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Environmental Impact Assessment on Noyyal River Basin Special Reference to Water Quality

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I. INTRODUCTION

Our country is in the throes of rapid industrialization, which is often accompanied with massive environmental and social burdens, principally borne by communities living in the vicinity of project sites. Monitoring tools like Environment Impact Assessment (EIA), therefore, assume great significance in ensuring sound economic development without compromising on environmental and social costs. Environment Impact Assessment or EIA can be defined as the study to predict the effect of a proposed activity/project on the environment. A decision making tool, EIA compares various alternatives for a project and seeks to identify the one which represents the best combination of economic and environmental costs and benefits.

By considering the environmental effects of the project and their mitigation early in the project planning cycle, environmental assessment has many benefits, such as protection of environment, optimum utilization of resources and saving of time and cost of the project. Properly conducted EIA also lessens conflicts by promoting community participation, informing decision makers, and helping lay the base for environmentally sound projects. Benefits of integrating EIA have been observed in all stages of a project, from exploration and planning, through construction, operations, decommissioning, and beyond site closure.

A. Indian Scenario

India is the country has the mixed economy in its path along with Agriculture and Industry. But, the nation has witnessed rapid industrial growth during the post liberalization period. Unfortunately, this rapid growth has caused environmental stress in certain regions of the country. Acceleration of industrial exports, especially during this globalization period has further aggravated the environmental problems, which has imposed social costs on many local communities. During the last decade, governments have passed different laws to control the environmental pollution caused by developmental activities. The State Pollution Control Boards are the regulatory agencies, which have been entrusted with implementing these laws. But in many cases these agencies have not been able to implement pollution control measures to the full extent, especially in respect of unorganized small industries, which are located in clusters. India has comparative advantage in certain export industries, such as cotton textiles, leather, etc. due to availability of raw materials and cheap labour. Often they are also 'water consuming' industries since they require large quantities of water for processing. These industries discharge the untreated or partially treated effluents on land or water bodies, which end up polluting the environment. In the initial stages the pollution levels from these units might be low, since the effluent load would be more or less within the assimilative capacity of the surrounding environment. Hence, the local public did not consider these industries to be a problem. But, the gradual increase in the effluent load in proportion with increased output which over takes the assimilative capacity of the environment has begun to have serious environmental impacts. On the other hand, these industries provide regional socio-economic benefits in the form of income, employment and foreign exchange in the sustainable manner. Since small industries have historically been promoted as a matter of industrial policy, the government agencies face a dilemma, in regulating the acute pollution problems caused by the small-scale sector. Therefore, it is necessary to devise appropriate strategies for the sustainable development of these regions. As a part of existing regulatory programs, a number of environmental management measures have been undertaken. However, there are few studies, which have made an assessment of the impact of pollution caused by these industrial clusters on the surrounding environment, and on the other economic sectors such as agriculture, which have been affected, by pollution.

B. Tamil Nadu State Scenario

Tamilnadu has witnessed great industrial growth after the independence era especially in the globalization economy particularly Iron and steel industries, Chemical industries, Leather industries and Textile industries and others.

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These industries created more employment opportunities and increased the GDP of the State. But on the other hand they exploited the nature for their cost. The wastes, which are cause and effect of these industries created more environment problems in their location region especially river basins like R. Cauvery, R. Palar and its tributaries. The effluents and wastes that are discharged into the river with high toxic chemicals polluted the river water and its basin. Consequently the whole environment gets effected and it reflects on the ground water, agriculture, animal husbandry and finally on public health.

II. STATE OF NOYYAL RIVER BASIN

The Noyyal river basin, Tamilnadu is an interesting case study for EIA. It has three different regions as agriculture dominating upper and lower basin while flourishing areas of spinning and weaving industries including the world famous "Baniyan City" Tiruppur in the middle basin.

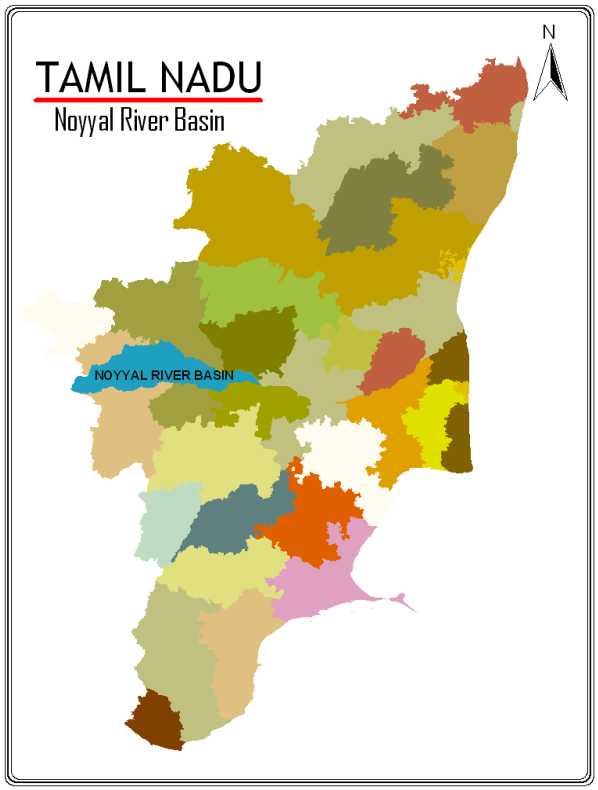


Figure-1 Study Area – Noyyal River Basin

Noyyal River basin located in Mid-West region of Tamilnadu State and made boundary with Kerala state (Figure-1). The whole basin falls under Tamilnadu State administrative area comprising Coimbatore, Erode and Karur Districts. The Noyyal river basin extended from 11.20' N to 11.00N and 77.00E to 77.56'E. Geographically this basin begins from Vellingiri hills, leeward side of Western Ghats and flows eastward and merges near Noyyal village with River Cauvari which also flows from the Western Ghats in the Madikere district, Karnataka and passes through Tamil Nadu and confluence with Bay of Bengal in Nagapattinam district of Tamil Nadu. It flows over a distance of 175 kilometers. The catchment area of the river is 3.49 lakh hectares.

The shape of the basin is like funnel, which is kept in horizontal position. The basin has large area in the northern side, it reduced gradually when moves towards the consequent river in the eastern direction(Figure-2 and 3). So the Noyyal river flows through eastern direction and confluences with river Cauvery at 11.04'N and 77.56'E. Both the south west and north east monsoon gives 400mm rainfall at moderate level at Noyyal river basin, because Tamilnadu is geographically located between Western and Eastern Ghats in either side. More than 100 villages are situated on both sides of the banks of River Noyyal throughout the course. Noyyal was the major source for irrigation, drinking water and domestic activities of the people living on both sides of the river and even for people living beyond 3 kms from the river.

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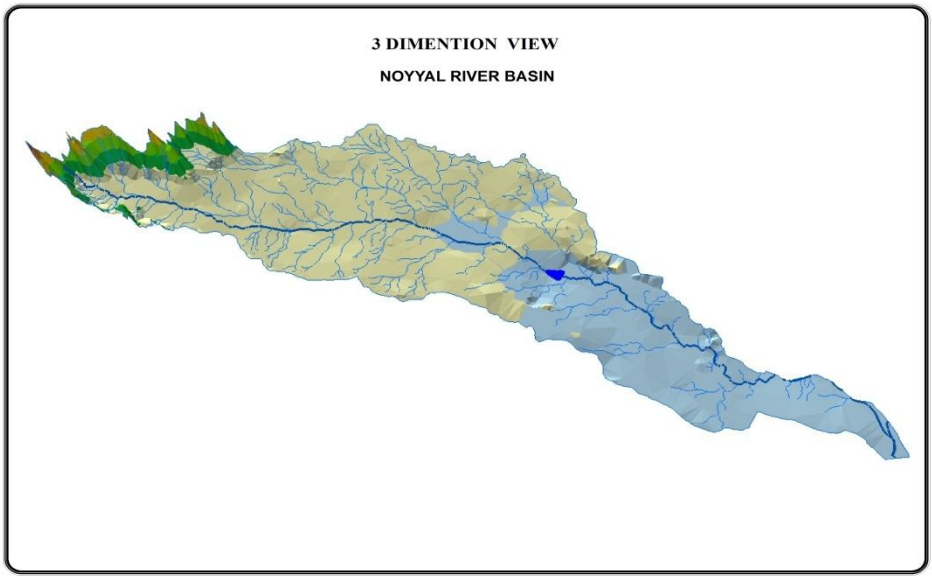


Figure-2

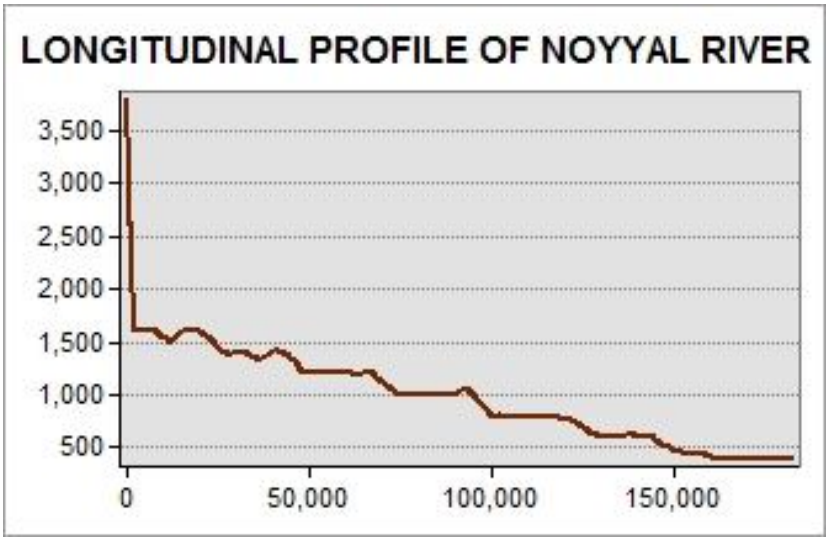


Figure-3

The primary activities of people in the basin are agriculture and animal husbandry. The secondary activity is yarn and cloth processing, knitting and dying.

