Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol. 3, No.4, 2013

Evaluation of the Environmental Effects of the Abandoned Quarries Strabag Quarry at Ibadan, Nigeria and RCC Quarry at Wasinmi, Ikire, Nigeria

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Abstract

The research work evaluates the environmental effects of the abandoned quarries Strabag and RCC quarries. Soil samples were collected at different locations in and around the study areas and water samples were also collected for the laboratory analysis. Soil samples were analysed for the determination of macronutrients and micronutrients while water samples were analysed for determination of chemical parameters such as pH, Fe, Cr, Si, K^+, Na^+, Ca^{++}, Mg^{++}, CC^-, SO_4, NO_3^- and water hardness in triplicate. The laboratory test results and data collected were subjected to analysis of variance (ANOVA) and the Turkey's test was used to verify the significant differences among treatment means at the 5% probability level. Linear correlation and regression analysis between soil and water parameters (Y) and the distance from quarry (X) was performed using Microsoft Excel®. The results obtained revealed that most of the deficiencies observed in chemical analysis of soil and water samples from the studied areas have no direct link with previous mining operation in the areas. It was also revealed from the findings that abandoned quarries (granite) have more of physical constraints than the chemical constraints.

Keywords: Environmental effects, abandoned quarries, macronutrients, micronutrients, physical constraints, chemical constraints.

1. Introduction

Minerals exploitation has an essential role in global development, by raising and maintaining living standards (Laurence, 2001). Also, extracting minerals is one of the oldest and most important human endeavours because it provides the raw ingredients for most of the world and, like agriculture, is the lifeblood of civilization (Eagles, 1984). In addition, mining affects our standard of living and impacts almost everything we do. A variety of items that are used in homes, offices, transportation, communication, and national defence all require minerals use (Bureau of Mines, 2002).

Indigenous and organized mining operations have been ongoing in Nigeria since the 20th century, shortly before the 1st World War (Ajakpo, 1986). However, the interest in the exploitation of these resources is on increase and have the widespread and increasing numbers of abundant mines of minerals (Limestone, Granite, Iron Ore, Gemstones etc) leaving behind vast bare and degraded land, (>10 hectares per mine) at close of mining operations (FME, 1999).

The cumulative effect of these pockets of mining activities, as they gained prominence, has been abandonment of the mine sites, which occur as a result of many factors. These include; total exploitation of minerals in a site; poor and rudimentary mining equipment; inadequate skills; weak regulatory institutions of the sectors in the past; inadequate financial investment; absence of developed market and the post 20th century government prohibition of illegal mining (Ashawa, 2007). Mines abandonment has led to serious negative environment and ecological impacts. The resultant effect of the abandoned mines and quarries in Nigeria ranges from devastation of agricultural land, distortion of the natural environment, accidental deaths, pollution due to dumping at the sites, breeding of disease vectors, creation of habitats for reptiles and other dangerous animals and so on (Alexander, 1985 and 1986). Pollution is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem that is physical system or living organisms. The rate of environmental pollution in developing nations most especially from manufacturing companies or industries is at an alarming rate. Many of the industries release solid particles, water droplets and gases in to the atmosphere, while some release their wastes on land or in to water bodies. Majority of these are not friendly with the environment (Akande *et al.,* 2013).

There are many physical, chemical and biological technologies for treating mined out area, however the treatment selected depends on severity of degradation, the site characteristics, regulatory requirement, cost and time constraints (Steffen *et al.,* 2004). More so, the technical approaches taken to reclamation are as varied as the minerals in question and their methods of extraction. For instance, the sand and gravel operators have to address the issue of post mining land use due to the proximity of most operations to urban areas. This segment of industry is recognized for its pioneering work in applying site-planning principles to mining and reclamation operations.

The focus of the research for this research is to carry out detailed analyses on abandoned granite quarries using Strabag quarry at Adebayi area, Ibadan, Oyo State and RCC quarry at Wasinmi, Ikire, Osun State as case studies to determine the environmental effects and necessary technical solutions of the abandoned quarries.

1.1 Location And Accessibility Of The Study Areas

Strabag abandoned (Granite) quarry is located at Adegbayi area of Egbeda Local Government in the accent city of Ibadan, Oyo state. The site is on latitude 07° 22′ 49″ N and Longitude 003° 58′ 57″E. It is accessible through many routes, among them are: Strabag bust-stop, at Adegbayi, along Ibadan-Ife expressway of Ibadan of about 400m distance and river Osun-Seni of about 300m distances.

Within the basement complex of Oyo state, the abandoned Strabag quarry is chosen as a case study. The quarry is over 30 years abandoned and is now within the hearth of the city. The granite deposite in this quarry is massive with parts of it covered with laterite overburden and some other parts covered with trees or stumps. The deposite is geometrically doom-shaped outcrop in which joints and cracks present. The quarry pit is full of water (suspected to have its main source from underground water)

RCC abandoned (Granite) quarry is located at Wasinmi, Irewole Local Government Area, Osun state. The site is located on Latitude 07° 25′ 28″ N and Longitude 004° 16′ 20″E. It is only accessible through KM 45, Ibadan-Ife expressway.

2. COLLECTION OF SAMPLES

Sampling of soil and water of both sites were conducted by two men (author and field assistance. Implements such as cutlass, spade, digger, water-fetcher, sampling bag, plastic bottles were used for sample collection. Meter-rule and a weight measuring scale were used for measurement.

2.1 Soil Sampling

Soil samples were collected at different locations in and around the study areas. The sampling was done within zero radius of the quarries to measure the degree of contamination and pollution resulting from quarrying activities after long abandonment. The sampling continued with 50meter increase in mine radius to study the behavioral pattern of pollution with distance from the abandoned quarry area.

Soil samples labeled SS_1, SS_2, SS_3 … SS_{13} were collected at Strabag while soil sample from RCC were labeled SR_1, SR_2, SR_3 … SR_{13}. Samples SS_{13} and SR_{13} were taken at location of 4km away from the quarries sites, where there is no influence of mining operation, to serve as control points.

As suggested by Ibitoye, (1994), that a good representative soil sample should be taken at a depth of at least 10cm. The soil samples were collected with a spade at an approximated depth of 15cm to eliminate the effects of exposure at the surface (Bache and Mac, 1984). The soil samples were later air-dried for 72 hours and sieved through a 2mm sieve. Thereafter, a further 24 hours drying was conducted.

2.2 Water Sampling

Water samples were collected at 13 different locations within and around each of the study areas. The sampling was done within zero radiuses of the quarries to measure the degree of contamination and pollution resulting from quarrying activities after long abandonment. The sampling continued with 50meter increase in mine radius to study the behavioral pattern of pollution with distance from the abandoned quarry areas.

The water samples labeled WS_1, WS_2, $WS_{3,}$…,WS_{13} were collected at Strabag while samples from RCC were labeled WR_1, WR_2, $WR_{3,}$….,WR_{13}. The choice of sample locations were based on availability and accessibility also some the location distances were on approximations. Samples WS_{13} and WR_{13} were taken at location of 4km away from each of the quarries sites to serve as control points. The water samples were collected at a depth of 30cm bellow the water surface where water mixes very well (FAO, 1995). 1.5 litres of each sample was taken to the laboratory immediately in a covered plastic container to avoid contamination and any possible chemical changes (Stiefel and Bush, 1983).

2.3 Analysis Of Soil Samples

The soil samples were analysed at Crop and Soil Science (CSS) Laboratory of the Federal University of Technology, Akure. All readings were taken at room temperature. Two principal contents looked for were macronutrients and micronutrients. The macronutrients are the major essential nutrients required in proportionately large qualities for plant growth and development while micronutrients are those essential nutrients required for some purpose but in minute quantities. The following nutrients compositions were determined: total Organic Matter by using ASTMD 2974-87 procedures, Exchangeable K, Na, Ca and Mg were extracted using ammonium acetate (Jackson, 1962), K and Na were determined on a flame photometer while Ca^{2+} and Mg^{2+} were determined by Ethylene De-amine Tetra Acetic (EDTA) titration method. Soil phosphorous was determined using the spectrophotometer. The nitrogen in the soil was determined using Macro-Kjeldahl's method. Macro-Kjeldahl's method was employed in the determination of total organic carbon. The pH using an electronic glass-electrode pH meter Jenway model.3015 and soil particle size were also determined using sieve analysis.

