—(*Continued*)

5	6	7	8
No.	Yes.	Yes, to the extent of preventing off-flow on to down-stream neighbour.	No.
Yes. practice is for authority constructing irrigation works to also provide community drainage scheme to which each farm is connected.	Yes.	Yes.	Yes.
...	7·3 to 8·3	..	7.0
Cummunity drains normally empty into a natural water-course.	Pumped into river.	River to ocean.	River and swamp.
Mechanical cleaning annually. Investigating chemical treatment & soil sterilization.	Mechanical as required.	Hand removal plus some chemical treatment.	Channels are patrolled & land cleaned. Mechanical treatment being developed.
Yes-suitable side slopes are used in sandy soils 1 to 3, clay soils 1 to 2.	Not entirely free. Timber sloping is occasionally required.	Yes generally.	Yes.
Yes-but are investigating possibility of reducing amount of dredging required.	Yes.	Yes.	Yes.

Table II

1	2	3	4
12	Can a typical design of a drain be spared	Drains are designed on the following principles; (*a*) Grades are even and not less than 12 in per mile. (*b*) Berms are at least 10 ft. wide, (*c*) number of inlet kept to a minimum, generally one per property. (*d*) All inlets concrete and below bed level.	Drain shape is determined by soil and method of making, i. e. dragline excavated to required depth, or apparently till sides fall in.
13	Any literature which can be spared or referred to.	Forwarded herewith H. L. Booman. Irrigation and water supply development in Victoria" H. B. Lincoln. and N. Z. Weed Bucket reprint from "Aqua". R. L. Walsh. "Weed cutter developed by commission Engineer" reprint from Commonwealth Engineer. W. P. Dunk. "Weed Control Report 1951–2" reprint from "Aqua".	See Section on tubewells.

5	6	7	8
Design is normally based on Manning's formula using value of n=0.030 & assuming channel section is trapezoidal in form. A typical drainage longitudinal sec. sheet is enclosed.	Plan of Neeta Irrigation Area is enclosed.	Plan enclosed.	...
This Commission is preparing a specification on design of channels and drains from which relevant extracts can be forwarded at a later date, if desired.	..	..	..

Table II

DRAINAGE BY COVERED

1	2	3	4
1	What types of drains are used.	Baked clay.	Baked clay.
2	Are the tiles shrouded	No.	Yes.
3	What is the thickness and size of shrouding.	..	Practice has been to cover top and sides of joint with strip of 2″ tax paper and cover with 3 – 6″ of loose sandy top soil. Method needs stable subsoils.
4	What is the usual slope of tile drains	3″ per chain	3—4″ per chain.
5	What is the usual depth of drain below natural surface.	4 ft—6 ft.	4 ft—6 ft. depending on soil type.
6	What is the distance of the drains apart.	44 ft—88 ft.	44 ft. to 132 ft. depending on soil type and salinity when drained.
7	What is the order of conductivity and pH of the drained water.	Total soluble salts 700 parts per million. pH 7. 5	2.5×10^{-3} m. mnv/cm. pH undetermined.
8	Any published literature.	* See below	* See below

Walters. D. V. Investigations of local problems related to dried fruits production in the Nyah-Woorinen district J. Counc. Sci. Ind. Res. 10, No. 2, May 1937.

Thomas, J. E. Investigation of the problem of salt accumulation on a Mallee soil in the Murray Valley Irrigation area. C. S. I. R. Bull. 128, 1939.

Tisdal, A. L. Note on the use of drainage water. J. Counc. Sci. Ind. Res. 14, No. 4, 1941.

—(*Continued*).

DRAINS OR TILES

5	6	7	8
Not used.	Cement concrete for main drains. Baked clay (tiles) for field drains.	Not used.	Baked. Clay, Not many tiles drains installed yet, but great interest being taken at present.
..	No.	..	No. Usually put strip of paper over joints.
..	..	..	..
..	0.20 ft. in 66 ft. as a minimum (i.e. = $2\frac{1}{2}$″ per chain).	..	For 4″ tiles minimum is 4″ per chain.
..	5 ft – 6 ft.	..	6 ft – 8 ft.
..	40 ft – 150 ft or more.	..	Varies up to 2 chains (132 ft).
..	pH 7.0 – 10.0	..	..
..	A parliamentary paper 35/1941.	..	..

Tisdal. A. L. Drainage investigations in the horticultural soils of the Murray valley.
C. S. I. R. Pamphlet, 13, 1942.

Lyon. A. V. and Tisdal, A. L. Production of dried grapes in the Murray Valley irrigation settlements ; 2. Irrigation, drainage and reclamation.
C. S. I. R. Bull. 149, 1942.

Table II—(*Concluded*).

LOWERING OF WATERTABLE BY TUBE WELL PUMPING

S. No.	Question.	W. C. I. C. (N. S. W.)	C. S. I. R. O. Merbein (Vic.)
1	Are the drainage wells deep or shallow.	Depth of wells – 30 feet to 60 feet.	Deep, *i.e.* to 90. feet.
2	Is the pumped water used for irrigation?	Generally No : will probably be re-used when salt content is lowered.	No, about 3% dissolved salts.
3	What is the usual discharge of drainage wells ?	0.3 to 1.3 cusecs (cubic feet per second)	140 gallons (Imperial) per minute.
4	What types of strainer are adopted ?	Monel-metal or bronze gauge varying from 8 to 28 meshes to the inch to pass not more than about 50% of material during development : spirally-wound wire screens with non wedging sections not yet available.	Brass wire gauge with rectangtlar slots backed by bronze frame.
5	What is the silt size to sand grade?	Mechanical analysis variable : insufficient samples to quote typical cases.	This is interpreted to mean slit size, or 'Silt' as material passing through the screen, which is essentially the same thing. sizes used are 20 and 40 thousand of an inch. For different cases will retain 25-40% by weight of the sand.

6	Are drainage wells developed with gravels, and to what diameter?	Gravel packing is resorted to where sands are likely to be unstable :—graded high porosity gravels used, size range dependent on sieve analysis of natural materail : gravels introduced during development from 10 inch casing surrounding the 8 inch well and approximate 7 inch screen.	No developing of "in situ" sand only.
7	What is the usual life of a tube well?	Life of tube well is unknown. the projcet is just emerging from the experimental state.	Insufficient time as yet to answer this question.
8	Any published literature?	None published.	The reference given here are applicable to both this section and to that on open drains ;— Tisdall, A. L. Free water investigation in the Australian areas of the Murray Valley. J. Counc. Sci. Ind. Res. 9, No. 4, 1936. Tisdall, A. L. J. Counc. Sci. Ind. Res. 12, No. 1, Feb. 1939.

REFERENCES AND SOURCES OF INFORMATION, FOR TABLE II.

