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The Water Quality Loss Due to Dust Pollution in South Katraj Region

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Abstract: ***Pure water is a basic need of every individual. It should compose of hydrogen and oxygen in a desirable limit. The variations in composition of hydrogen and oxygen along with additional unwanted material create water pollution. The water quality losses directly impart the color, taste, and odor of water. The contamination water is the loss of water quality index. Water is being termed as a "universal solvent" as it can dissolve any naturally occurring substance. The solubility power of water play important role in research area but sometime poses a major treat due to corrosion reaction with equipments. Corrosion reactions results in the slow dissolution of material of equipments by water. The presence of impurities in water affects the solubility and corrosive nature of water. The sources of surface and ground water monitoring always helps to minimize such impurities to avoid water contaminations. Ground water is source of fresh water which is being polluted due activities taking place on ground surface since last few years. The water quality loss in South Katraj Area of Pune city is due to deposition of unwanted dust particles into natural and artificial sources of water. The mass concentration of such dust deposition defines the percentage loss of water quality. The experimental observations exposed the excess in loss of water quality which results from dust emission due stone crushing industry. Local atmosphere is under the influence of such huge dustfall which is disturbing air, water, and soil of surrounding area.***

Keywords: Katraj, Water Quality Loss, Ground Water, Surface water effects of dust pollution

1. Introduction

Pure water is a basic need of society. Every indusial need water for their daily day life. The water has occupied around 70% area of earth. But the available sources of water have been polluted due to rapid industrialization which affects the nominal consumption of water requirement of water. The consumption of water for different purposes like household or a country which includes dirking, washing or processing in industry is on higher peak as the population of world increasing day by day. The use of water in world for last hundred years has been increasing rapidly which shows straight graph. The use of water for agricultural purpose reached around 600 to more than 3,000 cubic kilometers per year in 2000 which was at around 500 cubic kilometers in 1900. Agriculture shows highest water uses of 70% of water resources [1].

South Katraj region is basically known for hilly ranges and beautiful nature with different forest lands and naturally occurred lakes. Rapid growth of construction industry increased the need of building materials like wood, aggregates, stones and filling material.

The selected area of research examined the water quality of South Katraj Region of Pune city which is badly affected by stone crushing industries. This study work exposed the contamination of natural as well as artificial sources of ground water and surface water located within South Katraj region.

2. Literature Review

The identifications of impurities of water define the quality water. The definition of water quality may have different meaning and it change with place to place. The commonly use definition of water quality is physical, chemical and biological properties of water which defines its suitability for selected use. Wide use of water such as for drinking, fishery, industrial and agriculture use [2].

The water quality criteria and standards have been derived by many sources like the Member States of the European Union or by the Council or Parliament of the EU, or may be by different countries, or they may be issued by international bodies. EU had adopted eight primary directives which defined the quality of water designated for varies uses. Different nations made their own regulations to control the quality of water based on those eight directives. The provisions of different directives and associated regulations have been summarized by EU. The analysis and summarization for standards and limits were obtained by numbers of sampling observations. The required compliance was specified for respective regulations and directions [3]. The standards and levels of different consideration will be applicable if it will be granted by environment department and local government agency which may influence by geological and climatological variations of the area.

Surface Water Directive

The required regulatory principles for surface water were adopted on June, 16 1976 by Environmental Protection Agency. The consideration was made to covers the surface water quality which almost universally titled. The levels of contamination were established. The levels indicate the quality of source of water which can use for human consumption for drinking purpose [3].
The quality of surface water designated for drinking water were accepted by European Communities on November, 10 1989 and it signed by Minister for the Environment after a period of around one month. The regulations adopted by that community incorporate the necessities of surface water along with methods of directive analysis.

The regulations for surface water distribution for public supply were categorized as A1, A2, and A3. The category specified were representing the degree of water treatment which was applicable. The surface water quality was studied for total 39 parameters. The found the results, around 95% of surface water were taken comply with the standards and remaining 5% of samples which were not complying [3].

