# Relationship Between Land use and Water Quality in Salem City, Salem District

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## Abstract

Drinking water quality is crucial for human beings by means of sustainability, nevertheless, human activities adversely affect the water resources. Especially in drinking watersheds, extreme developments and lack of infrastructure system interfere with the quality and quantity of drinking water as these are strongly dependent on the land use types. Furthermore, the role of land use types on water sustainability should be investigated to avoid present and future problems like flood, drought and water contamination. In this study, Salem is selected as the study site, where is a great potential of population growth and an increase tendency in the residential and commercial areas. The aim of this study is to investigate the impact of land use change on water quality in Salem city.Several physical and chemical parameters were tested in the collected 25 samples, these includes pH, turbidity, chloride, iron, sulphate, TDS, Hardness, from the result it shows that, the groundwater must be taken to treatment before intake.

**Keywords: Physio-Chemical Analysis, Groundwater samples, Land use and Salem**

## I. INTRODUCTION

Understanding and modeling water quantity and quality is crucial to protect and use water resources effectively. It is well known that water is used extensively in urban areas for the disposal of wastes. Therefore, water can also have some problems due to impacts of human activities. These problems increase in urban catchments when direction of natural stream beds and impervious areas change in the watershed. Especially in urban catchments, water resources are highly polluted with pathogenic, organic and inorganic substances that are a public health threat. Typical pollutants include Total dissolved Solid (TDS), nutrients such as chloride (CL) and sulphate ($SO_4$), iron (Fe), pathogenic organisms and trace metals. And water gradually becomes insufficient due to contamination and extreme usage with increasing population, rapid urbanization and development of industrial and agricultural facilities.Thus, human beings are faced not only with the water quantity problems but also with the water quality problems.For this reason, land use type plays a major role in determining the water quality and quantity of surface waters, which frequently contribute to drinking water sources in many areas.

## II. STUDY AREA

Salem District is one of the land locked Districts in Tamilnadu. It is bounded on the North by Dharmapuri district, on the South by Namakkal district, on the West by Erode district and, on the East by Villupuram district . The elevation of landscape generally ranges from 500 ft to 1200 ft. above MSL with the exception of Yercaud which is at 5000 ft. above MSL. The Geographical area of the district is 520530 Ha.

The geographical extension is North Latitude Between 11 14` and 12 53` East Longitude Between 77 44` and 78 50`. The district has 4 Revenue divisions, one corporation and 3 municipalities. There are 20 Panchayat unions in the district as on 1996-97.Salem is a city and a corporation in Salem district in the Indian state of Tamil Nadu, located in the north central part of the southernmost state of India. It is the 5th largest Municipal Corporation and Urban agglomeration in Tamil Nadu next to Chennai, Coimbatore, Madurai and Trichy.Salem is a part of the Kongu Nadu, an ancient division of Tamilakam comprising the western Tamil Nadu. Almost completely surrounded by hills, Salem is at the base of the renowned tourist destination of Yercaud hills, which offers breathtaking views both along the ride up the hill and from the peak. There are also remote sites of beauty such as Kiliyur falls and Kavery peak. Yercaud is at an altitude of 1600 m above mean sea level.

## III. COLLECTION OF WATER SAMPLES

Ground water samples were collected from 25 bore wells at various locations in the salem city during February 2016. Ground water sample were collected in white polythene container of one litre capacities as per standard procedure. The samples should reach the lab within 48 hours from the time of collection.

## IV. ANALYSIS

Ground water sample was analyzed to determine the hydrogen ion concentration (pH) was measured using pH meter. Total Dissolved Solids (TDS) were computed by multiplying the EC by a factor 0.7. Total Hardness (TH) as CaCO3 and Calcium (Ca) were analyzed titrimerically, using standard EDTA.Chloride (Cl) was estimated by standard AgNO3 titration, sulphate (SO4), were analyzed using a colorimeter. The results were compared to WHO and BIS standards.

