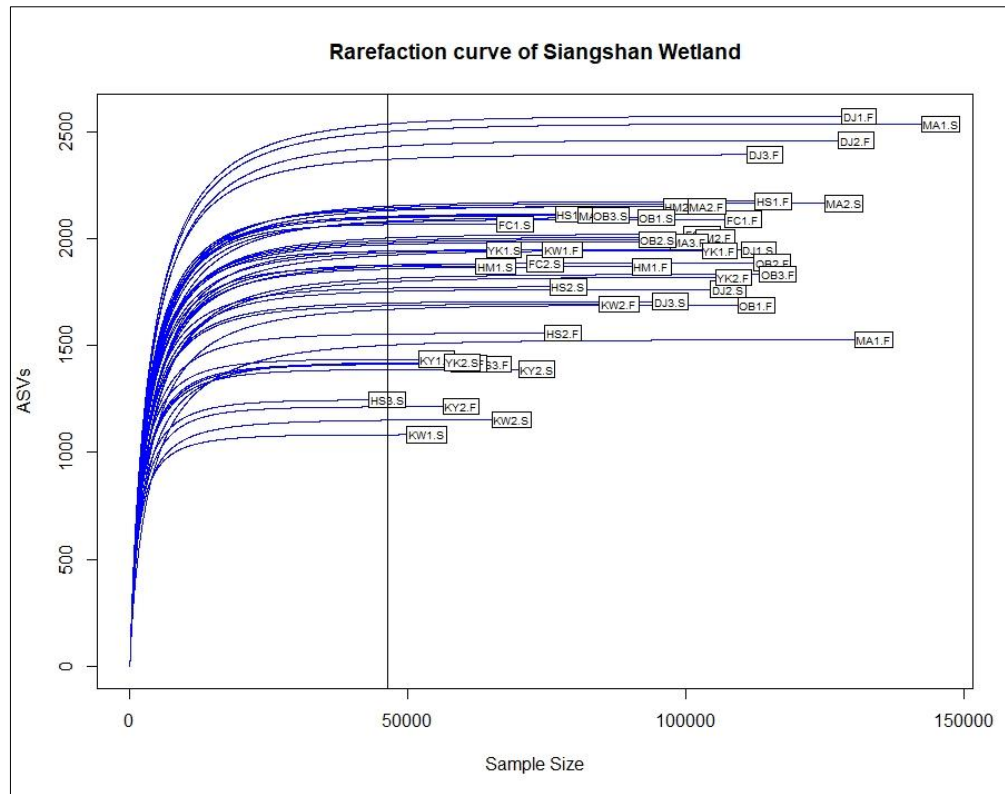
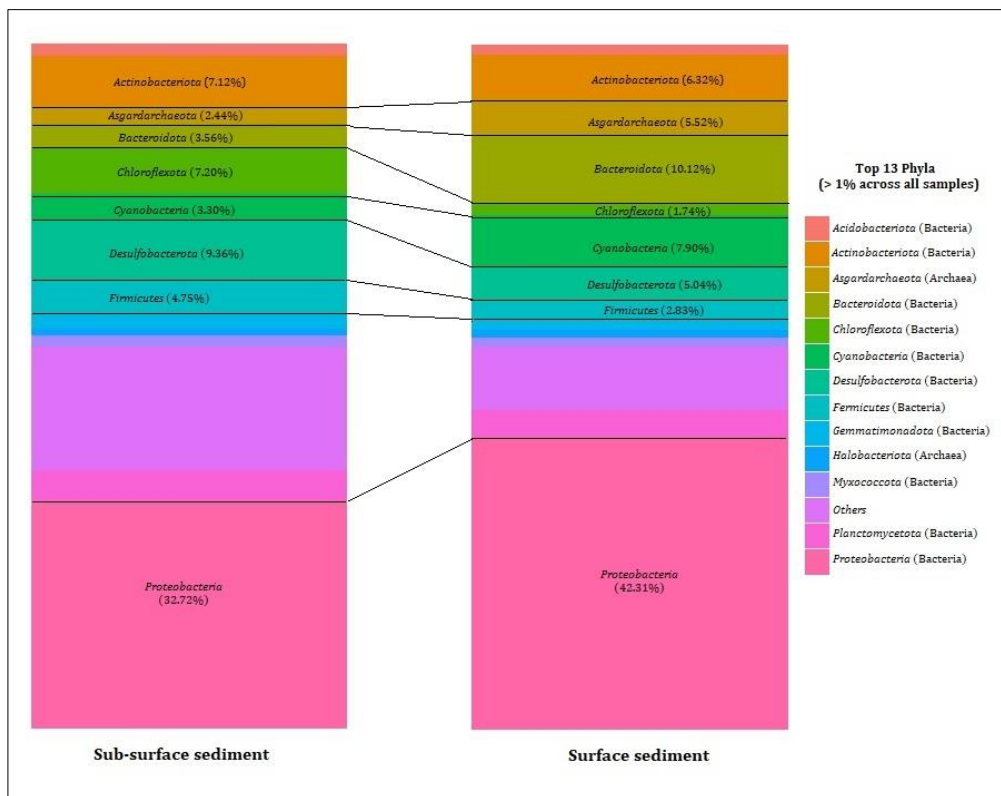




