

Table B-1: Groundwater Sampling Results - Perfluorinated Compounds (Golder, 2016)

Sample Name	Perfluorinated Compounds in Groundwater <sup>1</sup>				Provisional Drinking Water Guidelines	Non Potable water / contact recreation <sup>4</sup>	Ecological Freshwater Guidelines <sup>5</sup>	
	MW West	MW East	MW4	MW5			MDH <sup>2</sup> & US EPA <sup>3</sup>	AGDoH <sup>4</sup>
Laboratory Reference	ES1608774-010	ES1608774-011	ES1601475-001	ES1601475-002				
Sample Location	MW1	MW2	MW4	MW5				
Date	18/04/2016	18/04/2016	18/01/2016	18/01/2016				
<b>Perfluoroalkylsulfonic acids</b>								
Perfluorobutanesulfonic acid (PFBS)	0.345	0.88	0.306	1.50	7 <sup>2</sup>	-	-	-
Total Perfluorohexanesulfonic acid (T-PFHxS)	3.21	5.84	2.63	15.4	-	-	-	-
<b>Perfluorooctanesulfonic acid (PFOS)</b>								
Total Perfluorooctanesulfonic acid (T-PFOS)	37.9	53.2	24.0	39.6	0.027 <sup>2</sup>	-	-	0.13 31
<b>Summation Guideline Values</b>								
Sum of Total PFOS & PFHxS <sup>6</sup>	41.11	59.04	26.63	55.00	-	0.07	0.7	-
Sum of Total PFOS & PFOA <sup>6</sup>	38.02	53.5	24.5	41.0	0.07 <sup>1</sup>	-	-	-
<b>Perfluoroalkylcarboxylic acids</b>								
Perfluorohexanoic acid (PFHxA)	0.538	1.32	1.16	6.6	-	-	-	-
Perfluoroheptanoic acid (PFHpA)	0.245	0.324	0.917	3.18	-	-	-	-
Perfluorooctanoic acid (PFOA)	0.118	0.346	0.474	1.38	0.035 <sup>2</sup>	0.56	5.6	220 1.824
Perfluorononanoic acid (PFNA)	0.014	0.01	0.071	0.127	-	-	-	-
Perfluorodecanoic acid (PFDA)	0.0040	0.0030	0.018	0.029	-	-	-	-
Perfluoroundecanoic acid (PFUnDA)	<0.005	<0.005	0.006	0.007	-	-	-	-
Perfluorododecanoic acid (PFDoDA)	<0.005	<0.005	<0.005	<0.005	-	-	-	-
Perfluorotridecanoic acid (PFTDA)	<0.005	<0.005	<0.005	0.01	-	-	-	-
Perfluorotetradecanoic acid (PFTeDA)	<0.05	<0.05	<0.05	<0.05	-	-	-	-
<b>Perfluorooctanesulfonamides (FOSAs)</b>								
Perfluorooctanesulfonamide (PFOSA)	0.036	0.157	0.029	0.275	-	-	-	-
N-ethylperfluoro-1-octanesulfonamide (NEFOSA-M)	<0.005	<0.005	<0.005	<0.005	-	-	-	-
N-methylperfluoro-1-octanesulfonamide (NMeFOSA-M)	<0.05	<0.05	<0.05	<0.05	-	-	-	-
<b>Perfluorooctanesulfonamidoethanols (FOSEs)</b>								
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (NEFOSE-M)	<0.1	<0.1	<0.1	<0.1	-	-	-	-
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (NMeFOSE-M)	<0.1	<0.1	<0.1	<0.1	-	-	-	-
<b>Tetramer Sulfonic acids (FTSs)</b>								
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2 FTS)	1.39	1.85	4.46	17.3	-	-	-	-
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2 FTS)	0.05	0.06	0.48	2.73	-	-	-	-
<b>Perfluorodecane sulfonate (PFDCS)</b>								
Perfluorodecane sulfonate (PFDCS)	0.06	0.04	<0.005	0.015	-	-	-	-

Notes:

- Results in ug/L
- Guideline values for PFBS and PFBA (derived 2011) PFOS, PFDA (derived 2017) have been obtained from Minnesota Department of Health (MDH) (see <http://www.health.state.mn.us/divs/ehv/risk/guidance/htmltype.html>)
- US EPA PFOA and PFOS Drinking Water Health Advisories (see <https://www.epa.gov/sites/production/files/2016-05/documents/2016-05-05-drinking-water-health-advisories.pdf>)
- Australian Government Department of Health - Health Based Guidance Values for PFAS accessed 01/06/2017 ([https://www.health.gov.au/internet/main/publishing.nsf/Content/2200FE085D480353CA2580C900817CDDC/\\$File/Health%20Based%20Guidance%20Values.pdf](https://www.health.gov.au/internet/main/publishing.nsf/Content/2200FE085D480353CA2580C900817CDDC/$File/Health%20Based%20Guidance%20Values.pdf))
- WA Department of Environment Regulation (2017) ([https://www.dor.wa.gov.au/images/documents/your\\_environment/contaminated\\_sites/guidelines/Guideline\\_on\\_Assessment\\_and\\_Management\\_of\\_PFA\\_v2\\_1.pdf](https://www.dor.wa.gov.au/images/documents/your_environment/contaminated_sites/guidelines/Guideline_on_Assessment_and_Management_of_PFA_v2_1.pdf))
- Summations are made by adding compounds together, where one compound is below detection limit it is not included in the summation.

<LOR = Result is Less than Limit of Reporting

NR = Result Not Reportable

- Denotes No Guideline Value Available

0.48	Concentration exceeds provisional non potable water guidelines
0.40	Concentration exceeds provisional drinking water guidelines
0.48	Concentration exceeds 95% ecological guidelines

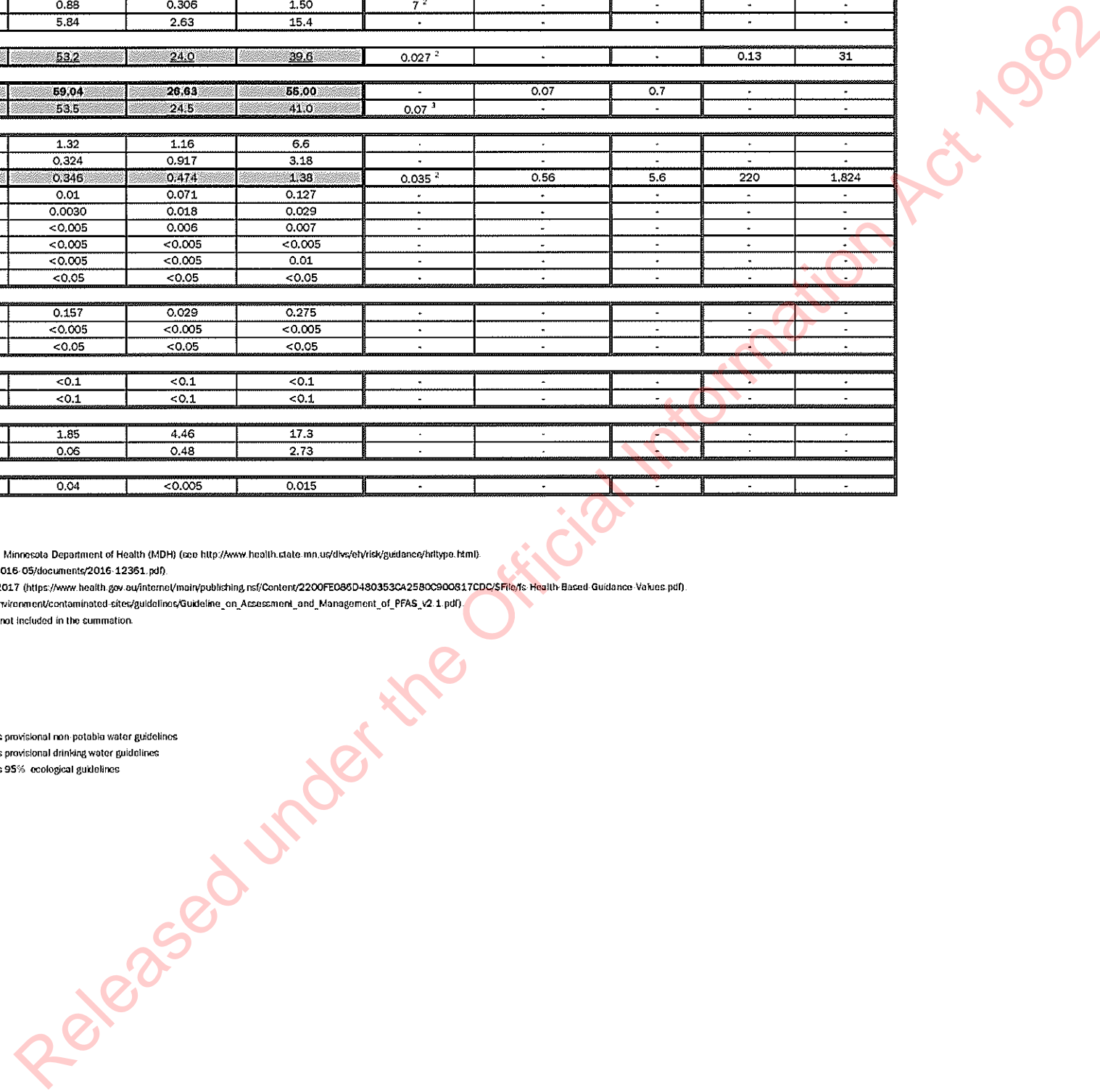


Table B-2: Soil and Sediment Analysis Results - Perfluorinated Compounds (Golder, 2016)

