D.4.3.1 Data sharing network

Document Control Sheet

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1. INTRODUCTION

One of the expected outputs according to the application form is creation of network for sharing data between project partners. IACKR (in collaboration with the University of Zagreb) are in charge for the implementation of data sharing network and will coordinate the activities of other partners involved in the specific activities needed to obtain data for synthesis of the results. Data acquired within activities 4.1 and 4.2 are a strong basis for a comprehensive analysis of the environmental and economic sustainability of present day usage of coastal fresh water aquifers for depicting future scenarios under the frame of WP3. A crucial pre-requisite is the analysis of potential margins for increasing the environmental and economic efficiency of exploitation for the selected case studies and the optimally distributed usage of aquifers.

All results will be shared among partners to provide a synergistic platform for exchange of ideas during the project development. Implementation of a data sharing network and emplacement of a continual monitoring system will allow share data among the involved territorial partners beyond the time of the project execution.

2. Data sharing network

As noted in application form the network should include: the identification of information to share; the responsibilities at each case study level and the tools and the modality for sharing.

Identification of information to share:

During first and second STC meetings has been defined what set of data deemed necessary for the accomplishment of the monitoring within the goal of the project. Subsequently, a first survey of available data from previous studies (both on Italian and Croatian side) has allowed defining the most suited areas to conduct the monitoring, based on the continuity and spectrum of the available time series. Taking into account available data and experience of experts from each partner it was decided what are best options for sampling locations, type of parameters to determine with related laboratory analyses.

The objective of WP 4 is to identify and map needs and barriers in coastal aquifer management in the assessed risk scenarios through three activities. For the implementation of Activity 4.1 "Case studies: physical investigation" studies on the spatial, temporal and methodological characterization of water monitoring and the spatial, temporal and methodological characterization of water quality for the three PILOT AREAS (Fano, Ravenna, Neretva) were done. During field campaigns the planned measurement of piezometric levels and physical-chemical parameters (T, pH and electrical conductivity) were performed, which are scheduled every two months, as well as the collection of aliquots for subsequent chemical and isotopic analyses, that are to be performed in both dry and wet periods to account for the presence of possible geochemical variations due to the influence of the climatic conditions.

The sampling points were selected on the basis of a previous monitoring networks used in order to obtain a distribution as homogeneous as possible over the investigated territories. The sampling sites are mainly consisting of domestic, industrial and drinkable water wells (Fano Table 1) and piezometers and water surface (Ravenna- Table 6. and Neretva-Fig1.). Water samples analyses were done in the laboratories of IGG-CNR and UNIZG and results were uploaded to data sharing network (Tables in Anexes).

The responsibilities for each case study:

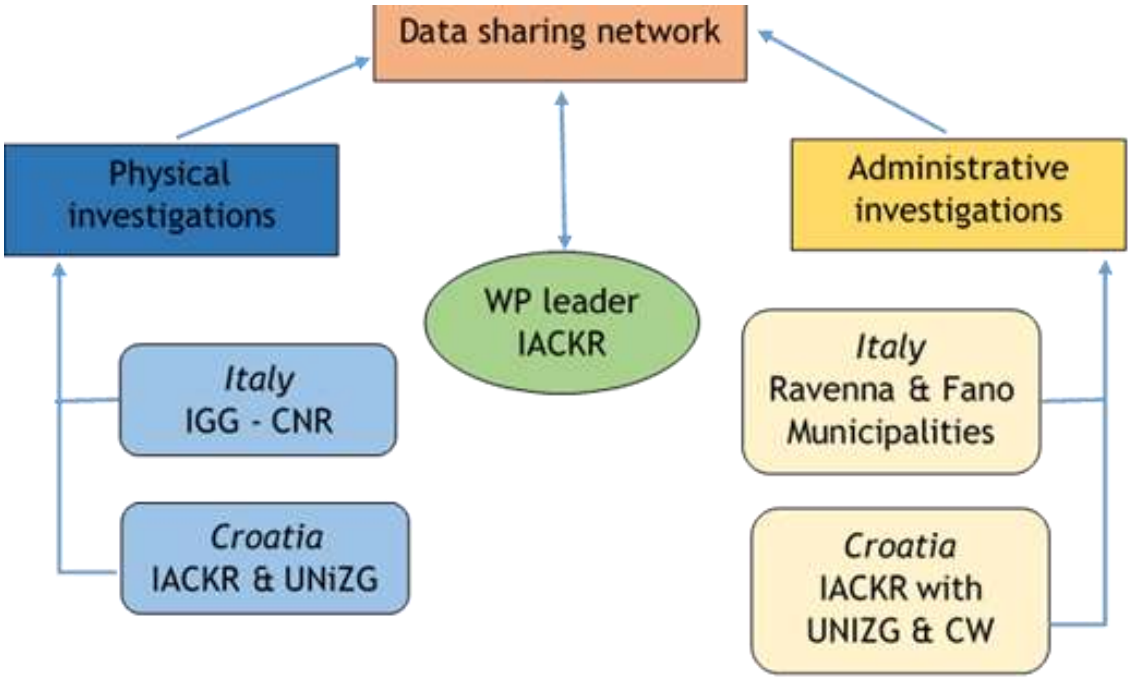
Project partners was included in data acquisition for each case study as was decided by application form with some modification that happen through project implementation. All data

obtained was divided in two main groups:

1. data from physical monitoring of 3 case studies (2 in Italy and 1 in Croatia) were responsibility of partners from technical WPs (IGG-CNR and IACKR (with UNIZG)). It was decided that one person form each partner was responsible for uploading data on network and taking over future communication regarding any questions that will arise from information shared.

2. data from administrative investigations (management, administration and exploitation) were delivered by IACKR (for Neretva) and by Fano (for Ravenna and Fano). During 4th STC meeting it was agreed that IACKR will send template to Ravenna and Fano for filling information about Act 4.2. (Management of coastal aquifers, their administration and exploitation). It was decided that Ravenna and Fano will organize one document for Italian side as they probably deal with same water and aquifers management issues. Template example is shown in figure 2.

Scheme of responsibilities to deliver D 4.3.1 is shown in figure 1.



The tools and modality to share:

During STC meetings it was discussed what type of data sharing platform partners included in this WP will use. WP responsible gave different proposals that mostly included online platforms available to all, like Sharepoint or Teams by Microsoft, Dropbox, Google Drive or project web page. As all of the partners had experience with use of Sharepoint and their institutions have privileges to access this platform it was decided to use Sharepoint as data sharing network. When some of the data or documents was ready for sharing PP responsible for their part of work uploaded it on Sharepoint and often informed other partners by email so they can look over the data and discuss possible questionable issues. Additional data of the Fano continuous monitoring data carried out with the 3 divers and 1 baro diver because of its size are available by demand from project partners (IACKR or CNR-IGG).

3. Anexes

Fig 1. Fano case study map with sampling locations

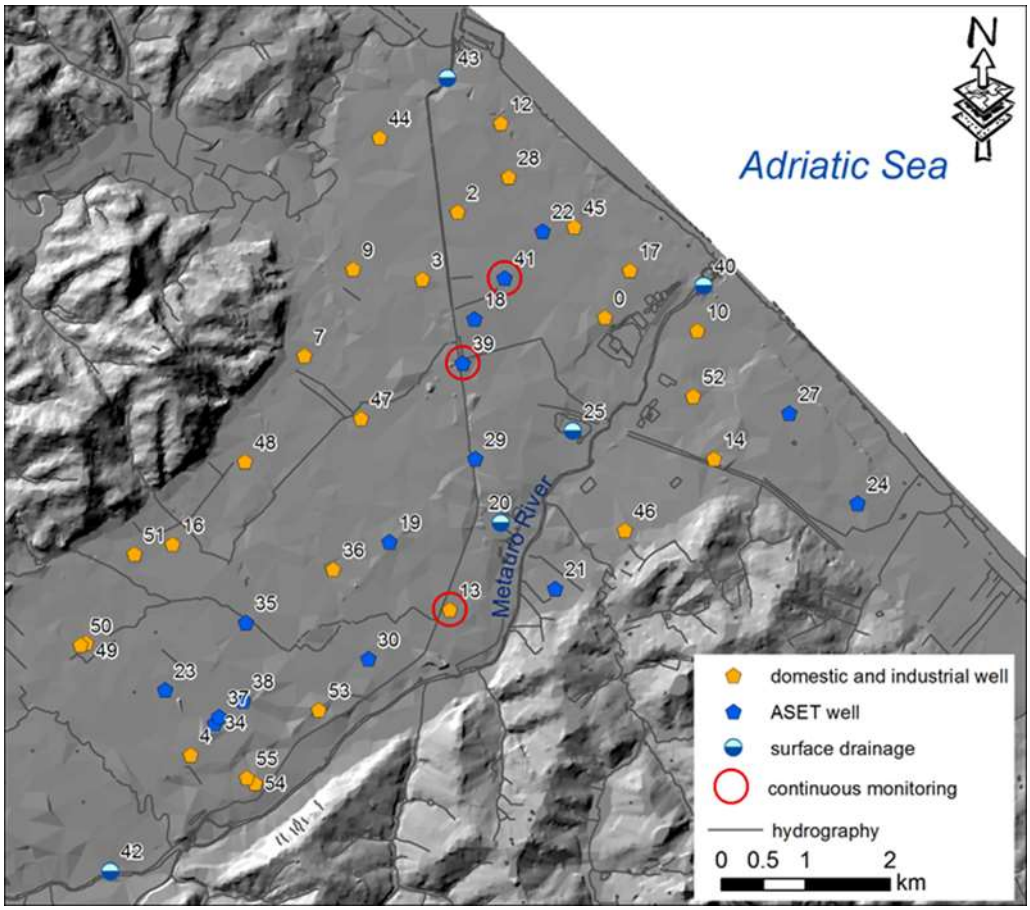


Table 1. Fano case study physical monitoring (ID and coordinates)