Abbreviated form.	Full title and address.
S. R. W. S. (Vic.)	The state rivers and water supply Commission, 100—110 Exhibition Street, Melbourne, C I. Victoria. (Secretary).
Csiro Merbein (Vic)	C. S. I. R. O. Commonwealth Research Station Merbein, Victoria. (Officer-in. Charge
I. and W. S. C. (Qld).	The Irrigation and Water supply commission, Box 5334, G. P. O., Brisbane, Queensland. (Secretary)
.E W. S. D. (S. A.)	The Engineering and Water supply department, Box 641 F, G. P. O., Adelaide, South Australia. (Engineer-in-Chief).
P. W. D. (V. A.)	The public works department, Perth, West Australia. (Under Secretary for water supply)
Csiro Griffith (NSW)	C. S. I. R. O. Irrigation Research Station Griffith, 55; New South Wales. (Officer-in-Chief)
W. C. I. C. (NSW)	Water Conservation and Irrigation Commission, Box 2708, G. P. O., Sydney, New South Wales.

TABLE No. III

Questioner together with replies on Drainage of Irrigated Soils from Egypt, Africa, America, Morocco and Holland.

TABLE

Questioner together with replies on Drainage of Irrigated

GENE

Serial No	Question	Egypt.	Africa.
1	Name of Country.	Egypt.	Union of S. Africa
2	Region—Arid/Semi-Arid /Humid.	Semi-Arid.	Arid, Semi arid and Humid.
3	Type of soil to be drained sandy/Light/Heavy/ Saline/Alkaline.	Medium arid, heavy soils saline and Alkaline.	Light sandy Alluvial Soils, Patches of heavier types also. Alkali called locally 'Brock' very common.
4	Mechanical Analysis of a typical drained area.	70 p.c. of drained area belong to clay and heavy clay soils containing not less that 50 p c. clay and 20 – 30 p.c. Silt and 20 – 30 p.c. fine sand.	Not available.
5	Are there salinity or Alkalinity problems ?	Yes, both.	Yes both problems. Discharge of heavily charged harmful salts water, a very serious problem.
6	What is the general depth of water table below natural surface ?	2—4 ft.	2 to 3 ft.
7	What is the usual order of permeability co-efficient ?	No data.	No data.

No. III

Soils from Egypt, Africa, America, Morcco and Holland.

RAL

America.	Morocco.	Holland
United States	Morocco French Protectorate	Netherlands.
All types.	Semi arid. Rainfall one to two ft.	Humid region.
All tyyes.	All types	Sandy Soils: non-Saline, non alkaline
(*a*) Clay particles below .002 mm. (*b*) Silt particles below .02 to .002 mm. (*c*) Sand particles below .2 mm.	Not availab'e.	Clay 0—8 per cent, Silt 0—4 per cent, Sand 88—100 per cent.
Yes.	Yes, Some lands has been abondoned.	No salinity or Alkalinity problems.
Probably ranges from 1—10 ft. where drainage is necessary.	1 to 15 ft below surface.	12—14 inches in very coarse Sand, 32 in very fine sand.
Highly variable.	Literature from Society for Research and Irrigation RABAT.	In coarse sand K = 1—3 meter per day. In fine sand K = 0.5 meter per day or less.

Table III

A. OPEN

Serial No.	Questions.	Egypt.	Africa
8	If drainage is done by open drains.	.....	
(*i*)	How deep are field drains ?	2.7 ft.	Minor 3 to 4 ft Main 8 to 10 ft
(*ii*)	What is their distance apart ?	(*a*) Heavy clay soils about 55 ft. (*b*) Clay soils about 90 ft. (*c*) Loams and clay loams about 120 ft.	No rigid rules, depends upon permeability of soil, severity of waterlogging and topographical condition etc.
(*iii*)	What is the side slope ?	1 : 1	Small drain almost vertical average 1 to 1 and 1½ to 1
(*iv*)	Are the field drains privately owned ?	Yes	Privately owned.
(*v*)	Is there any legislation compelling the owner to dig field drains ?	No	No
(*vi*)	Is the discharging drain Govt. owned ?	Main drains are Govt, owned.	Yes
(*vii*)	What is the order of Salinity or pH of drained water ?	Salinity-wide range, traces to about 500 parts/million. pH about 8.0	Report C 20/1
(*viii*)	How is the drained water disposed off, to a river/canal/lake ?	Mostly to lakes connected with the sea.	To rivers or to streams.
(*ix*)	What means are adopted to avoid weed growth and fungus ?	Accelerating the velocity of water which is not always possible.	Permanent drains are concrete lined

—(*Continued*)

DRAINS

America	Morocco	Holand
.....	.....	.....
Usually 6 – 12 ft.	No definite depth fixed so far.	24 inches.
Laterals commonly 0.5 to 1 mile	.....	8 – 30 m (fine and coarse sand.)
1.5 to 1 or flatter.	.....	1 : 1
Usually	Privately owned.	Yes.
Not generally	No	No
Most drainage is by private drainage districts.	Yes	Only the main discharges drains.
Highly variable	Variable.	Generally fresh water PH + 7.5.
Usually to rivers by gravity if possible.	.....	To a canal and mostly pumped out directly or indirectly into the sea.
Periodic cleaning most common. Some use of chemical weed Killers.	High velocity by big slopes.	Cleaning by hand work.

Table III

Serial No.	Questions.	Egypt.	Africa
(x)	Are the big drains free from the trouble of falling banks ?	Mostly.	No, side slope Preferable to excavate at the lower end.
(xi)	Is constant dredging and cleaning of weeds necessary ?	Yes, particularly weeds.	Weeds clearance done by cutting rather by up rooting them
(xii)	Can a typical design of a drain be spared ?	Attached.	Trapezoidal section, side slope 1 : 1 and 3 to 1 section usually parabolic $x = 2.5 \sqrt{Y}$
(xiii)	Any literature on the subject which can be either spared or referred to.	Reports of Ministry of Agriculture.	Canals of Parabolic Section.
			B. DRAINAGE BY COVERED
(i)	What types of drains are used, cement concrete or baked clay ?	Cement concrete tiles composed of cement and sand (500 kg of cement to $1m^3$ of sand).	Unreinforced precast concrete pipes for field drain size 12″ to 15″, Baked clay, glazed earthen ware, 4.0″ to 6.0″ and 2 ft. length.
(ii)	Are the tiles shrouded ?	Tiles are put square opposite each other.	Yes with shingle put in in the form of a filter.
(iii)	What is the thickness and size of shrouding ?	The joints are wapped by a piece of jute and covered by a layer 10 cm. thick of either broken red bricks or small size gravel.	Shrouding put all round from 3.0″ to 9.0″.

