Table 1 Procedures and classification of pollution indices.

<table>
<tr><th>Indices</th><th colspan="6">Procedures of calculation and classifications</th></tr>
<tr><td rowspan="3">Metal index (MI)</td><td colspan="6">$MI = \sum C_i/(MAC)_i$
where, C is the concentration of each element in the solution, MAC is the maximum allowed concentration of each element, and the subscript i indicating the ith sample. MI is classified into six categories (Siegel 2002):</td></tr>
<tr><td>MI < 0.3</td><td>MI = 0.3–1.0</td><td>MI = 1.0–2.0</td><td>MI = 2.0–4.0</td><td>MI = 4.0–6.0</td><td>MI > 6.0</td></tr>
<tr><td>Very pure</td><td>Pure</td><td>Slightly affected</td><td>Moderately affected</td><td>Strongly affected</td><td>Seriously affected</td></tr>
<tr><td rowspan="3">Heavy metal pollution index (HPI)</td><td colspan="6">$HPI = \frac{\sum WiQi}{\sum Wi}$
where, Qi is the sub-index of the ith parameter and Wi is the unit weight for the ith parameter.
$Q_i = \sum(\frac{[Mi(-)Li]}{Si-Li})$
where Mi, Ii and Si are the monitored heavy metal, ideal and standard values of the ith parameter, respectively. The sign (-) indicates numerical difference of the two values, ignoring the algebraic sign. Groundwater water quality is classified into three categories based on modified heavy metal pollution index (Mohan et al., 1996; Bodrud-Doza et al. 2016)</td></tr>
<tr><td>HPI < 45</td><td>HPI = 45–90</td><td>HPI > 90</td><td colspan="3"></td></tr>
<tr><td>Low pollution</td><td>Medium pollution</td><td>High pollution</td><td colspan="3"></td></tr>
<tr><td rowspan="3">Groundwater quality index (GWQI)</td><td colspan="6">$WQI = \sum Q_n Wn/\sum Wn$
$Q_n = 100[V_n - V_{in}]/[S_n - V_{in}]$
$W_n = K/S_n$
Where, Qn is the quality rating for nth water quality parameter; Vn is the estimated value of nth parameter in given sampling station; Sn is the standard permissible value of the nth parameter; Vin is the ideal value of nth parameter in pure water; Wn is the unit weight for nth parameter; K is a constant for proportionality. Groundwater water quality is classified into three categories based on modified GWQI (Vasanthavigar et al. 2010; Sharma and Patel, 2016)</td></tr>
<tr><td>GWQI <50</td><td>GWQI = 50–100</td><td>GWQI = 100.1–200</td><td>GWQI = 200.1–300</td><td>GWQI >300</td><td></td></tr>
<tr><td>Excellent water</td><td>Good water</td><td>Poor water</td><td>Very poor water</td><td>Unsuitable for drinking purposes</td><td></td></tr>
</table>

Table 2 Procedures and classification of the irrigation quality parameters.

Parameters	Procedures of calculation and classifications					
Sodium adsorption ratio (SAR)	$SAR = Na+/(\sqrt{Ca^{2+} + Mg^{2+}})/2$ All concentrations are stated in meq/L The ratio classifies the groundwater quality into four groups (Richards 1954).					
	< 10	10–18	18–26	> 26		
	Excellent	Good	Doubtful	Unsuitable		
Salinity hazard (EC)	< 250	250–750	750–2000	2000–3000	> 3000	
	Excellent	Good	Permissible	Doubtful	Unsuitable	
Sodium percentage (Na%)	$Na\% = Na^{+}/(Na^{+} + K^{+} + Ca^{2+} + Mg^{2+}) \times 100$ All the values are expressed in meq/L. It classifies the groundwater quality into five groups:					
	< 20%	20–40%	40–60%	60–80%	> 80%	
	Excellent	Good	Permissible	Doubtful	Unsuitable	
Kelly's ratio (KR)	$KR = Na^{+}/(Ca^{2+} + Mg^{2+})$ All the values are expressed in meq/L. The ratio classifies the groundwater quality into two groups.					
	< 1	> 1				
	Safe	Unsafe				
Magnesium ratio (MR)	$MR = Mg^{2+}/(Ca^{2+} + Mg^{2+}) \times 100$ Proposed by Raghunath (1987)					
	MR < 50%	MR > 50%				
	Suitable	Unsuitable				

Table 3 The minimum, maximum, average, standard deviation, and maximum. allowable concentrations of the measured physical and chemical parameters.

