

SEASONAL VARIATION IN QUALITY OF GROUND WATER

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ABSTRACT - Water plays an essential role in human life. Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water. Fresh water is one of the most important resources crucial for the survival of all the living beings. It is even more important for the human being as they depend upon it for food production, industrial and waste disposal, as well as cultural requirement. Human and ecological use of ground water depends upon ambient water quality. For example, seeing where different water quality parameters Such as pH, turbidity, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), Total alkalinity (TA) content of calcium (Ca²⁺), magnesium (Mg²⁺), sodium (Na), potassium (K), Iron (Fe), chloride (Cl⁻), fluoride (F⁻), sulphate (SO₄²⁻), Nitrite (NO₂⁻), DO, BOD, COD were determined using standard procedures. In this paper to study the seasonal variation in physico-chemical parameters in ground water in Jangareddygudem Mandal.

Key words: Jangareddygudem, physico, chemical, Seasonal, water

1. INTRODUCTION:

Ground water is considered as one of the purest forms of water available in nature and meets the overall demand of rural as well as urban population. Groundwater plays a vital role in human life. Increase in urbanization, industrialization, agriculture activity and various human activities increase the pollution of surface water & ground water. Once the groundwater is contaminated, its quality cannot be restored back easily and we need to devise ways and means to protect it. Consequently number of cases of water borne diseases has been seen which cause health hazards. An understanding of water chemistry is the bases of the knowledge of the multidimensional aspect of aquatic environmental chemistry which involves the source, composition, reactions and transportation of water. The quality of water is of vital concern for the mankind since it is directly linked with human welfare. Therefore, monitoring the quality of water is one of the essential issues of drinking water management. Considering the above aspects of groundwater contamination, the present study was undertaken to investigate the impact of the groundwater quality water samples at Jangareddygudem Mandal of West Godavari district, A.P, India.

2. LOCATION:

Latitude & Longitude: N17°06'625" & E81°17'334"

State: Andhra Pradesh

District: West Godavari

Country: India

Languages: Telugu

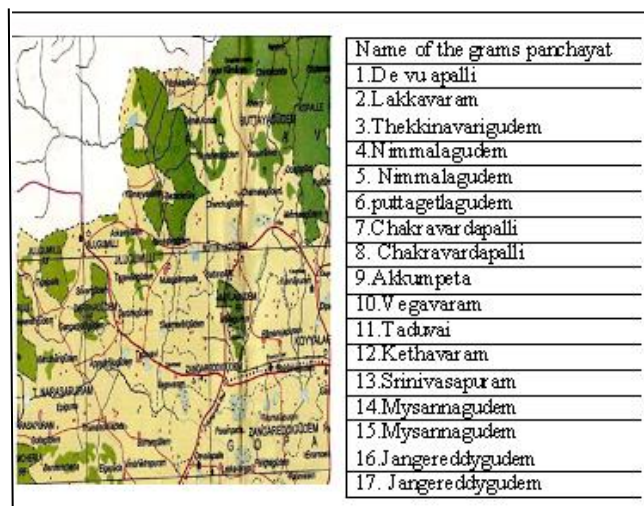


Figure:1. Map showing the Jangareddygudem Mandal

3. METHODOLOGY:

All physical, chemical and biological parameters of ground water sample were determined by adopting standard analytical methods which are listed below.

| S.NO | PARAMETERS | STANDARD ANALYTICAL METHODS |
|------|-----------------------------------------|--------------------------------------------------|
| 1 | PH | Eutech- 2700 pH meter |
| 2 | EC | Systemics-304 EC meter |
| 3 | TDS | Eco tester TDS low meter |
| 4 | Turbidity, sulphate | Nepheloturbidity-132 |
| 5 | Alkalinity | Volumetrically by H ₂ SO ₄ |
| 6 | TH, Ca ²⁺ , Mg ²⁺ | Complexometrically by EDTA |
| 7 | Sodium, potassium | Flame photometer-127 |
| 8 | Chloride, fluoride | Ion selectivity meter-eutech 2700 |
| 9 | Iron, phosphate, nitrite | Visible spectrophotometer |
| 10 | DO, BOD, COD | Standard methods |

