Supporting information for:

Contamination of Urban Stormwater Pond Sediments: A Study of 259 Legacy and Contemporary Organic Substances

Kelsey Flanagan,[1] Godecke-Tobias Blecken,[1] Heléne Österlund,[1] Kerstin Nordqvist,[1] Maria Viklander[1]*

[1]Urban Water Engineering, Department of Civil, Environmental and Natural Resources Engineering, Luleå University of Technology, 971 87 Luleå, Sweden

***Corresponding author:**

kelsey.flanagan@ltu.se

26 pages; 11 tables; 3 figures

I. Characteristics of studied facilities

Facility	Municipality	Facility type	Catchment classification	Catchment imperviousness	Catchment surface area (ha)	Type of inlet	Year of construction	Facility volume (m3)	Facility surface area (ha)
Ös-1	Östersund	Pond	Industrial / commericial	**97**	**91**	**Pipe**	**2000**	**9100**	**0.45**
Ör-1	Örebro	Pond	Industrial / commericial	**40**	**40**	**Pipe**	**1996**	**1300**	**0.13**
Ör-2	Örebro	Pond	Industrial / commericial	**50**	**57**	**Open channel**	**2000**	**ND**	**0.48**
Ör-3	Örebro	Pond	Residential	**22**	**1490**	**Pipe**	**2010**	**20500**	**1.78**
Ör-4	Örebro	Pond	Residential	**5**	**14.5**	**Open channel**	**2007**	**ND**	**0.33**
Ör-5	Örebro	Pond	Industrial / commericial	**80**	**30**	**Open channel**	**2006**	**5800**	**0.5**
Ör-6	Örebro	Pond	Industrial / commericial	**75**	**31**	**Open channel**	**2006**	**5800**	**0.8**
S-1	Stockholm	Pond	Industrial / commericial	**ND**	**78**	**Pipe**	**2009**	**1450**	**0.17**
S-2	Stockholm	Pond	Residential	**ND**	**304**	**Pipe**	**2007**	**530**	**0.05**
S-3	Stockholm	Pond	Residential	**ND**	**770**	**Pipe**	**1997**	**ND**	**0.06**
S-4	Stockholm	Pond	Road / highway	**50**	**2**	**Pipe**	**2002**	**498**	**0.03**
S-5	Stockholm	Pond	Road / highway	**ND**	**ND**	**ND**	**ND**	**ND**	**0.06**
S-6	Stockholm	Subsurface sedimentation tank	Road / highway	**100**	**1.14**	**Pipe**	**1997**	**132**	**0.006**
V-1	Växjö	Pond	Industrial / commericial	**46**	**519**	**Pipe / open channel**	**1989**	**3300**	**0.36**
V-2	Växjö	Pond	Residential	**30**	**69**	**Pipe / open channel**	**2008**	**6600**	**0.36**
V-3	Växjö	Pond	Industrial / commericial	**60**	**330**	**Pipe / open channel**	**1994**	**17600**	**1.1**
V-4	Växjö	Pond	Industrial / commericial	**54**	**7.5**	**Pipe**	**1988**	**870**	**0.06**

Table S1. Characteristics of studied facilities. ND means that data was unavailable for a given site.

II. Frequency of quantification of all substances

Frequency	Substances			
Never quantified	C_5-C_8 Aliphatics C_8-C_{10} Aliphatics Nap Acyl Acen A Dichloromethane 1,1-dichloroethane 1,2-dichloroethane 1,2-dichloropropane Chloroform Tetrachloromethane Trans-1,2-dichloroethene 1,1,1-trichloroethane Trichloroethene Vinyl chloride Monochlorobenzene 1,2,3-trichlorobenzene 1,2,3,4-tetrachlorobenzene 1,2,3,5+1,2,4,5-tetrachlorobenzene Diclobenil Quintozene-pentachloroaniline 2-monochlorophenol 3-monochlorophenol 4-monochlorophenol 2,3-dichlorophenol 2,4 + 2,5-dichlorophenol 2,6-dichlorophenol 3,4-dichlorophenol 3,5-dichlorophenol 2,3,4-trichlorophenol 2,3,5-trichlorophenol 2,3,6-trichlorophenol 2,4,5-trichlorophenol 2,4,6-trichlorophenol 3,4,5-trichlorophenol 2,3,5,6-tetrachlorophenol 2,3,4,5-tetrachlorophenol 2,3,4,6-tetrachlorophenol Pentachlorophenol Benzene Ethylbenzene Xylene	Styrene MTBE Aldrin Dieldrin Endrin Isodrin Telodrin alpha-HCH beta-HCH Lindane Heptachlor cis-Heptachlor epoxide trans-Heptachlor epoxide alpha-Endosulfan Simazine-2-hydroxy Carbofuran-3-hydroxy 6-chloronicotinic acid Acetamiprid Acetochlor Alachlor Aldicarb Aldicarb sulfone Aldicarb sulfoxide Ametryn Atrazine Azoxystrobin Boscalid Cyanazine Cyproconazole Atrazine-desethyl Terbuthylazine-desethyl Atrazine-desisopropyl Desmetryn Diazinon Difenacoum Diflufenican Dichlorvos Dicrotophos Dimethoate	Dimoxystrobin Diuron Epoxiconazole Fenoxycarb Fipronil Fipronil sulfone Fluazifop Fonofos Phorate Phosalone Phosphamidon Phosmet Phosmet oxon Hexazinone 2-hydroxyatrazine Imidacloprid Imidacloprid olefin Imidacloprid urea Indoxacarb Isoproturon Isoproturon-desmethyl Isoproturon-monodesmethyl Cadusafos Carbaryl Carbofuran Clomazone Chlorfenvinphos Chloridazon Chloridazon-desphenyl Chloridazon-methyldesphenyl Chlorpyrifos Chlorsulfuron Chlortoluron Clothiadinin Kresoxim-methyl Linuron Malaoxon Malathion Metamitron Metazachlor Methidathion Methiocarb Methiocarb sulfone	Methiocarb sulfoxide Metconazole Metolachlor Methomyl Methomyl oxime Metribuzin Oxamyl Pendimethalin Pethoxamid Pirimicarb Prochloraz Prometon Prometryn Propazine Propoxur Pyrimethanil Sebuthylazine Simazine Simetryn Tebuconazole Terbuthylazine Thiacloprid Thiamethoxam Pentanedial DeBB HBCD PFHpA PFOA PFNA PFDA PFBS PFHxS PFHpS 6:2 FTS 8:2 FTS PFTrDA DEP DNPP DNHP TetBT TCHT TPhT
$0<f_{quant}\leq25\%$	C_8-C_{10} Aromatics C_{16}-C_{35} Aromatics F BkF DahA Hexachloroethane Cis-1,2-dichloroethene 1,1,2-trichloroethane Tetrachloroethene 1,1-dichloroethene 1,2-dichlorobenzene 1,3-dichlorobenzene 1,4-dichlorobenzene 1,2,4-trichlorobenzene 1,3,5-trichlorobenzene Pentachlorobenzene	Hexachlorobenzene Toluene o,p'-DDT p,p'-DDT o,p'-DDD p,p'-DDD o,p'-DDE p,p'-DDE Terbuthylazine-desethyl-2-hydroxy Hydroxy-terbutylazine Carbendazim Propiconazole Terbutryn	Propional Butanal BDE 28 BDE 47 BDE 99 BDE 100 BDE 153 BDE 154 TBBP-A PFBA PFPeA PFHxA PFUnDA PFDoDA PFDS	FOSA PFTeDA MeFOSA EtFOSA MeFOSE EtFOSE DMP DPP DBP DiBP DNOP BBP DCP MPhT DPhT

