Critical Analysis of Water Quality for Different Uses in Rural and Urban Fringe Area around Nagpur

**Uzair Khan1, Dr V.P Thergaonkar2, Dr Arif Khan 3**

*1 Department of Civil (Environmental) Engineering (PG Student)*

*NUVA collage of Engineering and Technology, Nagpur, India, 440013*

*2 Ex- NEERI Scientist*

*Director, Enviro- Techno Consults, Nagpur, India*

*3 Department of Civil (Environmental) Engineering (Principal)*

*NUVA collage of Engineering and Technology, Nagpur, India, 441501*

***Abstract –*** *Concept of water quality index need to be propagated in India under the present circumstances leading to spread out colonies / residential areas.in the present paper Canadian standard has been used. water quality indices where worked out for urban fringe area and rural area around Nagpur. Canadian concept of water quality index was adopted. Uses of water for drinking, Agriculture, recreation etc. where considered because of the prevailing water uses in the surveyed area.*

***Keywords-*** *contaminated, El Nino, adsorbents, Fringe, urbanization*

**INTRODUCTION**

Both urban and rural drinking water supplies in India relay on heavily on rainfall pattern. Spatial distribution of rainfall has been disturbed due to global warming and other global phenomena like Elnino etc. Government of India has assured drinking water at the rate 50 to 150 LPCD in rural and urban area respectively. LPCD about 80% of these quantity emergent as waste water, sewage water, grey water. It is known that sewage is still to be provided to urban and rural area

Recently it has been realized that depletion rate of ground water has become a matter of

Concern. The reason for this is withdrawal of ground water both for drinking water supply and individual purpose

It is also fact that government has been insisting on rural sanitation program. This program has promoted both individuals and local cell bodies like gram panchayat, Zillah parishad etc. to provide pit latrines / pore flush latrines etc. organic matter get digested in the pit prefabricated rectangular septic tank followed by sock pit is also another alternative

CPHEEO, Government of India has recommended narrow /small bore sewerage for transmission of grey water /sewage followed by its treatment by low cost method like stabilization pond /artificial wet land system etc. visit to any rural or urban fringe area will indicate absence of sewerage, flowing grey water drains it has been mention above that rainfall pattern has changed and sudden precipitation, heavily rainfall within short period has become a regular phenomenon under such condition rise in ground water table can be substantial and probably reach the depth of pit latrine, low cost sanitation disposal system

Concept of water quality index summarized the technical finding of water quality surveys into numbers to make it easily comprehensible to decision makers because WQI is based on caused and effect of a water quality parameters which is generally descriptive

**METHOLOGY**

It was decided to find out drinking water quality index For the sources which are being used by consumers in rural urban fringe or urban area then grab sample where collected and analyzed for routine water quality criteria parameter as per IS 10500

Analysis was carried out as per standard method for examination of water, waste water etc. published by American Water Work Association (AWW) or Bureau of Indian Standard (BIS) .Analysis was carried out in the laboratory of Enviro-techno consultant Significance of this parameter are calcium and magnesium can cause hardness to water if chloride Concentration of dissolved species depend on Geology of the Area, Environmental location And the depth from which water is extracted or aquifer from which water is drawn

Inquiry was made for existence of pipe water supply on to the location Drinking water quality criteria Index was calculated by two methods namely Average Weighted arithmetic mean method, Hourtels method

Table 1- Well Water of Rural Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Jindal steel power (R) | Mahalgaon Dighoro  (R) | Umread road  (R) | Hingna  (R) |
| PH | 7.2 | 7.1 | 7 | 6.8 |
| Conductivity | 1430 | 1051 | 400 | 10140 |
| Turbidity | <2 | <2 | <2 | <2 |
| Total Dissolve Solid | 942 | 740 | 283 | 3540 |
| Total Alkalinity | 356 | 294 | 108 | 258 |
| Total Hardness | 340 | 330 | 176 | 2250 |
| Calcium Hardness | 174 | 150 | 102 | 870 |
| Magnesium Hardness | 166 | 180 | 74 | 1380 |
| Calcium ions | 70 | 60 | 41 | 348 |
| Magnesium ions | 40 | 43 | 18 | 331 |
| Chloride |  | 74 | 24 | 2338 |
| Sulphate | 35 | 22 | 22 | 42 |

