

# Appendix A

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## Tables

Table 1. Summary of the number of recycled water effluents sampled (n), treatment trains and key wastewater treatment processes relevant to reduction of pollutants of concern. Total of 31 recycled water effluents were sampled.

Key Processes	Treatment Train	Sampled	n
Lagoon	TT1	Yes	8
Aerated lagoon, Lagoon	TT2	Yes	4
Aerated lagoon, Lagoon, Chlorine	TT3	No	-
ASP with extended aeration	TT4	Yes	6
ASP with extended aeration, MF/RO	TT5	No	-
ASP with extended aeration, Lagoon	TT6	No	-
ASP	TT7	Yes	4
ASP, chlorine	TT8	Yes	2
ASP, Lagoon	TT9	Yes	4
ASP, Lagoon, MF/RO	TT10	No	-
ASP, Lagoon, Chlorine	TT11	No	-
ASP with extended aeration, UF, MF/RO, Chlorine	TT12	Yes	1
ASP, Lagoon, RO, Chlorine	TT13	Yes	1
ASP with extended aeration, Chlorine	TT14	Yes	1

UF – Ultra filtration; MF – membrane filtration / RO - Reverse osmosis.

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 2. Summary statistics of pharmaceutical and personal care products (PPCPs) detected in influent and effluent samples and analytical method. Highest concentration in **bold**.

Analyte	Group	Influent (n = 30) †							Effluent (LC n = 66, GC n = 38)						Method	
		LOR	Min	Mean*	S.D.*	Max	Freq.	Detects	LOR	Min	Mean*	S.D.*	max	Freq.		Detects
		µg/L	µg/L	µg/L	µg/L	µg/L	#	%	µg/L	µg/L	µg/L	µg/L	µg/L	#		%
Acesulfame K (sweetener)	Sweetener	0.5	<0.5	35.21	14.59	72	29	97%	0.025	<0.03	1.04	<b>1.43</b>	<b>8.1</b>	58	88%	LC
Amidotrizoate (sodium)	Xray	0.5	<0.5	4.19	9.86	54	23	77%	0.05	<0.05	<b>1.11</b>	1.04	4.2	59	89%	LC
Amitriptyline	Antidepressant	0.2	<0.2	0.12	0.46	30	18	60%	0.02	<0.02	0.03	0.03	0.15	23	35%	LC
Amphetamine	Stimulant, Illicit	0.05	0.24	0.11	0.64	30	5	17%	0.05	<0.05	NA	NA	NA	0	0%	LC
Atenolol	Beta-blocker	0.2	<0.2	2.12	0.93	4.9	29	97%	0.02	<0.02	0.08	0.10	0.56	47	71%	LC
Caffeine	Stimulant	1	<1	55.68	19.51	99	29	97%	0.1	<0.1	0.22	0.30	1.3	27	41%	LC
Carbamazepine	Anticonvulsant	0.2	<0.2	0.63	0.36	1.8	28	93%	0.02	<0.02	0.51	0.30	1.3	<b>61</b>	<b>92%</b>	LC
Cefalexin	Antibiotic	2	<2	4.25	2.45	11	25	83%	0.2	<0.2	0.30	0.32	1.2	24	36%	LC
Citalopram	Antidepressant	0.2	<0.2	0.35	0.13	0.55	26	87%	0.02	<0.02	0.09	0.10	0.31	41	62%	LC
Codeine	Analgesic, opioid	0.2	<0.2	97.9	<b>529</b>	<b>2,900</b>	<b>30</b>	<b>100%</b>	0.02	<0.02	0.18	0.70	4.2	32	48%	LC
Desmethyl Citalopram	Antidepressant	0.5	NA	NA	NA	30	0	0%	0.05	<0.05	0.10	0.11	0.53	33	50%	LC
Desmethyl Diazepam	Benzodiazepine	0.2	NA	NA	NA	30	0	0%	0.02	<0.02	0.01	0.01	0.04	18	27%	LC
Diclofenac	NSAID	0.2	0.45	0.17	0.86	30	28	93%	0.02	<0.02	0.14	0.18	0.7	41	62%	LC
DEET	Insect repellent	1	<1	1.70	1.28	5.5	30	73%	0.1	<0.1	0.12	0.13	0.3	11	29%	GC
Diethyl toluamide (DEET)	Insect repellent	2	<2	1.73	1.36	6	9	30%	0.2	<0.2	0.12	0.08	0.6	8	12%	LC
Diphenhydramine	Antihistamine	0.2	<0.2	-	-	30	0	0%	0.02	<0.02	0.02	0.01	0.05	11	17%	LC
Doxylamine	Antihistamine	0.2	<0.2	0.11	0.03	0.24	2	7%	0.02	<0.02	0.05	0.05	0.22	45	68%	LC
Erythromycin anhydrate	Antibiotic	0.2	<0.2	0.40	0.30	1.3	21	70%	0.02	<0.02	0.06	0.08	0.3	38	58%	LC
Fluoxetine	Antidepressant	0.2	NA	NA	NA	30	0	0%	0.02	<0.02	0.02	0.02	0.07	19	29%	LC
Furosemide	Diuretic	2	<2	2.05	1.27	5.8	16	53%	0.2	<0.2	0.33	0.45	1.8	18	27%	LC
Gabapentin	Anticonvulsants	0.2	<0.2	6.59	2.91	15	29	97%	0.02	<0.02	0.89	0.75	3.1	55	83%	LC
Galaxolid	Musk fragrance	1	<1	5.67	2.85	13	29	97%	0.1	<0.1	0.85	0.84	2.5	24	63%	GC
Hydrochlorothiazide	Diuretics	2	<2	1.84	1.54	3.4	3	10%	0.2	<0.2	0.60	0.63	2	31	47%	LC
Lamotrigine	Antiepileptic	0.2	<0.2	0.65	0.37	1.8	29	97%	0.02	<0.02	0.83	0.47	1.9	<b>61</b>	<b>91%</b>	LC

Freq. – frequency; Methods (LC/MSMS (LC) and GC/MSMS (GC)); † TT14 shares the same influent as another WWTP; \*Mean and SD include the half LOR when compound was not detected; NA – not applicable, i.e. below the limits of quantification; Compounds not detected in both influent and effluent by GC-MSMS: Icaridin, Moclobemide, Musk Ketone, Musk Xylene, Triclosan methyl ether; nonsteroidal anti-inflammatory drug (NSAID); Antitussive (cough suppressant); Biltricide (anti-worm biocide); Angiotensin II receptor antagonist (2RA)

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 2 (cont.) Summary statistics of pharmaceutical and personal care products (PPCPs) detected in influent and effluent samples and analytical method. Highest concentration in **bold**.

Analyte	Group	Influent (n = 30*)							Effluent (LC n = 66, GC n = 38)							Method
		LOR	Min	Mean*	S.D.*	Max	Freq.	Detects	LOR	Min	Mean*	S.D.*	max	Freq.	Detects	
			µg/L	µg/L	µg/L	µg/L	#	%		µg/L	µg/L	µg/L	µg/L	#	%	
Methadone	Analgesic, opioid	0.2	0.11	0.05	0.38	30	1	3%	0.02	<0.02	0.02	0.02	0.1	21	32%	LC
Methamphetamine	Stimulant	<0.2	0.2	1.75	1.20	6.6	29	97%	0.02	<0.02	0.07	0.08	0.46	45	68%	LC
Metoprolol	Beta-blocker	<0.2	0.2	0.50	0.24	1.2	28	93%	0.02	<0.02	0.13	0.12	0.39	52	79%	LC
Mirtazapine	Antidepressant	0.2	0.26	0.13	0.76	30	23	77%	0.02	<0.02	0.04	0.05	0.25	23	35%	LC
Naproxen	NSAID Analgesic	<0.2	0.2	3.58	1.51	6.2	29	97%	0.02	<0.02	0.09	0.12	0.5	40	61%	LC
Oxazepam	Anxiety relief	<0.2	0.2	0.38	0.25	1.2	25	83%	0.02	<0.02	0.21	0.16	0.65	59	89%	LC
Oxycodone	Analgesic, opioid	0.2	0.11	0.03	0.28	30	1	3%	0.02	<0.02	0.02	0.03	0.21	18	27%	LC
Paracetamol	Analgesic	<0.2	0.2	<b>247.2</b>	123.3	470	29	97%	0.02	<0.02	0.04	0.09	0.72	15	23%	LC
Pheniramine	Antihistamine	0.2	NA	NA	NA	30	0	0%	0.02	<0.02	0.02	0.01	0.07	1	2%	LC
Phenytoin	Anticonvulsant	0.2	NA	NA	NA	30	0	0%	0.02	<0.02	0.07	0.04	0.17	50	76%	LC
Pholcodine	Antitussive	1	NA	NA	NA	30	0	0%	0.1	<0.1	0.05	0.01	0.1	1	2%	LC
Praziquantel	Biltricide	0.2	NA	NA	NA	60	0	0%	0.02	<0.02	NA	NA	0.02	1	1%	LC
Primidone	Anticonvulsant	1	NA	NA	NA	30	0	0%	0.1	<0.1	0.13	0.12	0.7	30	45%	LC
Propranolol	Beta-blocker	0.2	0.11	0.03	0.25	30	1	3%	0.02	<0.02	0.03	0.03	0.11	23	35%	LC
Pseudoephedrine	Stimulant-	0.2	0.62	0.29	1.2	30	28	93%	0.02	<0.02	0.03	0.05	0.28	25	38%	LC
Roxithromycin	Antibiotic	0.5	0.28	0.10	0.59	30	3	10%	0.05	<0.05	0.04	0.03	0.13	16	24%	LC
Salicylic acid	Analgesic	20	28.80	16.14	70	30	21	70%	2	<2	NA	NA	NA	0	0%	LC
Sertraline	Antidepressant	0.2	0.16	0.09	0.4	30	9	30%	0.02	<0.02	0.04	0.05	0.23	24	36%	LC
Sulfamethoxazole	Antibiotic	<0.2	0.2	0.74	0.38	1.5	29	97%	<0.02	<0.02	0.11	0.13	0.65	50	76%	LC
Temazepam	Anxiety relief	<0.2	0.2	0.18	0.13	0.5	11	37%	<0.02	<0.02	0.14	0.10	0.41	59	89%	LC
Theophylline	Bronchodilator	2	3.48	1.75	7.2	30	19	63%	0.2	<0.2	0.17	0.17	0.4	3	5%	LC
Tonalid	Musk fragrance	<1	1	0.5	-	-	0	0%	<0.1	<0.1	0.13	0.13	0.3	19	50%	GC
Tramadol	Analgesic	<0.2	0.2	0.60	0.36	1.4	25	83%	<0.02	<0.02	0.25	0.19	0.68	55	83%	LC
Triclosan	Antimicrobial	<1	1	3.10	2.78	16	3	5%	<0.1	<0.1	0.35	0.21	0.1	3	3%	LC
Trimethoprim	Antibiotic	0.2	0.53	0.24	1.1	30	28	93%	0.02	<0.02	0.05	0.07	0.34	36	55%	LC
Valsartan	Angiotensin 2RA	<0.5	0.5	5.19	2.77	12	29	97%	<0.05	<0.05	0.25	0.30	1.3	46	69%	LC
Venlafaxine	Antidepressant	<0.2	0.2	1.30	0.77	4.7	29	97%	<0.02	<0.02	0.50	0.50	1.7	55	83%	LC

Freq. – frequency; Methods (LC/MSMS (LC) and GC/MSMS (GC)); \* TT14 shares the same influent as another WWTP; \*Mean and SD include the half LOR when compound was not detected; NA – not applicable, i.e. below the limits of quantification; Compounds not detected in both influent and effluent by GC-MSMS: Icaridin, Moclobemide, Musk Ketone, Musk Xylene, Triclosan methyl ether; nonsteroidal anti-inflammatory drug (NSAID); Antitussive (cough suppressant); Biltricide (anti-worm biocide); Angiotensin II receptor antagonist (2RA)

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 3. Summary statistics for Endocrine Disrupting Compounds across influent and effluent samples. Highest concentration and detects in bold. Note: Concentrations in ng/L as EDC compounds occur at low levels.