Frequency	Substances			
$25<f_{quant}\leq 50\%$	C_{10}-C_{12} Aliphatics C_{10}-C_{16} Aromatics Phen Fluo BaA	Chry BbF BaP BPer IP	PCB 28 PFOS OP NP DBP	DiDP DiNP TBT MOT DOT
$50<f_{quant}\leq 75\%$	C_{12}-C_{16} Aliphatics Pyr PCB 52	PCB 101 PCB 118 PCB 153	PCB 138 PCB 180 DEHP	MBT DBT
$75<f_{quant}<100\%$	C_{16}-C_{35} Aliphatics	Formaldehyde	Acetaldehyde	

Table S2: List of substances by frequency of quantification in stormwater pond sediments, n=32

III. Summary of quantified substances

Substance group	Substance	f_{quant} (%)	Concentrations		
			Median	Minimum	Maximum
Hydrocarbons	C_{10}-C_{12} Aliphatics (mg/kg TS)	41%	<10	<10	146
	C_{12}-C_{16} Aliphatics (mg/kg TS)	53%	11.5	<10	285
	C_{5}-C_{16} Aliphatics (mg/kg TS)	53%	18	<11	410
	C_{16}-C_{35} Aliphatics (mg/kg TS)	97%	205	<10	3820
	C_{8}-C_{10} Aromatics (mg/kg TS)	16%	<0.48	<0.095	1.8
	C_{10}-C_{16} Aromatics (mg/kg TS)	28%	<1.24	<0.085	1.24
	C_{16}-C_{35} Aromatics (mg/kg TS)	25%	<1	<1	4.2
Polycyclic aromatic hydrocarbons (PAHs)	F (mg/kg TS)	6%	<0.08	<0.08	0.095
	Phen (mg/kg TS)	38%	<0.08	<0.08	0.628
	Fluo (mg/kg TS)	50%	0.0855	<0.08	1.2
	Pyr (mg/kg TS)	53%	0.109	<0.08	1.41
	BaA (mg/kg TS)	38%	<0.08	<0.08	0.464
	Chry (mg/kg TS)	41%	<0.08	<0.08	0.395
	BbF (mg/kg TS)	50%	0.0935	<0.08	0.773
	BkF (mg/kg TS)	25%	<0.08	<0.08	0.179
	BaP (mg/kg TS)	34%	<0.08	<0.08	0.444
	DahA (mg/kg TS)	22%	<0.08	<0.08	0.13
	BPer (mg/kg TS)	44%	<0.08	<0.08	0.548
	IP (mg/kg TS)	31%	<0.08	<0.08	0.328
	Sum of 16 PAH (mg/kg TS)	53%	0.64	<0.2	6.4
	Carcinogenic PAH (mg/kg TS)	50%	0.28	<0.11	2.6
	Sum other PAH (mg/kg TS)	53%	0.36	<0.092	3.8
	Sum medium-weight PAH (mg/kg TS)	53%	0.215	<0.092	3.2
	Sum high-weight PAH (mg/kg TS)	50%	0.32	<0.11	3.2
BTEX	Toluene (mg/kg TS)	13%	<0.1	<0.1	1.28
Chlorinated aliphatics	Hexachloroethane (mg/kg TS)	3%	<0.01	<0.01	0.126
	Cis-1,2-dichloroethene (mg/kg TS)	3%	<0.04	<0.04	0.18
	1,1,2-trichloroethane (mg/kg TS)	3%	<0.01	<0.01	0.125
	Tetrachloroethene (mg/kg TS)	3%	<0.02	<0.02	0.094
	1,1-dichloroethene (mg/kg TS)	3%	<0.01	<0.01	0.167
Chlorobenzenes	1,2-dichlorobenzene (mg/kg TS)	3%	<0.02	<0.02	0.69
	1,3-dichlorobenzene (mg/kg TS)	3%	<0.02	<0.02	0.22
	1,4-dichlorobenzene (mg/kg TS)	3%	<0.02	<0.02	0.47
	1,2,4-trichlorobenzene (mg/kg TS)	3%	<0.03	<0.03	0.31
	1,3,5-trichlorobenzene (mg/kg TS)	3%	<0.05	<0.05	0.39
	Pentachlorobenzene (mg/kg TS)	3%	<0.01	<0.01	0.02
	sum tetra- and pentachlorobenzenes (mg/kg TS)	3%	<0.02	<0.017	0.04
	Hexachlorobenzene (mg/kg TS)	9%	<0.005	<0.005	0.168
Aldehydes	Formaldehyde (mg/kg TS)	97%	1.2	<0.38	8.4
	Acetaldehyde (mg/kg TS)	88%	0.86	<0.22	3.6
	Propional (mg/kg TS)	3%	<0.2	<0.2	0.5
	Butanal (mg/kg TS)	6%	<0.2	<0.2	0.5