Table 2- Well Water of Rural Area and Urban Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Balaji kalmeshwar yerla gaon (R) | Arneja rice mill katol road  (R) | ST. Vincent Paloti  (U) | Ramdaspeth  (U) |
| PH | 7.1 | 7.1 | 7.1 | 7 |
| Conductivity | 1228 | 700 | 3063 | 586 |
| Turbidity | Nill | <2 | <2 | <5 |
| Total Dissolve Solid | 663 | 664 | 2067 | 588 |
| Total Alkalinity | 340 | 258 | 508 | 250 |
| Total Hardness | 78 | 224 | 500 | 225 |
| Calcium Hardness | 24 | 166 | 304 | 165 |
| Magnesium Hardness | 54 | 58 | 196 | 60 |
| Calcium ions | 10 | 66 | 122 | 66 |
| Magnesium ions | 13 | 14 | 47 | 14 |
| Chloride | 30 | 54 |  | 40 |
| Sulphate | 52 | 29 | 237 | 13 |

Table 3- Well Water of Urban Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Ganeshpeth  (U) | Raghuji Nagar  (U) | Jaripatka (U) | Cotton Market  (U) |
| PH | 7 | 7 | 7.5 | 7.6 |
| Conductivity | 717 | 874 | 1158 | 1224 |
| Turbidity | <2 | <2 | <2 | <2 |
| Total Dissolve Solid | 570 | 805 | 926 | 1171 |
| Total Alkalinity | 218 | 306 | 136 | 410 |
| Total Hardness | 240 | 260 | 156 | 288 |
| Calcium Hardness | 170 | 150 | 94 | 188 |
| Magnesium Hardness | 70 | 110 | 62 | 100 |
| Calcium ions | 68 | 60 | 38 | 75 |
| Magnesium ions | 17 | 26 | 15 | 24 |
| Chloride | 46 | 66 | 160 | 97 |
| Sulphate | 34 | 47 | 89 | 109 |

Table 4 – Surface Water of Rural Area

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Beltarodi  (R) | Mahalgaon Dighoro  (R) | Wardha Road  (R) |
| PH | 7.5 | 7.6 | 6.4 |
| Conductivity | 280 | 1016 | 162 |
| Turbidity | <2 | <2 | <5 |
| Total Dissolve Solid | 273 | 726 | 21 |
| Total Alkalinity | 285 | 285 | 68 |
| Total Hardness | 118 | 270 | 68 |
| Calcium Hardness | 46 | 140 | Nill |
| Magnesium Hardness | 34 | 130 | Nill |
| Calcium ions | 18 | 56 | Nill |
| Magnesium ions | 8 | 31 | Nill |
| Chloride | 14 |  | 17 |
| Sulphate | 4 | 71 | 7 |

Table 5- Surface Water of Urban Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Panchpouli (U) | Shakardhara Shree Hospital RO Outlet (U)) | Pardi  Raw water (U) | Dhantoli (U) |
| PH | 7.4 | 6.5 | 7 | 7.6 |
| Conductivity | 267 | 37 | 699 | 328 |
| Turbidity | <2 | <2 | <2 | <2 |
| Total Dissolve Solid | 213 | 10 | 561 | 174 |
| Total Alkalinity | 86 | 14 | 274 | 112 |
| Total Hardness | 80 | Nill | 250 | 140 |
| Calcium Hardness | 65 | Nill | 188 | 72 |
| Magnesium Hardness | 15 | Nill | 62 | 68 |
| Calcium ions | 26 | Nill | 75 | - |
| Magnesium ions | 4 | Nill | 15 | - |
| Chloride | 10 | 8 | 34 | 18 |
| Sulphate | 13 | 0.8 | 28 | 9 |