2.4 Laboratory Analysis Of Water Sample

The water samples were analysed at Soil Science Laboratory of Obafemi Awolowo University (OAU), Ile-Ife, Osun state. All readings were taken at room temperature. The anlaysis was carried out to determine some chemical parameters such as pH, Fe, Cr, Si, K^+, Na^+, Ca^{++}, Mg^{++}, CC^-, SO_4 and NO_3^-. The samples were also subjected to hardness test.

The pH of water samples was determined using Electronic pH meter. Titrameter method was used in the determination of total hardness of water. The chloride and sulphate in water were determined using Molar titration method. Fe, Zn and Mn in water were determined using atomic Absorption mode and Na, K, Ca and Mg in water were determined using Atomic absorption Spectrophotometer model Buck Scientific 200.

Each of the tests was given 3 trials (1st, 2nd and 3rd) to avoid error in the experiments and data collected were subjected to analysis of variance (ANOVA) and the Turkey's test was used to verify the significant differences among treatment means at the 5% probability level. Linear correlation and regression analysis between soil and water parameters (Y) and the distance from quarry (X) was performed using Microsoft Excel®.

3. RESULTS

Table 1 and 2 show mean value and significant difference at 0.05 level of chemical analysis of various soil sample parameters with corresponding distances from Strabag and RCC respectively. Table 3 and 4 represent mean value and significant difference at 0.05 level of chemical analysis of various water sample parameters with corresponding distances from Strabag and RCC respectively.

4. DISCUSSION

4.1 SOIL QUALITY OF THE STUDY AREAS

The pH value ranges for plant growth is between 5.5 and 7.5 for each crop, the pH of soil as maintained at a suitable level by application to liming material, (Fitz-Patric, 1986). Most of the results obtained from the study areas show the soil samples to be moderately basic to almost neutral. All the samples, including control, could be seen within the allowable -limits for optimum plant growth. Figure 1 shows the pH value of the soil samples from both Strabag quarry and RCC quarry.

Generally, the mined out soil have very low organic matter contents as shown in Figure 2. The values of organic matter in SS are a little moderate except those that are very close to the quarry pit. May be, it was due to its long time abandonment. None of the values in SR is up to sufficient range of 1.5-3.0%. This is unlikely to do with the effect of mining activities in the area, since control, SR_{13}, is even 1.03. This may be as a result of monocropping method farming used in the area and several years of use. The significant differences among analysed mean values are very low.

Organic Carbon content of the sample in the two quarries is generally low according to Tekaliqu (1991) guideline. It is very low even with the control sample as shown in Figure 3. It shows that low content of the organic carbon has nothing to do with the abandoned quarry operation in the study areas.

Sodium in soil is present in small quantity and restricted to acid and semi acid regions. It is one of the most loosely held of metallic ions and readily lost during leaching. Sodium is beneficial to plants because it can replace a portion of the potassium requirements. Adeoye (1986) gave critical range of sodium in Nigeria

Agricultural soil as 0.03 – 0.5 Cmol /kg. Figure 4 shows that the sodium values in the study area are within the critical range. Also, the significant differences among analysed mean values in the two quarries are very low.

Potassium is another macronutrients needed for plant growth; it is an important component of rock forming mineral found in basement complex. If is principally found in the flesh coloured K-Feldspars (Awojobi, 2002). Potassium encourages the production of strong stiff straw and improves whiter hardness; it increase crop resistance to leaf diseases ensures high quality plant materials (Wendell, 1996). It is also important for photosynthesis, it's balancing effects on both nitrogen and phosphorous forms the basis of application of NPK fertilizer to soil. Adeoye (1986), gave the critical range of potassium as 0.27 – 0.70 Cmol/kg. Therefore, Figure 5 shows that potassium values Strabag is within the critical range while some soil samples in RCC quarries are even greater than the critical range. The significant differences among analysed mean values including the control are very low in the two study areas.

Calcium is important both as a soil conditioner and as a plant nutrient, the formation of high percentage of absorbed cations by calcium make soil becomes flocculated. This facilitates good aeration and good water infiltration and retention (Adeoye, 1986). The calcium raises the pH value from 5, 6 and 7 increase the bacteriological activities and strengthens plant cell wall (Troch, 1980). Critical range of calcium for Nigeria agricultural soil is 1.69- 9.00 (Cmol/kg). It can be observed from the Figure 6 that the calcium value is low though still fall within the critical range. Also, the significant difference level of the analysed mean values is moderately high.

Magnesium is mainly found as a component in Ferro magnesium minerals in rocks. They are essentially found in biotiles, muscorite, amphiboles etc. These minerals are generally stable under high temperature conditions but unstable under low temperature and quickly weather to produce magnesium ions (Lombin and Fayemi, 1976). Magnesium deficiency causes interval chlorosis (Olatunju, 1999) which could be seen on the green grain of the plant leaving the leaf tissues to become uniformly pale yellow (Wendell, 1996 and Lockwood Pimm, 2000). Critical range of magnesium stated by (Adeoye, 1986), to range between 0.62- 2.69 (Coml./kg) for Nigeria Agricultural soil. Results shown in Figure 7 indicated that the magnesium contents of soil sample in the study areas are moderate. There are moderately high significance differences among the mean values.

4.2 ANALYSIS OF WATER IN THE STUDY AREAS

The permissible range of pH in public water supplied is between 6.5 and 7.5 (WHO, 1982). All samples analysed as presented in Figure 8 are within the limitation range, however suitable for drinking except, sample from Strabag pit, SW_1 which is more acidic than other samples. Also, high level of pH in SW_1 is likely to be a result of level of pollution from the environment, since all others even the control samples fell within permissible range. The significant differences among analysed mean values are very low.

Electrical conductance is a parameter, which function of total amount of dissolved solids in water. The concentration of total dissolved solid is sometimes measured indirectly by specific conductance. The electrolytic capacity of natural water is a function of number of moles of each ion and the electric charge of the ion. Total amount of solids of water thus determines whether it is fresh or saline. Drinking water is recommended to have not more than 500mg/l of dissolved solids. Range obtained as shown in Figure 9 was between 140µs/cm and 320µs/cm in both quarries. The control values are even within obtained range.

Chloride basically is not a natural constituent of water. It was generally observed from sample analysis that the chloride values obtained are below the recommended unit. Though, no health-based guideline value is proposed for chloride. It concentrations in excess of about 250 mg/l can give rise to detectable tastes in water but the threshold depends on the associated cations. More so, since there are no significant changes with sample distances from the two quarries. Therefore, as shown in Figure 10, low values of chloride have nothing to do with the abandoned quarries.

The significant differences among analysed mean values in both quarries are moderately high. Sulphate is not a noxious substance (Akande and Awojobi, 2003 and Felter, 1980). Although high sulphate water may has laxative effect (Felter, 1980). It gets to quarries through several sources; such as the dissolution of gypsum and other mineral deposits containing sulphate or oxidation of sulphide, presence of sulphate in drinking water can also cause noticeable taste. Based on considerations of taste, the recommended guideline value is 250mg/l. All the samples observed are below guideline value as indicated in Figure 11. There are low significance differences among the mean values.

The permissible level of Nitrate in the public water supplies is 10mg/l (WHO, 1992). However, E.C directive suggests a guide level of 25mg/l. Water containing high Nitrate concentration is potentially harmful to infants and young children (Twort *et al.,* 1986). In line with the directive, all the water samples from both quarries as illustrated in Figure 12 has maximum value of 19.4mg/l, which indicates that they are all safe for consumption. There are moderately low significance differences among the mean values.

Manganese is an essential trace element with an estimated daily nutritional requirement of 0.03-0.05mg/kg. Neutrotoxic; a health-base guideline value of 0.5mg/l would be adequate to protect public health (WHO, 1982b). None of the water sample has Manganese except WS_1, Strabag pond water, with concentration of 0.277Ns which is within the permissible limit for public water (Figure 13).

