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SUITABILITY OF ELECTRICAL RESISTIVITY SURVEY FOR SELECTING ANICUT SITE IN ORDER TO AUGMENT GROUND WATER-A CASE STUDY

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ABSTRACT

Vertical Electrical Soundings (VES) using schlumberger configuration were conducted at three anicut sites at villages Binjwaria, Rampura and Manaklao, on Rampura rivulet, originating from Binjwaria of district Jodhpur. A total of 162 VES data were obtained along and across the main stream. A close distribution of observation has enabled mapping of sub surface topography. In order to augument the ground water of the area, three anicuts on this rivulet are proposed. Resistivity parameters reveal that sandstone is likely to encounter shallow depth at Binjwaria and therefore it is the best suitable site for anicut. Gradually depth to sandstone increases towards Manaklao as evident by the fence diagram. Hence suitability of constructing anicut in this direction is less.

INTRODUCTION

Artificial recharge is an important technique for augmenting ground water potential as it provides additional water resource, avoids evaporation losses, pollution, allows use of stored water during dry periods. Also the artificially recharged ground water at any place within the ground water basin can be utilised at a different place without any engineering construction like canal, pipe line etc. Artificial recharge can be achieved by several methods. The choice of method is always site specific and is based on the following consideration : (1) Source of water including periodicity, quality and quantity of water. (2) Terrain characteristics which include slope, nature and extent of soil and vegetation cover, land use, infiltration rate and rainfall pattern. (3) Existence of a potential and suitable aquifer.

In the present study an attempt has been made to assess sub surface hydrogeological conditions to study the feasibility of construction of anicuts on an ephemeral stream in arid condition for recharge of ground water.

MATERIAL AND METHODS

(a) Location & Physiography :

The area under study lies in Jodhpur district between atit lude 26°0′ to 26°25′

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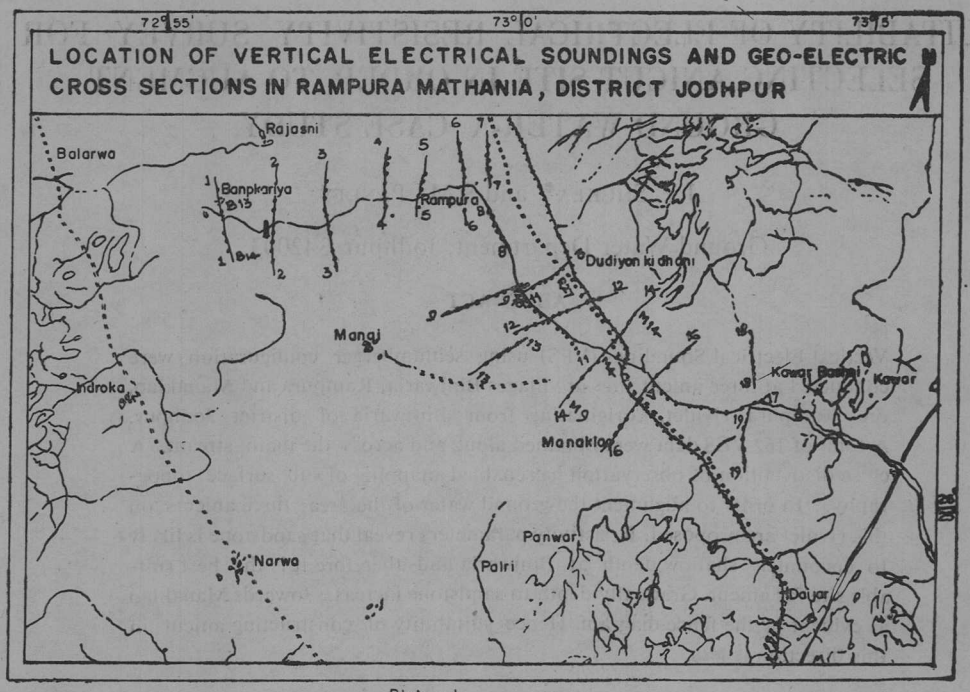


Plate - I

North and longitude 72°55′ to 73°5′ East. The sub-basin is almost flat, surrounded by small hills in the south-west and eastern parts. The foot hill zones at places form sediments comprising of denuded sand stones. The general ground slope is towards south east. Numerhus streamlets originate from the foot hill zones, majority of which die out before reaching the river Rampura (khari-nadi), the only ephemeral stream in the area.

(b) Ciimate :

The maximum temperature goes upto 45°C in May and mean monthly temperature for the month of May is 40°C. The lowest temperature recorded is 2°C in the month of December-January the mean for these months is 9.4°C. The average of rain fall received from 1968 to 1988 at Mandore and Osian are 306.5 mm and 232.3 mm respectively (Chandrashekar et al. 1984).