Substance group	Substance	f_{quant} (%)	Concentrations		
			Median	Minimum	Maximum
Polychlorinated Biphenyls (PCBs)	PCB 28 (µg/kg TS)	28%	<0.1	<0.1	2.2
	PCB 52 (µg/kg TS)	53%	0.135	<0.1	6.6
	PCB 101 (µg/kg TS)	75%	0.415	<0.1	20
	PCB 118 (µg/kg TS)	69%	0.26	<0.1	16
	PCB 153 (µg/kg TS)	75%	0.865	<0.1	24
	PCB 138 (µg/kg TS)	75%	0.935	<0.1	27
	PCB 180 (µg/kg TS)	72%	0.7	<0.1	25
	sum of 7 PCBs (µg/kg TS)	75%	3.2	<0.4	100
Alkylphenols	OP (mg/kg TS)	38%	<0.02	<0.01	0.529
	NP (mg/kg TS)	38%	<0.1	<0.1	30.5
Phthalates	DMP (mg/kg TS)	3%	<0.05	<0.05	0.099
	DPP (mg/kg TS)	6%	<0.05	<0.05	0.7
	DiBP (mg/kg TS)	19%	<0.05	<0.05	0.15
	DBP (mg/kg TS)	31%	<0.05	<0.05	0.79
	DNOP (mg/kg TS)	22%	<0.0775	<0.05	7
	DEHP (mg/kg TS)	66%	1.3	<0.05	33
	BBP (mg/kg TS)	6%	<0.05	<0.05	0.2
	DCP (mg/kg TS)	22%	<0.05	<0.05	0.84
	DiDP (mg/kg TS)	28%	<2.5	<2.5	22
	DiNP (mg/kg TS)	31%	<4	<2.5	430
Brominated flame retardants	BDE 28 (µg/kg TS)	3%	<0.26	<0.032	0.7
	tetraBDE (µg/kg TS)	9%	<3.3	<2	21
	BDE 47 (µg/kg TS)	22%	<0.335	<0.16	21
	pentaBDE (µg/kg TS)	9%	<4	<2.4	15
	BDE 99 (µg/kg TS)	25%	<0.425	<0.18	11
	BDE 100 (µg/kg TS)	22%	<0.33	<0.064	3.2
	BDE 153 (µg/kg TS)	9%	<0.275	<0.13	1.4
	BDE 154 (µg/kg TS)	9%	<0.235	<0.027	0.6
	decaBDE (µg/kg TS)	3%	<25.5	<10	110
	TBBP-A (µg/kg TS)	9%	<5	<5	6.66
Perfluorinated substances (PFASs)	PFBA (µg/kg TS)	19%	<0.5	<0.5	1.42
	PFPeA (µg/kg TS)	6%	<0.5	<0.5	0.895
	PFHxA (µg/kg TS)	3%	<0.5	<0.5	0.635
	PFUnDA (µg/kg TS)	3%	<0.5	<0.5	0.872
	PFDoDA (µg/kg TS)	6%	<0.5	<0.5	1.46
	PFOS (µg/kg TS)	44%	<0.5	<0.5	3.18
	PFDS (µg/kg TS)	9%	<0.5	<0.5	0.557
	FOSA (µg/kg TS)	9%	<0.5	<0.5	0.994
	PFTeDA (µg/kg TS)	6%	<0.5	<0.5	1.35
	MeFOSA (µg/kg TS)	3%	<0.5	<0.5	0.584
	EtFOSA (µg/kg TS)	9%	<0.5	<0.5	0.735
	MeFOSE (µg/kg TS)	3%	<0.5	<0.5	0.825
	EtFOSE (µg/kg TS)	13%	<0.5	<0.5	1.19

Substance group	Substance	f_{quant} (%)	Concentrations		
			Median	Minimum	Maximum
Organotins	MBT (µg/kg TS)	66%	12	<1	231
	DBT (µg/kg TS)	69%	12	<1	781
	TBT (µg/kg TS)	44%	<1	<1	31.3
	MOT (µg/kg TS)	47%	<1	<1	23.4
	DOT (µg/kg TS)	47%	<1	<1	40.7
	MPhT (µg/kg TS)	13%	<1	<1	10.1
	DPhT (µg/kg TS)	6%	<1	<1	2.69
Pesticides	o,p'-DDT (mg/kg TS)	3%	<0.01	<0.01	0.25
	p,p'-DDT (mg/kg TS)	6%	<0.01	<0.01	1.58
	o,p'-DDD (mg/kg TS)	3%	<0.01	<0.01	0.328
	p,p'-DDD (mg/kg TS)	3%	<0.01	<0.01	0.869
	o,p'-DDE (mg/kg TS)	3%	<0.01	<0.01	0.02
	p,p'-DDE (mg/kg TS)	3%	<0.01	<0.01	0.216
	Terbuthylazine-desethyl-2-hydroxy (mg/kg TS)	3%	<0.01	<0.01	0.1
	Hydroxy-terbutylazine (mg/kg TS)	3%	<0.01	<0.01	0.1
	Carbendazim (mg/kg TS)	3%	<0.01	<0.01	0.1
	Propiconazole (mg/kg TS)	6%	<0.01	<0.01	0.1
	Terbutryn (mg/kg TS)	3%	<0.01	<0.01	0.1

Table S3: Frequency of quantification (f_{quant}), minimal, maximal and median concentrations for compounds quantified in at least one sample

IV. Correlation test results between quantified concentrations of each substance and the total number of substances quantified in each sample

Substance	$f_{censored}$	P-value	tau
C_{10}-C_{12} Aliphatics*	0.59	4.25E-07	0.542
C_{12}-C_{16} Aliphatics*	0.47	2.07E-08	0.649
C_{16}-C_{35} Aliphatics*	0.03	5.16E-09	0.726
C_{10}-C_{16} Aromatics	0.72	0.963	0.006
C_{16}-C_{35} Aromatics*	0.75	2.42E-05	0.373
Phen*	0.63	6.18E-07	0.520
Fluo*	0.50	1.01E-08	0.653
Pyr*	0.47	2.6E-09	0.690
BaA*	0.63	2.22E-07	0.540
Chry*	0.59	2.86E-07	0.550
BbF*	0.50	1.25E-08	0.649
BkF*	0.75	4.02E-05	0.363
BaP*	0.66	4.01E-07	0.512
BPer*	0.56	2.63E-08	0.611
IP*	0.69	5.76E-06	0.442
Formaldehyde*	0.03	0.00175	0.389
Acetaldehyde*	0.13	0.00398	0.357
BDE 99*	0.75	0.00278	0.359
PCB28*	0.72	0.00062	0.369
PCB52*	0.47	3.18E-09	0.685
PCB101*	0.25	5.37E-10	0.762
PCB118*	0.31	7.17E-09	0.704
PCB153*	0.25	7E-11	0.800
PCB138*	0.25	5.62E-11	0.804
PCB180*	0.28	9.11E-11	0.792
sum of 7 PCBs*	0.25	4.55E-11	0.808
PFOS*	0.56	5.9E-05	0.442
OP*	0.63	1.49E-05	0.500
NP*	0.63	3.87E-07	0.542
DBP*	0.69	0.00017	0.389
DEHP*	0.34	4.19E-09	0.710
DiDP*	0.72	0.00681	0.300
DiNP*	0.69	0.00406	0.329
Monobutyltin*	0.34	7.67E-09	0.698
Dibutyltin*	0.31	2.16E-09	0.728
Tributyltin*	0.56	0.000127	0.421
Monooctyltin*	0.53	2.94E-06	0.524
Dioctyltin*	0.53	1.23E-07	0.593

Table S4: Results of the Kendall's tau test between censored substance concentrations**,** n=32**.** Significant correlations, considering α=0.01 are marked with a * The test was only computed for substances quantified in at least 8 of the 32 analyzed samples ($f_{cens} \leq 75\%$ censored).

