DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 79/110

YUNTA TOWN WATER SUPPLY
REPORT ON RESISTIVITY SOUNDINGS.

GEOLOGICAL SURVEY

by

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D.M. No. 671/73

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ABSTRACT

Thirteen Schlumberger Vertical Electrical Soundings have been conducted in the Yunta area as part of a continuing program to assess the groundwater potential of the area.

The geology was found to be unfavourable for this technique, hence a comprehensive quantitative interpretation of the soundings was not possible.

Analysis of the results suggests that the area around Woolshed Bore has a significant accumulation of freshwater and drilling with pump testing is recommended.

INTRODUCTION

At the request of the Engineering Division of this Department, thirteen Schlumberger Vertical Electrical Soundings were conducted in the Yunta area as part of a continuing program to assess the groundwater potential of the area with the view to establishing a town water supply. The soundings were conducted at the locations shown in Fig. 1.

Soundings 1 to 5 were all located on the banks of the creek which runs past Woolshed Bore with sounding 3 adjacent to the bore. Soundings 6, 7 and 8 were all located near the banks of another creek and sounding number 9 was located near a drainage line in the centre of a valley between two parallel groups of hills. Sounding number 10 was in the same valley on a creek bank and sounding 11 was located within 50 metres of S.A.D.M.E. bore number 176/75. Soundings 12 and 13 were located on the same creek as bore 176/75. Electrodes for soundings 1 to 8, 10 and 12 to 13 were emplaced in a straight line sub-parallel to their respective creeks and where feasible sub-parallel to

strike. For sounding 9 electrodes were emplaced along the long axis of the valley and for sounding 14 they were placed on the verge of the main Adelaide to Broken Hill road.

HYDROGEOLOGY

Reports by Waterhouse and Griffin (1973) and by Bowering (1975) indicate groundwater in the area occurs in cleaved and jointed metasediments of Proterozoic and early Palaeozoic age and in Recent alluvial gravels and sands. Weathered metasiltstones with estimated dips from 20^{o} to 40^{o} with prominent cleavage and jointing outcrop in all areas surveyed. In addition a number of drillholes in the area point to the presence of thick clay bands with variable sand content.

RESULTS

Tables 1 and 2 detail models calculated for the soundings. Extreme care should be exercised in using these models because they were calculated using Schlumberger Vertical Electrical Sounding theory which assumes an isotropic, homogeneous, horizontally layered earth and in the Yunta area the following conditions interact to partially invalidate these assumptions:

(a) there is a significant dip of the bedrock in all areas of investigation;

(b) the depth of weathering is variable along the spread length;

(c) cleavage, jointing and earth composition is highly variable.

A further problem in the interpretation was that the variable clay composition meant that resistivities of some clays were probably the same as that of fresh water and other clays the same as salty water, making it impossible to say conclusively which was which.

The problems detailed above suggest that a quantitative analysis of the results would not be worthwhile and therefore

the results of models presented in tables 1 and 2 should be treated as a guide only and used in a qualitative fashion.

The thirteen soundings are grouped into; Area A, soundings 1 to 5; Area B, soundings 6 to 10; and Area C, soundings 11 to 13.

AREA A

Area A (Table 1) is the most prospective area. Soundings 1, 2 and 3 suggest fresh water, possibly sitting on salt water and in the case of number 3 this possibility is confirmed by the adjacent Woolshed Bore which is pumping small amounts of fresh water.

Salty water appears to be present at the other sites but there may be a fresh water layer on top of the salt water. However, because it is not thick enough nor of sufficient lateral extent the method has not detected it. Again it must be emphasized that the thicknesses and resistivities presented in the models must be treated in a qualitative sense.

AREA B

Area B (Table 2) offers little hope of thick accumulations of fresh water. Soundings 8 and 9 indicate that no water is present and similarly soundings 6 and 7 indicate no water or possibly a thin layer of very salty water. Sounding 10 suggests the possibility of a thin fresh water layer on top of a thin salt water layer or clay band.