(c) Geology :

The rocks encountered in this area belong to Recent Marwar Super Group and Malani Igneous Suite of rhyolite of Post Delhi age. The igneous suite includes rhyolites and porphyries. Whereas Jodhpur sandstone belongs to Marwar Super Group, 1989.

(d) Instrumentation :

A. C. Resistivity meter (AQUAMETER) of low frequency has been used which essentially has two separate units viz., (a) Generator; (b) Amplifier. The generator generates low frequency (4 HZ) square wave electric pulses with the help of one transistorised oscillator. The amplifier unit consists of a filter and an amplifier.

(e) Field work and configuration :

Vertical Electrical Sounding technique with the schlumberger electrode configuration was adopted. The spread of the soundings has been taken from 200 m to 300 m depending upon the availability of space. As shown in Plate-1, soundings were taken across the stream channel on the either side of the river at an interval of 1 km. Based on the interpretation (Rijikswaterstaat 1969) and auxiliary graph (Bhattacharya and Patra 1968), geo-electric cross sections and fence diagram were prepared to infer sub surface condition.

RESULTS AND DISCUSSION

In all 162 Vertical Electrical Soundings along 19 sections were undertaken to select the suitable sites for the construction of anicut (Pande and Shukla 1989). Out of these three representative sections are being discussed below :

Geo-electric Section 1 :

The section (Plate 2) exhibits a five layer stratification viz.

—The first layer having resistivity 50-200 ohm-m and thickness 1 to 3 m corresponds to surface soil

—The second layer having resistivity 155-175 ohm-m corresponds to argillaceous sand stone. It has a maximum thickness of 42 m at B-12.

—The third layer having resistivity 400-500 ohm-m corresponds to sandstone. Thickness of this layer at B-16 is 35 m.

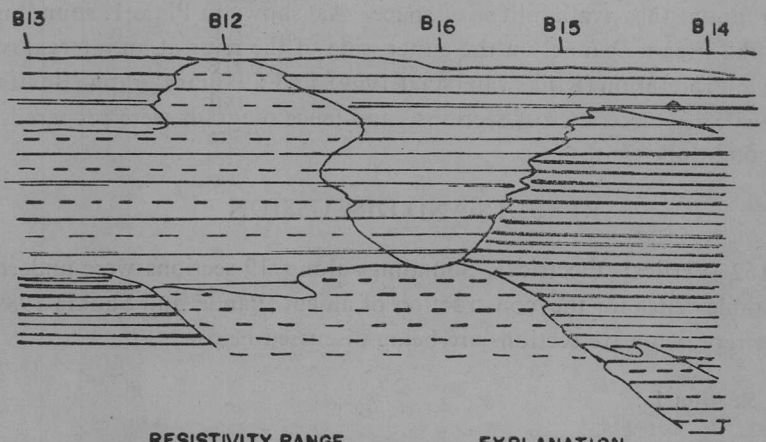
—The fourth layer having resistivity 500-950 ohm-m is due to compact sandstone. Thickness of this layer at B-15, B-14 varies from 20-45 m.

—The fifth layer having resistivity 28-36 ohm-m corresponds to shale.

GEO-ELECTRIC SECTION - I

BINJWARA

SCALE Horizontal : 1 cm = 100 m
Vertical : 1 cm = 10 m



INDEX	RESISTIVITY RANGE (ohm - m)	EXPLANATION
	50 - 200	SURFACE SOIL
	155 - 175	ARGILLACIOUS SANDSTONE
	400 - 520	SANDSTONE
	500 - 950	COARSE GRAINED OR COMPACT SANDSTONE
	28 - 36	SHALE OR CLAY

PLATE - 2

Geo-electric Section 10 :

The section (Plate 3) exhibits a simple three layer stratification viz. :

