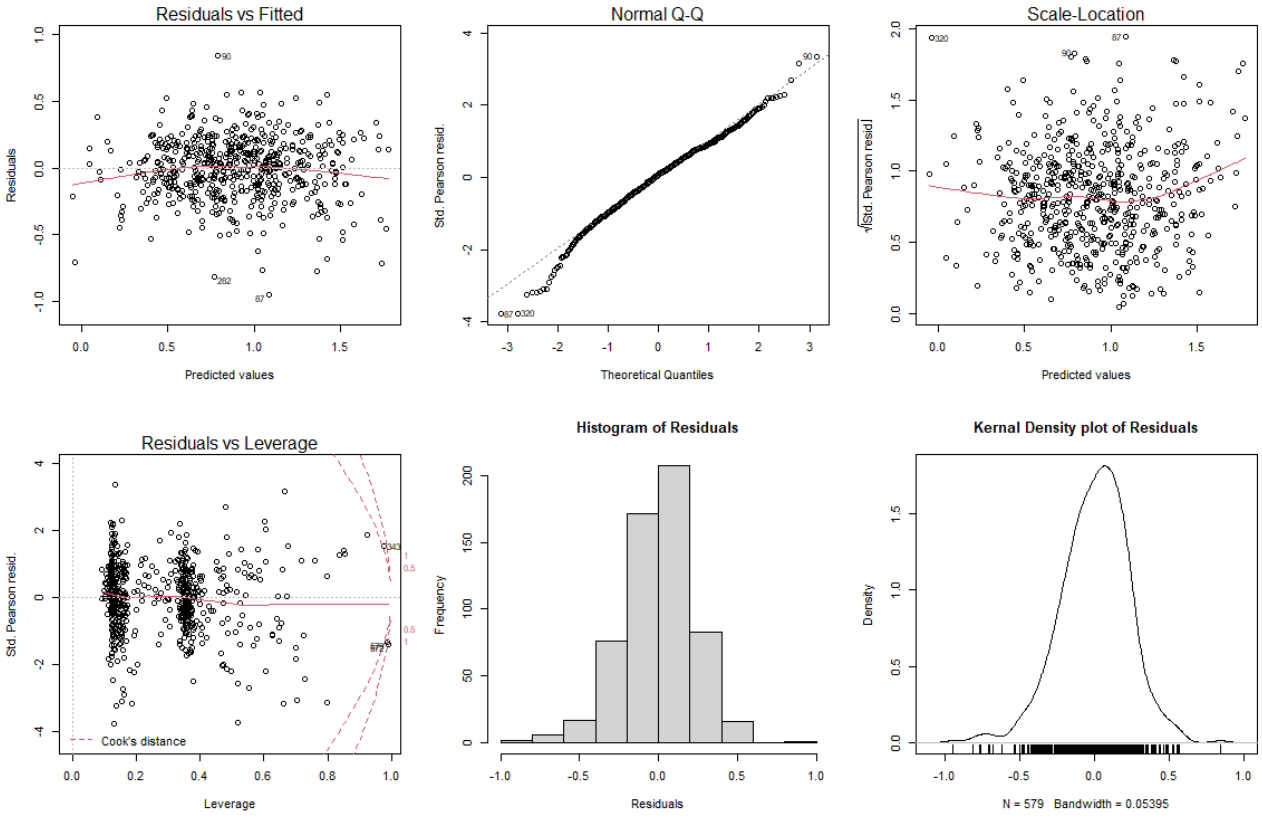


Figure F-10 Final model for site N75 chlorophyll-*a*: residual plots

N78 and N75 chlorophyll-*a* concentrations

Table F-21 Final model for upstream/downstream analysis at site N78 and N75 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-73.933523406950	16.345795476201	-4.523091	<0.0001
N78	-169.276609133651	70.153843303298	-2.412934	0.0199
Log_{10}(Flow)				
N75	-0.441894100369	0.201052868309	-2.197900	0.0330
N78	-0.198988094904	0.179273107181	-1.109972	0.2728
Linear trend				
N75	0.043162604136	0.009257089068	4.662654	<0.0001
N78	0.139866363650	0.038767089296	3.607863	0.0008
Quadratic trend				
N75	-0.000006131616	0.000001293712	-4.739551	<0.0001
N78	-0.000019978014	0.000005498724	-3.633209	0.0007

Table F-22 Final model for upstream/downstream analysis at site N78 and N75 chlorophyll-*a* concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Site	0.07334281	1	1.0718237	0.3059	0.39840534	1	5.8222515	0.0199
Site by Flow	0.02130338	2	0.1556626	0.8563	0.41486573	2	3.0314009	0.0580
Site by Linear trend	1.47488343	2	10.7768917	0.0001	2.37835531	2	17.3785108	<0.0001
Site by Quadratic trend	1.52731843	2	11.1600313	0.0001	2.44038758	2	17.8317772	<0.0001
Site by 1st order cosine	0.14343934	2	1.0481033	0.3588	0.09540539	2	0.6971219	0.5032
Site by 1st order sine	1.48752195	2	10.8692407	0.0001	1.48752195	2	10.8692407	0.0001

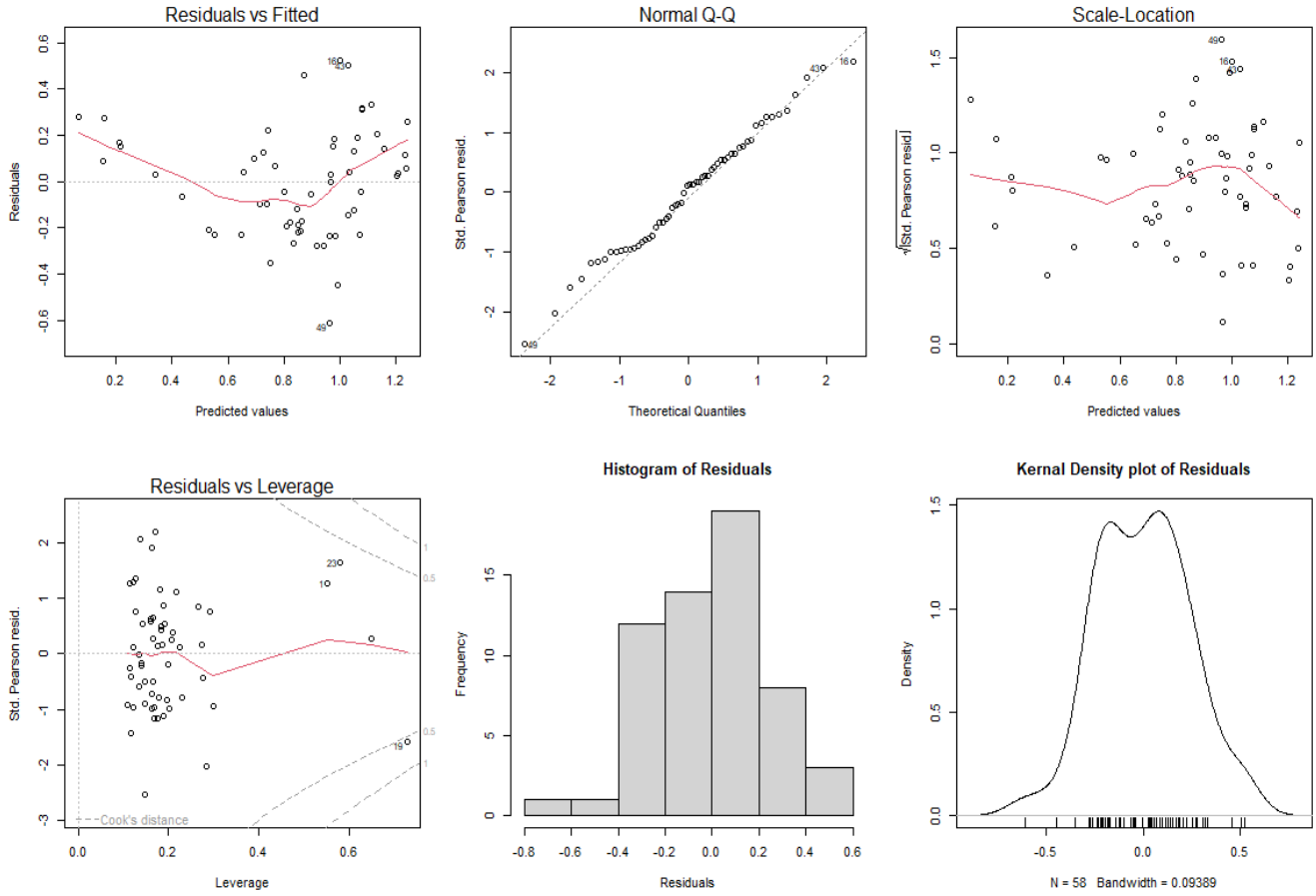


Figure F-11 Final model for upstream/downstream analysis at site N78 and N75 chlorophyll-*a* concentrations: residual plots

Model fit details and example relative changes in the outcome

Table F-23 Model fit details – Nepean River at Sharpes Weir (N75) and West Camden WWTP

Model	Total nitrogen		Dissolved inorganic nitrogen		Total phosphorus		Chlorophyll-*a*	
	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2
West Camden WWTP	0.75	0.72	0.35	0.25	0.35	0.27	NA	NA
Site N75	0.78	0.72	0.63	0.56	0.71	0.60	0.68	0.56
Upstream (N78) / downstream (N75)	0.88	0.85	0.85	0.83	0.55	0.45	0.60	0.50

Table F-24 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Nepean River at Sharpes Weir (N75) for prespecified changes at low, medium and high values of the explanatory variables

Parameter (flow ML/day, load kg/day)	Coefficient	p- value		Amount of change in X	Low value	% change	Medium value	% change	High value	% change
		type I SS	type III SS							
TN										
CW flow	-0.244	<0.0001	<0.0001	10	80	-2.8	100	-2.3	150	-1.6
MC flow	0.1	0.42	0.01	1	5	1.8	10	0.9	15	0.6
WC load	0.22	<0.0001	0.0009	10	80	2.6	100	2.1	150	1.4
DIN										
CW flow	-0.43	<0.0001	<0.0001	10	80	-4.9	100	-4.0	150	-2.7
MC flow	0.22	0.02	0.004	1	5	4.1	10	2.1	15	1.4
WC load	-0.002	0.004	0.99	NE	NE	NE	NE	NE	NE	NE
TP										
CW flow	0.1	<0.0001	<0.0001	10	80	1.2	100	1.0	150	0.6
MC flow	0.23	0.002	<0.0001	1	5	4.3	10	2.2	15	1.4
WC load	0.06	<0.0001	0.0006	0.1	0.5	1.1	0.8	0.7	1.1	0.5
Chl-*a*										
CW flow	-0.14	<0.0001	<0.0001	10	80	-1.6	100	-1.3	150	-0.9
MC flow	-0.07	<0.0001	0.38	1	5	-1.3	10	-0.7	15	-0.5
WC TN load	-0.0002	0.3	0.65	NE	NE	NE	NE	NE	NE	NE
WC TP load	-0.006	0.8	0.06	NE	NE	NE	NE	NE	NE	NE

Table F-25 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Nepean River at Sharpes Weir (N75) and Macquarie Grove Rd (N78) for prespecified changes at low, medium and high values of the explanatory variables

Parameter	Coefficient	p-value	Amount of change in X	Low Value	%change	Medium Value	% change	High Value	% change
TN									
N75 flow	-0.322	0.001	10	80	-3.722	100	-3.022	150	-2.057
N78 flow	0.129	0.12	10	80	1.531	100	1.237	150	0.836
DIN									
N75 flow	-0.38	0.1	10	80	-4.377	100	-3.557	150	-2.423
N78 flow	0.56	0.01	10	80	6.818	100	5.482	150	3.680
TP									
N75 flow	0.12	0.25	NE	NE	NE	NE	NE	NE	NE
N78 flow	0.08	0.4	NE	NE	NE	NE	NE	NE	NE
Chl-*a*									
N75 flow	-0.44	0.03	10	80	-5.050	100	-4.107	150	-2.800
N78 flow	-0.2	0.27	NE	NE	NE	NE	NE	NE	NE

Appendix G : Statistical analysis outcomes of Nepean River at Yarramundi – Winmalee WWTP

Winmalee WWTP total nitrogen load

Table G-1 Final model for Winmalee WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	2.36629127547327	0.013684568880508	172.916757	<0.0001
Period 1	-0.10261655026453	0.034559027906368	-2.969312	0.0030
Period 2	-0.10193979435728	0.020534159052309	-4.964401	<0.0001
Period 2: Linear trend	-0.00006395106639	0.000014839022453	-4.309655	<0.0001
Period 3: Linear trend	-0.00022658868615	0.000014718344450	-15.394985	<0.0001
Period 2: Quadratic trend	0.00000001315958	0.000000003234838	4.068079	<0.0001
Period 3: Quadratic trend	0.00000004070289	0.000000003329404	12.225279	<0.0001

Table G-2 Final model for Winmalee WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	2.968762978	2	125.5291488	<0.0001	0.3929918	2	16.616996	<0.0001
Period 2: Linear trend	0.004079001	1	0.3449474	0.5571	0.2196271	1	18.573126	<0.0001
Period 3: Linear trend	2.245828349	1	189.9221481	<0.0001	2.8025893	1	237.005551	<0.0001
Period 2: Quadratic trend	0.615338303	1	52.0370902	<0.0001	0.1956950	1	16.549265	<0.0001
Period 3: Quadratic trend	1.894953111	1	160.2498097	<0.0001	1.7673334	1	149.457442	<0.0001
1st order cosine by year	0.660497206	26	2.1483087	0.0007	0.6635823	26	2.158343	0.0007
1st order sine by year	1.965770085	26	6.3937909	<0.0001	1.9646394	26	6.390113	<0.0001
2nd order cosine by year	0.682560559	26	2.2200712	0.0004	0.6037194	26	1.963635	0.0027
2nd order sine by year	0.567968759	26	1.8473541	0.0060	0.5085538	26	1.654103	0.0207
3rd order cosine by year	0.848408035	26	2.7595005	<0.0001	0.8500116	26	2.764716	<0.0001
3rd order sine by year	0.602163455	26	1.9585745	0.0028	0.6021635	26	1.958575	0.0028

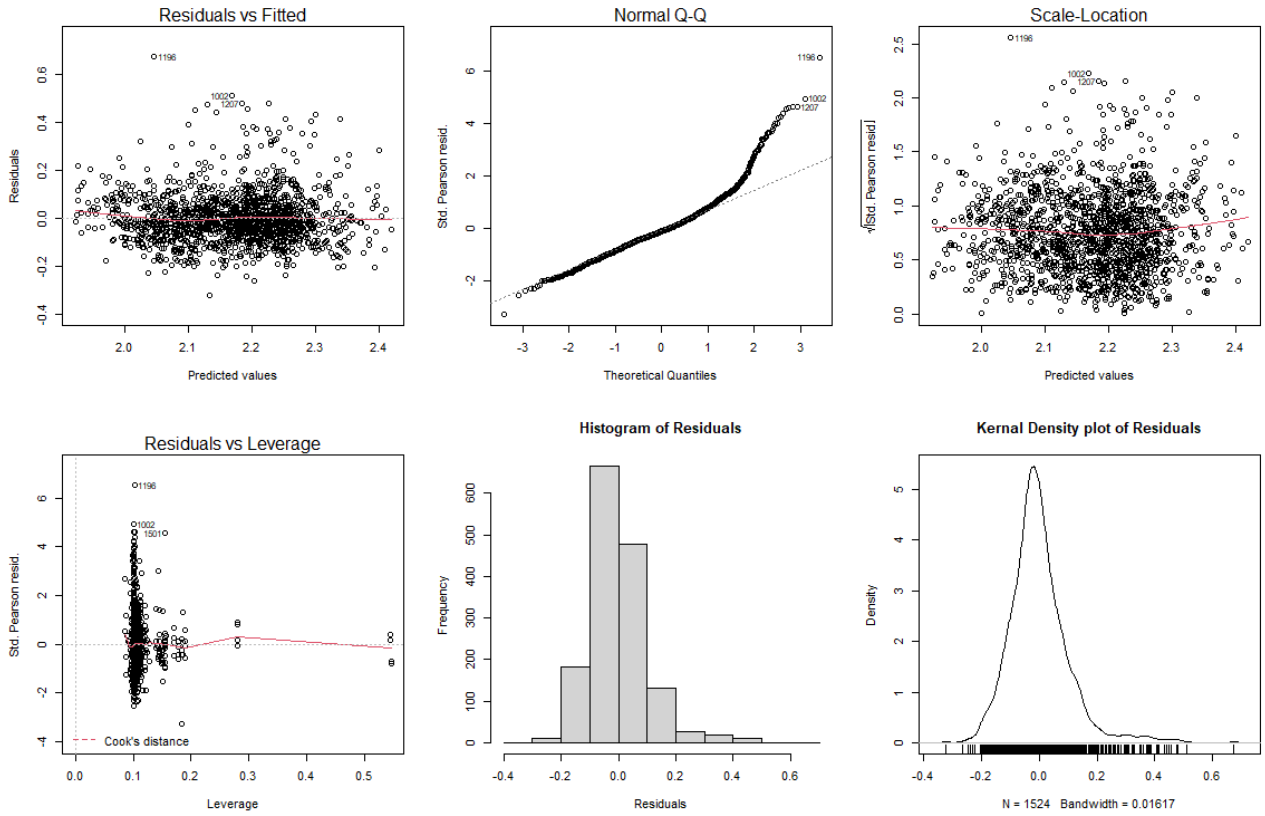


Figure G-1 Final model for Winmalee WWTP total nitrogen load: residual plots

N44 total nitrogen concentrations

Table G-3 Final model for site N44 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.29453619532865	0.087341363781737	-3.372242	0.0009
Log_{10}(N48A TN concentration)	0.31020262068194	0.034074610550302	9.103629	<0.0001
Log_{10}(N48A flow)	-0.06281177907311	0.014286804657967	-4.396489	<0.0001
Log_{10}(Winmalee WWTP TN load)	0.18356981599258	0.041866233003040	4.384675	<0.0001
Period	-13.58803168272611	11.550661371177132	-1.176386	0.2409
Period 1: Linear trend	0.00549232383423	0.004485113751734	1.224567	0.2223
Period 2: Linear trend	-0.00007679509524	0.000026360140916	-2.913304	0.0040
Period 1: Quadratic trend	-0.00000055108704	0.000000435230683	-1.266195	0.2070
Period 2: Quadratic trend	0.00000003969701	0.000000007731207	5.134646	<0.0001

Table G-4 Final model for site N44 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N48A TN concentration)	0.260867535	1	64.258373	<0.0001	0.336449150	1	82.876065	<0.0001
Log_{10}(N48A flow)	0.405699581	1	99.934225	<0.0001	0.078469753	1	19.329115	<0.0001
Log_{10}(Winmalee WWTP TN load)	0.471725973	1	116.198221	<0.0001	0.078048594	1	19.225373	<0.0001
Period	0.007607126	1	1.873831	0.1727	0.005618103	1	1.383883	0.2409
Period 1: Linear trend	0.064611645	1	15.915507	<0.0001	0.006087734	1	1.499565	0.2223
Period 2: Linear trend	0.817453508	1	201.359790	<0.0001	0.034455759	1	8.487338	0.0040
Period 1: Quadratic trend	0.015818434	1	3.896486	0.0499	0.006508662	1	1.603250	0.2070
Period 2: Quadratic trend	0.460554658	1	113.446439	<0.0001	0.107031436	1	26.364591	<0.0001
1st order sine by year	0.209183597	13	3.963638	<0.0001	0.292561859	13	5.543500	<0.0001
1st order cosine by year	0.741817474	13	14.056053	<0.0001	0.741817474	13	14.056053	<0.0001

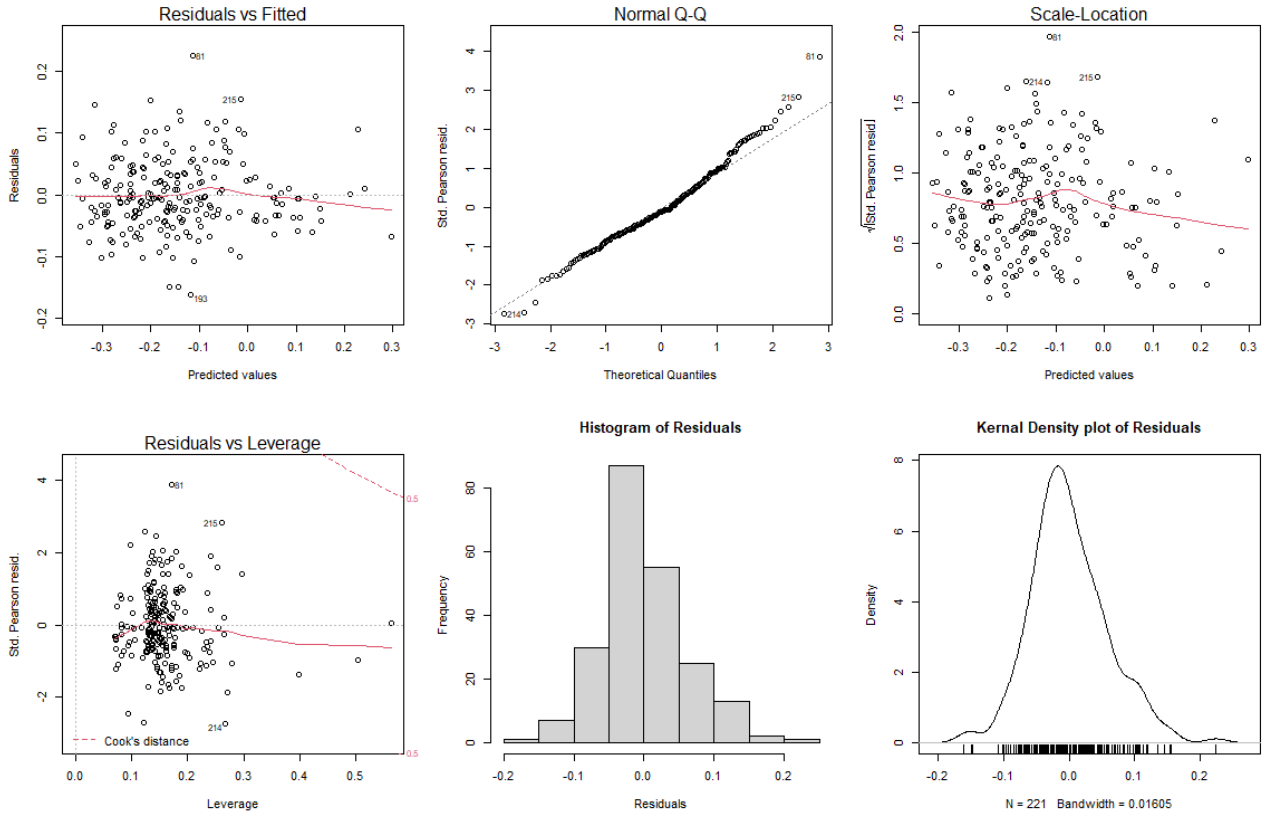


Figure G-2 Final model for site N44 total nitrogen concentrations: residual plots

N48A and N44 total nitrogen concentrations

Table G-5 Final model for upstream/downstream analysis of site N48A and N44 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.23933037991758	0.063686026421224	-3.75797319	0.0002
N48A	-0.63458063997634	0.091580706341678	-6.92919574	<0.0001
Log_{10}(Flow)				
N44	0.00576556127201	0.022764999807821	0.25326428	0.8003
N48A	0.16919293048019	0.022895193519757	7.38988864	<0.0001
Period				
N44	-27.75467193986897	47.632971301948125	-0.58267774	0.5606
N48A	12.67137611825248	10.033897101810570	1.26285689	0.2077
Linear trends				
Period 1: N44	0.01091669546938	0.018261375835205	0.59780246	0.5505
Period 1: N48A	-0.00455741072820	0.003990167604903	-1.14216022	0.2544
Period 2: N44	0.00000299766815	0.000032586475337	0.09199117	0.9268
Period 2: N48A	0.00011060033036	0.000035039098005	3.15648338	0.0018
Quadratic trends				
Period 1: N44	-0.00000106651490	0.000001748914207	-0.60981545	0.5425
Period 1: N48A	0.00000041070062	0.000000396373450	1.03614563	0.3011
Period 2: N44	0.00000001095525	0.000000009164928	1.19534442	0.2330
Period 2: N48A	-0.00000001636846	0.000000009578827	-1.70881683	0.0887

Table G-6 Final model for upstream/downstream analysis of site N48A and N44 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	2.84493036	1	376.693471	<0.0001	0.36261787	1	48.0137536	<0.0001
Site by Flow	0.49820068	2	32.983047	<0.0001	0.41292306	2	27.3372984	<0.0001
Site by Period	0.42923916	2	28.417495	<0.0001	0.01460872	2	0.9671604	0.3815
Period 1: Site by linear trend	0.60194304	2	39.851242	<0.0001	0.01255128	2	0.8309489	0.4368
Period 2: Site by linear trend	1.22811542	2	81.306570	<0.0001	0.07531115	2	4.9859248	0.0075

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period 1: Site by quadratic trend	0.11971189	2	7.925447	0.0005	0.01091675	2	0.7227363	0.4864
Period 2: Site by quadratic trend	0.07468192	2	4.944267	0.0078	0.03284455	2	2.1744516	0.1157
Site by 1st order sine by year	1.39343909	26	7.096286	<0.0001	1.38867934	26	7.0720461	<0.0001
Site by 1st order cosine by year	2.28033594	26	11.612933	<0.0001	2.18161317	26	11.1101738	<0.0001
Site by 2nd order sine by year	0.32018163	26	1.630570	0.0305	0.29246180	26	1.4894031	0.0639
Site by 2nd order cosine by year	0.20662309	26	1.052257	0.3991	0.21292008	26	1.0843256	0.3592
Site by 3rd order sine by year	0.43887326	26	2.235024	0.0008	0.44904083	26	2.2868040	0.0006
Site by 3rd order cosine by year	0.30676864	26	1.562263	0.0439	0.30676864	26	1.5622627	0.0439

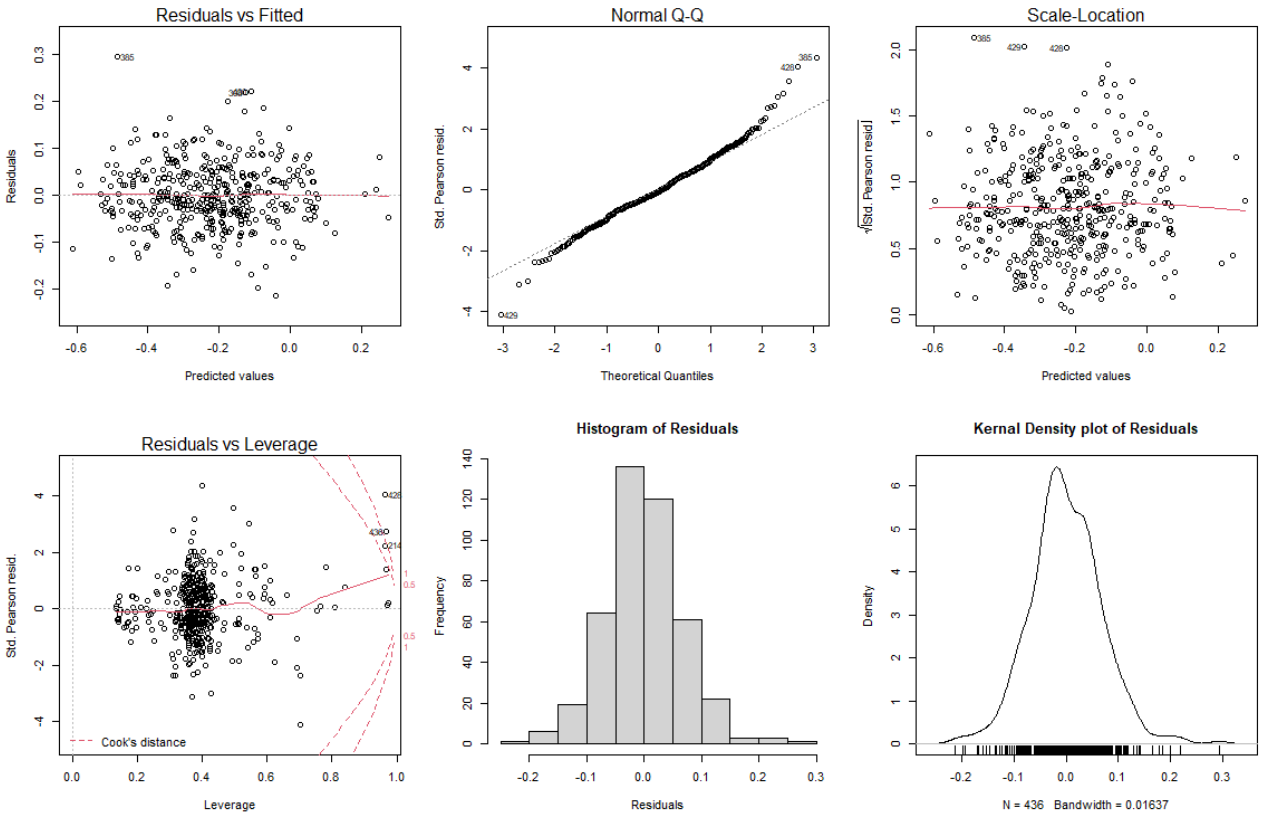


Figure G-3 Final model for upstream/downstream analysis of site N48A and N44 total nitrogen concentrations: residual plots

Winmalee WWTP dissolved inorganic nitrogen load

Table G-7 Final model for Winmalee WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	2.35292944007232	0.014683346806465	160.2447638	<0.0001
Period 1	0.03792326801481	0.180930968895373	0.2096008	0.8340
Period 2	-0.13681267644640	0.042194476003828	-3.2424310	0.0012
Period 2: Linear trend	-0.00006954284038	0.000031813212213	-2.1859735	0.0290
Period 3: Linear trend	-0.00026063005536	0.000015743591019	-16.5546764	<0.0001
Period 2: Quadratic trend	0.00000001339479	0.000000006102501	2.1949674	0.0284
Period 3: Quadratic trend	0.00000004814859	0.000000003555668	13.5413631	<0.0001

Table G-8 Final model for Winmalee WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	1.34812249	2	50.870690	<0.0001	0.15174527	2	5.726027	0.0033
Period 2: Linear trend	0.01425505	1	1.075814	0.2998	0.06331718	1	4.778480	0.0290
Period 3: Linear trend	2.38186188	1	179.756600	<0.0001	3.63139193	1	274.057312	<0.0001
Period 2: Quadratic trend	0.18092140	1	13.653947	0.0002	0.06383927	1	4.817882	0.0284
Period 3: Quadratic trend	2.77538993	1	209.455746	<0.0001	2.42972149	1	183.368514	<0.0001
1st order cosine by year	0.79557550	25	2.401650	0.0001	0.79602897	25	2.403019	0.0001
1st order sine by year	1.89323569	25	5.715220	<0.0001	1.80022733	25	5.434450	<0.0001
2nd order cosine by year	0.93346349	25	2.817900	<0.0001	0.86891980	25	2.623058	<0.0001
2nd order sine by year	0.57323210	25	1.730449	0.0143	0.49968712	25	1.508434	0.0518
3rd order cosine by year	0.87208659	25	2.632618	<0.0001	0.87534664	25	2.642459	<0.0001
3rd order sine by year	0.57870862	25	1.746981	0.0129	0.57870862	25	1.746981	0.0129

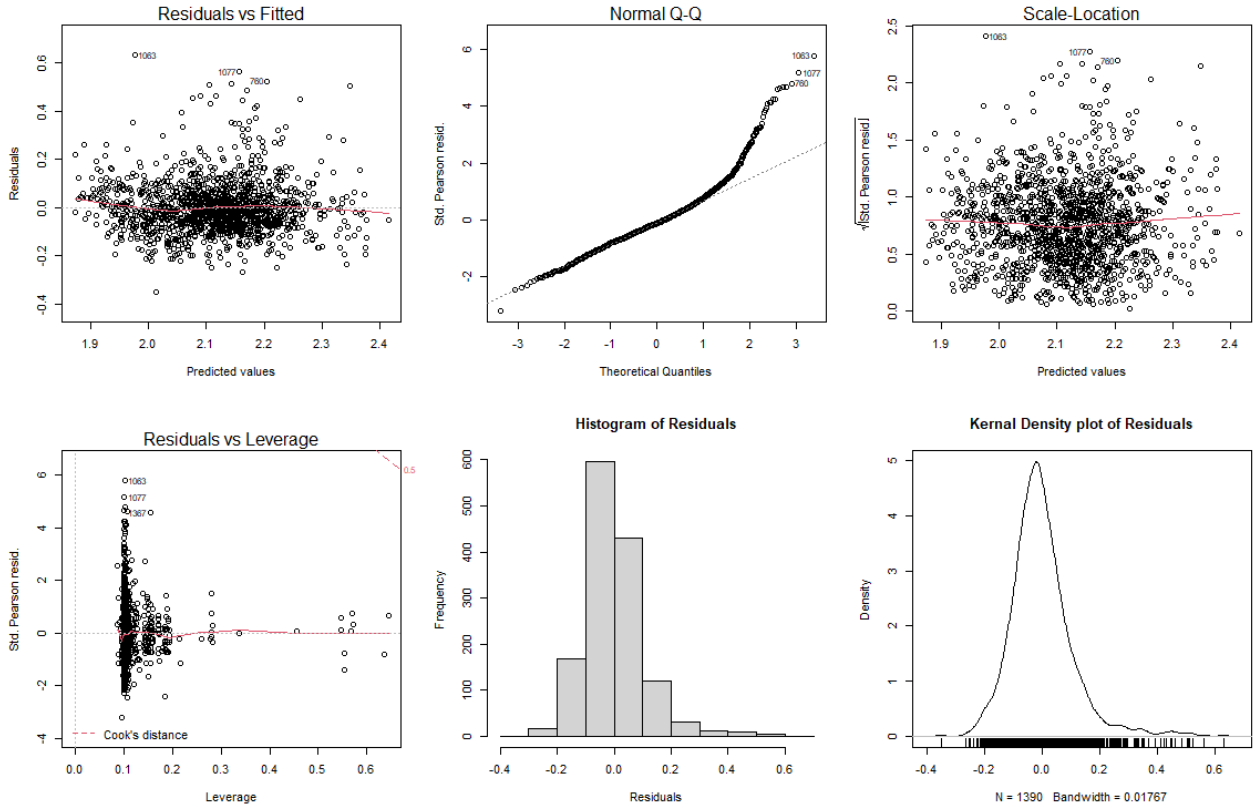


Figure G-4 Final model for Winmalee WWTP dissolved inorganic nitrogen load: residual plots

N44 dissolved inorganic nitrogen concentrations

TableG-9 Final model for site N44 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.539350905778	0.20499789352686	-2.631007	0.0092
Log_{10}(N48A DIN concentration)	0.301422612554	0.03313630428745	9.096446	<0.0001
Log_{10}(N48A flow)	-0.108956130958	0.03322339235042	-3.279500	0.0012
Log_{10}(Winmalee WWTP DIN load)	0.304230091637	0.09699619115617	3.136516	0.0020
Period 1	0.110402353293	0.05451500750216	2.025174	0.0443
Period 2: Linear trend	-0.000288849455	0.00005623557526	-5.136419	<0.0001
Period 2: Quadratic trend	0.000000112941	0.00000001605006	7.036794	<0.0001

Table G-10 Final model for site N44 dissolved inorganic nitrogen concentrations: type I and type III sums of squares

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N48A DIN concentration)	3.64217690	1	167.167641	<0.0001	1.80281989	1	82.745335	<0.0001
Log_{10}(N48A flow)	2.15899727	1	99.093067	<0.0001	0.23432802	1	10.755123	0.0012
Log_{10}(Winmalee WWTP DIN load)	2.30323497	1	105.713250	<0.0001	0.21434028	1	9.837732	0.0020
Period	0.02266276	1	1.040169	0.3091	0.08935798	1	4.101328	0.0443
Period 2: Linear trend	2.62512828	1	120.487421	<0.0001	0.57481705	1	26.382796	<0.0001
Period 2: Quadratic trend	3.34256988	1	153.416360	<0.0001	1.07884368	1	49.516473	<0.0001
1st order sine by year	0.64109287	13	2.263439	0.0087	0.95480335	13	3.371023	0.0001
1st order cosine by year	3.61783487	13	12.773107	<0.0001	3.61783487	13	12.773107	<0.0001