Analyte	Type	Influent (n = 30) †							Effluent (n = 66)						
		LOR	Min	Mean*	S.D.*	Max	Freq.	Detects	LOR	Min	Mean*	S.D.*	Max	Freq.	Detects
		ng/L	ng/L	ng/L	ng/L	ng/L	No.	%	ng/L	ng/L	ng/L	ng/L	ng/L	No.	%
17α-Estradiol (E2)	Hormone	20	<20	25	29	180	1	3%	2	<2	1	0	4	2	3%
17α-Ethinylestradiol (EE2)	Synthetic hormone	20	<20	NA	NA	NA	0	0%	2	<2	1	1	3	1	2%
17β-Estradiol (E2)	Natural hormone	40	<40	25	13	75	4	13%	2	<2	1	1	5	6	9%
4-t-Octylphenol	Surfactant	100	<100	NA	NA	NA	0	0%	10	<10	6	2	21	2	3%
Androstenedione	Androgen steroid hormone	40	<40	62	41	250	4	13%	5	<5	3	2	12	4	6%
Androsterone	Steroid hormone, weak androgen	40	<40	350	322	1,400	24	80%	2	<2	NA	NA	NA	0	0%
Bisphenol A	Plasticiser	200	<200	134	54	260	9	30%	10	<10	16	28	220	25	38%
Dihydrotestosterone	Androgen steroid hormone	40	<40	51	15	120	1	3%	5	<5	NA	NA	NA	0	0%
Estriol	Natural hormone	40	<40	106	118	470	18	60%	2	<2	1	1	11	1	2%
Estrone	Natural hormone	20	<20	28	21	110	18	60%	1	<1	3	5	29	23	35%
Etiocholanolone (5β-androsterone)	Steroid hormone	100	<100	1,875	1,500	4,600	<b>25</b>	<b>83%</b>	5	<5	NA	NA	NA	0	0%
Nonylphenol	Surfactant	500	<500	<b>1,582</b>	<b>2,686</b>	<b>12,000</b>	8	27%	50	<50	<b>86</b>	<b>96</b>	<b>540</b>	<b>28</b>	<b>42%</b>
Predicted estradiol equivalent	Toxic quotient	40	<40	28	16	83	7	23%	2	<2	2	2	13	8	12%
Testosterone	Natural hormone	100	<100	62	59	370	1	3%	5	<5	NA	NA	NA	0	0%

Freq. = frequency; NA – Not applicable; \*based on LOR for effluent; † TT14 shares the same influent as another WWTP; \*Mean and SD include the half LOR when compound was not detected Not detected - β-Trenbolone, Cumylphenol, Equilenin, Equilin, Mestranol, Norethindrone, Norgestrel, Progesterone. NC = Not Calculated

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 4. Summary statistics for PFAS across influent and effluent samples and estimated mean removal rate. Highest concentration and detects in bold.

Compound Name	Group	PFAS	Influent (n = 30) †						Effluent (n = 65)					
			Min	Mean*	S.D.*	Max	Freq.	Detects	Min	Mean*	S.D.*	Max	Freq.	Detects
			µg/L	µg/L	µg/L	µg/L	#	%	µg/L	µg/L	µg/L	µg/L	#	%
1H.1H.2H.2H-perfluorodecanesulfonic acid	n:2 FTSA	8:2 FTSA	<0.001	0.001	0.0005	0.003	2	7%	<0.001	NA	NA	NA	0	0%
1H.1H.2H.2H-perfluorohexanesulfonic acid	n:2 FTSA	4:2 FTSA	<0.001	0.001	0.0030	0.017	2	7%	<0.001	NA	NA	NA	0	0%
1H.1H.2H.2H-perfluorooctanesulfonic acid	n:2 FTSA	6:2 FTSA	<0.005	0.011	0.0334	0.18	7	23%	<0.005	0.004	<b>0.008</b>	<b>0.065</b>	2	3%
N-ethylperfluoro-1-octane sulfonamide	PFSSs	N-EtFOSA	<0.005	0.005	0.0073	0.019	1	3%	<0.005	0.004	0.008	0.051	2	3%
Perfluorobutanesulfonic acid	PFSAs	PFBS	<0.001	0.003	0.0037	0.015	18	60%	<0.001	0.001	0.002	0.009	32	49%
Perfluorobutanoic acid	PFCAs	PFBA	<0.005	0.006	0.0073	0.019	5	17%	<0.005	0.004	0.003	0.014	25	38%
Perfluorodecanoic acid	PFCAs	PFDA	<0.001	0.002	0.0019	0.007	16	53%	<0.001	0.002	0.002	0.009	43	66%
Perfluorododecanoic acid	PFCAs	PFDoDA	<0.001	NA	NA	NA	0	0%	<0.001	0.001	0.000	0.001	1	2%
Perfluoroheptanesulfonic acid	PFSAs	PFHpS	<0.001	0.001	0.0014	0.008	2	7%	<0.001	0.001	0.000	0.001	1	2%
Perfluoroheptanoic acid	PFCAs	PFHpA	<0.001	0.002	0.0026	0.012	8	27%	<0.001	0.003	0.002	0.009	50	77%
Perfluorohexanesulfonic acid	PFSAs	PFHxS	<0.001	0.010	0.0300	0.16	22	73%	<0.001	0.004	0.005	0.028	55	85%
Perfluorohexanoic acid	PFCAs	PFHxA	<0.001	0.008	0.0134	<b>0.058</b>	25	83%	<0.001	<b>0.011</b>	0.007	0.034	61	94%
Perfluorononanoic acid	PFCAs	PFNA	<0.001	0.001	0.0014	0.003	2	7%	<0.001	0.001	0.001	0.007	13	20%
Perfluorooctanesulfonic acid	PFSAs	PFOS	<0.0001	<b>0.0127</b>	<b>0.0397</b>	0.21	<b>28</b>	<b>93%</b>	<0.0001	0.0057	0.0048	0.021	<b>64</b>	<b>98%</b>
Perfluorooctanoic acid	PFCAs	PFOA	<0.001	0.004	0.0060	0.031	20	67%	<0.001	0.008	0.008	0.044	61	94%
Perfluoropentanesulfonic acid	PFSAs	PFPeS	<0.001	0.002	0.0041	0.021	4	13%	<0.001	0.001	0.001	0.005	2	3%
Perfluoropentanoic acid	PFCAs	PFPeA	<0.001	0.004	0.0056	0.029	23	77%	<0.001	0.008	0.006	0.024	60	92%
Perfluoropropanesulfonic acid	PFSAs	PFPrS	<0.001	0.001	0.0014	0.006	10	33%	<0.001	0.001	0.000	0.002	1	2%
Perfluorotetradecanoic acid	PFCAs	PFTeDA	<0.001	0.001	0.0019	0.006	2	7%	<0.001	0.001	0.001	0.006	3	5%
Perfluorotridecanoic acid	PFCAs	PFTrDA	<0.001	0.001	0.0014	0.002	2	7%	<0.001	0.001	0.002	0.015	1	2%
Perfluoroundecanoic acid	PFCAs	PFUnDA	<0.001	NA	NA	NA	0	0%	<0.001	0.001	0.000	0.002	3	5%

Freq. = frequency; NA – Not applicable; \*based on LOR for effluent; † TT14 shares the same influent as another WWTP; \*Mean and SD include the half LOR when compound was not detected  
 Not detected: <0.001: 1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA), Perfluorodecanesulfonic acid (PFDS), Perfluorononanesulfonic acid (PFNS); <0.005: 2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE), 2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE), N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA), N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA), N-methylperfluoro-1-octane sulfonamide (N-MeFOSA), Perfluorooctane sulfonamide (FOSA); PFAS Groups - Perfluoroalkyl carboxylic acids (PFCAs) Perfluoroalkyl sulfonic acids (PFSAs); Perfluoroalkyl sulfonamido substances- n:2 Fluorotelomer sulfonic acids (n:2 FTSA).

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 5. Summary statistics for the detected herbicides across influent and effluent samples and estimated mean removal rates.

Analyte	Type	Influent (n =30) †							Effluent (LC n = 66; GC n= 38-42)							Method	
		LOR	Min	Mean*	S.D.*	Max	Freq.	Detect	LOR	Min	Mean	S.D.	Max	n	Freq.		Detect
	Units	µg/L	µg/L	µg/L	µg/L	µg/L	#	%	µg/L	µg/L	µg/L	µg/L	µg/L	#	#	%	
2,4-D	Phenoxy acid	0.2	<0.2	0.16	0.10	0.49	1	3%	0.02	<0.02	0.04	0.05	0.29	66	21	32%	LC
2,4-DB <sup>^</sup>	Phenoxy acid	0.1	<0.1	0.25	0.01	0.17	1	3%	0.05	<0.05	NA	NA	NA	66	0	0%	LC
Atrazine by LC/MSMS	Triazine	<0.2	0.2	NA	NA	NA	0	0%	0.02	<0.02	0.021	0.029	0.16	66	17	26%	LC
Atrazine by GC/MSMS	Triazine	1	<1	NA	NA	NA	0	1%	0.1	<0.1	0.087	0.123	0.1	38	1	3%	GC
Atrazine, 2-hydroxy	Triazine metabolite	0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.01	0.01	0.04	66	5	8%	LC
Bromacil	Herbicide	0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.01	0.001	0.02	62	1	2%	LC
Bromoxynil		0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.01	0.002	0.03	66	1	2%	LC
Clomazone	Oxazolidione	0.1	<0.1	0.05	0.03	0.18	1	3%	0.01	<0.01	0.01	0.03	0.16	66	3	5%	LC
Cyanazine		0.01	<0.01	NA	NA	NA	0	0%	0.01	<0.01	0.01	0.001	0.01	66	1	2%	LC
Dalapon (2,2-DPA)	Chlorinated aliphatic	1	<1	0.98	0.09	0.5	1	3%	0.2	<0.2	0.21	0.42	<b>2.9</b>	66	8	12%	LC
DCPMU	Urea metabolite	0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.01	0.01	0.04	66	6	9%	LC
Desethyl Atrazine	Triazine (metb.)	0.1	<0.1	NA	NA	NA	0	0%	0.01	<0.01	0.01	0.01	0.03	62	6	10%	LC
Desisopropyl Atrazine	Triazine (metb.)	0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.05	0.09	0.48	62	13	21%	LC
Desisopropyl Atrazine	Triazine (metb.)	1	<1	NA	NA	NA	0	0%	0.02	<0.02	0.098	0.12	0.3	42	2	5%	GC
Diuron	Urea	0.2	<0.08	0.22	0.62	<b>3.5</b>	3	10%	0.02	<0.02	0.07	0.05	0.19	66	52	79%	LC
Fluroxypyr	Auxin	0.5	<0.5	NA	NA	NA	0	0%	0.05	<0.05	0.03	0.01	0.08	66	3	5%	LC
Haloxypop (acid)		0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.013	0.007	0.04	66	1	2%	LC
Hexazinone (LC/MSMS)	Triazine	0.1	<0.1	NA	NA	NA	0	0%	0.01	<0.01	0.08	0.36	<b>3.4</b>	66	6	6%	LC
Hexazinone (GC/LC)	Triazine	1	<1	NA	NA	NA	0	0%	0.1	<0.1	0.12	0.22	<b>0.2</b>	38	1	3%	GC