## V. RESULT AND DISCUSSION

### *A. Land Use/Land Cover from (2000-2016):*

Table – 1
land use and land cover from 2000 - 2016

| *Class* | *2000 (Acers)* | *2016 (Acers)* | *Area change (2000-2016) (Acers)* | *Change (%)* |
|---|---|---|---|---|
| *Urban* | *4249.65* | *5616.58* | *1366.93* | *+32.17* |
| *Sub urban* | *6989.60* | *8410.33* | *1420.73* | *+20.32* |
| *Com and Industrial* | *649.17* | *758.48* | *109.31* | *+16.83* |
| *Roads* | *492.16* | *787.88* | *295.72* | *+60.08* |
| *Mining activities* | *262.38* | *492.82* | *230.44* | *+87.82* |
| *Crop & Plantation* | *3501.60* | *3158.52* | *343.08* | *-9.79* |
| *Land with shrub* | *4288.81* | *1746.26* | *2542.55* | *-59.28* |
| *Scrub forest* | *1014.34* | *1069.22* | *54.88* | *+5.41* |
| *Fallow land* | *736.34* | *355.62* | *380.72* | *-51.70* |
| *Tanks* | *203.82* | *292.86* | *89.04* | *+43.68* |
| *River* | *71.38* | *63.52* | *7.86* | *-11.01* |
| *Barren rocky surface* | *1559.84* | *1268.36* | *291.48* | *-18.68* |
| *Total* | *24019.6* | *24019.6* | | |

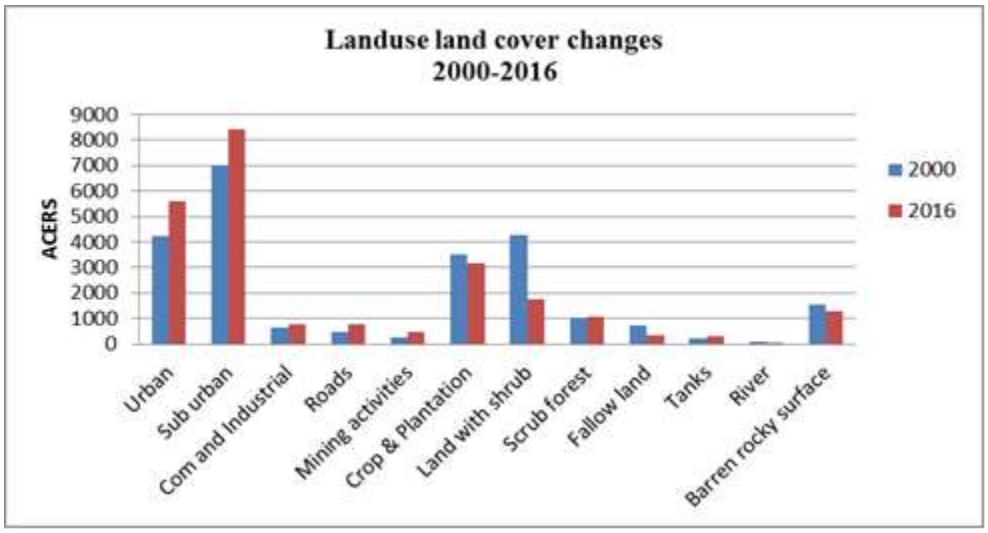



Fig. 1: Land use/land cover change

*1) Urban*

The urban area was occupied with 4249.65 acres and 5616.58 acres in 2000 and 2016 respectively. The total change of urban areas with built-up was 1366.93 acres with the increase of 32.17% in 16 years of period. The peripherals and urban fringe have turned as urban and hence urban area is extended.

*2) Sub-urban*

The sub-urban area was 6989.60 acres in 2000 and it had increased to 8410.33 acres in 2016 with the change of 1420.73 acres in 16years with increase of 20.32%. The growth of Sub-urban area is except in the northern part the city and particularly leaving the mining area, all other area concentrated.

*3) Commercial and industry*

There has been increased in the Commercial and industrial activity as the part of urbanization. The area occupied was 649.17 acres and 758.48 acres in 2000 and 2016 respectively with the increase of 109.31 acres and it increase of 16.83%. Urban or core area of the city has occupied more commercial and industrial complexes in urban areas than sub-urban areas.

*4) Roads*

There has been increased in roads with area of 295.72 acres with 60.08% during the period of 2000 and 2016. It was occupied 492.16 acres in 2000 and in 2016 and it has reached to 787.88 acres. During this decade 2000-10 national highway is widened with

six lane track under the prime ministers plan. The number of service roads for national highway is also constructed as the result it is found the increase of road area.

