

**Suppl. Table S1 .** Water quality index (WQI) classification for individual samples

Wells	WQI	Water quality classification type	Ionic balance	CO32-	pH	SAR	RSC (meq/L)	PI (%)	Salinity	Deep
W1	225.49	Very poor water	-9	0	7.51	5.00	-25.71	43.06	3.46	3.77
W2	227.81	Very poor water	-8	0	7.44	5.10	-25.14	44.52	3.34	1.78
W3	233.64	Very poor water	-9	0	7.11	4.84	-28.14	41.28	3.41	4.74
W4	197.14	poor water	-5	0	7.28	4.51	-25.78	41.02	2.84	2.07
W5	131.14	Poor water	-1	0	7.44	3.81	-15.21	44.34	1.74	2.07
W6	132.78	Poor water	9	0	7.33	3.81	-16.80	43.01	1.86	4.01
W7	209.06	Very poor water	-9	0	7.40	4.39	-27.97	39.43	3.05	1.57
W8	103.26	Poor water	2	0	7.90	3.33	-14.21	42.51	1.23	5.13
W9	103.02	Poor water	-2	0	7.75	3.18	-14.03	41.39	1.18	5.30
W10	247.95	Very poor water	-9	0	7.39	5.51	-28.46	44.03	3.99	7.12
W11	186.67	Poor water	-4	0	8.01	7.26	-7.59	66.71	2.05	25.60
W12	125.68	Poor water	-2	0	7.51	6.52	-6.99	63.67	2.06	34.50
W13	291.59	Very poor water	-10	0	7.71	10.88	-17.97	65.09	4.74	5.45
W14	198.94	Poor water	-9	0	7.71	7.92	-12.23	62.90	3.4	7.04
W15	92.24	Good water	-4	0	7.79	4.77	-5.95	60.29	1.22	21.40
W16	337.28	Water unsuitable for drinking purposes	-8	0	7.75	10.62	-21.65	62.36	5.35	3.80
W17	206.53	Very poor water	-8	0	7.67	4.84	-23.31	43.62	2.95	4.10
W18	161.81	Poor water	-5	0	7.70	5.10	-16.05	49.82	2.38	4.69
W19	118.8	Poor water	-4	0	7.33	4.20	-11.98	48.76	1.68	48.00
W20	235.53	Very poor water	-5	0	7.37	11.60	-15.00	67.77	3.55	48.60
W21	120.79	Poor water	-3	0	7.37	3.80	-13.48	45.77	1.64	14.80
W22	123.29	Poor water	-1	0	7.01	3.42	-15.95	41.36	1.81	8.48
W23	133.05	Poor water	6	0	6.84	3.81	-22.19	39.37	1.46	9.55
W24	194.92	Poor water	-3	0	6.59	4.94	-20.92	45.51	2.97	16.63
W25	174.68	Poor water	1	0	6.69	4.80	-20.93	44.87	2.61	14.30

W26	105.42	Poor water	7	0	7.23	3.80	-17.27	42.42	1.27	5.07
W27	121.07	Poor water	2	0	6.79	4.01	-21.12	41.06	1.31	7.42
W28	121.27	Poor water	9	0	7.00	3.39	-17.08	40.42	1.74	13.75
W29	259.92	Very poor water	-6	0	6.85	5.36	-30.74	42.49	4.16	16.50
W30	187.19	Poor water	2	0	7.02	5.17	-22.24	45.93	2.95	28.00
W31	172.62	Poor water	-9	0	7.01	3.32	-17.59	39.38	2.84	33.50
W32	112.17	Poor water	4	0	7.39	3.20	-16.08	40.18	1.53	40.00
W33	147.48	Poor water	-1	0	7.61	5.75	-12.49	55.49	2.2	29.50
W34	156.52	Poor water	-7	0	7.14	6.55	-9.91	60.21	2.66	49.70
W35	184.69	Poor water	-6	0	8.00	6.84	-14.25	57.63	2.94	46.00
W36	143.83	Poor water	0	0	6.78	5.01	-15.27	50.01	2.18	43.00
W37	196.68	Poor water	-7	0	7.24	7.56	-11.97	62.20	3.17	9.33
W38	149.36	Poor water	1	0	7.65	4.68	-15.58	48.57	2.29	37.34
W39	92.07	Good water	2	0	7.23	3.68	-8.51	51.25	1.21	14.40
W40	194.22	Poor water	-7	0	7.17	5.98	-14.77	54.48	3.3	23.65
W41	179.57	Poor water	-1	0	7.34	4.78	-18.87	45.91	2.47	2.13
W42	145.35	Poor water	-7	0	6.95	5.76	-10.06	54.76	2.11	4.16
W43	135.86	Poor water	6	0	7.41	3.14	-18.31	38.03	2.03	22.24
W44	209.68	Very poor water	-5	0	7.53	5.58	-21.62	47.65	3.43	54.55
W45	122.19	Poor water	-5	0	7.52	6.59	-4.61	65.45	1.9	2.40
W46	167	Poor water	1	0	7.50	4.47	-22.16	42.88	2.62	24.20
W47	115.76	Poor water	5	0	7.32	3.96	-13.21	47.10	1.67	40.50
W48	90.98	Good water	7	0	7.13	3.43	-8.16	48.71	1.34	60.70
W49	128.28	Poor water	0	0	7.32	4.51	-13.14	49.51	1.85	69.50
W50	154.83	Poor water	-8	0	6.88	6.54	-10.14	60.47	2.6	45.94

