Table 1. Formation lithology distribution statistics table

Quaternary System	Numbering	Depth (m)	Rock thickness (m)	Lithology
Lower alluvial deposits of the Holocene series (Q_4^{1al})	1	0~1.7	1.7	plain fill
	2	1.7~3.0	1.3	loess
	3	3.0~7.8	4.8	Fine sand
	4	7.8~15.0	7.2	Coarse sand
	5	15.0~19.9	4.9	Round gravel
	6	19.9~26.5	6.6	Fine sand
	7	26.5~29.8	3.3	Coarse sand
	8	29.8~36.1	6.3	Fine sand
	9	36.1~40.0	3.9	Round gravel
	10	40.0~41.3	1.3	Silty clay
	11	41.3~52.0	10.7	Fine sand
	12	52.0~65.0	13.0	Coarse sand
	13	65.0~67.0	2.0	Fine sand
	14	67.0~67.5	0.5	Silty clay
	15	67.5~70.0	2.5	Coarse sand
	16	70.0~74.8	4.8	Round gravel
Middle Pleistocene alluvial horizon (Q_2^{al})	17	74.8~78.2	3.4	Silty clay
	18	78.2~80.0	1.8	Fine sand
	19	80.0~92.9	12.9	Coarse sand
	20	92.9~96.4	3.5	Silty clay
	21	96.4~142.0	45.6	Coarse sand
	22	142.0~145.0	3.0	Silty clay
	23	145.0~147.8	2.8	Coarse sand
	24	147.8~154.8	7.0	Round gravel
	25	154.8~179.5	24.7	Coarse sand
	26	179.5~184.0	4.5	Fine sand
	27	184.0~187.5	3.5	Coarse sand
	28	187.5~191.0	3.5	Round gravel
	29	191.0~250.5	59.5	Coarse sand
Alluvial lacustrine strata of Lower Pleistocene (Q_1^{al+l})	30	250.5~256.0	6.0	Silty clay
	31	256.0~261.0	5.0	Fine sand
	32	261.0~268.0	7.0	Round gravel
	33	268.0~285.0	17	Coarse sand

Table 2. Geographical location and time of sampling point

Well number	Sampling date			Longitude(E)	Latitude(N)
	the first time	the second time	the third time		
17#	2019.05	2019.06	2019.07	108°47′05.88″	34°16′48.86″
18#	2019.05	2019.06	2019.07	108°46′48.50″	34°16′48.83″
19#	2019.05	2019.06	2019.07	108°46′14.50″	34°16′48.84″
23-1#	2019.05	2019.06	2019.07	108°44′51.22″	34°16′49.87″
23-2#	2019.05	2019.06	2019.07	108°44′51.44″	34°16′49.96″
26-2#	2019.05	2019.06	2019.07	108°45′06.15″	34°17′19.64″
27-1#	2019.05	2019.06	2019.07	108°45′09.36″	34°17′39.24″
27-2#	2019.05	2019.06	2019.07	108°45′08.80″	34°17′39.11″

28#	2019.05	2019.06	2019.07	108°44′54.04″	34°17′36.37″
30-1#	2019.05	2019.06	2019.07	108°44′59.40″	34°18′07.31″
31-1#	2019.05	2019.06	2019.07	108°44′55.39″	34°18′27.26″
31-2#	2019.05	2019.06	2019.07	108°44′55.31″	34°18′27.56″
40#	2019.05	2019.06	2019.07	108°44′45.79″	34°19′1.57″
Mixed	2019.05	2019.06	2019.07	108°48′27.86″	34°16′39.55″

Table 3. pH and oxidation-reduction potential (Eh)

Project	Month	Max	Minimum	The average value	Median	Coefficient of Variation
pH	May	8.46	7.71	8.17	8.21	2.55
	June	8.3	7.89	8.18	8.22	1.57
	July	8.32	7.94	8.16	8.17	1.19
Eh（mV）	May	-16.4	-123.8	-73.9	-70.3	1.04
	June	-16.3	-122.7	-66.2	-69.9	1.14
	July	-16.8	-123.2	-68.4	-69.1	1.10