Table 6- Surface Water of Urban Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Jaripatka Ring Road  (U) | Dhantoli  (U) | Shakkardhara  (U) | CA Road (U) |
| PH | 7.1 | 7 | 5.5 | 7.9 |
| Conductivity | 326 | 288 | 57 | 540 |
| Turbidity | <2 | <2 | Nill | <2 |
| Total Dissolve Solid | 289 | 144 | <15 | 270 |
| Total Alkalinity | 106 | 142 | 22 | 202 |
| Total Hardness | 116 | 92 | 12 | 188 |
| Calcium Hardness | 72 | 66 | 0 | 118 |
| Magnesium Hardness | 44 | 29 | 12 | 70 |
| Calcium ions | 29 | 26 | 0 | 47 |
| Magnesium ions | 11 | 6 | 3 | 17 |
| Chloride | 35 | 28 | 14 | 65 |
| Sulphate | 12 | 13 | Nill | 36 |

Table 7- Bore Well Water of Urban Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Manish nagar  (U) | Suraynagar  (U) | Jafar nagar  (U) | Civil lines  (U) |
| PH | 7.4 | 7.3 | 7.5 | 7.1 |
| Conductivity | 906 | 1440 | 330 | 841 |
| Turbidity | <2 | <2 | Nill | <2 |
| Total Dissolve Solid | 773 | 1221 | 250 | 663 |
| Total Alkalinity | 322 | 448 | 90 | 286 |
| Total Hardness | 248 | 226 | 132 | 312 |
| Calcium Hardness | 128 | 150 | 60 | 198 |
| Magnesium Hardness | 125 | 76 | 72 | 114 |
| Calcium ions | 51 | 60 | 24 | 79 |
| Magnesium ions | 30 | 18 | 17 | 27 |
| Chloride | - | 117 | 27 | 17 |
| Sulphate | 20 | 59 | 90 | 40 |

Table 8- Bore Well of Water Urban and Rural Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Gandhi Nagar hill road  (U) | Ramdaspeth  (U) | Jolibar chowk  (U) | Bhilgoan (R) |
| PH | 7.5 | 7.1 | 7.5 | 7 |
| Conductivity | 828 | 1584 | 1011 | 1454 |
| Turbidity | <2 | <2 | <2 | 41 |
| Total Dissolve Solid | 779 | 1267 | 931 | 1254 |
| Total Alkalinity | 236 | 176 | 316 | 434 |
| Total Hardness | 76 | 430 | 296 | 245 |
| Calcium Hardness | 36 | 248 | 174 | 140 |
| Magnesium Hardness | 40 | 182 | 122 | 105 |
| Calcium ions | 14 | 99 | 70 | 56 |
| Magnesium ions | 10 | 45 | 29 | 25 |
| Chloride | 146 | 171 | 85 | 87 |
| Sulphate | 30 | 39 | 66 | 131 |

Table 9- Bore Well Water of Rural Area

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Vihar ,Kamptee (R) | Mahal gaon Dighori  (R) | Bharath  wada  (R) | Saraswati Nagar  (R) |
| PH | 7 | 7.6 | 7 | 7 |
| Conductivity | 3625 | 953 | 1904 | 610 |
| Turbidity | <2 | <2 | <2 | <2 |
| Total Dissolve Solid | 1875 | 601 | 911 | 588 |
| Total Alkalinity | 216 | 282 | 454 | 238 |
| Total Hardness | 800 | 280 | 340 | 284 |
| Calcium Hardness | 560 | 110 | 240 | 168 |
| Magnesium Hardness | 240 | 170 | 100 | 116 |
| Calcium ions | 244 | 44 | 96 | 67 |
| Magnesium ions | 60 | 41 | 24 | 28 |
| Chloride | 640 | - | 180 | 32 |
| Sulphate | 402 | 25 | 150 | 40 |