Results

Table-1:Physio –Chemical Parameters of Jangareddygudem Mandal in Rainy season

| S.no | Sample Code | pH | EC | TDS | Turbidity | Alkalinity | Hardness | Sodium | Potassium | Calcium | Magnesium | Iron | Chloride | Fluoride | Nitrite | Sulphate | Phosphate | DO | COD | BOD |
|------|-------------|------|-------|------|-----------|------------|----------|--------|-----------|---------|-----------|------|----------|----------|---------|----------|-----------|------|------|------|
| | units | | µs/cm | mg/l | NTU | 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 | mg/L | mg/L |
| 01 | 3-1-15 | 7.51 | 600 | 384 | 000 | 132 | 115 | 33 | 666 | 30.00 | 9.74 | 000 | 77.3 | 0.172 | 000 | 26 | 000 | 4.0 | 1.2 | 1.6 |
| 02 | 3-2-15 | 7.98 | 200 | 128 | 000 | 72 | 70 | 8.3 | 4.3 | 12.00 | 9.74 | 000 | 688 | 0.902 | 000 | 24 | 000 | 5.2 | 27.2 | 2.0 |
| 03 | 3-3-15 | 6.90 | 600 | 384 | 000 | 138 | 130 | 41 | 6.0 | 30.00 | 30.96 | 000 | 71.3 | 0.159 | 000 | 41 | 000 | 3.6 | 36.8 | 2.0 |
| 04 | 3-4-15 | 7.33 | 600 | 384 | 000 | 164 | 130 | 41 | 12.2 | 34.00 | 8.53 | 000 | 88.7 | 0.110 | 000 | 35 | 000 | 4.4 | 8.8 | 2.0 |
| 05 | 3-4-25 | 7.96 | 600 | 384 | 000 | 162 | 130 | 41 | 12.9 | 34.00 | 30.96 | 000 | 89.2 | 0.127 | 000 | 35 | 000 | 4.0 | 19.2 | 1.2 |
| 06 | 3-5-15 | 7.44 | 1000 | 640 | 000 | 236 | 185 | 76 | 12.9 | 48.00 | 45.83 | 000 | 17.6 | 0.253 | 000 | 49 | 000 | 4.4 | 27.2 | 2.0 |
| 07 | 3-6-15 | 7.38 | 500 | 320 | 000 | 104 | 110 | 30 | 12.4 | 24.00 | 12.18 | 000 | 37.8 | 0.091 | 000 | 37 | 000 | 5.6 | 44.8 | 2.4 |
| 08 | 3-6-25 | 7.42 | 400 | 256 | 000 | 126 | 90 | 32 | 10.8 | 22.00 | 8.53 | 000 | 30.7 | 0.308 | 000 | 19 | 000 | 5.2 | 27.2 | 1.6 |
| 09 | 3-7-30 | 7.96 | 700 | 448 | 000 | 176 | 145 | 50 | 5.0 | 40.00 | 30.96 | 000 | 37.6 | 0.114 | 000 | 28 | 000 | 5.2 | 35.2 | 1.6 |
| 10 | 3-8-15 | 8.29 | 700 | 448 | 000 | 196 | 145 | 80 | 5.1 | 28.00 | 31.27 | 000 | 26.1 | 0.718 | 000 | 34 | 000 | 4.8 | 11.2 | 1.2 |
| 11 | 3-9-15 | 7.02 | 600 | 384 | 000 | 190 | 125 | 40 | 9.3 | 24.00 | 45.83 | 000 | 65.5 | 0.090 | 000 | 31 | 000 | 4.8 | 24 | 2.0 |
| 12 | 3-10-15 | 8.02 | 700 | 448 | 000 | 230 | 155 | 65 | 15 | 38.00 | 14.62 | 000 | 51.2 | 0.324 | 000 | 39 | 000 | 10.8 | 30.8 | 2.0 |
| 13 | 3-11-15 | 7.73 | 900 | 576 | 000 | 302 | 180 | 60 | 15.5 | 34.00 | 21.14 | 000 | 87.7 | 0.420 | 000 | 47 | 000 | 5.2 | 22.4 | 1.6 |
| 14 | 3-12-15 | 6.75 | 400 | 256 | 000 | 64 | 80 | 0.8 | 6.5 | 16.00 | 9.74 | 000 | 44.6 | 0.043 | 000 | 11 | 000 | 4.8 | 30.4 | 1.6 |
| 15 | 3-13-15 | 6.71 | 200 | 128 | 000 | 42 | 50 | 9.1 | 5.0 | 8.00 | 7.31 | 000 | 17.8 | 0.018 | 000 | 11 | 000 | 6.0 | 20.8 | 1.2 |
| 16 | 3-13-25 | 6.74 | 200 | 128 | 000 | 30 | 60 | 9.1 | 6.7 | 8.00 | 9.74 | 000 | 15 | 0.041 | 000 | 19 | 000 | 5.2 | 22.4 | 0.8 |
| 17 | 3-14-15 | 7.04 | 700 | 448 | 000 | 196 | 140 | 46 | 6.6 | 34.00 | 11.40 | 000 | 62.2 | 0.174 | 000 | 28 | 000 | 4.8 | 9.6 | 0.4 |
| 18 | 3-14-25 | 6.51 | 400 | 256 | 000 | 66 | 80 | 32 | 2.6 | 22.00 | 6.09 | 000 | 47.5 | 0.019 | 000 | 18 | 000 | 4.8 | 14.4 | 0.8 |