Table 4. Testing methods and instruments used

Testing Indicator	Testing method	Testing base	Testing equipment
pH	Glass electrode method	GB/T 5750.4-2006	PHS-3C pH instrument
Total dissolved solids	Weighing method	GB/T 5750.4-2006	BSA224S Electronic balance
Total hardness	EDTA disodium titration method	GB/T 5750.4-2006	Acid burette
Ammonia Nitrogen	Nessler's reagent spectrophotometry	HJ 535-2009	Spectrophotometer UV9100A UV-visible spectrophotometer
Sulfide	Methylene blue spectrophotometry	GB/T 16489-1996	
Nitrate Nitrogen	UV spectrophotometry	GB/T 5750.5-2006	
Nitrite Nitrogen	Diazo coupling spectrophotometry	GB/T 5750.5-2006	
Sulfate	Barium Sulfate Turbid metric Method	GB/T 5750.5-2006	
Chloride	Silver nitrate volumetric method	GB/T 5750.5-2006	Acid burette
Iron, manganese, zinc, sodium, cadmium, lead	Inductively coupled plasma mass spectrometry	HJ 700-2014	7800 Inductively coupled plasma mass spectrometer

Table 5. Groundwater quality standards

Serial number	Project / Classification	Class I	Class II	Class III	Class IV	Class V
1	pH		6.5≤pH≤8.5		5.5≤pH＜6.5 8.5＜pH≤9.0	<5.5 >9.0
2	Total hardness (calculated as $CaCO_3$)	≤150	≤300	≤450	≤650	>650
3	Total dissolved solids	≤300	≤500	≤1000	≤2000	>2000
4	Sulfate	≤50	≤150	≤250	≤350	>350
5	Chloride	≤50	≤150	≤250	≤350	>350
6	Fe	≤0.1	≤0.2	≤0.3	≤2.0	>2.0
7	Mn	≤0.05	≤0.05	≤0.10	≤1.50	>1.50
8	Sulfide	≤0.005	≤0.01	≤0.02	≤0.10	>0.10
9	Zn	≤0.05	≤0.50	≤1.00	≤5.00	>5.00
10	Na	≤100	≤150	≤200	≤400	>400

11	Nitrate (N)	≤2.0	≤5.0	≤20.0	≤30.0	>30.0
12	Nitrite (N)	≤0.01	≤0.10	≤1.00	≤4.80	>4.80
13	Ammonia Nitrogen (NH_4^+)	≤0.02	≤0.10	≤0.50	≤1.50	>1.50
14	Cd	≤0.0001	≤0.001	≤0.005	≤0.01	>0.01
15	Pb	≤0.005	≤0.005	≤0.01	≤0.10	>0.10

Table 6. Statistics of iron and manganese concentration in groundwater of Feng River

	Well number	May	June	July	The average value	Standard Deviation	Coefficient of Variation
Fe(mg/L)	17#	0.302	0.312	0.307	0.307	0.004	0.013
	18#	0.108	0.197	0.203	0.169	0.043	0.257
	19#	0.295	0.301	0.284	0.293	0.007	0.024
	23-1#	0.271	0.297	0.258	0.275	0.016	0.059
	23-2#	0.131	0.182	0.171	0.161	0.022	0.136
	26-2#	0.112	0.167	0.182	0.154	0.030	0.196
	27-1#	0.229	0.243	0.209	0.227	0.140	0.061
	27-2#	0.161	0.256	0.264	0.227	0.047	0.206
	28#	0.132	0.198	0.217	0.182	0.036	0.199
	30-1#	0.152	0.182	0.139	0.158	0.018	0.114
	31-1#	0.152	0.213	0.225	0.197	0.032	0.163
	31-2#	0.143	0.185	0.181	0.170	0.019	0.112
	40#	0.081	0.241	0.236	0.186	0.074	0.399
	Mixed	0.241	0.229	0.204	0.225	0.015	0.068
Mn(mg/L)	17#	0.112	0.105	0.124	0.114	0.008	0.069
	18#	0.031	0.032	0.047	0.037	0.007	0.199
	19#	0.304	0.392	0.315	0.337	0.039	0.116
	23-1#	0.093	0.086	0.073	0.084	0.008	0.098
	23-2#	0.097	0.108	0.102	0.102	0.004	0.044
	26-2#	0.074	0.091	0.092	0.086	0.008	0.096
	27-1#	0.149	0.113	0.158	0.140	0.019	0.139
	27-2#	0.042	0.042	0.039	0.041	0.001	0.034
	28#	0.072	0.084	0.076	0.077	0.005	0.065
	30-1#	0.084	0.098	0.085	0.089	0.006	0.072
	31-1#	0.022	0.021	0.032	0.025	0.005	0.199
	31-2#	0.092	0.054	0.069	0.072	0.016	0.218
	40#	0.051	0.050	0.052	0.051	0.001	0.016
	Mixed	0.072	0.065	0.058	0.065	0.006	0.088