V. Statistics addressing inter-site variability

Substance	$f_{censored}$	Inter-site factor of variation
C_{10}-C_{12} Aliphatics	0.60	14.6
C_{12}-C_{16} Aliphatics	0.50	28.5
C_{16}-C_{35} Aliphatics	0.03	382
C_{10}-C_{16} Aromatics	0.73	14.6
Phen	0.63	7.9
Fluo	0.50	15.0
Pyr	0.50	17.6
BaA	0.63	5.8
Chry	0.60	4.9
BbF	0.53	5.6
BaP	0.67	5.6
BPer	0.57	6.9
IP	0.70	4.1
Formaldehyde	0.03	22.1
Acetaldehyde	0.13	16.4
PCB28	0.73	22.0
PCB52	0.47	66.0
PCB101	0.27	200
PCB118	0.30	160
PCB153	0.27	240
PCB138	0.27	270
PCB180	0.30	250
PFOS	0.60	6.4
OP	0.63	52.9
NP	0.63	305
DBP	0.70	15.8
DEHP	0.37	660
DiDP	0.70	40.0
DiNP	0.67	172
Monobutyltin	0.37	231
Dibutyltin	0.33	781
Tributyltin	0.60	31.3
Monooctyltin	0.57	23.4
Dioctyltin	0.57	40.7

Table S5: Summary of factors of variability within ponds for substances quantified in at least 25% of samples

Substance	$f_{censored}$	P-value (all)	P-value (IC-Res)	P-value (IC-Ro)	P-value (Res-Ro)
C_{10}-C_{12} Aliphatics	0.60	0.030	**0.0013**	0.91	**0.0013**
C_{12}-C_{16} Aliphatics	0.50	0.12	**0.0071**	0.83	**0.0071**
C_{16}-C_{35} Aliphatics	0.03	0.042	**0.00080**	0.60	**0.00082**
C_{10}-C_{16} Aromatics	0.73	0.018	1	**0.0047**	1
Phen	0.63	0.011	**0.0013**	0.18	**0.0013**
Fluo	0.50	0.041	**0.00082**	0.38	**0.00082**
Pyr	0.50	0.041	**0.00032**	0.35	**0.00032**
BaA	0.63	0.14	0.045	0.75	0.045
Chry	0.60	0.22	0.054	0.69	0.054
BbF	0.53	0.15	0.013	0.59	0.013
BaP	0.67	0.12	0.58	0.46	0.578515
BPer	0.57	0.049	**0.0026**	0.67	**0.0026**
IP	0.70	0.082	0.046	0.75	0.046
Formaldehyde	0.03	0.42	0.19	0.32	0.19
Acetaldehyde	0.13	0.48	0.80	0.48	0.80
PCB28	0.73	0.048	0.011	0.10	0.011
PCB52	0.47	0.054	**0.0071**	0.19	**0.0071**
PCB101	0.27	0.15	0.012	0.31	0.012
PCB118	0.30	0.12	**0.0038**	0.31	**0.0038**
PCB153	0.27	0.21	0.012	0.52	0.012
PCB138	0.27	0.29	0.026	0.63	0.026
PCB180	0.30	0.25	0.033	0.60	0.033
PFOS	0.60	0.48	0.19	0.63	0.19
OP	0.63	**0.0022**	**0.0094**	0.04	**0.0094**
NP	0.63	0.027	0.046	0.39	0.046
DBP	0.70	0.27	0.12	0.22	0.12
DEHP	0.37	0.11	**0.0069**	0.35	**0.0069**
DiDP	0.70	0.37	**0.0027**	0.76	**0.0027**
DiNP	0.67	0.037	**0.0076**	0.12	**0.0076**
Monobutyltin	0.37	0.013	**0.0018**	0.10	**0.0018**
Dibutyltin	0.33	0.081	**0.0035**	0.36	**0.0035**
Tributyltin	0.60	0.18	0.054	0.63	0.053592
Monooctyltin	0.57	0.039	**0.0045**	0.24	**0.0045**
Dioctyltin	0.57	0.040	**0.0026**	0.76	**0.0026**

Table S6: Results of the Peto&Peto generalized Wilcoxon test for differences between substance concentrations observed in each city, n=32, n_{IC}=18, n_{Res}=9, n_{Ro}=5. P-values for significant differences, considering α=0.01, are in bold. The tests were only computed for substances for which $f_{censored}$<75%.

Substance	$\mathbf{f_{censored}}$	**P-value (Catchment area)**	**P-value (Ratio facility to catchment)**	**P-value (Facility age)**	**P-value (Sediment age)**	**P-value (Imperviousness)**
C_{10}-C_{12} Aliphatics	0.60	0.54	0.44	0.068	0.068	0.077
C_{12}-C_{16} Aliphatics	0.50	0.70	0.36	0.11	0.25	0.16
C_{16}-C_{35} Aliphatics	0.03	1	0.41	0.011	0.044	0.073
C_{10}-C_{16} Aromatics	0.73	0.81	0.73	0.84	0.84	0.86
Phen	0.63	0.22	0.85	0.13	0.22	0.19
Fluo	0.50	0.62	0.41	0.18	0.097	0.14
Pyr	0.50	0.64	0.46	0.24	0.085	0.23
BaA	0.63	0.73	0.49	0.21	0.063	0.25
Chry	0.60	0.93	0.34	0.31	0.071	0.22
BbF	0.53	0.83	0.40	0.22	0.057	0.20
BaP	0.67	0.81	0.38	0.27	**0.0078**	0.11
BPer	0.57	0.58	0.61	0.11	0.043	0.11
IP	0.70	0.94	0.59	0.096	**0.0053**	0.28
Formaldehyde	0.03	0.86	0.50	0.042	0.021	0.35
Acetaldehyde	0.13	0.76	0.79	0.081	**0.0013**	0.25
PCB28	0.73	0.84	0.51	0.65	0.53	0.59
PCB52	0.47	0.71	0.25	0.19	0.32	0.034
PCB101	0.27	0.51	0.05	0.058	0.58	0.33
PCB118	0.30	0.66	0.14	0.077	0.32	0.39
PCB153	0.27	0.51	0.05	0.045	0.49	0.25
PCB138	0.27	0.36	0.03	0.063	0.54	0.28
PCB180	0.30	0.36	0.04	0.044	0.38	0.21
PFOS	0.60	0.66	0.10	0.36	0.81	0.44
OP	0.63	0.18	0.98	0.22	0.25	0.077
NP	0.63	1	0.41	0.078	0.012	0.087
DBP	0.70	0.87	0.29	0.50	0.80	0.57
DEHP	0.37	0.87	0.07	0.077	0.75	0.12
DiDP	0.70	0.64	0.42	0.041	0.22	0.039
DiNP	0.67	0.84	0.61	0.10	0.12	0.045
Monobutyltin	0.37	0.45	0.64	0.027	0.12	0.13
Dibutyltin	0.33	0.75	0.30	0.014	0.11	0.21
Tributyltin	0.60	0.38	1	0.034	0.22	1
Monooctyltin	0.57	0.27	0.89	0.022	0.027	0.13
Dioctyltin	0.57	0.50	0.87	0.12	0.072	0.064

Table S7: Results of Kendall's tau test for correlation between censored concentrations and catchment and facility properties, n=30 for all except imperviousness for which n=21 P-values for significant correlations, considering α=0.01, are in bold. The test was only computed for substances for which $f_{censored}$<75%.