Ground Water Directive

This directive is known as a daughter directive. The construction of this directive is within the dangerous substance directive (76/464/EEC, q.v.). Principle provisions were set as follows:

1. To prevent the ground water from dangerous substances.
2. The discharge of effluents and radioactive substance in the path of ground water flow.
3. The local responsible authority should prohibit the discharge of such harmful material into ground water flow.
4. The material should undergo investigation prior to discharge.
5. Local government should monitor the ground water quality to identify the nature of contaminations

Quality of Ground Water

Ground water is percolated through different rock beds by traveling from ground level by the force of gravity. The flow of water through rock beds carry large soil particles which have been interacted in flow path. The rocks are made up of variety of soil compositions. Therefore ground water may show considerable variations in different parameters. The quality of ground water is influenced by means of human activities responsible for pollution of the area. The unsaturated zone stores a large quantity of pollutants and it pollutes water when it becomes saturated [4].

The study of Mr. Tan Choo Yong on tin mining and water contamination of rivers stated the water quality loss. The study was carried out in Malaysia, which is located between hilly region and alluvial type of deposits. The study showed the effect of tin mining since 18th century on water. The heavy percentage of tin metal in rivers was found due to discharge of effluent of tin mining in to river. To minimize the effect of tin contaminant of water, the land surrounded to the river were developed for plantation [5].

3. Methodology

The study of water quality in South Katraj area was started with selecting the study stations to determination the different water sampling locations. The area was divided into four parts namely Station 1: Khadi Machine Chouk, Station 2: ISKON Temple and Yewalewadi, Station 3: East Zone of Yewalewadi and Station 4: KJEI Engineering College Campus.

All the selected stations were used to obtain samples of surface water and ground water. List of Water sampling locations are shown in table 1.

Table 1: Sampling in Study Area

Study Station	*Location*	*Number of Samples*	
		Ground Water (Well)	*Surface Water (Lake)*
1	Khadi Machine Chouk	3	Nil
2	Sinhgad School and West Yewalewadi	3	1
3	East Zone of Yewalewadi	1	2
4	KJEI Engineering College Campus	1	2
Total Number of Samples		8	5

To Study the different water parameters, 13 water sampling locations were selected within four study stations. 8 sampling locations were of ground water sources and remaining 5 sampling locations were representing surface water. The sources of ground water in selected study area are artificial wells having large opening. The large circular rim of wells works as a large jar which allows the entry of huge dustfall inside the well. Ground water well S3W1 (Station 3 Well 1) is shown in Figure 1. The dustfall through the large mouth of well is responsible for contamination of ground water for some existent.

Figure 1: showing large opening of S3W1 in study area

The natural and artificial lakes are the sources of surface water and ground water in study area. The naturally formed lakes with larger surface area open to sky accept the huge dustfall from all directions. The water level in natural lakes is affected by annual rainfall. Station 2 has one naturally created lake i.e. lake S2L1 (Station 2 Lake No.1) in Katraj. Lake S2L1 is situated at the longest distance from stone crushing unit. Station 3 has two lakes one of them is naturally formed (i.e. lake S3L1) and another (i.e. lake S3L2) is artificial lake. Water of S3L2 is greenish in colour. It is situated at a distance of 1 km in east direction of Yewalewadi. It is affected by two crushing units. The rate of dustfall in this area is highest as compare to other stations.

Two lakes present at "Station 4" do occupy a large catchment area followed by hilly region. A source of ground water i.e. lake S4L1 (Station 4 Lake No.1) is an artificial lake form due to quarrying work.

The breaking of parental rock at the base of hill formed Lake S4L1 which is source of ground water. The water percolates from rock cuts and Lake S4L1 is being recharged. The water of Lake S4L1 is transported by tankers to fulfil the water demand of neighbouring society.

Lake S4L2 is formed by large catchment area which a source of surface water. It is adjoining and nearest source of surface water to the crushing unit. Figure 2 shows lakes which are present at Station 3 and Station 4.

