

Supplementary Table S1. Hydro-chemical and isotopic parameters for shallow wells (SW) and boreholes (BH) in Kisumu and the Kano plains during the wet season (May–July, 2017); values <0.04 for NO<sub>2</sub><sup>-</sup> and NO<sub>3</sub><sup>-</sup>, and <0.01 for NH<sub>4</sub><sup>+</sup> indicate attributes below detection limit; “–” represents samples not analyzed.

Station ID	pH (-)	EC (µS cm <sup>-1</sup> )	Temp (°C)	DO (mg O <sub>2</sub> L <sup>-1</sup> )	F <sup>-</sup> (mg L <sup>-1</sup> )	Cl <sup>-</sup> (mg L <sup>-1</sup> )	NO <sub>2</sub> <sup>-</sup> (mg L <sup>-1</sup> )	NO <sub>3</sub> <sup>-</sup> (mg L <sup>-1</sup> )	SO <sub>4</sub> <sup>-</sup> (mg L <sup>-1</sup> )	HCO <sub>3</sub> <sup>-</sup> (mg L <sup>-1</sup> )	Na <sup>+</sup> (mg L <sup>-1</sup> )	NH <sub>4</sub> <sup>+</sup> (mg L <sup>-1</sup> )	K <sup>+</sup> (mg L <sup>-1</sup> )	Ca <sup>2+</sup> (mg L <sup>-1</sup> )	Mg <sup>2+</sup> (mg L <sup>-1</sup> )	δ <sup>15</sup> N (‰)	δ <sup>18</sup> O (‰)
SW1	6.3	900	25.1	1.8	0.4	55.7	0.04	90.6	48.4	19.7	75.7	0.02	36.3	47.9	10.8	21.0	15.9
SW2	6.3	578	26.4	2.2	0.6	35.5	<0.04	47.9	35.1	–	50.6	<0.01	22.5	31.4	6.9	19.5	14.3
SW3	6.4	997	26.3	1.9	0.8	58.1	0.08	80.4	52.2	30.3	78.5	0.48	55.0	51.7	13.5	21.8	14.5
SW4	6.4	433	26.2	2.0	0.4	27.0	<0.04	19.8	33.5	23.7	40.9	0.04	23.4	22.8	4.4	28.9	19.8
SW5	6.8	540	26.1	1.2	0.3	37.3	0.15	11.4	36.6	25.7	43.0	0.03	11.7	35.7	8.6	25.6	14.5
SW6	6.3	740	27.4	2.2	0.4	48.9	<0.04	71.7	43.9	–	67.3	0.01	29.5	37.6	9.3	21.2	12.3
SW7	6.7	916	26	2.1	0.4	51.4	0.06	65.3	38.0	29.8	81.6	11.4	39.4	34.3	8.7	21.8	10.3
SW8	7.0	830	25.8	4.0	0.9	50.1	0.13	59.5	56.3	–	99.6	<0.01	27.4	36.0	6.2	20.5	7.5
SW9	6.3	591	27.1	2.3	0.4	40.0	<0.04	44.0	44.7	19.6	56.3	<0.01	26.8	26.3	6.8	25.2	17.1
SW10	8.0	912	27.6	3.9	3.3	4.5	<0.04	5.3	14.8	–	169	0.02	17.1	15.6	4.2	8.0	7.5
SW11	7.6	865	26.3	2.6	1.6	5.6	<0.04	0.2	11.5	109	177	0.03	5.9	13.4	3.7	13.1	14.0
SW12	7.1	814	25.7	1.3	1.0	3.8	<0.04	<0.04	10.8	86.6	119	0.09	3.4	23.5	10.3	–	–
SW13	7.5	885	25.3	4.4	0.7	1.7	<0.04	2.6	1.4	–	82.0	0.01	7.0	24.8	30.0	8.9	8.7