Code #	Type	Est (GB Roma40)	Nord (GB Roma40)	Reference Altitude by GPS (m a.s.l.)	Depth (m)
0	well	2362265.35	4854135.21	13.81	29
2	well	2360523.38	4855382.60	14.57	15
3	well	2360102.71	4854583.93	19.95	-
4	well	2357356.18	4848946.44	38.08	28
7	well	2358706.09	4853677.92	27.71	21
9	well	2359282.84	4854707.21	21.59	19
10	well	2363362.49	4853974.14	4.80	7
12	well	2361033.65	4856435.79	2.51	-
13	well	2360429.51	4850669.48	22.52	13
14	well	2363558.70	4852457.84	11.37	-
16	well	2357144.48	4851442.58	-	-
17	well	2362562.57	4854692.98	10.23	12
18	ASET well	2360719.78	4854114.23	17.29	35
19	ASET well	2359713.09	4851472.20	27.17	35
20	surface water	2361033.14	4851693.62	-	-
21	ASET well	2361677.84	4850915.78	13.67	6.5
22	ASET well	2361526.69	4855154.69	-	35
23	ASET well	2357053.90	4849714.26	38.93	30
24	ASET well	2365261.51	4851925.51	10.13	-
25	surface water	2361885.83	4852779.53	5.06	-
27	ASET well	2364451.17	4852993.66	10.65	32.5
28	well	2361123.61	4855799.45	-	41
29	ASET well	2360728.18	4852454.98	22.20	40
30	ASET well	2359462.55	4850081.96	28.75	31
34	ASET well	2357644.84	4849318.67	36.98	28
35	ASET well	2358011.29	4850515.38	37.52	30
36	well	2359047.76	4851149.12	31.46	29
37	ASET well	2357693.86	4849396.15	36.60	-

38	ASET well	2357976.32	4849584.49	35.41	-
39	ASET well	2360583.14	4853590.23	18.02	45
40	surface water	2363436.30	4854502.58	7.42	-
41	ASET well	2361079.50	4854597.59	15.67	32
42	surface water	2356404.12	4847559.11	36.37	-
43	surface water	2360398.97	4856964.58	4.52	-
44	well	2359596.18	4856263.50	14.79	-
45	well	2361900.79	4855207.81	9.33	10
46	well	2362500.89	4851607.19	19.33	-
47	well	2359377.36	4852937.54	25.74	-
48	well	2358001.90	4852423.76	33.28	-
49	well	2356119.62	4850272.49	46.16	-
50	well	2356053.36	4850250.17	46.75	-
51	well	2356688.75	4851327.09	44.18	17
52	well	2363313.45	4853200.67	6.37	-
53	well	2358878.02	4849478.53	33.05	20
54	well	2358119.99	4848611.64	33.70	15.5
55	well	2358022.13	4848677.39	33.37	20

Table 2. Fano case study_physical monitoring (water level)

	water level (m a.s.l.)								
CODE	jun-19	sept-19	dec-19	jun-20	sept-20	nov-20	Min	Max	Delta
0	1.01	1.01	0.81	1.17	0.39	0.54	0.39	1.17	0.78
2	2.89	2.94	3.03	2.69	2.27	2.49	2.27	3.03	0.76
3	5.47	5.36	5.33	4.97	4.58	4.59	4.58	5.47	0.89
4	23.80	23.16	23.13	23.80	22.99	22.91	22.91	23.80	0.89
7	16.21	16.17	16.31	16.32	16.05	16.27	16.05	16.32	0.27
9	9.09	9.15	9.16	7.75	-	8.81	7.75	9.16	1.41
10	0.52	-	-0.17	0.44	0.24	0.51	-0.17	0.52	0.69
12	1.47	1.50	1.56	1.46	1.35	1.45	1.35	1.56	0.21
13	13.02	12.59	13.04	12.98	12.21	12.51	12.21	13.04	0.83
14	3.81	3.67	3.79	3.75	3.61	3.71	3.61	3.81	0.19

17	1.43	1.30	1.46	1.27	1.10	1.28	1.10	1.46	0.36
18	5.09	4.88	4.89	-	4.38	4.31	4.31	5.09	0.77
19	12.01	11.96	11.89	11.86	11.20	11.11	11.11	12.01	0.90
20	-	9.39	-	-	9.11	-	9.11	9.39	0.28
21	9.26	9.06	8.92	8.90	8.64	8.45	8.45	9.26	0.81
23	22.72	23.58	23.25	23.68	22.78	22.74	22.72	23.68	0.96
24	0.30	0.16	0.58	0.21	0.00	0.26	0.00	0.58	0.58
25	-	4.83	-	-	4.52	4.58	4.52	4.83	0.31
27	0.21	0.39	0.64	0.32	0.14	0.35	0.14	0.64	0.50
29	7.26	7.45	7.65	7.41	5.76	7.02	5.76	7.65	1.89
30	16.18	16.07	15.99	16.23	16.31	16.46	15.99	16.46	0.47
34	24.35	21.93	22.68	23.40	24.54	26.31	21.93	26.31	4.38
35	19.24	19.57	19.19	19.70	19.07	19.05	19.05	19.70	0.65
36	13.92	13.76	13.51	13.71	13.08	12.96	12.96	13.92	0.96
37	-	21.55	22.40	23.10	22.68	22.66	21.55	23.10	1.55
38	-	20.69	20.96	21.81	21.07	21.08	20.69	21.81	1.12
39	6.08	5.83	5.80	5.43	5.28	5.14	5.14	6.08	0.94
40	-	0.32	1.00	0.39	0.27	0.44	0.27	1.00	0.73
41	-	3.68	3.72	3.45	3.16	3.24	3.16	3.72	0.56
42	-	27.09	28.77	27.52	26.88	26.92	26.88	28.77	1.89
43	-	-0.29	0.20	0.08	-0.02	0.07	-0.29	0.20	0.49
44	-	3.19	3.19	2.94	2.59	2.79	2.59	3.19	0.60
45	-	1.77	1.91	1.71	1.51	1.64	1.51	1.91	0.40
46	-	5.76	5.58	4.02	3.86	5.36	3.86	5.76	1.90
47	-	9.83	9.57	9.50	8.99	8.85	8.85	9.83	0.98
48	-	22.92	23.15	22.97	21.65	22.97	21.65	23.15	1.50
50	-	32.90	32.95	-	32.73	32.67	32.67	32.95	0.28
51	-	30.19	30.18	-	30.07	30.11	30.07	30.19	0.12
52	-	1.23	1.37	-	0.96	1.17	0.96	1.37	0.41
53	-	18.90	19.18	19.57	-	18.56	18.56	19.57	1.01
54	-	21.65	21.56	22.22	21.21	21.22	21.21	22.22	1.01
55	-	21.69	-	-	-	-	-	-	-

Table 3. Fano case study_physical monitoring (June 2019_ physical-chemical parameters)

ID	T	pH	E.C.	Eh	HCO_3	F	Cl	Br	NO_3	NO_2	SO_4	Na	NH_4	K	Mg	Ca	Err.	TDS	$\delta^{18}O$-H_2O	$\delta^{2}H$-H_2O
#	°C		µS cm^{-1}	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	V-SMOW)	V-SMOW)
0	16	7.2	1260	135	370	0.6	95	0.2	91	0.07	121	57	0.04	6.8	29	178	4.57	949	-7.3	-47.8
4	16	7.3	1140	158	410	0.4	40	0.3	55	0.07	75	34	0.05	4.4	22	148	2.31	789	-7.5	-48.8
7	17	7.1	1320	147	501	0.4	77	0.4	51	0.07	102	55	0.04	6.8	41	151	0.59	986	-7.7	-49.3
10	16	7.3	1200	155	416	0.4	55	0.4	42	0.07	109	46	0.06	6.7	25	149	1.5	849	-6.5	-43.4
12	17.5	7.4	1350	110	406	0.4	75	0.4	82	0.07	125	59	0.05	33.9	23	148	-0.05	952	-7.7	-50
14	21	7.2	1300	146	465	0.2	71	0.6	61	0.03	93	61	0.05	9.1	25	160	1.63	947	-7.2	-46.6
16	15.5	7.4	1400	152	394	0.5	116	0.4	58	0.07	87	57	0.04	1.8	36	149	1.83	900	-7.5	-49.4
17	17	7.3	1200	164	412	0.3	65	0.6	79	0.03	98	49	0.05	3.6	28	167	3.65	902	-7.3	-47.3
19	16	7.4	1180	324	364	0.5	63	0.5	77	0.1	109	40	0.06	3.3	23	142	-1.83	822	-7.4	-47.9
21	14.8	7.4	1260	169	438	0.5	65	0.4	41	0.07	103	61	0.05	3.6	36	134	2.3	883	-7.6	-50
22	15.5	7.3	1100	163	410	0.2	69	0.1	57	0.07	85	56	0.06	3.4	30	140	2.67	851	-7.4	-48.9
24	15.5	6.9	1400	297	439	1.5	95	0.6	48	0.1	111	83	0.06	4.7	31	138	0.78	952	-6.9	-45
27	16.8	6.9	1270	321	387	0.6	68	0.5	55	0.16	126	104	0.09	3.5	29	120	4.99	894	-7.1	-45.9
28	16	7.1	1133	340	422	0.2	139	0.4	41	0.07	77	94	0.06	4.2	33	139	2.91	951	-7.5	-48.7
29	16	7.3	1120	310	365	0.4	54	0.1	71	0.07	97	38	0.05	4.9	21	158	3.62	809	-7.4	-48.3
30	16	7.4	960	330	404	<dl	40	<dl	14	0.03	97	27	0.06	1.8	14	140	-3.39	737	-7.8	-50.3
34	21	7.7	670	139	254	<dl	34	<dl	4.7	0.16	70	26	0.15	2	16	76	-3.16	482	-8.1	-51.5
35	15	6.9	1200	314	433	<dl	54	0.4	84	0.03	113	45	0.05	2.8	42	136	-0.3	910	-7.5	-49.5
37	15	7.6	740	420	266	<dl	32	0.4	11	0.1	81	29	0.08	3.6	16	97	2.91	536	-8	-51.1
38	14	7.7	730	352	261	<dl	28	<dl	5.4	0.07	74	30	0.05	3.6	15	79	-0.81	497	-8.1	-50.8
40	27	7.7	710	158	244	<dl	35	<dl	7.1	1.31	76	28	0.06	2.2	16	83	0.84	493	-7.8	-50.2

