HYDROGEOLOGICAL REPORT FOR

Achamapuram Sand Quarry Project for Restoring the Functional Efficiency of the Cauvery River over an Extent of ***24.00.0Ha of Government land in S.F.No. 265/1(Part) of Cauvery River, Achamapuram Village, Manmangalam Taluk, Karur District, Tamil Nadu State.***

HYDROGEOLOGICAL REPORT FOR ACHAMAPURAMSAND QUARRY

The Applicant requires detailed information on Ground Water Occurrences at Proposed Project Site of Achamapuramsand quarry. The objective of the present study is to assess the availability of groundwater and comment on aspects of depth to potential aquifers, aquifer availability and type, possible yields and water quality. For this purpose all available hydrogeological information of the areas has been analyzed, and a geophysical survey was done.

1. INTRODUCTION

NAME OF THE APPLICANT WITH ADDRESS-

Name of the applicant	**:**	**The Executive Engineer.**
Address	**:**	Water Resources Department Mining and Monitoring Division Thiruchirappalli District, Tamil Nadu State – 620020.
Phone Number	**:**	98424 62467
State	**:**	Tamilnadu.

DETAILS OF THE AREA-

Survey No	**:**	265/1 (Part)
Land Classification	**:**	Government Land **River poramboke)**
Extent	**:**	24.00.0Ha
Village	**:**	Achamapuram,
Taluk	**:**	Manmangalam,
District	**:**	Karur.

The investigations involved hydrogeological, geophysical field investigations and a detailed study in which the available relevant geological and hydrogeological data were collected, analyzed, collated and evaluated within the context of the Client's requirements. The data sources consulted were mainly:

a) Central Ground Water Board (CGWB) Data
b) State & District Geological and Hydrogeological Reports and Maps.
c) Technical reports of the area by various organizations.

2. SCOPE OF THE WORKS –

The scope of works includes:

- Site visits to familiarize with the project areas. Identify any issues that might impact the Ground Water Scenario due to proposed mining activities.
- To obtain, study and synthesize background information including the geology, hydrogeology and existing borehole data, for the purpose of improving the quality of assessment and preparing comprehensive hydrogeological reports,
- To carry out hydrogeological evaluation and geophysical investigations in the selected sites in order to determine potential for groundwater at project site.
- To prepare hydrogeological survey reports in conformity with the provisions of the rules and procedure outlined by the Central Ground Water Board (CGWB), by Assessment of water quality and potential infringement of National standards, Assessment of availability of groundwater and Impact of proposed activity on aquifer, water quality and other abstractors.

3. BACKGROUND INFORMATION

Location

The investigated site falls in the Toposheet No: 58-J/ 01Latitude between10°58’31.6713"N to 10°58’37.4311"N and Longitude between78°10’48.2644"E to 78°10’53.5951"E on WGS datum-1984.

GEOLOGY

Regional Geology of KarurDistrict-

The entire district can be classified into hard rock and sedimentary formations. Hard Rock Formation: - More than 90 percent of the district is underlain by hard rock of Archaeon age. The gneissic type of formation is the major formation among the various types of hard rocks. Charnockite occurs in this district as pockets in Karur and Aravakurichitaluk. Quartzites which are resistant to weathering are also seen as patches in Charnockite and gneissic varieties and the above rock types. Sedimentary Formation: - Recent alluvial deposits such as sand, silt, clay, gravel etc. which are transported sediments by river are found on either side of Cauvery River in Karur, Krishnarayapuram and Kulithalai blocks. These formations are overlying the hard rock.