Supplementary Figure 1: Rarefaction curves of high-throughput MiSeq sequencing for surface and sub-surface samples (n = 44).



Supplementary Figure 2: Comparative of the relative abundance of dominant phyla among surface and sub-surface sediments. Top 13 Phyla (most dominant > 1% across all sites).

Supplementary Table 1: Study sites with their coordinates in the Siangshan wetland.

Area (label)	Site	Latitude	Longitude
Ke-Ya (KY)	KY1	24.80652	120.91699
	KY2	24.80856	120.9129
Ke-Ya Water center (KW)	KW1	24.80097	120.91515
	KW2	24.80104	120.9109
Da-Juang (DJ)	DJ1	24.79503	120.91683
	DJ2	24.79508	120.91346
	DJ3	24.7953	120.90984
Hui-Min (HM)	HM1	24.78619	120.91352
	HM2	24.78689	120.91006
Fong-Cin (FC)	FC1	24.77862	120.91212
	FC2	24.77954	120.90765
Hai-Shan (HS)	HS1	24.7733	120.91176
	HS2	24.77384	120.90574
	HS3	24.76817	120.90899
Oyster-Bed (OB)	OB1	24.76806	120.89961
	OB2	24.7693	120.90339
	OB3	24.77123	120.90026
Yen-Kan (YK)	YK1	24.74809	120.89984
	YK2	24.75125	120.90083
Mangrove-Area (MA)	MA1	24.7472	120.90167
	MA2	24.74934	120.90342
	MA3	24.75199	120.90427

Supplementary Table 2: Dual barcodes for each sample sequenced. 8 nucleotides were added to the 5' end of 515F and 805R during PCR amplification.

Samples	Surface (F)		Subsurface (S)	
	Forward barcodes	Reverse barcodes	Forward barcodes	Reverse barcodes
KY1	ATTACTCG	TATAGCCT	ATTACTCG	GGCTCTGA
KY2	ATTACTCG	ATAGAGGC	ATTACTCG	AGGCGAAG
KW1	TCCGGAGA	TATAGCCT	TCCGGAGA	GGCTCTGA
KW2	TCCGGAGA	ATAGAGGC	TCCGGAGA	AGGCGAAG
DJ1	CGCTCATT	TATAGCCT	CGCTCATT	GGCTCTGA
DJ2	CGCTCATT	ATAGAGGC	CGCTCATT	AGGCGAAG
DJ3	CGCTCATT	CCTATCCT	CGCTCATT	TAATCTTA
HM1	GAGATTCC	TATAGCCT	GAGATTCC	CCTATCCT
HM2	GAGATTCC	ATAGAGGC	GAGATTCC	GGCTCTGA
FC1	ATTCAGAA	TATAGCCT	ATTCAGAA	GGCTCTGA
FC2	ATTCAGAA	ATAGAGGC	ATTCAGAA	AGGCGAAG
HS1	GAATTCGT	TATAGCCT	GAATTCGT	AGGCGAAG
HS2	GAATTCGT	CCTATCCT	GAATTCGT	CAGGACGT
HS3	GAATTCGT	GGCTCTGA	GAATTCGT	GTA CTGAC
OB1	CTGAAGCT	TATAGCCT	CTGAAGCT	GGCTCTGA
OB2	CTGAAGCT	ATAGAGGC	CTGAAGCT	AGGCGAAG
OB3	CTGAAGCT	CCTATCCT	CTGAAGCT	TAATCTTA
YK1	TAATGCGC	TATAGCCT	TAATGCGC	CCTATCCT
YK2	TAATGCGC	ATAGAGGC	TAATGCGC	GGCTCTGA
MA1	CGGCTATG	TATAGCCT	CGGCTATG	GGCTCTGA
MA2	CGGCTATG	ATAGAGGC	CGGCTATG	AGGCGAAG
MA3	CGGCTATG	CCTATCCT	CGGCTATG	TAATCTTA

Supplementary Table 3: Thermocycler profile to achieve the amplification process for 3 replicates per sample.