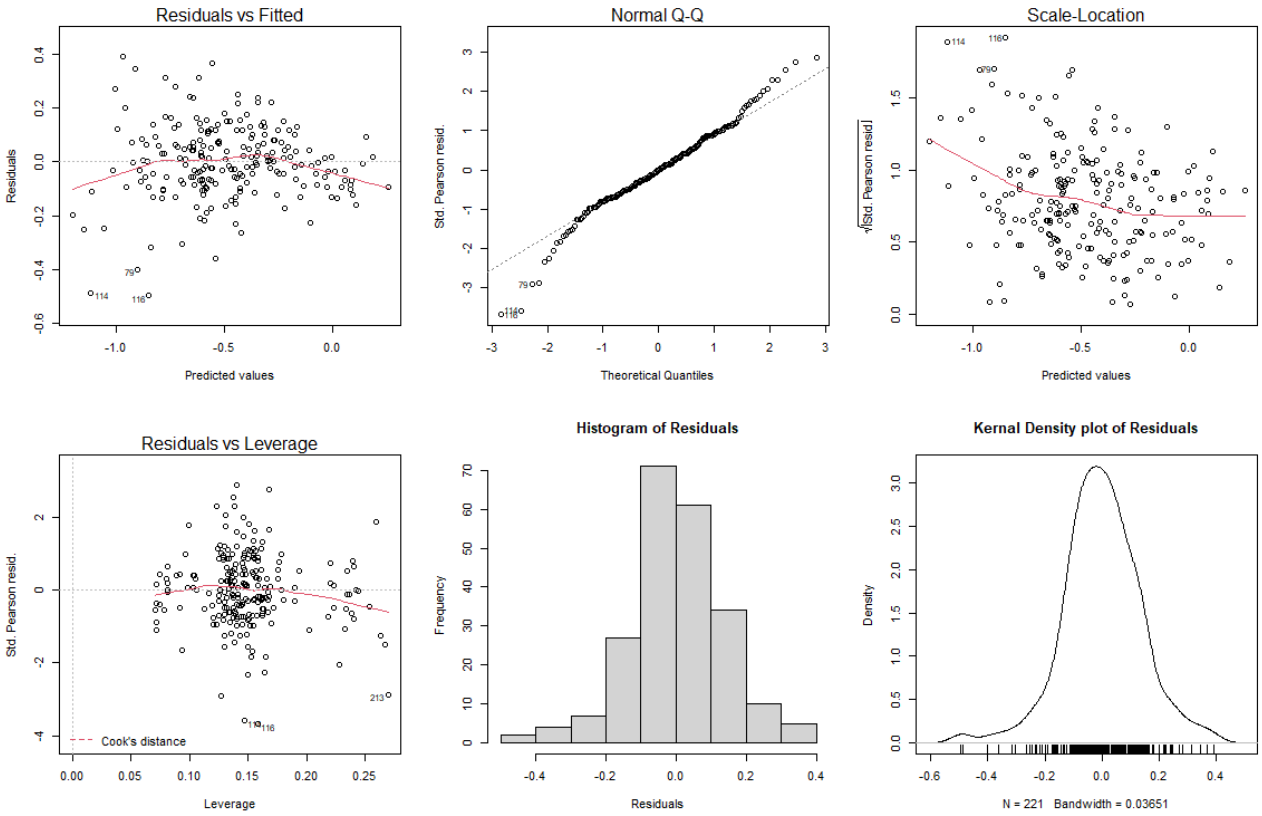


Figure G-5 Final model for site N44 dissolved inorganic nitrogen concentrations: residual plots

N48A and N44 dissolved inorganic nitrogen concentrations

Table G-11 Final model for upstream/downstream analysis of site N48A and N44 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.501335354051740	0.15782201439737	-3.17658697	0.0017
N48A	-1.715841278621910	0.22694855319096	-7.56048565	<0.0001
Log_{10}(Flow)				
N44	-0.002971561627722	0.05641454380688	-0.05267368	0.9580
N48A	0.434855862169174	0.05673718026317	7.66438974	<0.0001
Period				
N44	26.200662261210180	118.04051697124514	0.22196330	0.8245
N48A	23.070178922503413	24.86526388677242	0.92780752	0.3543
Linear trends				
Period 1: N44	-0.009665703128851	0.04525399498027	-0.21358784	0.8310
Period 1: N48A	-0.008334729405727	0.00988813911899	-0.84290171	0.4000
Period 2: N44	-0.000201221237143	0.00008075340022	-2.49179894	0.0133
Period 2: N48A	0.000141709961978	0.00008683130885	1.63201458	0.1039
Quadratic trends				
Period 1: N44	0.000000895595400	0.00000433403022	0.20664263	0.8364
Period 1: N48A	0.000000752334893	0.00000098226346	0.76591966	0.4444
Period 2: N44	0.000000079590257	0.00000002271185	3.50434940	0.0005
Period 2: N48A	-0.000000004889471	0.00000002373754	-0.20598052	0.8370

Table G-12 Final model for upstream/downstream analysis of site N48A and N44 dissolved inorganic nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	17.4606056	1	376.468721	<0.0001	2.65112247	1	57.1609432	<0.0001
Site by Flow	3.6798442	2	39.670624	<0.0001	2.72462087	2	29.3728223	<0.0001
Site by Period	1.6682807	2	17.984928	<0.0001	0.04221015	2	0.4550473	0.6349
Period 1: Site by linear trend	2.7855636	2	30.029816	<0.0001	0.03506803	2	0.3780515	0.6856

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period 2: Site by linear trend	4.9384301	2	53.238830	<0.0001	0.41150778	2	4.4362668	0.0127
Period 1: Site by quadratic trend	0.3003646	2	3.238086	0.0408	0.02918849	2	0.3146671	0.7303
Period 2: Site by quadratic trend	1.6644427	2	17.943554	<0.0001	0.57153532	2	6.1614463	0.0024
Site by 1st order sine by year	6.8800557	26	5.705428	<0.0001	6.29807467	26	5.2228079	<0.0001
Site by 1st order cosine by year	25.0590978	26	20.780772	<0.0001	22.29117280	26	18.4854133	<0.0001
Site by 2nd order sine by year	1.9053522	26	1.580052	0.0400	1.53170565	26	1.2701984	0.1768
Site by 2nd order cosine by year	1.6352748	26	1.356085	0.1211	1.40345032	26	1.1638400	0.2705
Site by 3rd order sine by year	2.9911223	26	2.480450	0.0002	2.98722018	26	2.4772137	0.0002
Site by 3rd order cosine by year	2.6176025	26	2.170701	0.0012	2.61760246	26	2.1707007	0.0012

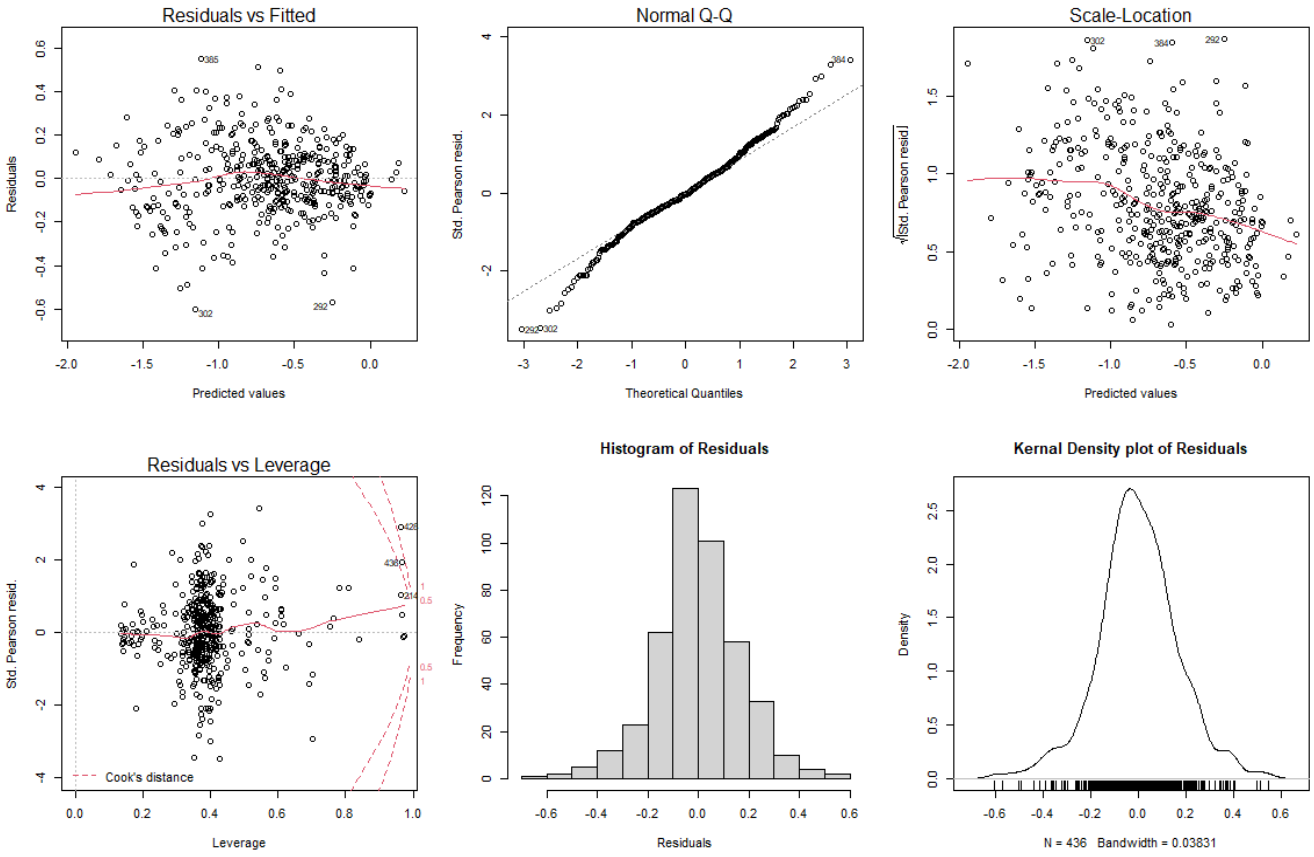


Figure G-6 Final model for upstream/downstream analysis of site N48A and N44 dissolved inorganic nitrogen concentrations: residual plots

Winmalee WWTP total phosphorus load

Table G-13 Final model for Winmalee WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.7497700347798	0.027115406564401	27.651071	<0.0001
Period 1	0.6413973793474	0.084303944728709	7.608154	<0.0001
Period 2	0.2551875278241	0.082563960808655	3.090786	0.0020
Period 3	0.1797890277942	0.041126026491281	4.371661	<0.0001
Period 2: Linear trend	0.0008565994283	0.000251051088552	3.412052	0.0007
Period 3: Linear trend	-0.0005037911456	0.000044723767992	-11.264506	<0.0001
Period 4: Linear trend	0.0002836417517	0.000029080168930	9.753786	<0.0001
Period 2: Quadratic trend	-0.0000006793529	0.000000173591179	-3.913522	<0.0001
Period 3: Quadratic trend	0.0000001779920	0.000000014362159	12.393124	<0.0001
Period 4: Quadratic trend	-0.0000001078767	0.000000006566442	-16.428487	<0.0001

Table G-14 Final model for Winmalee WWTP total phosphorus load: type I and type III sums of squares, mean square and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	60.5873315353	3	443.16266585	<0.0001	5.613694	3	41.061050	<0.0001
Period 2: Linear trend	0.0006574968	1	0.01442767	0.9044	0.530553	1	11.642100	0.0007
Period 3: Linear trend	0.7534484604	1	16.53317054	<0.0001	5.782581	1	126.889092	<0.0001
Period 4: Linear trend	33.0083156820	1	724.31246610	<0.0001	4.335547	1	95.136346	<0.0001
Period 2: Quadratic trend	0.4973549155	1	10.91362458	0.0010	0.697964	1	15.315656	<0.0001
Period 3: Quadratic trend	8.0427620003	1	176.48500562	<0.0001	6.999371	1	153.589527	<0.0001
Period 4: Quadratic trend	8.3601234014	1	183.44897256	<0.0001	12.299645	1	269.895197	<0.0001
1st order cosine by year	8.5190277191	26	7.18984088	<0.0001	8.441767	26	7.124634	<0.0001
1st order sine by year	11.7437227973	26	9.91140081	<0.0001	11.846599	26	9.998226	<0.0001
2nd order cosine by year	3.5593846270	26	3.00402933	<0.0001	3.169924	26	2.675334	<0.0001
2nd order sine by year	2.7949367242	26	2.35885491	0.0001	2.665927	26	2.249974	0.0003
3rd order cosine by year	1.3041560723	26	1.10067427	0.3310	1.304698	26	1.101132	0.3305
3rd order sine by year	1.5787022258	26	1.33238418	0.1227	1.578702	26	1.332384	0.1227

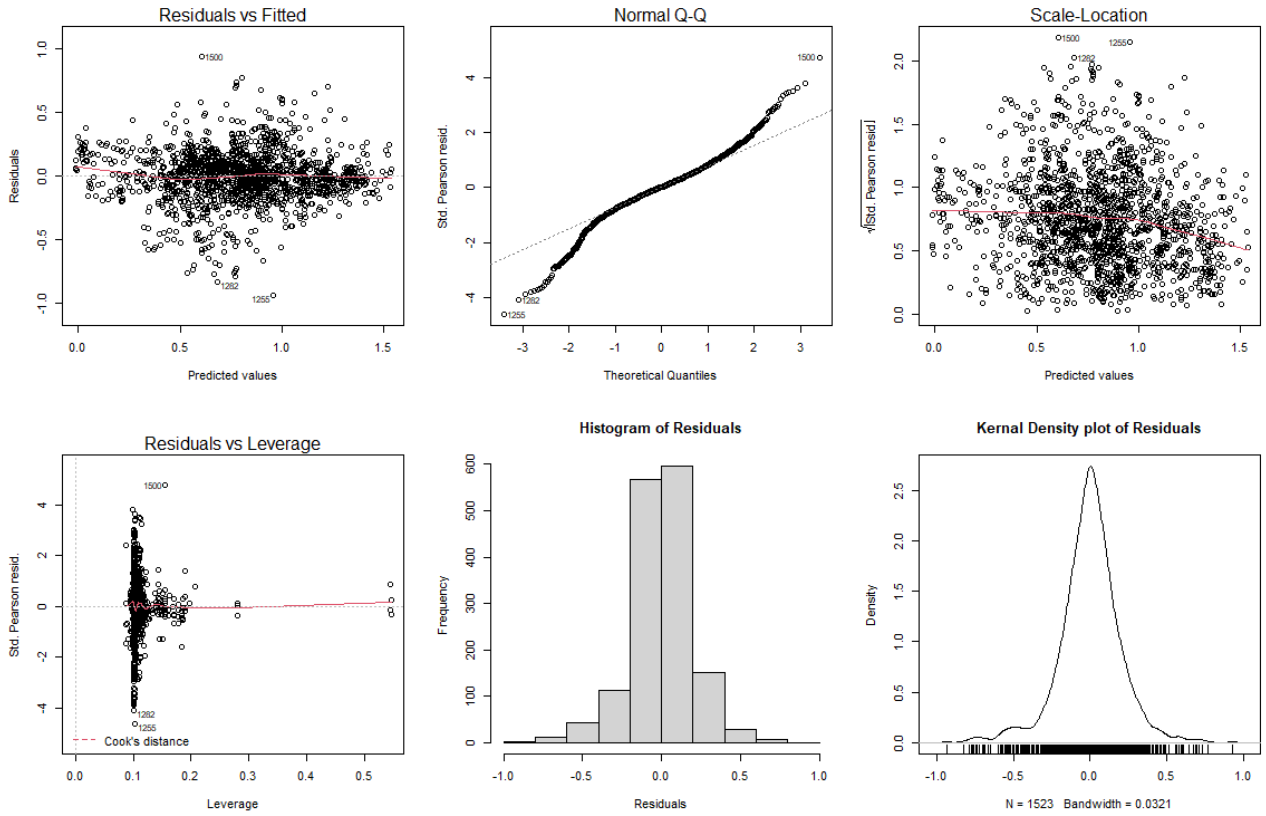


Figure G-7 Final model for Winmalee WWTP total phosphorus load: residual plots

N44 total phosphorus concentrations

Table G-15 Final model for site N44 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-1.18231966614087	0.146871102508887	-8.0500496	<0.0001
Log_{10}(N48A TP concentration)	0.35519893012275	0.064369433062575	5.5181305	<0.0001
Log_{10}(N48A flow)	-0.01369963494393	0.018757908935780	-0.7303391	0.4661
Log_{10}(Winmalee WWTP TP load)	0.16150139647028	0.026318035845231	6.1365292	<0.0001
Period 1	-27.51010548381128	16.353898809054620	-1.6821741	0.0942
Period 1: Linear trend	0.01063380985051	0.006351370283497	1.6742544	0.0958
Period 2: Linear trend	0.00016831973702	0.000033186804336	5.0718875	<0.0001
Period 1: Quadratic trend	-0.00000102463590	0.000000616414605	-1.6622512	0.0981
Period 2: Quadratic trend	-0.00000004167888	0.000000009889949	-4.2142660	<0.0001

Table G-16 Final model for site N44 total phosphorus concentrations: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N48A TP concentration)	2.355723358	1	290.7163674	<0.0001	0.246739531	1	30.4497639	<0.0001
Log_{10}(N48A flow)	0.002804566	1	0.3461074	0.5570	0.004322191	1	0.5333952	0.4661
Log_{10}(Winmalee WWTP TP load)	0.242294854	1	29.9012529	<0.0001	0.305140898	1	37.6569911	<0.0001
Period	0.284713495	1	35.1360752	<0.0001	0.022929612	1	2.8297098	0.0942
Period 1: Linear trend	0.035605395	1	4.3940096	0.0374	0.022714214	1	2.8031279	0.0958
Period 2: Linear trend	0.330317163	1	40.7639570	<0.0001	0.208446220	1	25.7240425	<0.0001
Period 1: Quadratic trend	0.040897621	1	5.0471155	0.0258	0.022389691	1	2.7630789	0.0981
Period 2: Quadratic trend	0.027371768	1	3.3779098	0.0677	0.143912561	1	17.7600383	<0.0001
1st order sine by year	0.510045588	13	4.8418445	<0.0001	0.497987624	13	4.7273787	<0.0001
1st order cosine by year	0.221562248	13	2.1032825	0.0157	0.221562248	13	2.1032825	0.0157

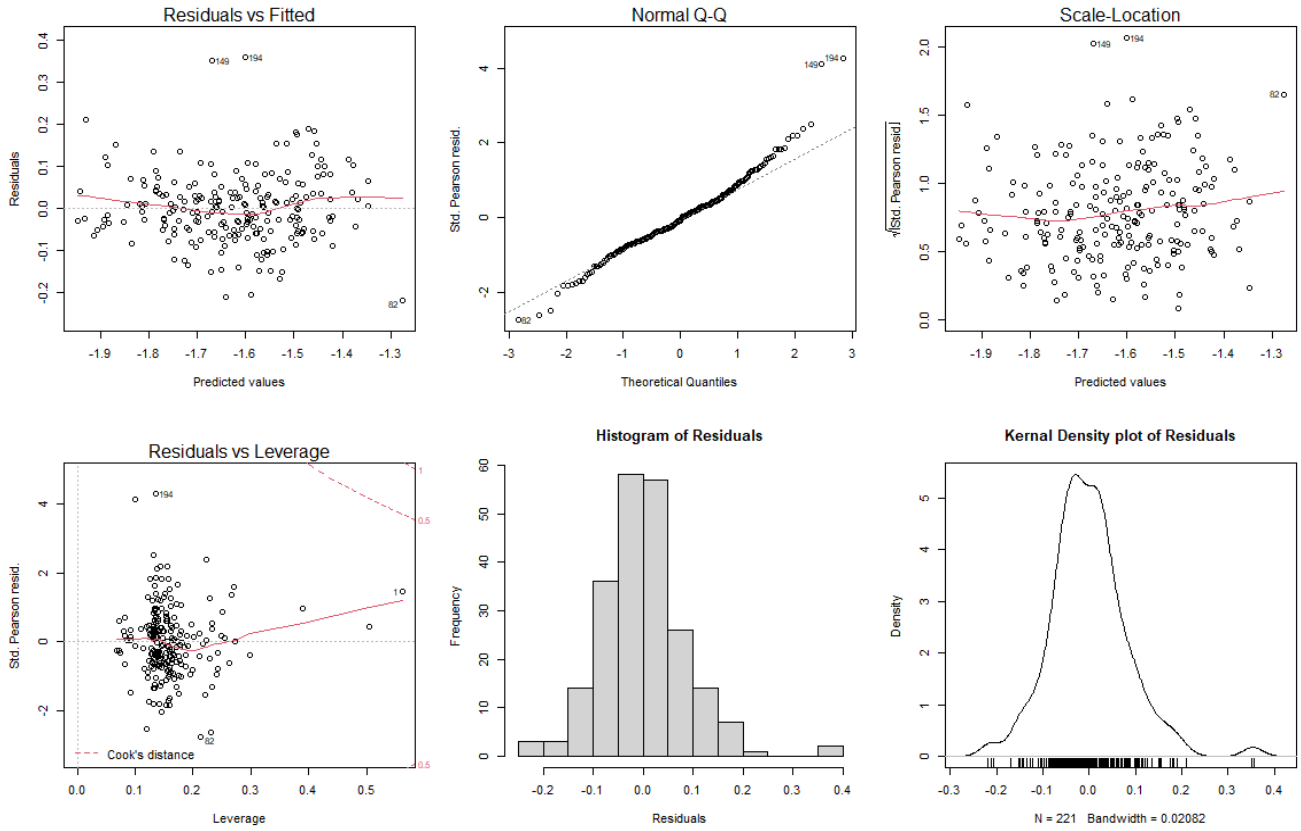


Figure G-8 Final model for site N44 total phosphorus concentrations: residual plots

N48A and N44 total phosphorus concentrations

Table G-17 Final model for upstream/downstream analysis at site N48A and N44 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-1.84847691798882	0.08107422081469	-22.799811	<0.0001
N48A	-0.36012193030650	0.11658498458049	-3.088922	0.0022
Log_{10}(Flow)				
N44	0.07292250994107	0.02898052720480	2.516259	0.0124
N48A	0.20154426610832	0.02914626770304	6.914925	<0.0001
Period				
N44	-63.78194822820920	60.63820040917373	-1.051844	0.2938
N48A	19.47724351262719	12.77345180689437	1.524822	0.1285
Linear trends				
Period 1: N44	0.02459625420532	0.02324727887796	1.058027	0.2910
Period 1: N48A	-0.00733275521646	0.00507960297833	-1.443569	0.1500
Period 2: N44	0.00020223365929	0.00004148355998	4.875031	<0.0001
Period 2: N48A	0.00005291860472	0.00004460582216	1.186361	0.2365
Quadratic trends				
Period 1: N44	-0.00000236889767	0.00000222642022	-1.063994	0.2883
Period 1: N48A	0.00000068644659	0.00000050459528	1.360390	0.1749
Period 2: N44	-0.00000007792194	0.00000001166723	-6.678702	<0.0001
Period 2: N48A	-0.00000002827534	0.00000001219413	-2.318766	0.0212

Table G-18 Final model for upstream/downstream analysis at site N48A and N44 total phosphorus concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	0.85349878	1	69.733601	<0.0001	0.11678168	1	9.541439	0.0022
Site by Flow	1.58219574	2	64.635246	<0.0001	0.66273703	2	27.073876	<0.0001
Site by Period	0.05969906	2	2.438803	0.0892	0.04199907	2	1.715730	0.1818
Period 1: Site by linear trend	0.12502072	2	5.107298	0.0067	0.03920668	2	1.601656	0.2035
Period 2: Site by linear trend	0.48506428	2	19.815658	<0.0001	0.30810760	2	12.586692	<0.0001

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period 1: Site by quadratic trend	0.10561858	2	4.314689	0.0143	0.03650707	2	1.491373	0.2269
Period 2: Site by quadratic trend	0.53025615	2	21.661818	<0.0001	0.61174739	2	24.990867	<0.0001
Site by 1st order sine by year	1.89565437	26	5.956964	<0.0001	1.86845748	26	5.871500	<0.0001
Site by 1st order cosine by year	2.16346812	26	6.798551	<0.0001	1.69038740	26	5.311927	<0.0001
Site by 2nd order sine by year	0.33321990	26	1.047121	0.4057	0.43568849	26	1.369121	0.1141
Site by 2nd order cosine by year	0.48786809	26	1.533092	0.0511	0.47606660	26	1.496007	0.0618
Site by 3rd order sine by year	0.37137919	26	1.167034	0.2673	0.39217415	26	1.232380	0.2069
Site by 3rd order cosine by year	0.53187266	26	1.671373	0.0244	0.53187266	26	1.671373	0.0244

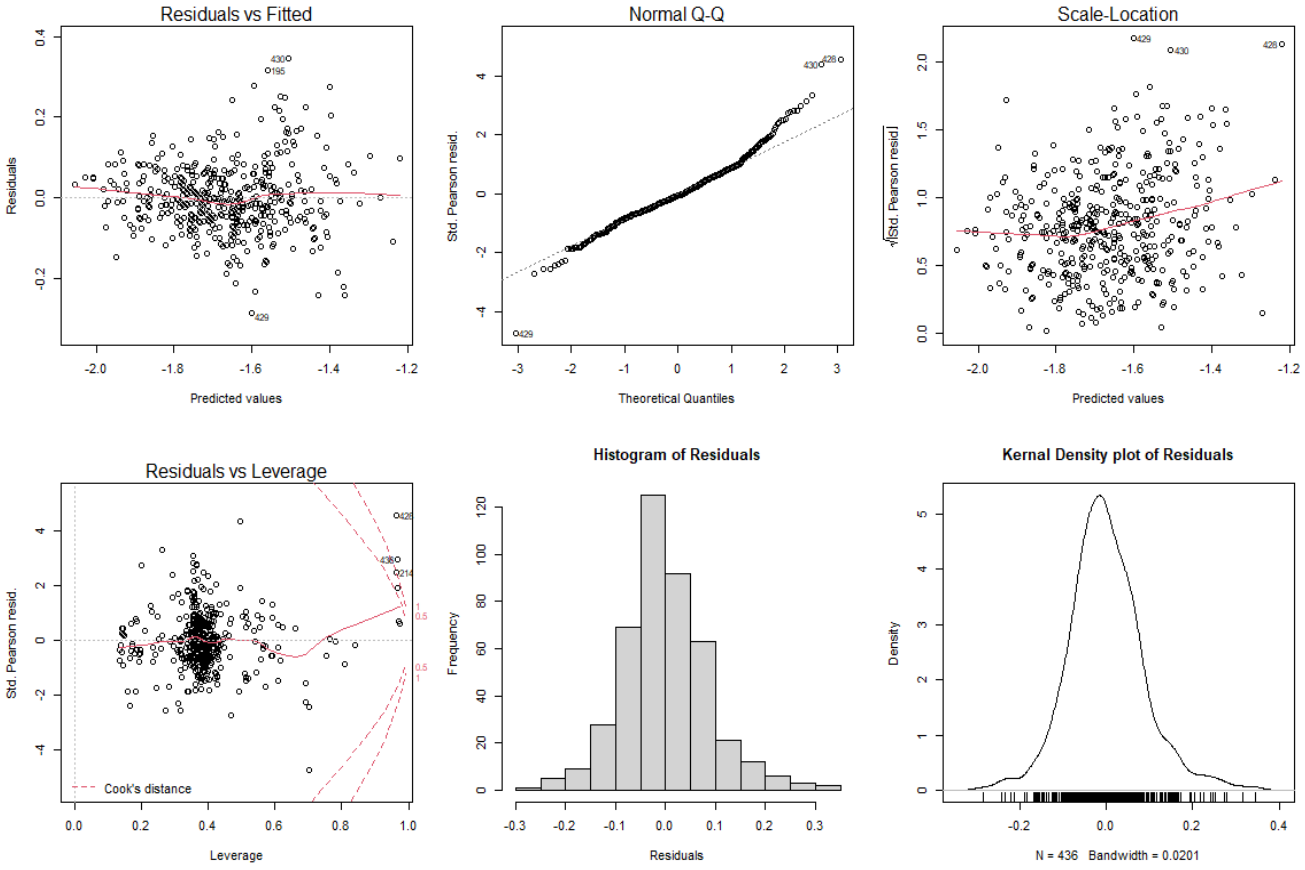


Figure E-9 Final model for upstream/downstream analysis at site N48A and N44 total phosphorus concentrations: residual plots

N44 Chlorophyll-*a*

Table G-19 Final model for site N44 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.65473638057074	0.30915392330558	2.1178330	0.0358
Log_{10}(N48A Chl-*a* concentration)	0.65035020318495	0.09149049895475	7.1083906	<0.0001
Log_{10}(N48A flow)	-0.10284052881687	0.05331409981201	-1.9289556	0.0555
Log_{10}(Winmalee WWTP TN load)	-0.17824980549462	0.16161743253769	-1.1029120	0.2718
Log_{10}(Winmalee WWTP TP load)	0.21149971725529	0.06400886709603	3.3042253	0.0012
Period 1	-77.63434996195174	84.87701943255951	-0.9146687	0.3618
Period 1: Linear trend	0.03003630740149	0.03259186036077	0.9215892	0.3582
Period 2: Linear trend	0.00024908942261	0.00008696154830	2.8643628	0.0048
Period 1: Quadratic trend	-0.00000290042942	0.00000312634058	-0.9277394	0.3550
Period 2: Quadratic trend	-0.00000006403683	0.00000002669231	-2.3990736	0.0176

Table G-20 Final model for site N44 chlorophyll-*a* concentrations: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N48A Chl-*a* concentration)	9.04647850	1	214.739413	<0.0001	2.12867991	1	50.5292170	<0.0001
Log_{10}(N48A flow)	0.18003213	1	4.273485	0.0404	0.15675169	1	3.7208695	0.0555
Log_{10}(Winmalee WWTP TN load)	0.10506743	1	2.494022	0.1163	0.05124477	1	1.2164149	0.2718
Log_{10}(Winmalee WWTP TP load)	0.44293871	1	10.514191	0.0014	0.45994626	1	10.9179047	0.0012
Period	0.76390646	1	18.133114	<0.0001	0.03524483	1	0.8366188	0.3618
Period 1: Linear trend	0.06286024	1	1.492135	0.2237	0.03578018	1	0.8493267	0.3582
Period 2: Linear trend	0.22164158	1	5.261183	0.0231	0.34563987	1	8.2045742	0.0048
Period 1: Quadratic trend	0.26840023	1	6.371110	0.0126	0.03625933	1	0.8607004	0.3550
Period 2: Quadratic trend	0.46332049	1	10.998000	0.0011	0.24246828	1	5.7555541	0.0176
1st order sine by year	1.14227778	13	2.085742	0.0177	0.64234743	13	1.1728942	0.3040
1st order cosine by year	0.96002547	13	1.752958	0.0552	1.44265615	13	2.6342178	0.0024
2nd order sine by year	0.98870847	13	1.805332	0.0464	1.04877932	13	1.9150185	0.0320
2nd order cosine by year	1.17171511	13	2.139493	0.0146	1.17171511	13	2.1394931	0.0146

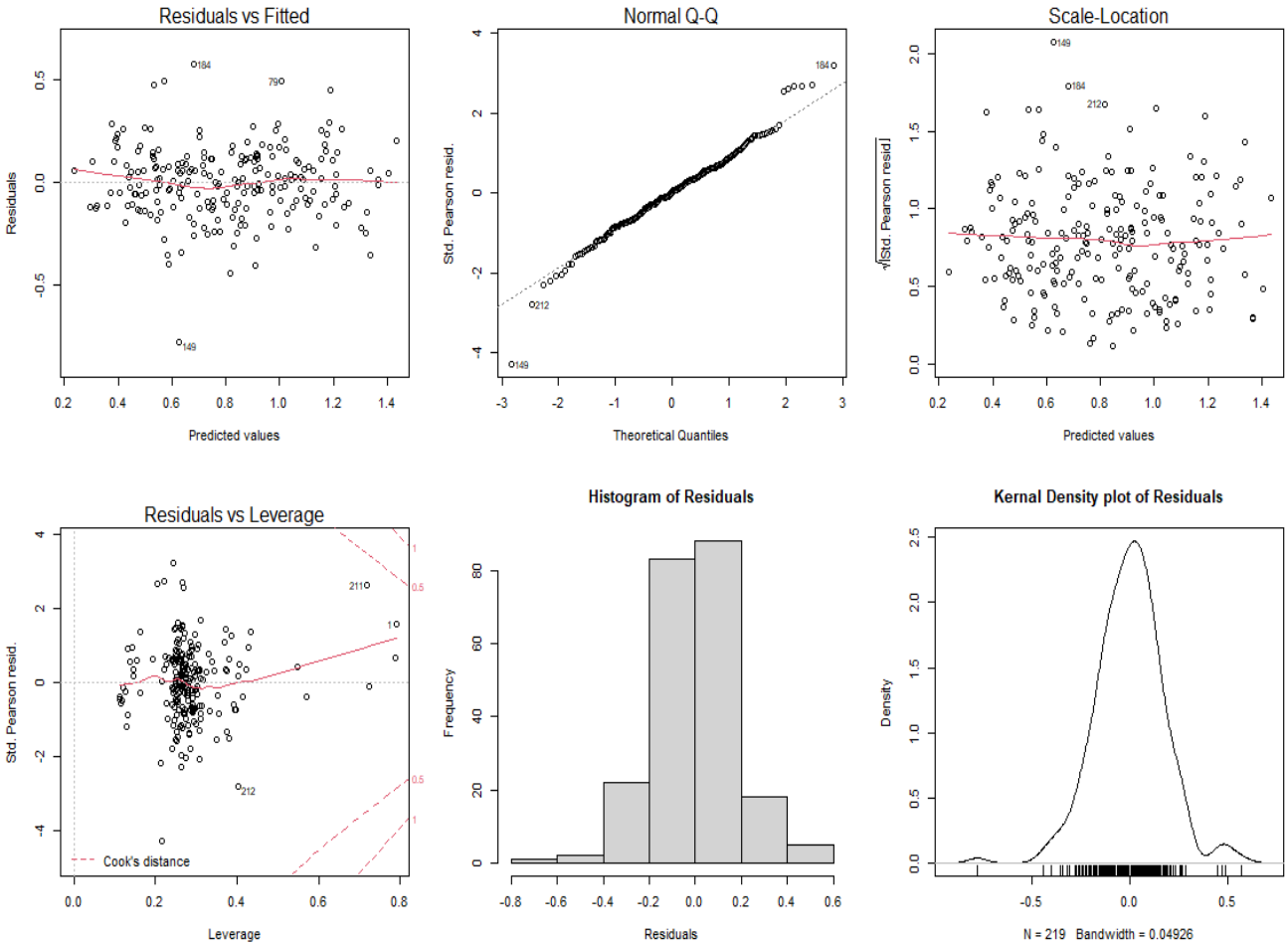


Figure G-10 Final model for site N44 chlorophyll-*a*: residual plots

N48A and N44 chlorophyll-*a* concentrations

Table G-21 Final model for upstream/downstream analysis at site N48A and N44 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.17530411713227	0.14121490626725	8.3228049	<0.0001
N48A	-0.17120783325897	0.20416538046862	-0.8385743	0.4023
Log_{10}(Flow)				
N44	-0.18738902569561	0.05003311561453	-3.7453000	0.0002
N48A	-0.08858804523249	0.05120371851297	-1.7301096	0.0846
Period				
N44	40.50670967206310	91.28863485287719	0.4437213	0.6575
N48A	58.10744895668489	24.42011267648023	2.3794914	0.0179
Linear trends				
Period 1: N44	-0.01524575246318	0.03505324755593	-0.4349312	0.6639
Period 1: N48A	-0.02232608141650	0.00971627023054	-2.2978037	0.0222
Period 2: N44	0.00048961296384	0.00008157006172	6.0023611	<0.0001
Period 2: N48A	0.00021785683401	0.00008685070612	2.5084060	0.0126
Quadratic trends				
Period 1: N44	0.00000142505967	0.00000336260492	0.4237963	0.6720
Period 1: N48A	0.00000212931931	0.00000096537805	2.2056844	0.0281
Period 2: N44	-0.00000017034077	0.00000002288731	-7.4425853	<0.0001
Period 2: N48A	-0.00000009109285	0.00000002385230	-3.8190388	0.0002

