

3.5. Water Environment

3.5.1. Surface Water Quality

To assess the quality of surface water in the study area, water samples were collected from 15 different sources from the study area. The locations of the sampling sites and the types of source are given in Table 3.28. The results of analysis are given in Table 3.29 (a, b and c).

Altogether 36 water quality parameters were monitored in this work. The water samples were brought to the lab after collection and then analysed for these parameters following standard methods (APHA 2006). When necessary, the samples were preserved also as per standard methods.

The results indicate that the surface water is free from major chemical pollution, but it has the problem of bacteriological pollution. The water is generally infested with coliform organisms and in some cases with faecal organisms. This indicates the unhygienic conditions in which some people live in the study area. Although no tests were performed for establishing the presence of pathogens, the results with the coliform organisms are indicative enough of the possibility of the water being infested with pathogens. Therefore, the water should not be used without disinfection.

In most cases, the dissolved oxygen levels of the water are less than satisfactory. The water generally contains high content of iron making it unsuitable for drinking and use in laundering, etc. Some samples also have high fluoride content. The water has some amount of turbidity and correspondingly, high suspended solid content. The water is rich in the nutrients (phosphate and nitrate), which again indicate that animal wastes and other nutrient-rich wastes have found their way into the surface water. The pH is within acceptable limits and in most cases, close to 7.0.

Table 3.28: Surface water quality sampling stations

S/N	Sample name	Sampling Location	Source
1	SW1	Jonai Bazar	Pond at Private residence
2	SW2	Mohmora	Pond at Private residence
3	SW3	Mohmora	Nulla near paddy field
4	SW4	Bijoypur	Pond at Private residence
5	SW5	UjaniBijoypur	Public Pond
6	SW6	Ratanpur	Pond at Private residence
7	SW7	Maj Ratanpur	Nulla near paddy field
8	SW8	Maj Bijoypur	Pond at Bijoypur M. E. School
9	SW9	Kuligaon Tinali	Private fishery
10	SW10	Gali Nadi	Small River
11	SW11	Rajakhana Nadi	Small River
12	SW12	Barensuti Nadi	Small River
13	SW13	Jonai Koblong Nadi	Small River
14	SW14	Brahmaputra	River
15	SW15	Tinimile Nadi	Small River

Table 3.29a: Quality of surface water in the study area

S/N	Parameters	Unit	SW1	SW2	SW 3	SW4	SW5
1	Odour	--	NC	NC	NC	NC	NC
2	Temperature	0C	26.2	27.1	26.6	27.3	26.6
3	Turbidity	NTU	6	4	9	7	11
4	pH	--	6.6	6.5	7.7	6.9	6.6
5	Conductance	mS/cm	0.12	0.03	0.05	0.19	0.14
6	Total Dissolved Solid	mg/L	20	28	30	40	32
7	Total Suspended Solid	mg/L	101	135	124	152	122
8	Dissolved Oxygen	mg/L	4.3	5.0	4.1	3.0	3.6
9	BOD , 3 days at 270C	mg/L	10.0	12.6	8.2	11.0	6.0
10	COD	mg/L	168	82	120	100	120
11	Oil & Grease	mg/L	BDL	BDL	BDL	BDL	BDL
12	Total Kjeldahl Nitrogen	mg/L	2.1	1.4	1.1	1.2	2.2
13	Chloride	mg/L	14.2	17.0	11.4	22.7	14.2
14	Sulphates as SO4	mg/L	42.0	56.3	32.8	44.1	50.8
15	Nitrate	mg/L	0.001	0.003	BDL	0.002	BDL
16	Phosphate	mg/L	6.9	2.8	5.3	3.2	9.1
17	Fluoride	mg/L	0.001	1.09	0.08	0.67	0.06
18	Cyanide	mg/L	BDL	BDL	BDL	BDL	BDL
19	Calcium	mg/L	6.81	9.61	6.01	11.4	4.80
20	Magnesium	mg/L	1.20	1.39	1.24	1.12	1.46
21	Sodium	mg/L	5.2	9.9	6.2	9.4	11.0
22	Potassium	mg/L	4.2	7.1	5.7	5.8	4.3
23	Manganese	mg/L	0.01	0.06	0.03	0.04	0.05
24	Zinc	mg/L	0.01	0.04	0.10	0.01	0.001
25	Iron	mg/L	0.62	0.47	0.85	0.48	0.32
26	Copper	mg/L	BDL	0.004	BDL	0.02	BDL
27	Lead	mg/L	0.001	0.03	0.03	0.07	BDL
28	Chromium (VI)	mg/L	BDL	BDL	BDL	BDL	BDL
29	Chromium (Total)	mg/L	BDL	0.04	0.002	BDL	0.001
30	Cadmium	mg/L	0.10	BDL	BDL	0.04	0.10
31	Arsenic	µg /L	BDL	BDL	BDL	BDL	BDL
32	Cobalt	mg/L	0.06	0.04	0.07	0.04	0.01
33	Nickel	mg/L	BDL	0.01	0.01	0.05	0.04
34	Phenol	µg /L	BDL	BDL	BDL	BDL	BDL
35	Total Coliform	MPN/100 ml	110.0	160.0	132.0	115.0	212.0
36	Faecal Coliform	MPN/100 ml	NIL	NIL	NIL	NIL	NIL