ID	Al	Sb	As	Ba	B	Co	Cr	Fe	Li	Mn	Ni	Pb	Cu	Rb	Zn	V	SiO_2	Sr
#	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L
0	< 5	0.1	0.2	85.8	185	0.1	4.6	25	14.4	< 1	3.3	0.1	1.3	< 1	< 5	0.5	24	721
4	6	0.2	0.3	79.4	137	0.1	1	15	12.9	< 1	2.2	0.3	4.2	< 1	11	0.4	23	680
7	7	0.1	0.2	81.1	133	0.2	3.4	15	17.8	< 1	3	0.2	3.6	1.51	5	0.5	17	652
10	< 5	0.1	0.2	44.2	165	< 0.1	0.4	5	22.9	1.4	2.4	0.1	1.8	< 1	5	0.4	22	1148
12	< 5	0.2	0.7	48.6	254	0.6	1.8	68	13.9	4.1	4.9	0.1	1.3	6.08	36	1	22	643
14	< 5	0.1	0.2	77.5	188	0.2	0.6	7	19.2	< 1	2	0.2	9.6	< 1	48	0.4	20	840
16	9	0.1	0.2	87.5	131	< 0.1	1.9	9	13	< 1	1.6	0.4	4.4	< 1	9	0.4	15	738
17	5	0.1	0.2	88	133	0.2	1.2	7	14.5	< 1	2.3	0.1	3.6	< 1	< 5	0.5	22	781
19	< 5	0.1	0.2	81.9	135	0.1	0.9	106	12.8	10.6	1.5	0.1	1.3	< 1	40	0.4	23	654
21	6	0.1	0.2	47.9	206	< 0.1	0.5	8	30.9	< 1	1.4	0.3	4.9	< 1	7	0.4	25	969
22	< 5	0.1	0.2	88.5	152	0.1	1	5	13.3	< 1	1.9	0.3	2.4	< 1	9	0.4	22	731
24	< 5	0.1	0.5	66.4	311	< 0.1	0.9	19	22.6	13.1	1.3	0.3	1.6	< 1	6	0.5	16	660
27	< 5	0.1	0.2	57.1	393	0.2	0.2	220	23.5	74.9	1.8	0.2	1.6	< 1	50	0.4	16	679
28	< 5	0.1	0.2	115	292	0.1	0.7	17	15.4	< 1	2.6	0.2	2.6	< 1	28	0.5	24	922
29	< 5	0.1	0.2	99.1	130	0.1	0.8	< 5	11.7	< 1	1.4	0.2	1.9	< 1	7	0.4	22	642
30	< 5	0.2	0.2	103	104	0.1	0.6	101	10.9	10	1.7	0.1	2	< 1	9	0.3	17	668
34	29	0.2	0.6	137	125	0.1	0.4	42	14.7	7.4	2.4	0.3	2.3	1.01	11	0.8	9	1084
35	< 5	0.1	0.2	68.8	172	0.1	1.1	7	14.4	< 1	2.1	0.2	1.8	< 1	31	0.4	25	712
37	6	0.2	0.2	67.8	120	< 0.1	0.5	< 5	12.2	< 1	1.3	0.4	1.7	< 1	< 5	0.4	12	838
38	5	0.1	0.2	66.7	123	< 0.1	0.4	11	12.7	< 1	1.4	0.1	1.4	< 1	< 5	0.4	13	837
40	8	0.2	0.6	124	123	0.2	5.3	38	13.8	5.3	4.7	0.3	2.5	1.06	7	0.8	10	947

Table 4a. Fano case study_physical monitoring (September 2020_physical-chemical parameters)

ID	T	pH	E.C.	Eh	HCO_3	F	Cl	Br	NO_3	NO_2	SO4	Na	NH_4	K	Mg	Ca	Err.	TDS	$\delta^{18}O-H_2O$	$\delta^{2}H-H_2O$
#	°C		$\mu S\ cm^{-1}$	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	(V-SMOW)	(V-SMOW)
0	17,5	7,2	602	91	383	0,6	78	0,3	78	0,03	110	57	0,03	3,7	30	140	-0,3	879	-7,3	-47,8
2	17,1	7,3	1088	nd																
3	17,1	7	1283	nd																
4	17,4	7,4	1086	187	429	0,5	55	0,3	47	0,013	83	40	0,04	4,4	27	137	-0,83	824	-7,4	-49,5
7	17	7	633	213	486	0,8	81	0,2	52	0,522	96	54	0,1	8,5	39	139	-1,54	957	-7,2	-46,6
10	17	7,2	1146	177	411	0,6	65	0,3	45	0,016	131	50	0,04	8,3	29	160	2,98	900	-6,5	-45,7
12	18,2	7,2	1213	nd	383	1,2	83	0,4	84	0,03	146	62	0,05	36,8	26	154	1,31	974	-7,6	-50,1
13	17,3	7,3	891	nd																
14	23	7,2	702	147	447	0,4	100	0,4	59	0,013	126	78	0,05	9,1	37	155	2,31	1011	-7,2	-46,6
16	16,5	7,4	1382	130	405	1,4	164	0,6	50	0,02	103	81	0,06	3,1	41	164	2,93	1013	-7,5	-49,7
17	17,4	7,1	1149	119	417	0,8	74	0,5	77	0,016	124	49	0,03	4,4	29	160	-0,58	936	-7,2	-48,8
18	17	8,3	565	-4	204	0,1	51	0,2	2	0,013	15	53	0,23	5	19	23	-0,34	373	-7,2	-47,8
19	16,6	7,2	1031	7,6	356	0,7	66	0,4	53	0,033	92	45	0,03	4	25	143	3,43	785	-7,4	-49,5
21	17,3	7,2	1280	203	464	1,1	103	0,5	39	0,033	131	80	0,03	5,7	42	141	0,73	1006	-7,6	-50,4
22	20	7,6	619	132	417	0,3	72	0,3	60	0,016	82	59	0,05	4	32	143	3,48	869	-7,4	-49,3
23	15,8	7,2	1132	136	422	0,6	58	0,3	78	0,033	129	47	0,04	3,6	46	138	1,03	921	-7,6	-50,5
24	15,7	7,3	1345	184	458	0,7	115	0,5	50,8	0,046	131	111	0,05	7,8	38	140	2,54	1052	-6,9	-47,1
25	26,4	9,1	585	nd																
27	16	7,4	829	115	393	0,6	91	0,4	81	0,013	143	70	0,03	8,6	30	155	0,66	972	-7,1	-46,7
28	16,8	7,2	1301	132	421	0,92	116	0,58	52	0,02	91	86	0,04	4,5	34	145	3,49	950	-7,5	-48,3
29	15,9	7,2	530	195	366	0,34	49	0,32	58,4	0,01	79	41	0,01	3	23	139	3,19	758	-7,3	-49,3
30	16,5	7,2	898	113	384	0,57	53	0,3	15	0,013	68	41	0,03	4	20	133	3,33	719	-7,3	-49,7
34	22	7,6	404	137	237	0,56	59	0,4	2	0,026	104	41	0,04	4,1	21	94	3,24	562	-6,7	-44,4
35	16,3	7,2	1177	137	437	0,56	67	0,26	78,8	0,02	143	48	0,05	3	45	145	-0,89	968	-7,5	-48,6
36	16,2	7,47	1010	105																
37	18,2	7,5	704	134	233	0,35	44	0,27	2,1	0,013	78	33	0,01	3,7	18	83	2,59	495	-6,8	-44,5
38	16,5	7,5	359	148	244	0,38	43	0,31	1,35	0,013	76	30	0,04	2,6	19	89	3,49	505	-6,9	-47,5
39	17,2	7,42	780	56																
40	21,8	7,7	796	nd	244	0,44	68	0,28	7,6	0,01	98	49	0,05	6,3	20	83	-0,2	577	-5,9	-42,6
41	19,3	7,79	734	-170																
42	23,4	8	774	nd	233	0,5	62	0,25	2,5	0,02	116	42	0,06	5,4	20	88	-0,47	569	-6,8	-45
43	23	8,2	7400	nd																
44	17,7	7,1	1304	nd	433	0,78	134	0,37	64,2	0,03	136	80	0,04	5	30	166	-1,48	1050	-7,3	-47,8
45	18,8	7,18	1149	190																
49	17,6	7,2	1882	nd	486	0,33	340	1	6,1	0,069	167	186	0,06	6,8	55	153	-1,71	1401	-7,3	-47,5
50	17	7,1	1176	nd	458	0,89	83	0,4	73,1	0,02	122	57	0,08	3,6	41	151	-0,56	989	-7,3	-48,9
51	16,6	7,01	2170	nd																
52	19	7,1	1370	nd																
54	16,6	7,01	1129	nd																

Table 4b. Fano case study_physical monitoring (September 2020_physical-chemical parameters)