Freq. – frequency; Methods (LC/MSMS (LC) and GC/MSMS (GC)); NA – Not applicable; <sup>^</sup> Several samples initially analysed for herbicides at a lower LOR (e.g. the triazine simazine; sulfonyl urea herbicides, the phenoxy acid herbicide 2,4-DB was only detected in one effluent sample at 0.17 ug/L; <sup>†</sup> TT14 shares the same influent as another WWTP; <sup>‡</sup>Mean and SD include the half LOR when compound was not detected; metb. – metabolite. Compounds not detected in either influent or effluent by LC-MSMS: 2,4-DP (Dichlorprop), 2,4,5-T, 3,4-Dichloroaniline, Acifluorfen, Ametryn, Amicarbazone, Asulam, DCPU, Dicamba, Ethametsulfuron methyl, Ethoxysulfuron, Flamprop-methyl, Fluazifop (acid), Fluometuron (KWHPDI), Halosulfuron methyl, Imazapic, Isoxaflutole metabolite (DKN), MCPB, Mesosulfuron methyl, Metribuzin (KWHPDI), Molinate (KWHPDI), Napropamide, Pendimethalin (KWHPDI), Picloram, Propachlor, Propazin-2-hydroxy, Sethoxydim, Sulfosulfuron, Terbutylazine desethyl, Terbutryn, Trifloxysulfuron. Compounds not detected in either influent or effluent by GC-MSMS: Ametryn (KWP), Atrazine (KWP), Bromacil, Desethyl Atrazine, Diclofop-methyl, Fluazifop-butyl, Fluometuron, Haloxypop-2-etoyl, Haloxypop-methyl, Metribuzin, Molinate, Oxadiazon, Oxyfluorfen, Pendimethalin, Propanil, Propazine.

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 5. (cont.) Summary statistics for the detected herbicides across influent and effluent samples and estimated mean removal rates.

Analyte	Type	Influent (n = 30) †							Effluent (LC n = 66; GC n = 38-42)							Method	
		LOR	Min	Mean*	S.D. *	Max	Freq.	Detect	LOR	Min	Mean	S.D.	Max	n	Freq.		Detect
	Units	µg/L	µg/L	µg/L	µg/L	µg/L	#	%	µg/L	µg/L	µg/L	µg/L	µg/L	#	#	%	
Imazapyr		0.02	<0.02	NA	NA	NA	0	0%	0.02	<0.02	0.01	0.003	0.03	66	3	5%	LC
Imazethapyr		0.02	<0.02	NA	NA	NA	0	0%	0.02	<0.02	0.01	0.001	0.02	66	1	2%	LC
loxynil		0.01	<0.01	NA	NA	NA	0	0%	0.01	<0.01	0.006	0.003	0.02	66	1	2%	LC
Metolachlor-OXA		0.05	<0.05	NA	NA	NA	0	0%	0.05	<0.05	0.03	0.04	0.21	66	4	6%	LC
MCPA	Phenoxy acid	0.1	0.1	0.17	0.52	<b>2.9</b>	4	13%	0.01	<0.01	0.11	0.18	0.91	66	47	71%	LC
Mecoprop	Chlorophenoxy	0.2	<0.1	0.10	0.02	0.23	2	7%	0.02	<0.02	0.03	0.02	0.11	66	27	41%	LC
Metolachlor	Sulfonyl-urea	0.1	<0.01	0.06	0.06	0.37	1	3%	0.01	<0.01	0.02	0.05	0.37	62	6	10%	LC
Metsulfuron methyl	Sulfonyl-urea	0.2	<0.2	NA	NA	NA	0	0%	0.02	<0.02	0.04	0.04	0.12	66	12	18%	LC
Triclopyr	Chloro-pyridinyl	0.1	<0.1	0.30	0.14	0.81	1	3%	0.05	0.05	0.04	0.05	0.4	66	9	14%	LC
Desisopropyl Atrazine	Triazine (metb.)	1	<1	NA	NA	NA	NA	0%	0.02	<0.02	0.10	0.12	0.3	42	2	5%	GC
Metolachlor		1	<1	NA	NA	NA	NA	0%	0.01	<0.01	0.09	0.13	0.4	42	1	2%	GC
Simazine ^	Triazine	0.03 / 0.1	<0.03 / <0.1	0.21	0.36	<b>1.8</b>	13	43%	0.01	<0.01	0.26	0.52	<b>2.3</b>	62	51	82%	LC
Simazine	Triazine	1	<1	NA	NA	NA	0	0%	0.02	<0.02	0.24	0.40	1.8	42	15	36%	GC
Tebuthiuron by LC/MSMS		0.01	<0.01	NA	NA	NA	0	0%	0.01	<0.01	0.007	0.007	0.06	62	8	13%	LC
Tebuthiuron (GC/MSMS)		1	<1	NA	NA	NA	0	0%	0.01	<0.01	0.09	0.13	0.34	42	2	5%	GC
Terbuthylazine	Chloro-triazine	0.01	<0.01	NA	NA	NA	0	0%	0.01	0.01	0.01	0.01	0.06	62	8	13%	LC
Terbuthylazine by GC/MSMS		1	<1	NA	NA	NA	0	0%	<0.01	0.01	0.08	0.12	0.02	42	1	2%	GC
Trinexapac (acid)		0.05	<0.05	NA	NA	NA	0	0%	<0.05	0.05	0.03	0.01	0.12	66	1	2%	LC

Freq. – frequency; Methods (LC/MSMS (LC) and GC/MSMS (GC)); NA – Not applicable; ^ Several samples initially analysed for herbicides at a lower LOR (e.g. the triazine simazine; sulfonyl urea herbicides, the phenoxy acid herbicide 2,4-DB was only detected in one effluent sample at 0.17 ug/L.; † TT14 shares the same influent as another WWTP; \*Several samples initially analysed for herbicides at a lower LOR (e.g. the triazine simazine; sulfonyl urea herbicides, the phenoxy acid herbicide 2,4-DB was only detected in one effluent sample at 0.17 ug/L.; \*Mean and SD include the half LOR when compound was not detected; metb. – metabolite. Compounds not detected in either influent or effluent by LC-MSMS: 2,4-DP (Dichlorprop), 2,4,5-T, 3,4-Dichloroaniline, Acifluorfen, Ametryn, Amicarbazone, Asulam, DCPU, Dicamba, Ethametsulfuron methyl, Ethoxysulfuron, Flamprop-methyl, Fluazifop (acid), Fluometuron (KWHPDI), Halosulfuron methyl, Imazapic, Isoxaflutole metabolite (DKN), MCPB, Mesosulfuron methyl, Metribuzin (KWHPDI), Molinate (KWHPDI), Napropamide, Pendimethalin (KWHPDI), Picloram, Propachlor, Propazin-2-hydroxy, Sethoxydim, Sulfosulfuron, Terbuthylazine desethyl, Terbutryn, Trifloxysulfuron. Compounds not detected in either influent or effluent by GC-MSMS: Ametryn (KWP), Atrazine (KWP), Bromacil, Desethyl Atrazine, Diclofop-methyl, Fluazifop-butyl, Fluometuron, Haloxypop-2-etotyl, Haloxypop-methyl, Metribuzin, Molinate, Oxadiazon, Oxyfluorfen, Pendimethalin, Propanil, Propazine..



## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 6. Summary statistics for detected insecticides across influent and effluent samples and the insecticide class.

Analyte	Influent (n = 30) †								Effluent (LC n = 66; GC n= 38-42)							Insecticide class	
	LOR	Min	Mean ‡	S.D. ‡	Max	n	Freq.	Detect	LOR	Min	Mean ‡	S.D. ‡	Max	n	Freq.		Detect
Units	µg/L	µg/L	µg/L	µg/L	µg/L	#	#	%	µg/L	µg/L	µg/L	µg/L	µg/L	#	#	%	
Insecticides																	
Diazinon	0.01	<0.01	NA	NA	NA	30	0	0%	0.01	<0.01	0.006	0.005	0.04	62	3	5%	Organophosphate
Imidacloprid	0.2	<0.2	0.21	0.24	<b>1.3</b>	30	12	40%	0.02	<0.02	0.11	0.19	<b>1.4</b>	66	41	62%	Nicotinoid
Imidacloprid metabolites	0.2	<0.2	0.11	0.05	0.31	30	2	7%	0.02	<0.02	0.02	0.04	0.3	66	11	17%	Nicotinoid
Fipronil	0.2	<0.2	0.10	0.01	0.05	30	1	3%	0.02	<0.02	0.02	0.02	0.02	62	2	3%	Phenyl-pyrazole
Piperonyl butoxide	0.7	0.70	0.70	0.36	1.6	30	8	27%	0.1	<0.1	0.09	0.12	0.1	38	1	3%	Insecticide synergist
Propoxur (LC/MSMS)	0.5	<0.5	0.29	0.27	<b>1.7</b>	30	1	3%	0.05	<0.05	NA	NA	NA	62	0	0%	Carbamate
Propoxur (GC/MSMS)	1	<1	0.54	0.24	<b>1.8</b>	30	1	3%	0.05	<0.05	NA	NA	NA	42	0	0%	Carbamate
Thiacloprid	0.2	<0.2	NA	NA	NA	30	0	0%	0.02	<0.02	0.012	0.009	0.07	66	5	8%	Neonicotinoid
Thiamethoxam	0.5	<0.5	0.26	0.11	0.8	30	1	3%	0.05	<0.05	NA	NA	NA	66	0	0%	Neonicotinoid

Freq. – frequency; † TT14 shares the same influent as another WWTP; ‡ Mean and SD include the half LOR when compound was not detected;

Other compounds measured but not detected by LC-MSMS - Acetamiprid, Chlorpyrifos (KWHPDI), Chlorpyrifos oxon (KWHPDI), Clothianidin, Dinotefuran, Fipronil amide, Fipronil Desulfinyl, Fipronil sulfide, Fipronil sulfone, Flupyradifurone, Methoxyfenozide, N-Desmethyl Acetamiprid, Total Acetamiprid, Not detected by GC-MS: α-Endosulfan, α-HCH, β-Endosulfan, β-HCH, <delta> -HCH, Aldrin, Amitraz, Azinphos-ethyl, Azinphos-methyl, Bendiocarb, Bifenthrin, Bioresmethrin, Bromophos-ethyl, Cadusafos, Carbaryl, Carbophenothion, Chlordane-1-hydroxy-2,3-epoxide, Chlordane cis, Chlordane trans, Chlordene, Chlordene-1-hydroxy, Chlordene epoxide, Chlorfenvinphos, Chlorpyrifos, Chlorpyrifos-methyl, Chlorpyrifos oxon, Coumaphos, Cyfluthrin, Cyhalothrin, Cypermethrin, DDD (op), DDD (pp), DDE (op), DDE (pp), DDT (op), DDT (pp), Deltamethrin, Demeton-O-methyl, Demeton-S, Demeton-S-methyl, Diazinon, Dichlorvos, Dieldrin, Dimethoate, Dioxathion, Disulfoton, Endosulfan ether, Endosulfan lactone, Endosulfan sulfate, Endrin, Endrin aldehyde, Ethion, Ethoprophos, Etrimphos, Famphur, Fenamiphos, Fenchlorphos, Fenitrothion, Fenthion-ethyl, Fenthion (methyl), Fenvalerate, Fipronil, Fluvalinate, HCB, Heptachlor, Heptachlor epoxide, Isofenphos, Lindane (<gamma>-HCH), Malathion (Maldison), Methidathion, Methoprene, Methoxychlor, Mevinphos, Monocrotophos, Nonachlor cis, Nonachlor trans, Omethoate, Oxychlordane, Oxydemeton-methyl, Parathion-methyl, Parathion (ethyl), Permethrin, Phenothrin, Phorate, Phosmet, Phosphamidon, Pirimicarb, Pirimiphos-methyl, Profenofos, Propargite, Prothiofos, Pyrazophos, Rotenone, Sulprofos, Temephos, Terbufos, Tetrachlorvinphos, Tetradifon, Tetramethrin, Total Aldrin & Dieldrin, Total Chlordane, Total DDT, Total Dimethoate, Total Endosulfan, Total Heptachlor, Transfluthrin, Triallate, Trifluralin.