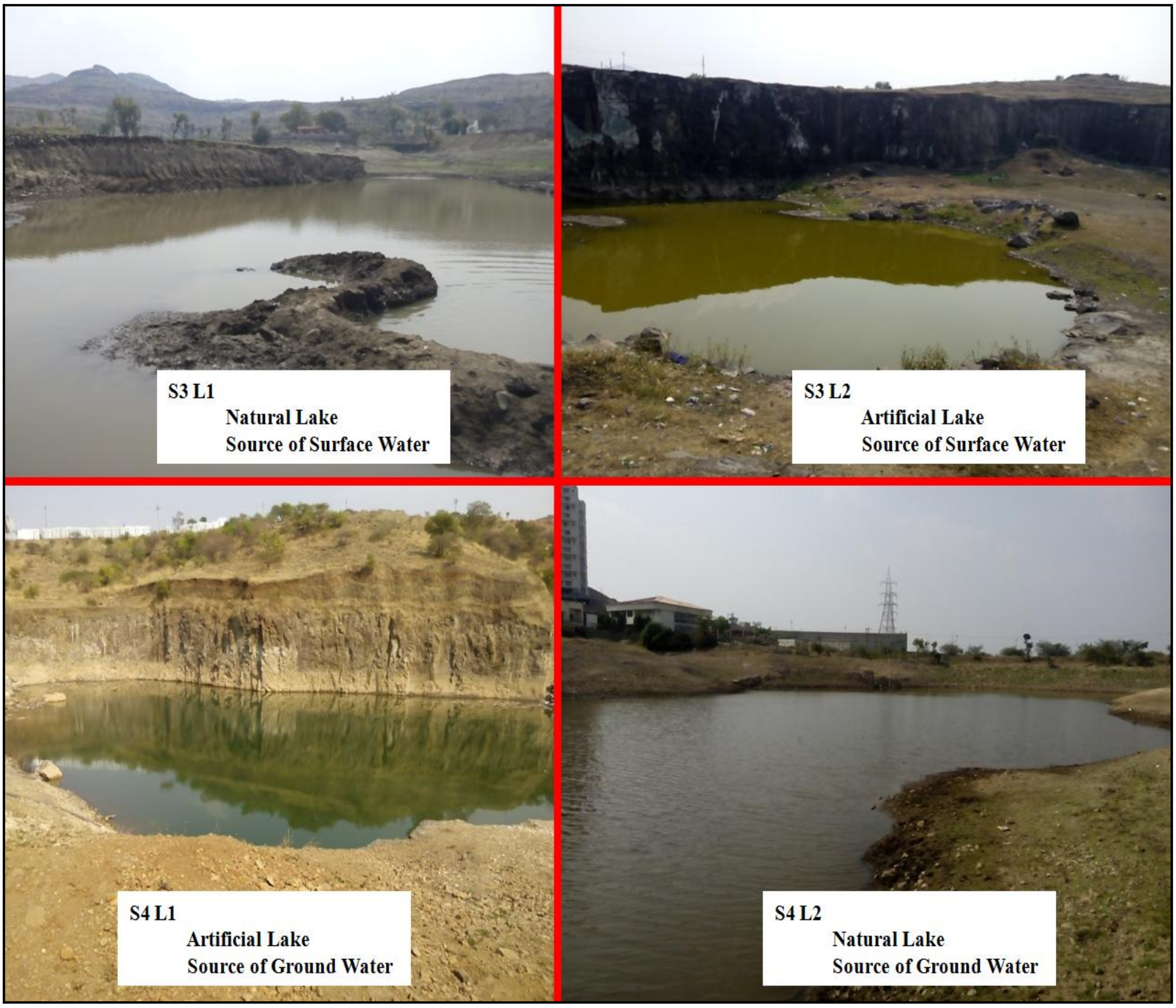

Figure 2: Showing natural and artificial sources of surface water and ground water of Station 3 (S3L1 & S3L2) and Station 4 (S4L1 & S4L2)

Determination of Water Quality

The water quality of surface water and ground water were determined by experimentation. Several parameters such as pH, electrical conductivity, turbidity, alkalinity, total hardness and chloride of surface water and ground water were tested time to time.