The secondary activity polluted its surrounding in the Noyyal basin by its chemical effluents. So the environments of the land, surface and ground water get affected and also a declining trend in the primary sector. Consequently these changes affect the natural environment and put this area as desertification. Soil, surface and underground water also getting polluted and it gives adverse effect to animal and human health also.

So there is an urgent need to analyze the impact of pollution on the environment and public health in the Noyyal river basin. It is proved by some regional studies in and around the Tiruppur region. The present study made an attempt to analysis the environmental impact on Noyyal river basin as whole by direct field survey in the basin.

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III. METHODOLOGY

Using the Survey of India topographical maps (No. 43/4, 43/7, 43/8 and 44/1) and the Taluk map the study area have been used to demarcate the boundary of the basin, location of villages and industries and the digital database have been created. Special attention has been given to the growth and functioning of bleaching and dyeing activities in Tiruppur region since it is the source of the problem. This data was mainly collected from the Pollution control Board records and previous investigations.

A. Field Study

1) Water quality

To determine the general quality of the water in the basin a total of 38 water samples were taken. The basin separated with grid system by using topographic map and every sample taken from well or bore well. The following quality parameters were assessed by research scholar based on instruments and other methods specified below.

Table -1 Water quality parameters and methods

No.	Parameters	Method
1	PH	PH meter
2	EC	Conductivity meter
3	TDS	Conductivity meter
4	Na, K	Flame photometer
5	Sulphate	UV Spectrometer
6	DO	Wrinkler Method
7	Cyanide	Titration method
8	Chlorine	Titration method
9	Alkalinity	Titration method
10	Hardness	Titration method

2) Public Health

Since Noyyal River is seasonal in nature the ground water is the main source for the domestic and irrigation purpose in the villages, which are, located both side of the river. From the ground water analysis the result shows the water quality of the Noyyal river basin has been polluted in different scale in various locations. This pollution leads to the contamination of aquifer as well as water sources. So, the wells and bore well which are used by people for their domestic and agricultural purpose also supplies the same. Due to the usage of polluted water there is ill health to the public. Public health survey had been conducted in the field through a structured questionnaire to know the level of public health in the area. Face to face survey results are tabulated and analyzed through the statistical packages and also portrayed spatially. Based on the different level of pollution 4 Public Health centers were selected for the intense health survey. Here the diseases like Diarrhea; skin disease, asthma and fever are taken to count for study.

3) Agriculture

The quality of the irrigation water can be graded based on the method at U.S.S.L diagram. It gives the water quality gradation based on sodium absorption ratio and electrical conductivity. It gives gradation to the irrigation water suitability like highly suitable, moderately suitable and low suitable. Based on this result the damage in the agriculture is discussed. During the field visit land use pattern had been clearly observed and crop damages were recorded and documented.

4) Animal Husbandry

When the water is getting polluted it affects the animals which are grown in domestic, because animals also part of agricultural life and associated with environment. This impact had been assessed through the direct people survey in the affected areas. The veterinary doctors were also interviewed and discussed in the field.

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IV. TIRUPPUR DYING INDUSTRIES – AN OVER VIEW

Tiruppur and its surrounding areas are climatically semi-arid regions. So it provides agriculture opportunities for their lively hood in only a part of the year. So during the remaining dry seasons people moves towards the other opportunities. The climate of Coimbatore is very suitable for the growing of cotton. After realizing the availability of labour and raw material , the textile related industries began their era in the Tiruppur regions.

A. Reasons for Industrial Growth in Tiruppur

The emergence of the hosiery industry in Tiruppur and its contribution in knitting segment including export is highly appreciable. The transformation of Tiruppur from a 'village agrarian economy' to 'knitwear capital of India' is within a very short period of 3 to 4 decades. There are number of reasons behind this quick transformation, which include (a) climate and water (b) availability of good quality raw materials and labour, (c) infrastructural facilities, (d) industrial structure and its functions, (e) export culture etc.

B. Industrial Growth

The growth of cotton textile and textile product units in Tiruppur from 1980s is estimated with the help of data gathered for different periods shown in the Table-2 and Figure-4.

From 1994 onwards the industrial growth-trend was very rapid and the number of units increased to 12,521 during 2003. That is the growth of units between 1994 and 2003 (10 years) was 5,440. In brief the analysis on the growth of industrial units reveals that rapid growth occurred during the liberalization period of the 1990s.

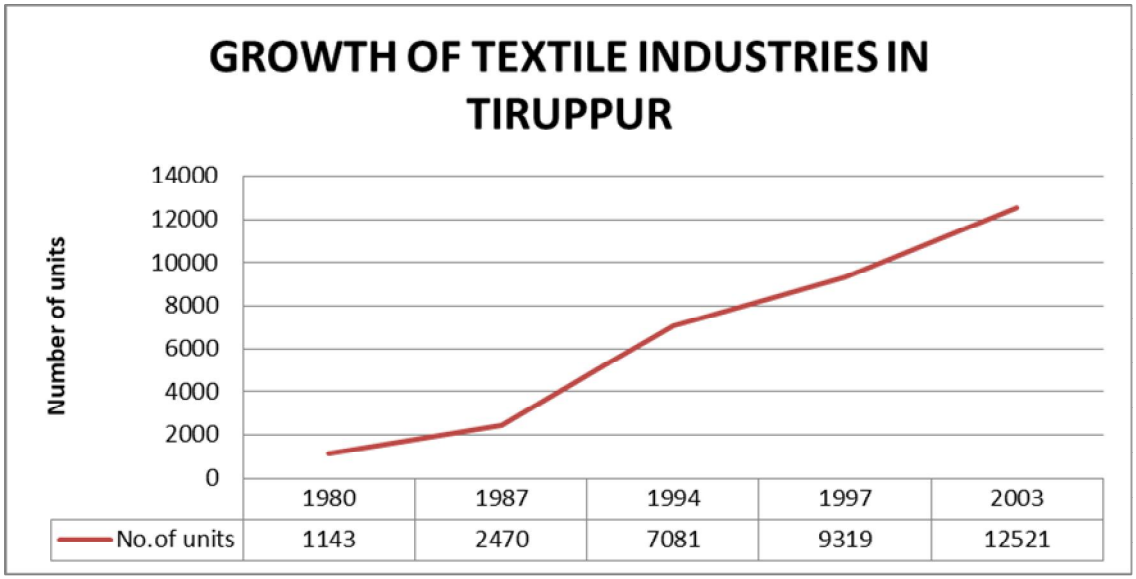


Figure-4

Table – 2 Growth of Textile Industries and Employment Generation in Tiruppur

Time Period	No. of Units	Rate of Increase	No. of persons Employed	Variation in Employment	Employment Per Units
1980	1,143	-	10,606	-	9
1987	2,470	132%	31,436	20,830	13
1994	7,081	461%	84,023	52,588	12
1997	9,319	31%	1,04,958	20,935	12
2003	12,521	34%	1,33,541	28,583	11

Source: Computed from SSI Directory and Directorate of Industry and Commerce, District Industrial Centre, Coimbatore.

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V. LOCATION OF INDUSTRY AND MODE OF EFFLUENT DISPOSAL

The physical location of the textile processing units in respect of effluent generation is important for the present study. Table-3 provides details regarding distribution of industry and effluent generation based on land use. From the data, it is evident that 77% of units are functioning in non-industrial area and they generate around 75% of the total effluents. Hence the possibility for contaminating the soils and ground water, in agricultural and residential area is very high. Since 239 units are located at a distance of less than 300 meters from the Noyyal riverbank, the potential for polluting the river is also high. The 424 units that have individual treatment plants discharge the effluent into Noyyal River, streams and irrigation land. Around 83% of the units are disposing their effluent in water bodies (18.27 MLD in Noyyal and 19.06 MLD in streams). 4.33 MLD effluent (9.05%) is discharged in industries on-land and 3.5 MLD (7.75%) is on irrigation land.

The above analysis on textile effluent during last two decades in Tiruppur clearly reveals the possibility of pollution accumulation and its impact at Tiruppur and downstream. This accumulation leads to environmental impact on the Noyyal river basin. This impact is the main purpose of this study.

Table – 3 Location of textile processing units and effluent generation

Sl. No.	Land use	No. of Units		Effluent Generation (KLD)	
		Actual	%	Actual	%
1	Industry	158	22.50	20,973	25.23
2	Agriculture	179	25.50	19,610	23.58
3	Residence	225	32.05	16,787	20.20
4	Public land	140	19.95	25,769	30.99
	Total	702	100.00	83,139	100.00

Source: Computed from PCB Data, 2000

A. Treatment Programme and Effluent Quality

As explained earlier, the 702 functioning units in Tiruppur treat their effluents through IETPs (424 units) and CETPs (278 units). At present 424 units have established IETPs that treat 45.16 MLD of effluents. The quality of the treated effluent is compared with untreated effluent and the effluent standard for bleaching, dyeing and bleaching & dyeing units respectively. The Pollution Control Board from the samples tested by the Board at different points in time obtained the average values of quality of the treated and untreated effluent.

From the table it is evident that there is substantial reduction in the concentration of COD, BOD and Oil &Grease and the treated effluents meet the PCB standard. In the case of Sulphate it's different. The untreated effluent itself meets the standard but the level does not decrease after treatment.

The TSS concentration in treated effluent shows a decrease for all 3 types units, but in most cases the effluent standard of 100 is not obtained. The TDS and Chloride levels remain unaffected after treatment, since there is no provision for removal of dissolved salt. Both TDS and Chloride level are far in excess of the respective effluent standard of 2100 and 1000 mg/l and are the primary cause of pollution in Noyyal River and its basin.

The details regarding the Common Effluent Treatment Plants, such as the location, area, registration date, number of units, water consumption, and effluent are given in Table-4.