ID	Al	Sb	As	Ba	B	Co	Cr	Fe	Li	Mn	Ni	Pb	Cu	Rb	Zn	V	SiO_2	Sr
#	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L
0	< 5	0.1	nd	93	116	0.1	0.8	8	11.7	0.6	4	0.2	1.1	0.48	10	0.4	24.6	718
4	< 5	0.1	0.2	92.6	98	0.1	0.5	6	11.6	0.8	2.1	0.2	6.8	0.59	20	0.3	24	727
7	< 5	0.1	0.2	85.9	87	0.2	2.3	7	13.1	1.2	3.4	0.3	23.5	2.07	6	0.6	15.7	553
10	< 5	0.1	0.2	49.7	145	< 0.1	0.3	< 5	22.6	0.9	2.7	0.2	2.2	0.49	16	0.3	24	1081
12	7	0.2	0.7	53.1	184	0.4	2	58	10.5	2	3.5	0.3	13.1	7.6	20	0.9	23.1	599
14	< 5	0.1	0.3	82.8	282	0.4	0.4	< 5	24.4	1.1	3.9	0.2	6.4	1.96	179	0.4	16.4	763
16	5	0.1	0.1	98.4	89	0.1	1.8	20	11	0.7	1.8	0.2	2.7	0.89	10	0.4	15.6	751
17	< 5	0.2	0.2	92.1	93	0.1	0.9	6	9.7	0.7	1.5	0.1	1.1	0.66	6	0.3	23.5	646
18	< 5	< 0.1	0.1	15.1	73	< 0.1	0.1	8	8.2	123	1	0.1	0.7	2.01	< 5	< 0.1	1.45	122
19	< 5	0.1	0.1	88.6	90	0.2	0.5	1562	10.3	47.8	2.3	0.1	1.7	0.43	64	0.3	24.2	607
21	< 5	0.1	0.2	59.1	169	< 0.1	0.5	< 5	28.7	0.2	1.1	0.2	2.3	0.79	12	0.2	28	947
22	7	0.1	0.1	102	104	0.1	1.2	7	13	0.6	2.3	0.2	1.1	4.12	15	0.3	23.3	715
23	24	0.1	0.2	63.3	119	0.1	1.3	12	12.9	0.7	1.2	0.2	2.1	0.4	8	0.3	26.7	691
24	5	0.1	0.6	75.7	270	< 0.1	0.9	8	24.3	5.4	1.7	0.1	1.3	0.71	14	0.3	17.2	659
27	< 5	0.1	0.2	71.6	161	0.1	1	8	17.6	5.5	1.7	0.3	1	0.45	132	0.3	19.9	621
28	< 5	0.1	0.2	115	173	0.1	0.7	7	12.4	1.2	1.7	0.1	1.1	0.61	27	0.3	25	825
29	< 5	0.1	0.2	108	86	0.1	0.8	< 5	9.7	0.2	1.5	1.4	1.7	0.45	23	0.3	24.8	607
30	< 5	0.1	0.1	103	88	0.1	0.4	98	10.8	14	1.4	0.1	1.2	0.45	10	0.2	21.6	704
34	6	0.3	1	170	112	0.1	0.3	8	11.8	3.7	2.5	0.2	2.8	1.41	11	0.8	14.2	1041
35	< 5	0.1	0.2	74.8	125	0.1	1.2	13	12.7	0.6	1.6	0.1	1.2	0.4	20	0.4	27	687
37	< 5	0.2	0.2	81.4	105	0.1	0.2	9	11.9	0.9	0.9	0.1	1.7	0.53	10	0.3	15.8	775
38	6	0.1	0.2	79.9	96	< 0.1	0.2	18	10.8	0.8	0.9	0.2	1.8	0.38	10	0.2	14.4	781
40	8	0.3	1.2	137	139	0.4	0.2	10	13	26.6	4.4	0.2	1.5	1.65	12	0.9	16.1	861
42	6	0.3	1.2	177	117	0.1	0.1	9	11.8	8.4	2.5	0.2	1.1	1.39	13	0.7	14.2	1077
44	6	0.1	0.2	101	146	0.4	1.4	9	9.8	0.4	2.6	0.2	4.7	0.72	27	0.4	17.4	601
49	6	0.6	1	140	151	1	0.2	13	24	122	6.5	0.2	3.5	1.33	31	0.6	20.7	1077
50	8	0.1	0.1	85.1	101	< 0.1	1.8	17	10.8	0.9	1.6	0.4	5.7	0.501	19	0.3	18.9	579

Table 5a. Fano case study_physical monitoring (November 2020_physical-chemical parameters)

ID	T	pH	E.C.	Eh	HCO_3	F	Cl	Br	NO_3	NO_2	SO4	Na	NH_4	K	Mg	Ca	Err.	TDS	$\delta^{18}O\text{-}H_2O$	$\delta^{2}H\text{-}H_2O$
#	°C		µS cm^{-1}	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	(V-SMOW)	(V-SMOW)
0	16,1	7,1	1284	nd	387	0,2	96	0,4	103	0,016	96	62	0,03	4,2	32	149	0,77	930	-7,4	-47,8
2	16,1	7	1005	nd																
3	14,9	7,1	1019	nd																
4	14,6	7,3	1022	nd	421	0,2	60	0,3	62	0,023	73	40	0,15	3,8	26	159	3,46	845	-7,5	-49
7	15,8	7,3	1055	nd	434	0,2	63	0,2	43	0,02	62	55	0,06	8	37	109	0,88	812	-7,7	-48,7
9	15,2	7,3	1323	-10,5																
10	15,4	7,2	1105	-5	403	0,3	59	0,3	43	0,02	103	48	0,22	5,8	27	153	4,24	842	-6,6	-44
12	16,5	7,1	1235	nd	366	0,3	84	0,3	102	0,026	100	62	0,06	34	25	150	3,95	924	-7,7	-49,9
13	16	6,8	854	nd																
14	11,2	7,5	1393	-20	434	0,3	135	0,6	89	0,02	149	88	0,12	10,5	40	168	0,78	1114	-7,1	-46,3
16	14,7	7,4	1378	-13,5	400	0,3	180	0,7	45	0,036	79	82	0,08	3,7	41	160	3,42	992	-7,5	-48,2
17	15,5	7,2	1223	nd	407	0,4	67	0,3	100	0,026	85	49	0,06	6,9	30	160	3,15	905	-7,4	-46,9
18	15	8,6	578	-8,1	205	0,5	47	0,2	1	0,02	6	60	0,08	5	22	7	0,54	353	-7,2	-44,4
19	14,1	7,5	1034	-22	346	0,4	67	0,4	62	0,026	100	45	0,14	3,9	26	143	2,9	794	-7,5	-48
21	16,5	7,2	1207	-3,7	417	0,5	105	0,7	51	0,016	105	77	0,17	5,7	40	134	2,31	935	-7,6	-48,2
22	15,6	7,4	1157	-17	418	0,3	67	0,3	59	0,02	66	62	0,28	5	34	103	-1,47	816	-7,4	-47,9
23	14,8	7,3	1125	-7,9	425	0,3	55	0,4	100	0,013	105	48	0,09	5	47	138	2,39	922	-7,6	-48,1
24	14,9	7,5	1840	-23	565	0,3	211	0,8	19	0,079	155	244	0,94	15	50	96	2,99	1357	-7,2	-45,3
25	11,1	7,9	567	nd																
27	14,7	7,3	1535	-11	406	0,2	172	0,8	72	0,02	109	125	0,39	7,7	33	157	3,99	1083	-7,3	-47,3
28	16,6	7,2	1267	-4	430	0,17	110	0,54	47	0,016	62	83	0,06	4,5	32	140	4,4	910	-7,4	-46,6
29	15,4	7,3	980	-7	364	0,2	71	0,37	60,3	0,013	82	41	0,04	3,8	22	140	0,28	785	-7,4	-46,7
30	15,3	7	811	4,8	387	0,16	37	0,3	10	0,016	53	31	0,09	3	17	128	2,83	666	-7,3	-47,1
34	8,8	8,2	639	-58	402	0,28	21	0,2	3	0,03	52	24	0,09	2,8	19	98	-4,73	622	-7,5	-46,9
35	14,9	7,2	1155	-5,7	425	0,26	60	0,43	104	0,02	107	49	0,05	4,5	45	142	1,55	936	-7,5	-49
36	13,1	7,4	934	nd																
37	17,6	7,6	673	-28,5	231	0,3	44	0,32	2,2	0,013	97	34	0,04	3,3	18	84	0,52	512	-7,3	-46,9
38	18,2	7,6	681	-27,4	238	0,29	38	0,34	0,1	0,013	72	34	0,05	3,9	17	82	4	485	-7,3	-47,1
39 Top	13,7	7,3	856	-10	323	0,27	41	0,22	2,2	0,016	78	37	0,06	2,5	20	109	3,64	613	-7,3	-45,7
9 Botto	12,5	6,9	2965	nd	31	0,8	915	3,9	0,4	0,036	13	195	7,1	12	43	272	-0,69	1493	-7,4	-47
40	7,8	8,2	617	19	292	0,16	19	0,03	1,77	0,016	59	23	0,08	3,5	17	92	3,54	507	-7,4	-47
41	14,9	7,3	761	-8,6																
42	8,5	8,4	624	20	283	0,5	20	0,06	1,9	0,02	54	21	0,09	3,5	17	90	3,96	491	-7,6	-47,4
43	7,8	8	627	25	300	0,6	31	0,09	3,8	0,03	75	24	0,08	3,4	18	94	-0,76	551	-7,6	-46,3
44	16,6	7,1	1215	nd	404	0,22	126	0,5	73	0,013	85	76	0,04	6,8	29	160	2,54	960	-7,7	-48,7
45	14,1	7,17	1263	nd																
46	14,6	7,22	1334	nd																
47	14,4	7,1	1184	nd																
48	14,8	7	1401	nd																
49	11,6	7,2	2110	nd	494	0,24	472	3	1,8	0,016	117	265	0,4	8,2	64	159	2,1	1585	-7,5	-47,8
50	14,5	7,2	1231	nd	461	0,28	82	0,45	63,4	0,013	88	62	0,03	3,1	42	151	3,66	953	-7,4	-48,1
51	14,4	7	2020	nd																
52	17,1	7,33	1044	nd																
53	14	7,38	740	nd																
54	14,3	6,73	1263	nd																