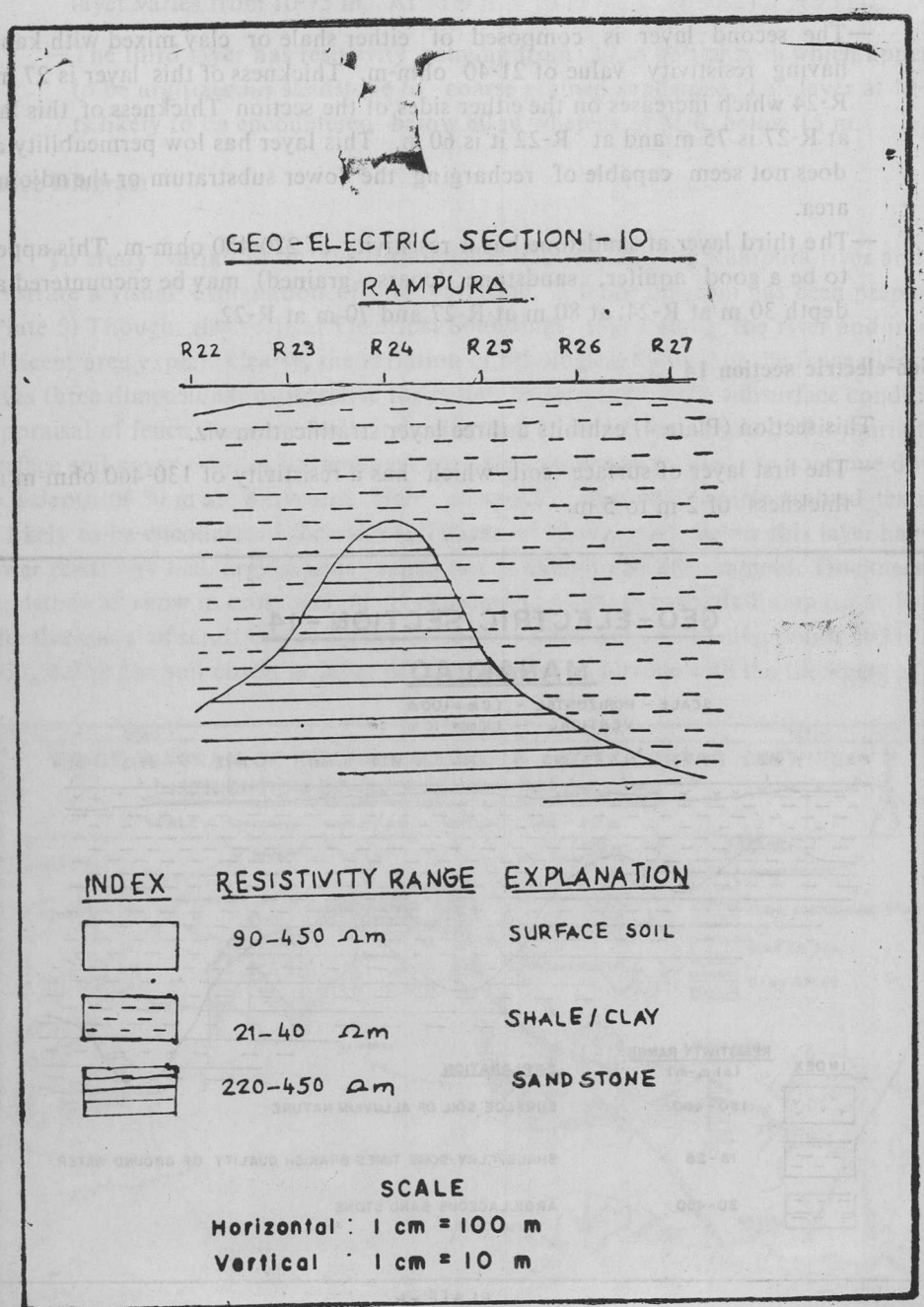


PLATE - 3

m is expected to be encountered which may continue upto B-38. Thickness of sandstone at B-31 and B-38 appears to be the same. Argillacous sandstone is expected to be encountered below coarse grained sandstone which may form a major formation upto R-2 i.e. in the N-E of the Rampura village.

In south of the village Rampura, the thickness as well as presence of sandstone diminishes. A thick bed of clay shale mixed with kankar is expected to be encountered near the anicut site. At a depth of about 60-63 m, sandstone is likely to be re-encountered.

It is further apparent that thickness of shale/clay layer increases towards Manaklao. The thickness of this shale/clay seems to decrease towards village Karwar Basni. It is also clear that shale/clay bed towards M-45 diminishes. At this point argillaceous sandstone below the surface layer is likely to be re-encountered. Below this zone compact sandstone of high resistivity is expected to be encountered.

A formation which is highly permeable and allows lateral flow of water through the base of anicut, is not suitable for construction of water. Also formation which is practically impermeablc, composed of clay or silt, restrict water to seep down, is not suitable formation having moderate permeabilities are best suited for the construction of anicuts.

Thus on the basis of study of fence diagram (Plate-5) and Geo-electric cross section (Plate 2-4), following conclusions may be drawn.

(1) Upper layer near the village Binjwaria is composed of sandstone with argillaceous sandstone as underlying formation. Sandstone may be taken as semi-permeable formation which may permit enough water to percolate and is considered suitable for construction of anicut.

(2) A thick clay/shale is present at Rampura village and sandstone is expected to be the subsequent layer. Since permeability of clay is very low, recharge will not be adequate so this does not seem to be proper site.

(3) A clay/shale layer present at Manaklao village is thicker than Rampura village so this site is also not feasible.

(4) The thickness of shale/clay horizon reduces considerably towards Karwar Basni village and also argillaceous sandstone is expected to be encountered below the soil cover, this site like Binjwaria is also ideal for construction of anicut.

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