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 7. Summary statistics for detected fungicides across influent and effluent samples. Highest concentration and detects in bold.

Analyte	Influent (n = 30) †							Effluent (n = 38 – 42)						Method
	LOR	Min	Mean †	SD †	max	n	Detects	Min	Mean	S.D.	Max	n	Detects	
<b>Fungicides</b>														
Flutriafol (by GC)	<1	<1	NA	NA	NA	30	0%	0.02	0.09	0.12	0.2	42	10%	GC/MSMS
Flutriafol (by LC)	<0.2	0.02	0.11	0.08	0.52	30	<b>3% (1)</b>	<b>&lt;0.02</b>	0.03	0.08	0.46	62	<b>16% (10)</b>	LC/MSMS/
Metalaxyl	1	<1	NA	NA	NA	30	0%	0.1	0.09	0.12	0.2	38	8%	GC/MSMS
Propiconazole	1	<1	NA	NA	NA	30	0%	0.1	0.10	0.13	0.3	38	8%	GC/MSMS
Tebuconazole	1	<1	NA	NA	NA	30	0%	0.1	0.09	0.12	0.2	38	3%	GC/MSMS
Thiabendazole	1	<1	<b>1.09</b>	0.51	<b>3.8</b>	30	3%	0.2	<b>0.20</b>	0.28	<b>1.0</b>	38	3%	GC/MSMS
Triadimenol	1	<1	NA	NA	NA	30	0%	0.1	0.09	0.12	0.2	38	3%	GC/MSMS

† Mean and SD include the half LOR when compound was not detected

Compounds not detected in either influent and/or effluent by LC-MSMS: flusilazole; Compounds not detected in either influent and/or effluent by GC-MSMS: benalaxyl, bitertanol, captan, dimethomorph, furalaxyl, procymidone, total triadimefon, triadimefron, vinclozolin.

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 8. Summary statistics for industrial compounds across influent and effluent samples per compound group and analytical method. Highest concentration and detects highlighted in bold.

Matrix	Influent (n = 30) †							Effluent (n = 38)							
Analyte	LOR	Min	Mean <sup>‡</sup>	SD <sup>‡</sup>	max	n	Detects	LOR	Min	Mean	S.D.	Max	n	Detects	Method
Units	µg/L	µg/L	µg/L	µg/L	n	n	%	µg/L	µg/L	µg/L	µg/L	µg/L	n	%	
Benzenesulfonanilide	2	<2	1.04	0.26	2.4	30	3%	0.2	<0.2	NA	NA	NA	38	0%	GC/MSMS
1H-Benzotriazole	7	<7	NA	NA	NA	30	0%	0.7	<0.7	0.64	0.84	0.9	38	8%	GC/MSMS
1H-Benzotriazole, 4-methyl	0.5	<0.5	NA	NA	NA	30	0%	0.5	<0.5	0.54	0.61	0.9	38	24%	GC/MSMS
1H-Benzotriazole, 5-methyl	0.2	<0.2	1.22	0.63	3.8	30	13%	0.2	<0.2	0.32	0.25	0.6	38	55%	GC/MSMS
2,4-Di-t-butylphenol	1	<1	NA	NA	NA	30	0%	0.1	<0.1	0.10	0.14	0.5	38	3%	GC/MSMS
2,6-Di-t-butyl-p-cresol (BHT)	1	<1	NA	NA	NA	30	0%	0.1	<0.1	0.09	0.12	0.1	38	3%	GC/MSMS
4-Chloro-3,5-dimethylphenol	1	<1	<b>4.70</b>	2.79	<b>12</b>	30	<b>87%</b>	0.1	<0.1	0.09	0.12	0.2	38	13%	GC/MSMS
N-Butylbenzenesulfonamide	1	<1	0.52	0.09	1	30	3%	0.1	<0.1	0.12	0.14	0.4	38	24%	GC/MSMS
Triethyl phosphate	1	<1	NA	NA	NA	30	0%	0.1	<0.1	0.12	0.13	0.3	38	45%	GC/MSMS
Tris(chloroethyl) phosphate	1	<1	NA	NA	NA	30	0%	0.1	<0.1	0.13	0.13	0.4	38	55%	GC/MSMS
Tris(chloropropyl) phosphate isomers	0.3	<0.3	2.89	1.24	7.9	30	20%	0.1	<0.3	<b>0.87</b>	0.59	<b>1.5</b>	38	<b>74%</b>	GC/MSMS
Tris(dichloropropyl) phosphate	1	<1	NA	NA	NA	30	0%	0.1	<0.1	0.13	0.13	0.3	38	50%	GC/MSMS

<sup>‡</sup>Mean and SD include the half LOR when compound was not detected; compounds not detected in either influent and/or effluent by GC-MSMS: 1-methyl, 2-benzyl-4-chlorophenol; 2,6-di-t-butylphenol; N-butyltoluenesulfonamide; tri-n-butyl phosphate

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 9. Summary statistics for phenols across influent and effluent samples. Highest concentration and detects highlighted in bold.

Matrix	Influent (n = 30) †							Effluent (n = 65)						
Analyte	LOR	Min	Mean	S.D.	Max	n	Detects	LOR	min	mean	sd	max	n	Detects
Units	µg/L	µg/L	µg/L	µg/L	µg/L	n	%	µg/L	µg/L	µg/L	µg/L	µg/L	n	%
2-Chlorophenol	0.00005	<0.00005	0.00005	0.00009	0.00044	30	3%	0.00005	0.00005	0.00004	0.00005	0.00012	65	2%
2-Methylphenol (o-Cresol)	0.00005	<0.00005	0.00056	0.00164	0.0088	30	30%	0.00005	<0.00005	NA	NA	NA	65	0%
2,4-Dimethylphenol	0.00005	<0.00005	0.00054	0.00255	0.014	30	10%	0.00005	<0.00005	NA	NA	NA	65	0%
2,4,6-Trichlorophenol	0.0001	<0.0001	NA	NA	NA	30	0%	0.0001	0.0001	0.0001	0.0001	0.0005	65	2%
3&4-Methylphenol (m&p-Cresol)	0.0001	<0.0001	0.0945	0.2799	<b>1.4</b>	30	73%	0.0001	0.0001	0.0001	0.0001	0.0003	65	2%
4-Chloro-3-methylphenol	0.0001	<0.0001	0.0001	0.0002	0.001	30	13%	0.0001	0.0001	0.0001	0.0001	0.0006	65	2%
Phenol	0.00005	<0.00005	0.03484	0.07038	0.3	30	77%	0.00005	0.00005	0.00006	0.00012	0.00083	65	14%
Total Halogenated Phenol*	0.001	0.001	0.001	0.001	0.001	30	7%	0.001	0.001	0.001	0.000	0.001	65	2%
Total Non-Halogenated Phenol*	0.01	0.01	0.13	0.34	1.7	30	57%	0.01	<0.01	NA	NA	NA	65	0%

‡Mean and SD include the half LOR when compound was not detected; compounds not detected in either influent and effluent by GC-MSMS: 2-Chlorophenol, 2-Cyclohexyl-4,6-dinitrophenol, 2-Methyl-4,6-dinitrophenol, 2-Methylphenol (o-Cresol), 2-Nitrophenol, 2,4-Dichlorophenol, 2,4-Dimethylphenol, 2,4-Dinitrophenol, 2,4,5-Trichlorophenol, 2,4,6-Trichlorophenol, 2,6-Dichlorophenol, 3&4-Methylphenol (m&p-Cresol), 4-Chloro-3-methylphenol, 4-Nitrophenol, Dinoseb, Pentachlorophenol, Phenol, Phenol-d6 (surr.), Tetrachlorophenols - Total

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 10. Summary statistics for disinfection by-products in effluent samples from four groups. Highest concentration and detects highlighted in bold.

Group	Analyte	Effluent (n = 34)								Guideline Value (AGWC)
		Units	LOR	Min	Mean	S.D.	Max	Hits	Detects	
Haloacetic acids (n = 34)	Bromochloroacetic Acid (BCAA)	µg/L	5	<5	3.04	1.88	11	3	9%	
	Bromodichloroacetic Acid (BDCAA)	µg/L	5	<5	4.51	4.09	20	6	18%	
	Chlorodibromoacetic Acid (CDBAA)	µg/L	5	<5	3.09	1.08	5	1	3%	
	Dalapon (2,2-DPA)	µg/L	10	<10	NA	NA	NA	NA	0%	
	Dibromoacetic Acid (DBAA)	µg/L	5	<5	2.60	0.60	6	1	3%	
	Dichloroacetic Acid (DCAA)	µg/L	5	<5	5.85	10.69	45	4	12%	100 <sup>c</sup>
	Monobromoacetic Acid (MBAA)	µg/L	5	<5	NA	NA	NA	NA	0%	
	Monochloroacetic Acid (MCAA)	µg/L	5	<5	2.78	0.95	7	2	6%	
	Trichloroacetic Acid (TCAA)	µg/L	5	<5	6.79	12.30	<b>64</b>	6	18%	
Haloacetonitriles (n = 34)	1,1,1-Trichloropropan-2-one	µg/L	0.5	<1	1.01	1.67	7.6	4	12%	
	1,1-Dichloropropan-2-one	µg/L	0.5	<1	0.65	0.53	3.1	3	9%	
	Bromochloroacetonitrile	µg/L	0.5	<1	0.66	0.53	3.3	4	12%	
	Chloral hydrate	µg/L	0.5	<1	1.61	4.03	<b>21</b>	3	9%	
	Chloropicrin	µg/L	0.5	<1	NA	NA	NA	NA	0%	
	Dibromoacetonitrile	µg/L	0.5	<1	NA	NA	NA	NA	0%	
	Dichloroacetonitrile	µg/L	0.5	<1	1.10	1.98	9.5	4	12%	
	Trichloroacetonitrile	µg/L	0.5	<1	NA	NA	NA	NA	0%	
Nitrosamines (n = 28)*	N-Nitrosodibutylamine	ng/L	5	<5	NA	NA	NA	NA	0%	
	N-Nitrosodiethylamine	ng/L	5	<5	NA	NA	NA	NA	0%	
	N-Nitrosodimethylamine	ng/L	5	<5	3.59	5.76	<b>33</b>	1	<b>4%</b>	10 <sup>f</sup>
	N-Nitrosodipropylamine	ng/L	5	<5	NA	NA	NA	NA	0%	
	N-Nitrosomethylethylamine	ng/L	5	<5	NA	NA	NA	NA	0%	
	N-Nitrosopiperidine	ng/L	5	<5	NA	NA	NA	NA	0%	
	N-Nitrosopyrrolidine	ng/L	20	<20	NA	NA	NA	NA	0%	
Trihalomethanes (n = 34)	Bromodichloromethane	µg/L	1	<1	4.3	11	49	6	18%	6 <sup>f</sup>
	Bromoform	µg/L	1	<1	0.7	1.0	5	2	6%	100 <sup>f</sup>
	Chloroform	µg/L	5	<5	9.5	17	<b>58</b>	6	18%	200 <sup>f</sup>
	Dibromochloromethane	µg/L	1	<1	1.9	5.1	23	5	15%	100 <sup>f</sup>

<sup>‡</sup>Mean and SD include the half LOR when compound was not detected; \*several missing samples due to breakages in transit  
Total Sum of Trihalomethanes not shown.