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Table – 4 Status of common effluent treatment plant (cetps) in Tiruppur

S. No	Name of the CETP	Location (Village)	Area (Acres)	Date of Registration	No. of Units	Water Consumption (KLD)	Effluent (KLD)
1	Angeripalayam	Mannarai	4.53	28.9.94	79	7,653	**7,454**
2	Andipalayam	Andipalayam	1.50	28.9.96	23	5,066	**4,836**
3	Chennakarai	Veerapandi	2.45	28.8.94	35	5,119	**4,571**
4	Kasipalayam	Agrahara Periyapalayam	3.00	28.9.94	16	2,311	**2,201**
5	Kunnengalpalayam	Karaipudur	1.46	14.6.96	20	3,362	**3,222**
6	Manikapuram Pudur	Mudalipalayam	1.00	28.2.96	11	2,371	**2,351**
7	Mannarai	Mannarai	3.00	28.9.94	21	3,465	**3,394**
8	Veerapandi	Veerapandi	4.02	28.9.94	73	10,472	**9,950**
	Total		20.96		278	39,819	**37,979**

Source: Computed from PCB Data.

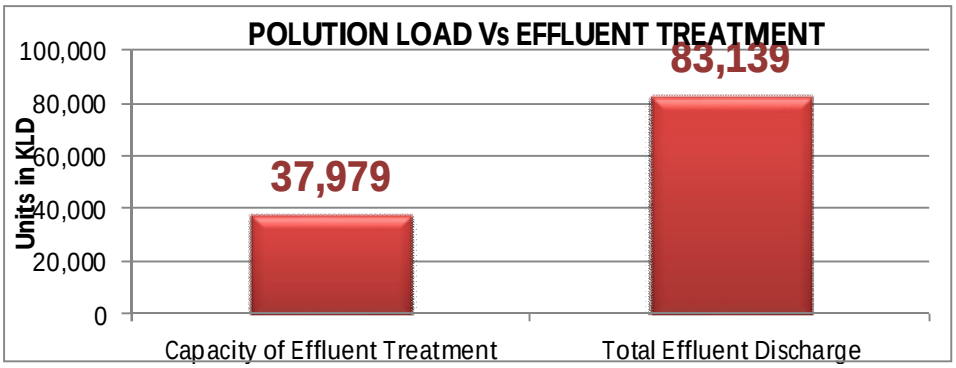


Figure-5

From the above analysis the following conclusions to be drawn :

1) The pollution load for all parameters increased over the period 1980-2000 due to the growth in the number of units and correspondingly high effluent generation and the low capacity of the effluent treatment plants leads to discharge of untreated effluents from the industries(Figure-5).

2) The possibility of accumulated pollution impact is very substantial in the case of TDS, Chloride and Sulphate. In the case of these three pollutants the discharged load concentration was very high and showed only a marginal decline after the effluent treatment plants were set up.

3) While TSS, COD, BOD and Oil & Grease load concentration increased over a period, they have reduced substantially after the introduction of treatment and also due to plant closure. However, the common effluent treatment plants do not seem to reduce the load significantly.

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VI. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

A. Impact On Water Resources

1) Surface Water

The Noyyal river water chemical composition tested by taking direct samples from it. The results tabulated below(Table-5).

The chemical composition of the Noyyal river water has drastic changes when moving from upstream to downstream. It can be identified easily by the colour comparision of the water samples(Plate.1). The table shows the middle stream has highest chemical composition compare with up and down stream. The upstream river has lowest level of pollution compare with the standard level on composition. This is shown by the table value of Mangalam and Marur samples. Moving to downstream, the pollution level of the river water increases geometrically. It shown by the hardness and alkaline values of the Kodumanal and Palayakottai samples. The chemical composition shows the river water influenced by the effluents which are untreated. This is evidenced by the composition of total dissolved solids, Sulphate, Cyanide and Chloride in the river water. In the down stream the composition of the same chemicals decreasing while the river moving away from Tiruppur region. This evidence proves that only the untreated effluents of the Tiruppur processing industries pollute the middle river stream.



Plate :1 Comparison of Noyyal River water between upstream and downstream.

2) Ground Water Quality

Groundwater contamination is the result of polluted water infiltrating through the soil and rock and eventually reaching the groundwater. The quality of ground water throughout the basin is not homogeneous. It is heterogeneous. This is mainly because of insufficient treatment of wastewater from industries and households that are located on the basin. The annexure-i will gives the chemical components availability, their sources and its level occurrence.

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Table – 5 Surface water quality of Noyyal River near Tiruppur

Sample No	1	6	9	29	31	34
Location	Mangalam ®	Marur ®	Kodumanal-pudur ®	Palayankottai ®	Velayutham Palayam®	Ichi palayam ®
Ph	8.25	7.78	7.71	7.72	7.60	7.65
Conductivity (mv)	67.7	36.4	39.4	44.1	36.4	39.2
Total Dissolved Solids (ppm)	1898	1593	6080	3480	2970	3114
Dissolved Oxygen (mg/lit)	4.8	0	0	3	4.2	2.6
Sulphate (ppm) So4	311.9	208	377	291	154	236
Cyanide (ppm)	0	0	0.0012	0.0012	0	0
Chloride (ppm)cl2	1071	1410	3013	1843	1914	1737
Hydroxide (OH)	0	0	0	0	0	0
Corbanate co3	39	0	73	70	45	247
Bi corbonate HCO3	298	273	602	575	367	440
Total	337	273	675	645	412	467
Ca as caco3	480	325	725	350	260	250
Ca Equivalent	198	130	290	140	104	100
Mg as caco3	489	450	1175	455	450	425
Mg equivalent	127	108	282	109	108	114
Total	969	775	1900	805	710	725
Sodium (Na) ppm	90	1250	1310	1115	985	970
Potassium (k) ppm	28	55	311	55	50	50

Source- Direct Sampling and Testing.

3) Pollution of Irrigation Water

Since a number of textile units which are located in the peripheral villages of Tiruppur have been discharging their untreated / partially treated effluents on land, the soil and ground water are highly contaminated. The available water quality data clearly indicates the evidence of ground water pollution in this region. Moreover, in these villages there is no external source of irrigation like the LBP / PAP systems. Farmers in these villages have irrigated their crops with ground water and local system tanks. But after the pollution problem emerged they are not in a position to continue / improve their agriculture. Although the pollution impact on agriculture has been known for some time, there is no comprehensive soil or water quality assessment report for the entire effected agricultural area for physical determining the extent of damage. Soils containing a large proportion of sodium with carbonate as the predominant anion are termed alkali soils; those with chloride or sulfate as the predominant anion are saline soils. Ordinarily, either type of sodium-saturated soil will support little or no plant growth. Sodium content is usually expressed in terms of percent sodium (also known as sodium percentage and soluble-sodium percentage), defined by

$$\% Na = \frac{(Na + K)100}{Ca + Mg + Na + K}$$

Where all ionic concentrations are expressed in milliequivalents per liter. The Salinity Laboratory of the U.S. Department of Agriculture recommends the sodium adsorption ratio (SAR) because of its direct relation to the absorption of sodium by soil. It is defined by

$$SAR = \frac{Na}{C\text{-}a\text{+-}M\sim g\text{-})/\text{-}2}$$

Where the concentrations of the constituents are expressed in milli-equivalents per liter.

It should be noted that human acts can markedly change the natural quality of groundwater(Table-6), usually for the worse. The resulting degradation of groundwater has become an important international concern.

Table -6 Quality classification of water for irrigation

			Boron, mg/l		
Water Class	Percent Sodium	Specific Conductance, µS/cm	Sensitive crops	Semi tolerant Crops	Tolerant Crops
Excellent	<20	<250	<0.33	<0.67	<1.00
Good	20-40	250-750	0.33-0.67	0.67-1.33	1.00-2.00
Permissible	40-60	750-2000	0.67-1.00	1.33-2.00	2.00-3.00
Doubtful	60-80	2000-3000	1.00-1.25	2.00-2.50	3.00-3.75
Unsuitable	>80	>3000	>1.25	>2.50	>3.75

Source-Ground Water Hydrology by David Keith Dodd

Based on the above discussion underground water samples are taken in the Noyyal river basin, tested in the laboratory and the test results are tabulated. Based on this analysis the quality of water in the Noyyal river basin is heterogeneous. So its usability also change based on its quality. To identify the possible usage of water for irrigation the USSL diagram method (David Keith Dodd) is followed(Figure-6 and 7) and tabulated(Table-7).