Determination of pH

pH is a measurement of hydrogen ions concentration in water. pH indicates the acidic or basic property of water. It is the most common method used to determine the quality of water. Value of pH shows variation with change in temperature of water. pH is determined by testing the sample with pH indicator.

Determination of Electrical Conductivity

Electrical conductivity defines the ability of flow of electric current through an aqueous solution. It takes place due to presence of dissolved ions in water. It is affected by temperature and shows higher value for increase in temperature. It can be measured in micro- ohms/cm^2.

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Electrical conductivity of surface water and ground water were determined by electrical conductivity meter.

Determination of Turbidity

Turbidity is nothing but the presence of soil or clay inside the water. Turbidity is measured in NTU i.e. Nephelometric Turbidity Unit. It also express in JTU (Jackson Turbidity Unit). Higher value of turbidity indicates the higher content of soil or clay material is present in the water. Turbidity of water samples were obtained by Nephelometer.

Determination of Alkalinity

It is the important chemical property of water to be tested to determine the water quality. Alkalinity is sub-divided into bicarbonate, carbonate and hydroxide alkalinity. It is used for lime and lime soda softening and zeolite softening. Alkalinity of water is expressed as $CaCO_3$ per mg/L.

Determination of Hardness

The presence of Ca^{+2} and Mg^{+2} ions in water solution is termed as hardness of water. It is the important property of water which distinguishes the water in terms of soft water and hard water. The softness and hardness of water affects the required consumption of water in case of using soap or detergent for washing clothes. It can be expresses as $CaCO_3$ per mg/L.

4. Results and Discussion

Effect of dust pollution on pH

pH of different sampling station was recorded by using Nephelometer. Effect of dustfall on pH is less as the distance of source of ground water increased from cluster of stone crushing unit. The pH of ground water slightly decreased from S4W1 to S2W1 as shown in Figure 3. It has highest value for sample S3W1 as Station 3 is under the effect of to crushing units. The pH of ground water samples of source has exceeded pH limit. pH should be lies in range between 6 – 8.5 as per recommended by WHO.

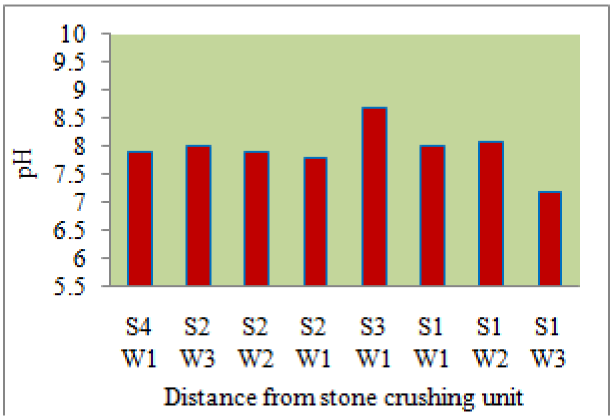

Figure 3: pH vs. Distance from stone crushing unit

The variations found in reading of pH of surface water were unpredictable. As the distance of sources of surface water increased from stone crushing industries, value of pH recorded had shown rise and fall on a graph as shown in Figure 4. Lake S4L2 has larger surface area close to crushing unit. The value of pH is higher shows the effect of dustfall at the place. pH recorded of lake S4L1 is less than that of lake S4L2 as it is a source good of ground water which used to supply the required water demand for neighboring society. pH recorded for station 3 lake S3L2 is the highest value among all the reading. The higher value of pH indicates the higher impact of dustfall in this area. Lake S2L1 is situated at the longest distance from crushing unit and hence it has recorded lower value of pH.