SW14	8.6	248	25.8	1.8	2.1	5.6	<0.04	<0.04	7.6	–	52.1	<0.01	1.3	2.5	0.4	–	–
SW15	7.5	970	26.6	2.8	2.8	13.0	<0.04	0.8	28.7	109	214	0.02	4.4	7.1	1.5	23.2	16.5
SW16	7.4	1302	27.7	6.2	3.5	75.5	<0.04	57.6	49.5	–	180	0.01	25.2	34.2	9.4	17.7	19.1
SW17	7.8	1420	28.2	6.2	8.0	18.4	0.06	11.6	23.4	16.6	311	0.06	36.2	6.5	0.9	14.3	8.7
BH1	7.1	747	30	2.2	3.2	15.7	<0.04	5.8	10.6	91.3	139	0.02	17.5	24.7	3.0	12.9	12.0
BH2	7.3	727	25.3	5.1	3.2	15.6	<0.04	2.8	10.2	–	136	0.01	14.7	23.1	2.0	10.0	9.3
BH3	7.4	1434	27.2	2.4	1.8	42.8	<0.04	0.0	84.4	120	241	0.02	14.9	42.0	8.9	–	–
BH4	7.5	1215	27.5	3.2	3.9	27.4	0.04	9.1	58.4	118	220	0.03	23.5	32.8	5.4	7.2	5.1
BH5	7.5	947	28	2.3	3.0	1.6	<0.04	1.2	3.8	117	159	0.05	32.0	27.2	4.7	8.6	5.5
BH6	7.5	985	28.1	2.4	2.4	2.4	<0.04	1.5	4.9	124	171	0.03	24.0	31.3	4.2	8.6	5.0
BH7	7.8	883	28.3	4.0	5.3	4.3	<0.04	11.8	11.9	99.3	168	0.01	19.6	16.6	3.4	4.8	4.6
BH9	7.4	1064	29	3.7	2.4	22.4	0.04	20.0	17.9	106	162	0.01	25.7	39.2	7.1	11.5	7.9
BH10	7.7	1074	29	5.9	2.7	26.0	<0.04	22.8	28.6	–	164	0.03	31.2	33.2	6.4	9.3	5.3
BH11	7.1	2520	28	1.7	2.9	80.1	<0.04	0.7	212.3	119	452	0.04	49.1	58.0	10.2	21.9	15.3
BH12	7.4	295	26	2.3	1.5	8.7	<0.04	4.5	23.1	–	33.6	0.14	4.9	19.5	2.1	19.5	9.3
BH13	7.1	950	26.8	2.2	1.3	26.4	0.06	10.2	22.1	77.1	82.7	0.00	6.1	54.9	29.2	25.4	18.6
BH14	7.8	1268	28.1	2.6	5.8	16.2	<0.04	2.8	42.4	–	269	0.03	13.5	13.8	2.8	6.9	6.7
BH15	7.6	1300	28	1.4	3.9	23.5	<0.04	1.1	57.3	128	266	0.02	12.1	18.5	4.8	12.1	11.1
BH16	7.5	1148	28.8	2.1	2.4	26.1	<0.04	<0.04	57.5	–	71.8	0.09	18.4	74.7	31.3	–	–
BH17	7.6	1202	27.7	5.3	4.6	37.6	<0.04	43.7	27.6	107	194	0.02	52.2	30.1	4.0	13.9	7.9
BH18	7.5	1113	27.7	2.1	2.7	14.5	0.04	14.5	37.7	122	180	0.02	46.7	30.8	8.6	4.1	1.1
BH19	7.5	743	26.6	1.9	2.1	5.3	<0.04	2.1	12.2	–	82.4	0.06	16.8	38.0	5.2	18.4	15.0
BH20	7.6	1057	27	5.8	2.8	5.9	<0.04	0.4	21.4	129	196	0.03	35.2	19.3	5.9	4.8	-2.4
BH21	7.0	536	27.8	1.8	2.5	15.8	<0.04	2.0	5.5	–	89.6	0.08	19.0	11.6	1.1	17.5	14.0
BH22	7.2	1224	37.6	1.8	8.1	27.7	<0.04	<0.04	20.1	2.4	282	0.03	7.5	3.6	0.3	–	–