Substance	$f_{censored}$	P-value (all)	P-value (Or-Os)	P-value (Or-St)	P-value (Or-Va)	P-value (Os-St)	P-value (Os-Va)	P-value (St-Va)
C_{10}-C_{12} Aliphatics	0.60	**0.0027**	**6.3E-05**	**0.0036**	**0.00053**	0.17	0.77	0.42
C_{12}-C_{16} Aliphatics	0.50	**0.00030**	**6.3E-05**	**0.0013**	**0.00021**	0.092	0.35	0.31
C_{16}-C_{35} Aliphatics	0.03	**1.6E-06**	**6.3E-05**	**2.7E-06**	**4.6E-06**	0.041	0.77	0.062
C_{10}-C_{16} Aromatics	0.73	0.90	1	1	1	0.58	0.65	0.48
Phen	0.63	0.018	0.014	**0.0036**	**0.00053**	0.77	1	0.89
Fluo	0.50	**0.0014**	**6.3E-05**	**8.6E-05**	**0.00053**	0.92	0.42	0.75
Pyr	0.50	**0.00056**	**6.3E-05**	**8.6E-05**	**6.3E-05**	0.69	0.42	0.68
BaA	0.63	**0.0095**	0.014	**0.0036**	**0.00053**	0.77	0.28	0.54
Chry	0.60	**0.0044**	0.014	**0.0012**	**0.00053**	0.46	0.28	0.48
BbF	0.53	**0.00059**	**6.3E-05**	**0.00035**	**6.3E-05**	0.77	0.42	0.31
BaP	0.67	**0.0083**	**6.3E-05**	0.025	**0.00053**	0.28	0.42	0.36
BPer	0.57	**0.0027**	**6.3E-05**	**0.0012**	**0.00053**	0.40	0.42	0.37
IP	0.70	**0.0054**	0.014	0.025	**0.00053**	0.91	0.28	0.12
Formaldehyde	0.03	**0.00024**	0.35	**0.0040**	**4.5E-05**	0.91	1	0.011
Acetaldehyde	0.13	**0.000018**	0.063	0.24	**2.3E-05**	0.46	0.88	**0.00040**
PCB28	0.73	0.014	1	**0.0012**	0.055	0.35	0.43	0.57
PCB52	0.47	**0.00062**	**6.3E-05**	**1.7E-05**	**0.00053**	0.85	0.89	0.79
PCB101	0.27	**0.000087**	**6.3E-05**	**2.7E-06**	**0.00010**	0.85	0.42	0.55
PCB118	0.30	**0.00037**	**6.3E-05**	**6.0E-06**	**0.0013**	0.85	0.59	0.43
PCB153	0.27	**0.000026**	**6.3E-05**	**3.0E-06**	**8.1E-06**	0.54	0.42	0.40
PCB138	0.27	**0.000025**	**6.3E-05**	**4.0E-06**	**5.3E-06**	0.54	0.59	0.38
PCB180	0.30	**0.000015**	**6.3E-05**	**2.7E-06**	**4.6E-06**	0.28	0.78	0.28
PFOS	0.60	**0.0052**	0.014	**0.0012**	**6.3E-05**	1	0.88	0.82
OP	0.63	**0.0099**	**6.3E-05**	**0.0098**	**0.00053**	0.88	0.53	0.59
NP	0.63	**0.0011**	**6.3E-05**	0.025	**6.3E-05**	0.17	0.77	0.15
DBP	0.70	**0.0093**	1	**0.0012**	**0.0082**	0.19	0.27	0.77
DEHP	0.37	**6.2E-05**	**6.3E-05**	**7.2E-06**	**4.6E-06**	0.85	0.89	0.75
DiDP	0.70	**0.0023**	**6.3E-05**	**0.0027**	**0.0018**	0.18	0.92	0.32
DiNP	0.67	**0.0027**	**6.3E-05**	**0.0024**	**0.0031**	0.18	0.81	0.44
Monobutyltin	0.37	**7.7E-05**	**6.3E-05**	**3.1E-05**	**4.6E-06**	1	0.42	0.44
Dibutyltin	0.33	**7.2E-06**	**6.3E-05**	**4.5E-06**	**4.6E-06**	0.85	0.42	0.093
Tributyltin	0.60	**0.0011**	0.46	0.065	**0.00056**	0.69	0.14	0.024
Monooctyltin	0.57	**0.00026**	**6.3E-05**	**0.0036**	**4.6E-06**	0.27	0.55	0.17
Dioctyltin	0.57	**3.3E-11**	**6.3E-05**	**0.0036**	**4.6E-06**	**0.00013**	**0.0023**	0.49

Table S8: Results of the Peto&Peto generalized Wilcoxon test for differences between substance concentrations observed in each city, n=32, n_{Os}=2, n_{Or}=12, n_{St}=11, n_{Va}=7. P-values for significant differences, considering α=0.01, are in bold. The tests were only computed for substances for which $f_{censored}$<75%.

VI. Statistics comparing inlet and outlet concentrations

Substance	$f_{censored}$	P-value	tau
C_{10}-C_{12} Aliphatics*	0.60	0.0052	0.381
C_{12}-C_{16} Aliphatics*	0.50	0.0097	0.419
C_{16}-C_{35} Aliphatics*	0.03	0.00063	0.667
C_{10}-C_{16} Aromatics	0.73	1	-0.010
Phen	0.63	0.018	0.305
Fluo*	0.50	0.00093	0.533
Pyr*	0.50	0.00076	0.543
BaA	0.63	0.016	0.295
Chry	0.60	0.015	0.333
BbF	0.53	0.011	0.390
BaP*	0.67	0.00023	0.419
BPer*	0.57	0.0032	0.419
IP	0.70	0.015	0.257
Formaldehyde	0.03	0.164	0.276
Acetaldehyde	0.13	0.0198	0.448
PCB28	0.73	0.047	0.276
PCB52*	0.47	0.0021	0.514
PCB101*	0.27	0.00025	0.695
PCB118*	0.30	0.00066	0.638
PCB153*	0.27	4.6E-05	0.771
PCB138*	0.27	5.6E-05	0.762
PCB180*	0.30	0.00020	0.695
PFOS*	0.60	0.0061	0.448
OP*	0.63	0.0014	0.438
NP	0.63	0.014	0.305
DBP*	0.70	0.00023	0.667
DEHP	0.37	0.042	0.305
DiDP	0.70	0.043	0.314
DiNP*	0.67	0.00035	0.648
Monobutyltin*	0.37	0.00055	0.638
Dibutyltin*	0.33	0.0065	0.371
Tributyltin*	0.60	0.0098	0.381
Monooctyltin*	0.57	1.2E-05	0.638
Dioctyltin*	0.57	0.0061	0.448

Table S9: Results of the Kendall's tau test for correlation between censored inlet and outlet substance concentrations, n=15 paired inlet-outlet concentrations. Significant correlations considering α=0.01 are marked with a *. The test was only computed for substances for which $f_{censored}$<75%.