There is usually no noticeable taste at non iron concentration below 0.3mg/l, although turbidity and colour may develop. Laundry and sanitary will stain at iron concentrations above 0.3mg/l. Iron value of about 2.5mg/l does not present a hazard to health. Also, WHO (1992) gave highest desirable level of 0.1mg/l and maximum level 0.1mg/l. The concentrations of iron in water samples, as shown in Figure 14, are within the permissible limits irrespective of the distance to the quarry. Significance differences among the mean values are moderately high.

Level of Zinc in drinking water above 3mg/l have an undesirable astringent taste and may result in discolouration. A guideline value of 3mg/l is recommended by (WHO, 1982). From the Figure 15, it shows that all the water samples from both quarries are within the recommended value. There are low significance differences among the mean values.

Magnesium is one of the earth's most common elements and forms highly soluble salts. Magnesium contributes to both carbonate and non-carbonate hardness in water (Twort *et al.,* 1986). Excessive concentrations of Magnesium are undesirable in domestic water because magnesium was a catheptic, a diuretic effect, especially when associate with high level of sulphate (Twort *et al.,* 1986). The permissible limit for magnesium in drinking water is 50mg/l and excessive limit is 150mg/l. All samples as shown in Figure 17 that they are within the permissible limits. Significance differences among the mean values are moderately high.

Although potassium is one of the abundant elements, the concentration found in most natural waters rarely exceeds 20mg/l. The E.C directive recommends a maximum concentration of 120mg/l with a guide level of 10mg/l (Twort *et al.,* 1986). As indicated in Figure 18, all the samples have low level of potassium but still within the permissible limits. Significance differences among the mean values are moderately high.

Sodium is one of the alkalis. The maximum permissible level of sodium is 200mg/l (WHO, 1993). Presence of sodium in water does not constitute any environmental problem. Sodium values from the water samples, as shown in Figure 19, are very low though they are still within the permissible limit. However, it has no connection with the previous quarry operation in the study area. Also, significance differences among the mean values are moderately high.

5. CONCLUSION

Environmental effects of abandoned granite quarries of both Srabag and RCC have been analysed. The sites have various conditions such as: high-walls, abandoned structures which serve as hide out for hoodlums, lack of drainage control, lack of acceptable vegetative cover, undesirable water bodies, pollution due to dumping at the sites, create habitat for reptiles and other dangerous animals. Other effects of the abandoned quarries include breeding ground for disease vectors, visual impacts, public health and safety concern.

Though, it was showed from the findings that abandoned quarries (granite) have more of physical constraints than the chemical constraints. Most of the deficiencies observed in chemical analysis of soil and water samples from the studied areas have no direct link with previous mining operation in the areas. Also, it was discovered that some people were benefiting in terms of provision of water for construction project in the area, fishing from the abandoned pond and illegal granite quarry operation.

Basic solutions to abandoned quarries are encouragement of natural drainage flow pattern during and after operation and putting the quarries into imaginative end-uses, such as recreational water bodies, and also conservative end-uses by means of "restoration blasting". The latter technique involves recreating geomorphologic features by controlling the last production blast, since the minerals involved are of low value and there is insufficient overburden material to make good the original contours.

References

Adeoye Z. A. (1986), "Critical Range of Nutrient for Nigeria Agricultural Soils"; M. Sc Project Thesis; University of Ibadan, (Unpublished) p. 74.

Akande, J. M., Ajaka, E. O., Omosogbe, F. M. and Lawal, A. I. (2013), "Environmental Effects of Processing Marine Clay in Olotu, Ondo State, Nigeria", Journal of International Institute for Science, Technology and Education (IISTE), Vol.3, No.2, pp. 82-86. www.iiste.org.

Akande, J. M. and Awojobi, D. A. (2003), "Assessment of Environment Impact of Exploitation of Granite Deposit in Ilorin, Nigeria", Journal of Science Engineering and Technology, Vol. 10 (2) pp 4891-4900

Alexander, M. J. (1986), "Soil Characteristics and the Factors Influencing their Development on Mine Spoil on the Jos Plateau", JPERDP, Interim Report No. 11

Alexander, M. J. (1985), "An Historical Introduction to the Reclamation of Minesland on the Jos Plateau".

Interim Report No. 4, Jos Plateau Environmental Resources Development Programme (JPERDP). Dept. of Geograpy and Planning, University of Jos and Dept. of Geography University of Durham, United Kingdom.

Awojobi, D. A. (2002), "Environmental Impact Assessment of Exploitation of Granite Deposits in Ilorin", Unpublished M. Eng. Project FUTA, p. 20.

Ashawa (2007): "Inventory of Abandoned Mines and Quarries; Action Plan for Remediation and Reclamation"; Final Report 2007; Prepare by Ashawa Consult Limited May 2007.

Laurence, D. C. (2001), "Mine closure and the community; Mining Environmental Management", 9(4): pp.10-12.

Bureau of Mines, (2002), "This is Mining", U. S. Bureau of Mines, Washington D. C., http://mcg.wr.usgs.gov/usbmak/thisis/html

FAO, (1995), "Food and Agricultural Organisation"; Soil Bulletin, Federal Ministry of Agriculture and Water Resources, pp. 18-25.

FME, (1999), "State of the Environment" Federal Ministry of Environment; in perspectives, Abuja, Nigeria.

Felter, C. W. (1980), "Applied Hydrogeology": Charles Merril Publishing Co. Columbs, Ohio pp. 306-334

Fitzpatick, E. A. (1986), "An Introduction to Soil Science" Longman Scientific and Technical England, pp. 184-196.

Steffen, Robertson and Kirsten (2004), "Mine Reclamation in Northwest Territories and Yukson". Department of Indian Affairs and Northern Development

Jackson, M. L. (1962), "Soil Chemical Analysis" Pretice Hall, New York.

Johnson, M. R. (1982) "Characterization and Effectiveness of Remining Abandoned Coal Mines in Pennsylvania". USBMRI 9562: pp. 36

Twort, A. C., and Crawly F.W. (1986), "Water Supply": Edward Amold, London.

WHO, (1993), "International Standard for Drinking Water", World Helath Organization,Geneva, pp. 10-15

WHO, (1992) "Our Planet Report of the World Health Organization Commission on Health and Environment". Geneva

WHO, (1982a), "Guidelines for Drinking Water Quality in small Communities", World Health Organization,Geneva, pp. 24-28

WHO, (1982b), "International Standard for Drinking Water", World Health Organization,Geneva,pp. 8-10.

Table 1: Mean Value and Significant Different of Chemical Analysis of Soil Samples at Strabag Quarry