Migmatite Complex is represented by hornblende-biotite gneiss, granitic gneiss and pink migmatite. This Complex is a group of banded felsic rocks of varying mineralogical composition that are formed due to the influx of quartzofeldspathic material into high grade metamorphic rocks. Two types of migmatite are seen in the Karur district, one is grey and the other is pink. Next to charnockite, migmatite gneiss is the second most extensive rock. The migmatite gneiss consists of quartz, k- feldspar, plagioclase, hornblende and biotite in varying proportions.Intrusive igneous rocks are seen in the area are meta-gabbro and anorthosites as for example around Kadavur and Aravakurichi. Meta gabbro is coarse grained, dark grey, mainly comprising pyroxene, amphibole and plagioclase. Anorthosite is pale pink to light brown, medium to coarse grained rock essentially made up of plagioclase with a small amount of pyroxene and amphibole. Quartz and pegmatite veins are of restricted areal extent. Minor bodies of younger granite are exposed in the area east of Aravakurichi.
Foliation/ gneissosity, the prominent planar structure seen in the metamorphic rocks is ENE-WSW in the west and near N-S in the central part of the district. The eastern part of the district shows complicated folded structures due to interference of two phases of folding, forming a series of domes and basins. Faults and shear zones trend N-S in the central part, and NW-SE in the southern part.

GEOMORPHOLOGY

The entire area of the district is a pediplain. The Rangamalai hills and Kadavur hills occurring in the southern side of the district constitutes the remnants of the much denuded Eastern Ghats and rise to heights of over 1031m above mean sea level. From these hills the district slopes gently towards north east and forms a vast stretch of plain country till the eastern boarder of the district. There are numerous small residual hills represented by Ayyarmalai, Thanthonimalai and Velayuthampalayam hills. The general elevation of the area is ranging between 100 m and 200m above mean sea level.

The prominent geomorphic units identified in the district through interpretation of Satellite imagery are 1) Structural hill, 2) Pediments, 3) Shallow Pediments, 4) Buried Pediments and 5) Alluvial plain.

SOILS

The soils of Karur district can be broadly classified into 4 major soils types Red Soil, Thin Red Soil, Red Loam and River Alluvium Soil. Red soil is the predominant one covering major part of the district followed by Thin Red soil and Red loam.

The red soils are predominantly seen in Kadavur, Kulithalai, Krishnarayapuram, Thanthoni and Thogamalai blocks. The thin red soils are seen in Aravakurichi and K.Paramathiy blocks. Major portion of the Karur block is covered by red loam.

4. GEOPHYSICAL INVESTIGATION METHODS

A variety of methods are available to assist in the assessment of geological sub-surface conditions. The main emphasis of the fieldwork undertaken was to determine the thickness and composition of the sub-surface formations and to identify water-bearing zones.This information was principally obtained in the field using, and vertical electrical soundings (VES). The VES probes the resistivity layering below the site of measurement. This method is described below.

Resistivity Method

Vertical electrical soundings (VES) were carried out to probe the condition of the sub-surface and to confirm the existence of deep groundwater. The VES investigates the resistivity layering below the site of measurement.

Basic Principles

The electrical properties of rocks in the upper part of the earth's crust are dependent upon the lithology, porosity, and the degree of pore space saturation and the salinity of the pore water. Saturated rocks have lower resistivity than unsaturated and dry rocks. The higher the porosity of the saturated rock, or the higher the salinity of the saturating fluids, the lower is the resistivity. The presence of clays and conductive minerals also reduces the resistivity of the rock.

The resistivity of earth materials can be studied by measuring the electrical potential distribution produced at the earth's surface by an electric current that is passed through the earth. Current is moved through the subsurface from one current electrode to the other and the potential difference is recorded as the current passes. From this information, resistivity values of various layers are acquired and layer thickness can be identified.

The apparent resistivity values determined are plotted as a log function versus the log of the spacing between the electrodes. These plotted curves identify thickness of layers. If

there are multiple layers (more than 2), the acquired data is compared to a master curve to determine layer thickness.

This method is least influenced by lateral in-homogeneities and capable of providing higher depth of investigation.