Substance	$f_{censored}$	Median factor of variation between inlet-outlet samples	Minimum factor of variation between inlet-outlet samples	Maximum factor of variation between inlet-outlet samples
C_{10}-C_{12} Aliphatics	0.60	1.0	1.0	14.6
C_{12}-C_{16} Aliphatics	0.50	1.0	1.2	21.7
C_{16}-C_{35} Aliphatics	0.03	1.1	1.4	17.4
C_{10}-C_{16} Aromatics	0.73	1.0	1.0	5.7
Phen	0.63	1.0	1.0	4.3
Fluo	0.50	1.0	1.1	8.1
Pyr	0.50	1.0	1.0	11.5
BaA	0.63	1.0	1.0	3.1
Chry	0.60	1.0	1.1	2.8
BbF	0.53	1.0	1.1	7.7
BaP	0.67	1.0	1.0	3.9
BPer	0.57	1.0	1.1	6.2
IP	0.70	1.0	1.0	4.1
Formaldehyde	0.03	1.0	2.0	14.5
Acetaldehyde	0.13	1.0	1.5	5.2
PCB28	0.73	1.0	1.0	10.0
PCB52	0.47	1.0	1.1	9.6
PCB101	0.27	1.0	1.3	21.9
PCB118	0.30	1.0	1.1	17.0
PCB153	0.27	1.0	1.2	21.7
PCB138	0.27	1.0	1.2	22.4
PCB180	0.30	1.0	1.1	25.5
PFOS	0.60	1.0	1.0	4.1
OP	0.63	1.0	1.0	11.9
NP	0.63	1.0	1.0	59.7
DBP	0.70	1.0	1.0	4.0
DEHP	0.37	1.0	1.3	27.9
DiDP	0.70	1.0	1.1	6.0
DiNP	0.67	1.0	1.5	39.1
Monobutyltin	0.37	1.0	1.7	15.1
Dibutyltin	0.33	1.0	1.8	35.0
Tributyltin	0.60	1.0	1.1	13.4
Monooctyltin	0.57	1.0	1.1	15.5
Dioctyltin	0.57	1.0	1.0	3.9

Table S10: Summary of factors of variability within ponds for substances quantified in at least 25% of samples

Substance	$f_{censored}$	P-value
C_{10}-C_{12} Aliphatics	0.60	0.390
C_{12}-C_{16} Aliphatics	0.50	0.990
C_{16}-C_{35} Aliphatics	0.03	0.858
C_{10}-C_{16} Aromatics	0.73	0.410
Phen	0.63	0.569
Fluo	0.50	0.638
Pyr	0.50	0.661
BaA	0.63	0.293
Chry	0.60	0.461
BbF	0.53	0.506
BaP	0.67	0.456
BPer	0.57	0.289
IP	0.70	0.661
Formaldehyde	0.03	0.749
Acetaldehyde	0.13	0.608
PCB28	0.73	0.903
PCB52	0.47	0.813
PCB101	0.27	0.981
PCB118	0.30	0.780
PCB153	0.27	0.875
PCB138	0.27	0.931
PCB180	0.30	0.795
PFOS	0.60	0.322
OP	0.63	0.743
NP	0.63	0.842
DBP	0.70	0.767
DEHP	0.37	0.599
DiDP	0.70	0.756
DiNP	0.67	0.544
Monobutyltin	0.37	0.811
Dibutyltin	0.33	0.892
Tributyltin	0.60	0.609
Monooctyltin	0.57	0.813
Dioctyltin	0.57	0.752

Table S11: Results of the paired Peto&Peto generalized Wilcoxon test for differences between censored inlet and outlet substance concentrations, n=15 pairs. Significant correlations, considering α=0.01 are marked with a * The test was only computed for substances for which $f_{censored}$<75%.

VII. Photographs of different types of sediments

Figure S1a. Grey, clay sediments collected from pond Or-2

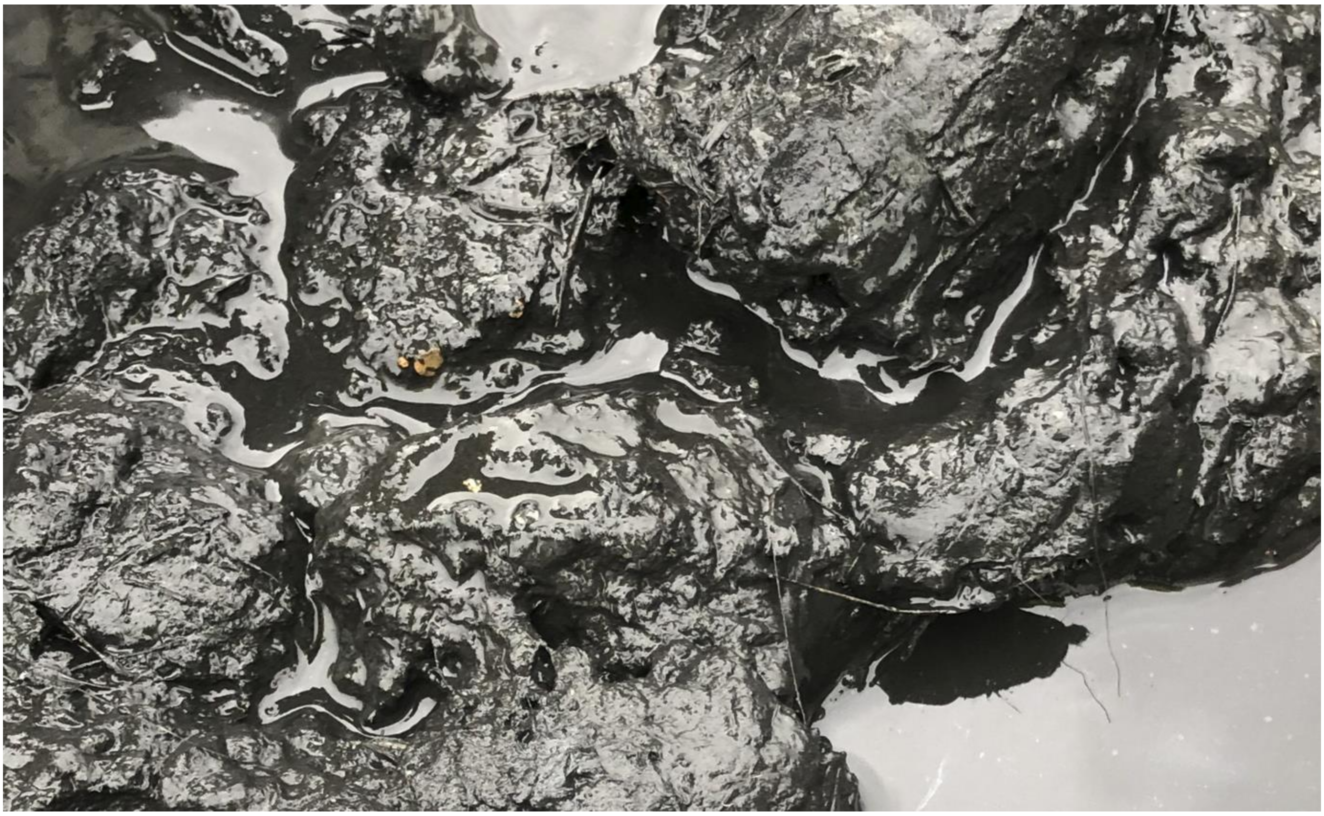

Figure S1b. Loose, black sediments collected from pond S-1.