Table G-22 Final model for upstream/downstream analysis at site N48A and N44 chlorophyll-*a* concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	0.20494972	1	4.0291149	0.0456	0.03577015	1	0.7032068	0.4023
Site by Flow	0.04927786	2	0.4843777	0.6165	0.86578747	2	8.5102755	0.0003
Site by Period	3.90971107	2	38.4305841	<0.0001	0.29802411	2	2.9294340	0.0549
Period 1: Site by linear trend	0.59738683	2	5.8720259	0.0031	0.27819602	2	2.7345335	0.0665
Period 2: Site by linear trend	1.84105098	2	18.0966478	<0.0001	2.15272151	2	21.1602197	<0.0001

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period 1: Site by quadratic trend	0.72582039	2	7.1344662	0.0009	0.25660698	2	2.5223235	0.0819
Period 2: Site by quadratic trend	4.33670195	2	42.6276996	<0.0001	3.55953958	2	34.9885664	<0.0001
Site by 1st order sine by year	4.43265345	26	3.3516044	<0.0001	4.20438605	26	3.1790075	<0.0001
Site by 1st order cosine by year	3.33401500	26	2.5209052	<0.0001	3.38593638	26	2.5601639	<0.0001
Site by 2nd order sine by year	2.31509569	26	1.7504831	0.0148	2.34400091	26	1.7723388	0.0130
Site by 2nd order cosine by year	2.26567215	26	1.7131131	0.0183	2.26567215	26	1.7131131	0.0183

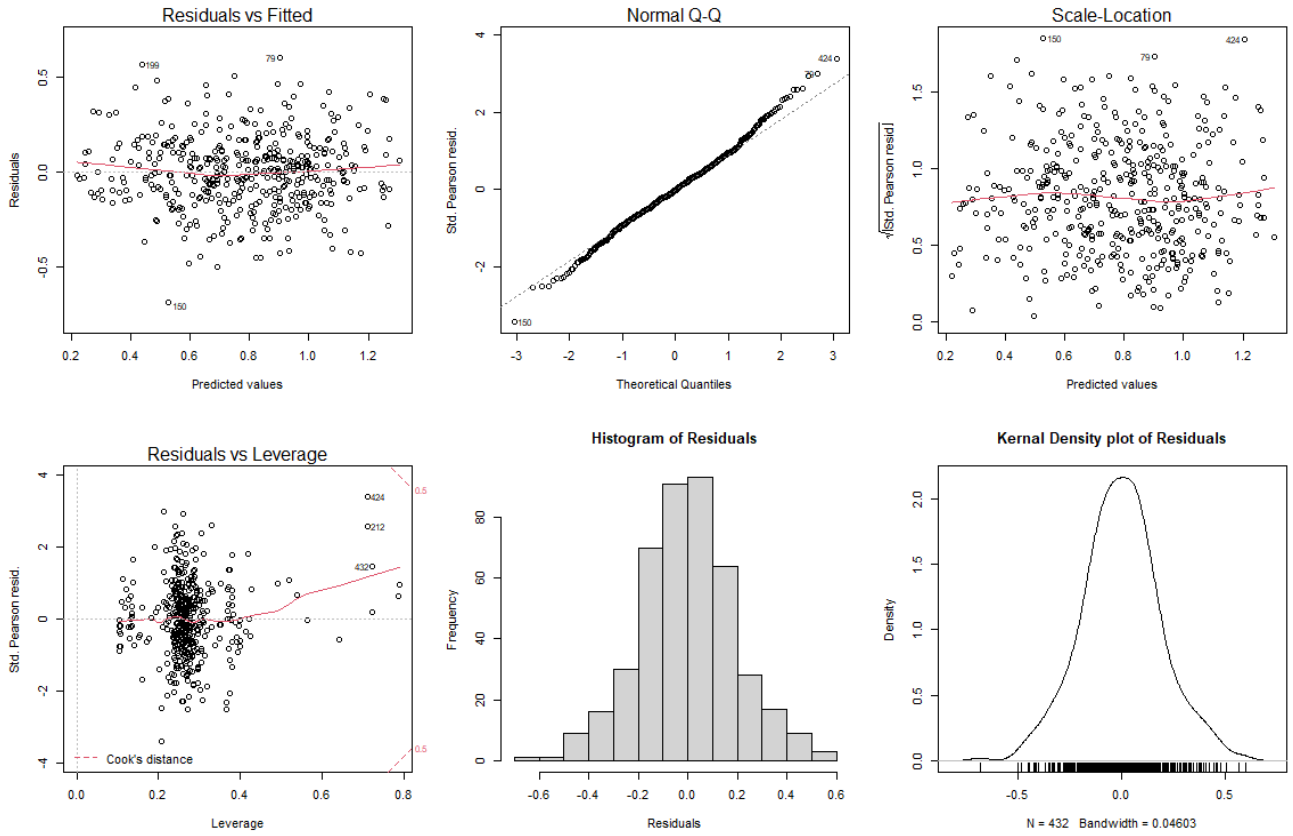


Figure G-11 Final model for upstream/downstream analysis at site N48A and N44 chlorophyll-*a* concentrations: residual plots

Model fit details and example relative changes in the outcome

Table G-23 Model fit details – Nepean River at Yarramundi (N44) and Winmalee WWTP

Model	TN		DIN		TP		Chl-*a*	
	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2
Winmalee WWTP	0.45	0.38	0.43	0.36	0.69	0.66	-	-
Site N44	0.82	0.79	0.82	0.79	0.73	0.68	0.71	0.59
Upstream (N48A) / downstream (N44)	0.84	0.74	0.86	0.77	0.74	0.58	0.60	0.45

Table G-24 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Nepean River at Yarramundi (N44) for prespecified changes at low, medium and high values of the explanatory variables

Parameter	Co-efficient	p- value		Amount of change in X	Low value	% change	Medium value	% change	High value	% change
		type I SS	type III SS							
TN										
Upstream N48A TN concentration (mg/L)	0.31	<0.0001	<0.0001	0.1	0.35	8.1	0.45	6.4	0.65	4.5
Upstream N48A flow (ML/day)	-0.06	<0.0001	<0.0001	100	800	-0.7	1100	-0.5	1500	-0.4
Winmalee TN load (kg/day)	0.18	<0.0001	<0.0001	10	90	1.9	125	1.4	225	0.86
DIN										
Upstream N48A DIN concentration (mg/L)	0.3	<0.0001	<0.0001	0.01	0.03	9.0	0.15	2.0	0.3	1.0
Upstream N48A flow (ML/day)	-0.11	<0.0001	0.0012	100	800	-1.3	1100	-1.0	1500	-0.7
Winmalee DIN load (kg/day)	0.3	<0.0001	0.0020	10	90	3.2	125	2.3	225	1.3
TP										
Upstream N48A TP concentration (mg/L)	0.36	<0.0001	<0.0001	0.001	0.015	2.4	0.02	1.8	0.025	1.4
Upstream N48A flow (ML/day)	-0.01	0.5570	0.4661	NE	NE	NE	NE	NE	NE	NE
Winmalee TP load (kg/day)	0.16	<0.0001	<0.0001	1	2	6.7	6	2.5	10	1.5
Chl-*a*										
Upstream N48A Chl-*a* concentration (µg/L)	0.65	<0.0001	<0.0001	1	5	12.6	7	9.1	10	6.4
Upstream N48A flow (ML/day)	-0.1	0.0404	0.0555	100	800	-1.2	1100	-0.9	1500	-0.6
Winmalee TN load (kg/day)	-0.18	0.1163	0.2718	NE	NE	NE	NE	NE	NE	NE
Winmalee TP load (kg/day)	0.21	0.0014	0.0012	1	2	8.9	6	3.3	10	2.0

NE= Not estimated

Table G-25 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Nepean River at Yarramundi (N44) and Smith Road (N48A) for prespecified changes at low, medium and high values of the explanatory variables

Parameter (flow ML/day)	Coefficient	p-value	Amount of change in X	Low value	%change	Medium value	% change	High value	% change
TN									
N44 flow	0.006	0.8	NE	NE	NE	NE	NE	NE	NE
N48A flow	0.17	<0.0001	100	800	2.0	1100	1.5	1500	1.1
DIN									
N44 flow	-0.003	0.9	NE	NE	NE	NE	NE	NE	NE
N48A flow	0.43	<0.0001	100	800	5.2	1100	3.8	1500	2.8
TP									
N44 flow	0.07	0.01	100	800	0.8	1100	0.6	1500	0.5
N48A flow	0.2	<0.0001	100	800	2.4	1100	1.8	1500	1.3
Chl-*a*									
N44 flow	-0.19	0.0002	100	800	-2.2	1100	-1.6	1500	-1.2
N48A flow	-0.09	0.08	100	800	-1.1	1100	-0.8	1500	-0.6

NE= Not estimated

Appendix H : Statistical analysis outcomes of Hawkesbury River at Wilberforce – South Creek WWTPs (St Marys, Quakers Hill and Riverstone) and Richmond WWTP

St Marys WWTP total nitrogen load

Table H-1 Final model for St Marys WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.82682301079786	0.02990648300512	61.084515	<0.0001
Period 1	0.87688874938389	0.07960575832643	11.015393	<0.0001
Period 2	0.45975890184759	0.03341864558933	13.757556	<0.0001
Period 1: Linear trend	0.00046497992138	0.00018508205866	2.512291	0.0121
Period 2: Linear trend	-0.00005318601142	0.00000792130982	-6.714295	<0.0001
Period 3: Linear trend	-0.00008994447940	0.00003888147191	-2.313299	0.0209
Period 1: Quadratic trend	-0.00000043230207	0.00000009938874	-4.349608	<0.0001
Period 3: Quadratic trend	0.00000004352918	0.00000001063450	4.093204	<0.0001

Table H-2 Final model for St Marys WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	141.5118276	2	1,559.752671	<0.0001	10.7729858	2	118.740558	<0.0001
Period 1: Linear trend	4.9446001	1	108.999414	<0.0001	0.2863168	1	6.311604	0.0121
Period 2: Linear trend	1.8746823	1	41.325743	<0.0001	2.0450685	1	45.081758	<0.0001
Period 3: Linear trend	3.2128641	1	70.824799	<0.0001	0.2427564	1	5.351353	0.0209
Period 1: Quadratic trend	1.3556492	1	29.884109	<0.0001	0.8582370	1	18.919090	<0.0001
Period 3: Quadratic trend	0.4401682	1	9.703126	0.0019	0.7600353	1	16.754318	<0.0001
1st order cosine by year	4.7234582	26	4.004790	<0.0001	4.9312850	26	4.180996	<0.0001
1st order sine by year	5.9818652	26	5.071732	<0.0001	5.9011235	26	5.003275	<0.0001
2nd order cosine by year	2.1194598	26	1.796987	0.0084	2.0880507	26	1.770356	0.0099
2nd order sine by year	2.0635836	26	1.749612	0.0114	2.3420406	26	1.985702	0.0023
3rd order cosine by year	2.6263734	26	2.226774	0.0004	2.6173071	26	2.219087	0.0004
3rd order sine by year	1.7814086	26	1.510369	0.0482	1.7814086	26	1.510369	0.0482

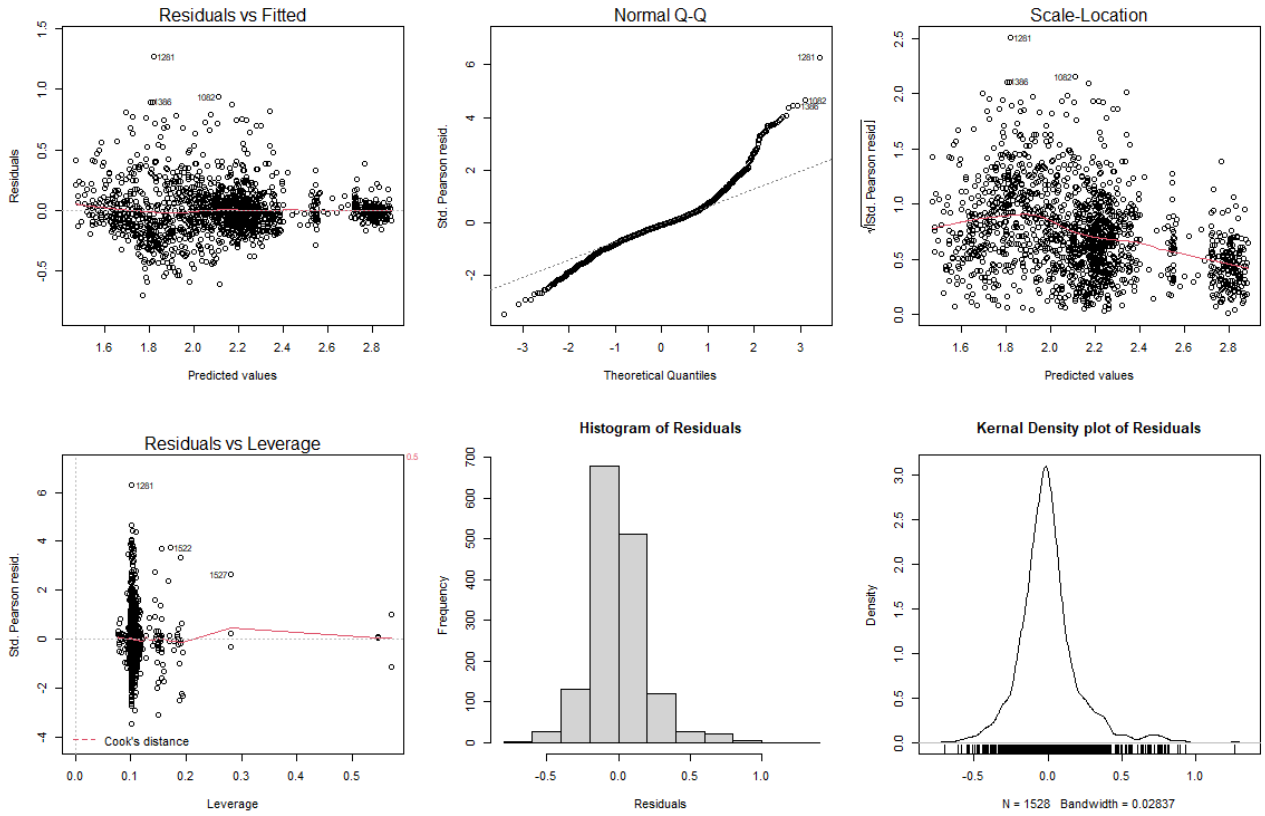


Figure H-1 Final model for St Marys WWTP total nitrogen load: residual plots

Quakers Hill WWTP total nitrogen load

Table H-3 Final model for Quakers Hill WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.762667927066591	0.022939672894884	76.839279	<0.0001
Period 1	0.512637983161468	0.030801673213419	16.643186	<0.0001
Period 1: Linear trend	-0.000057871348284	0.000015767526761	-3.670287	0.0003
Period 1: Quadratic trend	0.000000007511332	0.000000002752591	2.728822	0.0064
Period 2: Linear trend	0.000369089223987	0.000029780011750	12.393858	<0.0001
Period 2: Quadratic trend	-0.000000076091806	0.000000008136493	-9.351917	<0.0001

Table H-4 Final model for Quakers Hill WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	2.5967965	1	98.412218	<0.0001	7.3090654	1	276.995648	<0.0001
Period 1: Linear trend	0.8927126	1	33.831617	<0.0001	0.3554585	1	13.471007	0.0003
Period 1: Quadratic trend	0.1045649	1	3.962754	0.0467	0.1964895	1	7.446470	0.0064
Period 2: Linear trend	5.3037191	1	200.997942	<0.0001	4.0532361	1	153.607705	<0.0001
Period 2: Quadratic trend	2.6621213	1	100.887868	<0.0001	2.3077575	1	87.458348	<0.0001
1st order cosine by year	3.0926628	26	4.507859	<0.0001	3.0790339	26	4.487993	<0.0001
1st order sine by year	3.7642939	26	5.486827	<0.0001	3.6890194	26	5.377107	<0.0001
2nd order cosine by year	1.3159747	26	1.918162	0.0037	1.2240413	26	1.784160	0.0091
2nd order sine by year	1.2173939	26	1.774471	0.0097	1.0719775	26	1.562512	0.0358
3rd order cosine by year	1.8772207	26	2.736233	<0.0001	1.8731457	26	2.730293	<0.0001
3rd order sine by year	1.1309724	26	1.648503	0.0214	1.1309724	26	1.648503	0.0214

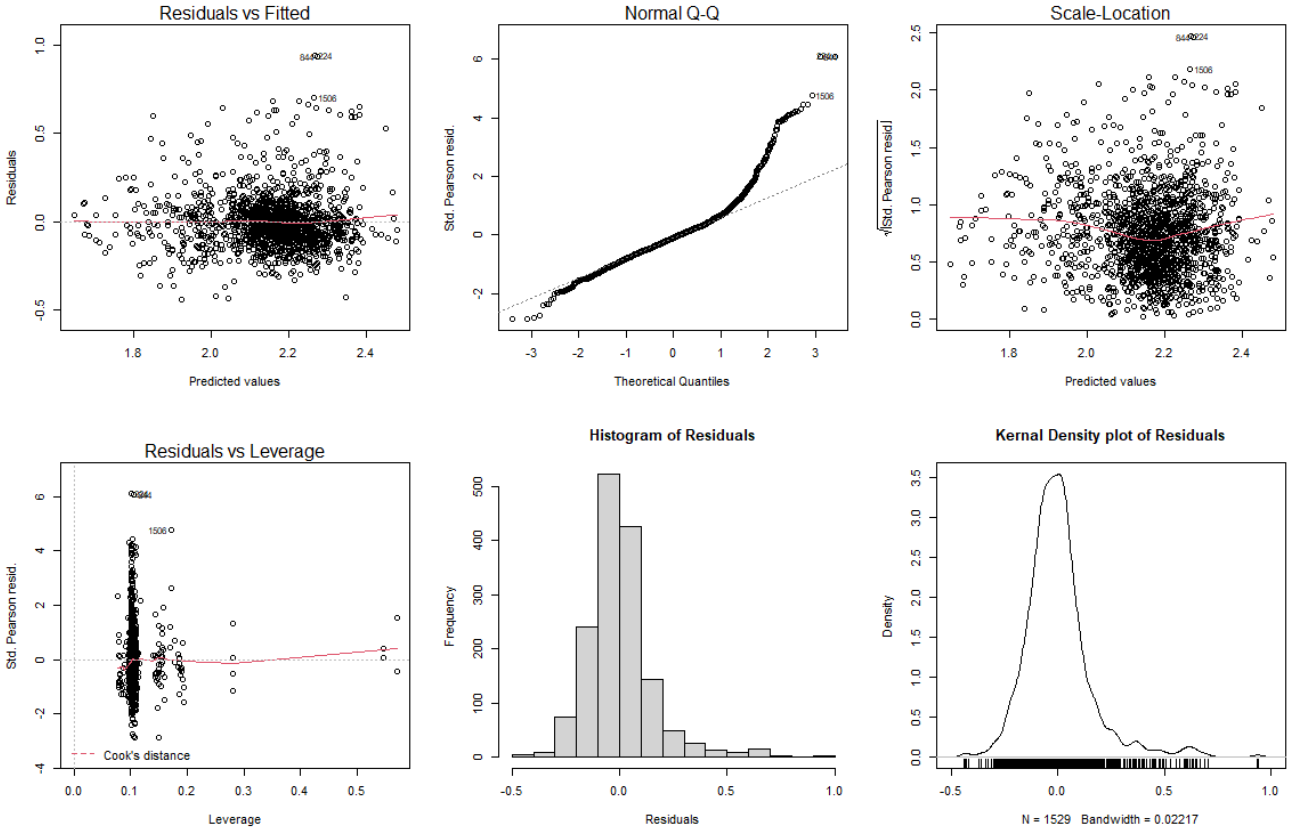


Figure H-2 Final model for Quakers Hill WWTP total nitrogen load: residual plots

Riverstone WWTP total nitrogen load

Table H-5 Final model for Riverstone WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.82541842859607	0.125413570243239	6.5815719	<0.0001
Period 1	0.63814664868470	0.134768181623178	4.7351433	<0.0001
Period 2	0.47241584855656	0.126621584771990	3.7309267	0.0002
Period 3	0.04277468471901	0.127364828920727	0.3358438	0.7370
Period 1: Linear trend	-0.00004369870991	0.000123998790707	-0.3524124	0.7246
Period 2: Linear trend	0.00002412727830	0.000021637255215	1.1150804	0.2650
Period 3: Linear trend	0.00003152522402	0.000031490250149	1.0011106	0.3170
Period 4: Linear trend	0.00084869783976	0.000712268955175	1.1915412	0.2336
Period 1: Quadratic trend	0.00000008655077	0.000000066692018	1.2977680	0.1946
Period 2: Quadratic trend	-0.00000003175359	0.000000005597627	-5.6726883	<0.0001
Period 3: Quadratic trend	0.00000010506528	0.000000009543932	11.0085951	<0.0001

Table H-6 Final model for Riverstone WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	28.9973118	3	466.561420	<0.0001	5.591812241	3	89.9712317	<0.0001
Period 1: Linear trend	0.1299903	1	6.274559	0.0124	0.002572942	1	0.1241945	0.7246
Period 2: Linear trend	7.5508225	1	364.474042	<0.0001	0.025759652	1	1.2434042	0.2650
Period 3: Linear trend	54.7952228	1	2,644.935207	<0.0001	0.020763081	1	1.0022225	0.3170
Period 4: Linear trend	0.1199863	1	5.791672	0.0162	0.029413440	1	1.4197705	0.2336
Period 1: Quadratic trend	0.7578090	1	36.579022	<0.0001	0.034891672	1	1.6842018	0.1946
Period 2: Quadratic trend	0.8120351	1	39.196488	<0.0001	0.666661698	1	32.1793927	<0.0001
Period 3: Quadratic trend	3.3835993	1	163.324473	<0.0001	2.510680554	1	121.1891667	<0.0001
1st order cosine by year	1.9580748	26	3.635200	<0.0001	1.851738238	26	3.4377840	<0.0001
1st order sine by year	3.0754036	26	5.709540	<0.0001	2.768863846	26	5.1404435	<0.0001
2nd order cosine by year	1.8413992	26	3.418589	<0.0001	1.701133628	26	3.1581839	<0.0001
2nd order sine by year	1.7212108	26	3.195457	<0.0001	1.394112080	26	2.5881931	<0.0001

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
3rd order cosine by year	1.5704445	26	2.915557	<0.0001	1.488786982	26	2.7639587	<0.0001
3rd order sine by year	1.1696714	26	2.171515	0.0006	1.169671414	26	2.1715152	0.0006

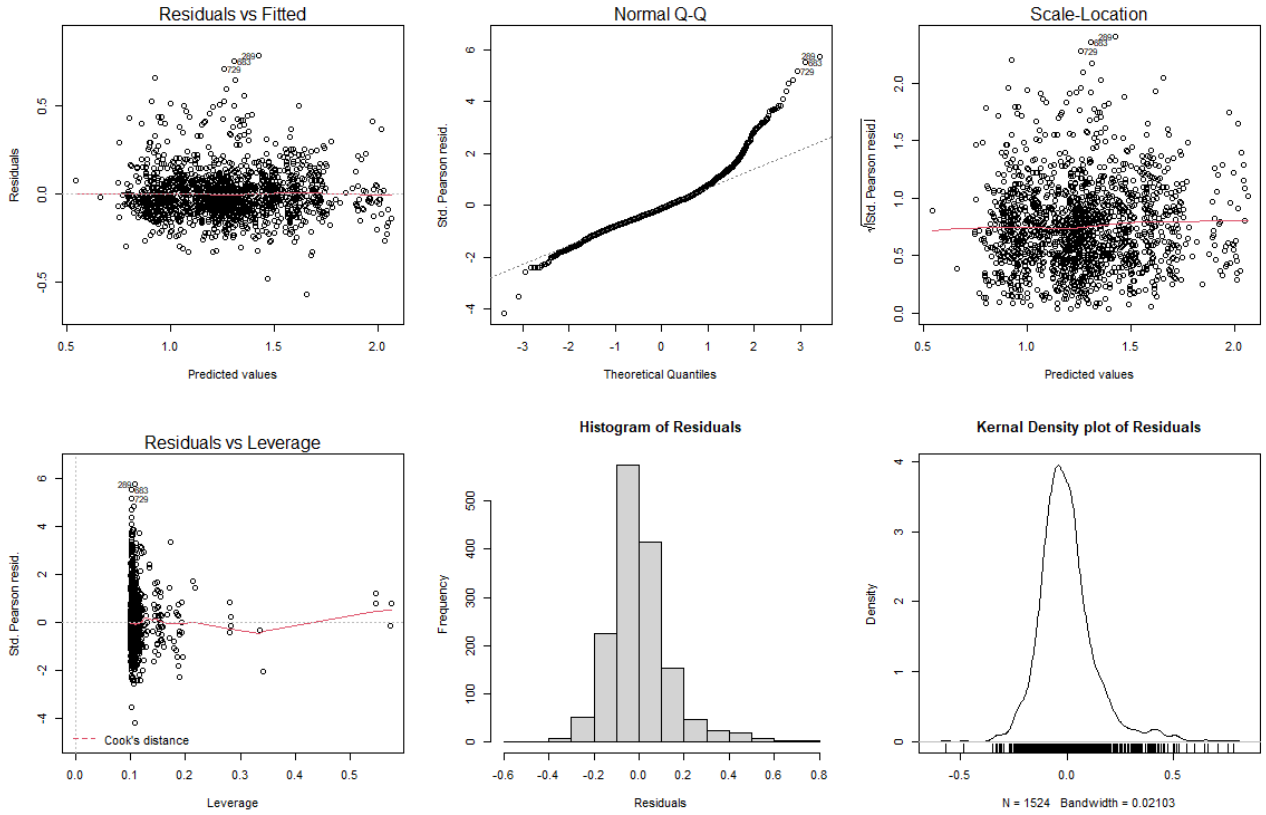


Figure H-3 Final model for Riverstone WWTP total nitrogen load: residual plots

Richmond WWTP total nitrogen load

Table H-7 Final model for Richmond WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.27359943386598	0.11577228062531	2.363255	0.0186
Period 1: Linear trend	0.00044978231073	0.00007170693177	6.272508	<0.0001
Period 1: Quadratic trend	-0.00000005643999	0.00000001039383	-5.430144	<0.0001

Table H-8 Final model for Richmond WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period 1: Linear trend	6.799362	1	142.446414	<0.0001	1.878015	1	39.344358	<0.0001
Period 1: Quadratic trend	2.867249	1	60.068775	<0.0001	1.407471	1	29.486466	<0.0001
1st order cosine by year	2.182620	14	3.266129	<0.0001	3.184413	14	4.765239	<0.0001
1st order sine by year	2.675034	14	4.002991	<0.0001	3.021496	14	4.521446	<0.0001
2nd order cosine by year	1.449579	14	2.169187	0.0086	2.520737	14	3.772098	<0.0001
2nd order sine by year	1.464951	14	2.192190	0.0078	1.464058	14	2.190855	0.0078
3rd order cosine by year	1.066032	14	1.595238	0.0781	1.200827	14	1.796949	0.0375
3rd order sine by year	2.417212	14	3.617179	<0.0001	2.417212	14	3.617179	<0.0001

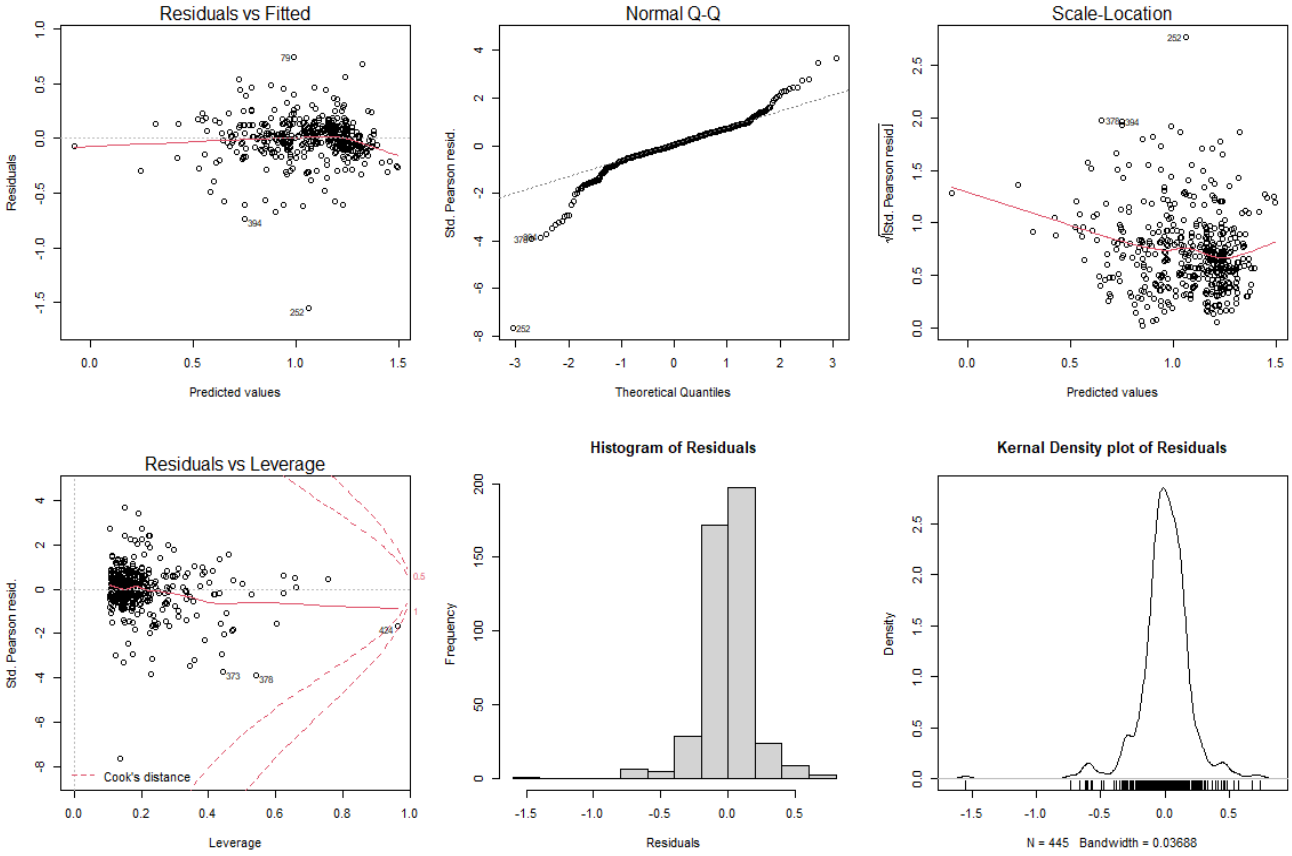


Figure H-4 Final model for Richmond WWTP total nitrogen load: residual plots

N35 total nitrogen concentrations

Table H-9 Final model for site N35 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.29101458480871	0.07394620441448	-3.93549050	<0.0001
Log_{10}(N39 TN concentration)	0.19560603426943	0.04973857805627	3.93268248	0.0001
Log_{10}(N39 flow)	-0.06441975020680	0.01976846257227	-3.25871321	0.0012
Log_{10}(Combined South Creek and Eastern Creek flow)	0.01892806779471	0.01015177478575	1.86450825	0.0630
Log_{10}(Riverstone WWTP TN load (lag 1))	0.05916522101035	0.04367710798474	1.35460482	0.1764
Log_{10}(St Marys WWTP TN load (lag 1))	0.10646629319056	0.03504359832384	3.03810962	0.0025
Log_{10}(Quakers Hill WWTP TN load (lag 1))	0.08488903079141	0.04329984672503	1.96049264	0.0507
Period 1	0.01248707498170	0.06673390163832	0.18711741	0.8517
Period 2	-0.00183911854794	0.03511890531296	-0.05236833	0.9583
Period 3	-0.03582300750034	0.03292225084827	-1.08810931	0.2773
Period 4	-0.07911473293845	0.04486020768317	-1.76358374	0.0786
Period 1: Linear trend	0.00036972912751	0.00014325320654	2.58094835	0.0102
Period 4: Linear trend	-0.00001607177060	0.00004686980800	-0.34290242	0.7319
Period 1: Quadratic trend	-0.00000026977251	0.00000007814230	-3.45232364	0.0006
Period 4: Quadratic trend	0.00000001161444	0.00000001476234	0.78676138	0.4319

Table H-10 Final model for site N35 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N39 TN concentration)	2.48490441541	1	199.935436301	<0.0001	0.192219604	1	15.4659915	0.0001
Log_{10}(N39 flow)	0.53688337083	1	43.197641858	<0.0001	0.131981238	1	10.6192118	0.0012
Log_{10}(Combined South Creek and Eastern Creek flow)	0.03152118371	1	2.536194785	0.1121	0.043206445	1	3.4763910	0.0630
Log_{10}(Riverstone WWTP TN load (lag 1))	2.82929235519	1	227.644893683	<0.0001	0.022805791	1	1.8349542	0.1764
Log_{10}(St Marys WWTP TN load (lag 1))	3.58576517856	1	288.510705281	<0.0001	0.114716739	1	9.2301101	0.0025
Log_{10}(Quakers Hill WWTP TN load (lag 1))	0.00002607883	1	0.002098303	0.9635	0.047769461	1	3.8435314	0.0507

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	0.15902932676	4	3.198875340	0.0133	0.079459242	4	1.5983229	0.1741
Period 1: Linear trend	0.27857172089	1	22.413883694	<0.0001	0.082790126	1	6.6612944	0.0102
Period 4: Linear trend	0.00095474280	1	0.076818616	0.7818	0.001461373	1	0.1175821	0.7319
Period 1: Quadratic trend	0.03147060433	1	2.532125166	0.1124	0.148129964	1	11.9185385	0.0006
Period 4: Quadratic trend	0.03586971081	1	2.886077322	0.0902	0.007693181	1	0.6189935	0.4319
1st order sine by year	0.95301981466	26	2.949230179	<0.0001	1.090141912	26	3.3735704	<0.0001
1st order cosine by year	0.78991137808	26	2.444472234	0.0001	0.789911378	26	2.4444722	0.0001