Amplification steps	Temperature °C		Time
Initial denaturation	95		4 minutes
	16 cycles	25 cycles	
Denaturation	95		10 seconds
Annealing	55	49	30 seconds
Elongation	72		1 minute
Final elongation	72		5 minutes
Hold	4		

Supplementary Table 4: Grain size analysis (GSA%) and total organic matter (TOM%) for surface ad sub-surface sediment at studied sites.

Site	Surface (F)				Sub-surface (S)			
	Gravel ($\emptyset_{-1}$)	Sand ($\emptyset_0 + \emptyset_1 + \emptyset_2 + \emptyset_3$)	Mud ($\emptyset_4 + \emptyset_5$)	TOM %	Gravel ($\emptyset_{-1}$)	Sand ($\emptyset_0 + \emptyset_1 + \emptyset_2 + \emptyset_3$)	Mud ($\emptyset_4 + \emptyset_5$)	TOM %
KY1	0.15	59.29	40.55	10.76	1.90	87.03	11.08	0.67
KY2	0.39	45.23	54.37	0.13	0.74	54.93	44.33	2.82
KW1	0.14	38.19	61.67	1.34	0.47	42.33	57.20	1.01
KW2	0.27	98.70	1.03	0.13	0.70	97.97	1.33	0.13
DJ1	0.09	46.38	53.52	2.02	0.09	50.74	49.16	2.08
DJ2	0.24	41.63	58.13	1.41	0.21	58.48	41.31	2.22
DJ3	0.08	41.19	58.72	2.22	0.00	49.07	50.93	1.34
HM1	0.38	43.41	56.21	0.87	0.84	59.81	39.35	0.87
HM2	0.07	35.81	64.13	1.08	0.52	58.54	40.94	2.22
FC1	0.25	41.01	58.74	0.61	0.08	52.35	47.57	0.13
FC2	0.00	39.77	60.23	1.01	0.00	52.44	47.56	0.27
HS1	0.00	66.83	33.17	0.67	0.08	74.54	25.37	0.20
HS2	0.19	87.45	12.36	0.61	0.31	74.83	24.87	0.07
HS3	0.07	29.83	70.10	0.87	0.07	15.79	84.14	0.13
OB1	0.66	26.84	72.50	1.55	0.18	49.51	50.31	1.08
OB2	0.38	28.13	71.50	1.48	0.19	43.51	56.30	1.01
OB3	0.10	17.59	82.31	1.95	0.50	41.69	57.81	2.15
YK1	0.08	73.36	26.56	0.74	0.00	77.46	22.54	0.13
YK2	0.00	24.45	75.55	1.61	0.00	31.89	68.11	1.55
MA1	0.00	50.33	49.67	1.55	0.00	51.92	48.08	1.61
MA2	0.00	50.20	49.80	4.77	0.00	49.47	50.53	4.71
MA3	0.00	33.98	66.02	2.55	0.20	31.24	68.56	2.89
Max.	0.66	98.70	82.31	10.76	1.90	97.97	84.14	4.71
Min.	0.00	17.59	1.03	0.13	0.00	15.79	1.33	0.07

Supplementary Table 5: Distribution of heavy metal concentration in surface sediments of Siangshan wetland (mean±SD mg/kg).