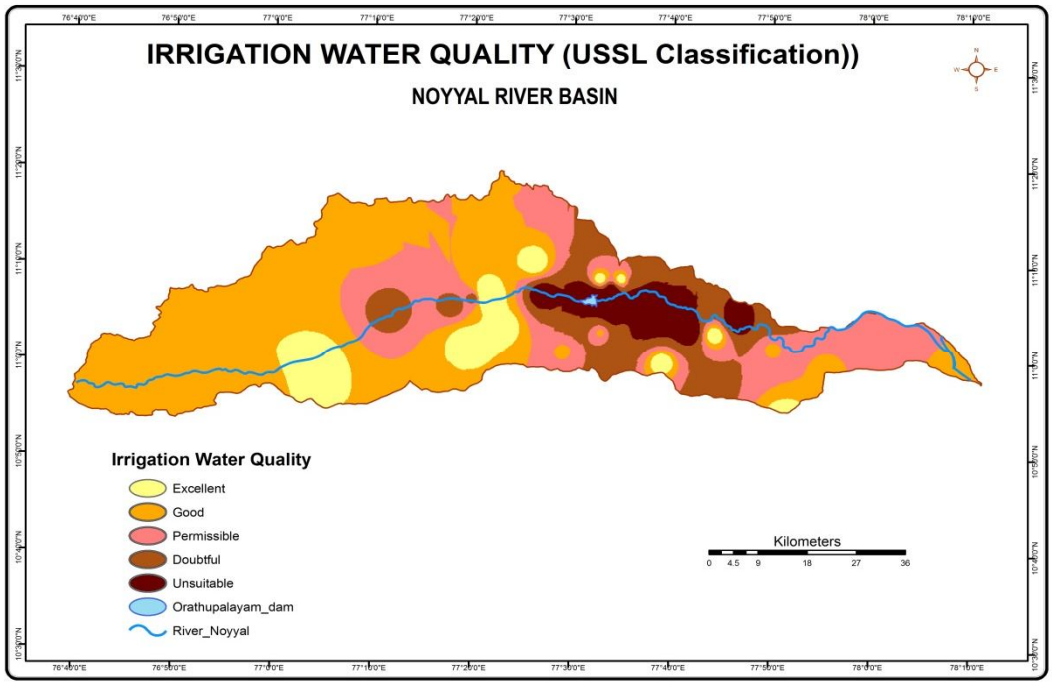


Figure-6 Irrigation water Quality

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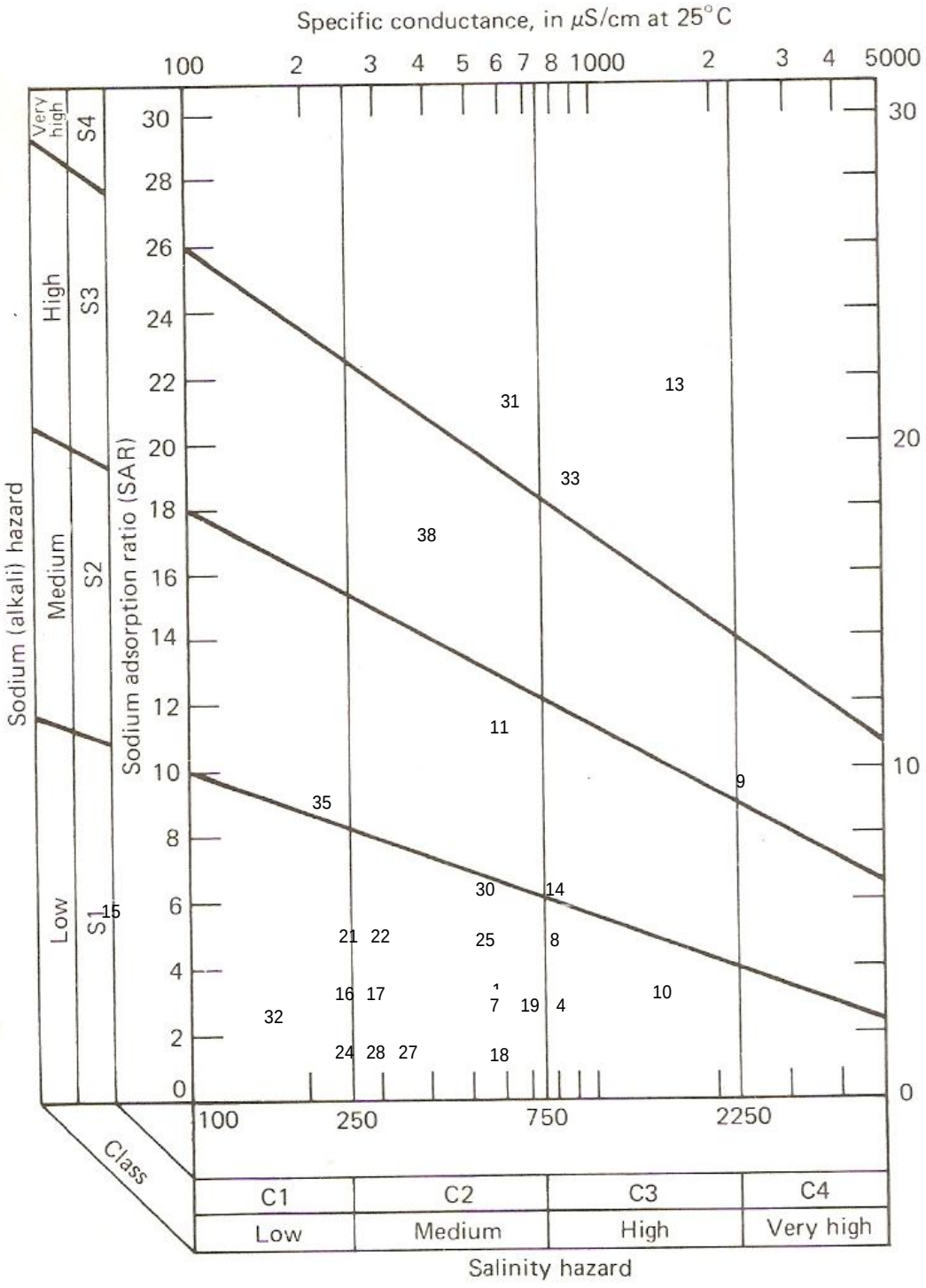


Figure-7 USSL Diagram- Suitability of irrigation water
(Status of under Ground water in Noyyal River Basin)

Table-7 Suitability of irrigation water

SUITABILITY	VILLAGES.
Excellent	Peelamedu, Somanur, Avinashi
Good	Chinniyankoil pirivu, Padiur, Sivagiriputhur, Pallar palayam, Muthur
Permissible	Vadakkalur, Ellapalayam, Peelamedu, Sevur, Maravan palayam, Kuppichi palayam
Doubtful	Tiruppur, Monthoppu, Chinnathandam palayam.
Unsuitable	Orathupalayam, Kodumanal, Palayakottai, Valayutham palayam, Ichipalayam.

VII. IMPACT ON AGRICULTURE

A. Cropping System in Noyyal River Basin

Agriculture is a major sector affected by textile pollution. Since the vast area has been affected to varying degrees in various ways, different approaches have to be used for environmental impact assessment. For convenience the study is restricted to the 4 villages that are selected through the USSL diagram which gives quality of irrigation water. Based on that Kodumanal, Chinnamuthur, Kumarapalayam and Avinashi are graded as very high, high, moderate and low polluted respectively. The study based on the people's participation.

B. Case Study

For getting more focused assessment of pollution impact on agriculture, 4 villages (Kodumanal, Chinnamuthur, Kumarapalayam and Avinashi) were selected for detailed study. Pattern of agriculture changed in the two decades considerably. After the pollution of river two important changes took place. That is

1) Quality of irrigation water changed
2) Fertility of the soil degraded.

Because of these changes the agriculture pattern now tremendously changed. In 4 villages, the total area cultivated during 1985-87 was 2808.3 ha., and it declined as 2006.2 ha. During 2001-02 (Table-8). The irrigated area declined sharply from 500 ha. to 144.6 ha. The rainfed area also showed a decline for 2308 ha. to 1861.6 ha.

Table –8 Agriculture status of case study villages in Tiruppur
(Area in Ha., Production Tonnes / Year)

Crop	Area			Production			Productivity		
	1985-87 (Average)	2001-02 (Average)	% Change	1985-87 (Average)	2001-02 (Average)	% Change	1985-87 (Average)	2001-02 (Average)	% Change
Paddy	60	-	- 100	177.2	-	- 100	2.95	-	- 100
Millet	13.9	-	- 100	21.1	-	- 100	1.58	-	- 100
Bajra/Jowar	2138.7	703.3	-67.1	356.8	131	- 63.28	0.17	0.19	11.5
Cotton	137.9	39.1	-71.65	301.7	59.5	- 80.28	2.2	1.5	- 30.59
Groundnut	38.7	13.6	-64.86	38.2	14.4	- 62.30	0.99	1.05	6.06
Greengram	76.2	48	-37.0	22.8	12.6	- 44.73	0.3	0.26	- 13.33
Blackgram	40.7	13.3	-67.32	9.2	1.2	- 86.96	0.23	0.09	- 60.87
Maize	42.7	10	-76.58	94.3	15.7	- 83.35	2.21	1.57	- 28.96
Ragi	13.3	-	-100	24.0	-	- 100	1.80	-	- 100
Cow Pea	33.0	30	-9.09	9.9	10.7	8.08	0.3	0.4	20.0
Tapioca	25.0	3.3	-86.8	4.3	2.77	- 35.58	0.17	0.84	38.8

Source **:** Computed from Agriculture Department Data.

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The summary of the discussion is provided below:

a) Before the emergence of textile pollution (1980) water quality in all local Systems tanks (all 4 villages have system tanks fed by the Noyyal River) were extremely good, hence it was a primary source of irrigation. Besides the ground water available in the villages was also of good quality and used for irrigation. But at present because of textile pollution both surface (tank) and ground water are unfit for irrigation. Hence the dependence of tank and wells has reduced substantially. Now the farmers are able to cultivate only rainfed crops in these villages.

b) Before the emergence of pollution, farmers in these villages cultivated crops like paddy, cotton, groundnut, banana etc. The water intensive crops have more or less disappeared from these villages, and farmers are cultivating rainfed crops like chollam, millets, jowar etc.

c) The soil quality was good in earlier years. But after irrigating with polluted water, soil quality deterioration has occurred. In earlier years, farmers used manure like cow dung, tree leaves etc. and very less amount of chemical fertiliser. Now the fertiliser consumption has increased substantially to compensate for the deteriorated soil quality. Still substantial improvement in production has not occurred.

d) After the emergence of textile pollution, area under cultivation, production and Productivity etc. have reduced considerably.

Thus, the impact of pollution is not much in evidence at the regional level but is very specific to the case study villages that are severely polluted. This is an indication that the impact of pollution varies substantially within the region. The focal groups discussion and opinion survey are also clearly substantiate the serious pollution impact on agriculture in the severely affected area.