<sup>f</sup>WHO (2006a) (for non-threshold chemicals corrected to apply carcinogenicity risk of 10<sup>-6</sup>)

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 11. Percent reduction (%R) (mean  $\pm$  S.E.) for each treatment train for A) PPCPs, and EDCs, B) PFAS, C) Insecticides, fungicides and industrial. Minimum and maximum show the lowest removal (or -% negative reduction) and highest reduction across all sites. Number of samples (or treatment train number) shown in brackets. Bolded numbers highlight where compounds have increased (negative reduction) between influent and effluent.

A	Treatment Train	TT1 (mean)	TT2	TT4	TT7	TT8	TT9	TT12	TT13	TT14	Min %R (site)	Max %R (site)	Paired detects <sup>†</sup>
	Treatment Types	Lagoon	Aerated Lagoon	Aerated Lagoon, Lagoon	ASP	ASP, Cl <sub>2</sub>	ASP, Lagoon	ASP + Lagoon + UF + RO1 + RO2	ASP, Lagoon, RO, Chlorine	ASP with extended aeration, Chlorine			
	n	8	4	6	4	2	4	1	1	1			
	Units	%	%	%	%	%	%	%	%	%	%	%	
Group	Compound												
PPCPs	Lamotrigine	<b>-24<math>\pm</math>21%</b> (8)	<b>-29<math>\pm</math>10%</b> (4)	<b>-75<math>\pm</math>12%</b> (6)	<b>-50<math>\pm</math>21%</b> (4) <sup>b</sup>	5.5 $\pm$ 15% (2) <sup>a</sup>	<b>-106<math>\pm</math>31%</b> (4)	96.7% (1) <sup>a</sup>	98.7% (1) <sup>a</sup>	<b>-15% (1)</b>	<b>-184%</b> (TT9)	98.7% (TT8) <sup>a</sup>	31
	Acesulfame K	94 $\pm$ 2.2% (8) <sup>a</sup>	96 $\pm$ 1.4% (4) <sup>a</sup>	98.5 $\pm$ 0.5% (6) <sup>a</sup>	98.8 $\pm$ 0.3% (3) <sup>a,OR</sup>	99.7 $\pm$ 0.3% (2) <sup>a</sup>	94.6 $\pm$ 3.6% (4)	99.9% (1) <sup>a</sup>	99.9% (1) <sup>a</sup>	99.7% (1)	81.7% (TT1)	99.9% (TT8) <sup>a</sup>	30
	Caffeine	99.6 $\pm$ 0.2% (8) <sup>a</sup>	99.6 $\pm$ 0.2% (4) <sup>a</sup>	99.7 $\pm$ 0.1% (6) <sup>a</sup>	99.5 $\pm$ 0.2% (3) <sup>a</sup>	99.9* $\pm$ 0.01% (2) <sup>a</sup>	99.3 $\pm$ 0.3% (4) <sup>a</sup>	99.9% (1) <sup>a</sup>	99.9% (1) <sup>a</sup>	99.9% (1) <sup>a</sup>	98.4%(TT9)	99.93% (TT7) <sup>a</sup>	30
	Carbamazepine	42 $\pm$ 12% (8)	36 $\pm$ 8% (4)	<b>-23<math>\pm</math>4%</b> (6)	13 $\pm$ 36% (2)	<b>-36<math>\pm</math>0.4%</b> (2)	<b>-18<math>\pm</math>30%</b> (4)	97.6% (1) <sup>a</sup>	98.9% (1) <sup>a</sup>	15.6% (1)	<b>-92%</b> (TT9)	98.9% (TT13) <sup>a</sup>	29
	Galaxolide	96.4 $\pm$ 1.4% (8) <sup>a</sup>	98.8 $\pm$ 0.2% (4) <sup>a</sup>	66 $\pm$ 3% (6)	67 $\pm$ 15% (3)	75 $\pm$ 7% (2)	90 $\pm$ 2% (4)	98.7% (6) <sup>a</sup>	99.0% (1) <sup>a</sup>	75.6% (1)	47.4% (TT7)	99.4% (TT1) <sup>a</sup>	30
	Paracetamol	99.9 $\pm$ 0.1% (8) <sup>a</sup>	99.99 $\pm$ 0.002% (4) <sup>a</sup>	99.97 $\pm$ 0.01% (6) <sup>a</sup>	99.98 $\pm$ 0.02% (3) <sup>a</sup>	99.996 $\pm$ 0.001% (2) <sup>a</sup>	99.996 $\pm$ 0.01% (4) <sup>a</sup>	99.992% (1) <sup>a</sup>	99.997% (1) <sup>a</sup>	99.997% (1) <sup>a</sup>	99.57% (TT1)	99.9977% (All TTs >99.9%)	30
	Venlafaxine	89 $\pm$ 4% (8) <sup>a</sup>	82 $\pm$ 6% (4)	<b>-7.4<math>\pm</math>10%</b> (6)	21 $\pm$ 24% (4) <sup>o</sup>	91 $\pm$ 8% (2) <sup>a</sup>	40 $\pm$ 18% (4)	98.8% (1) <sup>a</sup>	99.3% (1) <sup>a</sup>	74% (1)	<b>-7.4%</b> (TT4)	99.3% (TT13)	31
EDCs	17 $\beta$ -estradiol	97 $\pm$ 0.2% (2) <sup>a</sup>	NC	97% (1) <sup>a,OR</sup>	98% (1) <sup>a,OR</sup>	NC	NC	NC	NC	NC	97.2% (TT1) <sup>a</sup>	98.3% (TT7) <sup>a</sup>	4
	BPA	97 $\pm$ 0.3% (2) <sup>a</sup>	96 $\pm$ 0.1% (2)	95 $\pm$ 2% (4) <sup>a</sup>	NC	NC	92% (1) <sup>a</sup>	NC	NC	NC	89.6% (TT4) <sup>a</sup>	97.7% (TT1) <sup>a</sup>	9
	Estrone	97 $\pm$ 1.0% (4) <sup>a,OR</sup>	83 $\pm$ 9% (3) <sup>a</sup>	95 $\pm$ 0.8% (3) <sup>OR</sup>	92 $\pm$ 8% (2) <sup>a</sup>	98 $\pm$ 0.1% (2) <sup>a</sup>	66 $\pm$ 33% (2) <sup>a</sup>	97% (1) <sup>a</sup>	98.7% (1) <sup>a</sup>	NC	33% (TT9)	99.5 (TT7) <sup>a</sup>	17
	Etiocholanolane	99.7 $\pm$ 0.1% (8) <sup>a</sup>	99.8 $\pm$ 0.04% (3) <sup>a</sup>	99.6 $\pm$ 0.2% (6) <sup>a</sup>	99.7% (1) <sup>a</sup>	99.9 $\pm$ 0.1% (2) <sup>a</sup>	99.8 $\pm$ 0.1% (3) <sup>a</sup>	99.9% (1) <sup>a</sup>	99.9% (1) <sup>a</sup>	99.8% (1) <sup>a</sup>	98.4% (TT4) <sup>a</sup>	99.95% (TT4) <sup>a</sup>	24
	Nonylphenol	95 $\pm$ 1.7% (3) <sup>a</sup>	90 $\pm$ 7% (2)	99.6% (1)	NC	97% (1)	NC	NC	NC	NC	76% (TT2)	99.6% (TT4)	8

Note: TT3, TT5, TT6, TT10 and TT11 were not sampled; Positive values (%) indicate a removal (decrease in concentration between influent and effluent); negative values (-%) indicate an increase in concentration between influent and effluent. NC-not calculated, not detected in effluent or influent, or LORs differ

<sup>a</sup> Based only on influent concentration, where one or more site(s) had effluent concentration assumed half LOR;

<sup>b</sup> Based only on effluent concentrations, where one or more site(s) influent assumes half LOR concentration (PFAS, Phenols only as LOR was the same for influent and effluent);

<sup>OR</sup> Outlier removed as the value based on half LOR was outside the expected range (1.5 x min or max)

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 11. (cont.). Percent reduction (%R) (mean ±S.E.) for each treatment train for A) PPCPs, and EDCs, B) PFAS, C) Insecticides, fungicides and industrial. Minimum and maximum show the lowest removal (or -% negative reduction) and highest reduction across all sites. Number of samples (or treatment train number) shown in brackets. Bolded numbers highlight where compounds have increased (negative reduction) between influent and effluent.