Table 3.29b: Quality of surface water in the study area

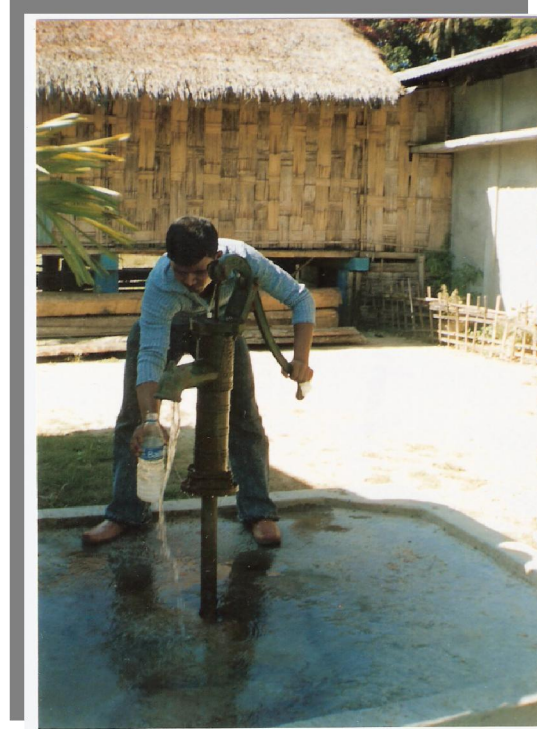
S/N	Parameters	Unit	SW6	SW7	SW8	SW9	SW10
1	Odour	--	NC	NC	NC	NC	NC
2	Temperature	0C	26.2	27.1	27.6	26.3	28.1
3	Turbidity	NTU	10	7	6	10	16
4	pH	--	6.3	7.2	6.4	6.7	6.4
5	Conductance	mS/cm	0.43	0.11	0.08	0.22	0.1
6	Total Dissolved Solid	mg/L	44	36	32	32	22
7	Total Suspended Solid	mg/L	155	165	145	135	145
8	Dissolved Oxygen	mg/L	5.0	4.1	4.8	4.4	3.1
9	BOD , 3 days at 270C	mg/L	10.0	12.0	20.0	14.0	6.0
10	COD	mg/L	72	80	64	164	180
11	Oil & Grease	mg/L	BDL	BDL	BDL	BDL	2.1
12	Total Kjeldahl Nitrogen	mg/L	2.3	1.6	1.8	0.2	2.1
13	Chloride	mg/L	8.5	14.2	22.7	17.0	25.5
14	Sulphates as SO4	mg/L	61.5	32.6	41.4	168	126
15	Nitrate	mg/L	BDL	0.001	BDL	BDL	0.08
16	Phosphate	mg/L	8.7	7.2	4.8	4.4	5.6
17	Fluoride	mg/L	0.003	BDL	0.001	0.17	1.9
18	Cyanide	mg/L	BDL	BDL	BDL	BDL	BDL
19	Calcium	mg/L	9.6	11.4	17.6	15.2	17.1
20	Magnesium	mg/L	1.2	1.2	1.4	1.4	1.2
21	Sodium	mg/L	5.8	5.9	7.2	6.4	11.7
22	Potassium	mg/L	5.3	4.6	5.3	4.2	5.5
23	Manganese	mg/L	0.02	0.03	0.08	0.05	0.02
24	Zinc	mg/L	0.05	0.05	0.02	0.20	0.01
25	Iron	mg/L	1.8	0.48	0.40	0.16	0.92
26	Copper	mg/L	0.001	0.002	BDL	BDL	0.001
27	Lead	mg/L	0.05	0.006	BDL	0.02	0.21
28	Chromium (VI)	mg/L	BDL	BDL	BDL	BDL	BDL
29	Chromium (Total)	mg/L	0.02	BDL	0.003	0.005	0.001
30	Cadmium	mg/L	BDL	0.06	0.07	0.003	0.002
31	Arsenic	µg /L	BDL	BDL	BDL	BDL	BDL
32	Cobalt	mg/L	BDL	0.06	0.01	0.02	0.004
33	Nickel	mg/L	0.07	BDL	0.002	0.02	0.02
34	Phenol	µg /L	BDL	BDL	0.003	BDL	0.005
35	Total Coliform	MPN/100 ml	62.0	142.0	154.0	166.0	122.0
36	Faecal Coliform	MPN/100 ml	NIL	NIL	10.0	16.0	12.0