Perfluorinated Compounds in Soil and Sediment <sup>1</sup>													WA DER FINAL HEALTH BASED SOIL GUIDANCE VALUES <sup>2</sup>	US EPA PFC SOIL SCREENING LEVELS <sup>3</sup>
Sample Name	Mangrove 01-0.1	Mangrove 01-0.3	Mangrove 02-0.1	Mangrove 02-0.3	Mangrove 03-0.1	Mangrove 03-0.3	Mangrove 04-0.1	Mangrove 04-0.3	Mangrove QC1	SB2-0.5	SB5-1.25			
Laboratory Reference	ES1608774-001	ES1608774-002	ES1608774-003	ES1608774-004	ES1608774-005	ES1608774-006	ES1608774-007	ES1608774-008	ES1608774-009	-	-			
Sample Location	Mangrove 01	Mangrove 01	Mangrove 02	Mangrove 02	Mangrove 03	Mangrove 03	Mangrove 04	Mangrove 04	Mangrove QC1	SB2	SB5			
Date	18/04/2016	18/04/2016	18/04/2016	18/04/2016	18/04/2016	18/04/2016	18/04/2016	18/04/2016	18/04/2016	28/09/2015	23/09/2015			
Depth	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	-	0.5	1.25			
<b>Perfluoroalkylsulfonic acids</b>														
Perfluorobutanesulfonic acid (PFBS)	<0.2	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	0.3	0.2	0.5	<0.2	-	-	
Perfluorohexanesulfonic acid (PFHxS)														
Total Perfluorohexanesulfonic acid (T-PFHxS)	<0.2	<0.2	2	2.1	5.2	1.8	0.4	0.5	2.4	35	1.6	-	-	
Perfluorooctanesulfonic acid (PFOS)														
Branched Perfluorooctanesulfonic acid (B-PFOS)	-	-	-	-	-	-	-	-	-	674	17.4	-	-	
Linear Perfluorooctanesulfonic acid (L-PFOS)	-	-	-	-	-	-	-	-	-	<0.5	<0.5	-	-	
Total Perfluorooctanesulfonic acid (T-PFOS)	1.6	5.7	60	22	109	16.6	<0.5	0.6	75	674	17.4	-	6,000	
<b>Sumation Guideline Values</b>														
Sum of Total PFOS & PFHxS <sup>4</sup>	1.6	5.7	62	25	114	18.4	0.4	1.1	77	709	19	100,000	-	
Sum of Total PFOS & PFOA <sup>4</sup>	1.6	5.7	60	22	110	16.6	<LOR	0.6	75	676	17.4	-	-	
<b>Perfluoroalkylcarboxylic acids</b>														
Perfluorohexanoic acid (PFHxA)	<0.2	<0.2	1.0	1.7	1.0	0.8	<0.2	<0.2	1.6	5	2.2	-	-	
Perfluoroheptanoic acid (PFHpA)	<0.2	<0.2	0.6	0.8	0.7	0.4	<0.2	<0.2	0.9	0.4	0.4	-	-	
Perfluorooctanoic acid (PFOA)	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	2.0	<0.5	1,000,000	16,000	
Perfluorononanoic acid (PFNA)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	-	-	
Perfluorodecanoic acid (PFDA)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.1	<0.2	-	-	
Perfluoroundecanoic acid (PFUnDA)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	-	
Perfluorododecanoic acid (PFDoDA)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	-	
Perfluorotridecanoic acid (PFTriDA)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	-	
Perfluorotetradecanoic acid (PFTeDA)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-	
<b>Perfluorooctanesulfonamides (FOSAs)</b>														
Perfluorooctanesulfonamide (PFOSA)	<0.2	<0.2	0.9	0.2	2.3	<0.2	<0.2	<0.2	1.0	64	0.7	-	-	
N-ethylperfluoro-1-octanesulfonamide (NEtFOSA-M)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-	
N-methylperfluoro-1-octanesulfonamide (NMeFOSA-M)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-	
<b>Perfluorooctanesulfonamideethanols (FOSEs)</b>														
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (NEtFOSE-M)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-	
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (NMeFOSE-M)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-	
<b>Telomer Sulfonic acids (FTSs)</b>														
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2 FTS)	<5.0	<5.0	8.0	8.0	24	7.0	<5.0	<5.0	10	62	5.0	-	-	
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2 FTS)	<1.0	<1.0	2.0	<1.0	4	<1.0	<1.0	<1.0	2.0	148	<1.0	-	-	
Perfluorodecane sulfonate (PFDS)	<0.2	<0.2	0.4	<0.2	5.8	<0.2	<0.2	<0.2	0.3	6.2	0.3	-	-	