7Sample	Distance From the Quarry(m)	PH	P Mg/kg	N (%)	O. C (%)	O. M (%)	K Cmol/kg	Na Cmol/kg	Ca Cmol/kg	Mg Cmol/kg	Soil Particles Size (%)		
											Sand	Clay	Silt
SS_1	0.00	5.73^{a}	7.50^{c}	0.21^{ab}	0.76^{b}	1.31^{ab}	0.35^{cd}	0.40^{bcd}	2.40^{def}	1.70^{h}	52.00^{cd}	30.00^{d}	40.00^{a}
SS_2	50.00	5.87^{a}	9.37^{f}	0.20^{a}	0.81^{b}	1.06^{b}	0.38^{de}	0.38^{abc}	2.34^{c}	1.60^{e}	52.00^{cd}	25.00^{abc}	23.00^{a}
SS_3	100.00	6.30^{a}	8.30^{d}	0.19^{a}	0.82^{b}	1.41^{bc}	0.30^{b}	0.38^{abc}	2.38^{def}	2.33^{g}	51.67^{bcd}	25.00^{abc}	22.00^{a}
SS_4	150.00	6.23^{a}	8.33^{d}	0.23^{bc}	0.95^{c}	1.65^{cd}	0.25^{a}	0.39^{abc}	2.40^{ef}	1.47^{d}	51.00^{bcd}	30.00^{d}	20.00^{a}
SS_5	200.00	5.87^{a}	$7.23a^{bc}$	0.24^{bc}	1.29^{e}	2.23^{ef}	0.39^{e}	0.41^{cd}	0.41^{a}	0.59^{a}	48.00^{a}	27.00^{c}	24.00^{a}
SS_6	250.00	5.83^{a}	8.87^{e}	0.26^{cd}	1.15^{d}	1.99^{de}	0.33^{bc}	0.39^{abc}	2.42^{f}	1.40^{c}	49.00^{ab}	26.00^{bc}	24.13^{a}
SS_7	300.00	6.07^{a}	9.40^{f}	0.31^{f}	2.14^{k}	3.67^{i}	0.35^{cd}	0.37^{ab}	1.97^{b}	1.80^{i}	50.00^{abc}	26.00^{bc}	22.00^{a}
SS_8	350.00	6.57^{ab}	7.40^{c}	0.29^{ef}	1.85^{i}	3.20^{hi}	0.39^{e}	0.36^{a}	2.39^{de}	1.75^{i}	49.00^{ab}	27.00^{c}	23.00^{a}
SS_9	400.00	6.30^{a}	6.83^{a}	0.26^{cd}	1.42^{f}	2.46^{efg}	0.30^{b}	0.39^{abc}	2.39^{def}	$1.60e^{f}$	52.00^{cd}	25.00^{abc}	22.00^{a}
SS_{10}	450.00	6.13^{a}	6.90^{ab}	0.25^{cd}	1.75^{h}	3.54^{i}	0.40^{e}	0.41^{cd}	2.35^{cd}	1.64^{fg}	51.00^{bcd}	24.00^{ab}	23.27^{a}
SS_{11}	500.00	6.30^{a}	7.27^{bc}	0.28^{de}	2.05^{j}	2.65^{fg}	0.32^{bc}	0.39^{abc}	2.40^{ef}	1.32^{b}	50.00^{abc}	27.00^{c}	24.00^{a}
SS_{12}	550.00	6.13^{a}	8.33^{d}	0.27^{de}	1.65^{g}	2.85^{gh}	0.45^{f}	0.43^{d}	2.36^{cde}	1.68^{gh}	53.00^{d}	23.00^{a}	23.13^{a}
SS_{13}	4000.00	7.20^{b}	9.27^{ef}	0.24^{bc}	0.12^{a}	0.21^{a}	0.35^{cd}	0.36^{a}	2.50^{g}	2.28^{g}	50.00^{abc}	27.00^{c}	21.03^{a}

* Alphabetical Index Indicates Significant Different at 0.05 level

Table 2: Mean Value and Significant Different of Chemical Analysis of Soil Samples at RCC Quarry

Sample	Distance From the Quarry(m)	PH	P Mg/kg	N (%)	O. C (%)	O. M (%)	K Cmol/kg	Na Cmol/kg	Ca Cmol/kg	Mg Cmol/kg	Soil Particles Size (%)		
											Sand	Clay	Silt
SR_1	0.00	6.27^{bc}	5.77^{a}	1.11^{a}	0.78^{bc}	1.37^{d}	0.74^{ab}	2.15^{a}	1.78^{a}	18.50^{a}	43.33^{a}	25.10^{a}	21.33^{bc}
SR_2	50.00	6.67^{d}	6.27^{b}	1.86^{a}	0.63^{abc}	1.11^{c}	0.74^{ab}	1.15^{a}	2.07^{a}	18.88^{a}	44.00^{a}	24.90^{a}	18.50^{a}
SR_3	100.00	6.53^{cd}	6.47^{bcd}	1.72^{a}	0.79^{bc}	1.37^{d}	0.72^{ab}	0.15^{a}	1.97^{a}	4.22^{a}	11.31^{a}	25.20^{a}	24.17^{def}
SR_4	150.00	6.80^{d}	6.50^{bcd}	2.50^{a}	1.00^{cd}	1.72^{f}	0.67^{a}	0.32^{a}	1.84^{a}	18.29^{a}	43.00^{a}	26.82^{a}	19.93^{ab}
SR_5	200.00	5.87^{a}	6.30^{b}	1.93^{a}	1.35^{de}	2.34^{h}	0.71^{ab}	0.21^{a}	1.97^{a}	17.77^{a}	34.67^{a}	24.03^{a}	25.30^{f}
SR_6	250.00	5.93^{ab}	6.60^{cde}	1.20^{a}	0.58^{ab}	1.01^{b}	0.91^{ab}	0.17^{a}	2.37^{a}	17.35^{a}	42.00^{a}	26.00^{a}	22.17^{bcd}
SR_7	300.00	6.03^{ab}	6.80^{ef}	1.40^{a}	0.43^{ab}	0.75^{a}	0.41^{a}	0.21^{a}	1.95^{a}	17.63^{a}	41.00^{a}	24.10^{a}	24.20^{def}
SR_8	350.00	6.17^{ab}	7.03^{f}	3.17^{a}	0.67^{abc}	1.17^{c}	0.54^{a}	0.31^{a}	1.78^{a}	16.48^{a}	39.77^{a}	24.13^{a}	26.27^{f}
SR_9	400.00	5.90^{a}	6.70^{de}	1.95^{a}	0.63^{abc}	1.10^{c}	0.48^{a}	0.18^{a}	2.22^{a}	18.10^{a}	43.67^{a}	24.90^{a}	20.20^{abc}
SR_{10}	450.00	6.07^{ab}	6.30^{b}	1.71^{a}	1.72^{e}	2.98^{i}	1.23^{b}	0.13^{a}	2.31^{a}	18.08^{a}	42.80^{a}	25.73^{a}	20.27^{abc}
SR_{11}	500.00	6.80^{d}	6.70^{de}	1.95^{a}	1.41^{e}	2.43^{h}	0.72^{ab}	0.49^{ab}	1.82^{a}	17.50^{a}	42.23^{a}	24.67^{a}	22.50^{cde}
SR_{12}	550.00	6.80^{d}	6.40^{bc}	1.62^{a}	0.39^{a}	1.61^{e}	0.87^{ab}	0.81^{b}	1.88^{a}	16.74^{a}	40.00^{a}	25.27^{a}	26.56^{f}
SR_{13}	4000.00	6.53^{cd}	6.73^{de}	1.44^{a}	1.44^{e}	1.91^{g}	1.89^{c}	0.25^{a}	1.97^{a}	17.86^{a}	41.53^{a}	24.47^{a}	24.73^{ef}

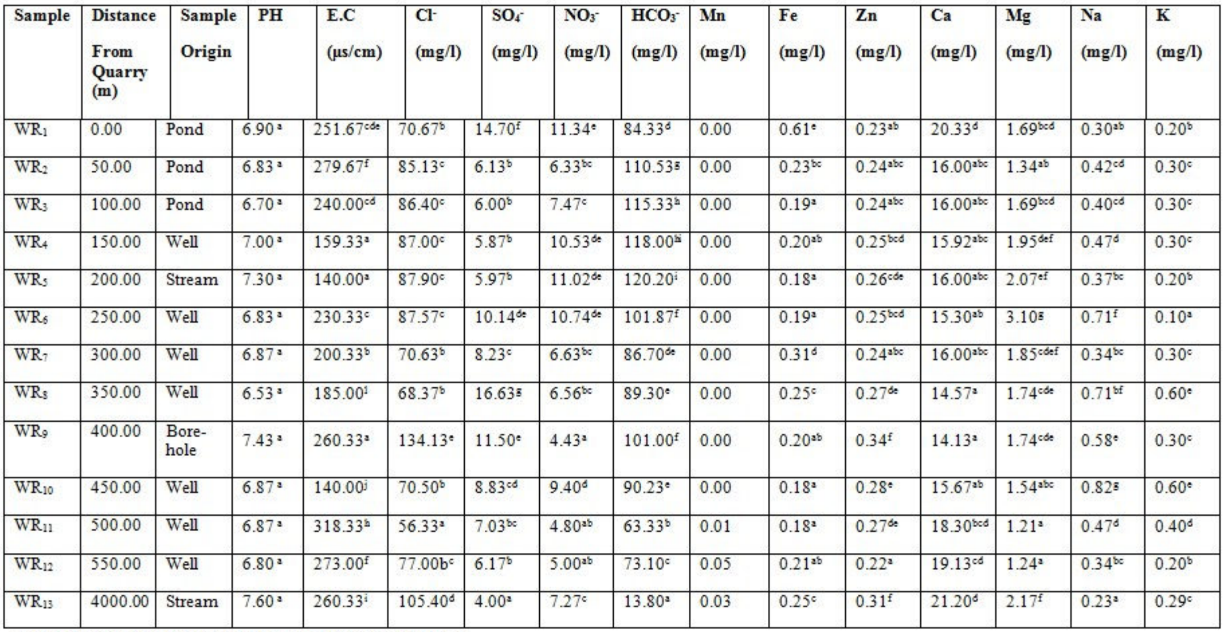
* Alphabetical Index Indicates Significant Different at 0.05 level