The resistance R of a certain material is directly proportional to its length L and cross-sectional area A, expressed as:

$$R = Rs * L/A \text{ (in Ohm)}$$

Where Rs is known as the specific resistivity (characteristic of the material and independent of its shape or size)

With Ohm's Law,

$$R = dV/I \text{ (Ohm)}$$

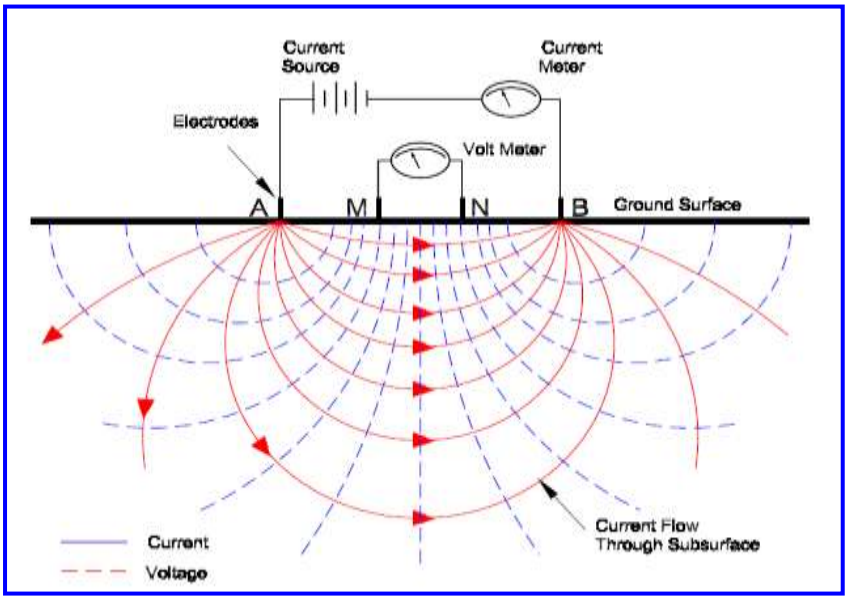
Where dV is the potential difference across the resistor and I is the electric current through the resistor. The specific resistivity may be determined by:

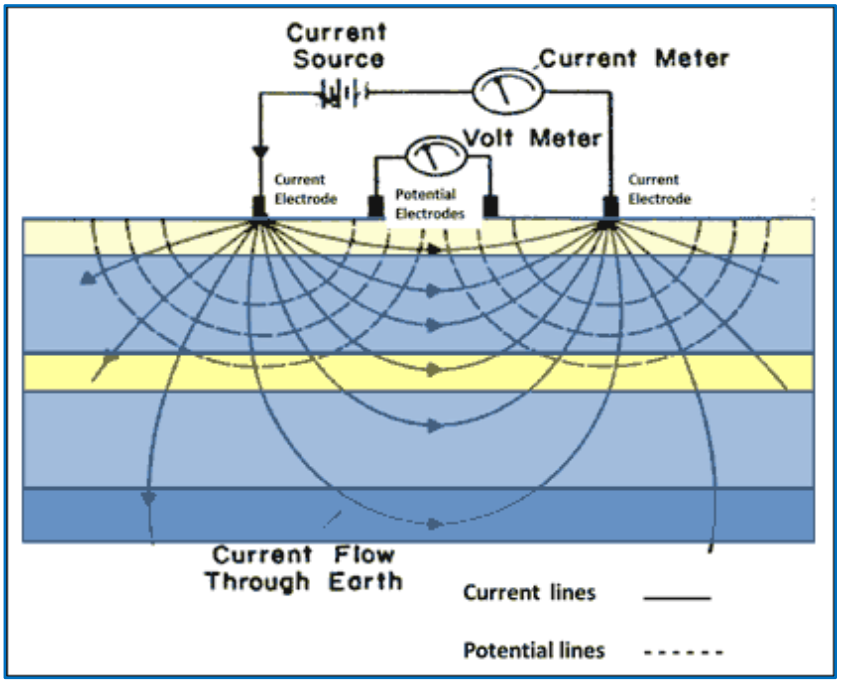
$$Rs = (A/L) * (dV/I) \text{ (in Ohm m)}$$