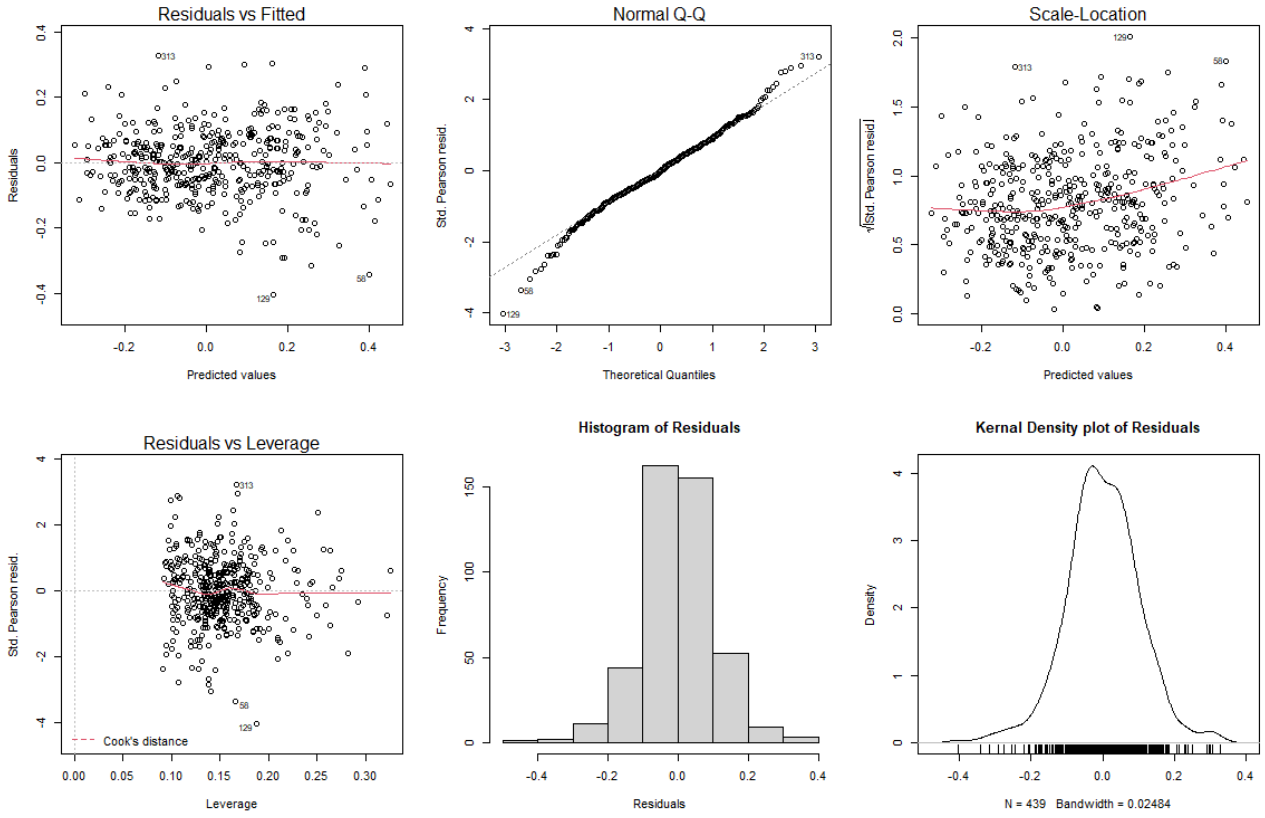


Figure H-5 Final model for site N35 total nitrogen concentrations: residual plots

N39 and N35 total nitrogen concentrations

Table H-11 Final model for upstream/downstream analysis of site N39 and N35 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.216079267847418	0.05745495250557	-3.7608467	0.0002
N39	-0.066910831664043	0.07808795511196	-0.8568649	0.3919
NS04A	0.490522413461490	0.06523364165763	7.5194700	<0.0001
Site by flow				
N35 flow	0.078632596098089	0.01969316661949	3.9928874	<0.0001
N39 flow	0.043156597357477	0.01906983465236	2.2630819	0.0240
NS04A flow	0.011127467649719	0.01323537384608	0.8407369	0.4008
Site by period				
N35 period 3	0.761069504583852	0.57122926230387	1.3323363	0.1832
N39 period 3	1.157645452401541	0.71427344646294	1.6207315	0.1056
NS04A period 3	2.896098910317211	1.10449612744673	2.6220997	0.0090
N35 period 4	-0.172867168207476	0.03480794957376	-4.9663129	<0.0001
N39 period 4	-0.192391743723638	0.03483889892330	-5.5223256	<0.0001
NS04A period 4	-0.011297115905245	0.03444285754608	-0.3279959	0.7430
Site by linear trend				
Period 3: N35	-0.001023713877837	0.00079090254411	-1.2943616	0.1960
Period 3: N39	-0.001498700101904	0.00096651165246	-1.5506281	0.1215
Period 3: NS04A	-0.003703060506863	0.00143030569451	-2.5889993	0.0099
Period 4: N35	-0.000032087762681	0.00003884743966	-0.8259943	0.4091
Period 4: N39	0.000088850427942	0.00003863277529	2.2998717	0.0218
Period 4: NS04A	0.000071000424349	0.00003863340874	1.8377986	0.0666
Site by quadratic trend				
Period 3: N35	0.000000312664011	0.00000026710938	1.1705467	0.2422
Period 3: N39	0.000000429814663	0.00000032014166	1.3425765	0.1799
Period 3: NS04A	0.000001184879335	0.00000045649108	2.5956243	0.0097
Period 4: N35	0.000000032183479	0.00000001199849	2.6822941	0.0075
Period 4: N39	-0.000000013290198	0.00000001201859	-1.1058032	0.2692
Period 4: NS04A	-0.000000005451032	0.00000001198854	-0.4546868	0.6495

Table H-12 Final model for upstream/downstream analysis of site N39 and N35 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	42.32921962	2	1,870.872857	<0.0001	1.27993188	2	56.570611	<0.0001
Site by flow	0.04155542	3	1.224448	0.2999	0.24629460	3	7.257176	<0.0001
Site by period	0.60244263	6	8.875615	<0.0001	0.75086614	6	11.062296	<0.0001
Period 3: Site by linear trend	0.20887575	3	6.154613	0.0004	0.12198179	3	3.594246	0.0135
Period 4: Site by linear trend	1.04339460	3	30.744068	<0.0001	0.10576440	3	3.116393	0.0257
Period 3: Site by quadratic trend	0.19568280	3	5.765878	0.0007	0.11210830	3	3.303319	0.0200
Period 4: Site by quadratic trend	0.11277782	3	3.323047	0.0195	0.09756341	3	2.874747	0.0356
Site by 1st order sine by year	0.58634161	3	17.276807	<0.0001	0.56841422	3	16.748568	<0.0001
Site by 1st order cosine by year	3.38477437	3	99.733825	<0.0001	3.38477437	3	99.733825	<0.0001

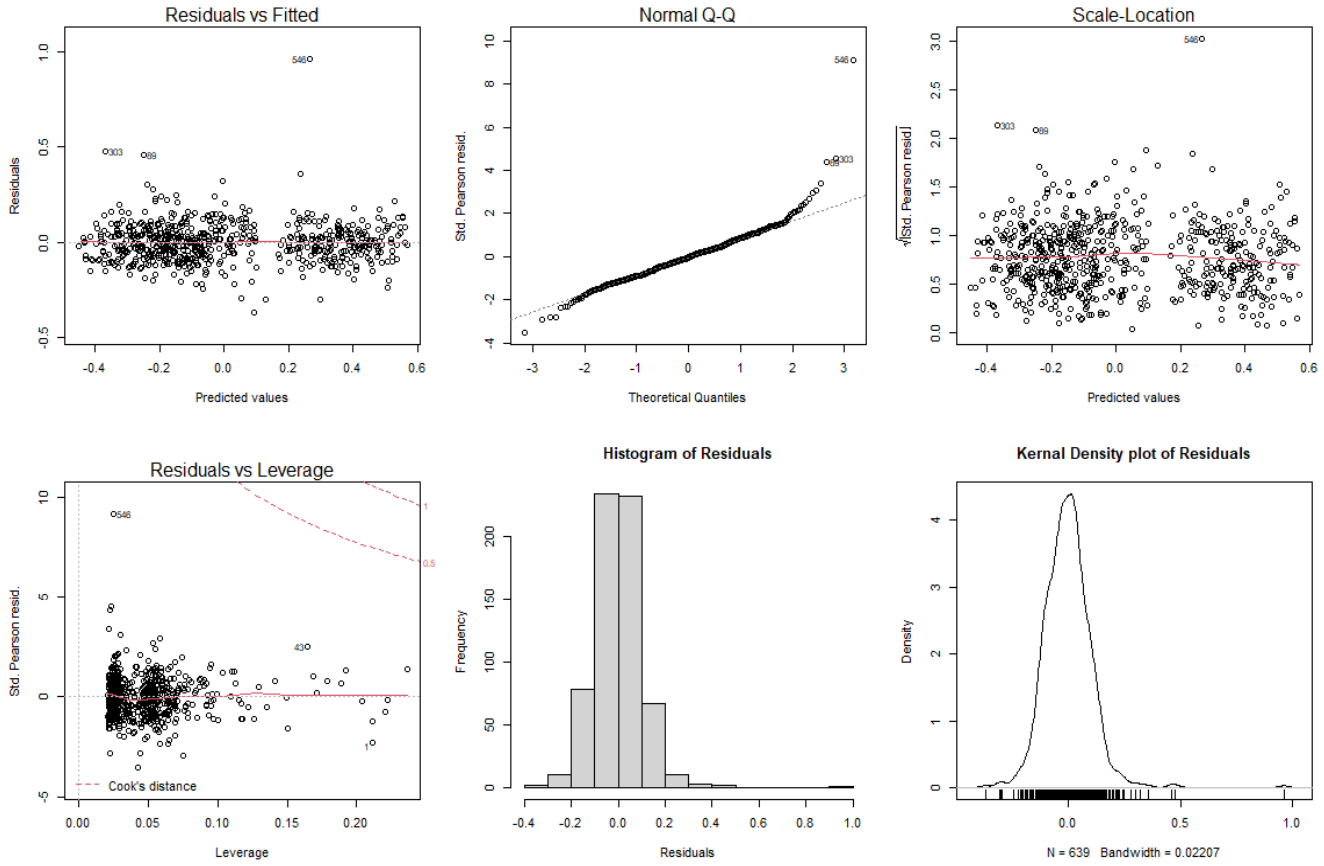


Figure H-6 Final model for upstream/downstream analysis of site N39 and N35 total nitrogen concentrations: residual plots

St Marys WWTP dissolved inorganic nitrogen load

Table H-13 Final model for St Marys WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.74150666700231	0.033472766558086	52.0275689	<0.0001
Period 1	1.32201587238970	1.710246097328141	0.7729975	0.4397
Period 2	0.36656414054218	0.045492558370686	8.0576726	<0.0001
Period 1: Linear trend	0.00052867347772	0.002489427432123	0.2123675	0.8319
Period 2: Linear trend	0.00005884590488	0.000035581218966	1.6538474	0.0984
Period 3: Linear trend	-0.00014644882476	0.000043466157439	-3.3692609	0.0008
Period 1: Quadratic trend	-0.00000069465747	0.000000953408909	-0.7286039	0.4664
Period 2: Quadratic trend	-0.00000003093463	0.000000009159742	-3.3772382	0.0008
Period 3: Quadratic trend	0.00000005896940	0.000000011880386	4.9635932	<0.0001

Table H-14 Final model for St Marys WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	101.9116471	2	919.790389	<0.0001	3.62030456	2	32.67459049	<0.0001
Period 1: Linear trend	6.1876019	1	111.690802	<0.0001	0.00249851	1	0.04509995	0.8319
Period 2: Linear trend	2.0646726	1	37.268872	<0.0001	0.15152902	1	2.73521107	0.0984
Period 3: Linear trend	3.1610881	1	57.059983	<0.0001	0.62888935	1	11.35191902	0.0008
Period 1: Quadratic trend	1.1335671	1	20.461727	<0.0001	0.02940952	1	0.53086368	0.4664
Period 2: Quadratic trend	0.3033986	1	5.476570	0.0194	0.63187090	1	11.40573818	0.0008
Period 3: Quadratic trend	0.5560997	1	10.038012	0.0016	1.36488894	1	24.63725720	<0.0001
1st order cosine by year	5.8373452	25	4.214736	<0.0001	5.68595493	25	4.10542806	<0.0001
1st order sine by year	8.3033527	25	5.995267	<0.0001	8.03607543	25	5.80228475	<0.0001
2nd order cosine by year	2.7305248	25	1.971520	0.0030	2.56324551	25	1.85073927	0.0067
2nd order sine by year	1.8952771	25	1.368446	0.1067	1.87319399	25	1.35250160	0.1152
3rd order cosine by year	2.5462176	25	1.838445	0.0072	2.54715286	25	1.83911989	0.0072
3rd order sine by year	2.1690171	25	1.566095	0.0377	2.16901711	25	1.56609467	0.0377

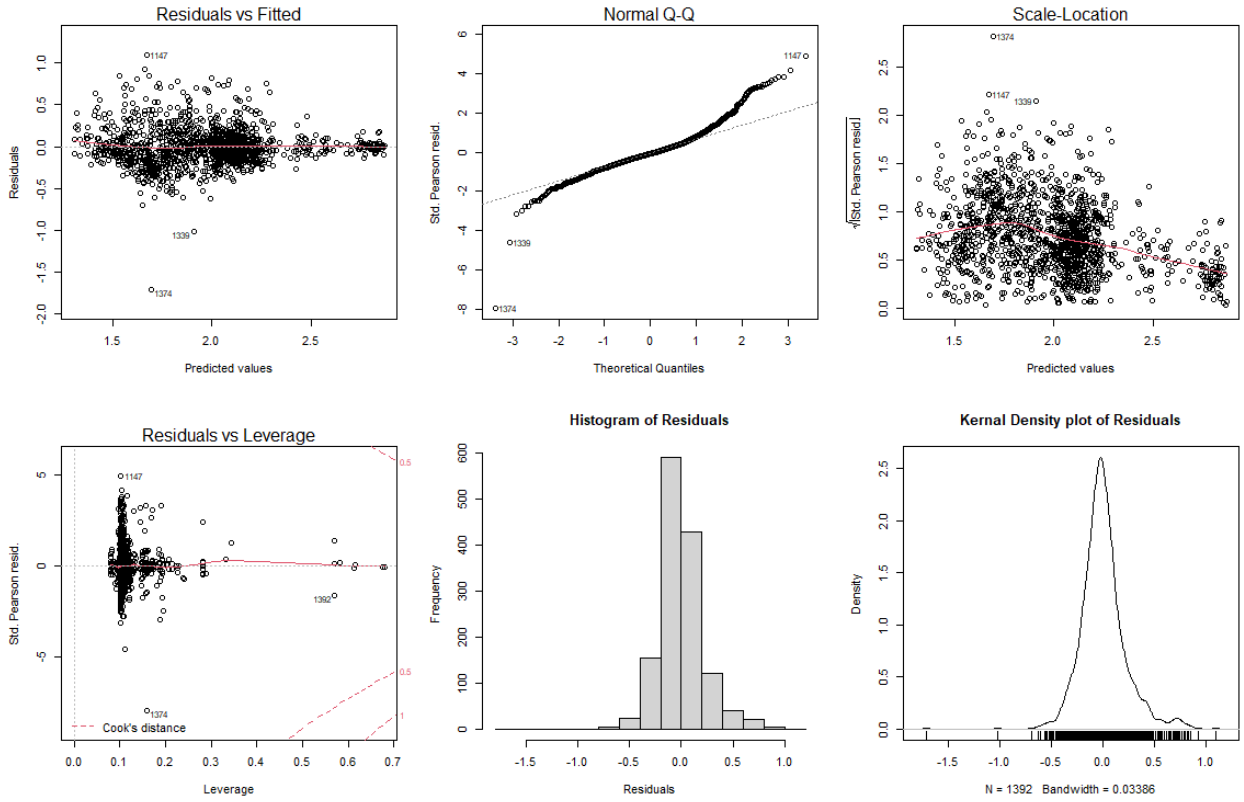


Figure H-7 Final model for St Marys WWTP dissolved inorganic nitrogen load: residual plots

Quakers Hill WWTP dissolved inorganic nitrogen load

Table H-15 Final model for Quakers Hill WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.66300349619746	0.028124662164489	59.129723	<0.0001
Period 1	0.54136813221984	0.064389524926857	8.407705	<0.0001
Period 1: Linear trend	-0.00006668390845	0.000035658811786	-1.870054	0.0618
Period 2: Linear trend	0.00038930499770	0.000051309338250	7.587410	<0.0001
Period 1: Quadratic trend	0.00000000666534	0.000000005315693	1.253899	0.2102
Period 2: Quadratic trend	-0.00000008096439	0.000000014495218	-5.585593	<0.0001

Table H-16 Final model for Quakers Hill WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	2.6745947	1	92.158373	<0.0001	2.05153113	1	70.689504	<0.0001
Period 1: Linear trend	1.5376519	1	52.982794	<0.0001	0.10149194	1	3.497102	0.0618
Period 2: Linear trend	5.9922771	1	206.475587	<0.0001	1.67074554	1	57.568794	<0.0001
Period 1: Quadratic trend	0.2494962	1	8.596878	0.0034	0.04562974	1	1.572262	0.2102
Period 2: Quadratic trend	1.2982015	1	44.732062	<0.0001	0.90544421	1	31.198845	<0.0001
1st order cosine by year	3.8072727	23	5.703783	<0.0001	2.89683560	23	4.339831	<0.0001
1st order sine by year	3.7049815	23	5.550537	<0.0001	3.53143972	23	5.290550	<0.0001
2nd order cosine by year	1.4270690	23	2.137932	0.0014	1.15414023	23	1.729050	0.0179
2nd order sine by year	1.4282242	23	2.139663	0.0014	0.87175082	23	1.305994	0.1521
3rd order cosine by year	1.3838601	23	2.073200	0.0022	1.38741050	23	2.078519	0.0021
3rd order sine by year	0.7997015	23	1.198055	0.2366	0.79970146	23	1.198055	0.2366

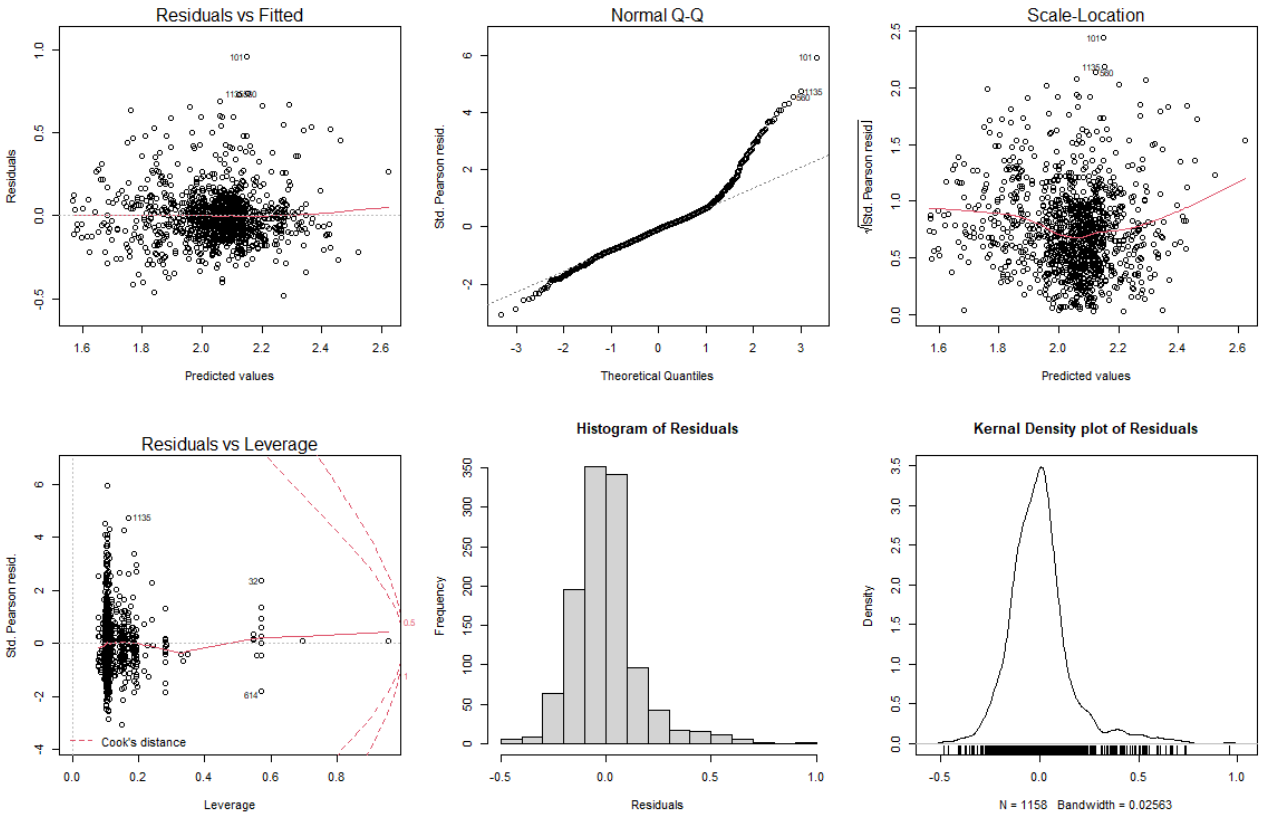


Figure H-8 Final model for Quakers Hill WWTP dissolved inorganic nitrogen load: residual plots

Riverstone WWTP dissolved inorganic nitrogen load

Table H-17 Final model for Riverstone WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.441865627856255	0.42963755075025	1.0284614	0.3041
Period 1	1.950999141165580	1.22681535005689	1.5902957	0.1123
Period 2	0.855556954894593	0.43029159320574	1.9883190	0.0472
Period 3	1.357196242398947	0.18766080763969	7.2321773	<0.0001
Period 1: Linear trend	-0.001509408271871	0.00167318423729	-0.9021172	0.3673
Period 2: Linear trend	-0.000083327198911	0.00004338911619	-1.9204632	0.0553
Period 4: Linear trend	0.001718291556683	0.00713760278713	0.2407379	0.8098
Period 1: Quadratic trend	0.000000629424772	0.00000064119755	0.9816394	0.3267
Period 2: Quadratic trend	0.000000006188888	0.00000001644902	0.3762465	0.7069
Period 4: Quadratic trend	-0.000002190877458	0.00002011119554	-0.1089382	0.9133

Table H-18 Final model for Riverstone WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	60.060761536	3	792.80080436	<0.0001	1.5516081786	3	20.48119572	<0.0001
Period 1: Linear trend	0.001918968	1	0.07599101	0.7829	0.0205509272	1	0.81381543	0.3673
Period 2: Linear trend	1.010792276	1	40.02731111	<0.0001	0.0931359730	1	3.68817872	0.0553
Period 4: Linear trend	0.053779740	1	2.12967434	0.1450	0.0014635058	1	0.05795474	0.8098
Period 1: Quadratic trend	0.321045414	1	12.71337838	0.0004	0.0243337728	1	0.96361589	0.3267
Period 2: Quadratic trend	0.073641886	1	2.91621410	0.0882	0.0035747894	1	0.14156144	0.7069
Period 4: Quadratic trend	0.102628956	1	4.06410028	0.0442	0.0002996856	1	0.01186753	0.9133
1st order cosine by year	1.820369675	15	4.80576838	<0.0001	1.0194514693	15	2.69134764	0.0005
1st order sine by year	3.073748956	15	8.11468447	<0.0001	0.7454952729	15	1.96810442	0.0154
2nd order cosine by year	1.407746976	15	3.71644617	<0.0001	1.5410548265	15	4.06837834	<0.0001
2nd order sine by year	2.337244430	15	6.17031558	<0.0001	1.3274825161	15	3.50454833	<0.0001
3rd order cosine by year	1.200080285	15	3.16820697	<0.0001	0.9975739074	15	2.63359097	0.0007
3rd order sine by year	0.651045889	15	1.71875844	0.0433	0.6510458894	15	1.71875844	0.0433

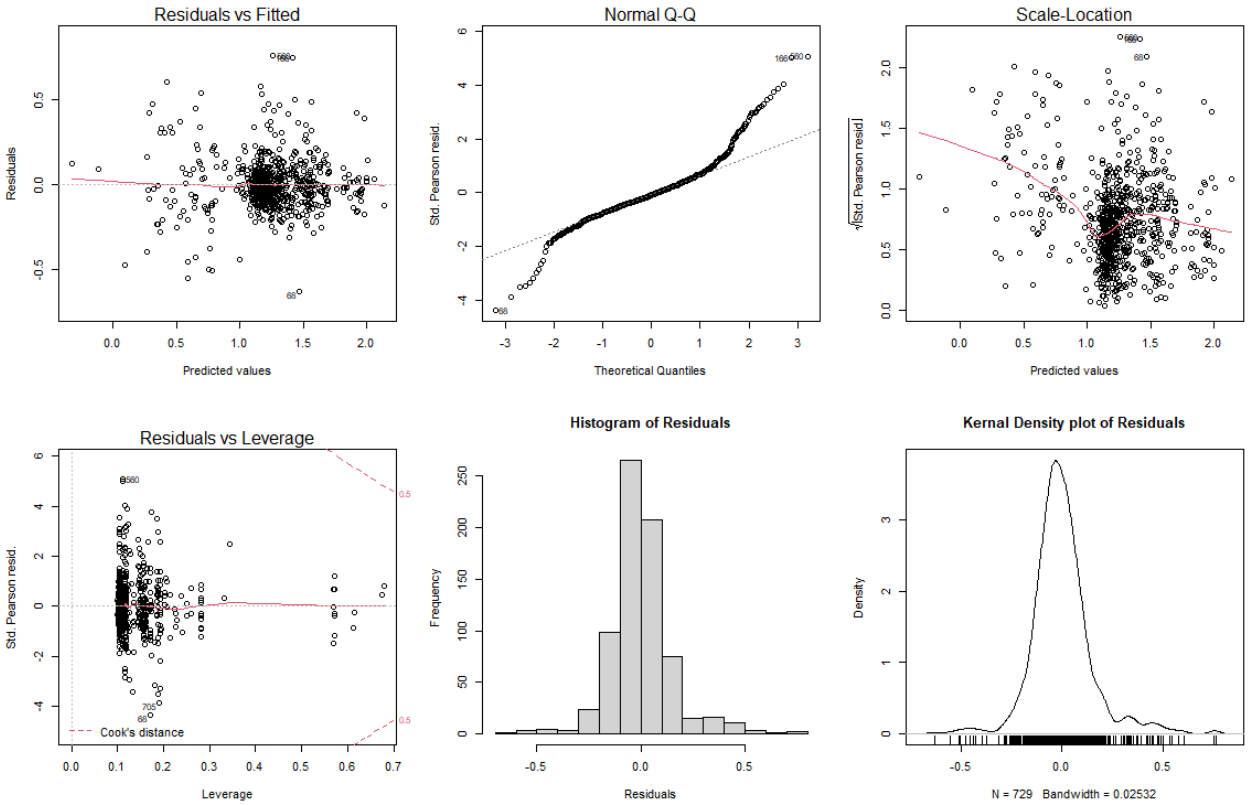


Figure H-9 Final model for Riverstone WWTP dissolved inorganic nitrogen load: residual plots

Richmond WWTP dissolved inorganic nitrogen load

No analyses of DIN were undertaken for Richmond WWTP.

N35 dissolved inorganic nitrogen concentrations

Table H-19 Final model for N35 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.1539806692	0.4635190869	-0.3321992	0.7425
Log_{10}(N39 DIN concentration)	1.1618318305	0.1180013086	9.8459233	<0.0001
Log_{10}(N39 flow)	0.3617966159	0.1472112541	2.4576695	0.0213
Log_{10}(Combined South Creek and Eastern Creek flow)	0.0789611801	0.0500225631	1.5785113	0.1270
Log_{10}(Riverstone WWTP DIN load (lag 1))	-0.0898453193	0.0852082032	-1.0544210	0.3018
Log_{10}(St Marys WWTP DIN load (lag 1))	0.2383547664	0.0871273455	2.7357056	0.0113
Log_{10}(Quakers Hill WWTP DIN load (lag 1))	-0.3794017752	0.2911550351	-1.3030919	0.2044
Linear trend	-0.0004925919	0.0002553134	-1.9293620	0.0651

Table H-20 Final model for N35 total dissolved inorganic nitrogen concentrations: type I and type III sums of squares, mean square and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N39 DIN concentration)	4.37266890	1	122.2367582	<0.0001	3.46782892	1	96.942205	<0.0001
Log_{10}(N39 flow)	0.52284665	1	14.6160344	0.0008	0.21606864	1	6.040140	0.0213
Log_{10}(Combined South Creek and Eastern Creek flow)	0.06375146	1	1.7821544	0.1939	0.08913333	1	2.491698	0.1270
Log_{10}(Riverstone WWTP DIN load (lag 1))	0.06451437	1	1.8034815	0.1914	0.03977158	1	1.111804	0.3018
Log_{10}(St Marys WWTP DIN load (lag 1))	0.27689960	1	7.7406522	0.0101	0.26772165	1	7.484085	0.0113
Log_{10}(Quakers Hill WWTP DIN load (lag 1))	0.01300301	1	0.3634954	0.5520	0.06074281	1	1.698049	0.2044
Linear trend	0.13315951	1	3.7224376	0.0651	0.13315951	1	3.722438	0.0651

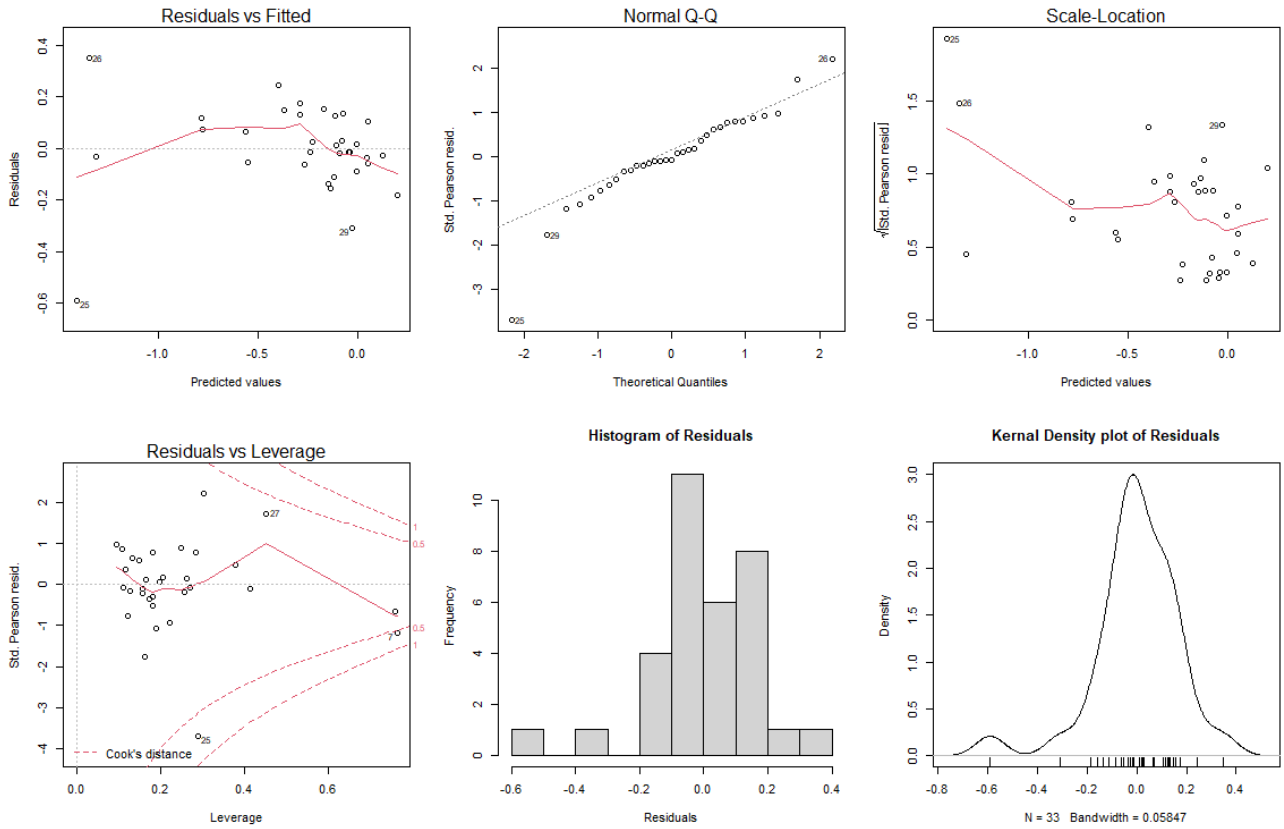


Figure H-10 Final model for N35 dissolved inorganic nitrogen: residual plots

N39 and N35 dissolved inorganic nitrogen concentrations

Table H-21 Final model for upstream/downstream analysis of site N39 and N35 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-1.25153538204131	0.12782623138523	-9.79091199	<0.0001
N39	0.49943178730841	0.17373069828180	2.87474691	0.0042
NS04A	1.37510271084062	0.14513232034822	9.47482068	<0.0001
Site by flow				
N35 flow	0.32228987115234	0.04381351238200	7.35594691	<0.0001
N39 flow	0.10368347441151	0.04242671850636	2.44382498	0.0148
NS04A flow	-0.00233526820897	0.02944616409795	-0.07930636	0.9368
Site by period				
N35 period 3	-1.21168425382322	1.27087536710066	-0.95342493	0.3408
N39 period 3	0.47662632503929	1.58912119596729	0.29993076	0.7643
NS04A period 3	3.69292392017180	2.45729169365178	1.50284312	0.1334
N35 period 4	-0.14425363762588	0.07744100068362	-1.86275534	0.0630
N39 period 4	-0.24898877111671	0.07750985704051	-3.21234977	0.0014
NS04A period 4	-0.01449564161907	0.07662874106156	-0.18916716	0.8500
Site by linear trend				
Period 3: N35	0.00168427939664	0.00175960621666	0.95719109	0.3389
Period 3: N39	-0.00048099990580	0.00215030274564	-0.22368939	0.8231
Period 3: NS04A	-0.00473142841808	0.00318215538756	-1.48686278	0.1376
Period 4: N35	-0.00031305892828	0.00008642809008	-3.62218959	0.0003
Period 4: N39	-0.00011091629093	0.00008595050310	-1.29046704	0.1974
Period 4: NS04A	0.00001141587136	0.00008595191240	0.13281696	0.8944
Site by quadratic trend				
Period 3: N35	-0.00000058977305	0.00000059426705	-0.99243774	0.3214
Period 3: N39	0.00000004842375	0.00000071225368	0.06798667	0.9458
Period 3: NS04A	0.00000152058861	0.00000101560494	1.49722450	0.1349
Period 4: N35	0.00000013704479	0.00000002669434	5.13385271	<0.0001
Period 4: N39	0.00000006222706	0.00000002673906	2.32719724	0.0203

Parameter	Estimate	Standard error	t-Statistic	p-value
Period 4: NS04A	0.00000002336269	0.00000002667220	0.87591905	0.3814

Table H-22 Final model for upstream/downstream analysis of site N39 and N35 dissolved inorganic nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	81.2808930	2	725.784098	<0.0001	6.0560811	2	54.076760	<0.0001
Site by flow	1.4926757	3	8.885731	<0.0001	3.3646707	3	20.029508	<0.0001
Site by period	2.1956917	6	6.535354	<0.0001	0.9561374	6	2.845889	0.0097
Period 3: Site by linear trend	0.6722179	3	4.001638	0.0077	0.1778976	3	1.059004	0.3660
Period 4: Site by linear trend	2.6332156	3	15.675238	<0.0001	0.8289087	3	4.934401	0.0022
Period 3: Site by quadratic trend	0.5517624	3	3.284580	0.0205	0.1809338	3	1.077079	0.3582
Period 4: Site by quadratic trend	1.9670915	3	11.709876	<0.0001	1.8220581	3	10.846508	<0.0001
Site by 1st order sine	2.3467977	3	13.970224	<0.0001	2.2160350	3	13.191809	<0.0001
Site by 1st order cosine	31.2052606	3	185.761426	<0.0001	31.2052606	3	185.761426	<0.0001