VIII. IMPACT ON ANIMAL HUSBANDRY

A. Impact Assessment on Lives Stock

When the animal fodder cultivated through the polluted water, the pollutants and chemicals changes the quality of the fodder and some remnants are stored in the fodder also. In this fodder fed to the animals the health of animals severely effected. Sometimes the animals directly fed to the grasses which are grown in the river banks and dam outlet. The impact on animals assessed through the public interview and vetinary doctors in the selected locality. The farmers in the affected hamlets said that they had to decrease the number of animals. The reason for this was that it was not possible to grow enough feed for them and/or the farmers had to buy water or collect water far away from the farm. Some farmers also explained that they had to change animal species, e.g. cattle to goats. Some farmers still let the animals drink the contaminated water, which was sometimes mixed with good quality water, but in some cases the farmers complained that the animals often had Diarrhea. They also had a decrease in milk production or produced milk with a salty taste. Some farmers told us that a higher frequency of pregnant cows got still born calves. The appearance of the animals had also changed. The goats, for example, looked very unhealthy since they had started to lose their skin. The goats also gave birth to comparatively small kids and had colds more frequently than before the contamination. Some farmers also claimed that the animals would become sterile if they were to drink the water. Those farmers that still gave the contaminated water to the animals and had not yet seen any negative effects, as yet expressed their worries about what would happen to the animals in the near future.

B. Fisheries

Fisheries is another sector which is seriously affected by industrial pollution. Since the Orthapalayam reservoir is highly contaminated by the textile effluents from Tiruppur, the fisheries activities in the reservoir was affected and frequent fish mortality occurred.

C. Salient Findings from the Study

Before Pollution (Before 1997 app.)	After Pollution (After 1997 app.)
• Produced irrigated crops • Varities like paddy, cotton, groundnut, banana, etc. had been produced. . • Farmers used manure like cow dung, tree leaves etc. and very less amount of chemical fertiliser. • Fishing was carried out in Orathupalayam reservoir.	• Producing only rain fed crops. • Varities of rain fed crops like chollam, millets, jowar has been produced. • fertiliser consumption has increased substantially to compensate for the deteriorated soil quality. Still substantial improvement in production has not occurred. • Reduction in area under cultivation, production and Productivity etc. • Not conducive for fish growth.

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IX. PUBLIC HEALTH ASSESSMENT

The release of more or less untreated effluents from the textile industries in Tiruppur and the stagnation of the effluents in the Orathupalayam dam had resulted in a terrible situation for the people who lived close to the dam. Through the in-depth interviews, identified how people were affected, what help they had received and what they thought of the future for people in general and for different groups of people.

A. Quality of Drinking Water

Based on the analysis of ground water samples from Noyyal river basin the nature of ground water quality as shown below.

B. PH

The PH of the water is normally 7.3 in the upstream areas like Vadakalur and adjoining areas. It increases when moving towards middle stream in the Tiruppur and adjoining regions. It reaches maximum level of 8.14 in Mangalam area, which is the cluster of textile processing industries. The high level of PH 7.5 to and above is evidence that river water have highly affected by industrial effluents(Figure-8).

C. Total Dissolved Solids

The amount of solids dissolved in the water determines the chemical property of the water. The upstream area has less amount of TSS (775 ppm) in Vadakalur and it increases by moving towards middle stream (3700 ppm) in the Orathupalayam region. The maximum level of TSS is identified in Kodumanal areas, which is very near to the Orathupalayam dam. Again it reduces when moving to downstream, (Attupalayam – 616 ppm)(Figure-9).

D. Dissolved Oxygen

Dissolved Oxygen content is the important composition to decide the level of utilization of water. The O2 content is high in the upstream 8.2 mg / lit in the Ellapalayam area. But it reduces when moving towards middle stream because the intrusion of chemical effluents. The amount of O2 is empty in some places like Kodumanal and marur areas. Because in the middle stream area experiences highest level of effluent intrusion. In the down stream again it raises with the high of 8.1 mg/lit in Pudur region(Figure-10).

E. Sulphate and Chloride

Sulphate and chlorides are more important constituents to determine the quality of the water. The upstream Noyyal river basin has low level of sulphate and chloride (Vadakalur So4 28.6 ppm and Cl2 243 ppm). The level increases to maximum level moving towards the middle stream because of the high pollution due to textile effluents (Kodumanal SO4 270 ppm Cl2 2127 ppm). The down stream has low level of these constituents because it located far away from the Tiruppur region(Figure-11).

F. Alkalinity

The level of alkalinity is very low in the upstream areas for example Vadakalur has 330 ppm. But moving to down stream basin it increases maximum up to 602 in the Kodumanal region because of the chemicals intrusion from processing industries. Alkalinity consists of three components that are Hydroxide (OH), Carbonate (CO2) and Bi carbonate (HCO3). In these components Bi carbonate is the sole contribution and in some areas in the mid basin Carbonate contributes substantially and all the places Hydroxide is absent(Figure-12).

G. Hardness

Hardness is the very important property of the water to determine the nature of usability. Hardness also has the same level as that of Sulphate proceeds low, high and moderate in up stream, middle stream and down stream respectively. Lower level of 300 ppm found in Chinniyankoil koil pirivu and the highest 825-ppm in Kodumanal area. Here Ca and Mg both participate equally to determine the hardness of the Noyyal basin under ground water. This reveals that the effluents form the textile industries is the sole responsible for the highest level in middle region(Figure-13).

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H. Sodium and Potassium

Sodium and potassium are also important elements to determine the quality of the under ground water. The level of these constituents has high fluctuations compare with other elements. Lowest level found in upstream region of Somanur (Na- 50 ppm and K- 0 ppm), highest level of Sodium in Pudur (550 ppm) and Potassium in Montoppu (155 ppm) .

The above discussion reviles that the chemical composition of the under ground water in increases from lowest to high level when moving from upstream to middle steam. But it again reduces considerably while moving to down stream. It evidences that the effluents released by the processing industries in the Tiruppur region affect the middle noyyal river basin.