—(*Continued*)

America.	Morocco	Holland.
Yes, if side slopes are flat enough.	Trouble of falling banks.	Mostly free from the trouble of falling banks. Grown with reed (Phragmites Communis.)
Usually	Maintenance necessary.	Yes.
.....	Each case is special and no universal design possible.	See fig A
.....	Ref. given	.....
DRAINS OR TILES		
Both clay usually, better in Saline soils.	Do not exist in Morocco	Mostly baked clay and some concrete tiles diameter 2 and 3 inches.
Occassionally.	.....	Yes, the joins are covered with fibrous peat.
Variable—One to two feet of coarse gravel probably near maximum.	.....	+ 1 inch. —

Table III

Serial No.	Questions.	Egypt.	Africa
(*iv*)	What is the usual slope of tiles drain ?	Min 10 Cm/100 m for field tiles less than four inches. 6/100 m for field 6" tiles 4/100 m for field 8" tiles 3/100 m for field 10" tiles and more.	Self clearing velocity necessary.
(*v*)	What is the usual depth of drain below natural surface ?	Mean usual depth = 1.10 m in clay soils.	Below water table and normal zone of root penetration.
(*vi*)	What is the distance of drains apart ?	Spacing of field tile drains is 50 m in average clay Boils and increase with the increase of percentage of sand.	20 to 40 ft.
(*vii*)	What is the order of conductivity and PH of the drained water ?	not determined yet.	Report C/20/1.
(*viii*)	Any published literature on the subject which can be spared and referred to.	None yet.	No dept. Literature

—(*Continued*)

America	Morcco	Holland
Minimum slope about .002 ft/ft., steeper slope if topography permits.	.....	For drainage only (clay – soils): 0.2 per cent for Sub irrigation horizontal.
Variable depending on soil but ranging generally between 3—5 ft.	.....	For drainage only (clay soils : 1 meter as an average, for Sub-Irrigation in coarse sand. 70m, in fine sand 1.00 m.
Variable depending on soil ranging from 50 to 150 feet.	....	In coarse sand : 20-30 m. In moderately fine sand 12 – 16 m. In very fine sand 8 m.
Highly variable.	....	PH: 7.0 – 7.9
....	.....	Copy of "La consommationd' d'eaus etc."

Table III

Serial No.	Questions.	Egypt.	Africa.
		C. LOWERING OF WATER TABLE	
(*i*)	Are the drainage well deep or shallow ?	Under experimental investigations.	Not practised in Africa as yet.
(*ii*)	Is the pumped water use for irrigation ?	....	....
(*iii*)	What is the usual discharge for drainage well ?	....	....
(*iv*)	What type of strainer are adopted ?	....	....
(*v*)	What is the slit size to sand grade ?	....	....
(*vi*)	Are drainage well developed with gravels and to what diameter ?	....	....
(*vii*)	What is the usual life of a tube well ?	....	....
(*viii*)	Any published information which can be useful for a tube well project.	....	....

—(*Continued*).

America	Morocco	Holland
BY TUBE WELL PUMPING.		
Usually shallow.	Not practised in Morocco	Not practised in this country.
If satisfactory chemically	....	....
Highly variable	....	....
Almost all commercial types are used.	....	....
Highly variable.	....	....
Occassionally.	.....	.....
No limit that I know of unless casing is corroded by water.	.....	....
....	....	....

TABLE No. IV

DICHARGE DIVISION

Statement showing variation in areas of various depths upto sub soil water-table in Chej and Rechna Doabs worked out from the depth maps of June observations for the years 1892, 1930, 1935, 1940, 1945 *and* 1950.

Total area of Chej Doab = 3,229,000 acres and of Rechna = 6,1918,000 acres.

Year	Particulars.	Areas in acres divided into zones of various depths upto spring levels.			
		0′ – 5′	5′ – 10′	10′ – 15′	Above 15 ft.
1	2	3	4	5	6
			CHEJ DOAB.		
1892	Areas	...	15,600	281,800	2,931,600
	p.c.		1	9	90
1930	Areas	174,800	1,005,900	860,600	1,187,700
	p.c.	5	31	27	37
1935	Areas	115,300	1,192,700	1,206,300	604,709
	p.c.	7	37	37	19
1940	Areas	211,300	1,279,500	891,300	846,900
	p.c.	6	40	28	26
1945	Areas	310,000	1,490,500	768,800	659,700
	p.c.	10	45	24	20
1950	Areas	226,900	1,663,700	806,000	532,400
	p.c.	7	52	25	16

Table IV—(*Continued*).

Year	Particulars	Areas in acres divided into zones of various depths upto spring levels.			
		0′ – 5′	5′ – 10′	10′ – 15′	Above 15 ft.
1	2	3	4	5	6
		RECHNA DOAB			
1892	Areas	...	45,500	367,400	6,499,109
	p.c.		1	5	94
1930	Areas	122,000	1,022,000	1,880,400	3,881,600
	p c.	2	15	27	56
1935	Areas	331,800	1,572,500	1,557,700	3,454,000
	p.c.	5	23	22	50
1940	Areas	242,500	1,327,100	1,890,700	3,455,700
	p.c.	4	19	27	50
1945	Areas	417,000	2,051,600	1,312,300	3,135,100
	p.c.	6	30	19	
1950	Areas	405,500	2,174,500	1,809,600	2,526,400
	p c.	6	31	26	37

TABLE No. V.

Moisture percentage for soil samples taken from Rakh Kot Lakhpat (unirrigated plot)

Depth from N. S. in ft.	Date of sampling. 3-11-42	23-12-42	15-1-43	3-2-43	12-2-43	25-2-43	9-3-43	25-3-43	19-4-43	19-5-43
1	4.9	9.5	13.5	10.4	10.0	6.4	4.3	4.8	4.9	4.6
2	7.1	7-3	7.3	7.5	9.1	6.9	6.1	6.9	6.2	6.2
3	6.8	7.2	7.7	7.6	8.1	6 9	6.6	7.2	6.9	7.3
4	6.2	7.5	7.6	7.2	7.7	6.2	7.1	7.0	6 6	6.9
5	6.2	7.0	7.7	6.6	7.0	6.1	6.2	7.3	6.8	9·1
6	5.8	7.4	8.5	6.0	6 5	6.9	8.4	10.2	10.6	11.8
7	4.8	7.7	10.3	7.0	7.7	8.4	10.2	13.1	15.8	10.4
8	4.6	11.3	16.0	13.0	14.7	9.5	16.5	14.2	14.6	15.7
9	14.7	18.6	20.9	20.3	21.7	19.5	20.7	20.3	22.1	21.0
10	18.1	20.4	21.9	22.7	22.7	21.3	21.2	21.5	23.6	22.6
11	22.3	24.0	25.5	27.2	25.0	25.5	24.4	27.3	26.2	26.2
12	25.1	26.2	27.6	27.8	26.1	27.7	26.2	27.5	27.1	29.1
13	23.5	26.3	27.9	25.6	28.6	27.2	25.3	28.1	28.1	27.7
14	23.3	22.9	24.0	24.4	24.9	24.2	24.9	25.4	26.4	25.3
15	28.6	27.5	31 0	32.7	34.0	28.2	30.7	27.4	31.1	31.0
		30.8	32.2							

TABLE No. VII.

Showing the moisture percentage in Soil at various depth.