Table-2 :Physio –Chemical Parameters of Jangareddygudem Mandal in Winter season

| S.No | Sample Code | pH | T.C | TDS | Hardness | Alkalinity | Total iron | Sulfate | Fluoride | Cadmium | Magnesium | Iron | Chloride | Phosphate | Nitrate | Calcium | Sulfate | NO ₃ | CO ₃ | SO ₄ |
|------|-------------|------|------|-----|----------|------------|------------|---------|----------|---------|-----------|------|----------|-----------|---------|---------|---------|-----------------|-----------------|-----------------|
| | unit | | mg/L | NTU | 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 | mg/L | mg/L | mg/L |
| 01 | 3-11# | 7.88 | 1200 | 768 | 005 | 250 | 195 | 80 | 10.6 | 58.00 | 12.18 | 000 | 127 | 0.288 | 000 | 52 | 000 | 8 | 0 | 4 |
| 02 | 3-21# | 8.01 | 800 | 512 | 001 | 242 | 150 | 59 | 12 | 34.00 | 15.83 | 000 | 505 | 0.324 | 000 | 34 | 000 | 48 | 44 | 2 |
| 03 | 3-31# | 6.86 | 700 | 448 | 000 | 140 | 125 | 51 | 13 | 28.80 | 12.91 | 000 | 495 | 0.144 | 000 | 40 | 000 | 38 | 32.4 | 2 |
| 04 | 3-41# | 7.81 | 800 | 512 | 0 | 200 | 195 | 48 | 4.4 | 32.00 | 28.01 | 000 | 711 | 0.208 | 000 | 28 | 000 | 48 | 0 | 24 |
| 05 | 3-42# | 7.78 | 1000 | 640 | 0 | 304 | 190 | 77 | 12.8 | 42.00 | 20.71 | 000 | 114 | 1.53 | 000 | 46 | 000 | 4 | 44 | 12 |
| 04 | 3-51# | 7.66 | 1000 | 640 | 0 | 234 | 210 | 29 | 12.9 | 42.00 | 25.58 | 000 | 105 | 0.311 | 000 | 20 | 000 | 48 | 0 | 24 |
| 07 | 3-41# | 7.60 | 500 | 320 | 0 | 124 | 115 | 38 | 7.5 | 20.00 | 15.83 | 000 | 132 | 0.091 | 000 | 36 | 000 | 4 | 0 | 14 |
| 08 | 3-42# | 7.40 | 400 | 384 | 0 | 198 | 115 | 51 | 4.1 | 22.00 | 14.62 | 000 | 147 | 0.224 | 000 | 31 | 000 | 3.4 | 0 | 04 |
| 09 | 3-71D | 7.95 | 700 | 448 | 0 | 242 | 140 | 40 | 5.2 | 58.00 | 3.65 | 000 | 337 | 0.784 | 000 | 30 | 000 | 3.4 | 12.8 | 0.8 |
| 10 | 3-81# | 7.91 | 700 | 448 | 0 | 312 | 130 | 40 | 7.9 | 24.00 | 17.05 | 000 | 143 | 0.428 | 000 | 37 | 000 | 4 | 3.2 | 04 |
| 11 | 3-91# | 7.30 | 400 | 384 | 0 | 118 | 120 | 91 | 14.8 | 28.00 | 12.18 | 000 | 288 | 0.110 | 000 | 34 | 000 | 44 | 12.8 | 2 |
| 12 | 3-101# | 8.35 | 1000 | 640 | 0 | 340 | 150 | 48 | 5.1 | 44.00 | 9.74 | 000 | 274 | 0.509 | 000 | 25 | 000 | 4 | 8 | 4 |
| 13 | 3-111# | 7.91 | 800 | 512 | 0 | 350 | 115 | 20 | 7.0 | 42.00 | 2.44 | 000 | 259 | 0.917 | 000 | 39 | 000 | 3.4 | 0 | 04 |
| 14 | 3-121# | 7.91 | 500 | 320 | 0 | 74 | 145 | 08 | 5.4 | 24.00 | 25.58 | 000 | 288 | 0.048 | 000 | 14 | 000 | 48 | 0 | 24 |
| 15 | 3-131# | 7.78 | 300 | 192 | 0 | 74 | 65 | 09 | 4.8 | 16.00 | 6.09 | 000 | 341 | 0.055 | 000 | 19 | 000 | 3.4 | 22.4 | 0.8 |
| 14 | 3-132# | 7.81 | 400 | 256 | 0 | 42 | 60 | 47 | 9.0 | 16.00 | 4.87 | 000 | 358 | 0.041 | 000 | 29 | 000 | 4 | 11.2 | 04 |
| 17 | 3-141# | 7.73 | 400 | 384 | 0 | 194 | 135 | 33 | 4.3 | 30.00 | 14.62 | 000 | 151 | 0.248 | 000 | 16 | 000 | 44 | 4.8 | 2 |
| 18 | 3-142# | 6.80 | 400 | 256 | 0 | 84 | 80 | 40 | 8.1 | 30.00 | 1.22 | 000 | 904 | 0.034 | 000 | 18 | 000 | 5.2 | 0 | 2.8 |