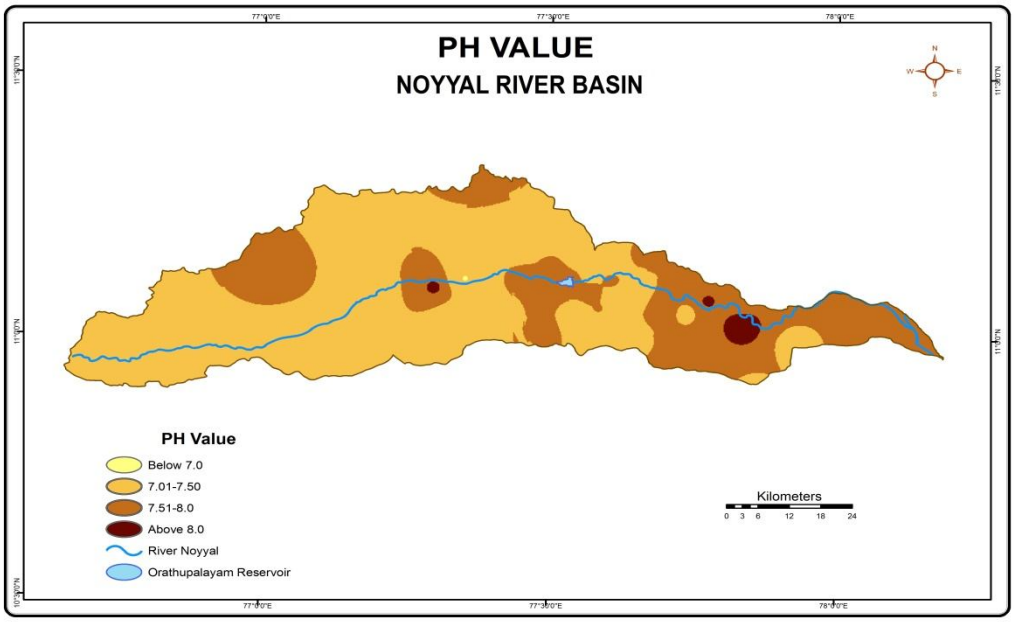


Figure-8

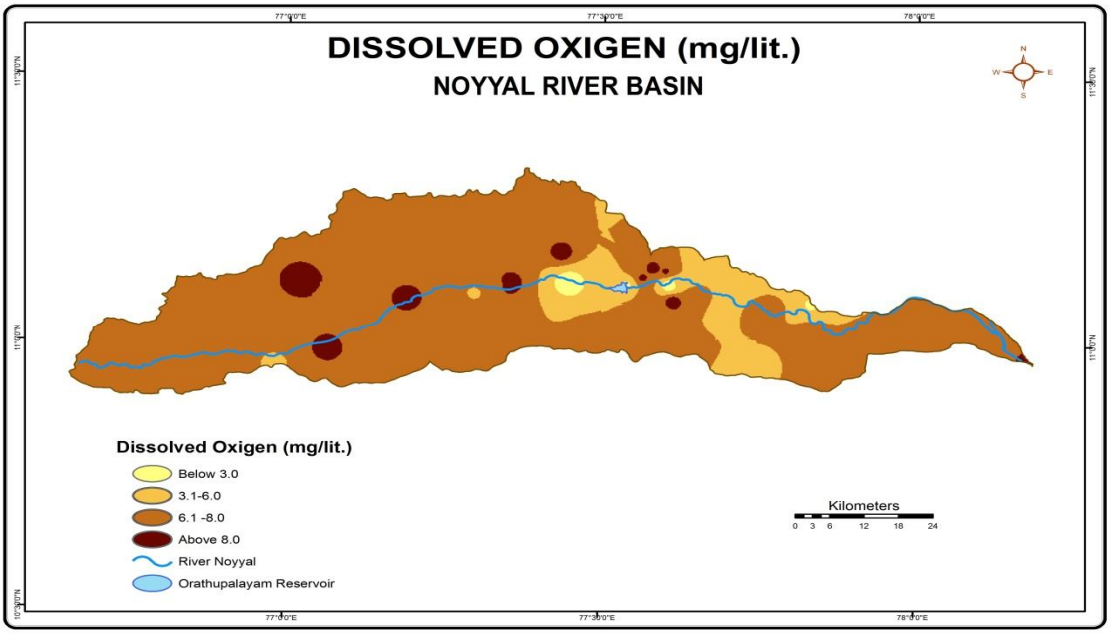


Figure-9

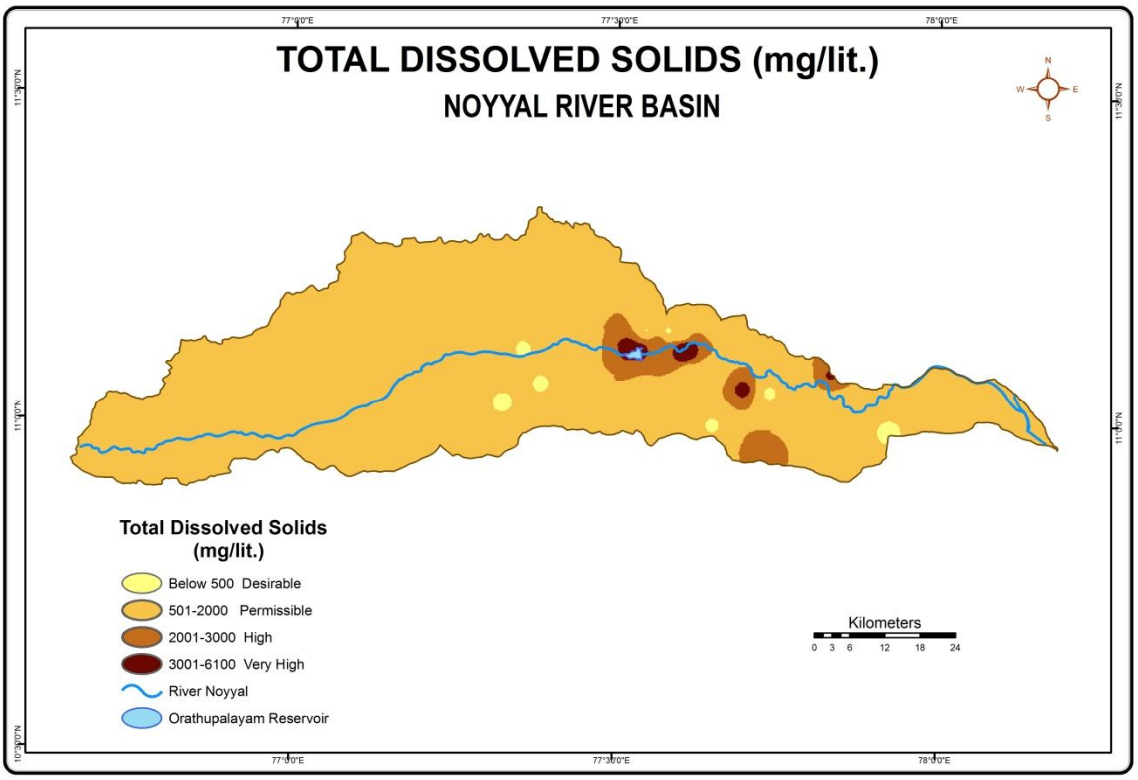


Figure-10

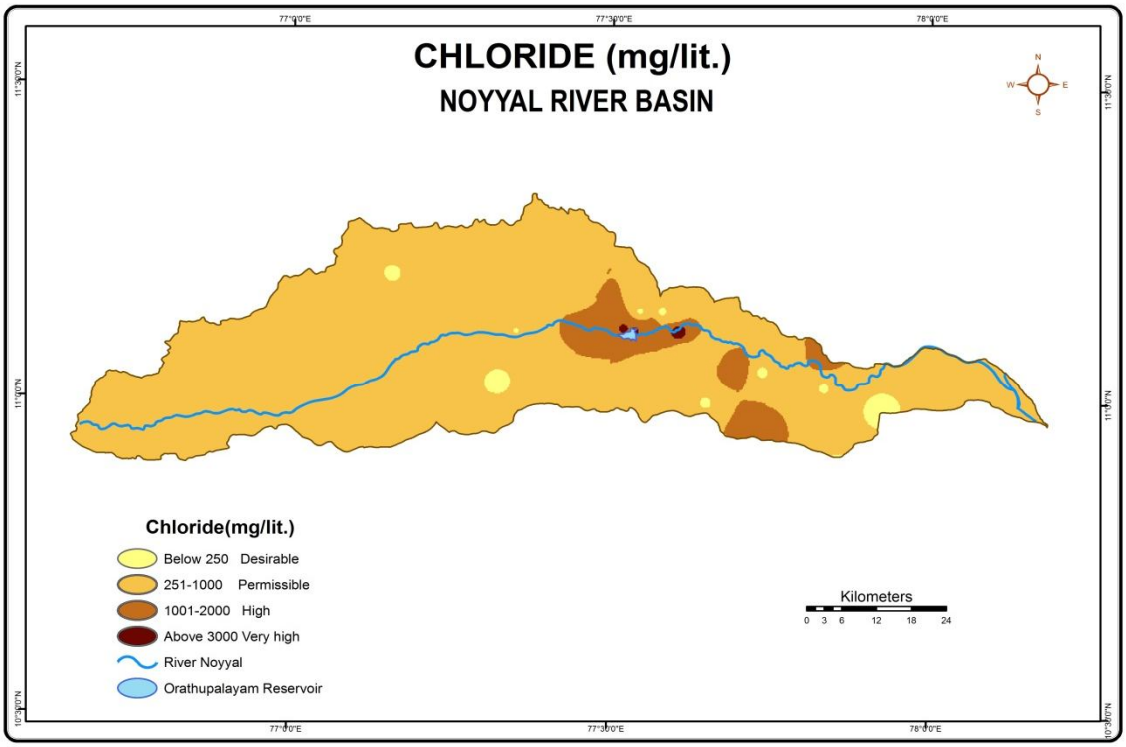


Figure-11

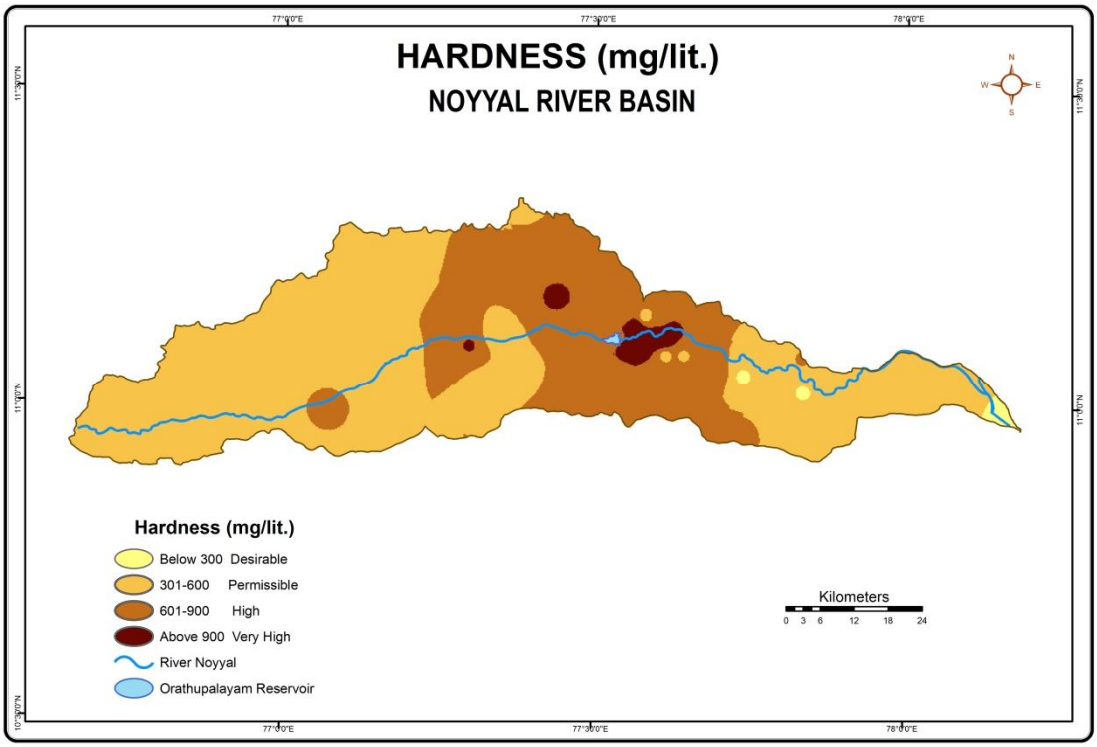


Figure-12

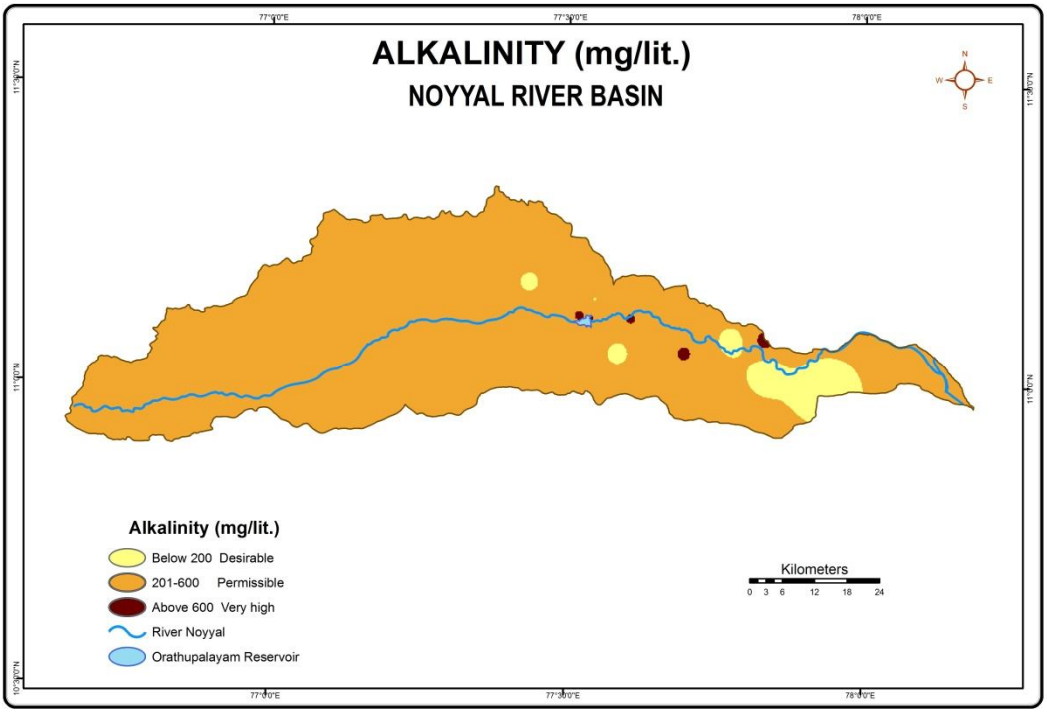


Figure-13

I. Source of Drinking Water

The study area villages have their source of drinking water in different places based on the quality of the ground water in their native places. Change in different sources of drinking water for the study area have observed and documented through the field survey. The result discussed below.