Thickness of Soil Crust ft.	5.0	7.0	15.0	...
Watertable level ft.	5.75	7.25	15.0	22.0

Depth in ft.	Moisture		Percentage.	
1	15.2	15.2	6.2	7.2
2	21.2	16.5	4.1	10.4
3	19.2	17.4	5.5	11.3
4	24.7	20.8	3.1	11.8
5	26.1	20.4	9.1	11.7
6	29.1	20.8	13.2	12.2
7	...	25.5	15.2	13.6
8	...	...	23.2	10.9
9	...	...	26.4	14.6
10	...	...	25.4	16.5
11	...	...	24.0	19.0
12	...	...	26.4	18.4
13	...	...	29.3	20.2
14	...	...	34.5	19.8
15	...	...	39.8	20.0
16	...	...	...	18.0
17	...	...	...	20.9
18	...	...	...	21.0
19	...	...	...	22.1
20	...	...	...	22.9
21	...	...	...	24.8

TABLE No. VIII

CHUHAR

Summary of Water

Well No.	Date of samples.	Milliequivalents per litre.							
		Ca.	Mg.	Na (diff).	K	CO_3 HCO_3	Cl	SO_4	Total.
1	30-ix-53	2.2	T	0.1	T	1.4	0.4	0.5	2.9
	17-vi-54	1.3	0.45	1.2	—	1.5	1.3	0.1	
2	18-vi-53	7.2	T	0.8	—	6.1	1.0	0.9	
	17-vi-54	1.1	1 3	6.2		6.9	1.4	0.3	
3	5-xi-53	2.1	T	0.4	T	2.0	0.4	0.1	
	17-vi-54	1.1	0.9	1.3		2.4	0.7	0.2	
4	5-xi-54	2.1	0.2	0	T	1.8	0.2	0.2	
	18-vi-54	1.3	1.2	2.1		3.6	0.9	0.1	
5	5-xi-53	2.0	0.1	0.2	T	1.9	0.3	0.1	
	25-v -54	1.3	1.0	0.4		2.2	0.4	0.2	
6	2-x -53	2.8	0.1	1.1	T	3.0	0.6	0.4	
	18-vi-54	1.1	0.9	2.6		3.5	0.9	8.2	
7	2-x -53	7.6	0.1	1.2	T	4.9	1.4	2.6	
	16-vi-54	1.2	1.9	5.0		6.5	1.3	0.2	

—(*Continued*).

KANA Well Number 1 to 12

Analysis 1953-54 13 to 24 on U. G. Canal

ppm by Evap.	ECX 10^6 25°C	pH	% Na		Res. CO_3 me/l	Salt Index.	SAR.
			Found.	Poss.			
170	224	8.1	5	13	0	—38	
208	235	7.6	41	86	0	—36	1.2
630	917	7.7	10	42	0	—93	
649	928	8.5	72	100	4.5	—21	5.5
170	251	8.4	16	80	0	—45	
230	268	8.7	42	100	0 3	—32	1.2
170	224.	8.6	0	0	0	—46	
324	425	8.8	47	100	1.1	—28	1.8
180	235	8.1	9	50	0	—43	
196	257	7.7	15	72	0	—33	0.3
300	417	8.1	28	100	0.1	—50	
339	458	8.3	57	100	1.6	—29	2.5
660	961	7.7	13	30	0	—105	
604	894	8.5	62	100	3.4	—29	4.0

Table VIII

Well No.	Date samples.	Milliequivalcnts per litre.							
		Ca.	No.	Na (diff).	K	CO_3 HCO_3	Cl	SO_4	Total.
8	5-xi-53	6.4	0.4	0.9	.01	6.4	1.1	0.2	
9	15-xi-53	7.1	0.2	0.6	T	6.4	1.2	0.3	
10	5-xi 53	3.3	0.1	0.6	.01	2.9	0.5	0.6	
	29- v-54	0.9	0.6	2.5		3.2	0.6	0.2	
11	5-xi-53	7.1	0.5	1.6	.01	7.2	1.3	0.7	
	18-vi-54	1.6	1.8	6.7		8.0	1.6	0.6	
12	4-xi-53	7.9	0.6	1.4	.03	8.0	1.4	0.5	
	18-vi-54	1.5	1.5	7.8		8.4	2.1	0.3	
13	29-ix-53	8.1	0.1	1.3	.01	6.3	1.7	1.5	
	16-vi-54	0.9	2.0	7.2		7.9	1.6	0.6	
14	4-xi-53	7.1	0.3	1.5	.01	6.6	1.1	1.2	
	11-vi-54	1.4	2.0	5.7		7.1	1.3	0.7	
15	29-ix-53	7.5	0.1	1.1	T	6.9	1.3	0.5	
	17-vi-54	1.2	1.3	6.7		6.5	1.7	0.9	
16	20-xii-53	8.7	T	1.7	T	6.3	1.5	2.6	
	17-xi-54	1.5	1.7	7.0		7.9	1.9	0.4	

—(*Continued*).

ppm by Evap.	Date 10^6 26°C	pH	%Na		Res. CO_3 me/l	Salt Index.	SAR.
			Found.	Poss.			
592	862	8.1	13	69	0	—87	
610	895	8 2	8	40	0	—93	
320	464	8.3	15	55	0	—56	
316	475	7.9	64	100	2.3	—22	2.8
730	1060	7.9	15	76	0	—91	
754	1051	8.4	66	100	4 6	—28	5.0
775	1140	7,9	17	76	0	—97	
805	1118	7.7	72	100	5.4	—24	6.3
730	1062	7.7	15	44	0	—97	
751	1062	8.7	71	100	5.0	—22	5.8
690	1000	8.0	18	68	0	—90	
679	1006	7.7	63	100	3.7	—30	4.4
670	978	8 0	11	56	0	—93	
674	950	7.9	73	100	4.1	—22	5.8
780	1080	7.7	16	42	0		
758	1062	7.9	69	100	4.7	—26	5.5

Table VIII

Well No.	Date samples.	Milliequivalcnts per litre.							
		Ca.	No.	Na (diff).	K	CO_3 HCO_3	Cl	SO_4	Total.
17	1-vii-53	8.1	T	2.9	T	6.2	1.2	3.8	
	17-vi-54	1.1	0.9	9.2		8.9	1.8	0.5	
18	4-xi-53	10.0	0.4	3.4	.02	7.4	2.4	4.0	
	17-vi-54	0.7	1.1	11.1		8.4	2.3	2.2	
19	26-vi-53	14.3	T	1.8	T	7.0	2.8	6.4	
	16-vi-54	1.3	2.8	9.6		10.0	3.1	0:7	
20	5-xi-53	5.5	T	0.1	T	4.0	0.8	0.8	
	17-vi-54	0.7	0.7	7.3		6.9	1.5	0.4	
21	5-xi-53	11.4	0.4	2.8	.02	9.0	2.3	3.3	
	17-vi-54	1.2	1.9	11.0		9.0	2 5	2.5	
22	1-ix-53	10.0	0.5	3.7	0.0	6.3	2.8	5.1	
	17-vi-54	1.7	1.5	10.7		9.1	2.5	2.3	
23	29-ix-53	8.4	0.2	2.8	T	6.6	2.0	2.8	
	17-vi-54	1.0	1 8	8.6		8.4	2.1	0.8	
24	5-xi-53	10.0	0.3	1.1	.03	9.0	1.6	0.8	
	17-vi-54	1.3	2.2	8.5		8.9	2.1	1.0	
U.G.	5-xi-53	2.1	0.4	0	T	1.8	0.4	0.2	
	18-vi-54	1.1	0.2	0.8		1.6	0.5	0.1	

—(*Concluded*).