*5) Mining Activities*

It has been increased during the period of 2000 and 2016 it was 230.44 acres and it increase of 87.82% among the classification to dedicate the mining activities for the great demand of minerals in and around the district. It was occupied 262.38 acres in 2000 and in 2016 it was 492.82 acres. This increase is found that the same mining area is extended due to mining activities and hence the area is increased.

*6) Crop land and plantation*

The analysis reveals that the crop land and plantation part has been decreased with 9.79% and it was 3501.60 acres in 2000 and in 2016 it was 3158.52 acres with the total change of 343.08 acres as the result of migration of rural people, working community occupancy and educational institution establishments. These are cause of high land value and government policy. The area includes in this category are Arisipalayam, Narasothipatti, Vellakaipatti, Gorimedu,Chinnathirupathi area and Seelanaickenpatti area

*7) Land with shrub*

It has been decreased in the land with shrub area of 2542.55 acres with 59.28% which was occupied 4288.81 acres in 2000 and in 2016 and it was 1746.26 acres. The area includes in this category are Northern of city bound, Seelanaickenpatti area and the way to Mellur road.

*8) Scrub forest*

The analysis reveals that the scrub forest was occupied 1014.34 acres in 2000 and in 2016 it was 1069.22 acres with the increase of 54.88 acres with the low rate of 5.41% during this period. This found around the Seelanaickenpatti and northern of city peripherals.

*9) Fallow land*

The table reveals that the fallow land had decreased 380.72 acres with 51.70 % and it was occupied 736.34 acres in 2000 and in 2016 it was 355.62 acres during this period. This category is mostly found in between Vellakaipatti and Gorimedu.

*10) Tanks*

The part of the tank occupied area was increased of 89.04 acres and it increase of 43.68%.The actual area was 203.82 acres in 2000 and in 2016 it was 292.86 acres. The increase is due to the pressure of urban need which leads the state government aided constructions were set up more tanks. This is mostly found in Ammapeti, Udyapatti, Chinnathirupathi,Narasothipatti and Burns colony.

*11) River*

The analysis reveals that river occupied area is 71.38 acres in 2000 and it was only 63.52 acres in 2016.The actual change area is 7.86 acres of decrease with 11.01%. The area of decrease is cause of urban occupancy.

*12) Barren rocky surface*

It has been decreased with an area of 291.48 acres of 18.68% from 2000 to 2016.The occupied area was 1559.84 acres in 2000 and it was 1268.36 acres in 2016. The change area is occurred due to new educational institutions and emergence of small scale industries too. This category area includes are Vellakaipatti, North of Burns colony,West Gorimedu and Chetichavadi area.

### *B. Water quality from (2000-2016)*

To identify the characteristics of the study area 25 samples were collected & the analysed result for the 25 samples is shown in table 2.

Table – 2
Physicochemical Characteristics of Groundwater Sample.