Table 3.29c: Quality of surface water in the study area

S/N	Parameters	Unit	SW11	SW12	SW13	SW14	SW15
1	Odour	--	NC	NC	NC	NC	NC
2	Temperature	0C	26.3	27.2	27.8	26.6	27.1
3	Turbidity	NTU	12	5	17	21	9
4	pH	--	6.6	6.3	6.6	6.8	6.9
5	Conductance	mS/cm	0.11	0.24	0.20	0.43	0.18
6	Total Dissolved Solid	mg/L	40	45	25	42	38
7	Total Suspended Solid	mg/L	161	175	122	165	171
8	Dissolved Oxygen	mg/L	3.8	4.3	5.1	5.3	4.1
9	BOD , 3 days at 270C	mg/L	12.0	8.0	16.0	6.0	14.0
10	COD	mg/L	200	82	160	260	100
11	Oil & Grease	mg/L	1.26	2.21	1.95	5.8	BDL
12	Total Kjeldahl Nitrogen	mg/L	3.1	3.8	1.9	2.6	3.2
13	Chloride	mg/L	17.0	22.7	19.8	25.5	14.2
14	Sulphates as SO4	mg/L	105	84	92	336	120
15	Nitrate	mg/L	0.06	0.01	0.04	0.1	0.09
16	Phosphate	mg/L	3.7	3.9	6.2	9.8	3.8
17	Fluoride	mg/L	1.1	2.3	2.4	3.4	2.1
18	Cyanide	mg/L	BDL	BDL	BDL	BDL	BDL
19	Calcium	mg/L	8.6	12.2	10.2	34.0	19.2
20	Magnesium	mg/L	2.21	1.20	2.46	1.65	1.08
21	Sodium	mg/L	5.7	7.1	6.8	12.6	5.9
22	Potassium	mg/L	4.1	3.9	5.1	7.3	2.2
23	Manganese	mg/L	0.01	0.001	0.01	0.05	0.05
24	Zinc	mg/L	0.001	0.01	0.002	0.45	0.003
25	Iron	mg/L	0.61	0.42	0.42	0.26	0.27
26	Copper	mg/L	BDL	BDL	BDL	0.001	0.002
27	Lead	mg/L	0.18	0.52	0.001	0.82	0.31
28	Chromium (VI)	mg/L	BDL	BDL	BDL	BDL	BDL
29	Chromium (Total)	mg/L	0.003	0.001	BDL	0.004	0.001
30	Cadmium	mg/L	0.001	BDL	BDL	0.003	0.001
31	Arsenic	µg /L	BDL	BDL	BDL	BDL	BDL
32	Cobalt	mg/L	0.003	0.02	0.005	0.04	0.002
33	Nickel	mg/L	0.005	0.01	BDL	0.03	BDL
34	Phenol	µg /L	BDL	0.01	BDL	0.02	0.09
35	Total Coliform	MPN/100 ml	132.0	80.0	132.0	26.0	142.0
36	Faecal Coliform	MPN/100 ml	16.0	14.0	NIL	16.0	NIL



Surface Water collection at Baren Suti Nadi



Ground Water collection at Mohmara

3.5.2. Ground Water Quality

Ground water quality in the study area was monitored with respect to 8 sites as the dependence of the people on groundwater for their water needs was significantly less. These sites are given in Table 3.30. Out of these 5 are from hand pumps, 2 from dug wells and 1 from ring well.

The water samples were brought to the laboratory after collection, stored and preserved as per standard methods (APHA 2006) and were analysed for 31 water quality parameters also as per standard methods. The results of the analysis are given in Table 3.31 (a, b).

The groundwater is also more or less pollution-free but with comparatively high dissolved solid load. Many of the samples have high fluoride content, higher than the WHO maximum permissible limit of 1.5 mg/L.