Table 5b. Fano case study - physical monitoring (November2020_physical-chemical parameters)

ID	Al	Sb	As	Ba	B	Co	Cr	Fe	Li	Mn	Ni	Pb	Cu	Rb	Zn	V	SiO_2	Sr
#	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L
0	7	<0.1	0.4	94.7	104	0.5	0.9	35	7.8	2.9	9.4	0.2	3	<1	17	0.1	25	399
4	<5	<0.1	0.4	82.4	87	0.7	0.4	27	7.4	<1	6.6	0.4	4.6	<1	17	<0.1	24.2	402
7	<5	<0.1	0.4	71	78	0.7	2.1	27	8.3	1.9	8.7	0.8	19.9	1.8	74	0.3	14.6	288
10	<5	<0.1	0.4	41.6	107	0.6	0.3	24	12.2	<1	5.7	<0.1	1.5	<1	5	<0.1	24.4	576
12	<5	0.2	0.9	43.7	123	0.9	1.8	37	6.5	<1	7.9	0.3	1.8	7.4	6	0.7	23.1	337
14	<5	0.1	0.5	74.1	256	0.9	0.4	19	20.1	<1	7.5	1	71.9	2.3	612	0.2	16.5	450
16	8	<0.1	0.4	89.4	93	0.4	1.2	134	8.7	1.3	4.8	0.2	3.7	<1	17	0.3	15.6	429
17	<5	0.6	0.4	81	90	0.6	0.9	27	6.5	<1	6.4	0.1	1.6	<1	7	0.2	22.9	363
18	<5	<0.1	<0.1	10.2	79	<0.1	0.1	10	7.7	77.3	1.4	<0.1	0.8	1.9	<5	<0.1	1	53
19	<5	<0.1	0.2	77.4	84	0.4	0.4	498	8.1	19.1	3.8	0.1	1.5	<1	43	<0.1	23.3	355
21	<5	<0.1	0.3	54.2	140	0.2	0.3	19	23.9	<1	2.8	0.2	1.9	<1	6	<0.1	27	545
22	<5	<0.1	0.2	99.1	93	0.3	0.7	13	14.9	<1	3	0.2	1.3	6.2	16	<0.1	22.2	457
23	<5	<0.1	0.2	60.9	104	0.2	1	14	13.2	<1	2.4	<0.1	0.9	<1	<5	<0.1	24.8	444
24	<5	<0.1	1.3	67.2	590	0.2	0.3	15	52.6	23.3	2.4	0.1	2.8	1.7	11	0.3	14.9	490
27	<5	<0.1	0.3	74.2	272	0.3	0.6	101	23.1	25.2	3	0.3	0.7	<1	110	0.1	19	463
28	<5	<0.1	0.3	106	154	0.3	0.4	12	13.3	<1	3.3	<0.1	0.7	<1	31	<0.1	24	514
29	<5	<0.1	0.2	105	87	0.2	0.6	12	11.3	<1	3.1	0.5	1.1	<1	14	<0.1	22.9	400
30	<5	<0.1	0.1	93.3	69	0.2	0.2	80	10.5	9.4	2.5	0.6	2.7	<1	9	<0.1	16.5	422
34	<5	0.1	0.3	115	58	0.2	<0.1	21	10	4.4	2.4	<0.1	1.2	<1	<5	<0.1	8.3	539
35	<5	<0.1	0.2	76.6	114	0.2	0.8	12	14.1	<1	3	0.1	1.2	<1	18	<0.1	25.5	462
37	<5	0.1	0.1	78.6	88	0.1	<0.1	9	12.4	1.2	1.4	<0.1	1	<1	7	<0.1	14.9	478
38	<5	0.1	0.1	79.6	92	0.1	<0.1	8	13.2	<1	1.4	<0.1	0.9	<1	<5	<0.1	14.6	518
39 top	<5	0.1	0.1	60.9	102	0.2	0.1	11	12	1.3	2	<0.1	1.5	<1	19	<0.1	13.7	441
39 bott	<5	<0.1	0.5	1289	82	1.2	<0.1	58100	21.9	250	2.6	<0.1	0.4	1.5	<5	0.9	2.8	1430
40	<5	0.1	0.3	114	63	0.2	0.3	32	10.7	4	2.3	0.3	1.1	<1	9	<0.1	8.2	539
42	<5	0.1	0.3	110	60	0.2	0.1	11	10.7	3.5	2.2	<0.1	0.8	<1	<5	<0.1	8	540
43	<5	0.1	0.3	111	64	0.2	<0.1	13	10.2	3.9	2.5	<0.1	0.9	<1	24	<0.1	8.2	531
44	<5	<0.1	0.2	72.6	116	0.7	0.8	11	10.2	<1	3.2	0.3	2	<1	17	<0.1	15.4	363
49	<5	0.4	1	255	140	0.8	<0.1	27	29.6	95.3	4.9	0.2	3.2	1.8	20	0.6	19.5	910
50	<5	<0.1	0.1	86	101	0.2	1.2	14	13	<1	2.5	0.4	7.1	<1	21	<0.1	17.8	411

Fig 2. Ravenna case study map with sampling locations

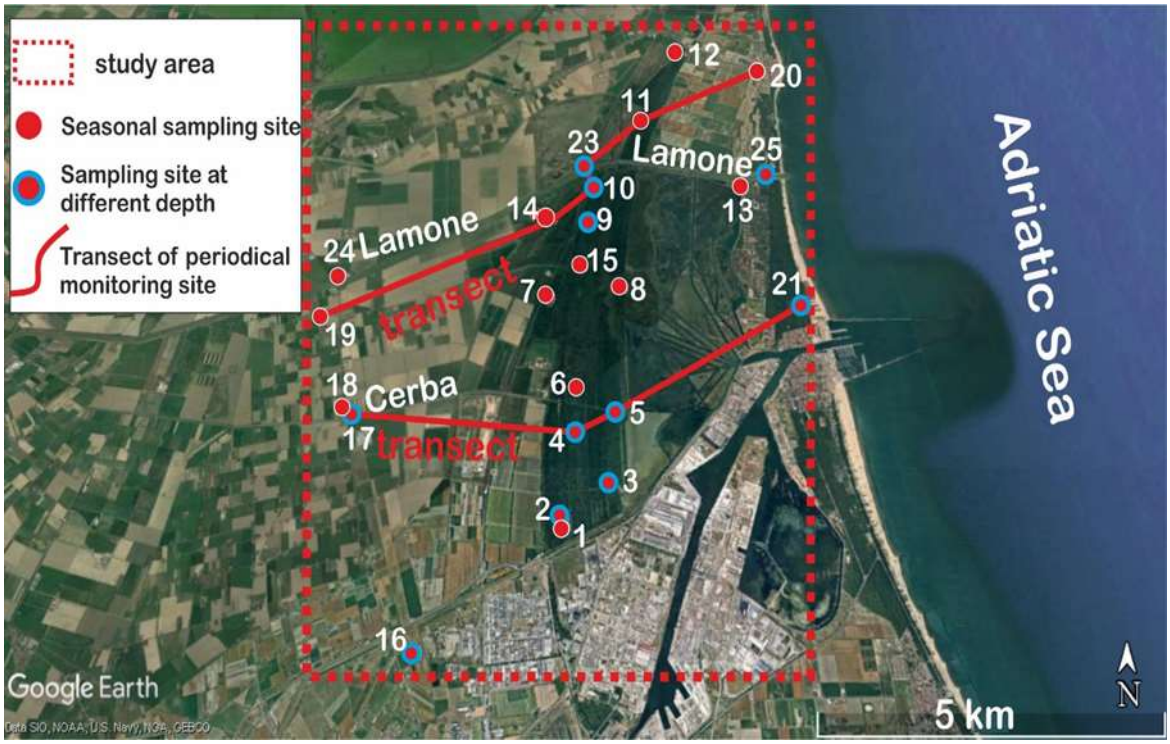


Table 6. Ravenna case study - physical monitoring (ID and coordinates)

Code	Type	Depth (m)	Est (GaussBoaga_Roma40)	Nord (GaussBoaga_Roma40)	Reference altitude by GPS (m a.s.l.)	GPS altitude error (m)
1	**piezometer**	6	2299247.58	4926985.29	2.03	1.53
2	**piezometer**	14	2299230.49	4927177.43	1.5	0.91
3	**piezometer**	6	2300012.5	4927728.65	0.2	0.86
4	**piezometer**	13	2299509.21	4928614.7	0.91	< 0.05
5	**piezometer**	14	2300187.55	4928919.24	1.06	< 0.05
6	**piezometer**	4	2299512.19	4929408.71	1.25	< 0.05
7	**piezometer**	4	2299657.85	4931360.55	1.89	0.98
8	**piezometer**	6	2300422.58	4931370.98	1.54	< 0.05
9	**piezometer**	17	2299863.93	4932843.53	1.62	< 0.05
10	**piezometer**	16	2300041.04	4933634.69	2.61	1.28
11	**piezometer**	6	2301095.45	4935391.44	1.52	< 0.05
12	**piezometer**	6	2301964.81	4937354	3.38	1.3
14	**piezometer**	6	2299142.38	4932951.26	1.75	< 0.05
15	**canal**	-	2299700.63	4931862.11	0.37	< 0.05
16	**piezometer**	20	2296993.4	4925241.2	0.17	< 0.05
17	**piezometer**	19	2295680.94	4929027.2	1.48	< 0.05
18	**canal**	-	2295593.55	4929103.65	3.29	< 0.05
19	**piezometer**	10	2294918.87	4930946.83	1.51	< 0.05
20	**piezometer**	12	2303734.57	4936732.8	1.86	1.03
21	**piezometer**	12	2303767.97	4930923	1.5	1.71
23	**canal**	-	2299830.63	4934270.68	6.57	< 0.05
24	**canal**	-	2295168.36	4931825.65	9.36	< 0.05
25	**canal**	-	2303540.26	4934013.27	4.76	< 0.05