Table 3: Correlation Matrix of Jangareddygudem Mandal in Rainy Season

| | pH | EC | TDS | Alkalinity | Total Hardness | Sulfate | Phosphate | Calcium | Magnesium | Chloride | Fluoride | Sulphate | DO | COD | BOD |
|----------------|----------|----------|----------|------------|----------------|----------|-----------|----------|-----------|----------|----------|----------|----------|----------|-----|
| pH | 1 | | | | | | | | | | | | | | |
| EC | 0.43158 | 1 | | | | | | | | | | | | | |
| TDS | 0.43158 | 1 | 1 | | | | | | | | | | | | |
| Alkalinity | 0.515099 | 0.863546 | 0.863546 | 1 | | | | | | | | | | | |
| Total hardness | 0.550855 | 0.982259 | 0.982259 | 0.897604 | 1 | | | | | | | | | | |
| Sulfate | 0.572227 | 0.895781 | 0.895781 | 0.778284 | 0.911089 | 1 | | | | | | | | | |
| Phosphate | 0.326887 | 0.537843 | 0.537843 | 0.618469 | 0.586517 | 0.432728 | 1 | | | | | | | | |
| Calcium | 0.462401 | 0.928725 | 0.928725 | 0.72239 | 0.918733 | 0.841927 | 0.508888 | 1 | | | | | | | |
| Magnesium | 0.498629 | 0.723992 | 0.723992 | 0.861818 | 0.779175 | 0.702273 | 0.504545 | 0.46834 | 1 | | | | | | |
| Chloride | 0.190913 | 0.279251 | 0.279251 | 0.430926 | 0.293772 | 0.091894 | 0.278387 | 0.318669 | 0.151455 | 1 | | | | | |
| Fluoride | 0.744426 | 0.614774 | 0.614774 | 0.646742 | 0.667253 | 0.80035 | 0.15363 | 0.486048 | 0.721585 | -0.01392 | 1 | | | | |
| Sulphate | 0.4922 | 0.823216 | 0.823216 | 0.769209 | 0.864476 | 0.776208 | 0.6585 | 0.754535 | 0.70481 | 0.349566 | 0.513525 | 1 | | | |
| DO | 0.277262 | -0.02414 | -0.02414 | 0.087934 | 0.075394 | 0.136455 | 0.327135 | 0.022138 | 0.133905 | -0.21477 | 0.145119 | 0.025764 | 1 | | |
| COD | -0.03663 | -0.09166 | -0.09166 | -0.1171 | -0.05168 | -0.16555 | -0.112167 | -0.08541 | 0.019825 | -0.27462 | -0.17694 | 0.117121 | 0.08118 | 1 | |
| BOD | 0.330219 | 0.199289 | 0.199289 | 0.164743 | 0.231757 | 0.118877 | 0.447406 | 0.224906 | 0.161489 | 0.205734 | 0.0172 | 0.452838 | 0.156319 | 0.513356 | 1 |