Table 3: Mean Value and Significant Different of Chemical Analysis of Water Samples at Strabag Quarry

Sample	Distance From Quarry (m)	Sample Origin	PH	E.C (µs/cm)	Cl^{-} (mg/l)	SO$_4^{-}$ (mg/l)	NO$_3^{-}$ (mg/l)	HCO$_3^{-}$ (mg/l)	Mn (mg/l)	Fe (mg/l)	Zn (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)
WS$_{1}$	0.00	Pond	8.47^{e}	200.00^{e}	99.00^{cd}	6.30^{c}	11.93^{i}	0.45^{fg}	0.27	0.29^{d}	0.05^{c}	28.00^{d}	6.80^{a}	17.13^{ab}	8.53^{i}
WS$_{2}$	50.00	Pond	7.23^{cd}	241.00^{h}	93.40^{b}	6.40^{c}	6.80^{c}	0.42	0.00	0.25^{c}	0.04^{bc}	27.00^{d}	7.50^{b}	23.50^{de}	4.25^{h}
WS$_{3}$	100.00	Pond	6.53^{a}	301.00^{k}	105.67^{e}	6.10^{abc}	7.20^{d}	0.48^{g}	0.00	0.25^{c}	0.03^{abc}	26.00^{d}	8.57^{f}	24.07^{e}	2.28^{abc}
WS$_{4}$	150.00	Well	6.80^{abc}	190.67^{d}	103.80^{de}	6.00^{abc}	6.30^{b}	0.90^{h}	0.00	0.24^{c}	0.02^{ab}	25.00^{cd}	8.20^{e}	20.80^{cd}	2.75^{cde}
WS$_{5}$	200.00	Stream	6.70^{ab}	222.00^{g}	117.33^{gh}	6.87^{d}	8.40^{e}	0.37^{c}	0.00	0.24^{c}	0.01^{a}	20.00^{b}	7.80^{bcd}	17.07^{ab}	2.16^{ab}
WS$_{6}$	250.00	Well	6.80^{abc}	183.00^{c}	112.33^{fg}	6.30^{c}	9.80^{g}	0.35^{c}	0.00	0.45^{f}	0.02^{a}	21.50^{b}	7.90^{cde}	16.17^{ab}	2.45^{bcd}
WS$_{7}$	300.00	Well	7.10^{bcd}	171.00^{b}	120.33^{h}	5.70^{a}	5.70^{a}	0.40^{de}	0.00	0.73^{h}	0.02^{ab}	22.00^{bc}	7.60^{bc}	14.33^{a}	1.89^{a}
WS$_{8}$	350.00	Well	6.70^{ab}	321.00^{l}	130.33^{i}	6.17^{bc}	7.23^{d}	0.43^{ef}	0.00	0.62^{g}	0.02^{ab}	22.50^{bc}	7.80^{bcd}	18.50^{bc}	3.20^{ef}
WS$_{9}$	400.00	Bore-hole	6.57^{a}	143.00^{a}	257.00^{j}	9.23^{e}	10.17^{h}	0.25^{b}	0.00	0.30^{d}	0.01^{a}	22.50^{bc}	7.70^{bc}	32.07^{f}	9.30^{j}
WS$_{10}$	450.00	Well	6.77^{abc}	274.00^{j}	108.17^{ef}	5.80^{ab}	7.40^{d}	0.38^{cd}	0.00	0.36^{e}	0.02^{a}	20.00^{b}	8.10^{de}	24.30^{e}	3.45^{fg}
WS$_{11}$	500.00	Well	6.60^{a}	241.00^{h}	94.67^{bc}	7.10^{d}	8.87^{f}	0.22^{ab}	0.14	0.25^{c}	0.02^{ab}	19.50^{b}	6.80^{a}	22.30^{de}	2.87^{de}
WS$_{12}$	550.00	Well	6.77^{abc}	215.00^{f}	79.67^{a}	6.40^{c}	10.43^{h}	0.35^{c}	0.21	0.13^{b}	0.02^{ab}	20.50^{b}	6.53^{a}	20.80^{cd}	3.75^{g}
WS$_{13}$	4000.00	Stream	7.57^{d}	261.00^{i}	130.17^{i}	9.20^{e}	19.40^{j}	0.19^{a}	0.19	0.04^{a}	0.02^{ab}	15.60^{a}	7.90^{cde}	32.10^{f}	9.27^{j}

* Alphabetical Index Indicates Significant Different at 0.05 level

Table 4: Mean Value and Significant Different of Chemical Analysis of Water Samples at RCC Quarry



Sample	Distance From Quarry (m)	Sample Origin	PH	E.C (µs/cm)	Cl^{-} (mg/l)	SO$_4^{-}$ (mg/l)	NO$_3^{-}$ (mg/l)	HCO$_3^{-}$ (mg/l)	Mn (mg/l)	Fe (mg/l)	Zn (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)
WR$_{1}$	0.00	Pond	6.90^{a}	251.67^{cde}	70.67^{b}	14.70^{f}	11.34^{e}	84.33^{d}	0.00	0.61^{e}	0.23^{ab}	20.33^{d}	1.69^{bcd}	0.30^{ab}	0.20^{b}
WR$_{2}$	50.00	Pond	6.83^{a}	279.67^{f}	85.13^{c}	6.13^{b}	6.33^{bc}	110.53^{g}	0.00	0.23^{bc}	0.24^{abc}	16.00^{abc}	1.34^{ab}	0.42^{cd}	0.30^{c}
WR$_{3}$	100.00	Pond	6.70^{a}	240.00^{cd}	86.40^{c}	6.00^{b}	7.47^{c}	115.33^{h}	0.00	0.19^{a}	0.24^{abc}	16.00^{abc}	1.69^{bcd}	0.40^{cd}	0.30^{c}
WR$_{4}$	150.00	Well	7.00^{a}	159.33^{a}	87.00^{c}	5.87^{b}	10.53^{de}	118.00^{hi}	0.00	0.20^{ab}	0.25^{bcd}	15.92^{abc}	1.95^{def}	0.47^{d}	0.30^{c}
WR$_{5}$	200.00	Stream	7.30^{a}	140.00^{a}	87.90^{c}	5.97^{b}	11.02^{de}	120.20^{i}	0.00	0.18^{a}	0.26^{cde}	16.00^{abc}	2.07^{ef}	0.37^{bc}	0.20^{b}
WR$_{6}$	250.00	Well	6.83^{a}	230.33^{c}	87.57^{c}	10.14^{de}	10.74^{de}	101.87^{f}	0.00	0.19^{a}	0.25^{bcd}	15.30^{ab}	3.10^{g}	0.71^{f}	0.10^{a}
WR$_{7}$	300.00	Well	6.87^{a}	200.33^{b}	70.63^{b}	8.23^{c}	6.63^{bc}	86.70^{de}	0.00	0.31^{d}	0.24^{abc}	16.00^{abc}	1.85^{cdef}	0.34^{bc}	0.30^{c}
WR$_{8}$	350.00	Well	6.53^{a}	185.00^{l}	68.37^{b}	16.63^{g}	6.56^{bc}	89.30^{e}	0.00	0.25^{c}	0.27^{de}	14.57^{a}	1.74^{cde}	0.71^{bf}	0.60^{e}
WR$_{9}$	400.00	Bore-hole	7.43^{a}	260.33^{a}	134.13^{e}	11.50^{e}	4.43^{a}	101.00^{f}	0.00	0.20^{ab}	0.34^{f}	14.13^{a}	1.74^{cde}	0.58^{e}	0.30^{c}
WR$_{10}$	450.00	Well	6.87^{a}	140.00^{j}	70.50^{b}	8.83^{cd}	9.40^{d}	90.23^{e}	0.00	0.18^{a}	0.28^{e}	15.67^{ab}	1.54^{abc}	0.82^{g}	0.60^{e}
WR$_{11}$	500.00	Well	6.87^{a}	318.33^{h}	56.33^{a}	7.03^{bc}	4.80^{ab}	63.33^{b}	0.01	0.18^{a}	0.27^{de}	18.30^{bcd}	1.21^{a}	0.47^{d}	0.40^{d}
WR$_{12}$	550.00	Well	6.80^{a}	273.00^{f}	77.00b^{c}	6.17^{b}	5.00^{ab}	73.10^{c}	0.05	0.21^{ab}	0.22^{a}	19.13^{cd}	1.24^{a}	0.34^{bc}	0.20^{b}
WR$_{13}$	4000.00	Stream	7.60^{a}	260.33^{i}	105.40^{d}	4.00^{a}	7.27^{c}	13.80^{a}	0.03	0.25^{c}	0.31^{f}	21.20^{d}	2.17^{f}	0.23^{a}	0.29^{c}