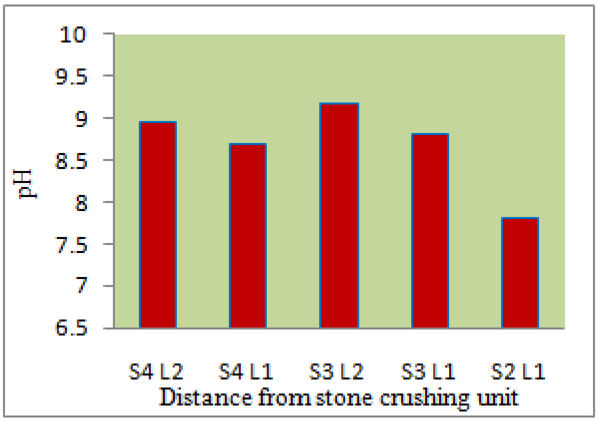

Figure 4: pH vs. Distance from stone crushing unit

Turbidity of water was obtained by Nephelometer and it has highest value for station 3. Turbidity of S4W1, S2W3, and S2W2 was found to be almost same. Turbidity of ground water is shown in following Figure 5 which shows increased or highest turbidity for S2W1 as the well is being recharged by the another sources of water present in the area. Water coming to the well at Station 3 i. e. S3W1 is under the impact of two crushing zones one of which is in the South of Trinity College and the other is in the North of Trinity College which leads to significantly perceptible increment in the turbidity obtained from the samples of the area.

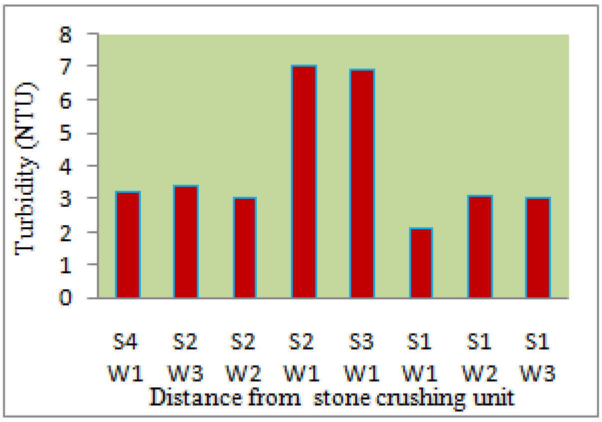

Figure 5: Turbidity vs. distance from stone crushing unit

Determination of Turbidity of surface water is important task to find the impact of dustfall on surface water. Dustfall concentration in surface water does not undergo dilution process for certain period which increases the turbidity of water. The turbidity of surface water obtained from study area was unpredictable for some stations as shown in Figure 6. The turbidity recorded for station 4 for lake S4L2 was greater as it occupies the nearest affected area from crushing unit. The highest value of turbidity was recorded for Lake S3L2 which indicates the impact of two crushing units.

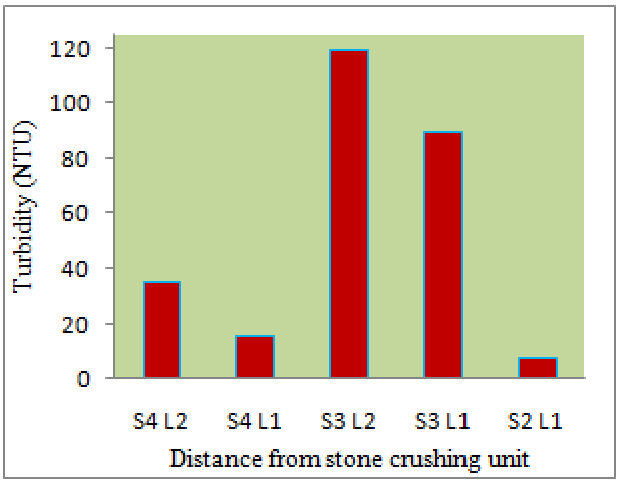

Figure 6: Turbidity vs distance from stone crushing unit

The electrical conductivity of ground water samples is found to be reduced as the distance of sources of ground water increased from crushing unit. It is shown in Figure 7 below. The electrical conductivity depends on concentration of dissolved ion present in water. S3W1 is highly influenced by dustfall which contain different metals. Higher the percentage of ion present in water, higher is the value of electrical conductivity. But when the percentage of such ions increases beyond the limit, their charges cancel each other and again electrical conductivity fall down as it was found in case of sample S3W1.