Table 7. Iron and manganese content in single well and river water（mg/L）

	17#	19#	23-2#	26-2#	30-1#	31-2#	The average value
Iron in river	0.013	0.018	0.004	0.005	0.027	0.031	0.016

water							
Manganese in river water	0.012	0.041	0.010	0.007	0.069	0.011	0.025
Iron in well water	0.302	0.295	0.131	0.112	0.152	0.143	0.189
Manganese in well water	0.112	0.304	0.097	0.074	0.084	0.092	0.127

Table 8. Formation lithology change and iron and manganese content statistics table

Category	Depth（m）	Rock thickness（m）	Lithology	Fe（mg/kg）		Mn（mg/kg）	
				The average value	Standard error	The average value	Standard error
Shallow（0~30m）	0~1.7	1.7	plain fill	17600	184	368	7.84
	1.7~3.0	1.3	loess	21200	324	490	10.02
	3.0~7.8	4.8	Fine sand	9373	211	183	16.35
	7.8~15.0	7.2	Coarse sand	9215	509	199	6.01
	15.0~19.9	4.9	Round gravel	11089	297	288	22.98
	19.9~26.5	6.6	Fine sand	7458	607	141	14.62
	26.5~29.8	3.3	Coarse sand	7065	216	119	1.78
	29.8~36.1	6.3	Fine sand	9923	316	211	16.10
	36.1~40.0	3.9	Round gravel	10659	429	248	10.12
	40.0~41.3	1.3	Silty clay	14500	451	400	16.33
Middle level（30~100m）	41.3~52.0	10.7	Fine sand	13378	534	279	6.52
	52.0~65.0	13.0	Coarse sand	13204	111	254	4.33
	65.0~67.0	2.0	Fine sand	10465	263	215	1.93
	67.0~67.5	0.5	Silty clay	17366	123	471	14.15
	67.5~70.0	2.5	Coarse sand	13000	957	262	12.67
	70.0~74.8	4.8	Round gravel	16925	1283	354	8.99
	74.8~78.2	3.4	Silty clay	24500	1006	562	11.75
	78.2~80.0	1.8	Fine sand	12226	542	235	10.89
	80.0~92.9	12.9	Coarse sand	15700	335	321	14.74
	92.9~96.4	3.5	Silty clay	23412	817	465	18.68
	96.4~100.0	3.6	Coarse sand	13979	700	286	8.18
Deep（Below 100m）	100.0~142.0	42.0	Silty clay	13979	700	286	8.18
	142.0~145.0	3.0	Coarse sand	21150	840	424	10.59
	145.0~147.8	2.8	Round gravel	12400	670	215	7.14
	147.8~154.8	7.0	Coarse sand	13989	325	241	15.57
	154.8~179.5	24.7	Fine sand	10340	361	205	3.34
	179.5~184.0	4.5	Coarse sand	9003	289	192	8.73
	184.0~187.5	3.5	Round gravel	9092	303	209	5.27
	187.5~191.0	3.5	Coarse sand	11800	397	203	6.01
	191.0~250.5	59.5	Silty clay	8555	154	162	3.93
	250.5~256.0	6.0	Fine sand	21428	734	493	14.17
	256.0~261.0	5.0	Round gravel	9763	244	233	12.12

	261.0~268.0	7.0	Coarse sand	12281	325	260	11.35
	268.0~285.0	17	plain fill	16800	511	307	8.49