1) *Tammareddipm:* Affected hamlets either brought water from BW in Rengappanpm in case of scarcity which was the case at the time of the interviews. Before that they received water through a pipeline from BW close to the LBP canal in Maravapm. Some people also brought water from a BW in Sellappanpm.
2) *Maravapalayam:* Some people in the affected hamlets bought water from Chennimalay. A couple ofyears ago they used to receive water from the BW 58. Many people had to buywater in this village, e.g. Semmankulipm., Karikadu and Kamachipuram.
3) *Kiranur:* Affected hamlets bring water from wells with good water within Kiranur
4) *Ellaigramman:* Affected people in the village bring water from wells with good water withinEllaigramman or receive water through a pipeline from Kumarapm as in Ramalingapuram hamlet.
5) *Orathupalayam:* Some affected hamlets used to receive water through the pipeline from Kumarapmbut because of scarcity many people now brought water from the common BW in Pandiannagar or from Thippanpm. A new BW had been drilled in Onakaradu but the water was soon found to have a salty taste and could not be used for drinking.
6) *Kodumanal:* New bore well established near Kuppanpalayam, probably 5 km from the village. People in many hamlets had to buy water and some people bought water for all purposes whereas most people could not afford buying water for washing and bathing. As always, the poorest people were the ones most severely affected. Women could be seen washing in the river water and even in the dam. There was no other way, they said, since they could not bring enough water from other places for all purposes and could not afford buying water. People complained that it was very difficult to wash clothes in the polluted water since the soap did not lather and dirt was not removed. Many new wells had been drilled in the upper regions to reach good water for the affected people but some wells did not supply sufficient amounts of water and others reached bad water, probably due to contamination from the dam. Many bore wells with good water in the upper regions were drying out in October 2003. Some people in the upper regions even had to fetch water from wells close to the dam for washing purposes e.g. in Ganapathy palayam they had a pipeline from Thangamman Kovilwhich carried high EC-water. For the people living in the affected areas around the Orathupalayam dam every day was a struggle for receiving fresh water.

Based on the Geographical Information System Raster calculation the Vulnerable areas in the Noyyal River Basin has been identifies and mapped (Figure-14)

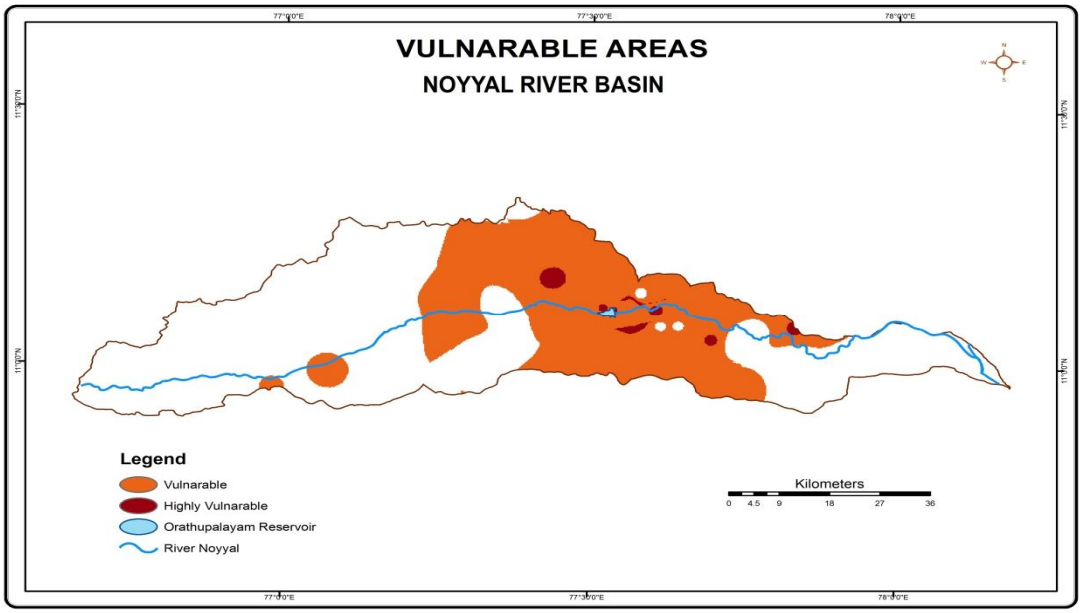


Figure-14

J. Effect on Farmers Health

Farmers were particularly affected by the pollution through irrigation with dam water or contaminated well water. The only constraint before the construction of the reservoir was the availability of water. The farmers could no longer exist on farming and could only grow rain-fed crops in fields where they had not used polluted water for irrigation. Many had been forced to change profession and started to commute to nearby cities to work in industries. We were told by many farmers who had walked in the fields while irrigating with polluted water that they had got skin irritations on their legs. One man also showed us the skin irritations he had. Many farmers had animals that were also affected by the contaminated water.

K. Public Health Impact Assessment

All people interviewed in the in-depth interviews said their skin was itching after taking bath in their well water (or in dam or river water) and that they got allergic diseases Their skin and hair got sticky and some people also said that had lost hair from washing in the polluted water. They stopped drinking the water as soon as they got Diarrhea. Everybody expressed their worries about the health effects of being in contact with the water. They had not received any information about the analyses made on the water in their area and knew nothing of the health effects other than what they had experienced themselves.

Based on the water quality 4 villages selected for the health survey (Table-9) and specific diseases which are frequently effects the people are observed by public interview (Table-10)

Table- 9 Sample villages and pollution level

Very High Polluted	Kodumanal
High Polluted	Chinnamuthur
Moderately Polluted	Kumarapalayam
Low Polluted	Avinasi

Table-10 Diseases observed based on the public interview Specific diseases

Village Name	No. of persons interviewed	Specific diseases observed
Kodumanal	100	Skin allergy, Joint pain, Respiratory problem, Ulcer, Diarrhea
Chinnamuthur	100	Skin allergy, Joint pain, Respiratory problem, Ulcer, Diarrhea
Kumarapalayam	100	Skin allergy, Joint pain, Respiratory problem, Ulcer, Diarrhea
Avinasi	100	Respiratory problem, Fever

The Kodumanal village that is very near the Tiruppur and Orathupalayam dam has diseases like Skin allergy, Joint pain, Respiratory problem, Ulcer and Diaria. These are cause and effect of the water pollution. The same result accured in Chinnamuthur village that is rated as highly polluted village. But in low polluted village Avinashi has only respiratory problem and fever that are common to all places. This reveals that villages near to the Tiruppur region highly effected by the polluted water. The highly effected villages again studied to find the level of impact on the public health. So the selected public health centers that are very near to highly effected villages surveyed. The survey gives the impact of pollution on the public health. The results tabulated in Table 11 and 12 and Figure 15 and 16. The analysis of the PHC's data gives the conclusion that the villages located near to the river basin and Tiruppur have more impact on public health compare with upstream and downstream villages. The villages Kodumanal and Kumarapalayam which are located in the northern side of the basin and Chinnamuthur located southern side of the basin, are within the 5 km from the river. So these are highly effected by the water blended with effluent. But Avinashi located nearly 17 km away from the river has less effected.

L. Public Health Center Report

Table-11 Savadipalayam includes Kodumanal & Chinnamuthur Area

	Adults		Children	
	M	F	M	F
Skin Disease	34	54	37	46
Diaria	51	58	37	46
Astuma	59	69	-	-
Alsar	66	53	28	36

Table-12 Kasipalayam includes Kumarapalayam

	Adults		Children	
	M	F	M	F
Skin Disease	23	29	8	4
Diaria	16	20	12	7
Astuma	36	31	-	-
Alsar	61	76	32	21

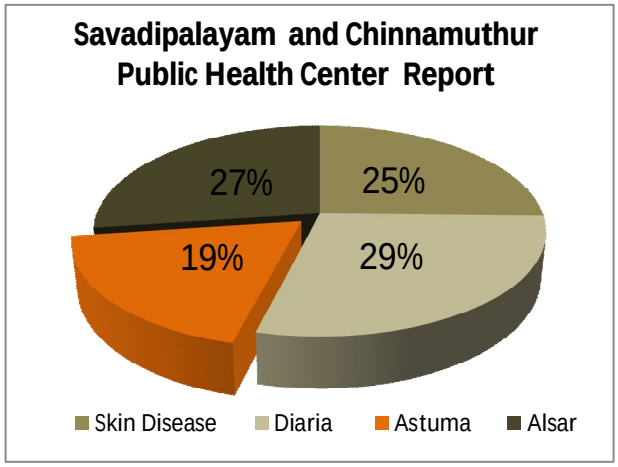


Figure-15

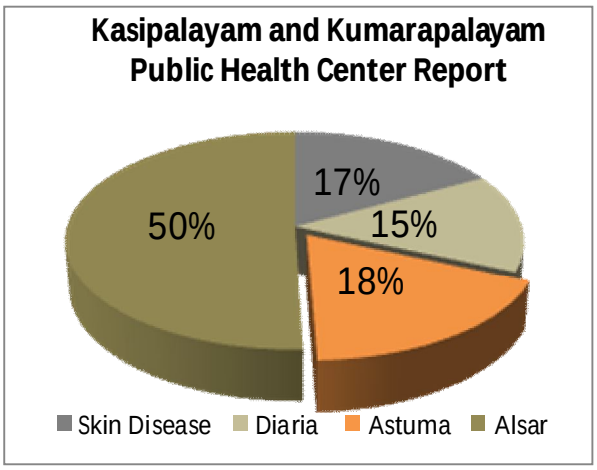


Figure-16

X. RESULTS

This study on "Environmental impact assessment" is a preliminary attempt to address the key issue raised by the impact of industrial effluents in Noyyal river basin. The industrial effluents are derived from the Tiruppur region of Coimbatore, which is located on the Noyyal River. These effluents affected the every aspect of the environment in the Noyyal river basin. The result of the above analysis is given below.