Table 7. Ravenna case study - physical monitoring (water level)

Code	Data	water level (m a.s.l.)	Data	water level (m a.s.l.)	Data	water level (m a.s.l.)	Data	water level (m a.s.l.)	Data	water level (m a.s.l.)
1RA	23.7.2019	0.5					16.9.2020	0.33	25.11.2020	0.54
2RA	23.7.2019	0.12					16.9.2020	-0.2	25.11.2020	0.23
3RA	23.7.2019	-1.28					16.9.2020	-1.7	25.11.2020	-1.34
4RA	23.7.2019	-0.99	3.12.2019	-0.29	23.7.2020	-1.37	16.9.2020	-1.04	25.11.2020	-0.74
5RA	23.7.2019	-0.18	3.12.2019	0.1	23.7.2020	-0.6	16.9.2020	-0.44	25.11.2020	-0.19
6RA	23.7.2019	-0.55					16.9.2020	-0.73	25.11.2020	-0.53
7RA	23.7.2019	-0.43					16.9.2020	-0.83	25.11.2020	-0.65
9RA	24.7.2019	-0.5					17.9.2020	-0.83	26.11.2020	-0.38
10RA	24.7.2019	0.41	3.12.2019	1.18	23.7.2020	0.32	17.9.2020	0.26	26.11.2020	0.65
11RA	24.7.2019	-1.53	3.12.2019	-1.41	23.7.2020	-1.58	17.9.2020	-1.58	26.11.2020	-1.56
12RA	24.7.2019	0.78					17.9.2020	0.62	26.11.2020	0.86
14RA	24.7.2019	0.18	3.12.2019	0.62	23.7.2020	0.44	17.9.2020	0.02	26.11.2020	0.6
16RA	25.7.2019	-1.86					15.9.2020	-2.43	26.11.2020	-2.13
17RA	25.7.2019	-0.97	3.12.2019	-0.68	24.7.2020	-1.15	15.9.2020	-1.32	26.11.2020	-1.3
18RA	25.7.2019	-1.16	3.12.2019	-1.38	24.7.2020	-1.21	15.9.2020	-1.17	24.11.2020	-1.46
19RA	25.7.2019	-0.28	4.12.2019	0.35	24.7.2020	-0.73	15.9.2020	-0.89	26.11.2020	-0.89
20RA	25.7.2019	-0.01	4.12.2019	0.77	24.7.2020	-0.17	17.9.2020	-0.04	26.11.2020	0.27
21RA	25.7.2019	-0.02	4.12.2019	0.24			17.9.2020	-0.15	27.11.2020	0
23RA			4.12.2019	0.194	24.7.2020	0.034	16.9.2020	-0.126	26.11.2020	-0.376
24RA							25.9.2020	2.076	26.11.2020	1.996
25RA							25.9.2020	0.33	26.11.2020	-0.25

Table 8a. Ravenna case study - physical monitoring (July 2019_physical-chemical parameters)

Code	T	pH	HCO_3	F	Cl	Br	NO_3	NO_2	SO_4	Ca	Mg	Na	K	NH_4	TDS	$\delta^{18}O$	δD
July 2019	°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	‰ vs. V-SMOW	‰ vs. V-SMOW
1	18.6	7.76	538	0.48	652	2.7	16	0.03	104	44	64	530	34	4.2	1990	-6.94	-48.3
2	18	7.18	1016	19	11636	57	17	0.03	1757	145	877	7447	192	35	23198	-2.52	-17.3
3	16	6.86	285	7.4	9915	58	15	0.082	3500	347	915	6274	283	55	21655	-2.58	-20.4
4 top	17	7.35	777	3.6	3811	16	15	0.007	931	340	280	2421	35	3.3	8634	-5.01	-36.9
4 bot	15.9	7.12	633	8	9262	31	6.6	0.033	2569	615	966	5210	106	24	19431	-3.16	-24.3
5 top	18.7	6.94	515	25	10496	43	11	0.705	4009	836	897	5856	75	2.5	22766	-3.6	-24.3
5 bot	16.2	7.26	656	11	20378	78	15	0.157	5922	428	2178	12815	371	23	42875	-0.2	-7.2
6	19.7	6.86	459	0.7	116	0.4	1.2	0.03	101	67	41	150	19	0.26	955	-7.36	-48.5
7	18.8	6.86	270	1.7	1852	6.3	30	0.426	297	440	181	732	32	5.6	3847	-6.87	-45.5
8	15.6	7.1	459	6	11473	53	3	0.01	3198	548	904	6643	237	4.4	23528	-2.31	-18.8
9 top	16	7.75	1074	0.59	2176	6.1	19	0.026	117	117	176	1282	32	5.4	5004	-6.75	-43.8
9 bot	14.8	7.67	1177	1.2	5644	23	5.5	0.043	881	150	452	3854	111	22	12320	-5.24	-36.5
10	16.7	8.46	1194	1.8	4552	19	2.5	0.007	425	202	360	2614	65	7.5	9443	-5.37	-36.3
11	16.6	7.16	967	2.3	4629	18	1.4	0.046	478	299	435	2402	38	3.5	9274	-4.57	-31.5
12	17.5	7.24	438	1.4	2072	7.7	2.9	0.01	322	141	140	1113	72	0.71	4311	-6.79	-47.1
13	31.3	8.15	187	21	16809	71	2.9	0.01	5853	428	1304	10285	378	0.45	35339	0.04	-0.5
14	20.5	7.2	833	0.59	525	3.2	35	0.033	54	122	79	339	42	7	2040	-6.66	-45.9
15	31	8.68	181	0.2	41	0.2	3.8	0.525	58	46	19	37	9.2	0.1	395	-8.41	-56.1
16 top	19.8	7.46	993	5.4	4409	19	26	0.039	361	427	382	2246	46	1.1	8915	-7.29	-47
16 bot	17.1		1003	11	9483	55	29	0.033	1731	237	773	5626	142	28	19117	-4.6	-32.4
17	16.5	7.17	1100	1.9	6617	20	6.3	0.023	340	246	495	3292	98	13	12230	-5.87	-41.1
18	29.7	8.21	193	0.31	42	0.18	2.4	0.026	62	49	19	34	8.1	0.13	409	-8.33	-57.2
19	20.8	7.24	682	0.33	265	1.7	1.4	0.03	105	134	61	201	4.5	0.39	1457	-7.71	-50.5
20	18.2	7.3	495	15	13980	63	5.5	0.016	5071	437	1147	8891	210	11	30326	-1.55	-11.8
21	19.1	7.63	299	1.6	1630	5.9	4.8	0.025	310	170	180	661	61	0.45	3323	-6.89	-45.3

Table 8b. Ravenna case study - physical monitoring (July 2019_physical-chemical parameters)

Code	Al	Sb	As	Ba	B	Li	Rb	V	SiO_2	Sr
July 2019	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L
1	< 5	< 0.1	2.1	17	462	17	10	0.2	5.5	406
2	7	0.1	7.4	1196	2966	21	30	1.9	18	4530
3	< 5	0.1	4.8	51	2499	36	35	0.1	4.2	2190
4 top	< 5	0.2	79	98	300	17	15	0.4	14	2780
4 bot	< 5	0.1	110	382	364	24	32	0.8	12	6800
5 top	< 5	0.1	7.2	69	124	35	17	0.4	14	5650
5 bot	< 5	0.1	54	148	3393	21	69	0.8	9	8600
6	< 5	0.1	0.7	8.2	239	5.1	< 1	0.4	14	255
7	< 5	0.1	0.5	126	73	14	11	0.2	17	1630
8	255	0.1	3.6	75	2162	41	30	0.8	8	4490
9 top	5	0.1	39	157	716	6.9	6.8	1.5	16	950
9 bot	7	0.2	21	336	1804	9.9	14	2.9	17	2050
10	16	< 0.1	11	441	538	14	11	1.3	15	2420
11	< 5	< 0.1	146	1155	611	19	11	0.3	14	2860
12	< 5	< 0.1	1.2	77	594	9.5	6.4	0.3	11	960
13	< 5	0.3	4.1	21	3675	64	104	1.7	1	6900
14	6	0.1	2.5	84.9	282	22	3.9	2	23	1150
15	6	0.3	1.9	30	53	5.4	5	1.5	3.9	411
16 top	8	0.1	2.2	427	499	14	10	0.9	10	3120
16 bot	< 5	< 0.1	5	737	1948	16	26	1.5	13	4940
17	10	0.1	13	392	1023	24	14	1.3	14	3040
18	9	0.3	2.2	39.3	59	5.8	3.4	1.1	3.5	423
19	< 5	0.1	7.9	138	260	16	< 1	0.3	14	1250
20	< 5	0.1	2.9	297	2430	20	21	1.4	9.3	5390
21	5	0.2	11	123	590	34	14	0.3	11	1530

Table 9a. Ravenna case study - physical monitoring (September 2020_physical-chemical parameters)