Sites	Heavy metal concentrations (mg/kg)											
	Fe	Al	Mn	Zn	Cu	Ni	Co	Cr	Ga	In	Cd	Pb
KY1	35130±3.89	57610±5.68	454.2±0.01	438.9±0.01	210.7±0.04	74.4±0.01	104.9±0.01	118.9±0.01	128.8±0.01	48.6±0.01	BDL	BDL
KY2	19630±0.58	13190±0.87	184.1±0.04	65.2±0.01	24.9±0.001	16.1±0.01	52.5±0.01	44.1±0.005	53.1±0.005	20.4±0.002	BDL	BDL
KW1	31590±1.28	30640±2.34	543.8±0.04	210.4±0.02	55.9±0.005	26.7±0.001	90.6±0.003	78.8±0.005	87±0.004	37.7±0.02	BDL	BDL
KW2	17060±0.25	7829±0.17	324.9±0.04	56±0.003	7.3±0.001	11.7±0.01	47.9±0.01	31.9±0.002	41.1±0.01	18.6±0.01	BDL	BDL
DJ1	42260±1.83	64560±1.02	848.6±0.08	167.1±0.01	77.3±0.005	34.8±0.01	136.6±0.01	123.7±0.004	138±0.01	60.5±0.02	BDL	BDL
DJ2	39500±1.99	56530±1.28	733.6±0.07	165.3±0.01	84.4±0.01	34.2±0.01	133.2±0.004	115.8±0.01	126.4±0.01	51.7±0.01	BDL	BDL
DJ3	37670±1.24	34460±1.47	697.6±0.05	220.5±0.01	98.2±0.01	36.2±0.01	134±0.02	99.1±0.01	100.5±0.01	56.5±0.01	BDL	BDL
HM1	28340±2.26	34280±1.18	617.5±0.02	102.4±0.01	32.4±0.001	21.5±0.005	88.8±0.01	71.6±0.005	91.2±0.01	37.1±0.01	BDL	BDL
HM2	30640±2.08	42590±2.55	641.7±0.10	108±0.01	37.6±0.002	24.6±0.01	99.2±0.01	82±0.01	106.5±0.003	39.8±0.01	BDL	BDL
FC1	23580±0.6	30000±3.42	616.6±0.09	77.7±0.01	14.8±0.001	15.4±0.002	80.5±0.01	58.9±0.001	84.8±0.01	28.2±0.01	BDL	BDL
FC2	27830±0.81	21540±0.37	622.5±0.01	87.6±0.002	18.9±0.002	15.8±0.004	86.2±0.01	60.9±0.004	80.7±0.01	33.7±0.004	BDL	BDL
HS1	32680±1.14	38700±2.53	705.7±0.01	97.5±0.004	12.7±0.002	22.4±0.01	107.6±0.03	82.5±0.01	111.6±0.01	41.9±0.02	BDL	BDL
HS2	25560±1.89	15660±1.28	673±0.05	67.8±0.002	4.9±0.0003	13.9±0.004	83.2±0.08	50.7±0.005	69.7±0.01	36.8±0.01	BDL	BDL
HS3	27300±1.12	33160±1.72	537.8±0.06	88.6±0.02	18.9±0.0004	19.3±0.01	80.8±0.01	69.6±0.004	88.9±0.01	37.7±0.01	BDL	BDL
OB1	32130±4.07	44980±1.13	662.1±0.08	98.1±0.01	27.3±0.002	23.1±0.01	110.7±0.02	87.7±0.005	107±0.004	42±0.02	BDL	BDL
OB2	35350±0.98	62610±0.69	714.7±0.15	123.5±0.01	37.2±0.001	28.5±0.01	121.5±0.01	107±0.002	129.9±0.01	50.7±0.02	BDL	BDL
OB3	36060±3.08	29700±1.38	917.4±0.06	124.3±0.01	44.5±0.01	28±0.004	132.4±0.002	86.9±0.001	92.5±0.01	53.6±0.02	BDL	BDL
YK1	12310±0.7	9663±0.58	265.4±0.05	17.4±0.002	0.1±0.0003	3.7±0.01	34.1±0.01	24.4±0.002	47.2±0.004	5.2±0.02	BDL	BDL
YK2	35920±0.91	54150±0.91	718.1±0.10	114.4±0.01	34±0.002	27.4±0.005	114.8±0.003	102.8±0.01	121.7±0.005	49.6±0.003	BDL	BDL
MA1	26200±0.97	41760±1.00	392.4±0.01	79.8±0.02	19.5±0.002	18.6±0.01	82±0.02	75.8±0.01	92.3±0.01	24.9±0.01	BDL	BDL
MA2	72900±1.93	55230±2.05	675.3±0.09	151.8±0.03	46.4±0.01	31.1±0.002	147.3±0.02	121.4±0.005	129.9±0.01	62.4±0.02	BDL	BDL
MA3	27270±2.35	38120±2.23	234.7±0.02	82.7±0.04	19.1±0.002	20.8±0.01	96.7±0.01	76.5±0.001	92.8±0.002	27.3±0.01	BDL	BDL
Average	31677.73	37134.64	580.99	124.77	42.14	24.92	98.43	80.50	96.44	39.31	BDL	BDL
Max.	72900.00	64560.00	917.40	438.90	210.70	74.40	147.30	123.70	138.00	62.40	BDL	BDL
Min.	12310.00	7829.00	184.10	17.40	0.10	3.70	34.10	24.40	41.10	5.20	BDL	BDL