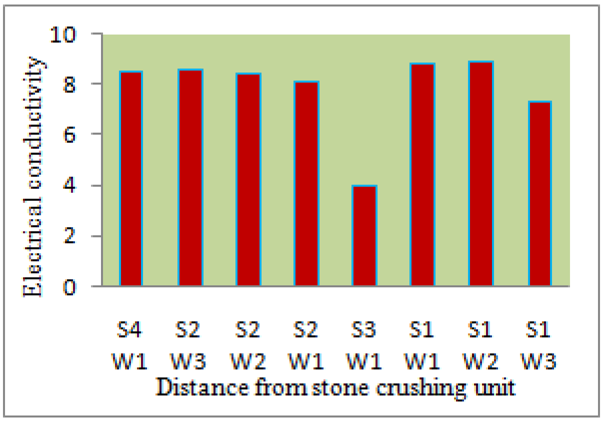

Figure 7: Electrical conductivity vs. distance from stone crushing unit

The electrical conductivity of surface water of Lake S4L1 had shown the highest value as the lake is being recharge by percolated water. It is a source of ground water with salts hence the conductivity found to be more. Higher percentage of dustfall over Lake S4L2 and Lake S3L1 decreased the percentage free ions and hence the conductivity is less. The electrical conductivity had distinctly low reading as the distance of sources of surface water increased from crushing unit which is reflected in Fig 8.

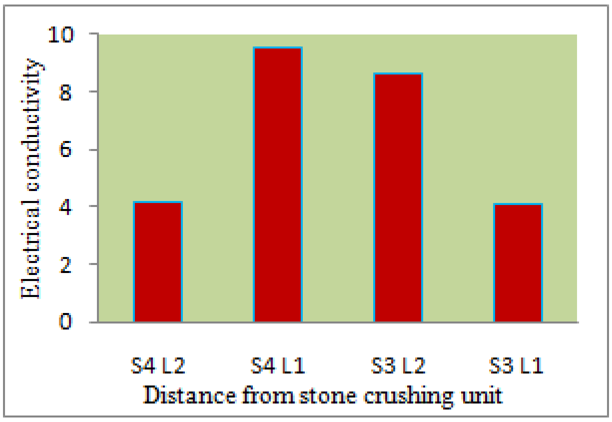

Figure 8: Electrical conductivity vs. distance from stone crushing unit

Total Alkalinity of groundwater sources was found within HDL as shown in Figure 9.

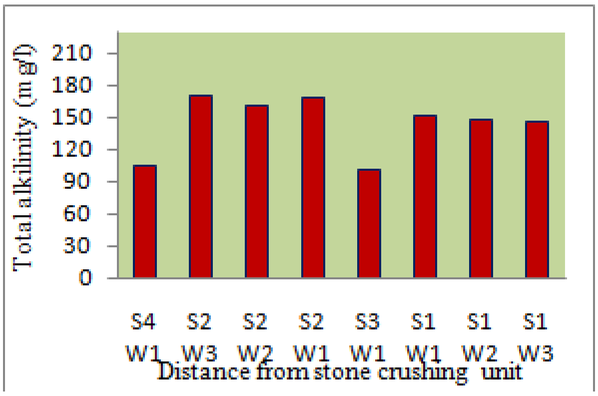

Figure 9: Total alkalinity vs. distance from stone crushing unit

Total Alkalinity of surface water sources within the study area decreases suddenly for S4L1 as the water is collected from a source originating in water percolation. Total alkalinity again increases for Lake S3L1 and Lake S3L2 as it has been impacted by two adjoining stone crushing zones.