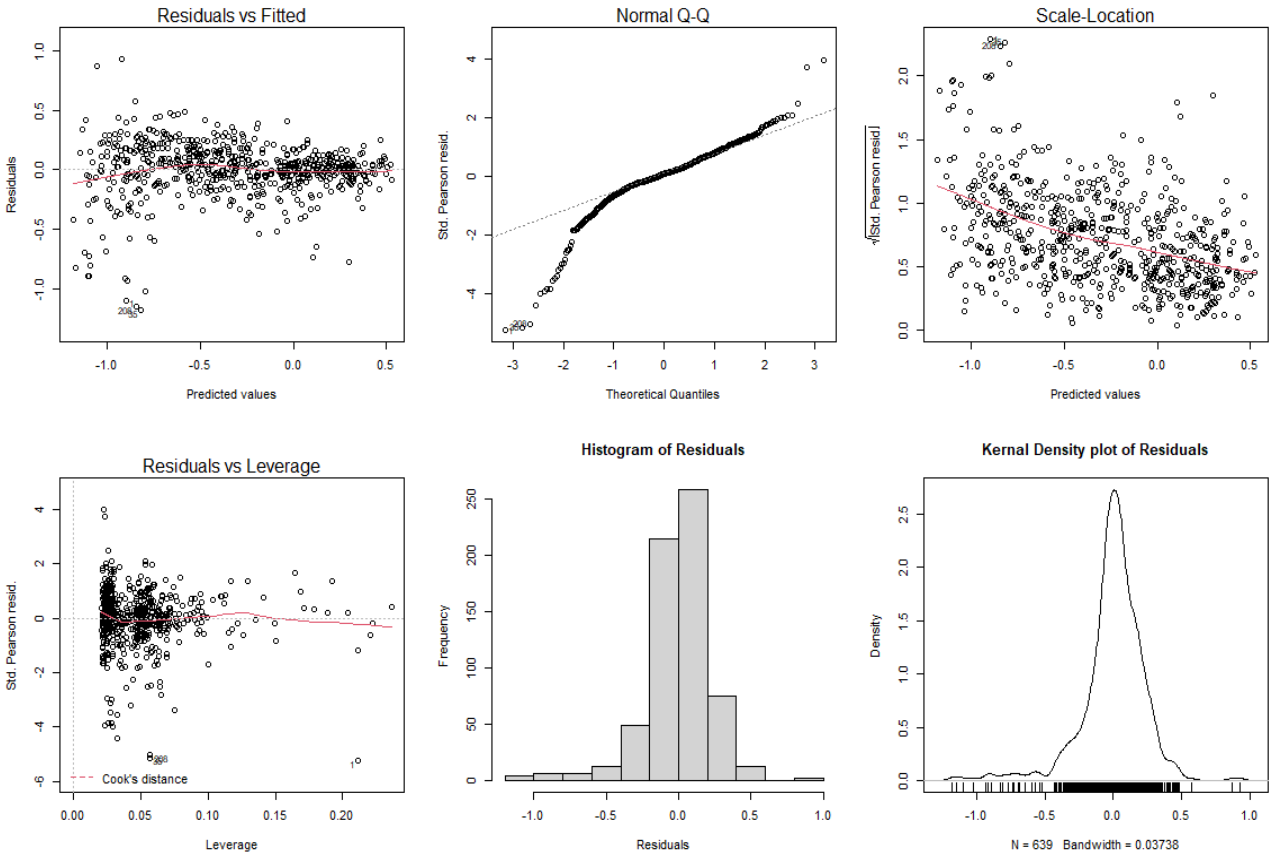


Figure H-11 Final model for upstream/downstream analysis of site N39 and N35 dissolved inorganic nitrogen concentrations: residual plots

St Marys WWTP total phosphorus load

Table H-23 Final model for St Marys WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.26868847150022	0.0161251994892	-16.662645	<0.0001
Period 1	1.54903130172636	0.0622033704920	24.902691	<0.0001
Period 2	0.71265809562859	0.0493402850080	14.443737	<0.0001
Period 1: Linear trend	-0.00062021881579	0.0000598662385	-10.360077	<0.0001
Period 2: Linear trend	-0.00041522075902	0.0000569326214	-7.293196	<0.0001
Period 2: Quadratic trend	0.00000009148759	0.0000000146672	6.237564	<0.0001

Table H-24 Final model for St Marys WWTP total phosphorus load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	202.439386	2	691.923809	<0.0001	112.654594	2	385.045606	<0.0001
Period 1: Linear trend	24.208535	1	165.486194	<0.0001	15.701194	1	107.331187	<0.0001
Period 2: Linear trend	3.669225	1	25.082316	<0.0001	7.781127	1	53.190706	<0.0001
Period 2: Quadratic trend	4.471933	1	30.569516	<0.0001	5.691632	1	38.907210	<0.0001
1st order cosine by year	10.575013	26	2.780359	<0.0001	10.752760	26	2.827091	<0.0001
1st order sine by year	19.196497	26	5.047100	<0.0001	19.119912	26	5.026964	<0.0001
2nd order cosine by year	7.974324	26	2.096591	0.0010	7.616113	26	2.002411	0.0020
2nd order sine by year	9.704103	26	2.551381	<0.0001	11.024536	26	2.898546	<0.0001
3rd order cosine by year	6.541497	26	1.719876	0.0137	6.480277	26	1.703780	0.0152
3rd order sine by year	6.744335	26	1.773205	0.0098	6.744335	26	1.773205	0.0098

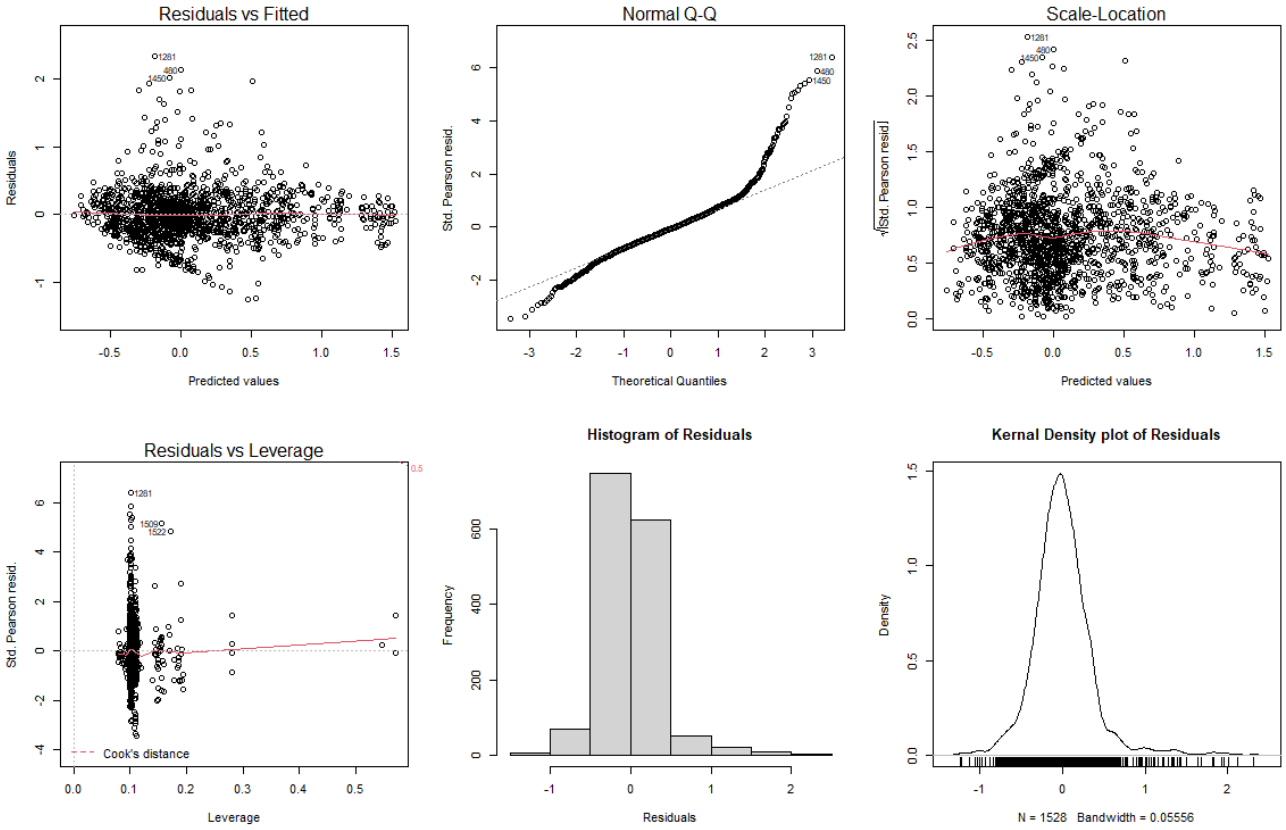


Figure H-12 Final model for St Marys WWTP total phosphorus load: residual plots

Quakers Hill WWTP total phosphorus load

Table H-25 Final model for Quakers Hill WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.06688786912501	0.0467161691806	-1.4317927	0.1524
Period 1	1.09957757196142	0.1766236562909	6.2255396	<0.0001
Period 2	-0.02467862044081	0.0517424993319	-0.4769507	0.6335
Period 1: Linear trend	-0.00053516211273	0.0005360350311	-0.9983715	0.3183
Period 2: Linear trend	0.00006478581604	0.0000107586527	6.0217406	<0.0001
Period 3: Linear trend	0.00034637443391	0.0000607496020	5.7016741	<0.0001
Period 1: Quadratic trend	0.00000008372631	0.0000003620427	0.2312609	0.8171
Period 3: Quadratic trend	-0.00000007291872	0.0000000166184	-4.3878306	<0.0001

Table H-26 Final model for Quakers Hill WWTP total phosphorus load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	76.6347286	2	345.557164	<0.0001	4.725135540	2	21.30632505	<0.0001
Period 1: Linear trend	4.4065952	1	39.739961	<0.0001	0.110524892	1	0.99674571	0.3183
Period 2: Linear trend	4.0557341	1	36.575793	<0.0001	4.020867975	1	36.26135985	<0.0001
Period 3: Linear trend	3.6821584	1	33.206778	<0.0001	3.604794493	1	32.50908786	<0.0001
Period 1: Quadratic trend	0.5509793	1	4.968892	0.0260	0.005930346	1	0.05348159	0.8171
Period 3: Quadratic trend	2.5291515	1	22.808626	<0.0001	2.134889621	1	19.25305711	<0.0001
1st order cosine by year	23.1872019	26	8.042652	<0.0001	22.918247263	26	7.94936294	<0.0001
1st order sine by year	16.6434065	26	5.772888	<0.0001	16.774958082	26	5.81851782	<0.0001
2nd order cosine by year	5.2925274	26	1.835752	0.0065	5.556893812	26	1.92744957	0.0035
2nd order sine by year	6.6655353	26	2.311990	0.0002	6.870942408	26	2.38323701	0.0001
3rd order cosine by year	7.4282248	26	2.576535	<0.0001	7.464353891	26	2.58906615	<0.0001
3rd order sine by year	9.2658222	26	3.213919	<0.0001	9.265822152	26	3.21391869	<0.0001

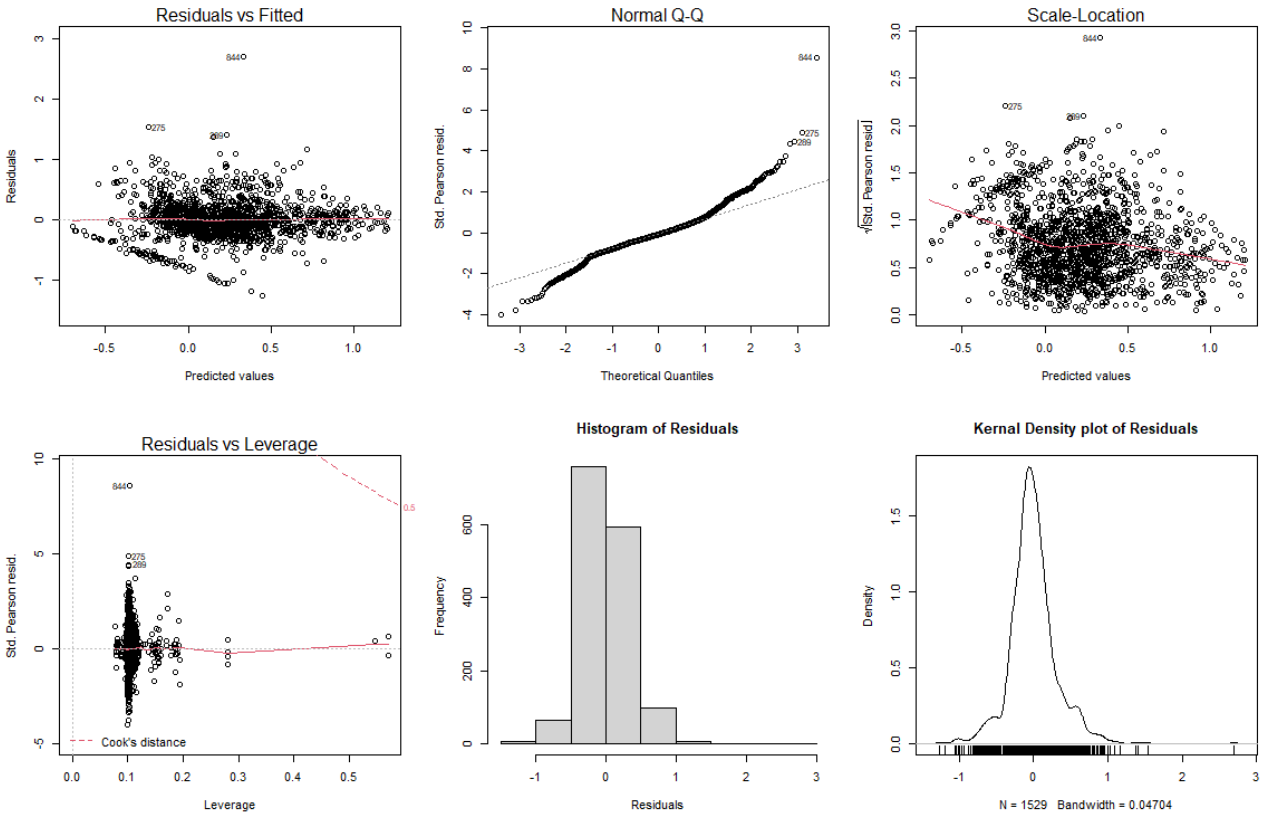


Figure H-13 Final model for Quakers Hill WWTP total phosphorus load: residual plots

Riverstone WWTP total phosphorus load

Table H-27 Final model for Riverstone WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-statistic	p-value
Intercept	-0.7852163208369	0.05270998860058	-14.896917	<0.0001
Period 1	0.1388500808589	0.12797255448643	1.084999	0.2781
Period 2	-0.4865529904461	0.06683122626489	-7.280324	<0.0001
Period 3	-0.2721017670641	0.07604140681392	-3.578337	0.0004
Period 1: Linear trend	0.0012962471196	0.00029309861438	4.422563	<0.0001
Period 2: Linear trend	-0.0003182724642	0.00005114440209	-6.223017	<0.0001
Period 3: Linear trend	-0.0003107360891	0.00007443098076	-4.174822	<0.0001
Period 1: Quadratic trend	-0.0000012053639	0.00000015764136	-7.646241	<0.0001
Period 2: Quadratic trend	0.0000000989765	0.00000001323121	7.480532	<0.0001
Period 3: Quadratic trend	0.0000001841543	0.00000002256147	8.162338	<0.0001

Table H-28 Final model for Riverstone WWTP total phosphorus load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-statistic	p-value	SS	DF	F-statistic	p-value
Period	116.114322	3	334.383043	<0.0001	7.668871	3	22.084619	<0.0001
Period 1: Linear trend	17.918071	1	154.800005	<0.0001	2.263958	1	19.559064	<0.0001
Period 2: Linear trend	4.208367	1	36.357441	<0.0001	4.482520	1	38.725936	<0.0001
Period 3: Linear trend	37.969522	1	328.030965	<0.0001	2.017419	1	17.429138	<0.0001
Period 1: Quadratic trend	20.675620	1	178.623361	<0.0001	6.767313	1	58.465004	<0.0001
Period 2: Quadratic trend	9.770510	1	84.410591	<0.0001	6.477169	1	55.958354	<0.0001
Period 3: Quadratic trend	8.857806	1	76.525443	<0.0001	7.711688	1	66.623761	<0.0001
1st order cosine by year	16.907729	26	5.618128	<0.0001	16.530205	26	5.492684	<0.0001
1st order sine by year	16.914125	26	5.620253	<0.0001	17.409792	26	5.784955	<0.0001
2nd order cosine by year	8.602434	26	2.858431	<0.0001	8.744544	26	2.905651	<0.0001
2nd order sine by year	9.381419	26	3.117273	<0.0001	9.194013	26	3.055002	<0.0001
3rd order cosine by year	8.260957	26	2.744964	<0.0001	8.253638	26	2.742532	<0.0001
3rd order sine by year	12.232526	26	4.064644	<0.0001	12.232526	26	4.064644	<0.0001

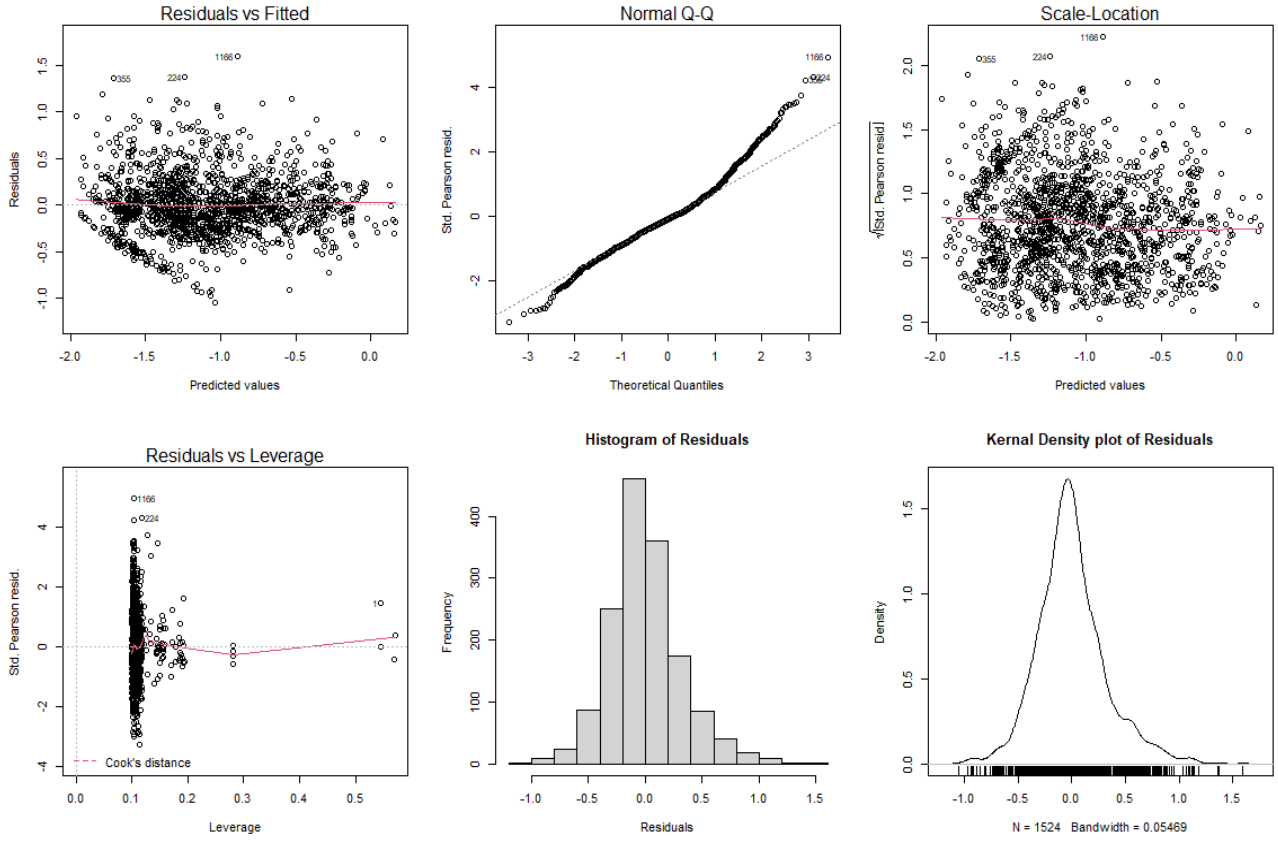


Figure H-14 Final model for Riverstone WWTP total phosphorus load: residual plots

Richmond WWTP total phosphorus load

Table H-29 Final model for Richmond WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-2.19358564636451	0.14567607194906	-15.057968	<0.0001
Linear trend	0.00038613918563	0.00009022871533	4.279560	<0.0001
Quadratic trend	-0.00000003918582	0.00000001307854	-2.996193	0.0029

Table H-30 Final model for Richmond WWTP total phosphorus load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Linear trend	12.357873	1	163.515842	<0.0001	1.3841467	1	18.314632	<0.0001
Quadratic trend	1.138480	1	15.064044	0.0001	0.6784589	1	8.977173	0.0029
1st order cosine by year	2.255086	14	2.131332	0.0100	3.0793241	14	2.910338	0.0003
1st order sine by year	3.819512	14	3.609906	<0.0001	4.3897222	14	4.148825	<0.0001
2nd order cosine by year	3.124633	14	2.953160	0.0003	4.5579833	14	4.307852	<0.0001
2nd order sine by year	3.057667	14	2.889869	0.0004	2.8474352	14	2.691175	0.0009
3rd order cosine by year	2.145194	14	2.027471	0.0153	2.3011908	14	2.174907	0.0084
3rd order sine by year	5.197393	14	4.912172	<0.0001	5.1973928	14	4.912172	<0.0001

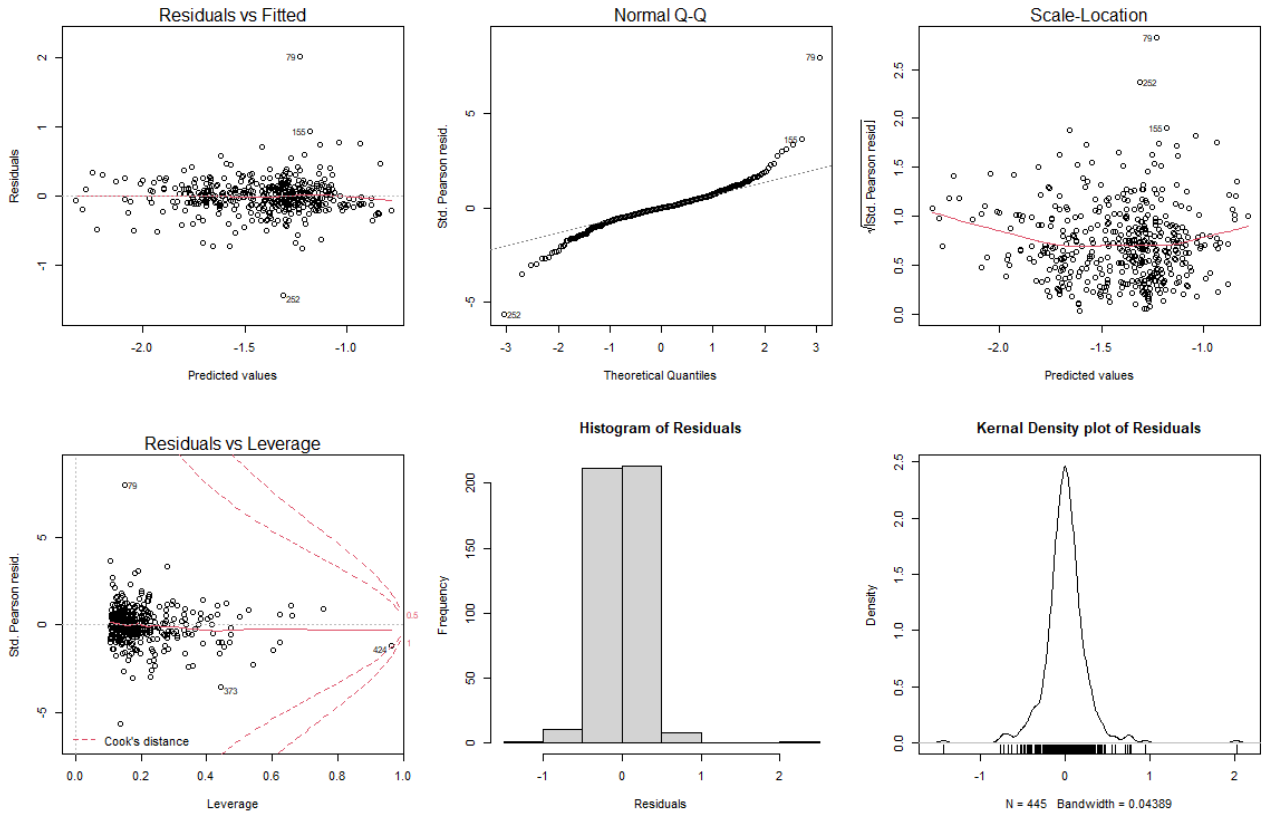


Figure H-15 Final model for Richmond WWTP total phosphorus load: residual plots

N35 total phosphorus concentrations

Table H-31 Final model for site N35 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-1.21810692893583	0.11002440903119	-11.07124264	<0.0001
Log_{10}(N39 TP concentration)	0.20500600528255	0.03903138707304	5.25233717	<0.0001
Log_{10}(N39 flow)	0.11298005627412	0.02434452900334	4.64088076	<0.0001
Log_{10}(Combined South Creek and Eastern Creek flow)	0.02479045373681	0.01278593290496	1.93888502	0.0533
Log_{10}(Riverstone WWTP TP load (lag 1))	0.03320781882677	0.02030047941749	1.63581451	0.1027
Log_{10}(St Marys WWTP TP load (lag 1))	0.02995158760695	0.02002601838018	1.49563368	0.1356
Log_{10}(Quakers Hill WWTP TP load (lag 1))	0.04526823691057	0.02266165627297	1.99756966	0.0465
Period 1	-0.00310482925567	0.08465031221504	-0.03667830	0.9708
Period 2	-0.00760071440901	0.04748696523030	-0.16005896	0.8729
Period 3	-0.03878743408214	0.04492351873039	-0.86341042	0.3885
Period 4	-0.08025365208124	0.05611098879943	-1.43026622	0.1535
Period 1: Linear trend	0.00000536788496	0.00017787578216	0.03017772	0.9759
Period 4: Linear trend	-0.00005721729849	0.00005918966499	-0.96667718	0.3343
Period 1: Quadratic trend	0.00000001954959	0.00000009793670	0.19961451	0.8419
Period 4: Quadratic trend	0.00000002104007	0.00000001841523	1.14253635	0.2540

Table H-32 Final model for site N35 total phosphorus concentrations: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N39 TP concentration)	3.0626648305	1	156.545419932	<0.0001	0.53971476749	1	27.5870457910	<0.0001
Log_{10}(N39 flow)	0.8421238597	1	43.044420644	<0.0001	0.42136642323	1	21.5377742328	<0.0001
Log_{10}(Combined South Creek and Eastern Creek flow)	0.1776199259	1	9.078886337	0.0028	0.07354670401	1	3.7592751088	0.0533
Log_{10}(Riverstone WWTP TP load (lag 1))	1.0993814151	1	56.193914390	<0.0001	0.05235126963	1	2.6758891169	0.1027
Log_{10}(St Marys WWTP TP load (lag 1))	1.4959681907	1	76.465098724	<0.0001	0.04376325130	1	2.2369201109	0.1356
Log_{10}(Quakers Hill WWTP TP load (lag 1))	0.3096506205	1	15.827519205	<0.0001	0.07806618739	1	3.9902845279	0.0465

Period	0.7792164576	4	9.957241024	<0.0001	0.08145690230	4	1.0408994848	0.3859
Period 1: Linear trend	0.0001125553	1	0.005753166	0.9396	0.00001781689	1	0.0009106946	0.9759
Period 4: Linear trend	0.0087902161	1	0.449304169	0.5031	0.01828192989	1	0.9344647718	0.3343
Period 1: Quadratic trend	0.0943571550	1	4.822983015	0.0287	0.00077954884	1	0.0398459538	0.8419
Period 4: Quadratic trend	0.0657577528	1	3.361149716	0.0676	0.02553872186	1	1.3053893125	0.2540
1st order sine by year	1.4266356534	26	2.804662578	<0.0001	1.51566365197	26	2.9796851888	<0.0001
1st order cosine by year	2.8439143252	26	5.590930007	<0.0001	2.84391432519	26	5.5909300074	<0.0001

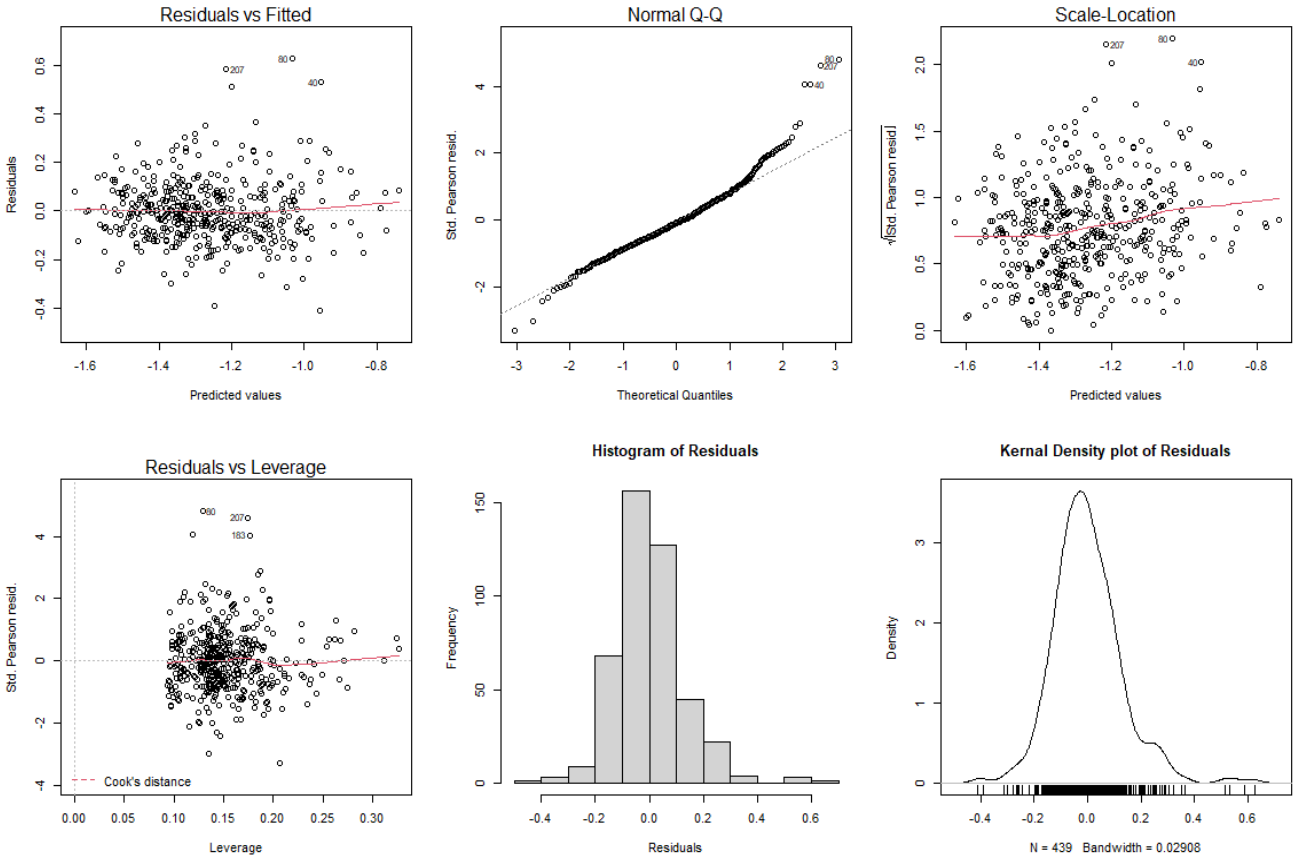


Figure H-16 Final model for site N35 total phosphorus concentrations: residual plots

N39 and N35 total phosphorus concentrations

Table H-33 Final model for upstream/downstream analysis at site N39 and N35 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-1.807719216589047	0.09387025001754	-19.25763718	<0.0001
N39	-0.602518620209755	0.12879114853585	-4.67826110	<0.0001
NS04A	0.528273958883583	0.11496389779430	4.59512916	<0.0001
Site by flow				
N35 flow	0.182442808162173	0.02829512948025	6.44785203	<0.0001
N39 flow	0.161155829831568	0.02726109330877	5.91156884	<0.0001
NS04A flow	0.166930334082576	0.01888680004805	8.83846568	<0.0001
Site by period				
N35 period 3	1.027197834404489	0.81358465595672	1.26255802	0.2072
N39 period 3	2.577966481885347	1.01180453962331	2.54788982	0.0111
NS04A period 3	-5.111579298076377	1.58289587647697	-3.22925808	0.0013
N35 period 4	-0.090573351254914	0.07178186092953	-1.26178606	0.2075
N39 period 4	0.048332478682605	0.07195069222894	0.67174446	0.5020
NS04A period 4	-0.039735336823567	0.07133832178087	-0.55699848	0.5777
Site by linear trend				
Period 3: N35	-0.001435418455693	0.00112239856394	-1.27888479	0.2014
Period 3: N39	-0.003139978420128	0.00136614877334	-2.29841616	0.0219
Period 3: NS04A	0.006576661368003	0.00204878310088	3.21003300	0.0014
Period 4: N35	0.000016191617169	0.00005526213751	0.29299658	0.7696
Period 4: N39	0.000391815138663	0.00005490554168	7.13616744	<0.0001
Period 4: NS04A	0.000164120070626	0.00005485882293	2.99168050	0.0029
Period 5: N35	-0.000021951454671	0.00021829284395	-0.10055966	0.9199
Period 5: N39	0.000593052129240	0.00021786631057	2.72209195	0.0067
Period 5: NS04A	-0.000003257151472	0.00021764731347	-0.01496527	0.9881
Site by quadratic trend				
Period 3: N35	0.000000472394367	0.00000037892078	1.24668373	0.2130
Period 3: N39	0.000000977288780	0.00000045242069	2.16013279	0.0311
Period 3: NS04A	-0.000002086052867	0.00000065399911	-3.18968762	0.0015

Parameter	Estimate	Standard error	t-Statistic	p-value
Period 4: N35	0.000000003680406	0.00000001697464	0.21681792	0.8284
Period 4: N39	-0.000000125803084	0.00000001698539	-7.40654480	<0.0001
Period 4: NS04A	-0.000000054712021	0.00000001691157	-3.23518358	0.0013

Table H-34 Final model for upstream/downstream analysis at site N39 and N35 total phosphorus concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	67.83016137	2	1,445.275590	<0.0001	2.4921693	2	53.101325	<0.0001
Site by flow	5.03637942	3	71.540999	<0.0001	3.6288064	3	51.546639	<0.0001
Site by period	0.67243021	6	4.775884	<0.0001	0.4886230	6	3.470408	0.0022
Period 3: Site by linear trend	0.09996325	3	1.419963	0.2358	0.4041478	3	5.740858	0.0007
Period 4: Site by linear trend	0.10547128	3	1.498203	0.2139	1.4070522	3	19.986962	<0.0001
Period 5: Site by linear trend	0.16123177	3	2.290273	0.0772	0.1741218	3	2.473374	0.0607
Period 3: Site by quadratic trend	0.38977943	3	5.536757	0.0009	0.3847161	3	5.464834	0.0010
Period 4: Site by quadratic trend	1.53399115	3	21.790110	<0.0001	1.5339912	3	21.790110	<0.0001