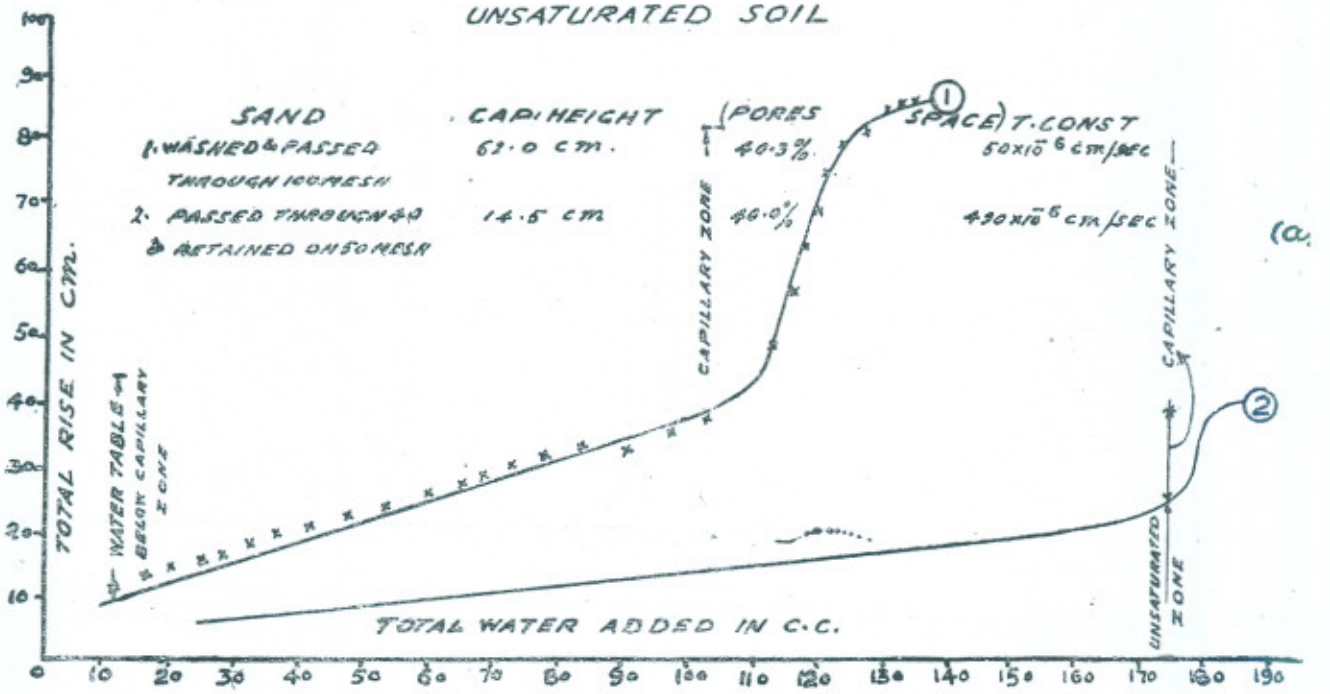
ppm by Evap.	Date 10^6 26°C	pH	% Na		Res. CO_3 me/l	Salt Index.	SAR.
			Found.	Poss.			
840	1230	7.8	26	61	0	—99	
859	1230	8.1	82	100	6.9	—14	9.0
1010	1450	8.1	23	51	0	—116	
962	1442	8.7	86	100	6.6	—6	11.7
1167	1680	7.5	12	20	0	—156	
1026	1476	8.8	70	100	5.9	—25	6.5
415	615	8.3	2	6	0	—74	
671	939	8.1	83	100	5.5	—12	8.7
1090	1590	8.2	19	50	0	—126	
1037	1464	8.8	78	700	6.0	—19	9.0
1030	1498	7.8	26	47	0	—113	
1025	1453	7.6	77	100	5.9	—17	8.6
850	1196	7.8	25	58	0	—99	
845	1219	8.8	75	100	5.6	—15	7.0
885	1290	8.2	11	49	0	—119	
906	1252	8.7	71	100	5.4	—20	6.3
170	218	8.6	0	0	0	—45	
156	195	8.9	38	100	0.4	—32	0.9