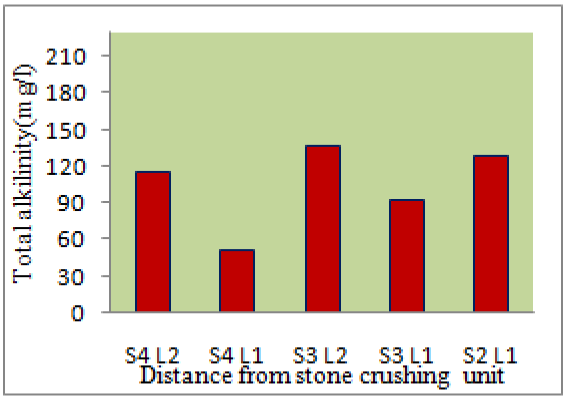

Figure 10: Total alkalinity vs. distance from stone crushing unit

The total hardness recorded for ground water decreased as distance of ground water source increases from stone crushing unit up to S2W1. The hardness test classified all the ground water samples as hard water as the value of total hardness exceeded standard limits. Total hardness obtained for S1W1 was observed to be a highest value of hardness as shown in Figure 11.

The higher percentage of total hardness of Lake S4L2 proved the impact of dustfall on sources of surface water. The value of total hardness of Lake S4L1 is less as usual as it is a source of fresh ground water. The hardness recorded for Lake S3L1 crossed HDL and hence it is known as a source of very hard water present within the effect of two stone crushing zone. The impact of dustfall on hardness of surface water is shown in Figure 12.

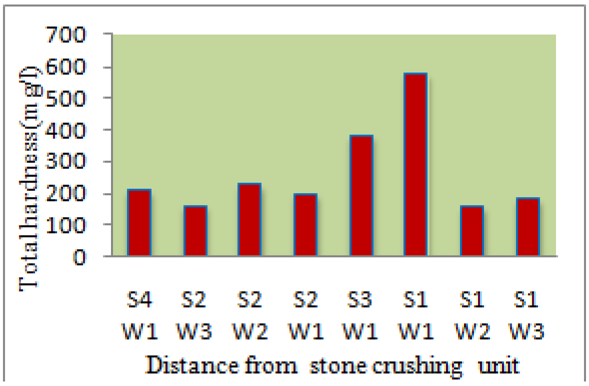

Figure 11: Total hardness vs. distance from stone crushing unit

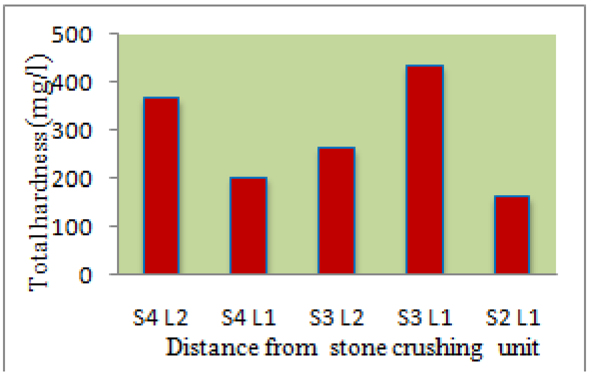

Figure 12: Total hardness vs. distance from stone crushing unit

5. Conclusion

The water quality loss is said to be deviations of water parameters from it standard limits.

1. pH of sources of water was recorded more than the standard limits (WHO recommended 6-8.5) .
2. Turbidity of Station 3 was found to be 119 NTU for lake water which is much more than HDL (5NTU).
3. Electrical conductivity of all study stations were more than MPL.
4. The studied water samples from all lakes were found to be hard as Hardness crossed HDL.

References

[1] Nitti, Gianfranco (May 2011). "Water Is Not an Infinite Resource and the World is Thirsty". The Italian Insider (Rome). p. 8.
[2] Mike Daniels Professor Water Quality and Nutrient Management “Agriculture and Natural Resources” FSA9528
[3] The Environmental Protection Agency, Ireland “Parameters of Water Quality - Interpretation and Standards” ISBN 1-84096-015-3
[4] Jamie Bartram and Richard Ballance “Water Quality Monitoring - A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes” ISBN 0 419 22320 7 (Hbk) 0 419 21730 4 (Pbk)
[5] Mr. Tan Choo Yong “Water Pollution by Agriculture, Agro-industry and Mining in Malaysia" ISBN 92-5-104503-8