* Alphabetical Index Indicates Significant Different at 0.05 level

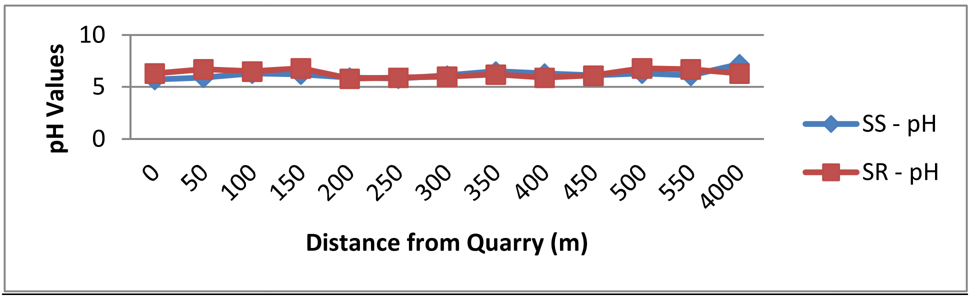


Figure 1: Analysis of pH Value of Soil Sample

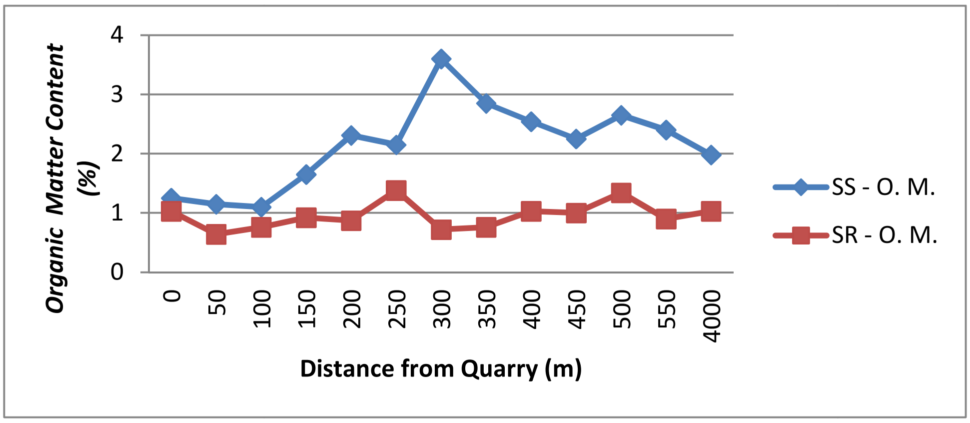


Figure 2: Analysis of Organic Matter Content of Soil Samples

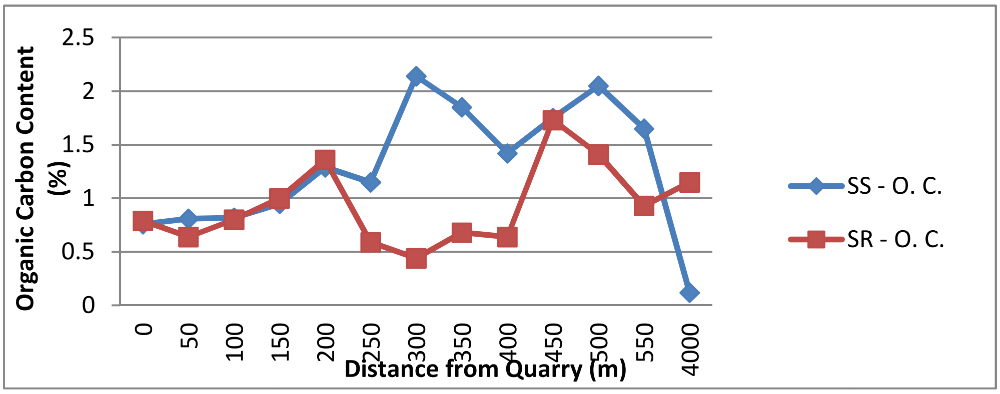


Figure 3: Analysis of Organic Carbon Content of Soil Samples

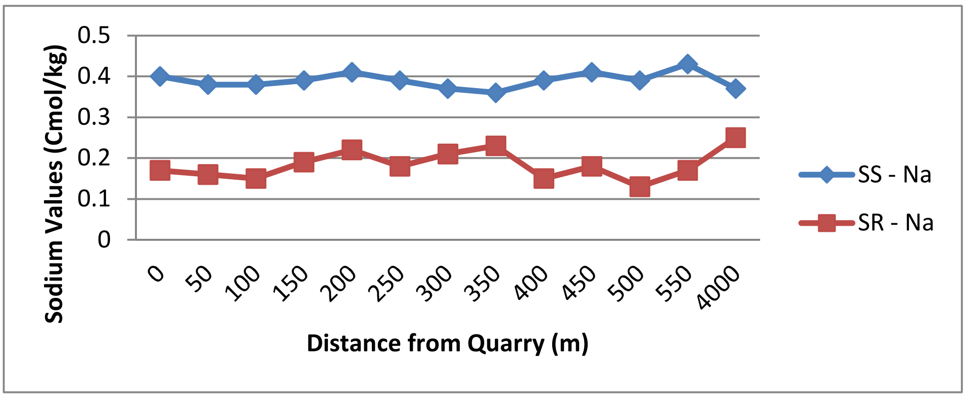


Figure 4: Analysis of Sodium Value of Soil Samples

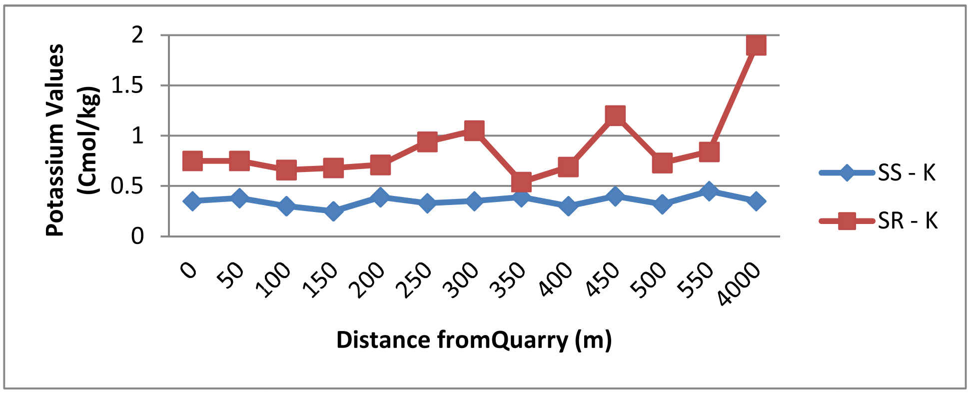


Figure 5: Analysis of Potassium Value of Soil Samples

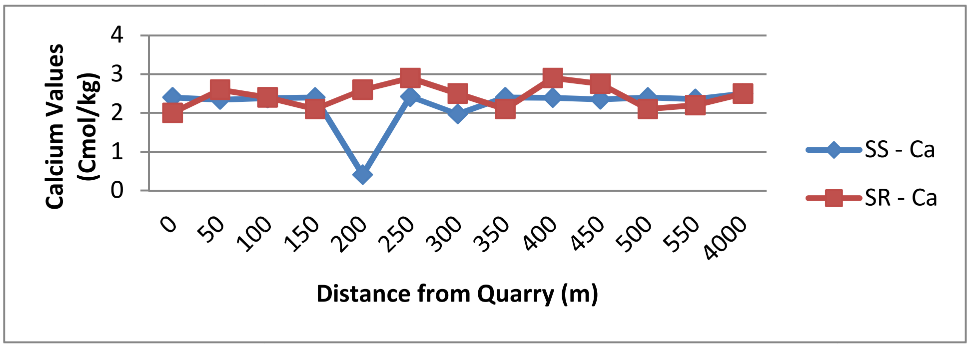


Figure 6: Analysis of calcium Value of Soil Samples