Table 4: Correlation Matrix of Jangareddygudem Mandal in Winter Season

| | pH | EC | TDS | Alkalinity | Total Hardness | Sulfate | Phosphate | Calcium | Magnesium | Chloride | Fluoride | Sulphate | DO | COD | BOD |
|----------------|----------|----------|----------|------------|----------------|----------|-----------|----------|-----------|----------|----------|----------|----------|---------|-----|
| pH | 1 | | | | | | | | | | | | | | |
| EC | 0.381376 | 1 | | | | | | | | | | | | | |
| TDS | 0.381376 | 1 | 1 | | | | | | | | | | | | |
| Alkalinity | 0.553735 | 0.799586 | 0.799586 | 1 | | | | | | | | | | | |
| Total hardness | 0.341347 | 0.854277 | 0.854277 | 0.539924 | 1 | | | | | | | | | | |
| Sulfate | 0.05653 | 0.466371 | 0.466371 | 0.238205 | 0.345498 | 1 | | | | | | | | | |
| Phosphate | 0.34134 | 0.281846 | 0.281846 | 0.0288 | 0.149556 | 0.435268 | 1 | | | | | | | | |
| Calcium | 0.313019 | 0.792004 | 0.792004 | 0.687244 | 0.66274 | 0.398245 | 0.50682 | 1 | | | | | | | |
| Magnesium | 0.153189 | 0.327259 | 0.327259 | 0.056629 | 0.698089 | 0.073927 | 0.097075 | 0.07353 | 1 | | | | | | |
| Chloride | 0.03891 | 0.54894 | 0.54894 | 0.308358 | 0.687786 | 0.272091 | 0.469958 | 0.334228 | 0.596446 | 1 | | | | | |
| Fluoride | 0.33466 | 0.542266 | 0.542266 | 0.723254 | 0.404143 | 0.147811 | 0.306475 | 0.567059 | -0.00374 | 0.508366 | 1 | | | | |
| Sulphate | 0.01833 | 0.54394 | 0.54394 | 0.464996 | 0.319666 | 0.613607 | 0.422731 | 0.376351 | -0.05403 | 0.185365 | 0.458294 | 1 | | | |
| DO | 0.01406 | 0.462529 | 0.462529 | 0.049261 | 0.419349 | 0.330337 | 0.230518 | 0.421677 | 0.368484 | -0.04591 | -0.20254 | 0.247531 | 1 | | |
| COD | 0.38115 | -0.24472 | -0.24472 | -0.17118 | -0.14893 | 0.048467 | 0.314898 | -0.16604 | -0.30603 | 0.05264 | 0.0985 | 0.067537 | -0.36739 | 1 | |
| BOD | 0.013887 | 0.48325 | 0.48325 | 0.104526 | 0.463938 | 0.140134 | 0.332193 | 0.424774 | 0.211657 | 0.113164 | -0.20999 | 0.06709 | 0.694559 | 0.14935 | 1 |