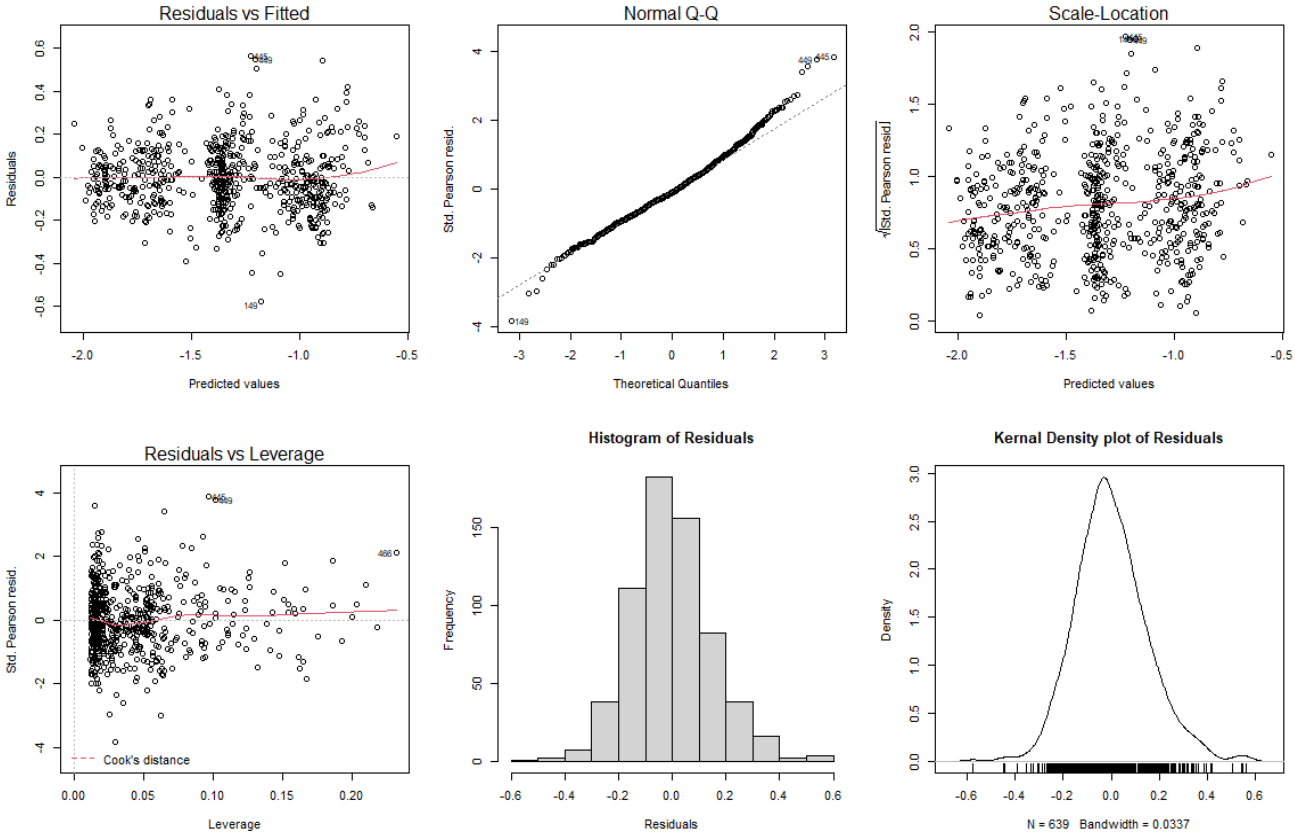


Figure H-17 Final model for upstream/downstream analysis at site N39 and N35 total phosphorus concentrations: residual plots

N35 Chlorophyll-*a*

Table H-35 Final model for site N35 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	2.1114991868202	0.22170751594227	9.5238052	<0.0001
Log_{10}(N39 Chl-*a* concentration)	0.0958359351270	0.04022666427513	2.3823983	0.0177
Log_{10}(N39 flow)	-0.4881276229355	0.04062264467978	-12.0161458	<0.0001
Log_{10}(Combined South Creek and Eastern Creek flow)	-0.0639885538145	0.02117937550207	-3.0212673	0.0027
Log_{10}(Riverstone WWTP TN load (lag 1))	0.1341227856925	0.08298616799544	1.6162065	0.1070
Log_{10}(Riverstone WWTP TP load (lag 1))	-0.0301166794666	0.03013567529844	-0.9993697	0.3183
Log_{10}(St Marys WWTP TN load (lag 1))	0.0086908324795	0.06793070756250	0.1279367	0.8983
Log_{10}(St Marys WWTP TP load (lag 1))	-0.0134023462825	0.03458592601712	-0.3875087	0.6986
Log_{10}(Quakers Hill WWTP TN load (lag 1))	-0.0764644178587	0.08720925013820	-0.8767925	0.3812
Log_{10}(Quakers Hill WWTP TP load (lag 1))	0.0082885254789	0.03640091964374	0.2277010	0.8200
Period 1	0.3055741901878	0.13035795697297	2.3441161	0.0196
Period 2	0.2153252391502	0.12697633793334	1.6957903	0.0908
Period 3	0.0548683454630	0.15427162970772	0.3556606	0.7223
Period 4	0.1962657427801	0.13443881868078	1.4598889	0.1452
Period 3: Linear trend	0.0005138764641	0.00021613377375	2.3775852	0.0180
Period 4: Linear trend	0.0004206216035	0.00008853145647	4.7510977	<0.0001
Period 5: Linear trend	0.0009146655797	0.00060347145787	1.5156733	0.1305
Period 3: Quadratic trend	-0.0000002216849	0.00000010891638	-2.0353677	0.0426
Period 4: Quadratic trend	-0.0000001344755	0.00000002849842	-4.7186996	<0.0001

Table H-36 Final model for site N35 chlorophyll-*a* concentrations: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N39 Chl-*a* concentration)	4.32039115	1	104.3830989	<0.0001	0.2349208751	1	5.67582149	0.0177
Log_{10}(N39 flow)	14.84823538	1	358.7417821	<0.0001	5.9761744128	1	144.38776088	<0.0001
Log_{10}(Combined South Creek and Eastern Creek flow)	0.10176127	1	2.4586099	0.1178	0.3778080189	1	9.12805586	0.0027
Log_{10}(Riverstone WWTP TN load (lag 1))	0.01589689	1	0.3840779	0.5358	0.1081151588	1	2.61212351	0.1070
Log_{10}(Riverstone WWTP TP load (lag 1))	0.02422320	1	0.5852462	0.4448	0.0413375944	1	0.99873971	0.3183
Log_{10}(St Marys WWTP TN load (lag 1))	1.47352191	1	35.6011246	<0.0001	0.0006774595	1	0.01636781	0.8983
Log_{10}(St Marys WWTP TP load (lag 1))	0.09896980	1	2.3911664	0.1229	0.0062152090	1	0.15016297	0.6986
Log_{10}(Quakers Hill WWTP TN load (lag 1))	0.32463132	1	7.8432766	0.0054	0.0318190018	1	0.76876512	0.3812
Log_{10}(Quakers Hill WWTP TP load (lag 1))	0.08300745	1	2.0055070	0.1576	0.0021459654	1	0.05184774	0.8200
Period	1.32677832	4	8.0139290	<0.0001	0.4584700045	4	2.76922379	0.0273
Period 3: Linear trend	0.08990268	1	2.1720998	0.1415	0.2339726337	1	5.65291144	0.0180
Period 4: Linear trend	0.13325005	1	3.2193966	0.0737	0.9342880916	1	22.57292981	<0.0001
Period 5: Linear trend	0.18296346	1	4.4205009	0.0362	0.0950832650	1	2.29726557	0.1305
Period 3: Quadratic trend	0.09423108	1	2.2766762	0.1323	0.1714662531	1	4.14272186	0.0426
Period 4: Quadratic trend	0.87320826	1	21.0972064	<0.0001	0.9215895363	1	22.26612552	<0.0001
1st order sine by year	1.97362194	26	1.8339933	0.0087	2.1815570475	26	2.02721749	0.0026
1st order cosine by year	5.62844507	26	5.2302470	<0.0001	5.6284450702	26	5.23024703	<0.0001

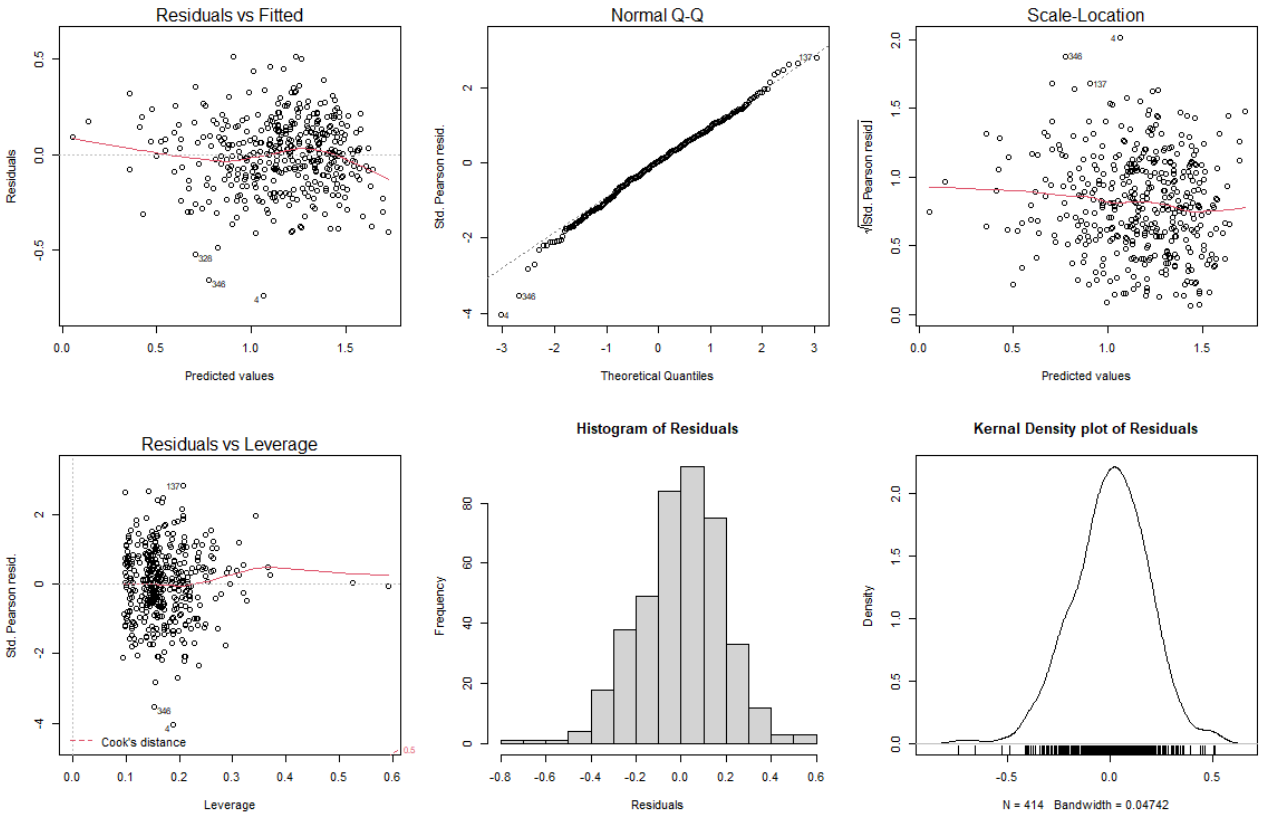


Figure H-18 Final model for site N35 chlorophyll-*a*: residual plots

N39 and N35 chlorophyll-*a* concentrations

Table H-37 Final model for upstream/downstream analysis at site N39 and N35 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	3.4605636762839	0.46608802863618	7.4246998	<0.0001
N39	-2.1706884749609	0.65200784770826	-3.3292367	0.0010
NS04A	-2.7991616169490	0.63082326457351	-4.4373151	<0.0001
Site by flow				
N35 flow	-0.5833969242834	0.06709407030263	-8.6952084	<0.0001
N39 flow	-0.1949060621257	0.06489606937050	-3.0033570	0.0029
NS04A flow	-0.1972634475042	0.03716834181920	-5.3072975	<0.0001
Site by period				
N35 period 3	-0.2588702274851	0.49546161898929	-0.5224829	0.6016
N39 period 3	0.4667761966733	0.54259932280330	0.8602595	0.3902
NS04A period 3	0.8144570772911	0.88424084447213	0.9210806	0.3576
N35 period 4	-0.8878445348111	0.42799140140174	-2.0744448	0.0387
N39 period 4	-0.0971853537401	0.42397940837210	-0.2292219	0.8188
NS04A period 4	0.4199666183857	0.42235665606854	0.9943412	0.3207
Site by linear trend				
Period 3: N35	-0.0003133445866	0.00017704223317	-1.7698861	0.0776
Period 3: N39	-0.0004551053564	0.00022795604229	-1.9964610	0.0466
Period 3: NS04A	-0.0002352687494	0.00048621662986	-0.4838764	0.6288
Period 4: N35	0.0004920912244	0.00010364761643	4.7477331	<0.0001
Period 4: N39	0.0005069756367	0.00010144117246	4.9977305	<0.0001
Period 4: NS04A	0.0004974867008	0.00010448385633	4.7613738	<0.0001
Period 5: N35	-0.0171357172307	0.00886856013352	-1.9321871	0.0541
Period 5: N39	-0.0162170758639	0.00816943452383	-1.9850916	0.0479
Period 5: NS04A	0.0040163778483	0.00803638059046	0.4997745	0.6175
Site by quadratic trend				
Period 4: N35	-0.0000001433466	0.00000003162786	-4.5322886	<0.0001
Period 4: N39	-0.0000001766389	0.00000003117828	-5.6654494	<0.0001
Period 4: NS04A	-0.0000001910826	0.00000003150977	-6.0642329	<0.0001

Parameter	Estimate	Standard error	t-Statistic	p-value
Period 5: N35	0.0000542771326	0.00003730409680	1.4549912	0.1465
Period 5: N39	0.0000758452220	0.00003400663204	2.2303068	0.0263
Period 5: NS04A	-0.0000111008706	0.00003353855577	-0.3309883	0.7408

Table H-38 Final model for upstream/downstream analysis at site N39 and N35 chlorophyll-*a* concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	17.8983086	2	160.0557811	<0.0001	1.1762319	2	10.5184641	<0.0001
Site by flow	9.8019173	3	58.4358207	<0.0001	6.3066312	3	37.5980697	<0.0001
Site by period	7.7034750	6	22.9627976	<0.0001	0.8234819	6	2.4546648	0.0243
Period 3: Site by linear trend	0.5130353	3	3.0585482	0.0283	0.4110977	3	2.4508299	0.0632
Period 4: Site by linear trend	1.2428772	3	7.4096268	<0.0001	3.9244558	3	23.3963202	<0.0001
Period 5: Site by linear trend	0.3354338	3	1.9997466	0.1136	0.4430362	3	2.6412367	0.0492
Period 4: Site by quadratic trend	8.0377313	3	47.9183217	<0.0001	4.9993732	3	29.8046260	<0.0001
Period 5: Site by quadratic trend	0.3321741	3	1.9803134	0.1165	0.4026175	3	2.4002737	0.0675
Site by 1st order sine by year	4.4236169	39	2.0286273	0.0004	4.6255248	39	2.1212203	0.0002
Site by 1st order cosine by year	7.6293292	39	3.4987356	<0.0001	6.8448331	39	3.1389733	<0.0001
Site by 2nd order sine by year	5.8671480	39	2.6906165	<0.0001	5.8288344	39	2.6730463	<0.0001
Site by 2nd order cosine by year	5.9787383	39	2.7417907	<0.0001	6.1759035	39	2.8322088	<0.0001
Site by 3rd order sine by year	2.8744381	39	1.3181891	0.1026	2.8789287	39	1.3202485	0.1014
Site by 3rd order cosine by year	2.1433950	39	0.9829399	0.5030	2.1433950	39	0.9829399	0.5030

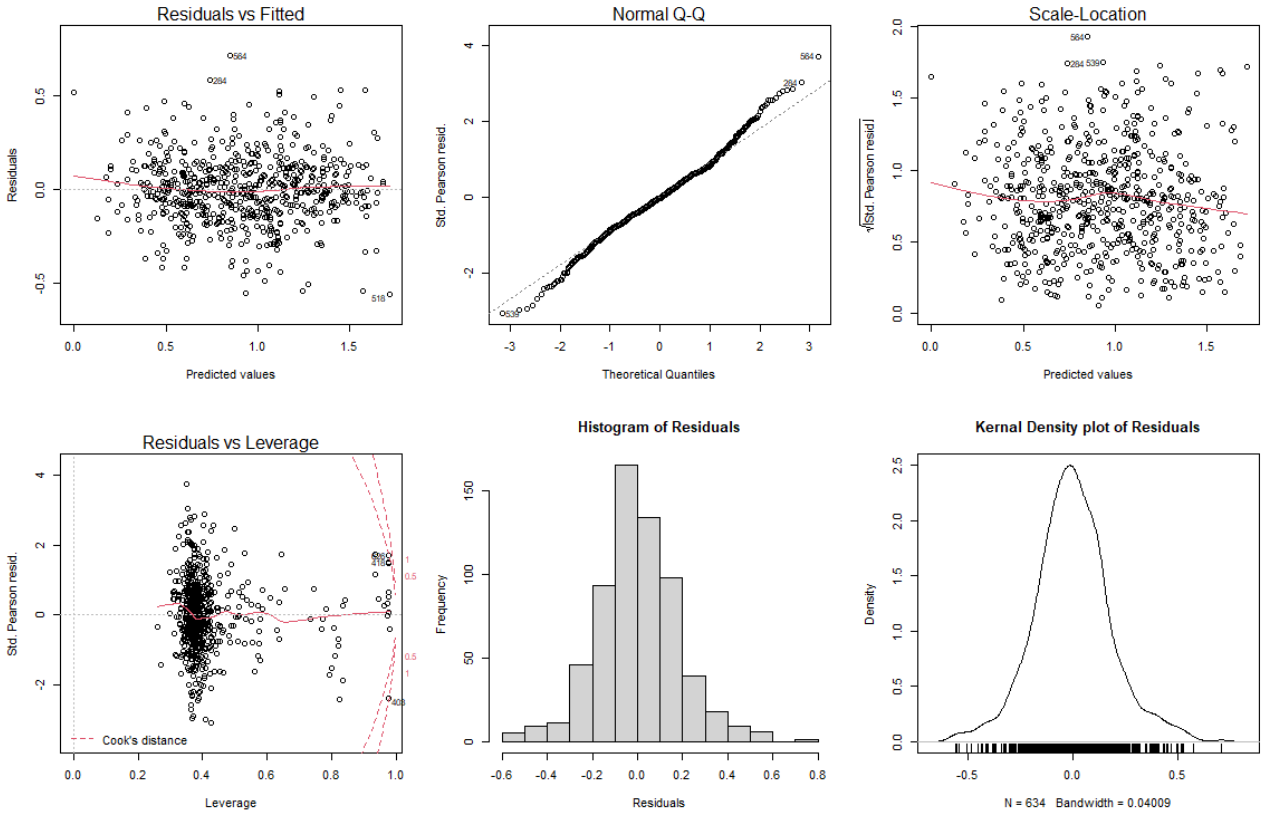


Figure H-19 Final model for upstream/downstream analysis at site N39 and N35 chlorophyll-*a* concentrations: residual plots

Model fit details and example relative changes in the outcome

Table H-39 Model fit details – Hawkesbury River at Wilberforce (N35), South Creek WWTPs (St Marys, Quakers Hill and Riverstone) and Richmond WWTP

Model	Total nitrogen		Dissolved inorganic nitrogen		Total phosphorus		Chlorophyll-*a*	
	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2
St Marys WWTP	0.74	0.70	0.67	0.63	0.60	0.55	NA	NA
Quakers Hill WWTP	0.40	0.33	0.45	0.38	0.51	0.46	NA	NA
Riverstone WWTP	0.79	0.77	0.82	0.79	0.65	0.60	NA	NA
Richmond WWTP	0.55	0.44	NA	NA	0.55	0.44	NA	NA
Site N35	0.72	0.67	0.86	0.82	0.63	0.56	0.69	0.63
Upstream (N39) / downstream (N35)	0.88	0.87	0.78	0.77	0.84	0.83	0.78	0.63

Table H-40 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Hawkesbury at Wilberforce (N35) for prespecified changes at low, medium and high values of the explanatory variables

Parameter	Co-efficient	p- value		Amount of change in X	Low value	% change	Medium value	% change	High value	% change
		type I SS	type III SS							
TN										
Upstream N39 TN concentration (mg/L)	0.19	<0.0001	0.0001	0.1	0.3	5.6	0.6	3.0	0.9	2.0
Upstream N39 flow (ML/day)	-0.06	<0.0001	0.0012	100	850	-0.7	1150	-0.5	1550	-0.4
South/Eastern Creek flow (ML/day)	0.02	0.1121	0.0630	NE	NE	NE	NE	NE	NE	NE
Riverstone TN load (kg/day)	0.06	<0.0001	0.1764	1	5	1.1	10	0.6	80	0.1
St Marys TN load (kg/day)	0.11	<0.0001	0.0025	10	30	3.2	90	1.2	200	0.5
Quakers Hill TN load (kg/day)	0.08	0.9635	0.0507	10	80	0.9	150	0.5	250	0.3
DIN										
Upstream N39 DIN concentration (mg/L)	1.16	<0.0001	<0.0001	0.005	0.3	1.9	0.5	1.2	1	0.6
Upstream N39 flow (ML/day)	0.36	0.0008	0.0213	100	850	4.1	1150	3.0	1550	2.3
South/Eastern Creek flow (ML/day)	0.078	0.1939	0.1270	NE	NE	NE	NE	NE	NE	NE
Riverstone DIN load (kg/day)	-0.0898	0.1914	0.3018	NE	NE	NE	NE	NE	NE	NE

Parameter	Co-efficient	p- value		Amount of change in X	Low value	% change	Medium value	% change	High value	% change
		type I SS	type III SS							
St Marys DIN load (kg/day)	0.238	0.0101	0.0113	5	30	3.7	50	2.3	100	1.2
Quakers Hill DIN load (kg/day)	-0.379	0.5520	0.2044	NE	NE	NE	NE	NE	NE	NE
TP										
Upstream N39 TP concentration (mg/L)	0.21	<0.0001	<0.0001	0.005	0.01	8.9	0.02	4.8	0.03	3.3
Upstream N39 flow (ML/day)	0.11	<0.0001	<0.0001	100	850	1.2	1150	0.9	1550	0.7
South/Eastern Creek flow (ML/day)	0.02	0.0028	0.0533	50	100	0.8	250	0.4	400	0.2
Riverstone TP load (mg/day)	0.033	<0.0001	0.1027	0.05	0.15	1.0	0.25	0.6	0.5	0.3
St Marys TP load (mg/day)	0.03	<0.0001	0.1356	0.1	0.3	0.9	0.5	0.5	1	0.3
Quakers Hill TP load (mg/day)	0.045	<0.0001	0.0465	0.1	0.8	0.5	2.5	0.2	8	0.1
Chl-*a*										
Upstream N39 Chl-*a* concentration (µg/L)	0.1	<0.0001	0.0177	0.5	3	1.6	10	0.5	15	0.3
Upstream N39 flow (ML/day)	-0.49	<0.0001	<0.0001	100	850	-5.3	1150	-4.0	1550	-3.0
South/Eastern Creek flow (ML/day)	-0.06	0.1178	0.0027	10	100	-0.6	250	-0.2	400	-0.1
Riverstone TN load (kg/day)	0.13	0.5358	0.1070	NE	NE	NE	NE	NE	NE	NE
Riverstone TP load (kg/day)	-0.03	0.4448	0.3183	NE	NE	NE	NE	NE	NE	NE
St Marys TN load (kg/day)	0.009	<0.0001	0.8983	10	30	0.3	90	0.1	200	0.1
St Marys TP load (kg/day)	-0.013	0.1229	0.6986	NE	NE	NE	NE	NE	NE	NE
Quakers Hill TN load (kg/day)	-0.08	0.0054	0.3812	10	80	-0.9	150	-0.5	250	-0.3
Quakers Hill TP load (kg/day)	0.008	0.1576	0.8200	NE	NE	NE	NE	NE	NE	NE

NE= Not estimated

Table H-41 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Hawkesbury River – Wilberforce (N35) and Freemans Reach (N39) and South Creek (NS04A) for prespecified changes at low, medium and high values of the explanatory variables

Parameter (flow ML/day)	Coefficient	p-value	Amount of change in X	Low value	%change	Medium value	% change	High value	% change
TN									
N35 flow	0.08	<0.0001	100	1000	0.8	1300	0.6	1600	0.5
N39 flow	0.04	0.02	100	850	0.4	1150	0.3	1550	0.3
NS04A flow	0.01	0.4	NE	NE	NE	NE	NE	NE	NE
DIN									
N35 flow	0.3	<0.0001	100	1000	2.9	1300	2.2	1600	1.8
N39 flow	0.1	0.01	100	850	1.1	1150	0.8	1550	0.6
NS04A flow	-0.002	0.9	NE	NE	NE	NE	NE	NE	NE
TP									
N35 flow	0.18	<0.0001	100	1000	1.7	1300	1.3	1600	1.1
N39 flow	0.16	<0.0001	100	850	1.8	1150	1.3	1550	1.0
NS04A flow	0.17	<0.0001	10	100	1.6	250	0.7	400	0.4
Chl-*a*									
N35 flow	-0.6	<0.0001	100	1000	-5.6	1300	-4.3	1600	-3.6
N39 flow	-0.2	0.003	100	850	-2.2	1150	-1.7	1550	-1.2
NS04A flow	-0.2	<0.0001	10	100	-1.9	250	-0.8	400	-0.5

NE= Not estimated

Appendix I : Statistical analysis outcomes of Hawkesbury River at Cattai SRA – Cattai Creek WWTPs (Castle Hill and Rouse Hill)

Castle Hill WWTP total nitrogen load

Table I-1 Final model for Castle Hill WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	2.057018803682463	0.011040312865356	186.318887	<0.0001
Period 1	-0.084681181888333	0.035472991100453	-2.387202	0.0171
Period 1: Linear trend	-0.000105933965122	0.000070947991190	-1.493121	0.1356
Period 2: Linear trend	-0.000049158404880	0.000007345354611	-6.692448	<0.0001
Period 1: Quadratic trend	0.000000071425347	0.000000031879600	2.240472	0.0252
Period 2: Quadratic trend	0.000000005991983	0.000000001023058	5.856933	<0.0001

Table I-2 Final model for Castle Hill WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	0.05062535	1	3.257215	0.0713	0.08857268	1	5.698732	0.0171
Period 1: Linear trend	0.03112545	1	2.002599	0.1573	0.03465068	1	2.229412	0.1356
Period 2: Linear trend	0.21616743	1	13.908128	0.0002	0.69613200	1	44.788862	<0.0001
Period 1: Quadratic trend	0.55669138	1	35.817307	<0.0001	0.07801903	1	5.019714	0.0252
Period 2: Quadratic trend	0.58846650	1	37.861706	<0.0001	0.53316559	1	34.303667	<0.0001
1st order cosine by year	1.09526393	26	2.710341	<0.0001	1.08452911	26	2.683776	<0.0001
1st order sine by year	3.04108802	26	7.525478	<0.0001	3.04732147	26	7.540903	<0.0001
2nd order cosine by year	0.66176300	26	1.637599	0.0229	0.69653721	26	1.723651	0.0134
2nd order sine by year	1.05759666	26	2.617129	<0.0001	0.92571865	26	2.290784	0.0002
3rd order cosine by year	1.12598081	26	2.786353	<0.0001	1.12647775	26	2.787582	<0.0001
3rd order sine by year	0.93921579	26	2.324184	0.0002	0.93921579	26	2.324184	0.0002

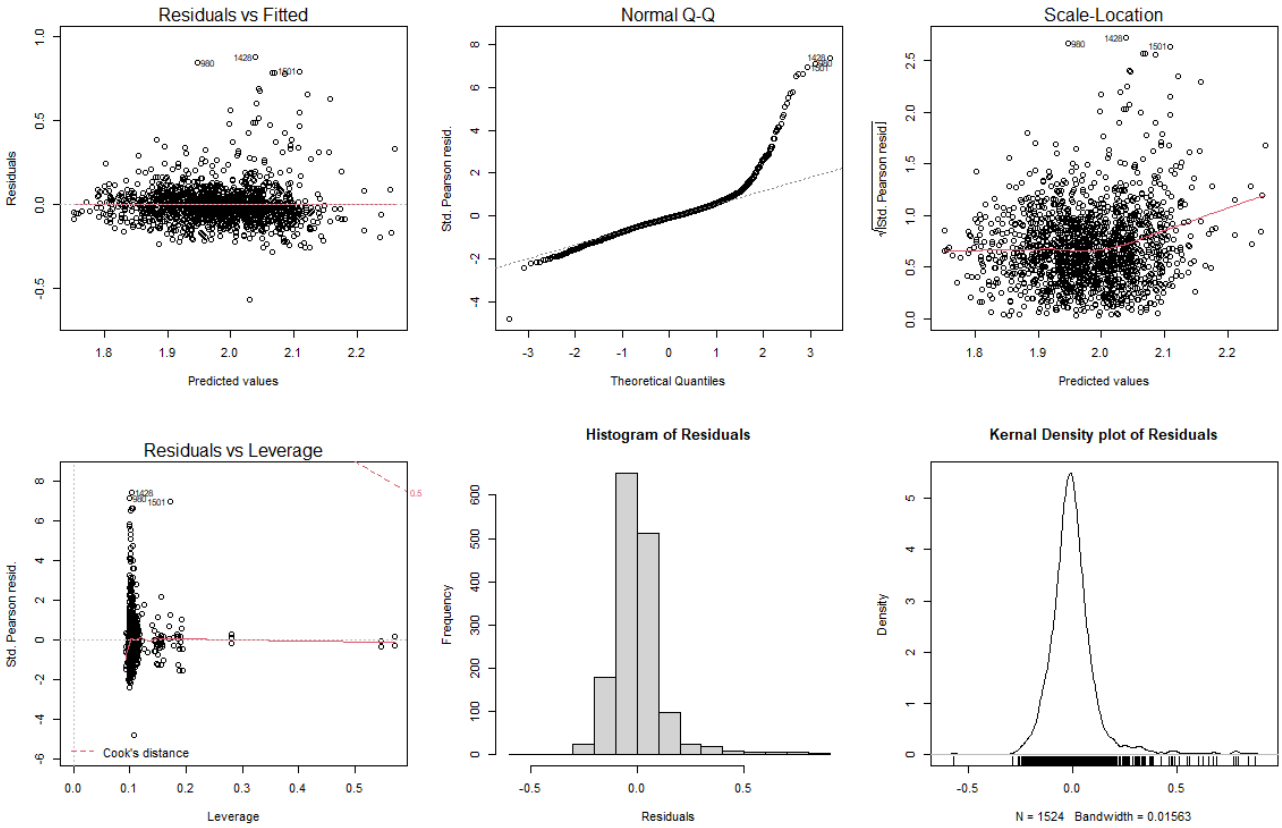


Figure I-1 Final model for Castle Hill WWTP total nitrogen load: residual plots

Rouse Hill total nitrogen load

Table I-3 Final model for Rouse Hill WWTP total nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.63148956982852	0.022979213084449	70.998496	<0.0001
Period 1	-1.35847372462820	0.036467394557452	-37.251735	<0.0001
Period 1: Linear trend	0.00068857113248	0.000020836341891	33.046642	<0.0001
Period 2: Linear trend	0.00031434818099	0.000029199784361	10.765428	<0.0001
Period 1: Quadratic trend	-0.00000007852238	0.000000003311217	-23.714055	<0.0001
Period 2: Quadratic trend	-0.00000006175591	0.000000007733328	-7.985683	<0.0001

Table I-4 Final model for Rouse Hill WWTP total nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	90.747928	1	2,615.017148	<0.0001	48.156531	1	1,387.691774	<0.0001
Period 1: Linear trend	100.658585	1	2,900.605363	<0.0001	37.898049	1	1,092.080552	<0.0001
Period 2: Linear trend	6.132292	1	176.709796	<0.0001	4.021840	1	115.894444	<0.0001
Period 1: Quadratic trend	24.809385	1	714.914041	<0.0001	19.515237	1	562.356405	<0.0001
Period 2: Quadratic trend	2.010087	1	57.923225	<0.0001	2.213025	1	63.771127	<0.0001
1st order cosine by year	7.064964	26	7.830228	<0.0001	7.046873	26	7.810178	<0.0001
1st order sine by year	5.145271	26	5.702597	<0.0001	4.783095	26	5.301191	<0.0001
2nd order cosine by year	2.134864	26	2.366109	0.0001	1.973380	26	2.187133	0.0005
2nd order sine by year	3.071696	26	3.404417	<0.0001	2.861526	26	3.171481	<0.0001
3rd order cosine by year	2.007799	26	2.225280	0.0004	1.994075	26	2.210069	0.0004
3rd order sine by year	1.991917	26	2.207678	0.0005	1.991917	26	2.207678	0.0005

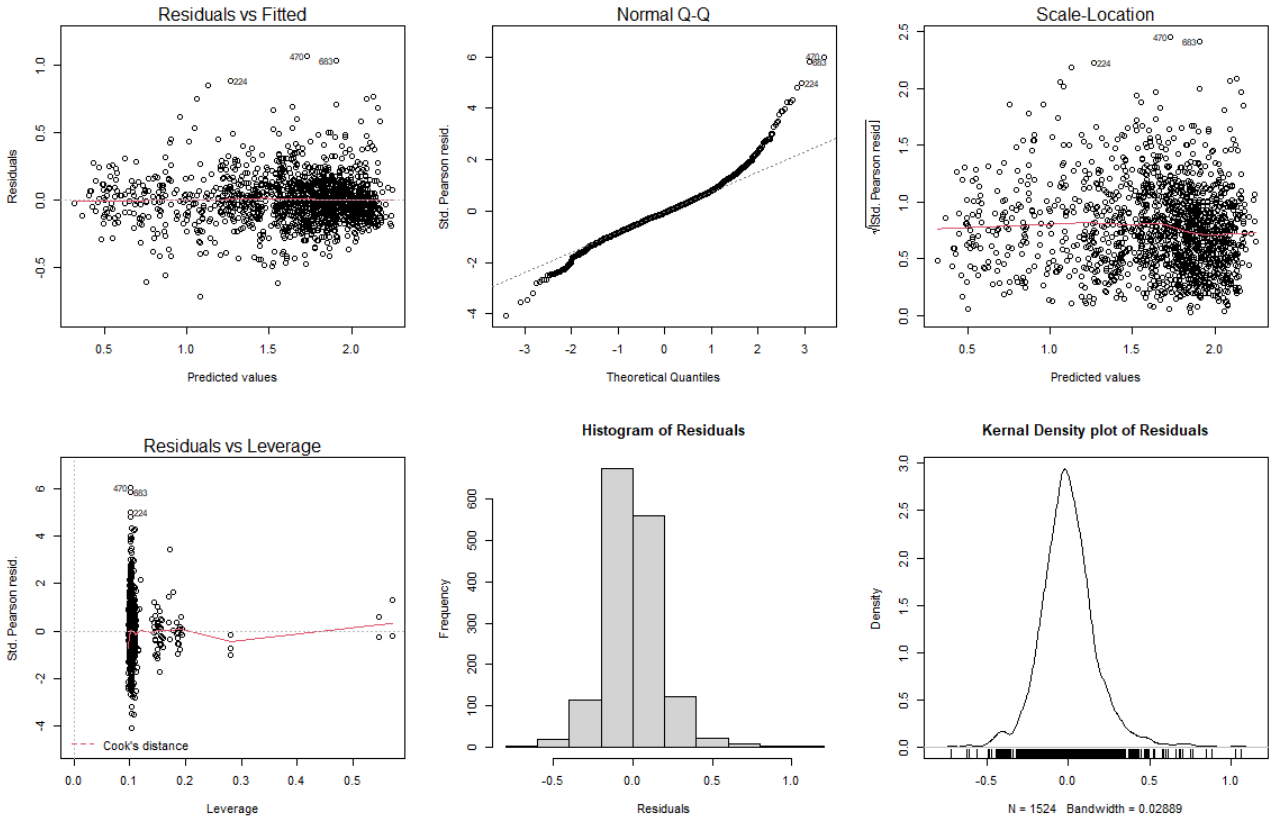


Figure I-2 Final model for Rouse Hill WWTP total nitrogen load: residual plots

N3001 total nitrogen concentrations

Table I-5 Final model for site N3001 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.30807073965	0.070954994926	-4.3417766	<0.0001
Log_{10}(N35 TN concentration)	0.82224870421	0.044356941907	18.5370918	<0.0001
Log_{10}(N35 flow)	0.05278595331	0.016223676600	3.2536369	0.0013
Log_{10}(Cattai Creek flow)	0.00727905634	0.007283720778	0.9993596	0.3188
Log_{10}(Castle Hill WWTP TN load (lag 1))	0.08242481901	0.035427158917	2.3265997	0.0210
Log_{10}(Rouse Hill WWTP TN load (lag 1))	-0.04954896902	0.035971022823	-1.3774690	0.1699
Period 1: Linear trend	0.00001133763	0.000005090009	2.2274284	0.0271
1st order sine	-0.02288456376	0.007845390758	-2.9169438	0.0039
1st order cosine	-0.01999877032	0.008530746909	-2.3443165	0.0201