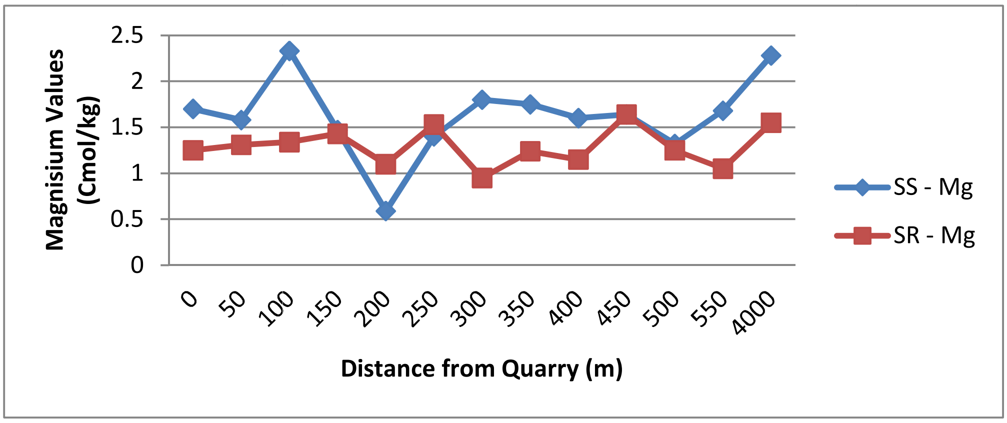


Figure 7: Analysis of Magnesium Value of Soil Samples

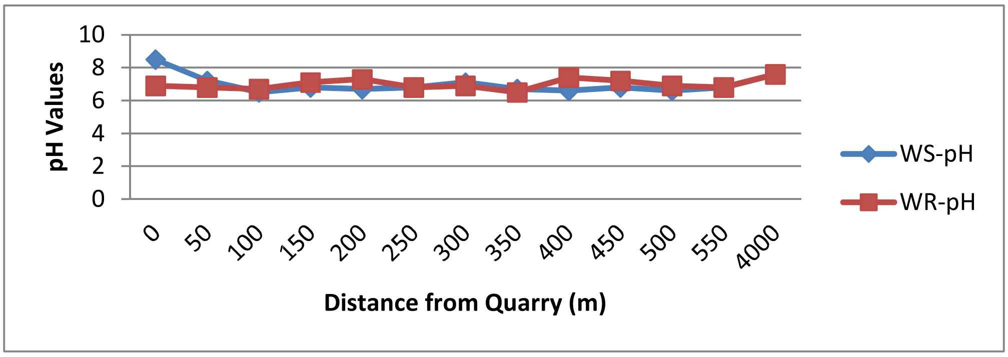


Figure 8: Analysis of pH Value of Water Samples

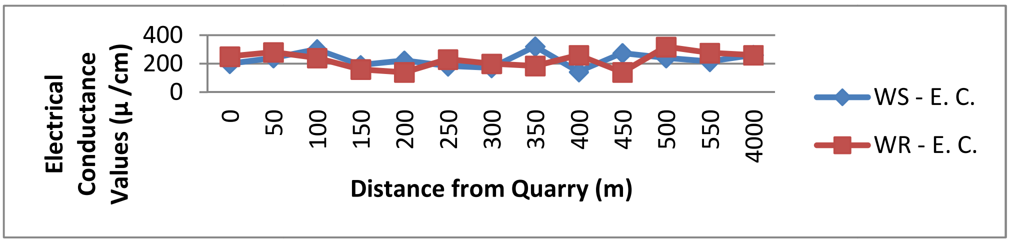


Figure 9: Analysis of Electrical conductance of Water Samples

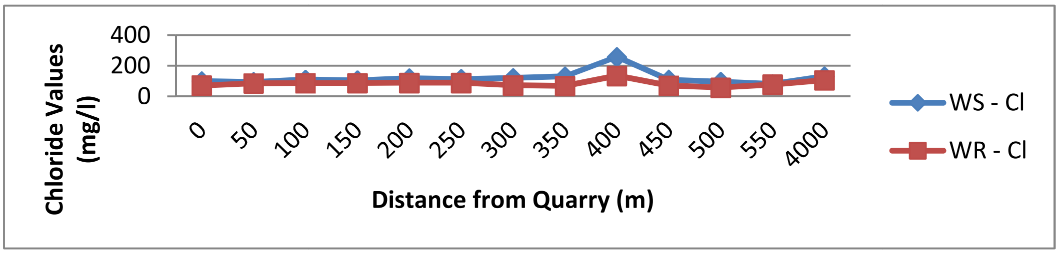


Figure 10: Analysis of Chloride of Water Samples

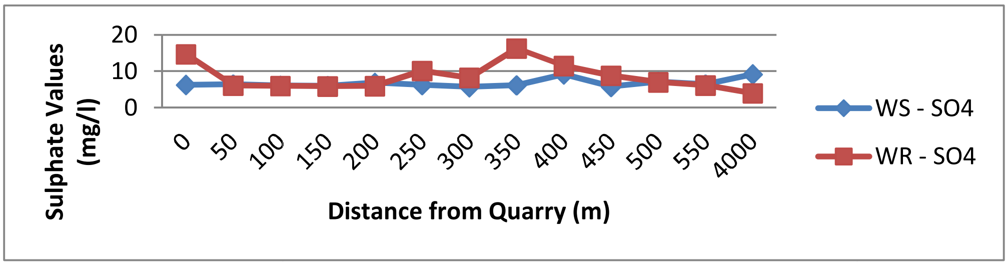


Figure 11: Analysis of Sulphate of Water Samples

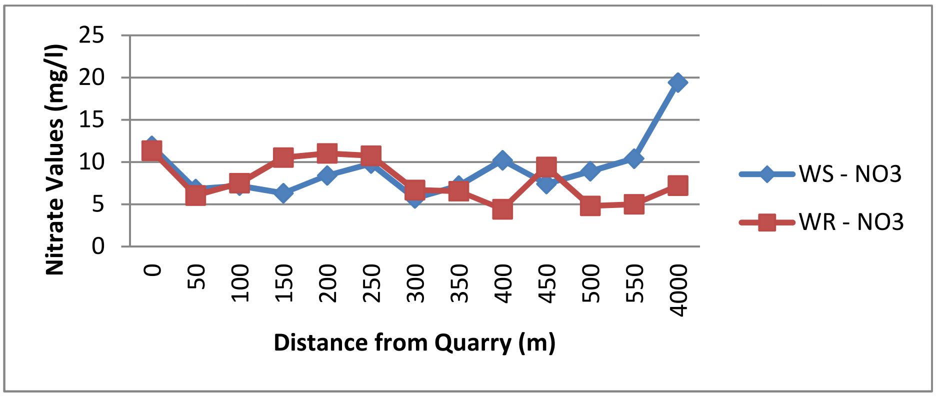


Figure 12: Analysis of Nitrate of Water Samples

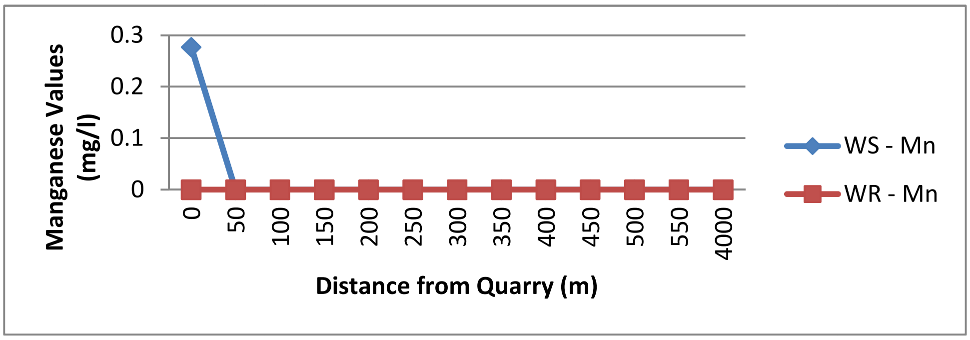