Figure S3c. Peat-like sediment collected from pond S-3

Figure S1d. Sandy sediment collected from pond S-5

VIII. Regulatory limits exceeded by each sample

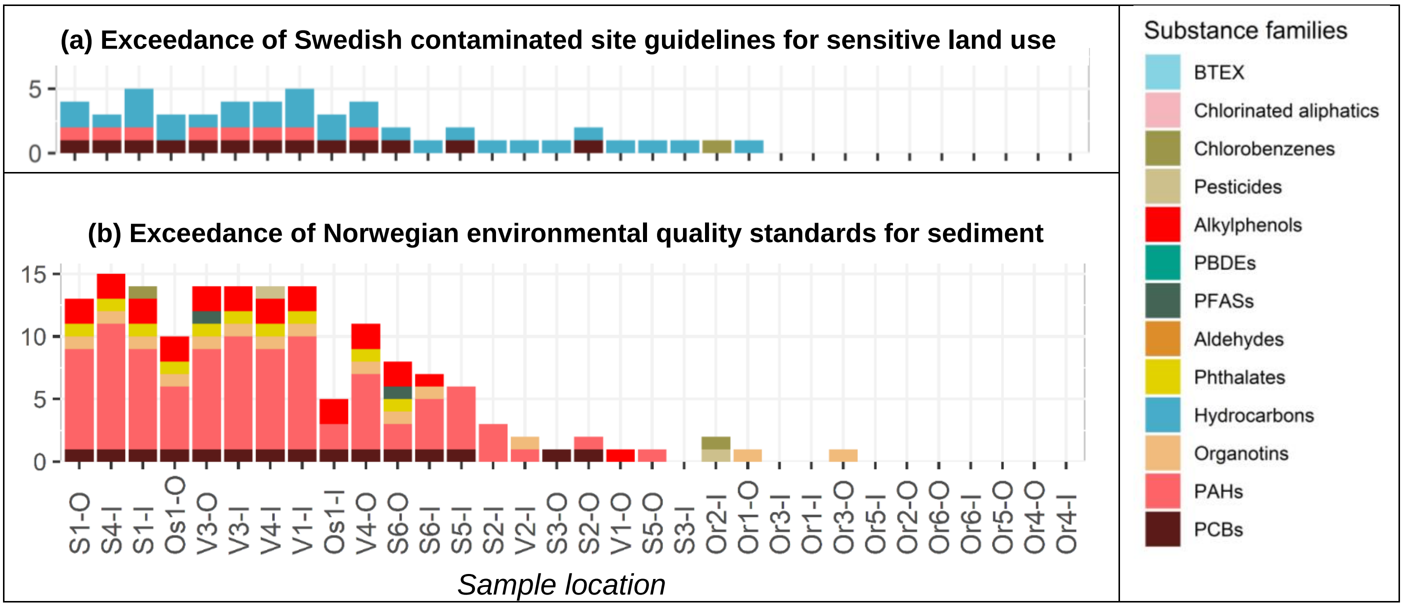

Figure S2a. Total number of quantified substances exceeding Swedish contaminated site guidelines for sensitive land use,[50] and **Figure S2b**. total number of quantified substances exceeding Norwegian environmental quality standards for sediment[51]

IX. Ratios of observed concentrations to regulatory limits

Note: The following graphs present the ratios of substance concentrations quantified in the stormwater sediments to corresponding environmental standards. Substances below the limit of quantification are not included in this graph. The two standard systems (Swedish contaminated site guidelines and Norwegian environmental quality standards for sediment) do not apply to the same lists of substances; in some cases, standards apply to several substances within a family.

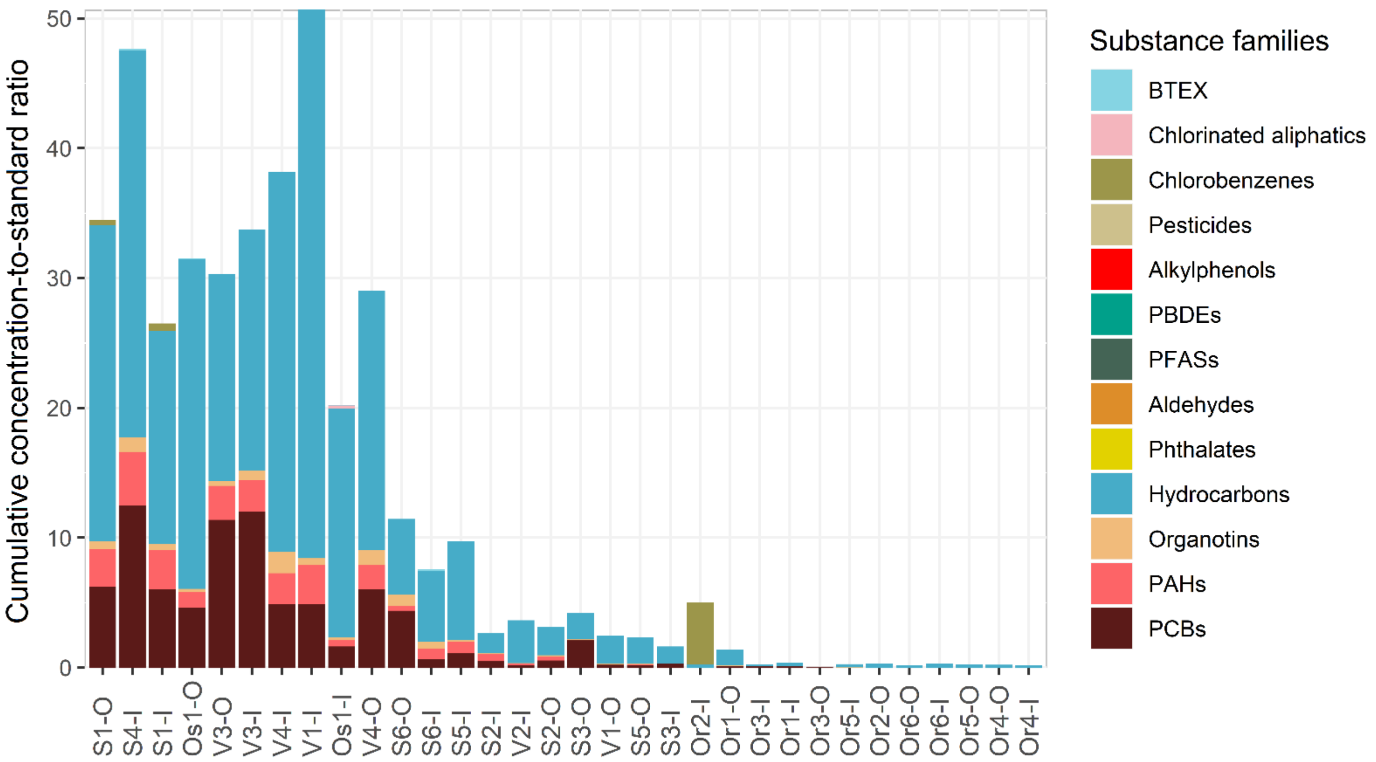

Figure S3a. Sum of ratios of quantified substance concentrations to Swedish contaminated site guidelines for sensitive land use,[46] sorted by substance family.