Table I-6 Final model for site N3001 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N35 TN concentration)	3.6630046029	1	701.2664794	<0.0001	1.794888958	1	343.6237725	<0.0001
Log_{10}(N35 flow)	0.0996961220	1	19.0863938	<0.0001	0.055295853	1	10.5861533	0.0013
Log_{10}(Cattai Creek flow)	0.0009396406	1	0.1798901	0.6719	0.005216725	1	0.9987196	0.3188
Log_{10}(Castle Hill WWTP TN load (lag 1))	0.0068194869	1	1.3055614	0.2546	0.028274683	1	5.4130664	0.0210
Log_{10}(Rouse Hill WWTP TN load (lag 1))	0.0011602887	1	0.2221323	0.6379	0.009911013	1	1.8974209	0.1699
Period 1: Linear trend	0.0122462179	1	2.3444858	0.1273	0.025915636	1	4.9614371	0.0271
1st order sine	0.0360924529	1	6.9097449	0.0092	0.044443730	1	8.5085610	0.0039
1st order cosine	0.0287069369	1	5.4958196	0.0201	0.028706937	1	5.4958196	0.0201

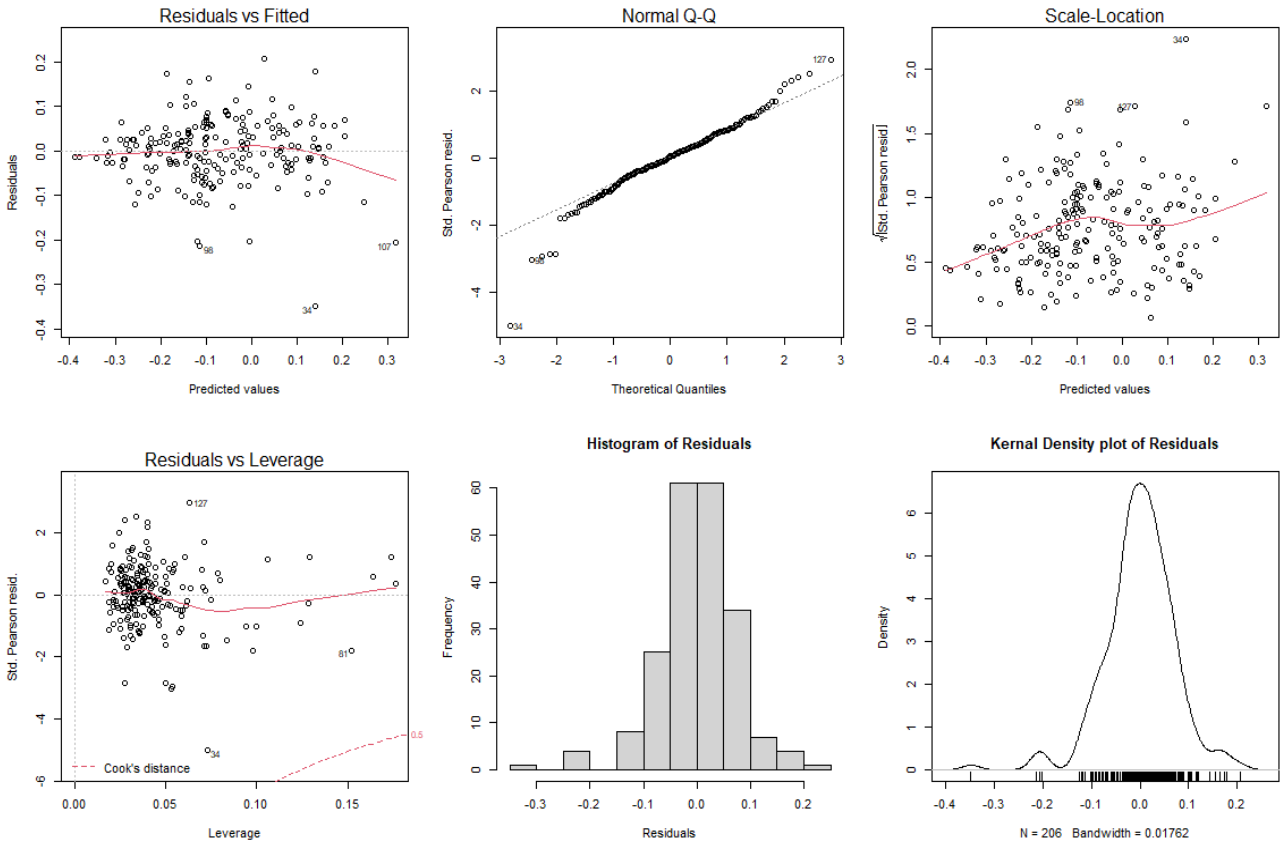


Figure I-3 Final model for site N3001 total nitrogen concentrations: residual plots

N35 and N3001 total nitrogen concentrations

Table I-7 Final model for upstream/downstream analysis of site N35 and N3001 total nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.886029605591976	0.311465734044982	2.8447097	0.0046
N35	0.433241725805195	0.394179911777287	1.0990964	0.2722
NC11A	-1.076010549443428	0.396995249528991	-2.7103865	0.0069
Site by flow				
N3001 flow	0.167206025756176	0.023253811027781	7.1904784	<0.0001
N35 flow	0.113030859442944	0.022262205697522	5.0772534	<0.0001
NC11A flow	0.029088762423418	0.010916563373720	2.6646447	0.0079
Site by linear trend				
N3001	-0.000471096105707	0.000095965063093	-4.9090376	<0.0001
N35	-0.000551461053893	0.000076204136322	-7.2366289	<0.0001
NC11A	0.000079617866063	0.000073935938620	1.0768493	0.2820
Site by quadratic trend				
N3001	0.000000036750244	0.000000006933032	5.3007461	<0.0001
N35	0.000000042285990	0.000000005637527	7.5008046	<0.0001
NC11A	-0.000000003575781	0.000000005428016	-0.6587639	0.5103

Table I-8 Final model for upstream/downstream analysis of site N35 and N3001 total nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	11.5940426	2	467.630785	<0.0001	0.2466007	2	9.946322	<0.0001
Site by flow	0.2220081	3	5.969607	0.0005	1.0485250	3	28.193938	<0.0001
Site by linear trend	0.6893904	3	18.537115	<0.0001	0.9623098	3	25.875684	<0.0001
Site by quadratic trend	1.0821212	3	29.097310	<0.0001	1.0511548	3	28.264649	<0.0001
Site by 1st order sine by year	3.6132038	39	7.473534	<0.0001	3.7262032	39	7.707262	<0.0001
Site by 1st order cosine by year	5.6813269	39	11.751231	<0.0001	5.6813269	39	11.751231	<0.0001

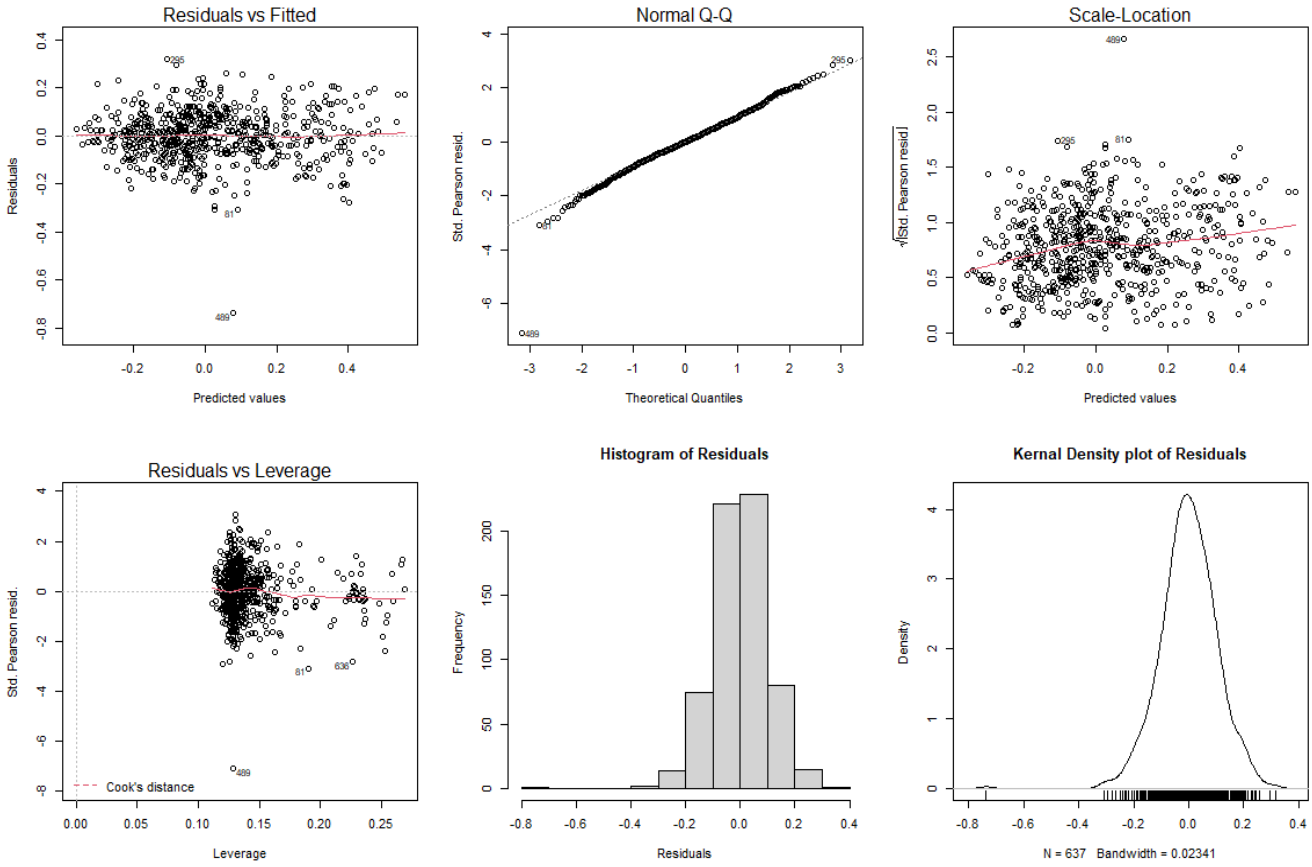


Figure I-4 Final model for upstream/downstream analysis of site N35 and N3001 total nitrogen concentrations: residual plots

Castle Hill WWTP dissolved inorganic nitrogen load

Table I-9 Final model for Castle Hill WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	2.004846968609069	0.013908833721059	144.1419898	<0.0001
Period 1	-0.844100998655358	0.795331659382299	-1.0613195	0.2889
Period 1: Linear trend	0.000959514850789	0.000987822133182	0.9713437	0.3317
Period 2: Linear trend	-0.000045484816829	0.000013914712847	-3.2688290	0.0011
Period 1: Quadratic trend	-0.000000293734737	0.000000302874864	-0.9698221	0.3325
Period 2: Quadratic trend	0.000000005908966	0.000000001869173	3.1612736	0.0016

Table I-10 Final model for Castle Hill WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	0.1005350197	1	6.74590431	0.0096	0.01678686	1	1.1263991	0.2889
Period 1: Linear trend	0.1312397961	1	8.80619618	0.0031	0.01406122	1	0.9435087	0.3317
Period 2: Linear trend	0.0008706699	1	0.05842199	0.8091	0.15924346	1	10.6852430	0.0011
Period 1: Quadratic trend	0.2124275939	1	14.25390103	0.0002	0.01401720	1	0.9405549	0.3325
Period 2: Quadratic trend	0.1012472078	1	6.79369216	0.0094	0.14893657	1	9.9936506	0.0016
1st order cosine by year	0.5549035660	17	2.19023847	0.0038	0.33443305	17	1.3200278	0.1729
1st order sine by year	0.9917538381	17	3.91451334	<0.0001	1.06687634	17	4.2110265	<0.0001
2nd order cosine by year	0.4929652300	17	1.94576405	0.0126	0.53686328	17	2.1190323	0.0054
2nd order sine by year	0.5832047247	17	2.30194489	0.0021	0.34247072	17	1.3517530	0.1545
3rd order cosine by year	0.5172845805	17	2.04175403	0.0079	0.52099356	17	2.0563936	0.0074
3rd order sine by year	0.4651040152	17	1.83579413	0.0209	0.46510402	17	1.8357941	0.0209

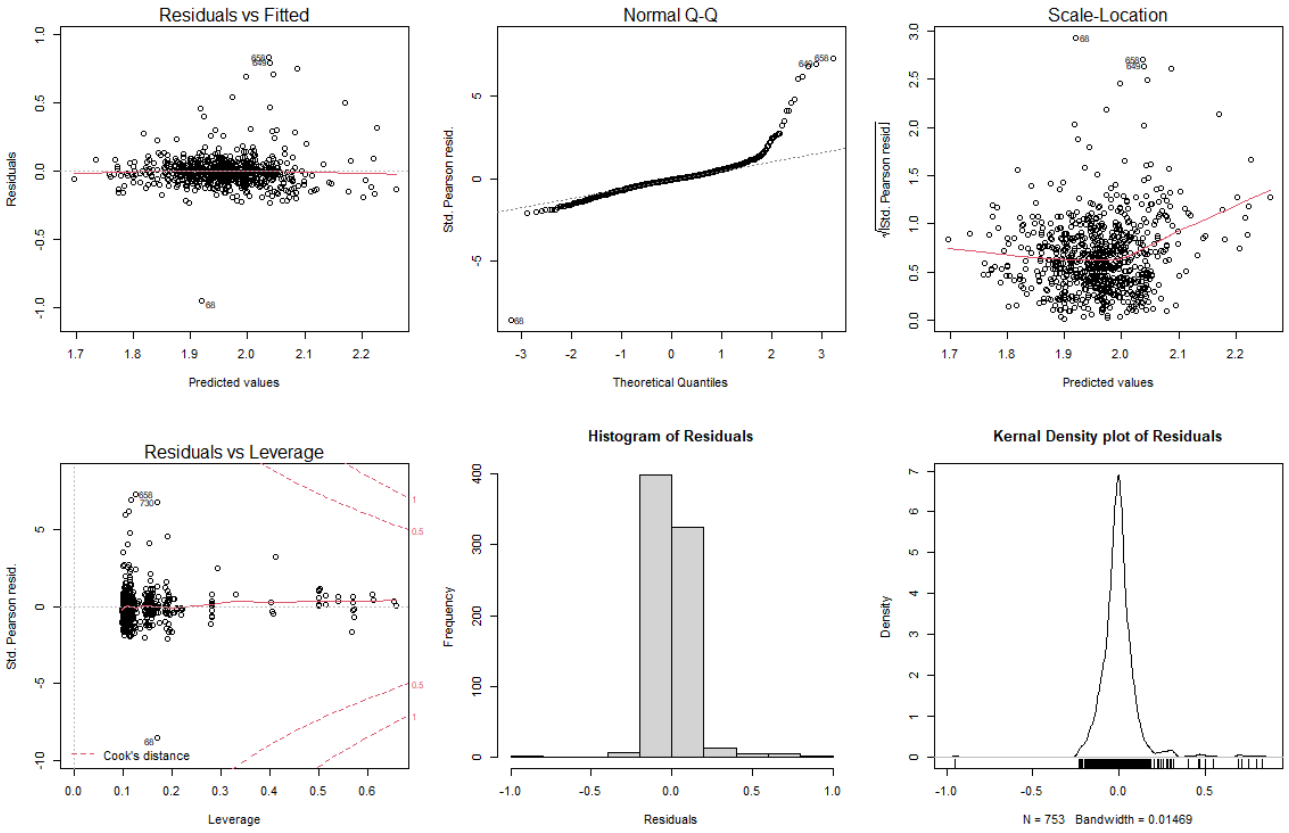


Figure I-5 Final model for Castle Hill WWTP dissolved inorganic nitrogen load: residual plots

Rouse Hill WWTP dissolved inorganic nitrogen load

Table I-11 Final model for Rouse Hill WWTP dissolved inorganic nitrogen load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-52.04335067837132	38.160213796131785	-1.363812	0.1730
Period 1	52.32828464867038	38.160339229064874	1.371274	0.1707
Period 1: Linear trend	0.00066244315093	0.000063584928998	10.418242	<0.0001
Period 2: Linear trend	0.03192624334023	0.022009830134903	1.450545	0.1473
Period 1: Quadratic trend	-0.00000008005613	0.000000009798726	-8.170055	<0.0001
Period 2: Quadratic trend	-0.00000471346052	0.000003171680728	-1.486108	0.1377

Table I-12 Final model for Rouse Hill WWTP dissolved inorganic nitrogen load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	32.7615921916	1	847.428525783	<0.0001	0.07269599	1	1.880393	0.1707
Period 1: Linear trend	63.5634848228	1	1,644.166434953	<0.0001	4.19614772	1	108.539758	<0.0001
Period 2: Linear trend	0.0001298963	1	0.003359967	0.9538	0.08134375	1	2.104080	0.1473
Period 1: Quadratic trend	17.7917531398	1	460.210817783	<0.0001	2.58054758	1	66.749797	<0.0001
Period 2: Quadratic trend	0.2246879830	1	5.811897208	0.0162	0.08538130	1	2.208517	0.1377
1st order cosine by year	5.0793177044	17	7.728487979	<0.0001	5.22565081	17	7.951143	<0.0001
1st order sine by year	2.4433718528	17	3.717737517	<0.0001	2.72941476	17	4.152969	<0.0001
2nd order cosine by year	1.9927932538	17	3.032155026	<0.0001	1.96010659	17	2.982420	<0.0001
2nd order sine by year	2.3439820851	17	3.566509996	<0.0001	2.34398209	17	3.566510	<0.0001

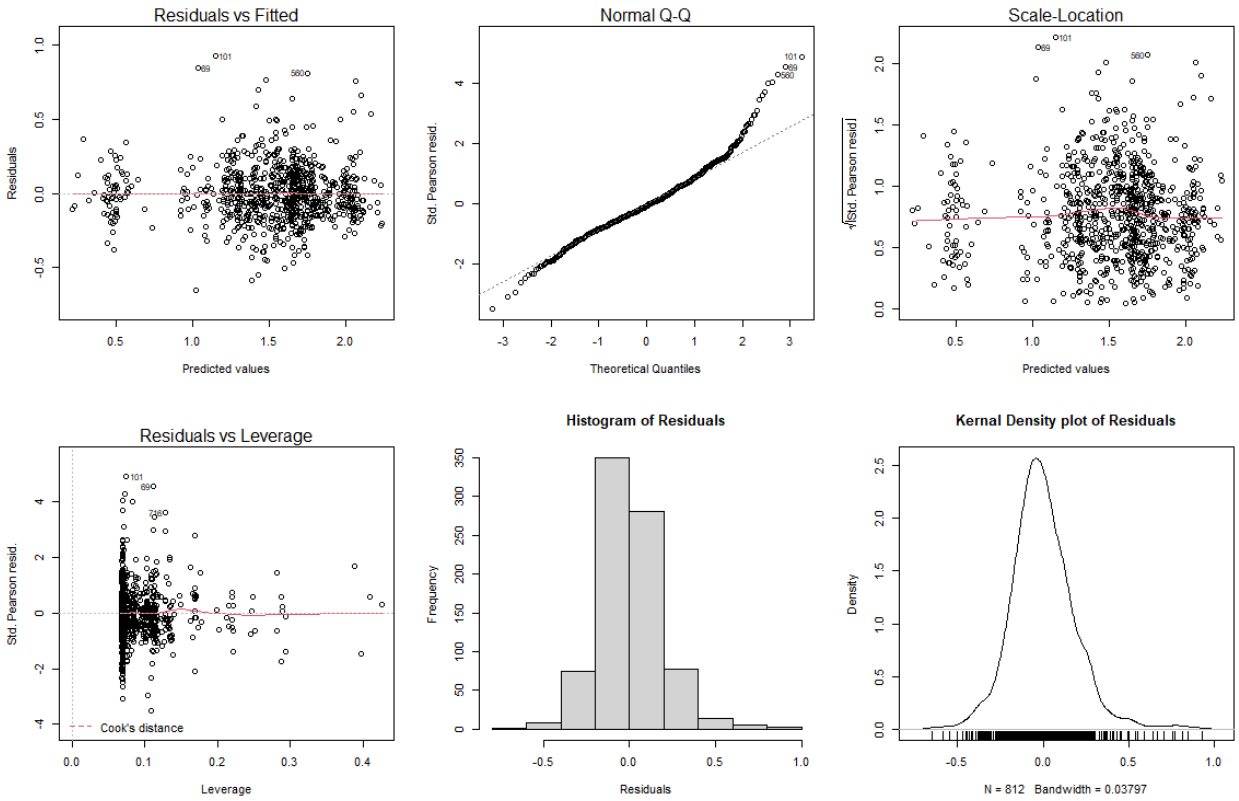


Figure I-6 Final model for Rouse Hill WWTP dissolved inorganic nitrogen load: residual plots

N3001 dissolved inorganic nitrogen concentrations

Table I-13 Final model for N3001 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.8185561875	0.9724617407	-0.8417361	0.4076
Log_{10}(N35 DN concentration)	1.1521826110	0.1401407361	8.2216110	<0.0001
Log_{10}(N35 flow)	0.1296634508	0.1640888338	0.7902028	0.4366
Log_{10}(Cattai Creek flow)	-0.0237263535	0.0801401053	-0.2960609	0.7695
Log_{10}(Castle Hill WWTP DIN load (lag 1))	-0.1867677376	0.5877148815	-0.3177863	0.7532
Log_{10}(Rouse Hill WWTP DIN load (lag 1))	0.4014640963	0.5066633093	0.7923686	0.4353

Table I-14 Final model for N3001 total dissolved inorganic nitrogen concentrations: type I and type III sums of squares, mean square and p p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N35 DIN concentration)	9.65114583870	1	137.9270081314	<0.0001	4.729806858	1	67.59488665	<0.0001
Log_{10}(N35 flow)	0.10660041084	1	1.5234538964	0.2281	0.043692476	1	0.62442042	0.4366
Log_{10}(Cattai Creek flow)	0.00005169314	1	0.0007387599	0.9785	0.006133265	1	0.08765207	0.7695
Log_{10}(Castle Hill WWTP DIN load (lag 1))	0.00047641851	1	0.0068086195	0.9349	0.007066427	1	0.10098813	0.7532
Log_{10}(Rouse Hill WWTP DIN load (lag 1))	0.04771864979	1	0.6819595007	0.4164	0.043932314	1	0.62784800	0.4353

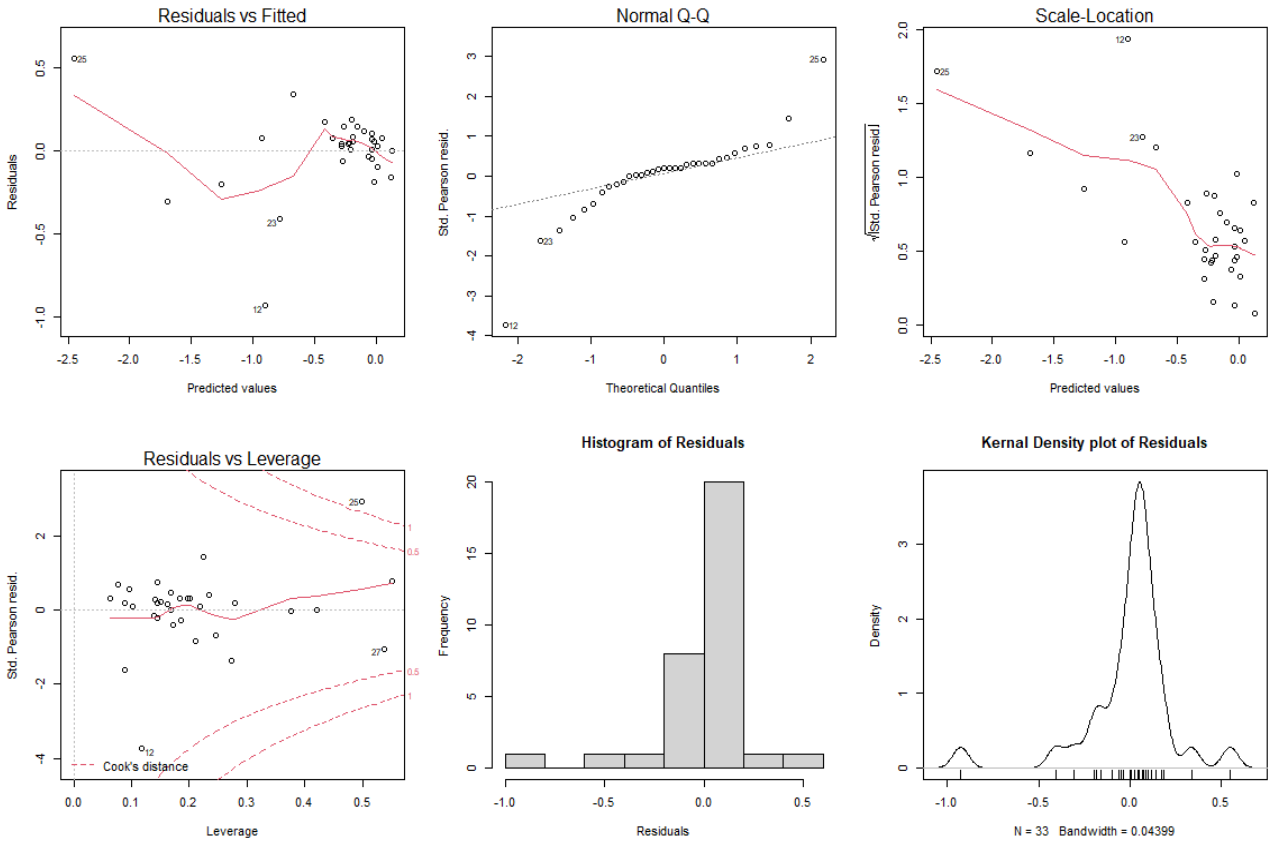


Figure I-7 Final model for N3001 dissolved inorganic nitrogen: residual plots

N35 and N3001 dissolved inorganic nitrogen concentrations

Table I-15 Final model for upstream/downstream analysis of site N35 and N3001 dissolved inorganic nitrogen concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	1.0503466666983958	0.84371891250587	1.24490118	0.2139
N35	1.2106669777451549	1.05284986734521	1.14989517	0.2509
NC11A	-1.4285191153964258	1.05908570666699	-1.34882296	0.1782
Site by flow				
N3001 flow	0.5326388328607022	0.07979403422264	6.67517112	<0.0001
N35 flow	0.3529799276107148	0.07361961433906	4.79464516	<0.0001
NC11A flow	0.0314317262867639	0.03147729592121	0.99855230	0.3186
Site by linear trend				
N3001	-0.0009756918567293	0.00026983026580	-3.61594669	0.0003
N35	-0.0011813184708058	0.00020533271485	-5.75319170	<0.0001
NC11A	0.0000579551965866	0.00019316741701	0.30002574	0.7643
Site by quadratic trend				
N3001	0.0000000735146134	0.00000001956596	3.75727101	0.0002
N35	0.0000000898353809	0.00000001526972	5.88323559	<0.0001
NC11A	-0.0000000004462455	0.00000001425355	-0.03130767	0.9750

Table I-16 Final model for upstream/downstream analysis of site N35 and N3001 dissolved inorganic nitrogen concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	39.203550	2	252.464626	<0.0001	0.6712544	2	4.322771	0.0139
Site by flow	7.143573	3	30.668983	<0.0001	5.3218426	3	22.847879	<0.0001
Site by linear trend	1.258677	3	5.403784	0.0012	3.5920376	3	15.421434	<0.0001
Site by quadratic trend	4.429536	3	19.017004	<0.0001	3.7835195	3	16.243509	<0.0001
Site by 1st order sine by year	16.235484	39	5.361740	<0.0001	17.4272688	39	5.755325	<0.0001
Site by 1st order cosine by year	50.426709	39	16.653332	<0.0001	43.3894620	39	14.329294	<0.0001
Site by 2nd order sine by year	4.160177	39	1.373891	0.0723	3.9529901	39	1.305468	0.1100

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site by 2nd order cosine by year	7.588741	39	2.506168	<0.0001	7.3486662	39	2.426884	<0.0001
Site by 3rd order sine by year	4.555272	39	1.504370	0.0301	4.5887313	39	1.515420	0.0278
Site by 3rd order cosine by year	4.717895	39	1.558076	0.0204	4.7178947	39	1.558076	0.0204

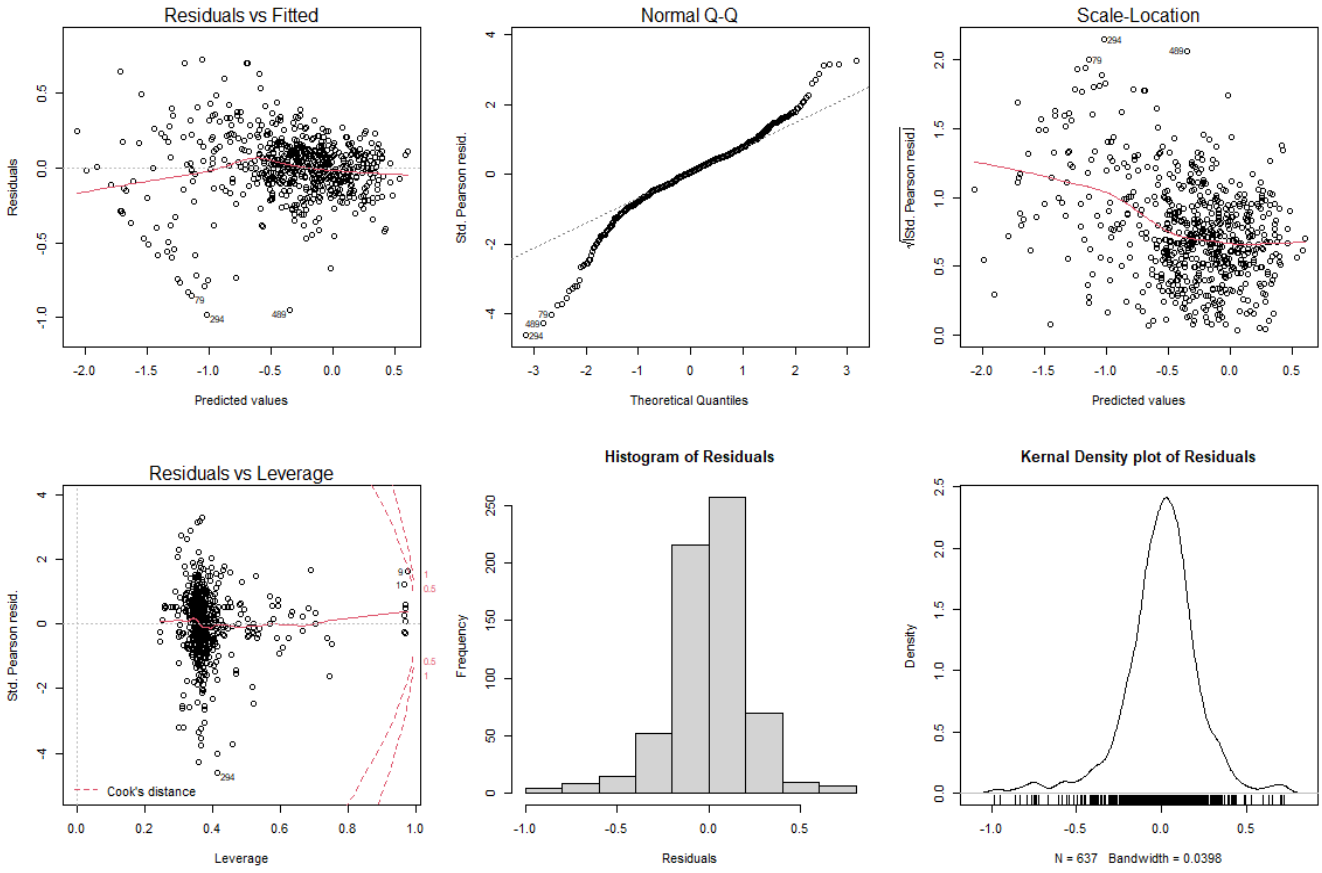


Figure I-8 Final model for upstream/downstream analysis of site N35 and N3001 dissolved inorganic nitrogen concentrations: residual plots

Castle Hill WWTPs total phosphorus load

Table I-17 Final model for Castle Hill WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.03957755965144	0.030474732987205	-1.2987008	0.1943
Period 1	-0.22771205757844	0.055448327796389	-4.1067435	<0.0001
Period 1: Linear trend	0.00002991689040	0.000038452864806	0.7780146	0.4367
Period 2: Linear trend	-0.00006255853737	0.000020275494136	-3.0854260	0.0021
Period 2: Quadratic trend	0.00000000746132	0.000000002823963	2.6421446	0.0083

Table I-18 Final model for Castle Hill WWTP total phosphorus load: type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	2.7955389	1	23.606179	<0.0001	1.99726176	1	16.8653419	<0.0001
Period 1: Linear trend	0.4908529	1	4.144876	0.0420	0.07168286	1	0.6053067	0.4367
Period 2: Linear trend	0.6532933	1	5.516561	0.0190	1.12737946	1	9.5198538	0.0021
Period 2: Quadratic trend	0.6519204	1	5.504967	0.0191	0.82670962	1	6.9809279	0.0083
1st order cosine by year	15.3530508	26	4.986336	<0.0001	15.60399696	26	5.0678374	<0.0001
1st order sine by year	20.1269035	26	6.536779	<0.0001	19.95873737	26	6.4821619	<0.0001
2nd order cosine by year	8.1201789	26	2.637257	<0.0001	7.87468726	26	2.5575264	<0.0001
2nd order sine by year	7.4456985	26	2.418200	<0.0001	7.76973835	26	2.5234413	<0.0001
3rd order cosine by year	7.5096527	26	2.438971	<0.0001	7.52421684	26	2.4437013	<0.0001
3rd order sine by year	4.9808909	26	1.617685	0.0258	4.98089091	26	1.6176846	0.0258

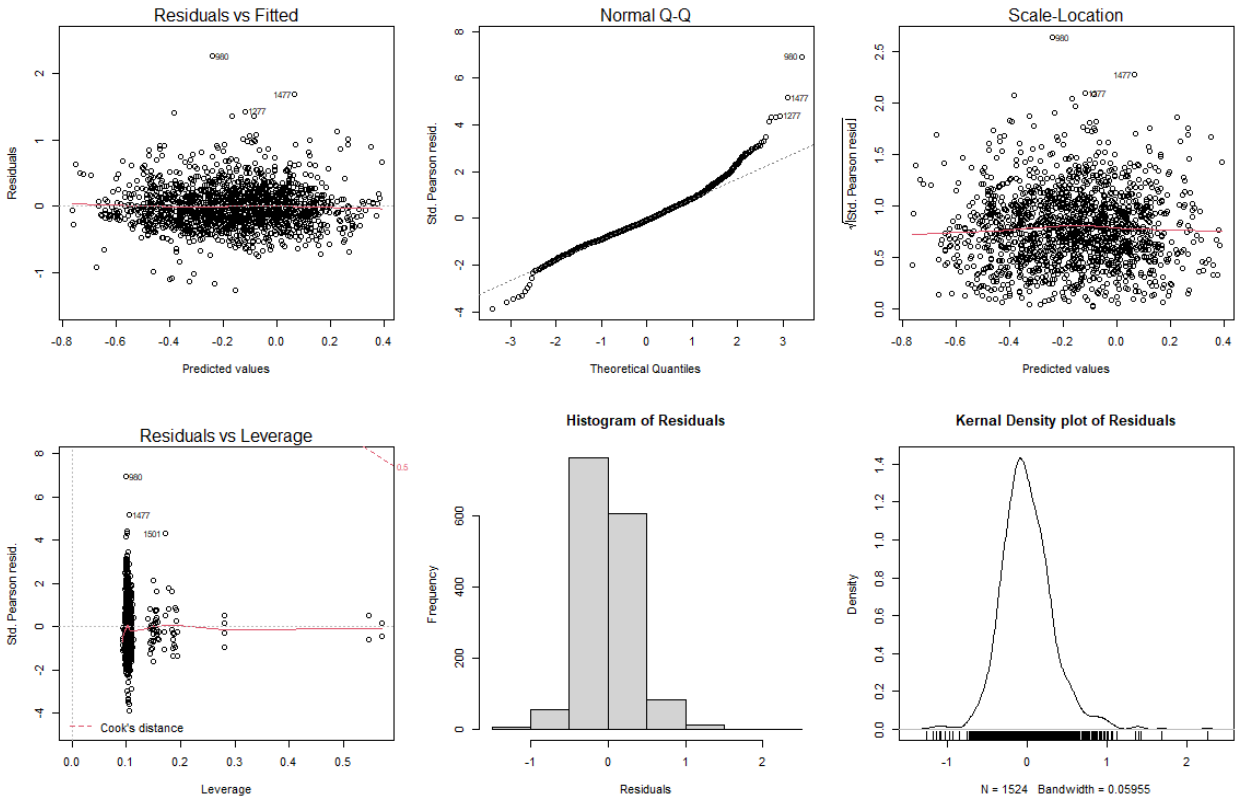


Figure I-9 Final model for Castle Hill WWTP total phosphorus load: residual plots