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FIG. 1

RISE OF WATERTABLE IN SATURATED AND UNSATURATED SOIL



SAND COLUM IN UNSATURATED STATE
WATER ADDED FROM BELOW
(SAND SAME IN ALL CASES)
EXPERIMENT REPEATED THRICE

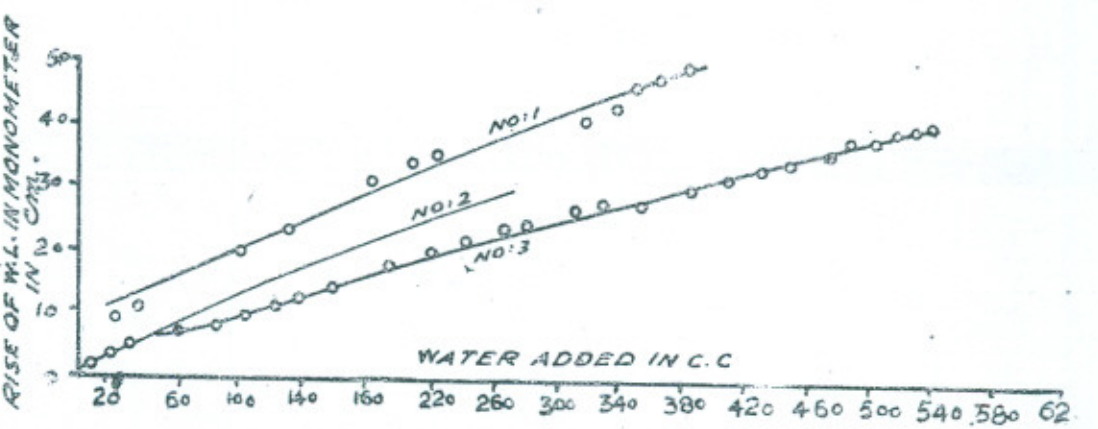
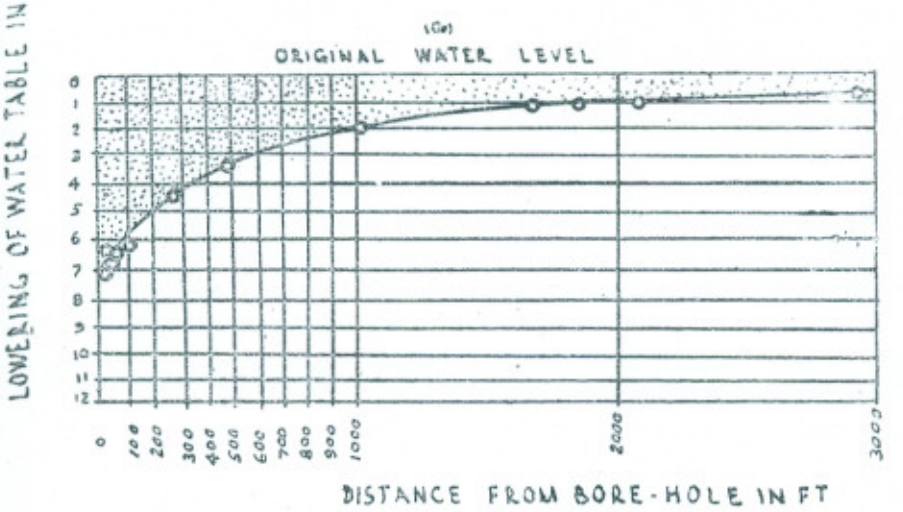
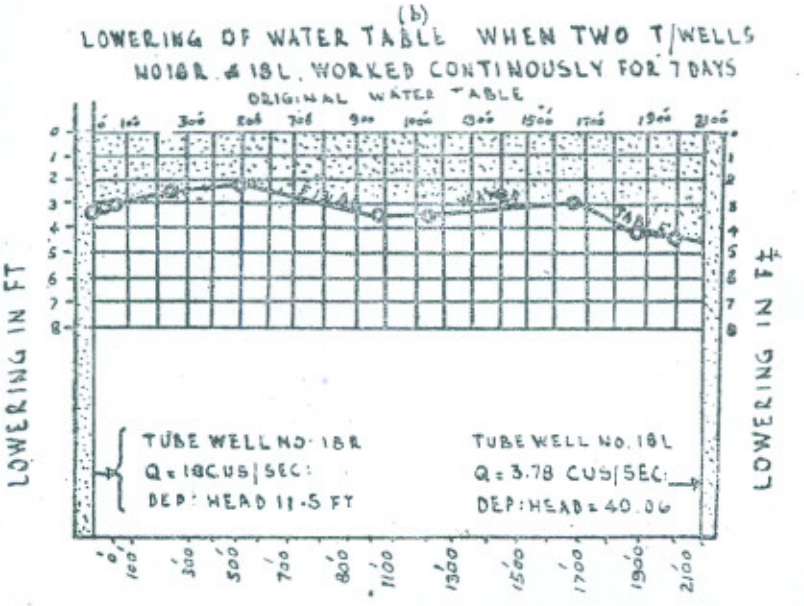


FIG. 2

TUBE WELL EXPERIMENTS SHEIKHUPURA DRAIN R.D 110
WATER LEVEL AFTER 22 DAYS OF WORKING OF WELL NO 18 R
WITH DEPRESSION HEAD 35.5 Ft

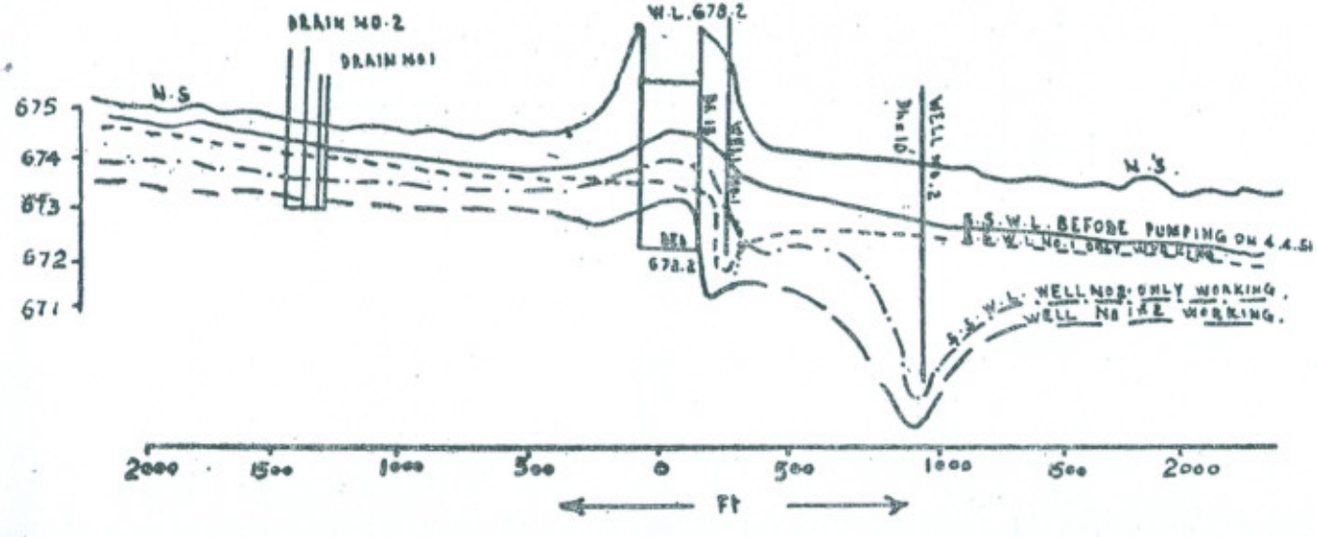




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FIG.3.