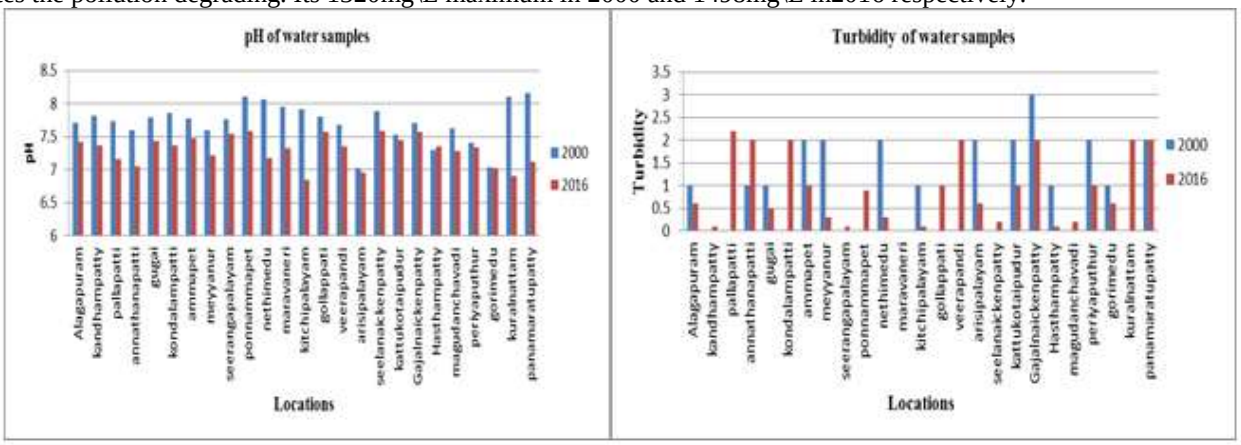
| S.no | Locations | pH | | Turbidity (NTU) | | TDS (mg/L ) | |
|---|---|---|---|---|---|---|---|
| | | 2000 | 2016 | 2000 | 2016 | 2000 | 2016 |
| 1 | Alagapuram | 7.71 | 7.42 | 1 | 0.6 | 525 | 670 |
| 2 | Kandhampatty | 7.82 | 7.37 | 0 | 0.1 | 746 | 825 |
| 3 | Pallapatti | 7.73 | 7.16 | 0 | 2.2 | 715 | 530 |
| 4 | annathanapatti | 7.6 | 7.05 | 1 | 2 | 380 | 605 |
| 5 | gugai | 7.79 | 7.43 | 1 | 0.5 | 1519 | 750 |
| 6 | kondalampatti | 7.86 | 7.36 | 0 | 2 | 497 | 1010 |
| 7 | ammapet | 7.77 | 7.47 | 2 | 1 | 1299 | 870 |
| 8 | meyyanur | 7.6 | 7.22 | 2 | 0.3 | 1896 | 770 |
| 9 | seerangapalayam | 7.76 | 7.55 | 0 | 0.1 | 1103 | 925 |
| 10 | ponnammapet | 8.11 | 7.59 | 0 | 0.9 | 466 | 965 |
| 11 | nethimedu | 8.06 | 7.17 | 2 | 0.3 | 1139 | 885 |
| 12 | maravaneri | 7.96 | 7.32 | 0 | 0 | 648 | 505 |
| 13 | kitchipalayam | 7.91 | 6.85 | 1 | 0.1 | 216 | 860 |
| 14 | gollappati | 7.81 | 7.57 | 0 | 1 | 1421 | 1140 |
| 15 | veerapandi | 7.68 | 7.35 | 0 | 2 | 711 | 720 |
| 16 | arisipalayam | 7.02 | 6.96 | 2 | 0.6 | 990 | 500 |
| 17 | seelanaickenpatty | 7.89 | 7.58 | 0 | 0.2 | 1052 | 825 |
| 18 | kattukotaipudur | 7.53 | 7.45 | 2 | 1 | 2430 | 915 |