---

**Suppl. Table S2.** Correlation coefficient matrix of Ghiss Nekkork groundwater chemical parameters

	<b>TDS</b>	<b>pH</b>	<b>T</b>	<b>EC</b>	<b>Na.</b>	<b>K.</b>	<b>NO3.</b>	<b>HCO3.</b>	<b>Ca2.</b>	<b>Mg2.</b>	<b>Cl.</b>	<b>SO42.</b>	<b>Br.</b>	<b>WQI</b>
<b>TDS</b>	1													
<b>pH</b>	0.06	1												
<b>T</b>	0	-0.42	1											
<b>EC</b>	1	0.09	-0.01	1										
<b>Na.</b>	0.88	0.16	-0.04	0.87	1									
<b>K.</b>	0.37	0.36	-0.3	0.37	0.42	1								
<b>NO3.</b>	0.29	0.24	-0.27	0.29	0.32	0.83	1							
<b>HCO3.</b>	0.33	-0.23	0.21	0.32	0.37	-0.08	-0.15	1						
<b>Ca2.</b>	0.38	-0.23	-0.35	0.38	0.18	-0.13	-0.14	0.16	1					
<b>Mg2.</b>	0.65	-0.26	0.06	0.64	0.43	0.03	-0.05	0.38	0.66	1				
<b>Cl.</b>	0.92	0.12	-0.01	0.92	0.89	0.46	0.32	0.31	0.2	0.56	1			
<b>SO42.</b>	0.36	-0.06	-0.31	0.35	0.23	-0.14	-0.17	0.22	0.84	0.56	0.1	1		
<b>Br.</b>	0.19	0.1	-0.07	0.19	0.17	0.12	-0.05	-0.06	0.16	0.16	0.22	0.21	1	
<b>WQI</b>	0.98	0.11	-0.13	0.97	0.87	0.46	0.37	0.31	0.47	0.68	0.89	0.46	0.22	1