BDL: Below detection limit

Supplementary Table 6: Distribution of heavy metal concentration in sub-surface sediments of Siangshan wetland (mean±SD mg/kg).

Sites	Heavy metal concentrations (mg/kg)											
	Fe	Al	Mn	Zn	Cu	Ni	Co	Cr	Ga	In	Cd	Pb
KY1	15690±1.26	12680±0.69	184.4±0.01	65±0.01	14.1±0.001	20.9±0.01	48.8±0.004	34.4±0.003	48.7±0.001	15.9±0.01	BDL	BDL
KY2	28790±2.52	27370±1.22	314.1±0.01	118.4±0.01	47.9±0.004	32.1±0.004	101.8±0.01	77±0.001	80±0.004	39.7±0.001	BDL	BDL
KW1	30460±2.81	39580±2.09	510.8±0.02	120±0.01	47.5±0.004	30±0.01	112.5±0.02	86.4±0.004	97.5±0.003	36.5±0.02	BDL	BDL
KW2	20770±4.02	15130±0.67	389.2±0.02	48.8±0.004	10±0.002	14.8±0.01	68±0.1	45.2±0.01	60.4±0.002	20.2±0.01	BDL	BDL
DJ1	41040±2.07	56840±3.50	676.9±0.11	162±0.01	81.6±0.0003	34.8±0.01	156±0.02	122.4±0.003	126.7±0.01	57.2±0.004	BDL	BDL
DJ2	38060±2.23	50840±0.72	374.6±0.03	160.8±0.01	90.2±0.01	36.6±0.001	127±0.01	114.3±0.003	114.7±0.01	48.3±0.004	BDL	BDL
DJ3	36270±0.63	48980±1.14	634±0.05	196.4±0.002	98±0.00052	37.3±0.01	132±0.01	113±0.004	110.4±0.01	47.1±0.02	BDL	BDL
HM1	29160±1.05	41300±4.02	439.7±0.02	86.6±0.01	28.8±0.001	21.7±0.01	103.3±0.01	79.4±0.005	97.9±0.005	31.9±0.01	BDL	BDL
HM2	34080±2.92	53810±2.59	508.5±0.05	124.9±0.01	66.3±0.004	29.4±0.01	123.8±0.001	102.1±0.004	119±0.005	39.7±0.02	BDL	BDL
FC1	26640±2.03	23020±0.50	453±0.04	63.8±0.01	9.1±0.0004	18.4±0.01	90.3±0.002	59.7±0.005	78.3±0.002	30.2±0.01	BDL	BDL
FC2	28990±1.21	24050±2.01	496.7±0.03	69.6±0.005	10.6±0.0003	19.9±0.07	100±0.01	65.6±0.003	84.5±0.002	34.9±0.004	BDL	BDL
HS1	26520±0.65	25650±0.82	379.7±0.05	69.8±0.0004	12.9±0.001	18.5±0.001	88.5±0.01	61.2±0.002	83.2±0.01	27.4±0.003	BDL	BDL
HS2	30330±1.62	29100±2.69	510.9±0.07	75.5±0.002	9.6±0.001	20.4±0.01	106.9±0.01	71.5±0.003	100.1±0.01	36.3±0.01	BDL	BDL
HS3	21890±0.43	31880±0.79	313±0.04	61.5±0.01	16.1±0.002	14.4±0.004	69.5±0.01	59.9±0.005	77.4±0.01	19.7±0.01	BDL	BDL
OB1	35950±2.69	42320±2.15	670.7±0.05	126.9±0.01	45.8±0.002	29.8±0.01	118.8±0.01	94.2±0.01	107.7±0.02	47.6±0.02	BDL	BDL
OB2	35590±1.79	39250±3.73	648.2±0.02	120±0.004	44.1±0.003	30±0.01	133±0.01	93.1±0.01	102.8±0.01	49.1±0.02	BDL	BDL
OB3	37870±2.3	64830±3.56	529.2±0.08	145.9±0.01	49.2±0.002	33.4±0.005	144.1±0.02	116.2±0.09	133.1±0.01	48.6±0.01	BDL	BDL
YK1	12750±0.47	12870±1.05	141.7±0.03	19.7±0.002	BDL	3.8±0.01	38.2±0.01	27.8±0.001	62.5±0.001	2.1±0.01	BDL	BDL
YK2	35860±1.39	48340±2.74	596.1±0.04	131±0.001	39.5±0.01	30.2±0.01	129.2±0.02	99.9±0.01	114.8±0.01	45.7±0.10	BDL	BDL
MA1	16800±1.3	18010±1.45	98.9±0.02	54.3±0.005	16.3±0.001	11.5±0.01	53.2±0.01	41±0.005	54.6±0.003	10.8±0.01	BDL	BDL
MA2	39000±0.62	65330±4.11	266.9±0.03	129.4±0.01	39.5±0.01	29.3±0.01	133.6±0.01	121.3±0.01	135±0.01	45.8±0.01	BDL	BDL
MA3	26230±1.42	41460±0.43	133±0.01	94.9±0.003	23.8±0.001	21.6±0.01	79.6±0.01	76.9±0.002	97.6±0.01	22±0.01	BDL	BDL
Average	29488.18	36938.18	421.37	102.05	38.14	24.49	102.64	80.11	94.86	34.40	BDL	BDL
Max.	41040.00	65330.00	676.90	196.40	98.00	37.30	156.00	122.40	135.00	57.20	BDL	BDL
Min.	12750.00	12680.00	98.90	19.70	BDL	3.80	38.20	27.80	48.70	2.10	BDL	BDL