A. Surface Water

The effluents directly discharged into river water. So river water is polluted from the place where the effluents are blending with river. The above analysis shows that the contamination of river water starts with the Tiruppur region and it increases towards the Orathupalayam dam and reduces gradually. It evidences that industrial effluents from the Tiruppur region is the source for the Noyyal river pollution. The polluted effects the environment where ever it drains. The Noyyal river is the main source for the usage of all the purpose in the basin area. So the major source of surface water polluted and its consequence it effects the soil, ground water, agriculture, animal husbandry and public health.

B. Ground Water

The main source for recharging the ground water is Noyyal river water, as it polluted the ground water also get polluted. It proved in the ground water sample analysis. The ground water pollution accelerating when moving towards Tiruppur region and it gradually reduces moving away from it. The damage is not confined to Tiruppur town and its immediate surroundings, but extends more than 30 Km downstream to the Orthapalayam Dam and beyond. The areas very near to the river basin after Tiruppur region is seviorly polluted. The pollution is high in the right hand side of the river compare to the left hand side of the river. This is because of the slope of the basin is towards the right handside of the river. So, all effluents easily percolated through aquifers in the right side.

Finally the aquifers, drinking and domestic supply source to the people in the Noyyal river basin supplies polluted water and leads to the animal husbandry and public health disorder.

C. Agriculture and Animal Husbandry

As discussed earlier, the agriculture and health of animal husbandry also changed enough through the last decade. The forms near the Orathupalayam dam and neighboring areas got significant changes in the pattern of crops cultivation, production and productivity. It is the consequence of pollution of underground water and the degradation of the cultivable land. The physical properties of the soils like fertility, texture, color and salt composition are changed significantly. So these effected areas the cultivation of crops also. In some other distance regions also have same problem, because of the river water pumped to the distant fields for irrigation. For people who did not own land but worked for farmers as labourers, the pollution had resulted in unemployment. On the farms where they used to work, not as many laborers were needed anymore since less land was cultivated and many fields had to be left as fellow or gave poor yields. The water scarcity due to rain failure during the recent years, and no water in the LBP canal, had further added to the difficult situation. The bore well in the village was affected by the contamination and could not be used for drinking. Instead the villagers had to bike kilometers away to fetch water. They used the bore well for washing and bathing but it was not sufficient and they therefore had to go to the river downstream of the dam to wash clothes.

It reveals that the people following agriculture having short of pure irrigation water. The lands will get proper agricultural conditionality, even if the polluted water stopped in the river and using of it , takes minimum of 5 to 7 yrs. Because ,the land environment polluted to that level which take long duration to make it neutral.

D. Public Health

The previous chapter identified that, the waterborne diseases are very prone near to the Noyyal river basin after the Tiruppur region. The previous chapters explains that the pollution of water in the river and the consequence of underground water pollution are the effluents delivered by the industries. The public health is very much effected near to the river basin compare to the far off places from the basin. The impact extended more distance in right hand side of the river compare to the left hand side. This is based on the terrain slope which will makes the high percolation of water in the right side, because of the slope always towards right, that is east and south. The river Bhavani located very near to the Noyyal basin in the north side. So that the water from the Bhavani river basin also percolates into the northern boundry of the Noyyal basin. These reasons explain the pollution level difference in the Noyyal river basin. And when moving towards east, the river enters to the drier part of the region. So, water scarcity increases towards the downstream. The domestic supply of water which supplied from the distance places is high cost. So the peoples are forced to use the comparatively less polluted waters near by places, resulting diseases spreads.

Any problem in the world is having the solution. The environmental impact on the Noyyal river basin is also has its own remedial measure.

XI. SUGGESTIONS TO REDUSE THE ENVIRONMENTAL IMPACT

The environmental impact can be reduced in two phases as follows:

A. Phase I : Strategies to be followed in Tiruppur region

1) Increasing effluent treatment plants in Upper basin (Tiruppur region).
2) Introduction of modern methods of cleaner technology to treat effluents.
3) Implementing zero discharge technique.
4) Imposing strict regulations on industries to treat effluents.
5) Providing financial and technical assistants.

B. Phase II: Strategies to be followed in lower basin (after Orathupalayam Reservoir)

1) Completely open the Orathupalayam dam till all the stored effluents get washed away.
2) Create canals to bypass the Orathupalayam reservoir to avoid additional storage of effluents.
3) Use the fresh water from River Bhavani by link canal to clean the dam.
4) Lining of river to avoid the seepage of water into the soil till stored effluents washed away.
5) Regular monitoring of water quality in the Orathupalayam Reservoir and downstream and educate public about the same.
6) Giving awareness to the public not to use the water until it reaches permissible limit for both irrigation and domestic.

The government and financial institutions could aid the process by offering incentives to make the changes. Research institutions could provide technical support, as they have done in the case of effluent treatment. WTO rules in the future may also require that the hosiery industry produce goods for export that are produced in an environmentally sustainable manner. Since the hosiery industry is export oriented it may be under pressure to meet ISO 14000 or other international standards. Not controlling pollution adequately may not remain an option for very much longer. In any case, if the industry takes a long-term view, it would be better to make the investment in cleaner technologies as soon as possible.

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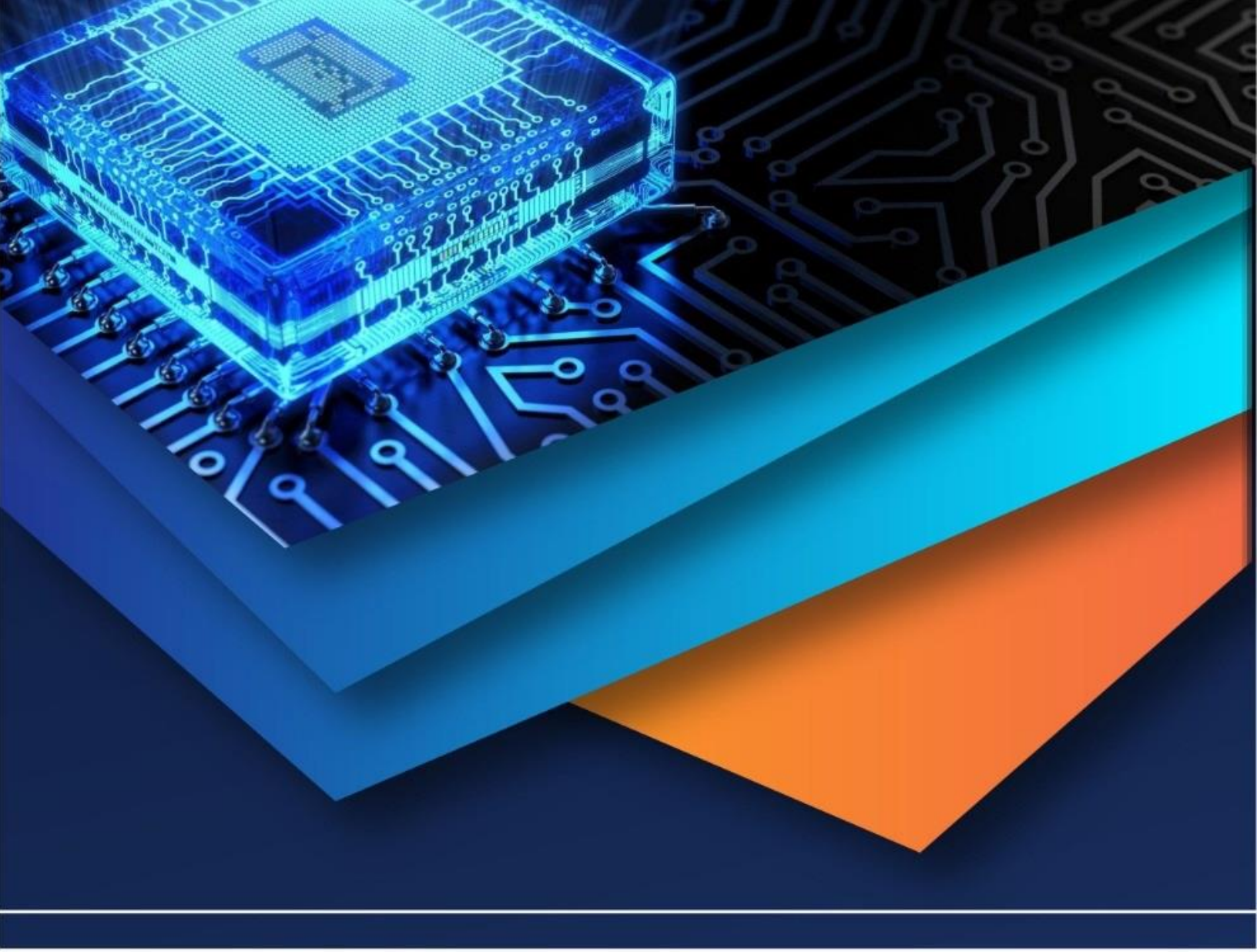
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