BH23	7.0	484	26.1	4.4	0.7	3.4	<0.04	5.4	0.9	45.1	34.4	<0.01	5.9	27.2	16.2	11.5	11.9
BH24	7.4	638	27.5	6.7	0.9	2.2	<0.04	4.5	2.7	56.6	52.7	<0.01	12.5	30.5	12.2	9.8	8.7
BH25	7.2	1013	26.2	2.0	3.8	5.1	<0.04	0.4	21.3	–	219	0.02	14.5	7.0	2.2	13.2	9.6
BH26	7.6	1701	26.7	3.3	10.5	–	0.04	1.4	69.4	17.5	370	0.05	15.3	10.7	3.6	24.6	17.7
BH27	10.2	1080	31.2	3.5	9.0	70.8	<0.04	<0.04	71.9	7.7	187	0.00	7.8	1.1	0.2	–	–
BH28	10.1	1065	31.5	2.3	10.9	73.9	<0.04	<0.04	74.8	14.2	174	<0.01	6.1	1.5	0.1	–	–
BH29	6.9	943	27.8	3.1	1.6	9.0	<0.04	10.7	6.7	92.2	136	<0.01	15.4	24.5	7.5	14.9	12.0
BH30	7.6	1045	25.9	2.0	5.7	2.8	<0.04	<0.04	6.1	128	213	0.06	18.2	12.1	4.2	–	–

BH31	7.3	1577	28	3.6	7.2	35.4	<0.04	2.0	84.8	–	290	0.04	34.4	20.4	5.8	14.1	6.6
BH32	8.2	1378	27	1.8	6.2	12.7	<0.04	0.1	48.1	167	318	0.06	14.0	5.2	1.4	25.8	20.8
BH33	7.3	1144	28.1	3.9	4.1	21.3	<0.04	2.9	38.9	103	173	0.02	66.5	19.1	4.4	9.0	2.4
BH34	7.5	1247	26.6	2.3	–	–	–	–	–	–	246	0.03	38.7	9.8	1.0	10.7	8.7
BH35	7.6	1034	27.5	5.1	2.4	14.0	<0.04	7.4	12.9	99.9	182	0.03	39.8	11.6	1.8	7.4	9.6
BH36	7.4	1245	28.7	3.3	6.8	16.8	<0.04	6.8	13.7	143	225	0.04	45.1	12.7	2.1	10.1	4.7

Supplementary Table S2. Hydro-chemical and isotopic parameters for shallow wells (SW) and boreholes (BH) in Kisumu and the Kano plains during the dry season (February, 2018); values <0.04 for NO<sub>2</sub><sup>-</sup> and NO<sub>3</sub><sup>-</sup>, and <0.01 for NH<sub>4</sub><sup>+</sup> indicate attributes below detection limit; “–” represents samples not analyzed.

Station ID	pH (-)	EC (µS cm <sup>-1</sup> )	Temp (°C)	DO (mg O <sub>2</sub> L <sup>-1</sup> )	Cl <sup>-</sup> (mg L <sup>-1</sup> )	NO <sub>2</sub> <sup>-</sup> (mg L <sup>-1</sup> )	NO <sub>3</sub> <sup>-</sup> (mg L <sup>-1</sup> )	SO <sub>4</sub> <sup>-</sup> (mg L <sup>-1</sup> )	HCO <sub>3</sub> <sup>-</sup> (mg L <sup>-1</sup> )	Na <sup>+</sup> (mg L <sup>-1</sup> )	NH <sub>4</sub> <sup>+</sup> (mg L <sup>-1</sup> )	K <sup>+</sup> (mg L <sup>-1</sup> )	Ca <sup>2+</sup> (mg L <sup>-1</sup> )	Mg <sup>2+</sup> (mg L <sup>-1</sup> )	δ <sup>15</sup> N (‰)	δ <sup>18</sup> O (‰)