Notes :  
 1. Results in ug/kg.  
 2. WA Department of Environment Regulation (2017) human health guidelines industrial/commercial. ([https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Guideline\\_on\\_Assessment\\_and\\_Management\\_of\\_PFAAS\\_v2.1.pdf](https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Guideline_on_Assessment_and_Management_of_PFAAS_v2.1.pdf)).  
 3. Residential Soil Screening Levels for Perfluorooctanoic Acid (PFOA) and Perfluorooctyl Sulfonate (PFOS) sourced from US EPA (2009) (no commercial/industrial levels available), ([http://archive.epa.gov/epa/region4/water/documents/web/pdf/final\\_pfc\\_soil\\_screening\\_values11\\_20\\_09.pdf](http://archive.epa.gov/epa/region4/water/documents/web/pdf/final_pfc_soil_screening_values11_20_09.pdf)).  
 4. Summations are made by adding compounds together, where one compound is below detection limit it is not included in the summation.

<LOR = Result is Less than Limit of Reporting  
 - Denotes No Guideline Value Available



Table B-3: Groundwater Sampling Results - Perfluorinated Compounds (T&T Results, 2017)

Sample Name	Perfluorinated Compounds in Groundwater <sup>1</sup>										Provisional Drinking Water Guidelines		Non Potable water/contact recreation <sup>4</sup>	Ecological Freshwater Guidelines <sup>5</sup>	
	MW1	MW1	MW2	MW2	MW3	MW3	MW4	MW4	MW5	MW5	MDH <sup>2</sup> & US EPA <sup>3</sup>	AGDoH <sup>4</sup>		95% ecosystem protection	80% ecosystem protection
Laboratory Reference	ES1523916-001	Z17-MY00447	ES1623916-002	Z17-MY00448	ES1623916-003	Z17-MY00449	ES1623916-004	Z17-MY00450	ES1623916-005	Z17-MY00451					
Sample Location	MW1	MW1	MW2	MW2	MW3	MW3	MW4	MW4	MW5	MW5					
Date	17/10/2016	28/04/2017	17/10/2016	28/04/2017	17/10/2016	28/04/2017	17/10/2016	28/04/2017	17/10/2016	28/04/2017					
Easting NZTM															
Northing NZTM															
<b>Perfluoroalkylsulfonic acids</b>															
Perfluorobutanesulfonic acid (PFBS)	2.16	0.75	2.27	1.6	0.455	0.44	1.84	1.2	0.388	0.28	7 <sup>2</sup>	-	-	-	-
Perfluoropentanesulfonic acid (PFPeS)	-	1.3	-	2.7	-	0.92	-	1.9	-	0.44	-	-	-	-	-
Perfluorohexanesulfonic acid (PFHxS)															
Total Perfluorohexanesulfonic acid (T-PFHxS)	16.8	7.1	18.9	12	10.2	9.0	23	11	6.1	3.0	-	-	-	-	-
Perfluoroheptanesulfonic acid (PFHpS)	-	0.73	-	1.2	-	1.1	-	1.1	-	0.21	-	-	-	-	-
Perfluorooctanesulfonic acid (PFOS)															
Total Perfluorooctanesulfonic acid (T-PFOS)	42.9	32	79.6	59	98.0	76	69.3	53	41.7	16	0.027 <sup>2</sup>	-	-	0.13	31
Perfluorodecanesulfonic acid (PFDS)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
<b>Summation Guideline Values</b>															
Sum of Total PFOS & PFHxS <sup>6</sup>	59.7	39.1	98.5	68	981.2	85	92.3	64	47.8	19	-	0.07	0.7	-	-
Sum of Total PFOS & PFOA <sup>6</sup>	44.69	33.1	81.71	57.9	981.54	77.5	71.98	55	42.44	16.66	0.07 <sup>1</sup>	-	-	-	-
<b>Perfluoroalkylcarboxylic acids</b>															
Perfluorobutanoic acid (PFBA)	1.33	1.2	1.27	1.6	0.7	0.91	1.39	1.8	0.31	0.31	7 <sup>2</sup>	-	-	-	-
Perfluoropentanoic acid (PFPeA)	15.6	7.8	11.5	7.6	12.1	4.0	17.6	12	2.44	1.3	-	-	-	-	-
Perfluorohexanoic acid (PFHxA)	6.96	9.8	6.86	11.0	3.76	6.3	8.13	26	1.35	1.7	-	-	-	-	-
Perfluoroheptanoic acid (PFHpA)	2.76	2.0	2.73	2.8	1.82	0.99	2.54	2.5	0.739	0.56	-	-	-	-	-
Perfluorooctanoic acid (PFOA)	1.79	1.1	2.11	1.9	1.54	1.5	2.68	2.0	0.744	0.66	0.035 <sup>2</sup>	0.56	5.6	220	1,824
Perfluorononanoic acid (PFNA)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