	Minimum	Maximum	Average	Std. Deviation	MAC
pH	6.5	7.8	7.276	.2901	6.5–8.5
EC (µS/cm)	1554	5450	3334	1566.933	1500
TDS (mg/l)	1088	3815	2334.07	766.945	1000
Ca^{2+} (mg/l)	204	593	443.16	129.463	75
K^{+} (mg/l)	15	80	42.49	20.137	12
Mg^{2+} (mg/l)	17	60	27.90	11.866	30
Na^{+} (mg/l)	49	568	235.59	150.493	200
HCO_3^{-} (mg/l)	66	145	99.85	17.862	200
Cl^{-} (mg/l)	201	642	455.74	123.422	250
NO_3^{-} (mg/l)	8	25	14.11	3.716	50
SO_4^{2-} (mg/l)	327	1987	1015.23	446.293	250
PO_4^{3-} (mg/l)	0	0	.02	.008	NA
SO_2 (mg/l)	12.00	36.00	25.5667	6.87165	NA
F^{-} (mg/l)	1.20	2.10	1.6533	.25152	1.5
As (µg/l)	.40	1.50	.9200	.31775	10
B (µg/l)	22.00	90.00	51.7667	21.41653	2400
Cd (µg/l)	.20	.90	.5733	.19815	3
Cr (µg/l)	2.00	3.00	2.4800	.25107	50
Cu (µg/l)	.90	2.30	1.4700	.30643	2000
Hg (µg/l)	.03	.15	.0720	.02833	6
Ni (µg/l)	.10	.80	.4433	.22997	70
Pb (µg/l)	.90	1.80	1.3667	.21549	10
Sb (µg/l)	.003	.011	.00697	.002371	20
Se (µg/l)	8.20	13.00	10.7567	1.40754	40
Zn (µg/l)	9.50	18.60	13.8933	2.44779	50

Table 4 Principal component loadings.

	PC1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9
pH	.034	**.576**	.014	.042	.198	-.074	.262	.297	**.554**
EC	**.983**	.050	-.013	-.010	-.046	.045	.091	-.086	.012
TDS	**.983**	.050	-.014	-.008	-.045	.044	.091	-.085	.012
Ca^{2+}	**.847**	.247	-.002	-.127	-.043	-.251	-.278	-.141	.112
K^{+}	-.365	.467	-.476	.040	.016	.165	.320	-.286	-.311
Mg^{2+}	**.556**	-.610	.159	.194	.209	-.031	.180	.121	-.178
Na^{+}	**.864**	-.070	.003	.053	-.070	.283	.332	-.012	-.036
HCO_3^{-}	-.074	-.728	.169	.379	.088	.100	-.135	-.249	-.016
Cl^{-}	**.731**	.328	.076	-.225	-.072	-.288	-.329	-.171	.089
NO_3^{-}	-.052	-.622	**.547**	.063	-.121	.227	.029	.077	.362
$SO4^{2-}$	**.956**	-.023	-.039	.045	-.031	.121	.202	-.035	-.008
PO_4^{3-}	.172	.280	-.548	.461	-.124	-.111	-.151	.380	-.023
SO_2	.384	.124	.073	.499	.227	-.125	.249	.212	-.323
F^{-}	-.102	-.415	-.534	.048	.024	.329	.308	.248	.284
As	-.212	.172	.318	-.552	.336	.173	.355	-.147	-.158
B	-.037	.353	.304	.174	**.537**	-.084	.179	-.229	.203
Cd	.004	.153	.150	.300	**.575**	.344	-.297	.008	-.250
Cr	-.195	.445	.268	.257	-.098	.301	-.349	-.013	.092
Cu	-.291	.477	.343	.128	-.180	-.416	.335	.111	-.094
Hg	.066	-.072	-.189	-.324	**.702**	-.134	.052	.069	.176
Ni	.233	.436	-.094	.088	.223	**.620**	-.296	-.037	.085
Pb	-.046	.255	**.550**	**.516**	-.212	-.047	.208	-.084	.065
Sb	-.053	.427	.178	.024	-.236	**.502**	.096	.170	.009
Se	.178	-.029	.374	-.292	.207	-.088	-.237	**.668**	-.255
Zn	-.139	-.127	-.215	**.545**	.369	-.361	-.090	-.145	.155
% of Variance	23.08	13.39	8.60	7.97	7.15	6.76	5.77	4.66	4.21
Cumulative %	23.08	36.47	45.06	53.03	60.18	66.93	72.71	77.37	81.58