SW1	6.4	861	25.1	2.6	90.4	0.15	38.2	67.2	20.1	79.0	0.01	36.7	40.7	10.6	31.2	16.1
SW2	6.5	290	25.7	2.4	14.0	0.42	10.3	28.5	–	31.1	<0.01	15.2	12.2	2.9	24.5	14.7
SW3	6.7	895	26.1	4.2	92.2	0.12	25.2	58.6	4.9	77.9	0.21	48.7	39.2	12.9	37.8	19.1
SW4	6.2	417	26.1	1.6	31.1	<0.04	0.4	27.5	–	41.5	0.07	20.6	23.8	4.7	38.8	15.8
SW5	6.7	655	24.5	2.4	73.4	<0.04	0.4	46.2	36.6	50.7	0.03	9.6	42.4	10.0	51.8	20.2
SW6	6.4	673	26.8	4.5	62.2	0.12	30.0	49.2	–	62.7	<0.01	26.9	30.5	8.4	30.6	17.4
SW7	6.6	978	25.6	2.9	103.0	0.41	25.2	54.6	52.7	93.5	14.1	43.5	37.3	10.2	37.4	19.4
SW8	7.6	1177	24.8	3.7	28.7	<0.04	4.4	46.9	25.2	129.1	0.07	62.1	30.5	12.4	48.1	29.3
SW9	6.4	377	28.5	9.8	31.1	0.06	6.4	45.5	–	37.8	<0.01	20.3	16.0	4.5	35.8	21.6
SW10	8.2	835	27.3	6.2	4.3	1.74	5.7	17.9	–	170.6	0.03	16.2	7.7	2.9	12.4	12.7
SW11	7.4	882	26.3	4.1	5.5	1.96	0.04	13.6	111.3	188.1	0.03	6.0	12.7	3.8	–	–
SW12	7.3	772	26.1	3.2	2.8	1.07	0.3	9.0	85.3	125.8	0.03	3.1	20.1	9.5	–	–
SW15	7.6	1024	26.7	3.7	15.0	2.20	0.3	37.4	121.7	235.7	0.06	4.6	9.3	1.8	–	–
SW18	7.0	830	25.5	3.4	44.6	0.15	6.1	19.3	–	–	–	–	–	–	–	–
BH1	7.1	731	28.9	3.4	16.3	<0.04	3.7	11.8	83.3	131.6	0.02	17.5	18.1	3.0	15.7	12.8
BH2	7.4	734	36.0	5.1	0.1	<0.04	0.04	–	82.1	135.7	0.03	16.3	13.5	1.7	–	–
BH3	7.1	1276	26.3	2.3	59.5	1.93	<0.04	121.2	111.2	235.0	0.04	14.9	36.8	9.4	–	–
BH4	7.2	1210	28.5	2.5	32.5	1.96	8.8	75.8	111.0	218.2	0.04	23.5	25.1	5.2	9.2	7.0
BH5	7.3	936	28.3	4.0	5.1	1.70	4.4	5.9	106.7	150.9	0.03	31.1	20.2	5.5	10.4	8.1
BH6	7.3	978	28.0	3.7	2.2	1.87	2.4	5.9	114.4	168.8	0.03	23.9	21.5	4.1	11.7	8.2
BH7	7.7	878	28.0	4.9	3.9	1.63	7.7	11.9	104.1	172.1	0.02	19.4	15.3	3.0	9.8	9.2
BH9	7.2	1129	29.0	4.3	36.8	1.80	36.0	23.7	100.1	172.5	0.03	27.2	25.8	6.7	21.0	17.1
BH11	7.1	2562	29.0	2.6	136.5	2.03	0.5	359.9	119.4	461.0	0.09	48.6	52.7	9.5	23.1	15.8
BH13	6.8	924	26.8	3.0	29.9	0.06	11.3	26.4	82.4	77.8	0.02	6.3	43.1	30.0	31.2	24.1
BH14	7.7	1262	27.5	4.9	20.0	2.31	2.8	64.5	25.4	276.1	0.06	14.0	10.3	2.9	14.6	13.2