Rouse Hill WWTP total phosphorus load

Table I-19 Final model for Rouse Hill WWTP total phosphorus load: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.76386259142543	0.02812108556524	-27.163339	<0.0001
Period 1	-0.68434738833202	0.08487294146206	-8.063199	<0.0001
Period 1: Linear trend	0.00047402433071	0.00007368660402	6.432978	<0.0001
Period 2: Linear trend	0.00006044839203	0.00000975348199	6.197622	<0.0001
Period 1: Quadratic trend	-0.00000002806723	0.00000001508946	-1.860055	0.0631

Table I-20 Final model for Rouse Hill WWTP total phosphorus load: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (orthogonal) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Period	0.6241836	1	4.155324	0.0417	9.7661242	1	65.0151727	<0.0001
Period 1: Linear trend	100.8795351	1	671.576588	<0.0001	6.2162963	1	41.3832109	<0.0001
Period 2: Linear trend	3.3221593	1	22.116323	<0.0001	5.7697588	1	38.4105152	<0.0001
Period 1: Quadratic trend	5.4542015	1	36.309783	<0.0001	0.5197078	1	3.4598056	0.0631
1st order cosine by year	13.5918158	26	3.480139	<0.0001	13.8591485	26	3.5485888	<0.0001
1st order sine by year	19.2730008	26	4.934788	<0.0001	19.4677725	26	4.9846583	<0.0001
2nd order cosine by year	7.0882866	26	1.814932	0.0074	6.5921449	26	1.6878967	0.0168
2nd order sine by year	11.1806685	26	2.862773	<0.0001	11.0324269	26	2.8248161	<0.0001
3rd order cosine by year	3.7719763	26	0.965802	0.5133	3.7707668	26	0.9654923	0.5137
3rd order sine by year	6.8132519	26	1.744510	0.0117	6.8132519	26	1.7445104	0.0117

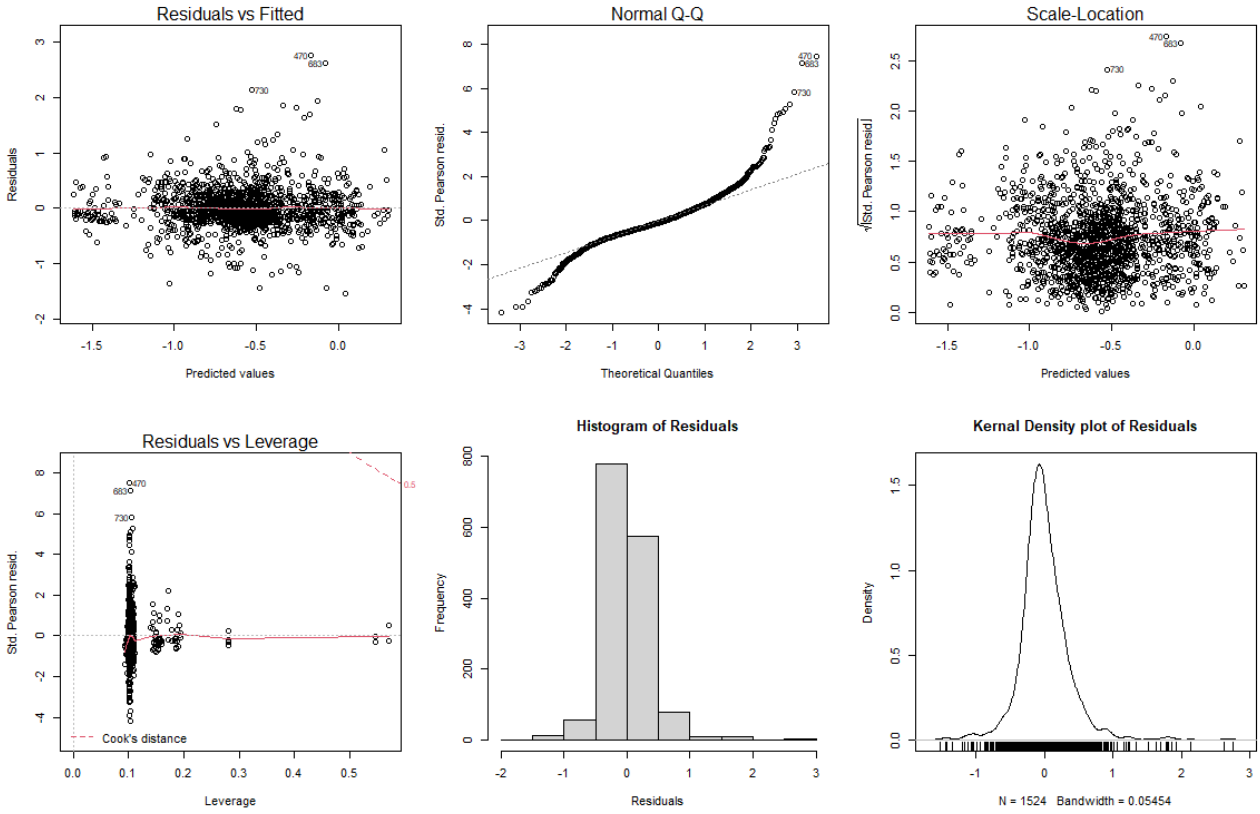


Figure I-10 Final model for Rouse Hill WWTP total phosphorus load: residual plots

N3001 total phosphorus concentrations

Table I-21 Final model for site N3001 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-0.604431593152	0.099061381992	-6.10158652	<0.0001
Log_{10}(N35 TP concentration)	0.792117372292	0.044916772651	17.63522456	<0.0001
Log_{10}(N35 flow)	0.071185048272	0.017910636529	3.97445664	<0.0001
Log_{10}(Cattai Creek flow)	0.013111949936	0.008157195548	1.60740905	0.1096
Log_{10}(Castle Hill WWTP TP load (lag 1))	0.026748963696	0.016929612888	1.58001036	0.1157
Log_{10}(Rouse Hill WWTP TP load (lag 1))	-0.044770227507	0.024929320525	-1.79588639	0.0740
Period 1: Linear trend	0.000007703072	0.000004785479	1.60967616	0.1091
1st order sine	-0.000127927635	0.008065638022	-0.01586082	0.9874
1st order cosine	0.015580204237	0.009673016873	1.61068718	0.1088

Table I-22 Final model for site N3001 total phosphorus concentrations: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N35 TP concentration)	4.5227515610	1	718.22910738	<0.0001	1.958401436405	1	311.0011453387	<0.0001
Log_{10}(N35 flow)	0.1318046272	1	20.93104573	<0.0001	0.099470719007	1	15.7963055806	<0.0001
Log_{10}(Cattai Creek flow)	0.0097782322	1	1.55281822	0.2142	0.016270187141	1	2.5837638502	0.1096
Log_{10}(Castle Hill WWTP TP load (lag 1))	0.0016227276	1	0.25769493	0.6123	0.015720255412	1	2.4964327268	0.1157
Log_{10}(Rouse Hill WWTP TP load (lag 1))	0.0140724790	1	2.23475994	0.1365	0.020309416692	1	3.2252079349	0.0740
Period 1: Linear trend	0.0147687599	1	2.34533184	0.1273	0.016316114884	1	2.5910573400	0.1091
1st order sine	0.0001260803	1	0.02002201	0.8876	0.000001584131	1	0.0002515656	0.9874
1st order cosine	0.0163366172	1	2.59431318	0.1088	0.016336617201	1	2.5943131812	0.1088

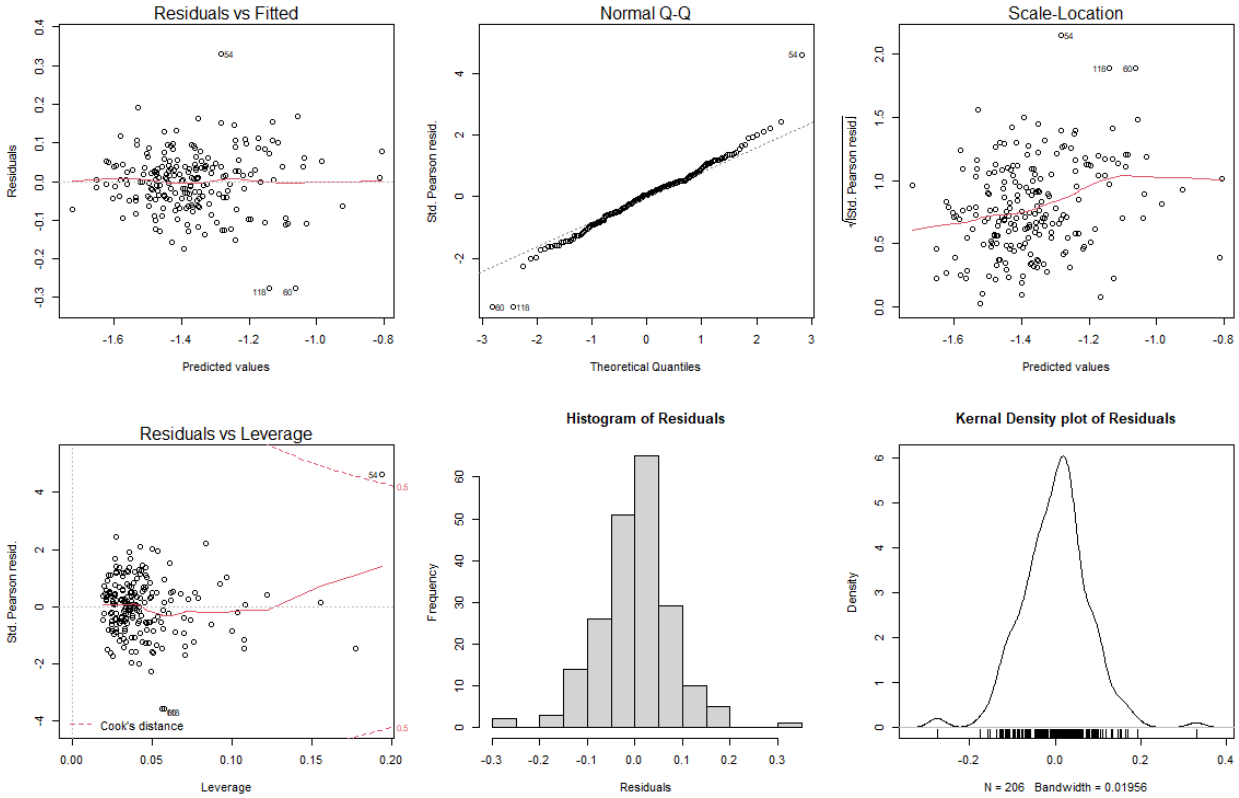


Figure I-11 Final model for site N3001 total phosphorus concentrations: residual plots

N35 and N3001 total phosphorus concentrations

Table I-23 Final model for upstream/downstream analysis of site N35 and N3001 total phosphorus concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	-1.570755682760529	0.362405832714164	-4.3342450	<0.0001
N35	0.256124159680521	0.458647881780190	0.5584331	0.5768
NC11A	-0.211600147031352	0.461923666917218	-0.4580847	0.6471
Site by flow				
N3001 flow	0.226991856276758	0.027056962702946	8.3894064	<0.0001
N35 flow	0.189070708589991	0.025903180709758	7.2991310	<0.0001
NC11A flow	0.078229328415772	0.012701963032821	6.1588377	<0.0001
Site by linear trend				
N3001	-0.000148940233446	0.000111660111531	-1.3338714	0.1828
N35	-0.000178246103233	0.000088667292936	-2.0102802	0.0449
NC11A	0.000109923970049	0.000086028132389	1.2777677	0.2019
Site by quadratic trend				
N3001	0.000000011848674	0.000000008066927	1.4687965	0.1425
N35	0.000000013701779	0.000000006559543	2.0888315	0.0372
NC11A	-0.000000008040094	0.000000006315766	-1.2730196	0.2036

Table I-24 Final model for upstream/downstream analysis of site N35 and N3001 total phosphorus concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	0.1606543	2	4.786198	0.0087	0.02286634	2	0.6812321	0.5064
Site by flow	2.7875573	3	55.364442	<0.0001	2.71198989	3	53.8635781	<0.0001
Site by linear trend	0.1514936	3	3.008856	0.0298	0.12508646	3	2.4843766	0.0599
Site by quadratic trend	0.1307036	3	2.595940	0.0517	0.13663371	3	2.7137198	0.0442
Site by 1st order sine by year	2.1271347	39	3.249816	<0.0001	2.07718798	39	3.1735079	<0.0001
Site by 1st order cosine by year	4.4390753	39	6.781977	<0.0001	4.43907534	39	6.7819767	<0.0001

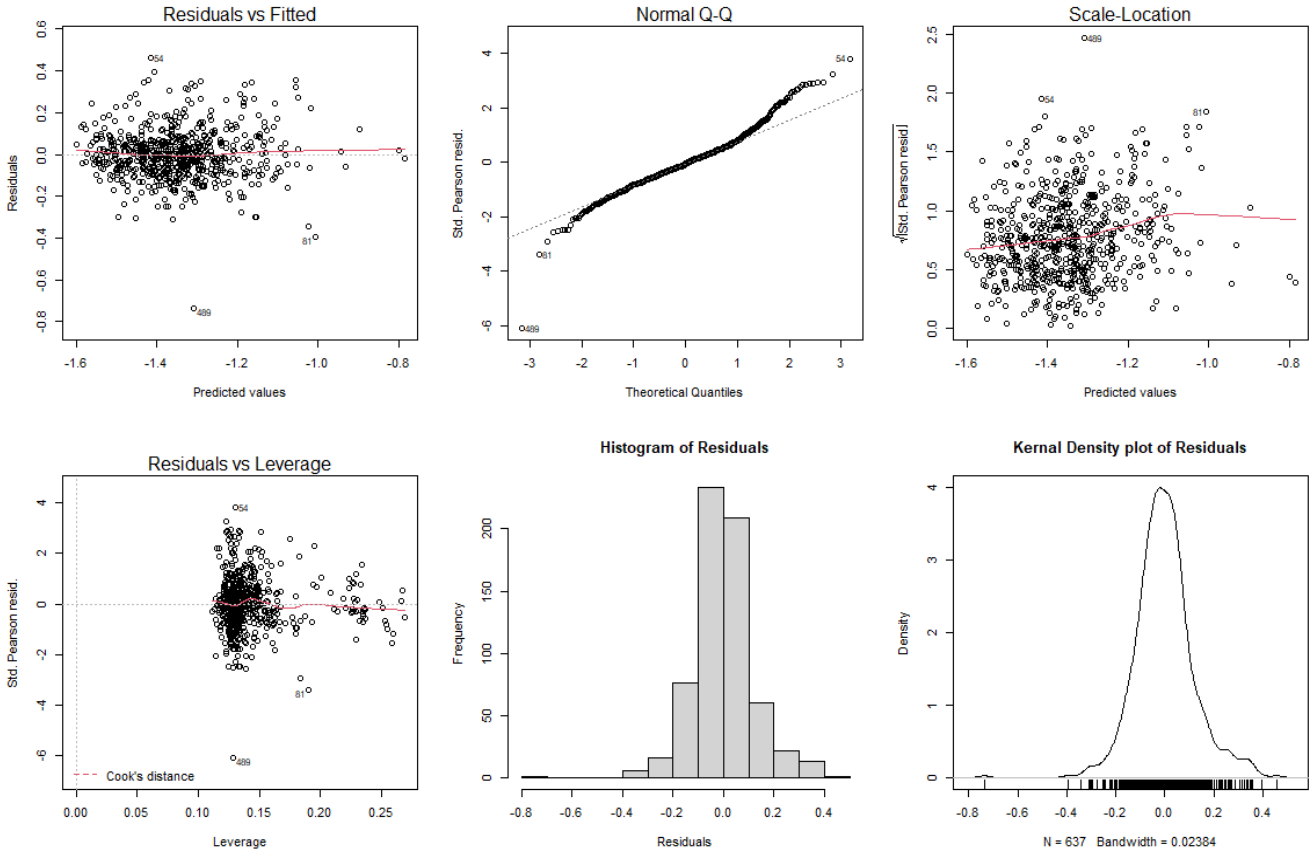


Figure I-12 Final model for upstream/downstream analysis of site N35 and N3001 total phosphorus concentrations: residual plots

N3001 Chlorophyll-*a* concentrations

Table I-25 Final model for site N3001 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	2.6005890924174	0.56632061380416	4.59207917	<0.0001
Log_{10}(N35 Chl-*a* concentration)	0.7070578217949	0.04800107795767	14.73004049	<0.0001
Log_{10}(N35 flow)	-0.1648910994728	0.04586362060221	-3.59524820	0.0004
Log_{10}(Cattai Creek flow)	-0.0458352735186	0.01697271023259	-2.70052766	0.0075
Log_{10}(Castle Hill WWTP TN load (lag 1))	-0.2068278872133	0.08795430713129	-2.35153791	0.0197
Log_{10}(Castle Hill WWTP TP load (lag 1))	-0.0130593841393	0.03723849707527	-0.35069579	0.7262
Log_{10}(Rouse Hill WWTP TN load (lag 1))	-0.0033091269089	0.10211601800523	-0.03240556	0.9742
Log_{10}(Rouse Hill WWTP TP load (lag 1))	0.0427720535417	0.07287626834581	0.58691333	0.5579
Period 1: Linear trend	-0.0003487168469	0.00014255690795	-2.44615888	0.0153
Period 1: Quadratic trend	0.0000000232098	0.00000001016497	2.28331220	0.0235

Table I-26 Final model for site N3001 chlorophyll-*a* concentrations: type I and type III sums of squares and p values

Parameter	Type I (sequential) SS				Type III (non-sequential) SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Log_{10}(N35 Chl-*a* concentration)	17.14190924798	1	664.462426908	<0.0001	5.59753276794	1	216.97409278	<0.0001
Log_{10}(N35 flow)	1.30570353296	1	50.612269951	<0.0001	0.33346212914	1	12.92580963	0.0004
Log_{10}(Cattai Creek flow)	0.06548931018	1	2.538526214	0.1127	0.18814211617	1	7.29284966	0.0075
Log_{10}(Castle Hill WWTP TN load (lag 1))	0.20481014078	1	7.938943162	0.0053	0.14265688315	1	5.52973052	0.0197
Log_{10}(Castle Hill WWTP TP load (lag 1))	0.00538424285	1	0.208706453	0.6483	0.00317285239	1	0.12298754	0.7262
Log_{10}(Rouse Hill WWTP TN load (lag 1))	0.06712140407	1	2.601790174	0.1084	0.00002709118	1	0.00105012	0.9742
Log_{10}(Rouse Hill WWTP TP load (lag 1))	0.00003629291	1	0.001406802	0.9701	0.00888662214	1	0.34446726	0.5579
Period 1: Linear trend	0.12350069406	1	4.787189671	0.0299	0.15436828805	1	5.98369329	0.0153
Period 1: Quadratic trend	0.13449909337	1	5.213514592	0.0235	0.13449909337	1	5.21351459	0.0235

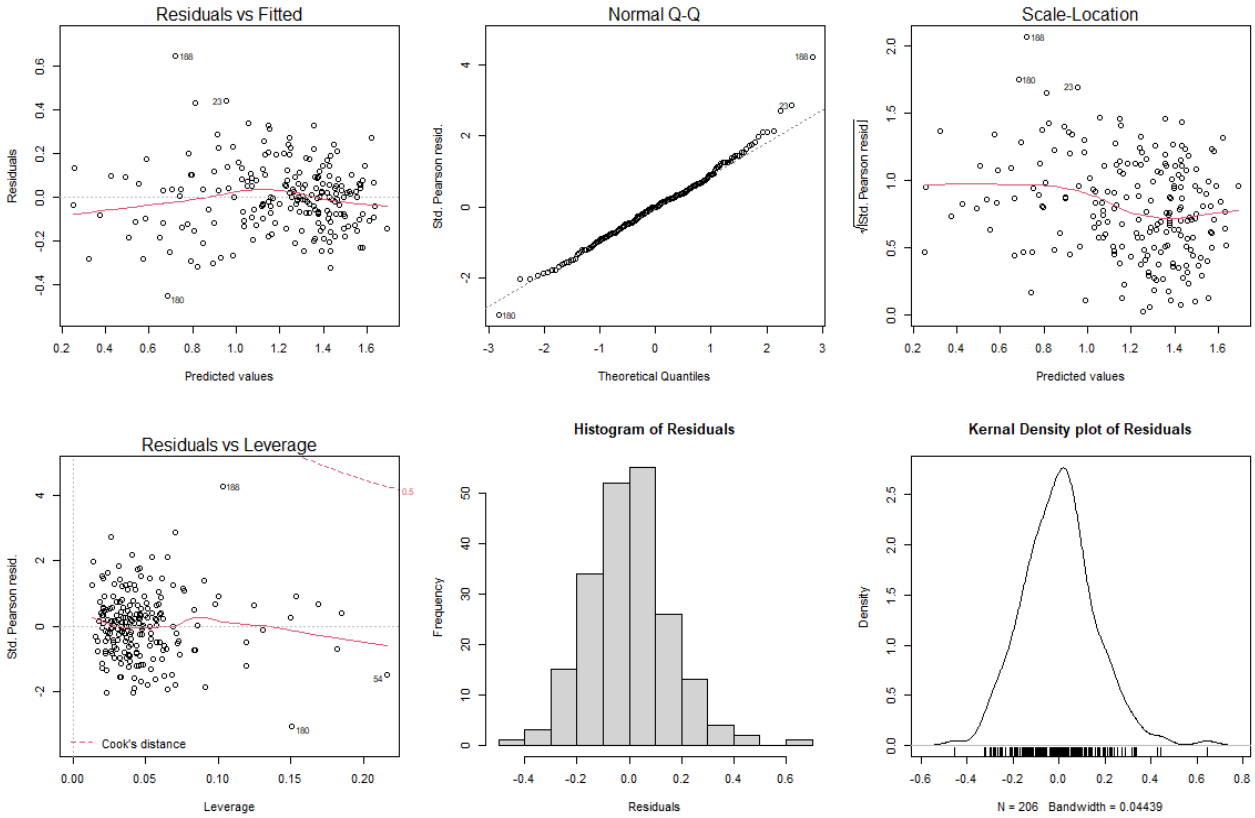


Figure I-13 Final model for site N3001 chlorophyll-*a*: residual plots

N35 and N3001 chlorophyll-*a* concentrations

Table I-27 Final model for upstream/downstream analysis at site N35 and N3001 chlorophyll-*a* concentrations: estimated regression coefficients, standard errors and p values

Parameter	Estimate	Standard error	t-Statistic	p-value
Intercept	0.566986109938423	0.73675198489127	0.7695753	0.4420
N35	-0.625536825066827	0.92868055953117	-0.6735759	0.5010
NC11A	0.449496486568888	0.92481451463427	0.4860396	0.6272
Site by flow				
N3001 flow	-0.669414768670960	0.06967772349847	-9.6072997	<0.0001
N35 flow	-0.507876361312621	0.06770251233454	-7.5015881	<0.0001
NC11A flow	-0.143028230558489	0.02748659524543	-5.2035630	<0.0001
Site by linear trend				
N3001	0.000774567389323	0.00023562110670	3.2873430	0.0011
N35	0.000799219057171	0.00018789108566	4.2536295	<0.0001
NC11A	0.000029156264245	0.00016867759605	0.1728520	0.8629
Site by quadratic trend				
N3001	-0.000000056883207	0.00000001708538	-3.3293495	0.0010
N35	-0.000000057894958	0.00000001392879	-4.1564960	<0.0001
NC11A	-0.000000004397103	0.00000001244648	-0.3532808	0.7241

Table I-28 Final model for upstream/downstream analysis at site N35 and N3001 chlorophyll-*a* concentrations: type I and type III sums of squares

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site	14.0841242	2	118.9482132	<0.0001	0.1088062	2	0.9189285	0.3998
Site by flow	24.0927936	3	135.6513050	<0.0001	10.3990293	3	58.5503663	<0.0001
Site by linear trend	0.9923777	3	5.5874521	0.0009	1.7127278	3	9.6432884	<0.0001
Site by quadratic trend	2.9662642	3	16.7011606	<0.0001	1.6864399	3	9.4952780	<0.0001
Site by 1st order sine by year	6.0959333	39	2.6401808	<0.0001	5.9946030	39	2.5962941	<0.0001
Site by 1st order cosine by year	11.7101486	39	5.0717270	<0.0001	10.2145188	39	4.4239619	<0.0001
Site by 2nd order sine by year	6.0003623	39	2.5987885	<0.0001	5.9316307	39	2.5690205	<0.0001

Parameter	Type I SS				Type III SS			
	SS	DF	F-Statistic	p-value	SS	DF	F-Statistic	p-value
Site by 2nd order cosine by year	3.1061187	39	1.3452763	0.0866	1.9419731	39	0.8410788	0.7406
Site by 3rd order sine by year	2.2362029	39	0.9685113	0.5275	2.3446997	39	1.0155018	0.4485
Site by 3rd order cosine by year	3.5262017	39	1.5272165	0.0256	3.5262017	39	1.5272165	0.0256

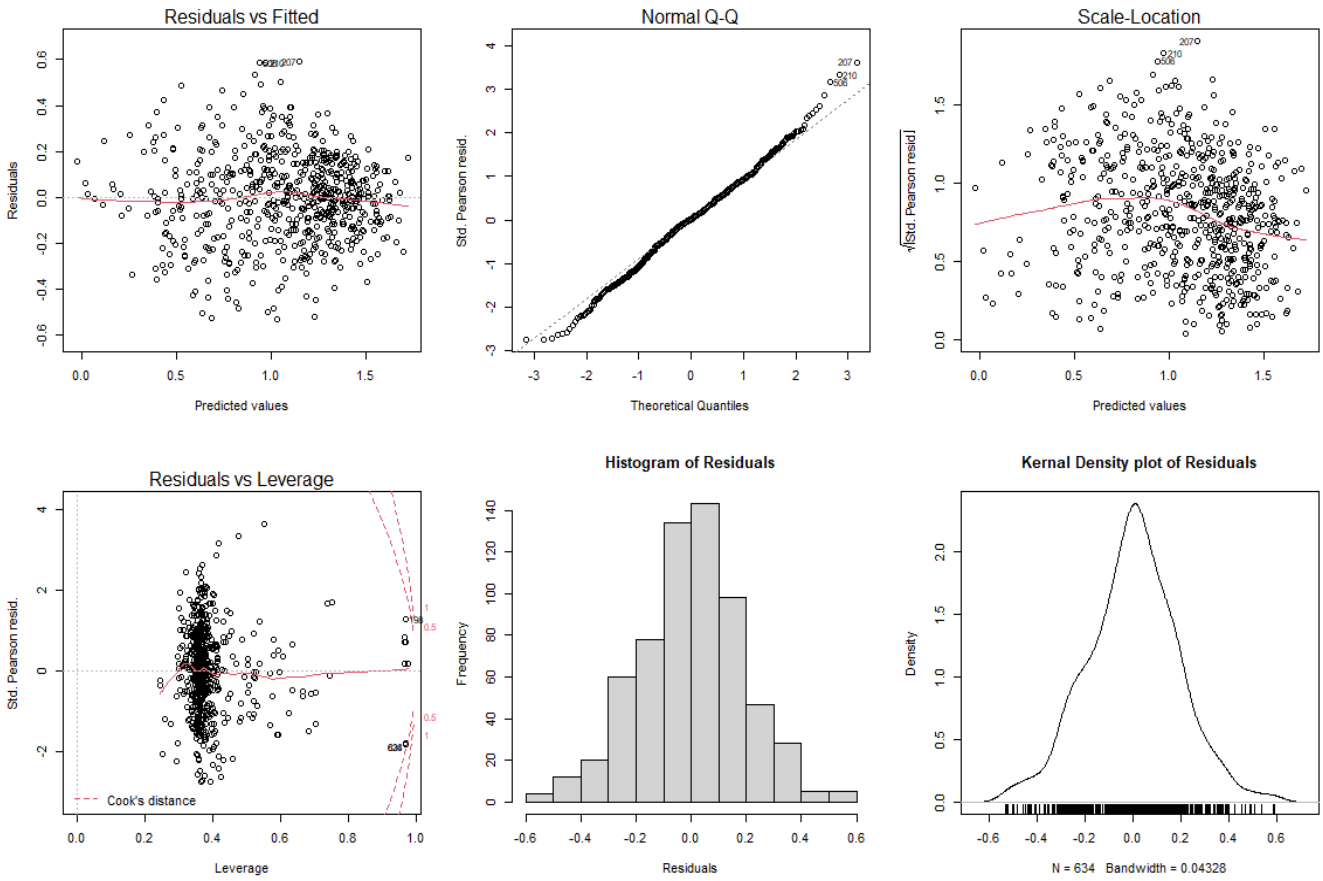


Figure I-14 Final model for upstream/downstream analysis at site N35 and N3001 chlorophyll-*a* concentrations: residual plots

Model fit details and example relative changes in the outcome

Table I-29 Model fit details – Hawkesbury River off Cattai SRA (N3001) and Cattai Creek WWTPs (Castle Hill and Rouse Hill)

Model	Total nitrogen		Dissolved inorganic nitrogen		Total phosphorus		Chlorophyll-*a*	
	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2	R^2	Adj R^2
Castle Hill WWTP	0.31	0.22	0.30	0.19	0.30	0.21	NA	NA
Rouse Hill WWTP	0.84	0.82	0.82	0.80	0.46	0.39	NA	NA
Site N3001	0.79	0.78	0.84	0.81	0.79	0.78	0.79	0.78
Upstream (N35) / downstream (N3001)	0.77	0.73	0.82	0.71	0.52	0.44	0.77	0.62

Table I-30 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) of Hawkesbury off Cattai SRA (N3001) for prespecified changes at low, medium and high values of the explanatory variables

Parameter	Co-efficient	p- value		Amount of change in X	Low value	% change	Medium value	% change	High value	% change
		type I SS	type III SS							
TN										
Upstream N35 TN concentration (mg/L)	0.82	<0.0001	<0.0001	0.005	0.5	0.8	1	0.4	1.5	0.3
Upstream N35 flow (ML/day)	0.05	<0.0001	0.0013	100	1000	0.5	1300	0.4	1600	0.3
Cattai Creek flow (ML/day)	0.007	0.6719	0.3188	NE	NE	NE	NE	NE	NE	NE
Castle Hill TN load (kg/day)	0.08	0.2546	0.0210	10	40	1.8	100	0.8	160	0.5
Rouse Hill TN load (kg/day)	-0.05	0.6379	0.1699	NE	NE	NE	NE	NE	NE	NE
DIN										
Upstream N35 DIN concentration (mg/L)	1.15	<0.0001	<0.0001	0.005	0.1	5.8	0.5	1.2	1	0.6
Upstream N35 flow (ML/day)	0.13	0.2281	0.4366	NE	NE	NE	NE	NE	NE	NE
Cattai Creek flow (ML/day)	-0.02	0.9785	0.7695	NE	NE	NE	NE	NE	NE	NE
Castle Hill DIN load (kg/day)	-0.19	0.9349	0.7532	NE	NE	NE	NE	NE	NE	NE
Rouse Hill DIN load (kg/day)	0.4	0.4164	0.4353	NE	NE	NE	NE	NE	NE	NE
TP										
Upstream N35 TP concentration (mg/L)	0.79	<0.0001	<0.0001	0.0005	0.03	1.3	0.05	0.8	0.08	0.5
Upstream N35 flow (ML/day)	0.07	<0.0001	<0.0001	100	1000	0.7	1300	0.5	1600	0.4
Cattai Creek flow (ML/day)	0.01	0.2142	0.1096	NE	NE	NE	NE	NE	NE	NE
Castle Hill TP load (kg/day)	0.03	0.6123	0.1157	NE	NE	NE	NE	NE	NE	NE
Rouse Hill TP load (kg/day)	-0.04	0.1365	0.0740	NE	NE	NE	NE	NE	NE	NE
Chl-*a*										

Parameter	Co-efficient	p- value		Amount of change in X	Low value	% change	Medium value	% change	High value	% change
		type I SS	type III SS							
Upstream N35 Chl-a concentration (μg/L)	0.71	<0.0001	<0.0001	1	10	7.0	20	3.5	30	2.4
Upstream N35 flow (ML/day)	-0.16	<0.0001	0.0004	100	1000	-1.5	1300	-1.2	1600	-1.0
Cattai Creek flow (ML/day)	-0.05	0.1127	0.0075	5	30	-0.8	55	-0.4	100	-0.2
Castle Hill TN load (kg/day)	-0.21	0.0053	0.0197	10	40	-4.6	100	-2.0	160	-1.3
Castle Hill TP load (kg/day)	-0.01	0.6483	0.7262	NE	NE	NE	NE	NE	NE	NE
Rouse Hill TN load (kg/day)	-0.0003	0.1084	0.9742	NE	NE	NE	NE	NE	NE	NE
Rouse Hill TP load (kg/day)	0.04	0.9701	0.5579	NE	NE	NE	NE	NE	NE	NE

NE= Not estimated

Table I-31 Examples of relative changes in the outcome (TN, DIN, TP or Chl-*a* concentrations) Hawkesbury River off Cattai SRA (N3001) and Wilberforce (N35) and Cattai Creek (NC11A) for prespecified changes at low, medium and high values of the explanatory variables

Parameter (flow ML/day)	Coefficient	p-value	Amount of change in X	Low Value	% change	Medium Value	% change	High Value	% change
TN									
N3001 flow	0.17	<0.0001	100	1100	1.5	1400	1.2	1700	1.0
N35 flow	0.11	<0.0001	100	1000	1.1	1300	0.8	1600	0.7
NC11A flow	0.03	0.008	5	30	0.5	55	0.3	100	0.1
DIN									
N3001 flow	0.5	<0.0001	100	1100	4.4	1400	3.5	1700	2.9
N35 flow	0.35	<0.0001	100	1000	3.4	1300	2.6	1600	2.1
NC11A flow	0.03	0.3	NE	NE	NE	NE	NE	NE	NE
TP									
N3001 flow	0.2	<0.0001	100	1100	1.8	1400	1.4	1700	1.2
N35 flow	0.19	<0.0001	100	1000	1.8	1300	1.4	1600	1.2
NC11A flow	0.08	<0.0001	5	30	1.2	55	0.7	100	0.4
Chl-*a*									
N3001 flow	-0.7	<0.0001	100	1100	-5.9	1400	-4.7	1700	-3.9
N35 flow	-0.5	<0.0001	100	1000	-4.7	1300	-3.6	1600	-3.0
NC11A flow	-0.14	<0.0001	5	30	-2.1	55	-1.2	100	-0.7

NE= Not estimated