TUBE-WELL EXPERIMENTS AT CHUHARKANA 1951
S.S.W L OBSERVATIONS WITH PUMPING OF WELLS NO 1 AND 2



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FIG 4 a

TUBE WELL EXPERIMENTS AT CHUHARKANA

S S W L ON 19 11 45 BEFORE PUMPING STARTED

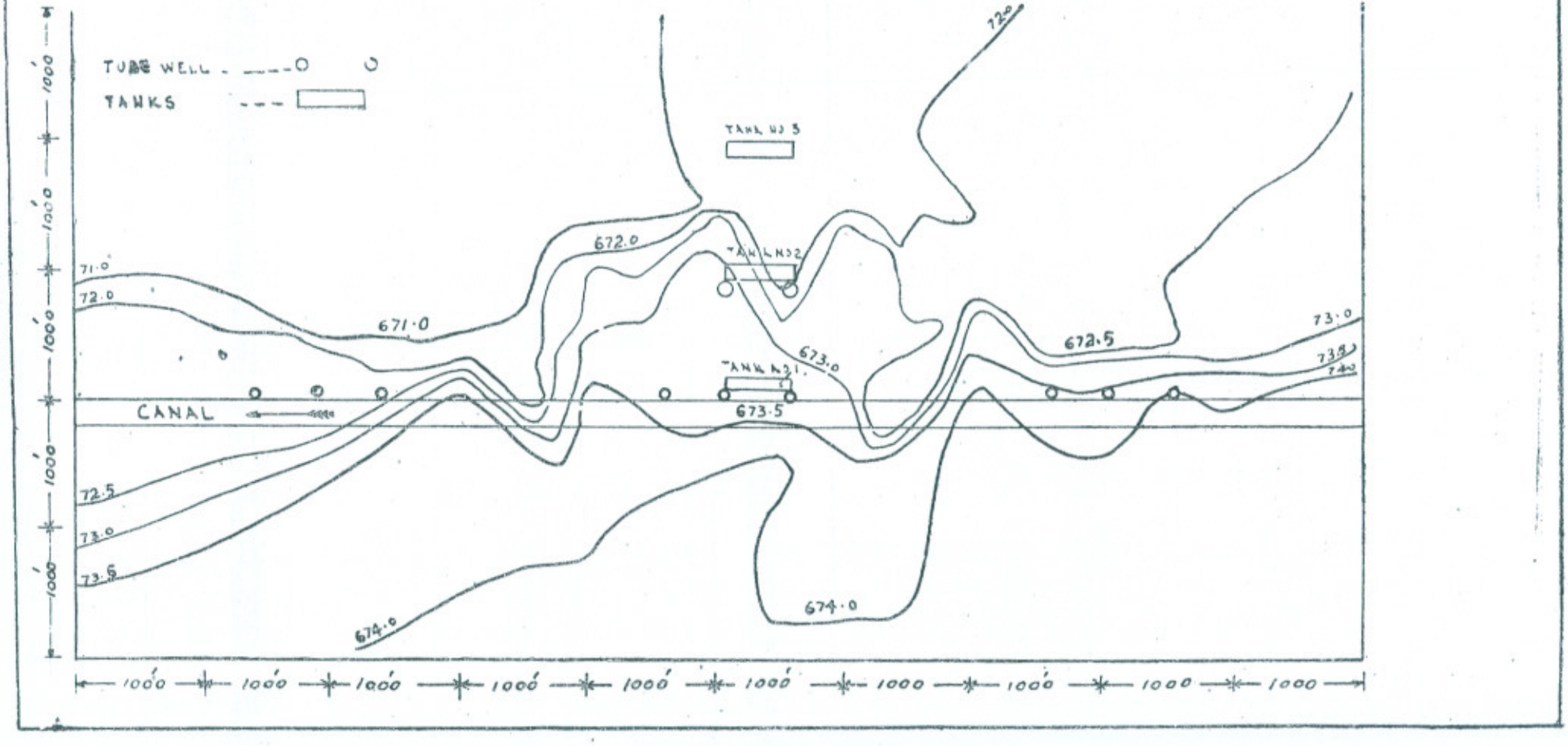
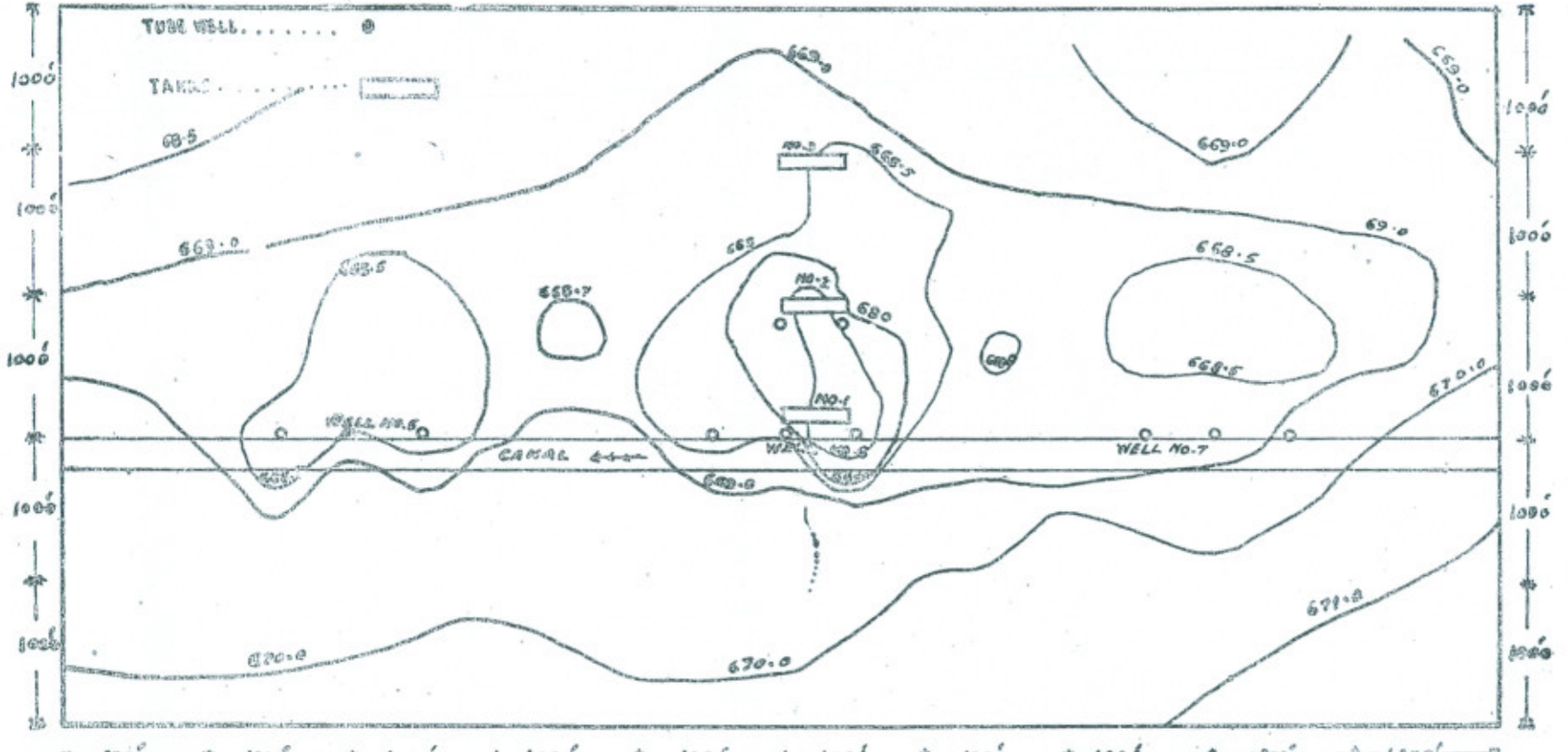


FIG: 46.

TUBE WELL EXPERIMENTS AT CHUNARKANA
CONTINUOUS WORKING OF WELLS
S.D.W.L. ON 11.6.47.