Code	T	pH	HCO_3	F	Cl	Br	NO_3	NO_2	SO_4	Ca	Mg	Na	K	NH_4	TDS	$\delta^{18}O$	δD
September 2020	°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	‰ vs. V-SMOW	‰ vs. V-SMOW
1	16.76	7.92	516	0.9	793	2	19	0.016	136	69	75	534	34	5.5	2184	-7.49	-53.19
2 top	16.45	7.08	863	1.6	5390	18	3.3	0.046	1599	336	287	3825	63	1	12387	-5.34	-36.04
2 bot	14.02	7.28	576	0.68	18367	52	0.97	0.062	5233	422	1447	10269	231	31	36629	-0.68	-7.06
3 top	16.14	8.06	971	0.73	5300	19	15	0.026	1763	85	312	4054	124	5.2	12648	-3.79	-28.99
3 bot	14.71	7.39	432	1.2	14536	34	0.78	0.026	4032	357	1053	8434	256	7.1	29143	-1.82	-12.14
4	14.22	7.17	632	0.7	9229	21	16	0.02	1748	470	792	4920	73	14	17914	-3.44	-26.5
5	16.6	6.81	567	1	16011	42	13	0.036	5088	782	1343	9744	187	7.7	33786	-1.33	-7.15
5*	14.74	7.12	604	1.8	21145	57	0.1	0.033	8690	596	1628	12906	309	19	45957	-0.4	-10.43
6	16.38	8.02	447	0.83	122	0.18	2.2	0.115	112	39	31	199	21	0.77	975	-7.34	-52.87
7	16.44	6.99	416	0.9	2645	8.4	12	0.016	507	587	262	1041	57	6.7	5543	-6.41	-45
9	15.34	7.5	926	0.38	1129	2.7	1.6	0.02	172	214	115	763	23	3	3350	-6.7	-46.57
10 top	16.72	7.42	1116	0.78	1420	3.9	1.7	0.026	513	190	126	1161	27	3.2	4563	-5.73	-41.79
10 bot	14.46	7.45	1337	0.71	8035	16	5.3	0.043	1400	310	625	4350	103	19	16201	-4.5	-31.41
11	15.62	7.19	1081	0.44	5563	14	0.51	0.03	873	319	503	2996	52	9	11411	-4.15	-33.38
12	15.9	7.17	653	0.71	2849	9.8	1.95	0.023	775	216	262	1879	82	0.58	6729	-6.5	-49.56
14	20.3	7.14	915	0.9	1509	4.3	34	0.026	89	151	148	867	62	9	3789	-6.72	-49.73
16	19.4	7.38	1091	1.2	13013	30	1.6	0.026	92.1	239	844	6572	154	25	22062	-4.1	-26.16
17 top	15.11	6.98	1196	0.66	3625	9.8	30	0.039	1291	296	384	2407	98	8.7	9346	-6.31	-45
17 bot	14.63	7.21	1143	1.4	9136	31	0.41	0.039	1835	252	778	5847	144	18	19185	-4.66	-35.01
18	26.07	8.68	154	0.23	34	0.05	3.9	0.046	52	46	14	25	7.1	0.45	336	-8.12	-60.19
19	17.27	6.83	1086	0.6	5752	16	5.5	0.046	1040	284	494	3594	78	7.4	12357	-5.13	-37.59
20	16.17	7.33	451	1.9	14225	42	0.31	0.043	4825	487	1246	9830	224	10	31342	-1.48	-12.04
21	16.82	7.59	301	1.7	1923	5.1	0.27	0.02	502	131	200	999	74	0.65	4138	-6.95	-50.48
23	25	7.99	173	0.9	1390	3.9	13	0.03	309	82	102	744	34	0.45	2852	-8.1	-56.17
23 top	22.8	8.02	174	1.4	3395	9.7	9.5	0.082	489	119	234	1785	66	0.38	6283	-7.45	-50.74
23 bot	23.3	8.2	180	1.4	5503	17	5.7	0.066	1581	195	447	3373	126	0.45	11430	-6.24	-44.41
24	23.2	8.47	194	0.23	45	0.08	8.4	0.043	63	64	15	36	12	0.12	436	-8.82	-61.04
25	23.4	8.2	183	0.72	8107	19	2.5	0.053	1959	235	576	4413	206	0.45	15702	-5.03	-37.42

Table 9b. Ravenna case study - physical monitoring (September 2020_physical-chemical parameters)

Code	Al	Sb	As	Ba	B	Li	Rb	V	SiO_2	Sr
September 2020	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L
1	< 5	< 0.1	46	38	429	16	12	0.2	10	620
2 top	< 5	0.2	78	63	1426	27	9.8	0.5	16	2435
2 bot	< 5	< 0.1	43	203	1091	31	50	1.1	12	7185
3 top	< 5	0.1	4.2	38	2949	20	21	0.6	12	1078
3 bot	< 5	< 0.1	43	102	2630	27	49	0.3	13	4291
4	< 5	0.1	135	320	394	18	28	0.7	15	5452
5	< 5	0.2	36	129	571	28	42	0.3	16	7329
5*	< 5	0.1	112	167	1070	19	57	0.6	13	8131
6	6	0.2	2.5	6.3	351	3.5	0.67	0.6	19	206
7	< 5	0.1	1.8	210	61	12	18	0.4	25	2597
9	< 5	0.1	51	104	571	5.1	5	0.9	18	1023
10 top	< 5	0.1	23	149	352	11	6.3	0.5	20	1183
10 bot	< 5	< 0.1	6.9	712	693	14	17	1.5	19	3707
11	< 5	< 0.1	169	1362	610	17	13	0.2	18	3244
12	< 5	< 0.1	1.2	184	589	9.7	9.7	0.2	14	1692
14	< 5	< 0.1	0.8	107	382	25	5.5	2.7	24	1182
16	< 5	0.2	11	842	2117	13	25	1.3	16	5341
17 top	< 5	0.2	49	372	747	26	12	1.2	17	3429
17 bot	96	0.1	14	760	1050	18	22	1.4	20	4727
18	< 5	0.4	1.3	32	26	1.6	3.2	1.1	4.9	312
19	< 5	0.1	13	569	602	14	6.9	0.4	17	3704
20	< 5	0.1	8.2	282	996	12	18	0.9	11	6016
21	< 5	0.1	16	118	665	22	17	0.1	14	1436
23	< 5	0.4	1.9	37	211	6.9	9.7	1.4	6.2	787
23 top	17	0.5	1.9	37	409	14	20	1.3	5.8	1295
24	7	0.3	1.6	39	34	2.5	7.9	1.2	6.7	352
25	9	0.3	2	33	848	28	44	1.3	5.1	2768

Table 10a. Ravenna case study_physical monitoring (November 2020_physical-chemical parameters)

Code	T	pH	HCO_3	F	Cl	Br	NO_3	NO_2	SO_4	Ca	Mg	Na	K	NH_4	TDS	$\delta^{18}O$	δD
November 2020	°C		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	‰ vs. V-SMOW	‰ vs. V-SMOW
1	16.1	8.1	516	1.5	775	2.6	0.13	0.02	59	37	49	541	33	3.8	2017	-7.4	-51.9
2 top	14.4	7.2	769	4.7	7015	24	23	0.033	727	319	326	4177	83	2	13469	-4.88	-34.4
2 bot	13.5	7.3	544	5	18026	62	3.7	0.039	1769	402	1246	9581	218	27	31884	-0.72	-8.3
3 top	14.5	7.9	836	4.8	8123	35	3.8	0.026	1396	153	488	5095	165	5	16304	-3.49	-26.1
3 bot	14.2	7.3	333	4.8	15582	56	5.2	0.016	2046	418	1086	9195	260	15	29001	-1.9	-14.2
4	13.8	7.2	644	4.9	12125	38	3	0.043	845	582	888	5343	95	15	20584	-3.21	-24.9
5 top	14.6	6.8	556	4.7	17548	66	0.7	0.059	1978	920	1164	8090	106	7	30441	-2.37	-20.9
5 bot	13.5	7.3	601	5.2	24960	134	2.8	0.039	2580	522	1862	13640	370	21	44698	-0.28	-8.3
6	14.7	8.3	467	0.5	118	0.3	1.8	0.03	92	21	20	223	17	0.5	961	-7.4	-49.4
7	14.9	7.18	417	0.14	2262	7.1	36	0.062	197	476	205	895	51	5.5	4552	-6.65	-43.1
9	13	7.76	936	0.95	1605	4.5	2.9	0.03	107	225	153	980	23	3.5	4041	-6.68	-45.3
10 top	13.6	7.29	1193	1.1	5914	19	36	0.026	614	339	498	3572	99	7.7	12292	-4.84	-32.2
10 bot	13.2	7.38	1342	1.9	9464	31	11	0.026	799	345	810	5750	102	17	18673	-4.07	-29.3
11	14.3	7.13	1030	0.46	5955	21	4.2	0.046	188	248	558	3420	52	0.8	11477	-3.89	-29.2
12	14.9	7.16	523	0.12	2785	8.6	0.43	0.02	336	170	218	1720	75	0.2	5837	-6.55	-46.5
14	16.1	7.19	1005	0.87	879	3.3	27	0.049	36	170	124	615	40	6.5	2907	-5.88	-43.9
16	13.9	7.41	1076	4.7	15370	44	6.8	0.036	1045	587	1398	7233	248	20	27032	-4.18	-28.5
17 top	14.5	7.16	1011	2.5	9050	32	9.4	0.039	263	256	586	4453	165	12	15840	-5.61	-38.7
17 bot	14.2	7.41	931	4.9	12195	44	4.6	0.033	1027	171	828	6801	154	21	22182	-4.59	-33.7
18	6.9	7.97	949	0.74	5413	20	3.7	0.194	237	175	416	3183	105	11	10513	-4.64	-35.4
19	17.6	6.9	1146	0.4	7108	18	2.7	0.033	291	302	548	3833	113	6.6	13368	-5.18	-35.8
20	15	7.16	415	0.5	17210	53	12	0.059	1574	476	1196	9464	177	11	30588	-1.62	-12.3
21 top	14.5	7.58	309	4.5	2177	10	1.2	0.062	335	123	208	1169	82	0.2	4419	-6.71	-46.6
21 bot	14.5	7.66	322	2.6	5552	21	1.4	0.164	505	170	403	3089	167	3.5	10237	-5.62	-38.6
23 top	9	8.15	264	5	4068	15	6.7	0.026	492	147	279	2138	88	0.3	7503	-6.17	-37.1
23 bot	13	8.19	181	4.8	19531	66	2.5	0.02	2369	422	1486	10964	367	1.2	35394	-0.65	-5.7
24	6.4	8.4	289	0.11	42	0.17	2.9	0.095	57	77	22	40	15	0.3	545	-7.52	-48.7
25 top	9.3	8.18	268	0.4	4495	15	2.8	0.39	622	161	327	2553	120	0.2	8565	-5.84	-36.1
25 bot	11.4	8.2	284	4.6	20746	75	11	0.033	2137	430	1453	10553	347	0.5	36041	-0.91	-7