BDL: Below detection limit

Supplementary Table 7: Alpha diversity indices (observed taxa, Chao1, Shannon index) within the surface and sub-surface sediments of Siangshan wetland.

Site	Sediment layer	Observed richness (S _{obs})	Chao1 richness	Shannon diversity
KY1.F	Surface	1416	1416	6.58
KY1.S	Sub-surface	1436	1436	6.77
KY2.F	Surface	1214	1214	6.4
KY2.S	Sub-surface	1389	1389	6.59
KW1.F	Surface	1946	1946	7.02
KW1.S	Sub-surface	1083	1083	6.43
KW2.F	Surface	1694	1694	6.8
KW2.S	Sub-surface	1153	1153	6.39
DJ1.F	Surface	2571	2573.87	7.18
DJ1.S	Sub-surface	1949	1949	6.92
DJ2.F	Surface	2459	2464.69	7.1
DJ2.S	Sub-surface	1763	1763	6.8
DJ3.F	Surface	2392	2392	7.16
DJ3.S	Sub-surface	1706	1706	6.78
HM1.F	Surface	1868	1868	6.79
HM1.S	Sub-surface	1871	1871	6.67
HM2.F	Surface	2005	2005	6.94
HM2.S	Sub-surface	2150	2150	7.01
FC1.F	Surface	2090	2090	6.97
FC1.S	Sub-surface	2068	2068	6.83
FC2.F	Surface	2019	2019	6.98
FC2.S	Sub-surface	1883	1883	6.54
HS1.F	Surface	2174	2174	6.97
HS1.S	Sub-surface	2114	2114	6.9
HS2.F	Surface	1557	1557	6.73
HS2.S	Sub-surface	1774	1774	6.88
HS3.F	Surface	1414	1414	6.56
HS3.S	Sub-surface	1245	1245	6.48
OB1.F	Surface	1689	1689	5.78
OB1.S	Sub-surface	2097	2097	6.68
OB2.F	Surface	1888	1888	6.5
OB2.S	Sub-surface	1994	1994	6.91
OB3.F	Surface	1833	1833	5.95
OB3.S	Sub-surface	2110	2110	7.05
YK1.F	Surface	1944	1944	6.56
YK1.S	Sub-surface	1946	1946	6.59
YK2.F	Surface	1818	1818	6.63
YK2.S	Sub-surface	1421	1421	6.23
MA1.F	Surface	1526	1526.84	5.69
MA1.S	Sub-surface	2536	2541.2	7.2
MA2.F	Surface	2150	2150	7.12
MA2.S	Sub-surface	2164	2167.235	7.02
MA3.F	Surface	1984	1984	6.84
MA3.S	Sub-surface	2107	2107	7

F refer to surface; S refer to sub-surface

Supplementary Table 9: Permutation results of the association between environmental variables and microbiota community structure at the class level.