**Suppl. Table S3.** Physico-chemical characteristics of groundwater in the Ghiss-Nekkork aquifer (May 2019).

Wells	TDS (mg/L)	pH	T(°C)	EC (µS/cm)	Na <sup>+</sup> (mg/L)	K <sup>+</sup> (mg/L)	NO <sub>3</sub> <sup>-</sup> (mg/L)	HCO <sub>3</sub> <sup>-</sup> (mg/L)	Ca <sup>2+</sup> (mg/L)	Mg <sup>2+</sup> (mg/L)	Cl <sup>-</sup> (mg/L)	SO <sub>4</sub> <sup>2-</sup> (mg/L)	Br <sup>-</sup> (mg/L)
1	3155	7.51	19.53	6310	470.5	5.3	2.1	478.85	343.08	199.68	1065	1311.66	4.08
2	3055	7.44	18.28	6110	485	6.5	3.4	436.15	336.67	188.16	1029.5	1514.34	4.12
3	3122	7.11	17.78	6244	470.5	7.4	9	466.65	384.79	201.6	1047.25	1479.92	4.06
4	2622	7.28	8.36	5244	414.5	4.1	11.4	378.2	349.5	176.64	869.75	1166.35	4.09
5	1652	7.44	8.46	3303	281	6.3	7.1	326.35	275.75	82.56	461.5	718.93	3.14
6	1757	7.33	12.03	3514	292.5	3.8	6.4	335.5	285.37	97.92	266.25	772.47	3.5
7	2800	7.4	12.4	5601	417.5	4.3	2.9	381.25	400.8	172.8	1100.5	1242.83	3.42
8	1130	7.9	13.33	2901	236.5	3.3	2.4	298.9	240.48	86.4	426	543.02	2.39
9	1140	7.75	12.62	2280	236	3	9.7	414.8	208.42	126.72	568	458.89	2.43
10	3609	7.39	9.59	7218	536	13.7	5.5	445.3	333.47	232.32	1668.5	799.23	2.38
11	1934	8.01	7.91	3869	401.5	45.3	79.9	256.2	147.49	53.76	710	349.9	2.46
12	1935	7.51	20.43	3880	396.5	2.5	8.7	427	139.48	85.44	781	151.05	1.94
13	4581	7.71	21.01	9166	886	17.2	18.5	405.65	200.4	177.6	2272	432.12	3.72
14	3065	7.71	20.02	6156	544.5	13.5	11.7	332.45	156.31	120	1455.5	279.54	3.71
15	1155	7.79	12.99	2310	260.5	10.7	4.1	326.35	125.05	61.44	639	64.62	3.74
16	5035	7.75	15.4	10070	954	29.1	33.8	481.9	250.1	207.36	2698	516.25	3.7
17	2847	7.67	12	5695	438.5	9.5	3.4	469.7	307.81	190.08	1065	1001.91	3.59
18	2149	7.7	15.05	4298	385.5	9.2	2.2	340.38	216.43	131.52	674.5	860.42	2.79
19	1590	7.33	15.09	3180	298	1.7	8.6	433.1	192.38	115.2	639	439.77	2.83
20	3344	7.37	14.99	6687	896	4.8	12.9	463.6	253.3	120.96	1349	1040.15	3.02
21	1593	7.37	21.5	3178	270	4	3.9	341.6	184.37	120	568	546.84	2.4
22	1637	7.01	18.9	3280	262.5	3.3	4.3	384.3	208.42	144	603.5	520.08	4.3
23	1674	6.84	20	2747	331	2.8	3.2	390.4	240.48	201.6	603.5	718.93	2.75
24	2802	6.59	20.87	5594	423.5	8.9	23.7	420.9	272.54	172.8	994	661.57	2.43
25	2524	6.69	20.89	5049	411.5	3.8	9.6	420.9	288.58	163.2	816.5	703.63	2.55
26	1260	7.23	20.51	2305	288	2.9	4.8	305	232.46	129.6	461.5	462.71	2.34
27	1224	6.79	19.53	2475	341.5	7.5	9.2	384.3	264.53	172.8	852	481.84	5.33

28	1699	7	20.98	3284	262.5	3.8	5.9	341.6	256.51	120	497	393.88	2.44
29	4019	6.85	19.7	8037	535.5	10.5	21.2	427	336.67	254.4	1775	546.84	2.48
30	2669	7.02	21.42	5337	443	9.1	9.1	340.05	256.51	182.4	852	734.23	2.83
31	2681	7.01	24.49	5363	267.5	3.4	10.2	430.05	240.48	153.6	852	623.33	3.07
32	1441	7.39	17.11	2881	234.5	3	6.6	256.2	216.43	115.2	745.5	358.58	3.09
33	2124	7.61	20.74	4249	400	4.6	7.9	353.8	192.38	105.6	674.5	546.84	3.2
34	2403	7.14	20.71	4807	440.5	4.3	11.2	439.2	200.4	86.4	958.5	342.64	3.44
35	2773	8	20.86	5546	500.5	5	15.3	366	160.32	148.8	1065	550.67	3.55
36	2048	6.78	22.28	4100	374	2.4	5	353.8	216.43	124.8	639	630.97	2.51
37	3034	7.24	22.35	6124	523.5	14.3	10.8	347.7	148.3	124.8	1349	321.99	4.2
38	2065	7.65	20.94	4148	339	14	13.8	262.3	204.41	117.6	852	274.57	3.73
39	1166	7.23	22.44	2286	218.5	12.1	3.9	292.8	124.25	86.4	568	69.6	3.74
40	3108	7.17	20.86	6216	449.5	6.2	18.1	372.1	200.4	132	1455.5	258.89	3.74
41	2393	7.34	21.05	4774	399	16.6	13	460.55	240.48	175.2	887.5	611.85	3.85
42	1906	6.95	25.13	3811	442	9	3.1	744.2	212.42	141.6	923	443.59	2.14
43	1918	7.41	25.27	3836	251.5	3	5.8	359.9	200.04	172.8	461.5	600.38	2.45
44	3177	7.53	21.6	6466	490	4.4	13.9	460.55	220.44	220.8	1242.5	630.97	3.18
45	1840	7.52	23.33	3679	396.5	2.9	0.9	555.1	132.26	86.4	674.5	281.84	3.13
46	2372	7.5	20.58	4744	378	2.6	5	298.9	316.63	136.8	816.5	722.75	2.98
47	1574	7.32	20.56	3153	272.5	3.2	5.3	286.7	208.42	91.2	426	500.96	3.44
48	1265	7.13	20.57	2530	214.5	2.1	5.5	436.15	160.32	88.8	213	314.34	2.91
49	1788	7.32	20.6	3575	322	2.5	7.2	375.15	204.41	110.4	603.5	489.48	2.96
50	2342	6.88	22.79	4697	443	3.4	6.7	411.75	156.31	110.4	1136	366.35	2.09