Table 5: Statistical Analysis of Jangareddygudem Mandal In Rainy Season

| NAME OF THE PARAMETER | MIN | MAX | MEAN | S.D | CV |
|-----------------------|-------|-------|----------|----------|----------|
| pH | 6.51 | 8.29 | 7.355 | 0.522222 | 7.100291 |
| EC | 200 | 1000 | 555.5556 | 225.4987 | 40.58977 |
| TDS | 128 | 640 | 355.5556 | 144.1192 | 40.58977 |
| Turbidity | 0 | 1 | 0.055556 | 0.215702 | 424.2641 |
| Alkalinity | 30 | 192 | 148.7778 | 85.11281 | 57.22145 |
| TH | 50 | 185 | 116.6667 | 78.99472 | 71.42405 |
| Sodium | 8 | 80 | 18.97222 | 22.01806 | 56.54811 |
| Potassium | 2.6 | 15.5 | 8.616667 | 4.010717 | 46.41825 |
| Calcium | 8 | 48 | 27 | 11.06664 | 40.98757 |
| Magnesium | 6.09 | 21.14 | 11.97611 | 4.244568 | 35.44195 |
| Chloride | 1.5 | 89.2 | 51.29444 | 26.65625 | 51.96714 |
| Flouride | 0.019 | 0.118 | 0.186811 | 0.117416 | 94.97007 |
| Sulphate | 11 | 49 | 29.55556 | 11.19991 | 37.89442 |
| DO | 1.6 | 10.4 | 5.111111 | 1.440588 | 28.0614 |
| COD | 1.2 | 44.8 | 22.42222 | 10.87812 | 48.51491 |
| BOD | 0.4 | 2.4 | 1.555556 | 0.529197 | 34.01268 |

Table 6: Statistical Analysis of Jangareddygudem Mandal In Winter Season

| NAME OF THE PARAMETER | MIN | MAX | MEAN | S.D | CV |
|-----------------------|-------|-------|----------|----------|----------|
| pH | 6.8 | 8.35 | 7.691667 | 0.78801 | 5.044817 |
| EC | 100 | 1200 | 700 | 242.5156 | 34.64795 |
| TDS | 192 | 768 | 448 | 155.2228 | 34.64795 |
| TURBIDITY | 0 | 5 | 0.111111 | 1.188177 | 156.4511 |
| ALKALINITY | 62 | 160 | 202.4444 | 98.8845 | 48.84525 |
| TH | 60 | 210 | 137.5 | 41.91144 | 31.95159 |
| SODIUM | 8 | 91 | 47.16667 | 21.14214 | 49.06462 |
| POTASSIUM | 4.1 | 14.8 | 8.494444 | 1.781267 | 19.81269 |
| CALCIUM | 16 | 58 | 28.82222 | 12.61668 | 38.41945 |
| MAGNESIUM | 1.22 | 28.01 | 11.50611 | 8.016115 | 59.49924 |
| CHLORIDE | 3.58 | 114 | 35.71056 | 31.10659 | 91.216 |
| FLOURIDE | 0.014 | 1.53 | 0.151222 | 0.185272 | 109.6947 |
| SULPHATE | 14 | 52 | 30.44444 | 10.52291 | 34.56416 |
| DO | 1.6 | 8 | 4.411111 | 1.027724 | 23.29989 |
| COD | 0 | 32.6 | 6.7 | 9.018545 | 134.9017 |
| BOD | 0.4 | 4 | 1.766667 | 1.144295 | 64.77141 |

The statistical data of water quality parameters in Two seasons are shown in the table no's 5,6 which gives the method for determination of criteria of accuracy and precision.

Table 6: Comparison of Ground water sample to Indian Standards

| S.NO | PARAMETER | DESIRABLE LIMITS | PERMISSIBLE LIMITS |
|------|-------------------------------|------------------|--------------------|
| | TDS | 500 | 2000 |
| | TH | 300 | 600 |
| | TA | 300 | 600 |
| | Ca | 75 | 150 |
| | Mg | 35 | 75 |
| | Na | - | - |
| | K | - | - |
| | Cl ⁻ | 250 | 1000 |
| | F ⁻ | 1.0 | 1.5 |
| | SO ₄ ²⁻ | 200 | 400 |

7. CONCLUSIONS:

From the above Tables We can conclude that In the Jangareddygudem Mandal we are analyse 18 sample. The pH values of the Both the season are with in desirable limits. Ec values in winter season are somewhat higher than the Rainy season. Alkalinity, Hardness Sodium, potassium ,Chloride values of both the season are close to each other which are in desirable limits .The fluoride values of winter season is high when compare to Rainy season. The quality of Ground water sources in the jangareddygudem Mandalare suitable for Drinking.

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