Envi. variables	Explains %	Contribution %	F-ratio	P-value
Mn	14	14	8.07	0.001**
Cu	13	13	6.04	0.002**
Al	7	7	4.58	0.004**
Co	6	6	3.7	0.005**
Ni	6	6	3.98	0.005**
Sand	6	6	4.9	0.001**
Cr	3	3	2.2	0.036*
TOM	3	3	2.16	0.055
In	2	2	1.88	0.071
Gravel	2	2	1.88	0.097
Mud	2	2	1.56	0.131
Ga	1	1	0.9	0.472
Zn	0	0	0.43	0.878
Fe	0	0	0.16	0.994

**P < 0.01; *P < 0.05; 999 iterations.

Supplementary Table 10: Summary of RDA results from CANOCO.

Statistic	Axis 1	Axis 2	Axis 3	Axis 4	Total inertia
Eigenvalues	0.366	0.113	0.087	0.033	1.000
Species-environment correlations	0.898	0.801	0.837	0.711	
Cumulative percentage variance of species data	36.6	47.9	56.6	59.9	
of species-environment relation	56	73.2	86.5	91.6	
Sum of all unconstrained eigenvalues					1.000
Sum of all canonical eigenvalues					0.654

Supplementary Table 11: The total averages of HM concentrations at Siangshan sediments in comparison with other studies worldwide and background values (mg/kg).

Study sites	HMs concentration range (Average)												Reference
	Fe	Al	Mn	Zn	Cu	Ni	Co	Cr	Ga	In	Cd	Pb	
Siangshan wetland, Hsinchu, Taiwan	12310 - 72900 (30582.95)	7829 - 65330 (37036.41)	98.90 - 917.40 (501.18)	17.40 - 438.90 (113.41)	BDL - 210.70 (40.18)	3.70 - 74.40 (24.70)	34.10 - 156 (100.54)	24.40 - 123.70 (80.31)	41.10 - 138 (95.65)	2.10 - 62.40 (36.85)	BDL	BDL	Present study
Eastern sea area of Shandong Peninsula, China	--	--	--	26.07	19.52	--	--	22.61	--	--	0.15	15.47	Liu et al., 2021.
Coastal areas of Bohai sea and Yellow sea, China	--	--	--	77.98		23.7	--	56.8	--	--	0.16	26.79	Tian et al., 2020.
Abu Zenima coast, Egypt	2384	--	--	22.4	5.1	2.87	--	--	--	--	0.55	17.3	Nour and El-Sorogy, 2020.
Lake Bafa, Turkey	26060	--	439.2	33.72	22.64	155.53	15.08	71.38	--	--	0.66	12.175	Algül and Beyhan, 2020.
Sfax solar saltern, southern coast of Sfax, Tunisia	8828.8	--	--	101.1	34.3	50.4	--	--	--	--	11.1	68.6	Bahloul et al., 2018.
Nakdong River, Korea	--	--	--	113.76	16.4	18.31	--	47.82	--	--	0.36	23.85	Kim et al., 2020.
Love River, Kaohsiung, Taiwan	39.175	--	--	172	55.1	22.7	--	47.57	--	--	0.52	17.6	Ma et al., 2018.
Shiangshan wetland, Hsinchu, Taiwan	18878.26	8669.91	--	64.17	25.02	34.64	--	68.64	36.14	1.32	0.82	39.97	Young, 2019.
Main rivers and wetlands in Hsinchu, Taiwan		12173.95	--	112.32	36.92	24.88	--	22.33	5.67	10.05	0.34	17.09	Ye and Young, 2008.
Upper limits for natural background Concentrations in Taiwan	--	--	--	150	50	50	20	60	20	--	0.3	40	Lai et al., 2018.
Average shale values	47200	80000	850	95	45	68	19	90	19	0.1	0.3	20	Turekian and Wedepohl, 1961.