**Suppl. Table S4.** Water Quality Index (WQI) results for drinking and irrigation

Wells	WQI	Water quality classification type For drinking water	WQI	Water quality classification type for irrigation
w1	225.49	Very poor water	207.48	Very poor water
w2	227.81	Very poor water	212.91	Very poor water
w3	233.64	Very poor water	216.82	Very poor water
w4	197.14	poor water	182.21	poor water
w5	131.14	Poor water	117.85	Poor water
w6	132.78	Poor water	117.09	Poor water

<b>w7</b>	209.06	Very poor water	196.73	Poor water
<b>w8</b>	103.26	Poor water	97.95	Good water
<b>w9</b>	103.02	Poor water	99.32	Good water
<b>w10</b>	247.95	Very poor water	223.04	Very poor water
<b>w11</b>	186.67	Poor water	141.46	Poor water
<b>w12</b>	125.68	Poor water	106.19	Poor water
<b>w13</b>	291.59	Very poor water	250.67	Very poor water
<b>w14</b>	198.94	Poor water	168.64	Poor water
<b>w15</b>	92.24	Good water	80.57	Good water
<b>w16</b>	337.28	Water unsuitable for drinking purposes	291.02	Very Poor water
<b>w17</b>	206.53	Very poor water	188.44	Poor water
<b>w18</b>	161.81	Poor water	164.44	Poor water
<b>w19</b>	121.54	Poor water	107.94	Poor water
<b>w20</b>	164.05	Poor water	217.21	Very poor water
<b>w21</b>	118.8	Poor water	190.91	Poor water
<b>w22</b>	235.53	Very poor water	113.33	Poor water
<b>w23</b>	120.79	Poor water	129.86	Poor water
<b>w24</b>	141.35	Poor water	167.88	Poor water
<b>w25</b>	168.37	Poor water	155.05	Poor water
<b>w26</b>	123.29	Poor water	100.80	Poor water
<b>w27</b>	133.05	Poor water	124.17	Poor water
<b>w28</b>	194.92	Poor water	106.06	Poor water
<b>w29</b>	111.73	Poor water	223.03	Very poor water
<b>w30</b>	174.68	Poor water	165.08	Poor water
<b>w31</b>	130.87	Poor water	145.07	Poor water
<b>w32</b>	105.42	Poor water	103.93	Poor water
<b>w33</b>	121.07	Poor water	128.24	Poor water
<b>w34</b>	121.27	Poor water	132.94	Poor water
<b>w35</b>	259.92	Very poor water	159.35	Poor water
<b>w36</b>	172.57	Poor water	128.72	Poor water
<b>w37</b>	158.57	Poor water	165.41	Poor water
<b>w38</b>	135.05	Poor water	126.40	Poor water
<b>w39</b>	116.45	Poor water	79.35	Good water
<b>w40</b>	144.48	Poor water	162.53	Poor water
<b>w41</b>	187.19	Poor water	158.00	Poor water
<b>w42</b>	172.62	Poor water	135.82	Poor water
<b>w43</b>	112.17	Poor water	119.19	Poor water
<b>w44</b>	147.48	Poor water	183.45	Poor water
<b>w45</b>	156.52	Poor water	106.12	Poor water
<b>w46</b>	184.69	Poor water	150.14	Poor water
<b>w47</b>	143.83	Poor water	101.78	Poor water

<b>w48</b>	117.86	Poor water	76.76	Good water
<b>w49</b>	130.77	Poor water	119.86	Poor water
<b>w50</b>	124.85	Poor water	137.11	Poor water