Figure 13: Analysis of Manganese of Water Samples

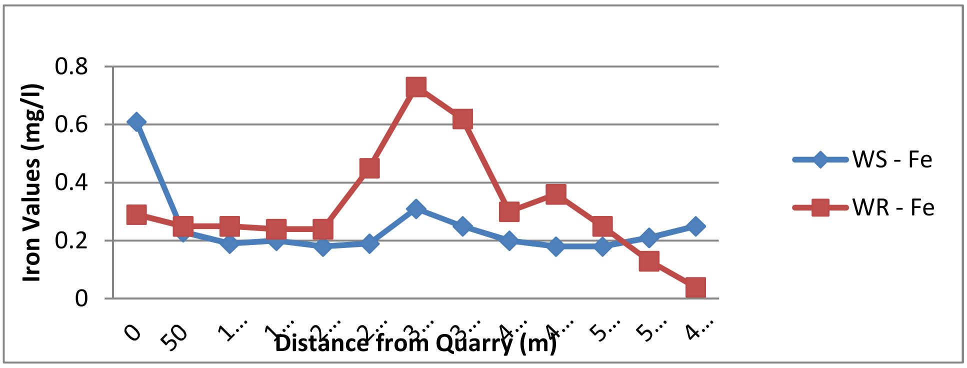


Figure 14: Analysis of Iron of Water Samples

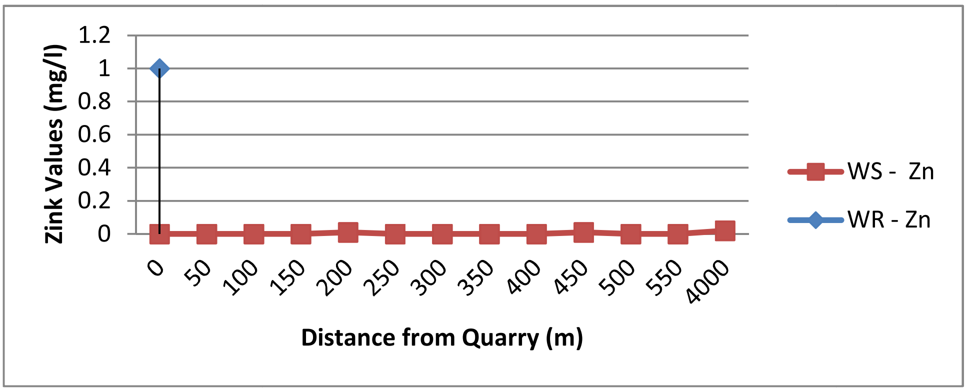


Figure 15: Analysis of Zinc of Water Samples

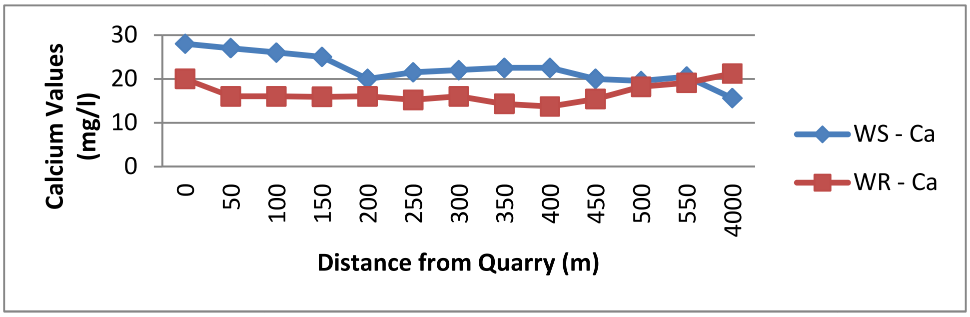


Figure 16: Analysis of Calcium of Water Samples

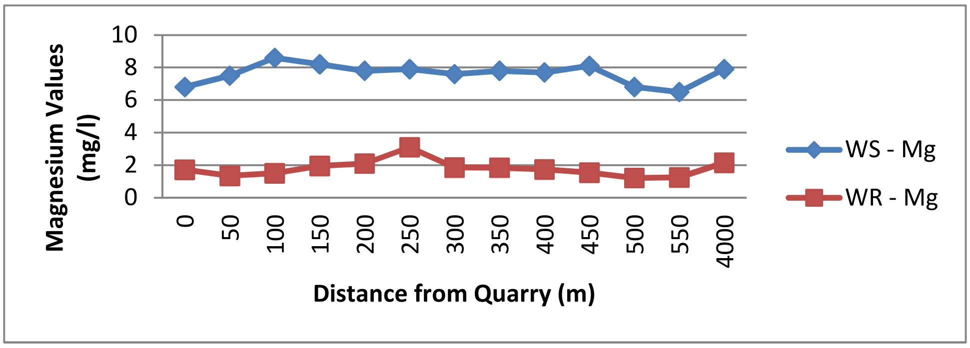


Figure 17: Analysis of Magnesium of Water Samples

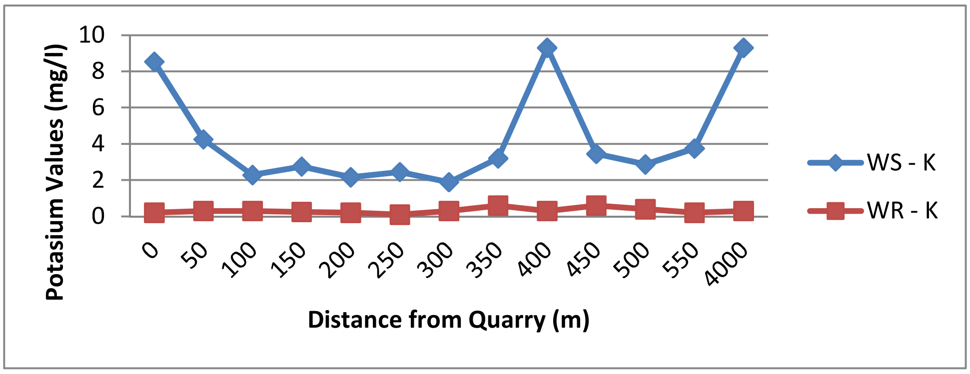


Figure 18: Analysis of Potassium of Water Samples

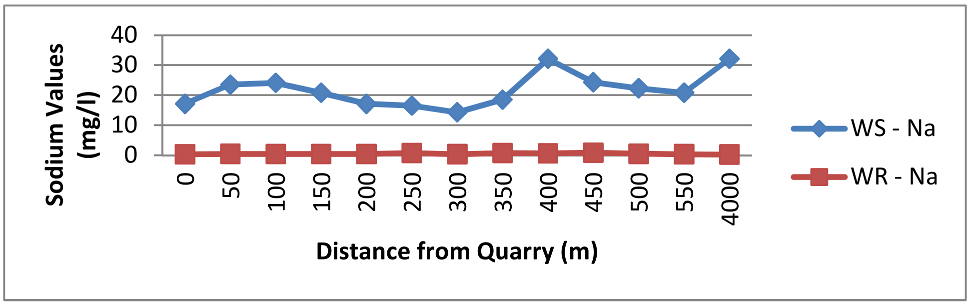


Figure 19: Analysis of Sodium of Water Samples

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