Table 3.30: Ground water quality sampling stations

S/N	Sample name	Sampling Location	Source
1	GW1	Jonai Bazaar	Hand Pump
2	GW2	Mohmora, Private residence	Hand Pump
3	GW3	Bijoypur, Private residence	Ring Well
4	GW4	Ujani Bijoypur, private residence	Dug Well
5	GW5	Ratanpur, private residence	Hand Pump
6	GW6	Bijoypur M.E. school,	Hand Pump
7	GW7	Ratke, private residence	Hand Pump
8	GW8	Kuligaon Tiniali, private residence	Dug Well

Table 3.31a: Quality of ground water in the study area

S/N	Parameters	Unit	GW1	GW2	GW3	GW4
1	Odour	--	NC	NC	NC	NC
2	Temperature	0C	26.3	27.2	27.6	26.3
3	pH	--	7.8	7.2	6.8	6.8
4	Turbidity	NTU	6	7	5	6
5	Conductance	mS/cm	0.33	0.05	0.15	0.13
6	Total Suspended Solid	mg/L	24	26	14	20
7	Total Dissolved Solid	mg/L	155	169	149	204
8	Chloride	mg/L	11.4	8.5	17.1	8.5
9	Sulphates as SO4	mg/L	BDL	50.4	40.0	BDL
10	Nitrate	mg/L	BDL	BDL	0.005	BDL
11	Phosphate	mg/L	2.2	6.1	BDL	4.2
12	Fluoride	mg/L	1.3	1.6	1.8	1.6
13	Cyanide	mg/L	BDL	BDL	BDL	BDL
14	Calcium	mg/L	8.01	19.2	14.5	16.03
15	Magnesium	mg/L	2.4	1.4	1.5	1.4
16	Sodium	mg/L	5.2	5.5	5.4	7.8
17	Potassium	mg/L	4.3	4.3	2.5	5.4
18	Manganese	mg/L	0.02	0.03	0.01	0.01
19	Zinc	mg/L	0.17	0.19	0.22	BDL
20	Iron	mg/L	0.38	0.54	0.82	0.29
21	Copper	mg/L	BDL	BDL	BDL	BDL
22	Lead	mg/L	BDL	0.05	BDL	BDL
23	Chromium (VI)	mg/L	BDL	BDL	BDL	BDL
24	Chromium (Total)	mg/L	BDL	0.03	BDL	BDL
25	Cadmium	mg/L	BDL	BDL	0.01	BDL
26	Arsenic ($\mu\text{g/l}$)	$\mu\text{g/L}$	BDL	BDL	BDL	BDL
27	Cobalt	mg/L	0.03	0.03	BDL	0.01
28	Nickel	mg/L	0.01	0.02	BDL	0.04
29	Phenol	$\mu\text{g/L}$	BDL	BDL	BDL	BDL
30	Total Coliform	MPN/100 ml	NIL	NIL	NIL	NIL
31	Faecal Coliform	MPN/100 ml	NIL	NIL	NIL	NIL

Table 3.31b: Quality of ground water in the study area

S/N	Parameters	Unit	GW5	GW6	GW7	GW8
1	Odour	--	NC	NC	NC	NC
2	Temperature	0C	27.3	27.2	26.8	26.7
3	pH	--	6.9	6.1	6.8	6.9
4	Turbidity	NTU	8	10	9	7
5	Conductance	mS/cm	0.17	0.12	0.14	0.13
6	Total Suspended Solid	mg/L	20	13	12	16
7	Total Dissolved Solid	mg/L	189	250	212	167
8	Chloride	mg/L	11.4	14.2	14.6	14.2
9	Sulphates as SO4	mg/L	30.0	28.6	28.4	50.0
10	Nitrate	mg/L	BDL	0.007	BDL	BDL
11	Phosphate	mg/L	2.8	BDL	BDL	7.2
12	Fluoride	mg/L	0.06	1.3	1.1	1.0
13	Cyanide	mg/L	BDL	BDL	BDL	BDL
14	Calcium	mg/L	32.1	15.0	14.8	7.8
15	Magnesium	mg/L	1.2	1.2	1.4	1.6
16	Sodium	mg/L	4.7	10.5	3.8	11.9
17	Potassium	mg/L	4.3	5.3	4.2	4.4
18	Manganese	mg/L	0.02	0.04	0.02	0.06
19	Zinc	mg/L	0.01	0.01	0.01	0.05
20	Iron	mg/L	0.55	0.46	0.31	0.72
21	Copper	mg/L	0.002	BDL	BDL	BDL
22	Lead	mg/L	0.002	0.01	BDL	BDL
23	Chromium (VI)	mg/L	BDL	BDL	BDL	BDL
24	Chromium (Total)	mg/L	BDL	BDL	BDL	BDL
25	Cadmium	mg/L	0.001	BDL	BDL	BDL
26	Arsenic ($\mu\text{g}/\text{l}$)	$\mu\text{g}/\text{L}$	BDL	BDL	BDL	BDL
27	Cobalt	mg/L	0.01	0.03	BDL	0.002
28	Nickel	mg/L	BDL	0.01	BDL	0.02
29	Phenol	$\mu\text{g}/\text{L}$	BDL	BDL	BDL	BDL
30	Total Coliform	MPN/100 ml	NIL	NIL	NIL	NIL
31	Faecal Coliform	MPN/100 ml	NIL	NIL	NIL	NIL