B	Treatment Train	TT1 (mean)	TT2	TT4	TT7	TT8	TT9	TT12	TT13	TT14	Min %R (site)	Max %R (site)	Paired detects <sup>†</sup>
	Treatment Types	Lagoon	Aerated Lagoon	Aerated Lagoon, Lagoon	ASP	ASP, Cl <sub>2</sub>	ASP, Lagoon	ASP, Lagoon, UF, RO1, RO2	ASP, Lagoon, RO, Chlorine	ASP with extended aeration, Chlorine			
	n	8	4	6	4	2	4	1	1	1			
Units	%	%	%	%	%	%	%	%	%	%	%	%	
Group	Compound												
PFAS	PFOS	<b>-315±159%</b> (8)	<b>-114±58%</b> (6)	15±14% (6)	6±31% (4)	<b>-129%</b> (1) <sup>b,OR</sup>	<b>-364±314%</b> (3)	99.9% (1)	<b>-250%</b> (1) <sup>b</sup>	<b>30%</b> (1)	<b>-1,383%</b> (TT1)	99.9% (TT12) <sup>a</sup>	29
	PFOA	<b>-461±117%</b> (7) <sup>b,OR</sup>	<b>-285±132%</b> (4) <sup>b</sup>	<b>-119±39%</b> (6) <sup>b</sup>	<b>-30±63%</b> (4) <sup>b</sup>	<b>-339±361%</b> (2)	<b>-385±185%</b> (4) <sup>b</sup>	97% (1) <sup>a</sup>	NC	<b>-117%</b> (1)	<b>-925%</b> (TT1)	97% (TT12) <sup>a</sup>	29
	PFHxS	<b>-58±31%</b> (6) <sup>b,OR</sup>	<b>-27±42%</b> (4) <sup>b</sup>	<b>-25±16%</b> (6) <sup>b</sup>	19±18% (4)	<b>-6±19%</b> (2)	<b>-45±32%</b> (4) <sup>b</sup>	99.7% (1)	NC	<b>-100%</b> (1) <sup>b</sup>	<b>-150%</b> (TT2) <sup>b</sup>	99.7% (TT12) <sup>a</sup>	28
	6:2 FTSA	77±6% (3) <sup>a</sup>	NC	58% (1) <sup>a</sup>	71±8% (3) <sup>a</sup>	NC	NC	NC	NC	NC	58% (TT4_&_TT7) <sup>a</sup>	87% (TT7) <sup>a</sup>	7
	N-EtFOSA	(1) <sup>OR</sup>	(1) <sup>OR</sup>	NC	87% (1)	NC	NC	NC	NC	NC	NC <sup>OR</sup>	87% (TT4) <sup>a</sup>	3
	PFPeA	<b>-333±98%</b> (7) <sup>b,OR</sup>	<b>-128±58%</b> (4) <sup>b</sup>	<b>-171±85%</b> (5) <sup>OR</sup>	<b>-45±66%</b> (4)	<b>-308±308%</b> (1)	<b>-248±81%</b> (4) <sup>b</sup>	98% (1) <sup>a</sup>	NC	<b>-117%</b> (1)	<b>-650%</b> (TT1)	98.3% (TT12)	28
	PFHxA	<b>-486±111%</b> (7) <sup>OR</sup>	<b>-219±78%</b> (4) <sup>a</sup>	<b>-147±66%</b> (6)	<b>-55±78%</b> (4) <sup>b</sup>	<b>-276±249%</b> (2)	<b>-331±104%</b> (4) <sup>b</sup>	99.1% (1) <sup>a</sup>	NC	<b>-125%</b> (1)	<b>-950%</b> (TT1)	99.1% (TT12) <sup>a</sup>	29
	PFBS	50±25% (7) <sup>a,OR</sup>	65±9% (4) <sup>a</sup>	<b>-89±56%</b> (3) <sup>b</sup>	<b>-64±81%</b> (4) <sup>b</sup>	<b>-263±38%</b> (2) <sup>b</sup>	71±9% (2) <sup>b</sup>	96.4% (1) <sup>a</sup>	NC	NC	<b>-300%</b> (TT7_&_TT8) <sup>b</sup>	96.4% (TT12) <sup>a</sup>	23
Herbicides	Diuron	<b>-10%</b> (1) <sup>b,OR</sup>	71±24% (2) <sup>OR</sup>	<b>-2±8%</b> (3) <sup>b,OR</sup>	NC	<b>-10%</b> (1) <sup>b,OR</sup>	<b>-3±8%</b> (2) <sup>b,OR</sup>	NC	NC	NC	<b>-10%</b> (TT1,TT4, &TT9) <sup>b</sup>	95% (TT2)	8
	MCPA	72±11% (3) <sup>b,OR</sup>	88% (1) <sup>OR</sup>	29±29% (3) <sup>b,OR</sup>	52±32% (2) <sup>b</sup>	NC	-15% (1) <sup>b,OR</sup>	NC	NC	-20% (1) <sup>b</sup>	<b>-20%</b> (TT7_&_TT14) <sup>b</sup>	88% (TT2)	10
	Simazine	<b>-107±89%</b> (8) <sup>b</sup>	<b>-413±13%</b> (2)	26±17% (6) <sup>b</sup>	47±23% (2)	<b>-9%</b> (1)	<b>-126±97%</b> (4) <sup>b</sup>	NC	94% (1)	85% (1) <sup>b</sup>	<b>-635%</b> (TT1)	94% (TT13)	25
	Triclopyr	97% (1) <sup>a</sup>	66% (1) <sup>b</sup>	85% (1) <sup>b</sup>	63% (1) <sup>b</sup>	NC	88% (1) <sup>b</sup>	NC	NC	NC	63% (TT7) <sup>a</sup>	97% (TT1) <sup>a</sup>	5

Note: TT3, TT5, TT6, TT10 and TT11 were not sampled; Positive values (%) indicate a removal (decrease in concentration between influent and effluent); negative values (-%) indicate an increase in concentration between influent and effluent. NC-not calculated, not detected in effluent or influent, or LORs differ

<sup>a</sup> Based on influent concentration only: where one or more site(s) had effluent concentration <LOR, effluent was taken as half LOR;

<sup>b</sup> Based on effluent concentrations: where one or more site(s) had influent concentration <LOR, influent was taken as half LOR (PFAS, Phenols only as LOR was the same for influent and effluent);

<sup>OR</sup> Outlying estimate removed (based on %reduction using only influent<sup>a</sup> or effluent<sup>b</sup> data - see above), as the value based on half LOR was outside the expected range (1.5 x min or max)

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 11. (cont.). Percent reduction (%R) (mean  $\pm$ S.E.) for each treatment train for A) PPCPs, and EDCs, B) PFAS, C) Insecticides, fungicides and industrial. Minimum and maximum show the lowest removal (or -% negative reduction) and highest reduction across all sites. Number of samples (or treatment train number) shown in brackets. Bolded numbers highlight where compounds have increased (negative reduction) between influent and effluent.

C	Treatment Train	TT1 (mean)	TT2	TT4	TT7	TT8	TT9	TT12	TT13	TT14	Min %RE (site)	Max %RE (site)	Paired detects <sup>†</sup>
	Treatment Types	Lagoon	Aerated Lagoon	Aerated Lagoon, Lagoon	ASP	ASP, Cl <sub>2</sub>	ASP, Lagoon	ASP, Lagoon, UF, RO1, RO2	ASP, Lagoon, RO, Chlorine	ASP with extended aeration, Chlorine			
	n	8	4	6	4	2	4	1	1	1			
	Units	%	%	%	%	%	%	%	%	%	%	%	
Group	Compound												
Insecticides	Fipronil	NC	NC	70% (1)	NC	NC	NC	NC	NC	NC	70% (TT4)	70% (TT4)	1
	Imidacloprid	94 $\pm$ 1% (4)	79 $\pm$ 17% (2)	33 $\pm$ 8% (3)	57% (1)	<b>-10%</b> (1)	66% (1)	NC	NC	NC	<b>-10.0%</b> (TT8)	96% (TT1)	12
	Imidacloprid metabolites	78% (1)	NC	50% (1)	NC	NC	NC	NC		74% (1) <sup>b</sup>	50% (TT4)	78% (TT1)	2
Fungicides	Flutriafol	NC	NC	74.0% (1)	NC	NC	NC	NC	NC	NC	74% (TT4)	74% (TT4)	1
	Thiabendazole	NC	NC	NC	74% (1)	NC	NC	NC	NC	NC	74% (TT7)	74% (TT7)	1
Industrial Compounds	4-Chloro-3,5-dimethylphenol	96.7 $\pm$ 1.3% (8) <sup>a</sup>	99.2 $\pm$ 0.1% (4) <sup>a</sup>	98 $\pm$ 0.7% (6) <sup>a</sup>	97 $\pm$ 0.7% (4) <sup>a</sup>	94 $\pm$ 5% (2) <sup>a</sup>	99.2 $\pm$ 0.1 (4) <sup>a</sup>	99.0% (1) <sup>a</sup>	98.6% (1)	98.8% (1)	89.6% (TT8)	99.5% (TT2)	27
	1H-Benzotriazole, 5-methyl	NC	97% (1) <sup>a</sup>	85% (1)	NC	52% (1) <sup>a</sup>	88% (1)	NC	NC	NC	52% (TT8)	97% (TT2)	4
	Tris(chloropropyl) phosphate isomers	89% (1)	86% (1)	92% (1)	66% (1)	NC	77 $\pm$ 5% (2)	NC	NC	NC	66% (TT7)	92% (TT4)	6
Phenols	Phenol	99.4 $\pm$ 0.3% (5) <sup>a</sup>	99.7 $\pm$ 0.2% (3) <sup>a</sup>	97 $\pm$ 3% (5) <sup>a,b,OR</sup>	99.9 $\pm$ 0.1% (2) <sup>a,b,OR</sup>	98 $\pm$ 1.5% (2) <sup>a</sup>	99.7 $\pm$ 0.1% (4) <sup>a</sup>	85% (1)	99.8% (1) <sup>a</sup>	99.5 (1)	85% (TT12) <sup>b</sup>	99.99% (TT4)	22
	3&4-Methylphenol (m&p-Cresol)	99.6 $\pm$ 0.2% (5) <sup>a</sup>	99.3 $\pm$ 0.7% (3) <sup>a</sup>	95.8 $\pm$ 2.4% (5) <sup>a</sup>	99.9 $\pm$ 0.1% (2) <sup>a</sup>	94 $\pm$ 6% (2) <sup>a</sup>	99.8 $\pm$ 0.1% (3) <sup>a</sup>	99.4% (1) <sup>a</sup>	99.8% (1) <sup>a</sup>	99.4% (1) <sup>a</sup>	88% (TT4) <sup>a</sup>	99.99% (TT1) <sup>a</sup>	21

Note: TT3, TT5, TT6, TT10 and TT11 were not sampled; Positive values (%) indicate a removal (decrease in concentration between influent and effluent); negative values (-%) indicate an increase in concentration between influent and effluent. NC-not calculated, not detected in effluent or influent, or LORs differ

<sup>a</sup> Based on influent concentration only: where one or more site(s) had effluent concentration <LOR, effluent was taken as half LOR;

<sup>b</sup> Based on effluent concentrations: where one or more site(s) had influent concentration <LOR, influent was taken as half LOR (PFAS, Phenols only as LOR was the same for influent and effluent);

<sup>OR</sup> Outlier removed as the value based on half LOR was outside the expected range (1.5 x min or max)



## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 12. Maximum concentrations of emerging contaminants detected in treated effluent, guideline values for drinking water (DWG), freshwater (FW) ecosystem protection and irrigation. Sources for guidelines listed in footnotes. For freshwater ecosystem guidelines (GV) or trigger values (TVs), the species protection level (99, 95, 90%) or the unknown protection assessment factor (AF) is shown along with the reliability and the default indicator is underlined. Values with † exceed DWGs, values shown with # exceed FGVs. Underlined analytes superscript indicates this compound was a Tier 1 priority substance (See O'Connor and Stevens, 2021 [Appendix 5I])