Fig 3. Neretva case study map with sampling locations

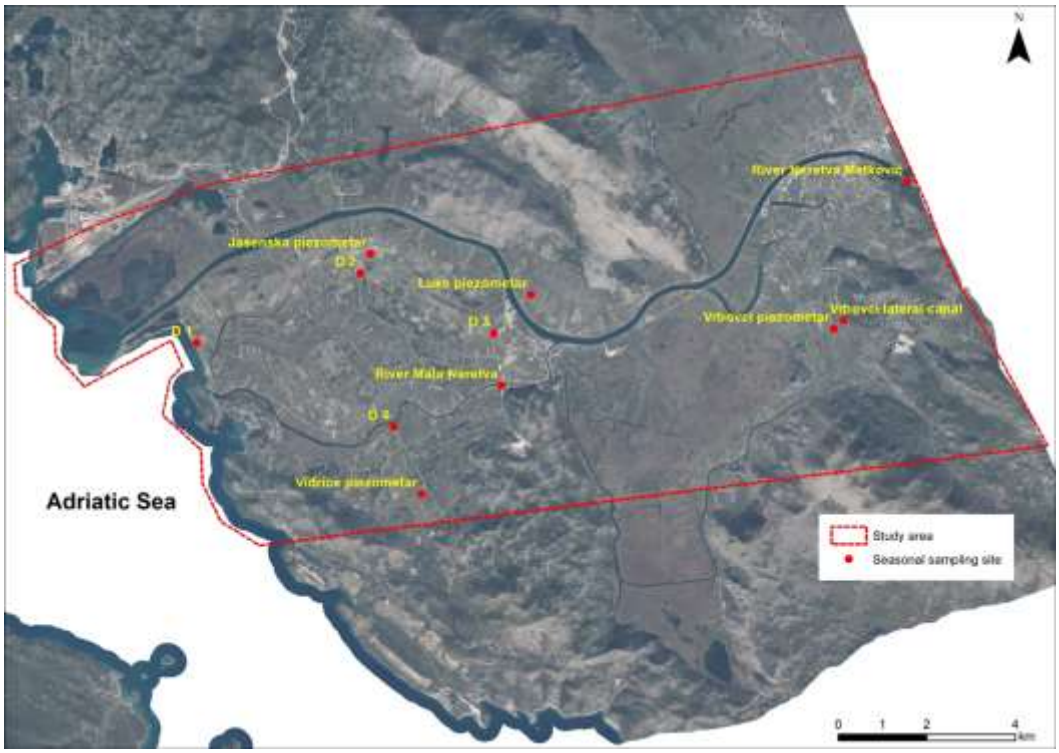


Table 11. Neretva case study physical monitoring (ID and coordinates)

Code	Type	Depth (m)	Est (GaussBoaga_Roma40)	Nord (GaussBoaga_Roma40)	Reference altitude by GPS (m a.s.l.)
River Mala Neretva	**river**	1	6463745	4762840	
River Neretva Metković	**river**	1	6472978	4767278	
Vrbovci lateral canal	**canal**	0.5	6471488	4764174	
Luke piezometar	**piezometer**	4	4764877.081	6464439.338	0,702
Vrbovci piezometar	**piezometer**	4	4763988.972	6471264.654	-0.204
Vidrice piezometar	**piezometer**	4	4760422.205	6461889.559	-0.018
Jasenska piezometar	**piezometer**	4	4765867.325	6460830.516	0,361
D 1	**piezometer**	10	4763928.232	6456877.678	0.962
D 2	**piezometer**	10	4765431.001	6460601.042	1.027
D 3	**piezometer**	10	4764014.631	6463587.243	1.510
D 4	**piezometer**	10	4761950.522	6461293.671	2.494

Table 12. Neretva case study - physical monitoring (September 2020_physical-chemical parameters)

Sampling date:	9.9.2020														
September	pH	E.C./ 25°C	HCO_3^-	NH_4 - N	NO_3 - N	NO_2 - N	PO_4-P	Cl^-	SO_4^{2-}	Ca^{2+}	K^+	Mg^{2+}	Na^+	$\delta^{18}O$	δD
Code	25°C	mS / m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	‰ vs. V-SMOW	‰ vs. V-SMOW
River Mala Neretva	8.0	92.60	195	0.86	0.16	<0,01	<0,01	181	56	56	4.1	21	96	-7.18	-46.4
River Neretva Metković	7.9	80.60	204	0.89	0.31	<0,01	<0,01	137	55	55	3	18	72	-8.41	-54.8
Vrbovci lateral canal	7.5	50.10	244	0.67	<0,08	<0,01	<0,01	45	10.0	10	<1,0	6.8	21	-6.70	-41.9
Luke piezometar	7.0	688	424	2.10	<0,08	<0,01	<0,01	1689	1175	1175	32	146	845	-5.69	-36.6
Vrbovci piezometar	7.0	123.6	464	1.50	<0,08	<0,01	0.021	117	182	182	9.7	18	41	-6.04	-38.8
Vidrice piezometar	7.1	912	763	30	4.30	0.120	0.1	2573	738	738	96	162	1436	-4.98	-28.8
D 1	7.5	5280	92	2.5	0.16	0.26	0.010	20630	2773	871	378	1160	11240	0.89	5.4
D 2	7.8	3180	226	28	<0,08	0.14	0.047	12192	478	201	282	351	6720	-2.04	-9.8
D 3	7.7	3910	59	11	<0,08	0.92	<0,01	14360	1749	574	312	654	7910	-1.50	-8.6
D 4	7.6	2090	1052	47	<0,08	0.017	0.20	7278	379	102	199	381	4050	-4.13	-24.9

Table 13. Neretva case study - physical monitoring (February 2021_physical-chemical parameters)

Sampling date:	3.2.2021														
Code	pH	E.C./ 25°C	HCO_3^-	NH_4 - N	NO_3 - N	NO_2 - N	PO_4-P	Cl^-	SO_4^{2-}	Ca^{2+}	K^+	Mg^{2+}	Na^+	$\delta^{18}O$	δD
February	25°C	mS / m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	‰ vs. V-SMOW	‰ vs. V-SMOW
River Mala Neretva	7.5	63.4	268	0.76	0.17	<0,01	<0,01	79	18	79	1.7	8.8	36	-7.53	-44.25
River Neretva Metković	7.9	39.4	217	0.83	0.34	<0,01	0.018	16	17	66	<1,0	5.8	5.5	-8.27	-50.10
Vrbovci lateral canal	7.5	78.1	281	0.83	0.28	<0,01	<0,01	118	20	87	2.6	11	59	-7.81	-46.28
Luke piezometar	7.1	266	403	0.89	49	0.014	<0,01	435	298	312	6.6	29	214	-6.07	-36.89
Vrbovci piezometar	7.1	130.3	390	0.79	38	<0,01	<0,01	101	89	196	<1	16	60	-6.32	-36.69
Vidrice piezometar	7.3	1081	1342	32	<0,08	0.015	2.7	2514	1973	365	103	412	1520	-4.77	-29.11
Jasenska piezometar	7.3	2370	2562	90	<0,08	0.023	7.2	7346	717	199	203	576	4290	-4.38	-27.16
D 1	7.4	5440	110	2.4	0.14	0.065	0.012	20445	2745	801	408	1148	11200	0.77	5.27
D 2	7.9	3240	275	28	<0,08	0.37	0.046	11943	377	191	302	363	6550	-2.10	-12.09
D 3	8.4	4050	38	17	<0,08	0.42	<0,01	14580	1713	669	328	591	7850	-1.50	-8.66
D 4	7.7	2120	1098	45	<0,08	0.12	0.22	6700	317	89	206	387	4040	-4.12	-24.70

Fig 1. Template for filling data regarding Activity 4.2. Management of coastal aquifers

Act 4.2 - Management of coastal aquifers, their administration and exploitation

1. Foreword – short introduction done by IACKR
2. National policies and strategies

2.1. Italy: national policies and strategies

2.2. Croatia: national policies and strategies

3. Institutions involved in groundwater management
   - *list of the national institution and their activities and responsibilities related to the costal aquifer administration and exploitation*
   - *Any differences at regional level? Please explain*

3.1. Italy: Institutions involved in groundwater management

3.2. Croatia: Institutions involved in groundwater management

4. Costal aquifers monitoring and data management
   - *monitoring network - activities and responsibilities, systematic groundwater monitoring on national or regional level*
   - *groundwater monitoring under the water framework directive*
   - *data management*

4.1. Italy: Costal aquifers monitoring and data management

4.2. Croatia: Costal aquifers monitoring and data management

5. Groundwater exploitation
   - Instruments for Groundwater Abstraction Control – national/regional level
   - Legal and Institutional Framework
   - economic instruments

5.1. Italy: Costal aquifers exploitation (Ravenna and Fanno)

5.2. Croatia: Costal aquifers exploitation

6. Issues and Problems – overview for Italy and Croatia