BH15	7.3	1286	27.6	2.9	29.7	0.06	1.2	84.3	131.7	266.7	0.05	12.3	16.0	4.9	17.6	16.8
BH16	7.2	920	28.0	4.1	20.8	<0.04	2.4	73.7	–	39.4	<0.01	14.8	59.9	23.5	–	–
BH17	7.4	1262	27.7	5.9	55.9	<0.04	69.9	37.8	95.9	196.8	0.02	53.1	19.7	4.0	16.2	8.9
BH18	7.2	979	28.5	2.9	8.8	0.11	6.3	14.3	109.5	153.7	0.02	29.7	25.1	0.0	15.5	13.3
BH19	7.4	723	26.9	4.4	5.9	0.76	3.7	11.7	–	80.3	0.02	16.8	32.1	5.3	18.7	14.3
BH20	7.4	1044	27.2	6.0	5.9	2.24	0.3	27.6	123.3	193.0	0.04	34.5	16.6	5.9	6.9	-1.1
BH23	6.7	482	26.0	4.4	3.7	1.04	6.6	1.0	53.4	37.4	<0.01	6.0	24.9	17.5	12.4	12.3
BH24	7.3	779	29.6	6.1	1.9	0.92	4.6	2.7	72.7	67.9	0.01	16.0	34.3	15.6	17.2	11.1
BH25	7.7	1007	25.7	2.9	4.6	1.44	0.04	26.0	126.6	225.7	0.04	14.8	8.6	2.2	–	–

BH26	7.7	1790	26.7	2.9	40.4	3.17	1.9	103.7	163.9	381.5	0.09	14.6	10.9	3.4	32.2	20.1
BH27	9.6	1103	32.0	2.7	139.8	0.43	0.04	106.3	38.7	218.5	0.02	10.6	1.2	0.18	-	-
BH28	9.6	1066	31.4	2.7	155.5	0.17	0.04	117.5	20.2	205.6	0.01	7.7	1.7	0.15	-	-
BH29	7.4	940	29.0	5.3	24.9	1.28	9.6	21.7	89.4	158.7	0.03	13.4	21.5	5.8	18.5	13.5
BH30	7.7	1044	26.1	2.7	1.4	2.15	0.1	7.2	130.6	219.7	0.05	18.6	12.3	4.3	-	-
BH31	7.5	1535	27.5	4.0	47.1	2.51	2.4	126.9	-	297.8	0.06	36.4	23.7	6.2	17.5	12.2
BH32	8.1	1360	26.1	3.2	12.4	2.69	0.1	67.3	172.0	327.1	0.08	14.3	4.8	1.3	-	-
BH33	7.2	1125	28.1	4.8	29.0	1.46	4.9	58.6	102.9	174.8	0.03	67.9	24.2	4.3	12.2	7.8
BH35	7.7	1037	27.3	5.4	28.2	1.32	15.7	30.5	99.2	182.6	0.04	40.6	17.0	1.8	16.4	8.4
BH36	7.4	1256	28.7	3.9	20.1	2.58	8.2	17.1	134.1	234.9	0.05	49.1	16.3	1.9	11.5	7.3
BH38	6.8	964	27.5	3.2	56.9	2.06	9.2	24.8	77.7	131.3	0.03	20.2	27.4	5.4	17.3	11.3
BH39	7.0	727	28.1	4.7	1.4	1.89	0.9	3.8	-	167.8	0.03	25.9	31.9	6.8	8.0	-1.7
BH40	7.0	727	26.7	4.6	4.2	1.66	5.0	0.4	-	62.2	<0.01	3.5	35.4	24.3	11.3	6.8
BH41	7.1	748	26.4	3.7	1.9	1.09	3.0	3.7	65.0	29.8	<0.01	12.4	38.0	25.4	17.5	13.4
BH42	7.5	1386	28.7	2.0	1.3	2.86	3.5	7.7	-	59.2	0.01	13.3	37.4	14.9	11.3	14.8
BH43	7.1	944	29.7	3.2	8.4	1.51	7.3	9.3	-	307.0	0.08	38.1	10.0	0.8	16.7	11.0
BH44	7.3	1219	28.6	2.9	40.2	0.06	3.4	64.6	-	144.5	0.02	19.9	26.8	7.7	18.8	13.0