Vertical Electrical Sounding (VES)

When carrying out a resistivity sounding, current is led into the ground by means of two electrodes. With two other electrodes, situated near the center of the array, the potential field generated by the current is measured. From the observations of the current strength and the potential difference, and taking into account the electrode separations, the ground resistivity can be determined. During a resistivity sounding, the separation between the electrodes is step-wise increased (known as a Schlumberger Array), thus causing the flow of current to penetrate greater depths. When plotting the observed resistivity values against depth on double logarithmic paper, a resistivity graph is formed, which depicts the variation of resistivity with depth. This graph can be interpreted with the aid of a computer, and the actual resistivity layering of the subsoil is obtained. The depths and resistivity values provide the hydro geologist with information on the geological layering and thus the occurrence of groundwater.

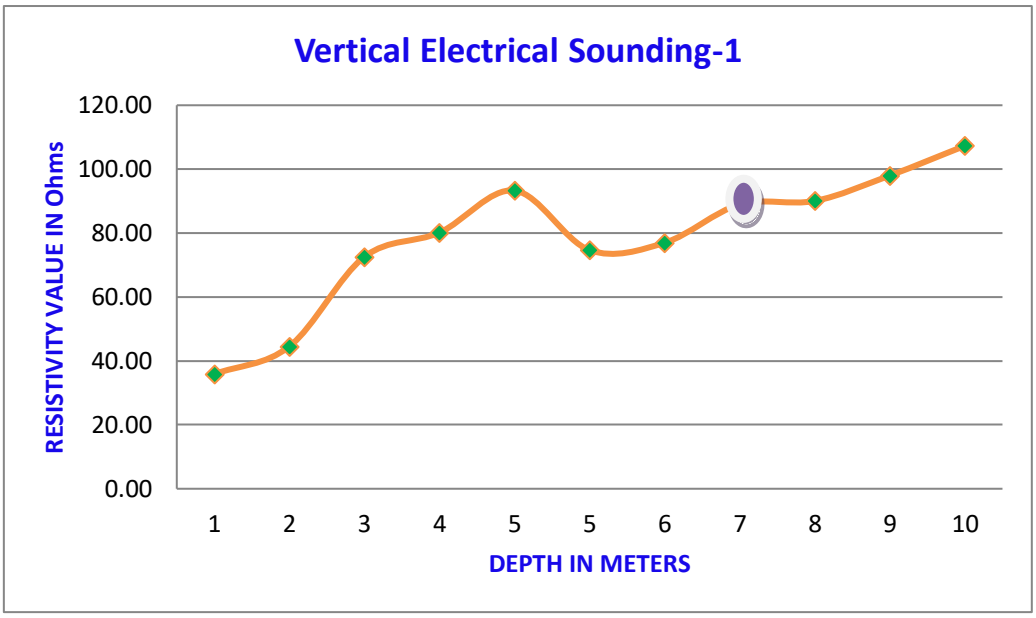
Vertical Electrical Sounding Methods




Current Source
Current Meter
Volt Meter
Current Electrode
Potential Electrodes
Current Electrode
Current Flow Through Earth
Current lines
Potential lines