The WQI Canadian Standard 1993 tool is used for calculating WQI where the data is put up into Excel sheet

**RESULT**

Table 10 - Well Water of Rural Area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Data | Overall | Drinking | Aquatic | Recreation | Irrigation |
| WQI | 83 | 79 | 100 | 100 | 100 |
| Quality | Good | Fair | Excellent | Excellent | Excellent |

Table 11 - Well Water of Urban Area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Data | Overall | Drinking | Aquatic | Recreation | Irrigation |
| WQI | 70 | 75 | 100 | 100 | 41 |
| Quality | Fair | Fair | Excellent | Excellent | Poor |

Table 12 - Surface Water of Urban Area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Data | Overall | Drinking | Aquatic | Recreation | Irrigation |
| WQI | 72 | 66 | 41 | 100 | 100 |
| Quality | Fair | Fair | Poor | Excellent | Excellent |

Table 13- Well Water of Urban Area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Data | Overall | Drinking | Aquatic | Recreation | Irrigation |
| WQI | 71 | 78 | 100 | 100 | 35 |
| Quality | Fair | Fair | Excellent | Excellent | Poor |

Table 14 - Bore Well Water of Rural Area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Data | Overall | Drinking | Aquatic | Recreation | Irrigation |
| WQI | 71 | 78 | 100 | 100 | 35 |
| Quality | Fair | Fair | Excellent | Excellent | Poor |

Table 15 - Bore Well Water of Rural Area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Data | Overall | Drinking | Aquatic | Recreation | Irrigation |
| WQI | 66 | 62 | 100 | 100 | 27 |
| Quality | Fair | Marginal | Excellent | Excellent | Poor |

**CONCLUSION**

Present study has confirmed the utility of water quality index before selecting any source for intended use of a source. This will help in prioritization of sources for execution water supply schemes. Further utility is to specify water quality in numbers which can be taken by the executives so that it will be advisable to find out water quality indices of proposed drinking water supply sources before finalizing any water supply source in urban areas. Examination in three season of the year are advisable. This is also applicable to rural areas

**REFERENCES**

1. *Mangesh P. Bhorkar; Analysis of Surface Water Quality of Wainganga River in Central Region of India; National conference in recent trends in Environmental Engineering; Nov-2011*
2. *https://www.researchgate.net/publication/336050289\_Reverse\_Osmosis\_Units\_in\_an\_Urban\_Area\_-\_A\_Case\_Study*
3. *https://www.researchgate.net/publication/283015086\_Adaptability\_of\_water\_management\_strategies\_in\_the\_context\_of\_Climate\_change\_for\_drought\_prone\_areas\_of\_West\_*
4. *https://www.semanticscholar.org/paper/Determination-of-optimal-fluoride-concentration-in-Chandra-Sharma/dec4e599ea949328f1d6c1ce7e64ff1aee076d9b*
5. *https://www.semanticscholar.org/paper/Water-quality-and-dental-fluorosis.-Chandra-Thergaonkar/e7a294eb4ac8e6c76a1a806107441adf3908c3b9.*
6. *https://www.researchgate.net/publication/284381424\_Performance\_Evaluation\_of\_Effluent\_Treatment\_Plant\_for\_Textile\_Mill\_at\_Ramtek\_MS\_India*
7. *NEERI manual; Water and Wastewater Analysis.*
8. *Sanyogita R. Verma, P.R. Chaudhari, R.K.Singh and S.R Wate; Studies on the Ecology and Trophic Status of An Urban Lake At Nagpur City, India Vol.4, No.3 pp 652-659; 2009*
9. *https://www.mae.gov.nl.ca/waterres/quality/background/ss-wqi.html*