Group	Analyte	Max. Effluent (ug/L)	Drinking Water GV (ug/L)	Drinking Water Guideline Source	FW GV 99% (µg/L)	FW GV 95% (µg/L)	FW GV 90% (µg/L)	FW TV AF (µg/L)	FW GV-TV Reliability	Freshwater Source	Irrigation Guideline (µg/L)	Irrigation Guideline Source
PPCP	<u>Amidotrizoate (sodium)</u> <sup>1</sup>	4.2 <sup>†</sup>	0.35	AGWR 2008								
	<u>Caffeine</u> <sup>1</sup>	1.3 <sup>†</sup>	0.35	AGWR 2008								
	Carbamazepine	1.3	100	AGWR 2008				<u>10</u>	Int. - High	CCME EWGs		
	Cefalexin	1.2	35	AGWR 2008								
	Codeine	4.2	50	AGWR 2008								
	Desmethyl Diazepam	0.04	2.5	AGWR 2008*								
	Diclofenac	0.7	1.8	AGWR 2008								
	DEET	0.3	2500	AGWR 2008								
	Erythromycin anhydrate	0.3	17.5	AGWR 2008								
	Fluoxetine	0.07	10	AGWR 2008								
	Galaxolide	2.5	1750	AGWR 2008								
	Metoprolol	0.39	25	AGWR 2008								
	Naproxen	0.5	220	AGWR 2008								
	Paracetamol	0.72	175	AGWR 2008								
	Roxithromycin	0.13	150	AGWR 2008								
	Salicylic acid	-	105	AGWR 2008								
	Sulfamethoxazole	0.65	35	AGWR 2008								
	Temazepam	0.41	5	AGWR 2008								
	Tonalid	0.3	4	AGWR 2008								
	<u>Triclosan</u> <sup>1</sup>	0.1	0.35	AGWR 2008								
	Trimethoprim	0.34	70	AGWR 2008								

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 12. (cont.) Maximum concentrations of emerging contaminants detected in treated effluent, guideline values for drinking water (DWG), freshwater (FW) ecosystem protection and irrigation. Sources for guidelines listed in footnotes. For freshwater ecosystem guidelines (GV) or trigger values (TVs), the species protection level (99, 95, 90%) or the unknown protection assessment factor (AF) is shown along with the reliability and the default indicator is underlined. Values with <sup>†</sup> exceed DWGs, values shown with <sup>#</sup> exceed FGVs. Underlined analytes superscript indicates this compound was a Tier 1 priority substance (See O'Connor and Stevens, 2021 [Appendix 5I])

Group	Analyte	Max. Effluent (µg/L)	Drinking Water GV (µg/L)	Drinking Water Guideline Source	FW GV 99% (µg/L)	FW GV 95% (µg/L)	FW GV 90% (µg/L)	FW TV AF (µg/L)	FW GV-TV Reliability	FW Source	Irrigation Guideline (µg/L)	Irrigation Guideline Source
EDC	17α-Estradiol (E2)	0.004	0.175	AGWR 2008								
	<u>17α-Ethinylestradiol (EE2)<sup>1</sup></u>	0.003 <sup>†</sup>	0.0015	AGWR 2008								
	17β-Estradiol (E2)	0.005	0.175	AGWR 2008								
	4-t-Octylphenol	0.021	50	AGWR 2008								
	Androstenedione	0.012	7	AGWR 2008 **								
	Androsterone	-	14	AGWR 2008								
	Bisphenol A	0.22	200	AGWR 2008								
	Dihydrotestosterone	-	7	AGWR 2008 **								
	Estriol	0.011	0.05	AGWR 2008								
	Estrone	0.029	0.03	AGWR 2008								
	Etiocholanolone (5β-androsterone)	4.6	7	AGWR 2008 **								
	Nonylphenol	0.54	500	AGWR 2008				<u>1</u>	Int. - High	CCME EWGs		
	Testosterone	-	7	AGWR 2008								
	PFHxS	Perfluorohexanesulfonic acid	0.028	0.07	ADWG 2011 (2022)							
PFOS	Perfluorooctanesulfonic acid	0.021 <sup>#</sup>	0.07	ADWG 2011 (2022)	<u>0.00023</u>	0.13	2		Aus. - High	HEPA 2020		
PFOA	Perfluorooctanoic acid	0.044	0.56	ADWG 2011 (2022)	<u>19</u>	220	632		Aus. - High	HEPA 2020		
PFAS	<u>PFAS (sum)<sup>1</sup></u>											

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 12. (cont.) Maximum concentrations of emerging contaminants detected in treated effluent, guideline values for drinking water (DWG), freshwater (FW) ecosystem protection and irrigation. Sources for guidelines listed in footnotes. For freshwater ecosystem guidelines (GV) or trigger values (TVs), the species protection level (99, 95, 90%) or the unknown protection assessment factor (AF) is shown along with the reliability and the default indicator is underlined. Values with <sup>+</sup> exceed DWGs, values shown with <sup>#</sup> exceed FGVs. Underlined analytes superscript indicates this compound was a Tier 1 priority substance (See O'Connor and Stevens, 2021 [Appendix 5I])

Group	Analyte	Max. Effluent (µg/L)	Drinking Water GV (µg/L)	Drinking Water Guideline Source	FW GV 99% (µg/L)	FW GV 95% (µg/L)	FW GV 90% (µg/L)	FW TV AF (µg/L)	FW GV-TV Reliability	FW Source	Irrigation Guideline (µg/L)	Irrigation Guideline Source
Herbicides	2,4-D	0.29	30	ADWG 2011 (2022)	140	<u>280</u>	450		Aus -High	ANZG'21		
	2,4-DB <sup>+</sup>	0.17	90	WHO 2017								
	Atrazine	0.16	20	ADWG 2011 (2022)	0.7	<u>13</u>	45		Aus -High	ANZG'21	10	CCME EWGs
	Atrazine, 2-hydroxy	0.04	200	WHO 2017								
	Bromacil	0.02	400	ADWG 2011 (2022)				<u>180</u>	Aus -Low	ANZG'21	0.2	CCME EWGs
	Bromoxynil	0.03	10	ADWG 2011 (2022)				<u>5</u>	Int. - High	CCME EWGs	0.33	CCME EWGs
	Cyanazine	0.01	0.6	WHO 2017								
	Dalapon (2,2-DPA)	2.9	500	ADWG 2011 (2022)							4	ANZECC/ARMC ANZ 2000
	Desethyl Atrazine	0.03	11.2	AGWR 2008								
	Desisopropyl Atrazine	0.48	11.2	AGWR 2008								
	Desisopropyl Atrazine	0.48	11.2	AGWR 2008								
	Diuron	0.19	20	ADWG 2011 (2022)				<u>0.2</u>	Aus -Low	ANZG'21	2	ANZECC/ARMC ANZ 2000
	Haloxypol (acid)	0.04	1	ADWG 2011 (2022)								
	Hexazinone (LC/MSMS)	3.4	400	ADWG 2011 (2022)				<u>75</u>	Aus -Low	ANZG'21		
	Hexazinone (GC/LC)	3.4	400	ADWG 2011 (2022)				<u>75</u>	Aus -Low	ANZG'21		
	Imazapyr	0.03	9000	ADWG 2011 (2022)				<u>240</u>	Aus -Low	ANZG'21		
	loxynil	0.02 <sup>+</sup>						<u>0.4</u>	Aus -Low	ANZG'21		
	MCPA	0.91	40	ADWG 2011 (2022)				<u>1.4</u>	Aus -Low	ANZG'21		
	Mecoprop	0.11	10	WHO 2017								
	Metolachlor	0.37	300	ADWG 2011 (2022)	0.0084	<u>0.46</u>	2.6		Aus -High	ANZG'21		

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 12. (cont.) Maximum concentrations of emerging contaminants detected in treated effluent, guideline values for drinking water (DWG), freshwater (FW) ecosystem protection and irrigation. Sources for guidelines listed in footnotes. For freshwater ecosystem guidelines (GV) or trigger values (TVs), the species protection level (99, 95, 90%) or the unknown protection assessment factor (AF) is shown along with the reliability and the default indicator is underlined. Values with <sup>†</sup> exceed DWGs, values shown with <sup>#</sup> exceed FGVs. Underlined analytes superscript indicates this compound was a Tier 1 priority substance (See O'Connor and Stevens, 2021 [Appendix 5I])

Group	Analyte	Max. Effluent (µg/L)	Drinking Water GV (µg/L)	Drinking Water Guideline Source	FW GV 99% (µg/L)	FW GV 95% (µg/L)	FW GV 90% (µg/L)	FW TV AF (µg/L)	FW GV-TV Reliability	FW Source	Irrigation Guideline (µg/L)	Irrigation Guideline Source
Herbicides	Metsulfuron methyl	0.12 <sup>#</sup>	40	ADWG 2011 (2022)	0.0037	<u>0.018</u>	0.048		Aus. - High	ANZG'21		
	Triclopyr	0.4	20	ADWG 2011 (2022)								
	Desisopropyl Atrazine	0.48	11.2	AGWR 2008								
	Metolachlor	0.37	300	ADWG 2011 (2022)	0.0084	<u>0.46</u>	2.6		Aus. - High	ANZG'21		
	Simazine	2.3	20	ADWG 2011 (2022)	0.2	<u>3.2</u>	11		Aus. - High	ANZG'21		
	Tebuthiuron	0.06 <sup>#</sup>	500	USEPA DWS 2018	0.02	<u>2.2</u>	20		Aus. - High	ANZG'21	0.27	CCME EWGs
	Terbutylazine	0.06	10	ADWG 2011 (2022)								
Insecticides	<u>Diazinon</u> <sup>1</sup>	0.04 <sup>#</sup>	4	ADWG 2011 (2022)	0.00003	<u>0.01</u>	0.2		Aus. - High	ANZG'21		
	Fipronil	0.02	0.7	ADWG 2011 (2022)								
	Imidacloprid	1.4 <sup>#</sup>						<u>0.23</u>	Int. - High	CCME EWGs		
	Piperonyl butoxide	0.1	600	ADWG 2011 (2022)								
	Propoxur (LC/MSMS)	-	3	USEPA DWS 2018								
Fungicides	Metalaxyl	0.2	100	NZ MoH 2017								
	Propiconazole	-	100	ADWG 2011 (2022)								
	Thiabendazole	1	400	NZ MoH 2017								

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 12. (cont.) Maximum concentrations of emerging contaminants detected in treated effluent, guideline values for drinking water (DWG), freshwater (FW) ecosystem protection and irrigation. Sources for guidelines listed in footnotes. For freshwater ecosystem guidelines (GV) or trigger values (TVs), the species protection level (99, 95, 90%) or the unknown protection assessment factor (AF) is shown along with the reliability and the default indicator is underlined. Values with \* exceed DWGs, values shown with # exceed FGVs. Underlined analytes superscript indicates this compound was a Tier 1 priority substance (See O'Connor and Stevens, 2021 [Appendix 5])

Group	Analyte	Max. Effluent (µg/L)	Drinking Water GV (µg/L)	Drinking Water Guideline Source	FW GV 99% (µg/L)	FW GV 95% (µg/L)	FW GV 90% (µg/L)	FW TV AF (µg/L)	FW GV-TV Reliability	Freshwater Source	Irrigation Guideline (µg/L)	Irrigation Guideline Source
Industrial Compounds	1H-Benzotriazole, 5-methyl	0.6*	0.007	AGWR 2008								
	2,6-Di-t-butyl-p-cresol (BHT)	0.1	1000	AGWR 2008								
	N-Butylbenzenesulfonamide	0.4	262	AGWR 2008								
	Tris(chloroethyl) phosphate	0.4	1	AGWR 2008				4	Int. – Mod	USEPA		
	Tris(dichloropropyl) phosphate	0.3	1	AGWR 2008								
	2-Chlorophenol	0.00012	300	ADWG 2011 (2022)	<u>340</u>	490	630		Aus - High	ANZG WQGs		
	2,4,6-Trichlorophenol	0.0005	20	ADWG 2011 (2022)	<u>3</u>	20	40		Aus - High	ANZG WQGs		
4-Methylphenol (p-Cresol)	0.0003	600	AGWR 2008									
	Phenol	0.00083	150	AGWR 2008	85	<u>320</u>	600		Aus - High	ANZG WQGs		