AREA C

Area C (Table 2) is also unlikely to contain suitable accumulations of fresh water. All three soundings suggest that some salt water is present but no freshwater. Sounding 11 is near a bore which does contain saltwater, however, the geological log of this bore bears little resemblance to the interpretation of the sounding because the bore is in the creek and so passed through deposits of this creek.

CONCLUSIONS

Of the three areas, Area A is the only prospective one. It appears that the fresh water in this area sits on a layer of salt water and as a result sustained heavy pumping would lead to invasion by the salt water. Drilling and pump testing in this area are recommended since it is unlikely that resistivity soundings will be able to predict accurately the volume of fresh water present.

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REFERENCES

Bowering, O.J.W., 1975. Yunta Town Water Supply Report on Groundwater Investigations. Department of Mines and Energy unpublished Report Book 75/109.

Waterhouse, J.D. and Griffin, G.K., 1973. Yunta Water Supply Preliminary Investigations and Recommendations. Department of Mines and Energy unpublished Report Book 73/251.

TABLE 1

MODELS FOR VERTICAL ELECTRICAL SOUNDINGS - AREA A

Sounding #	Layer #	Thickness (m)	Resistivity (Ω m)	Interpretation[1]
1	1	0.5	18)	surface material.
	2	0.6	33)	
	3	2.0	40	fresh/brackish water.
	4	8.7	30	salt water.
	5	RESISTIVE BASEMENT		
2	1	0.3	510	surface material.
	2	6.6	50	fresh water?
	3	RESISTIVE BASEMENT		
3	1	0.7	300)	
	2	1.5	450)	surface material.
	3	12	80	fresh water - in jointing & cleavage?
	4	65	450	representative of a gradual tightening of cleavage & jointing?
	5	RESISTIVE BASEMENT		
4	1	0.5	280)	
	2	1.2	54)	surface material.
	3	0.3	400)	
	4	9.0	35	brackish or salt water.
	5	RESISTIVE BASEMENT		
5	1	5.7	210	surface material.
	2	7.5	31	brackish or salt water.
	3	60	470	representative of a gradual tightening of jointing & cleavage?
	4	RESISTIVE BASEMENT		

1. fresh water used here to mean: less than 1000 mg/litre T.D.S.
brackish " " " " " : less than 5000 mg/litre T.D.S.
salt " " " " " : greater than 5000 mg/litre T.D.S.

TABLE 2

MODELS FOR VERTICAL ELECTRICAL SOUNDINGS - AREAS B & C

Sounding #	Layer #	Thickness (m)	Resistivity (Ω m)	Interpretation[1]
6	1	0.24	300)	
	2	0.90	17)	surface material.
	3	1.8	50)	
	4	1.0	1.6	clay or salt water.
	5	RESISTIVE BASEMENT		
7	1	0.2	50)	
	2	1.5	22)	surface material.
	3	1.0	5	clay or salt water.
	4	RESISTIVE BASEMENT		
8 & 9		All one layer of RESISTIVE BASEMENT		
10	1	0.34	300	surface material.
	2	1.0	60	(fresh water? (clay?
	3	1.6	6.5	(salt water? (clay?
	4	RESISTIVE BASEMENT		
11	1	1.6	160	surface material.
	2	3.8	32	brackish/salt water, clay?.
	3	5.9	2.3	clay or salt water.
	4	RESISTIVE BASEMENT		
12	1	0.23	250	surface material.
	2	1.9	20	(salt water? (clay?
	3	5.5	5	clay or salt water.
	4	RESISTIVE BASEMENT		
13	1	0.2	50)	
	2	2.7	130)	surface material.
	3	7.8	30	(brackish/salt water? (clay?
		RESISTIVE BASEMENT		