Perfluorodecanoic acid (PFDA)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
Perfluoroundecanoic acid (PFUnDA)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
Perfluorododecanoic acid (PFDDA)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
Perfluorotridecanoic acid (PFTDA)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
Perfluorotetradecanoic acid (PFTeDA)	-	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.005	-	-	-	-	-
<b>Perfluorooctanesulfonamides (FOSAs)</b>															
Perfluorooctanesulfonamide (FOSA)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<0.01	-	-	-	-	-
N-ethylperfluoro-1-octanesulfonamide (NEFOSA-M)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<0.01	-	-	-	-	-
N-methylperfluoro-1-octanesulfonamide (NMeFOSA-M)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<0.01	-	-	-	-	-
<b>Perfluorooctanesulfonamidoacetic acids (FOSAAAs)</b>															
N-ethylperfluorooctanesulfonamidoacetic acid (NEFOSAA)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<0.01	-	-	-	-	-
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<0.01	-	-	-	-	-
<b>Perfluorooctanesulfonamidoethanols (FOSEs)</b>															
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (NEFOSE-M)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	<0.01	-	-	-	-	-
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (NMeFOSE-M)	-	<1.5	-	<1.5	-	<1.5	-	<1.5	-	0.44	-	-	-	-	-
<b>Telomer Sulfonic acids (FTSs)</b>															
1H,1H,2H,2H-perfluorohexanesulfonic acid (4:2 FTS)	<0.010	<0.3	<0.010	<0.3	<0.010	<0.3	<0.010	<0.3	<0.010	<0.005	-	-	-	-	-
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2 FTS)	7.16	20	15.50	20	4.77	15	10.7	38	1.97	1.7	-	-	-	-	-
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2 FTS)	0.431	1.3	1.51	1.3	0.595	2.5	0.771	3.7	0.343	0.55	-	-	-	-	-
1H,1H,2H,2H-perfluorodecanesulfonic acid (10:2 FTS)	<0.010	<0.3	<0.010	<0.3	<0.010	<0.3	<0.010	<0.3	<0.010	<0.005	-	-	-	-	-

Notes:

- Results in ug/L
- Guideline values for PFDS and PFBA (derived 2011) PFOS, PFOA (derived 2017) have been obtained from Minnesota Department of Health (MDH) (see <http://www.health.state.mn.us/divs/chem/s/guidance/trf/type.html>)
- US EPA PFOA and PFOS Drinking Water Health Advisories (see <https://www.epa.gov/sites/production/files/2016-05/documents/2016-12361.pdf>)
- Australian Government Department of Health - Health Based Guidance Values for PFAS accessed 01/03/2017 ([https://www.health.gov.au/internet/main/publishing.nsf/Content/2200FE0960480353CA2580C000817CDC/\\$File/Health Based Guidance Values.pdf](https://www.health.gov.au/internet/main/publishing.nsf/Content/2200FE0960480353CA2580C000817CDC/$File/Health%20Based%20Guidance%20Values.pdf))
- WA Department of Environment Regulation (2017) ([https://www.dor.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Guideline\\_on\\_Assessment\\_and\\_Management\\_of\\_PFAS.pdf](https://www.dor.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Guideline_on_Assessment_and_Management_of_PFAS.pdf))
- Summations are made by adding compounds together, where one compound is below detection limit it is not included in the summation.

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 NR = Result Not Reportable  
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0.48	Concentration exceeds provisional non potable water guidelines
0.48	Concentration exceeds provisional drinking water guidelines
0.48	Concentration exceeds 95% ecological guidelines

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