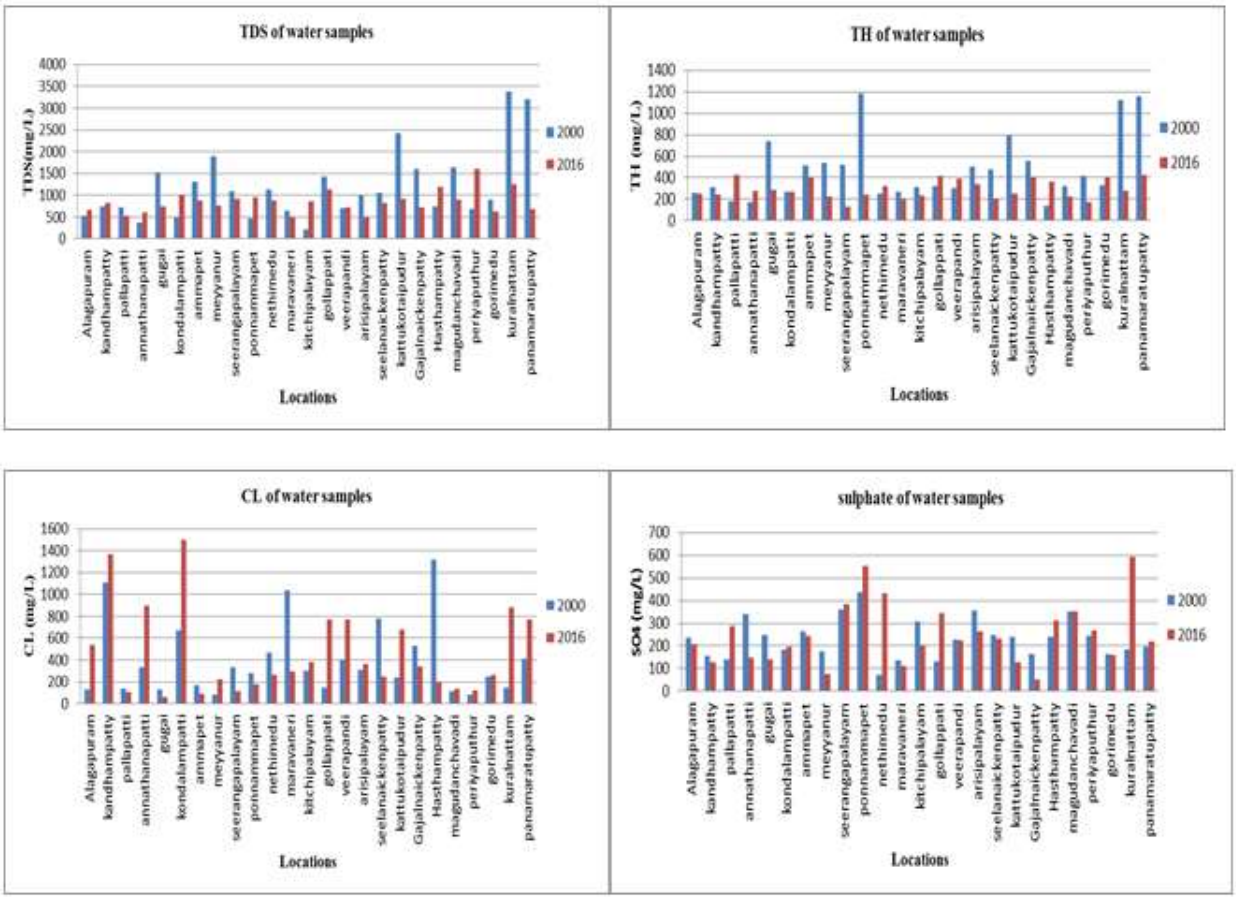
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *19* | *Gajalnaickenpatty* | *7.71* | *7.57* | *3* | *2* | *1603* | *715* |
| *20* | *Hasthampatty* | *7.3* | *7.35* | *1* | *0.1* | *735* | *1200* |
| *21* | *magudanchavadi* | *7.63* | *7.28* | *0* | *0.2* | *1640* | *900* |
| *22* | *periyaputhur* | *7.4* | *7.34* | *2* | *1* | *681* | *1600* |
| *23* | *gorimedu* | *7.04* | *7.02* | *1* | *0.6* | *889* | *630* |
| *24* | *kuralnattam* | *8.1* | *6.9* | *0* | *2* | *3376* | *1250* |
| *25* | *panamaratupatty* | *8.16* | *7.12* | *2* | *2* | *3203* | *690* |

Table – 3
Physicochemical Characteristics Of Groundwater Sample.