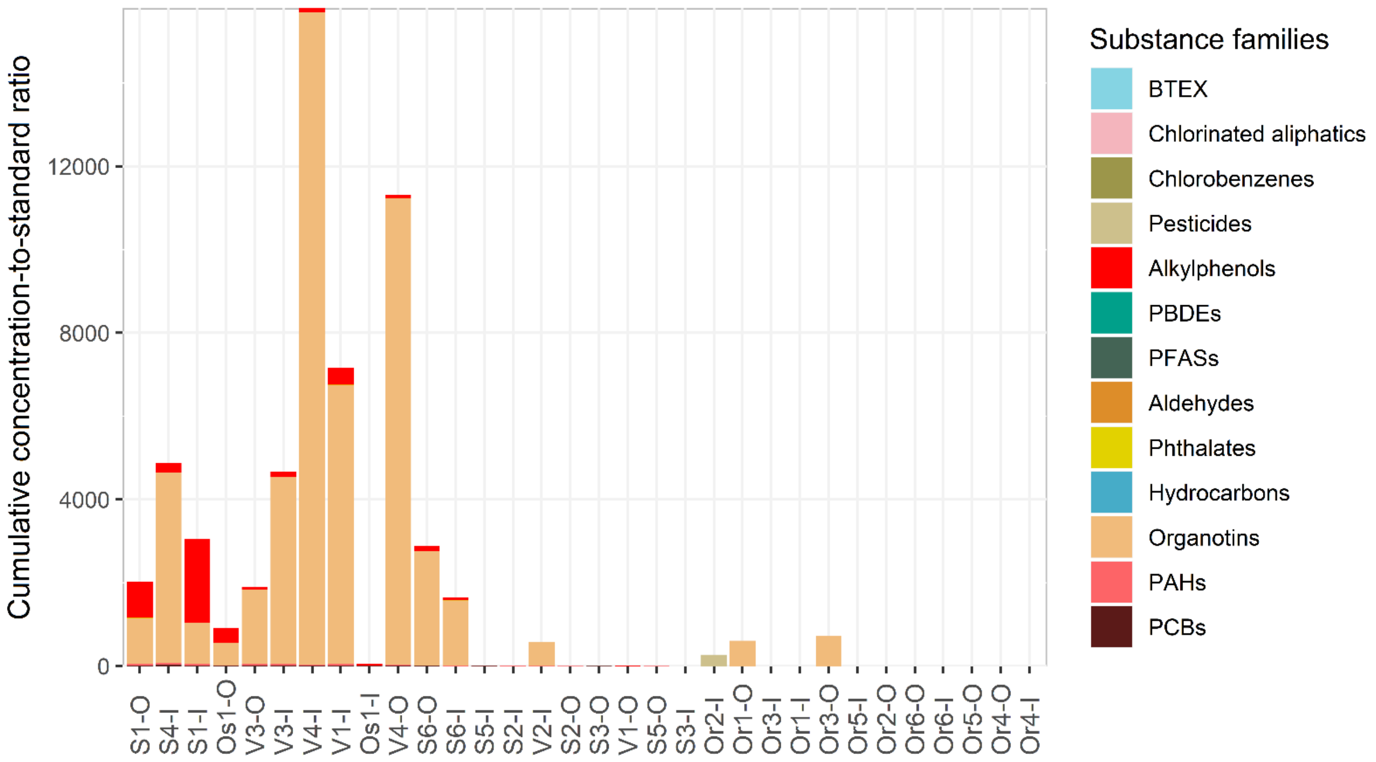

Figure S3b. Sum of ratios of quantified substance concentrations to Norwegian environmental quality standards for sediment[47] sorted by substance family.

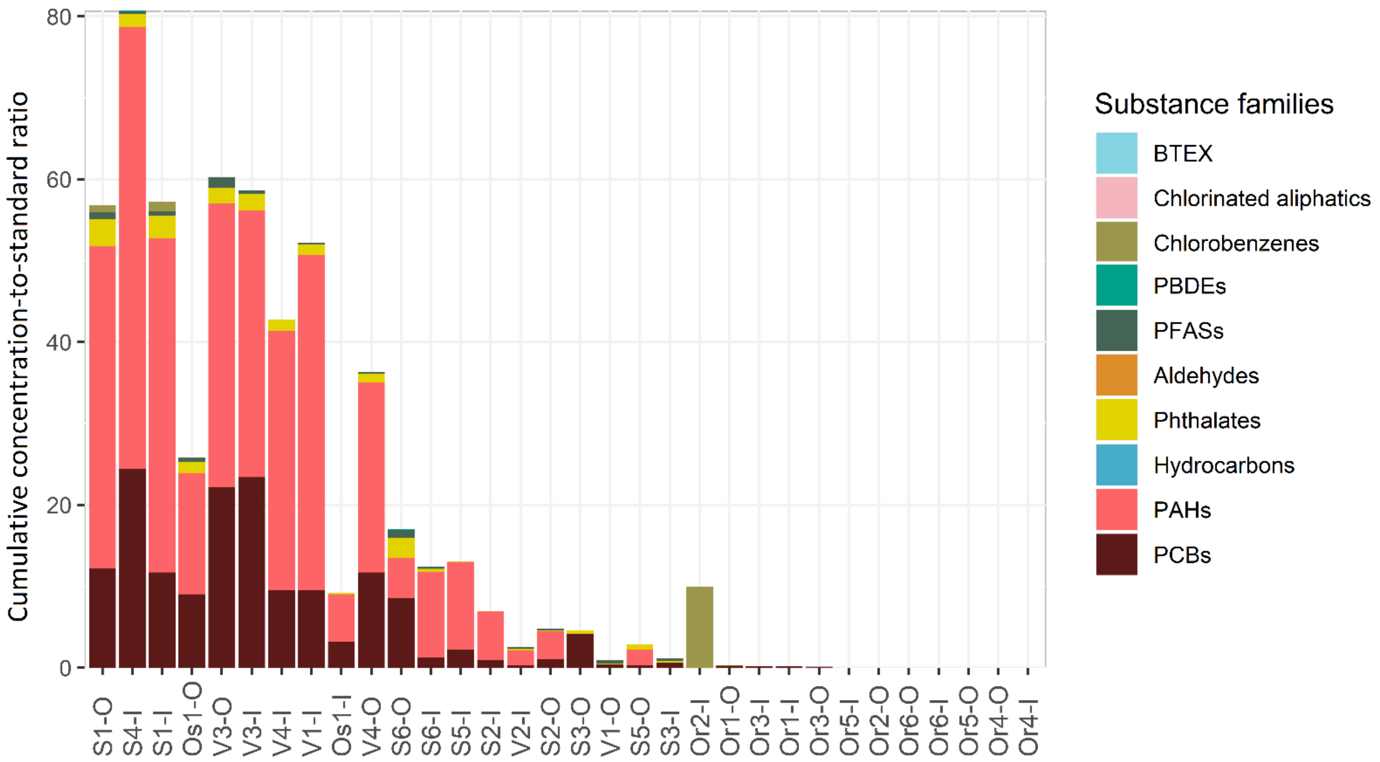

Figure S3c. Sum of ratios of quantified substance concentrations to Norwegian environmental quality standards for sediment[47] sorted by substance family, excluding organotins, alkylphenols and pesticides