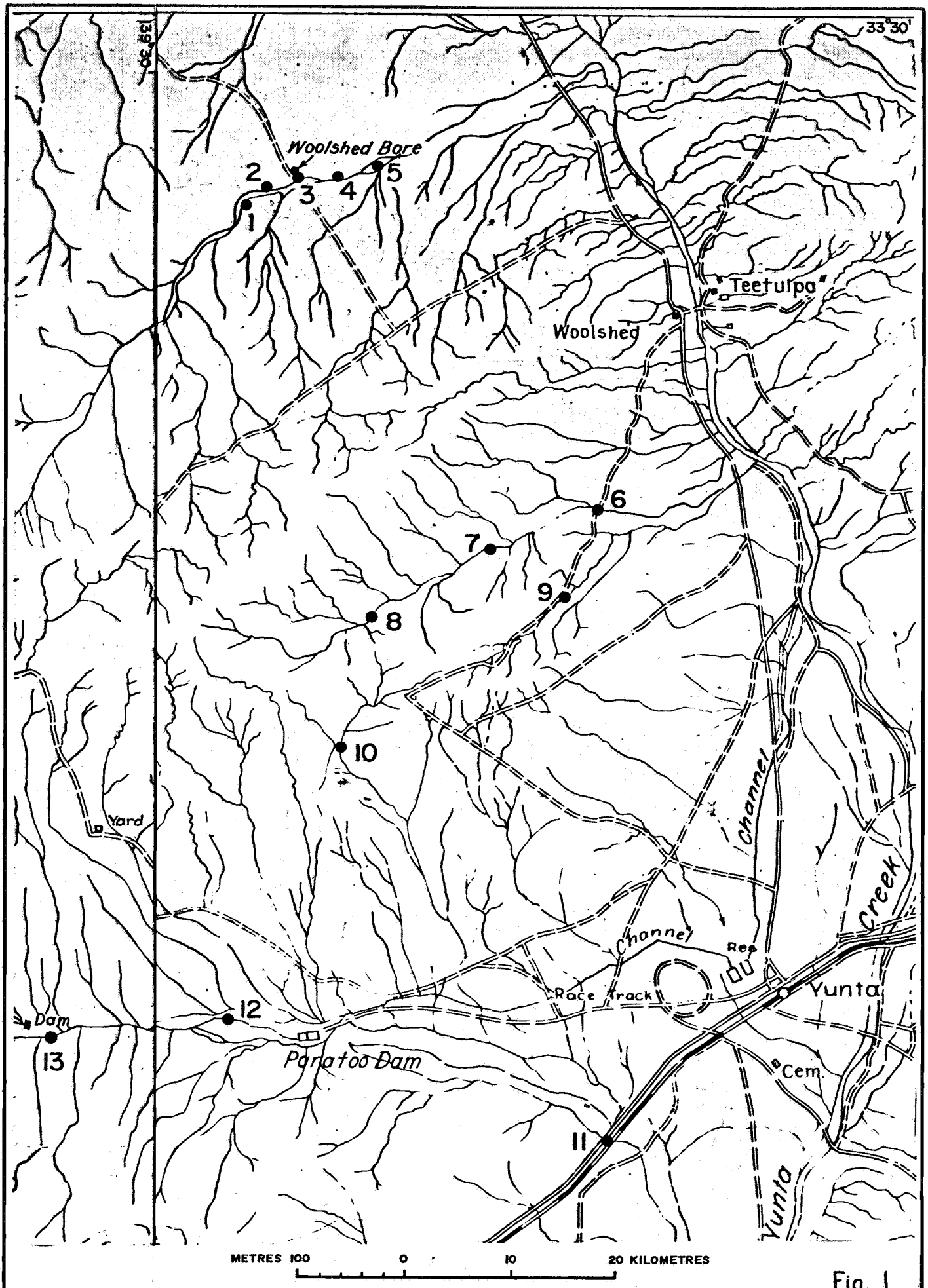

Fig. 1

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 1 : 47,520
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