| *S.no* | *Locations* | *TH (mg/L)* | | *Chloride (mg/L)* | | *Sulphate (mg/L)* | | *Iron (mg/L)* | |
|---|---|---|---|---|---|---|---|---|---|
| | | *2000* | *2016* | *2000* | *2016* | *2000* | *2016* | *2000* | *2016* |
| *1* | *Alagapuram* | *264* | *255* | *128* | *533.4* | *237* | *208.98* | *0.2* | *0.1* |
| *2* | *Kandhampatty* | *316* | *246.5* | *1110* | *1364* | *156* | *126.7* | *1.8* | *0* |
| *3* | *Pallapatti* | *180* | *425* | *140* | *106.7* | *140* | *286.32* | *0.6* | *0.5* |
| *4* | *Annathanapatti* | *172* | *280.5* | *332* | *900.78* | *342* | *148.09* | *0.8* | *0* |
| *5* | *Gugai* | *740* | *289* | *132* | *62.03* | *250* | *141.52* | *0* | *0* |
| *6* | *Kondalampatti* | *268* | *272* | *670* | *1498* | *183* | *194.17* | *0* | *0* |
| *7* | *Ammapet* | *512* | *403.75* | *168* | *86.85* | *265* | *243.54* | *0.6* | *0.2* |
| *8* | *Meyyanur* | *540* | *221* | *84* | *225.35* | *176* | *75.69* | *0.2* | *0.2* |
| *9* | *Seerangapalayam* | *520* | *127.5* | *336* | *111.67* | *360* | *385.05* | *0* | *0* |
| *10* | *Ponnammapet* | *1184* | *246.5* | *276* | *173.71* | *438* | *552.89* | *0* | *0.1* |
| *11* | *Nethimedu* | *252* | *318.75* | *470* | *260.55* | *70* | *431.95* | *0.1* | *0* |
| *12* | *Maravaneri* | *272* | *195.5* | *1040* | *292.82* | *136* | *113.54* | *0* | *0.4* |
| *13* | *Kitchipalayam* | *312* | *238* | *304* | *379.67* | *310* | *202.39* | *0* | *0* |
| *14* | *Gollappati* | *320* | *416.5* | *148* | *774.23* | *132* | *342.26* | *0.4* | *0* |
| *15* | *Veerapandi* | *304* | *390* | *396* | *769.26* | *230* | *224.61* | *0* | *0.2* |
| *16* | *Arisipalayam* | *504* | *340* | *310* | *362.3* | *356* | *265.75* | *0* | *0.3* |
| *17* | *Seelanaickenpatty* | *480* | *195.5* | *776* | *248.15* | *248* | *232.01* | *0* | *0.2* |
| *18* | *Kattukotaipudur* | *790* | *255* | *240* | *679.93* | *241* | *128.35* | *0.3* | *0* |
| *19* | *Gajalnaickenpatty* | *560* | *405* | *532* | *342.45* | *164* | *52.65* | *0.4* | *0* |
| *20* | *Hasthampatty* | *136* | *361.25* | *1320* | *203.48* | *240* | *312.64* | *0.2* | *0.2* |
| *21* | *Magudanchavadi* | *320* | *221* | *116* | *138.96* | *352* | *350.49* | *0* | *0* |
| *22* | *Periyaputhur* | *419* | *170* | *80* | *119.12* | *243* | *268.22* | *0.1* | *0.1* |
| *23* | *Gorimedu* | *332* | *408* | *248* | *260.5* | *165* | *157.97* | *0.3* | *0* |
| *24* | *Kuralnattam* | *1120* | *276.25* | *144* | *883.42* | *182* | *592.38* | *0.5* | *0* |
| *25* | *Panamaratupatty* | *1162* | *425* | *410* | *769.27* | *194* | *220.5* | *0.1* | *0* |

The summarized results are shown in the above table for groundwater .all parameters are clearly intimated about the water quality.pH is an important parameter to distinguish between acidic and basic nature . pH was ranged from 7.02 to 8.16 in 2000 and 6.85 to 7.59 in 2016 respectively .It shows the pH values is within the permissible limits. Turbidity is caused due to presence of suspended matter, clay silt, colloidal organic particles and other microscopic organisms. In our study area turbidity is found to be minimum of 0.1 NTU in 2000 and 0.1 NTU in 2016 respectively. T.D.S is a measure of the solid material dissolved in water .this includes salts , some organic materials , and a wide range of other materials from nutrients to other materials , in the present study area TDS ranged between 216mg\L to 3376mg\L in 2000 and 500mg\L to 1600mg\L in2016 respectively.Chloride level of water indicates the pollution degrading. Its 1320mg\L maximum in 2000 and 1498mg\L in2016 respectively.






## VI. CONCLUSION

A study of the groundwater quality analysis of Salem city shows that it is not fit for drinking purposes with respect to the highly pollution of groundwater. The groundwater sources, once get polluted, the effects of the pollutants may persist for longer duration. Ground water forms the major source of drinking water supply in the municipal area of Salem city. Hence, people consuming it are prone to health hazards. Therefore, an effective water quality management plan is needed for the Salem district. Also, an attempt is made to improve the groundwater quality in Salem city.

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