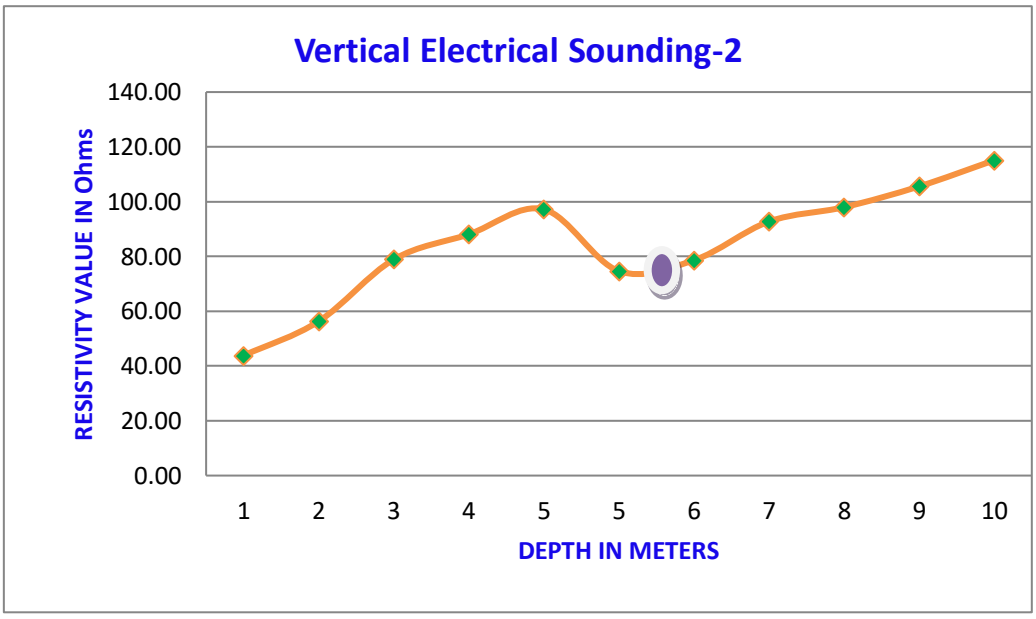
Vertical Electrical Sounding data's with Graphs

Vertical Electrical Sounding -1					
GPS Coordinates - 10°58'21.29"N 78°10'36.95"E					
S.NO	AB/2 (m)	MN/2(m)	Geometric Factor (K)	Resistance (R) Ohm	Apparent Resistivity Rho Ohm-meter
1	1	0.5	2.4	15.23	35.9
2	2	0.5	11.8	3.78	44.5
3	3	0.5	27.5	2.64	72.6
4	4	0.5	49.5	1.62	80.2
5	5	1	77.8	1.2	93.3
6	5	1	37.7	1.98	74.6
7	6	1	55.0	1.4	77.0
8	7	1	75.4	1.18	89.0
9	8	1	99.0	0.91	90.1
10	9	1	125.7	0.78	98.0
11	10	1	155.5	0.69	107.3



Above the vertical electrical sounding graphs purple color is fracture zone

Vertical Electrical Sounding -2					
GPS Coordinates - 10°57'56.47"N 78°11'0.23"E					
S.NO	AB/2 (m)	MN/2(m)	Geometric Factor (K)	Resistance (R) Ohm	Apparent Resistivity Rho Ohm-meter
1	1	0.5	2.4	18.6	43.8
2	2	0.5	11.8	4.78	56.3
3	3	0.5	27.5	2.87	78.9
4	4	0.5	49.5	1.78	88.1
5	5	1	77.8	1.25	97.2
6	5	1	37.7	1.98	74.6
7	6	1	55.0	1.43	78.6
8	7	1	75.4	1.23	92.7
9	8	1	99.0	0.99	98.0
10	9	1	125.7	0.84	105.6
11	10	1	155.5	0.74	115.1



Above the vertical electrical sounding graphs purple color is fracture zone

5. Conclusion –

The lease applied area exhibits slightly flat topography having gentle slope towards east side.The altitude of the area between 100.40m to 105.88m above from MSL and the River bed level is 102.1m on the upstream side and 101.1m on the downstream side above from MSL. The sand is derived by erosion of weathered rocks and Mineral particles and transported by the river water and deposited on the floor of the river in the interface.

The proposed depth of quarrying operation is 2m only, hence the ground water will not be affected in any manner due to the quarrying operation during the entire life period.

Based on the available information and the geophysical investigations it is concluded that the proposed project area is considered tohave medium groundwater potential. Productive aquifers are expected at depth of 7m to 8m where minor fractures are observed and shallow aquifers are expected above 6m-8m BGL.The ultimate pit limit as per the approved mining plan depth is 2m only BGL which will have no impact on the Ground Water.

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