## EPA Publication 2054 Appendix A (Emerging contaminants in recycled water)

Table 12. (cont.) Maximum concentrations of emerging contaminants detected in treated effluent, guideline values for drinking water (DWG), freshwater (FW) ecosystem protection and irrigation. Sources for guidelines listed in footnotes. For freshwater ecosystem guidelines (GV) or trigger values (TVs), the species protection level (99, 95, 90%) or the unknown protection assessment factor (AF) is shown along with the reliability and the default indicator is underlined. Values with <sup>†</sup> exceed DWGs, values shown with <sup>#</sup> exceed FGVs. Underlined analytes superscript indicates this compound was a Tier 1 priority substance (See O'Connor and Stevens, 2021 [Appendix 5])

Group	Analyte	Max. Effluent (µg/L)	Drinking Water GV (µg/L)	Drinking Water Guideline Source	FW GV 99% (µg/L)	FW GV 95% (µg/L)	FW GV 90% (µg/L)	FW TV AF (µg/L)	FW GV-TV Reliability	Freshwater Source	Irrigation Guideline (µg/L)	Irrigation Guideline Source
Haloacetic acids	Dalapon (2,2-DPA)	2.9	500	ADWG 2011 (2022)							4	ANZECC/ARMCANZ 2000
	Dichloroacetic Acid (DCAA)	45	100	ADWG 2011 (2022)								
	Monobromoacetic Acid (MBAA)	-	0.35	AGWR 2008								
	Monochloroacetic Acid (MCAA)	7	150	ADWG 2011 (2022)								
	Trichloroacetic Acid (TCAA)	64	100	ADWG 2011 (2022)								
Haloacetonitriles	<u>Bromochloroacetonitrile</u> <sup>1</sup>	3.3 <sup>†</sup>	0.7	AGWR 2008								
	Chloral hydrate	21	100	ADWG 2011 (2022)								
	Dibromoacetonitrile	-	70	WHO 2017								
	Dichloroacetonitrile	9.5	20	WHO 2017								
	Trichloroacetonitrile	-	1	WHO 2017								
Nitrosamines	N-Nitrosodimethylamine	33 <sup>†</sup>	0.1	ADWG 2011 (2022)								
Trihalomethanes	Chloroform	33	250	ADWG 2011 (2022)								
	Dibromochloromethane	23 <sup>†</sup>	0.001	AGWR 2008								

Notes:

\*used value for Diazepam; \*\*used value for testosterone

DWG – drinking water guidelines

AGWR (2008). Australian Guidelines for Water Recycling - Phase 2: Augmentation of

# Figures

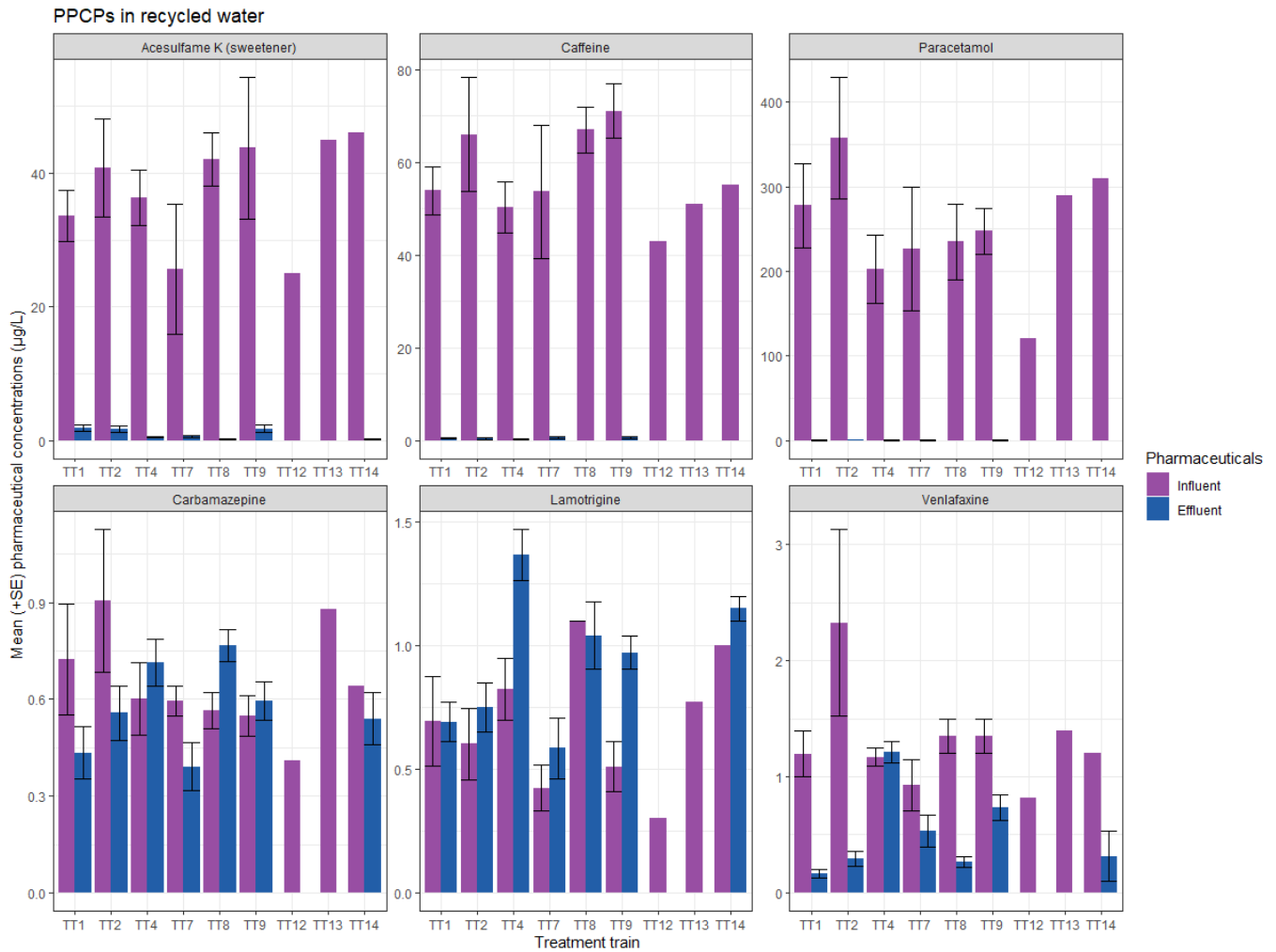


Figure 1. Mean concentration ( $\pm$ SE) of selected pharmaceuticals and personal care products in the influent and effluent from all sites ( $n=30$ ) and across seven different treatment trains. Sites per treatment train type: TT1:  $n = 8$ , TT2:  $n = 4$ , TT4:  $n = 6$ , TT7:  $n = 4$ , TT8:  $n = 2$ , TT9:  $n = 4$ , TT12:  $n = 1$ , TT13:  $n = 1$ , TT14:  $n = 1$ .

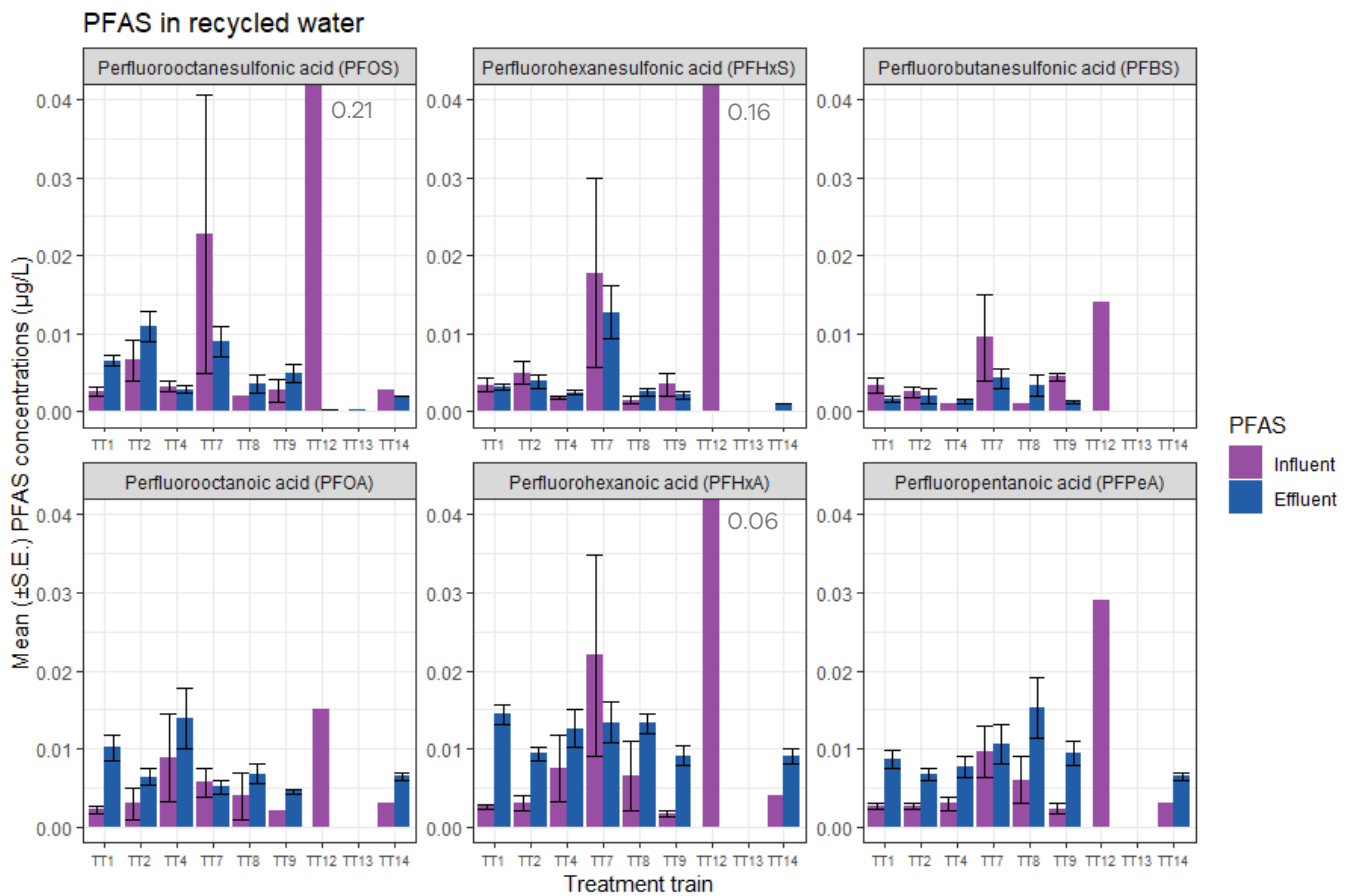


Figure 2. Mean ( $\pm$ SE) PFAS concentrations from influent and effluent samples across eight wastewater treatment train types. Sites per treatment train type: TT1: n = 8, TT2: n = 4, TT4: n = 6, TT7: n = 4, TT8: n = 2, TT9: n = 4, TT12: n = 1, TT13: n = 1, TT14: n = 1.