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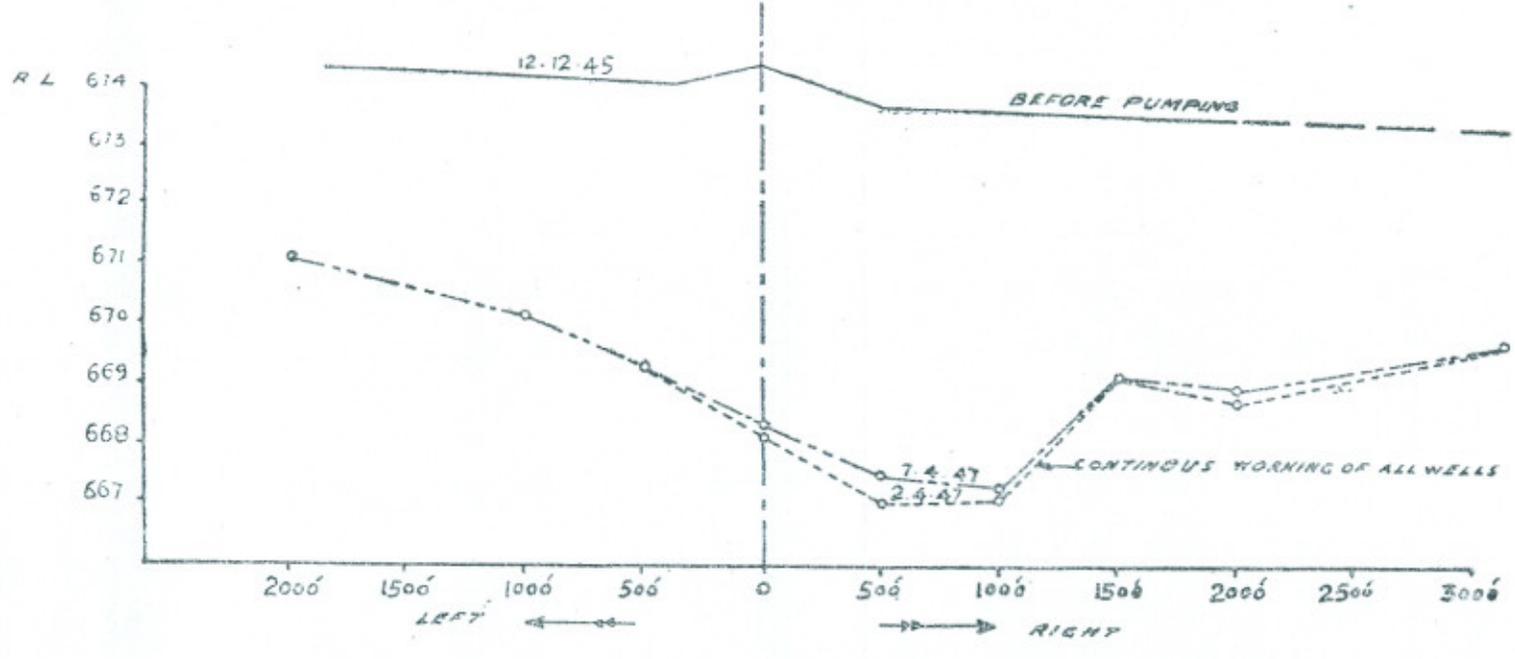


FIG·4C

TUBEWELL EXPERIMENTS AT CHUHARKANA

EFFECT OF TUBEWELL PUMPING ON SUB-SOIL WATER LEVEL

WITH ALTERNATIVE WORKING OF WELLS



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FIG. 5

COMPARISON IN LOWERING
OF S.S.W.L. AT TWO SITES ON UPPER G.B.
CASE (i) TUBE WELL NO. 29 B AT R.D. 112 WORKED FOR 48 HRS:
CASE (ii) " " " 33 A " " 123 " " " " " "
DEPRESSION HEAD 13·0' IN BOTH CASES

CHUHARKANA TUBE-WELL EXPT:
CONDUCTED AT R·D·S. 112000 AND 123000

REFERENCES:-
O..... TUBE WELL
△..... OBSERVATION PIPE

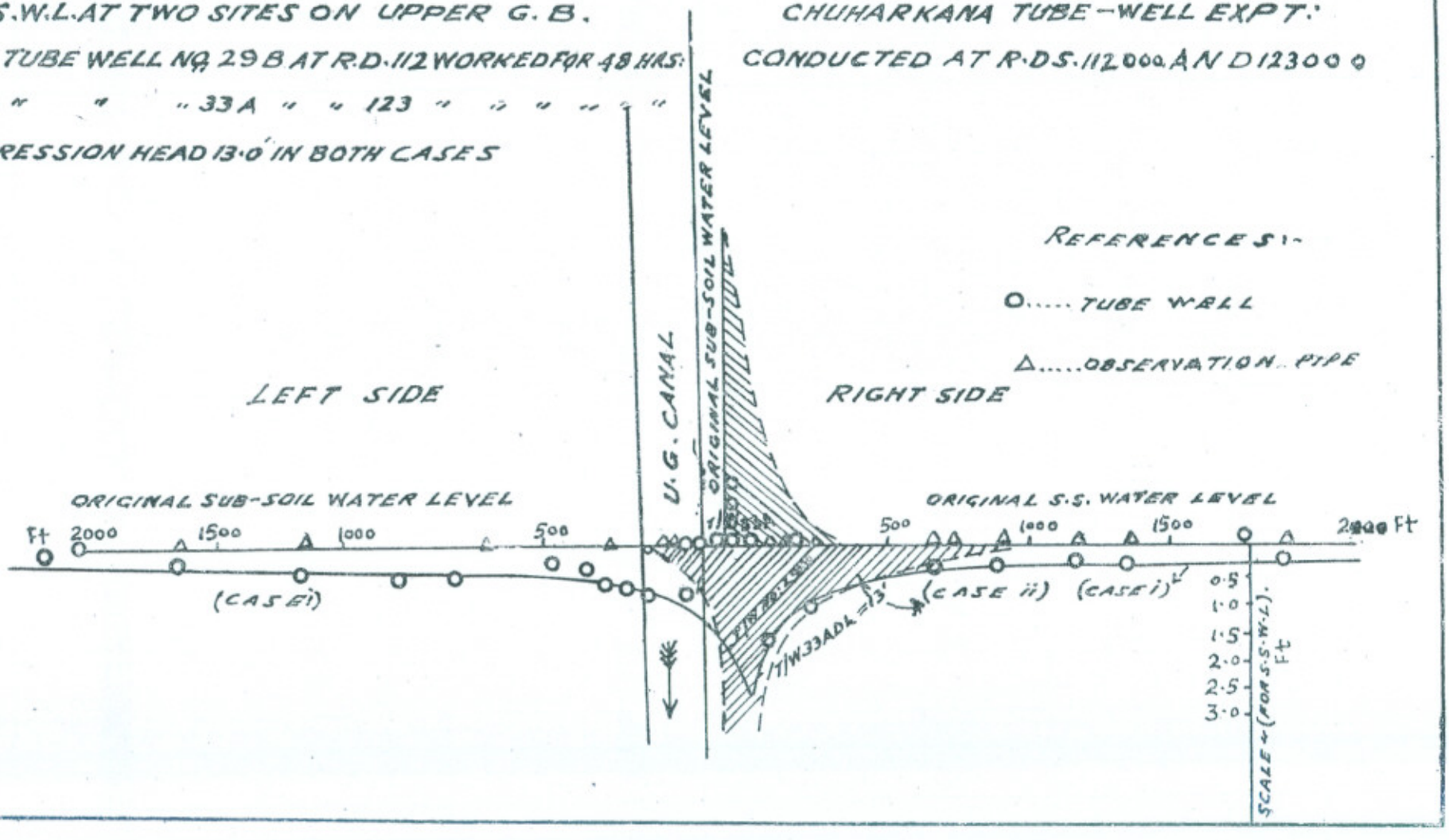
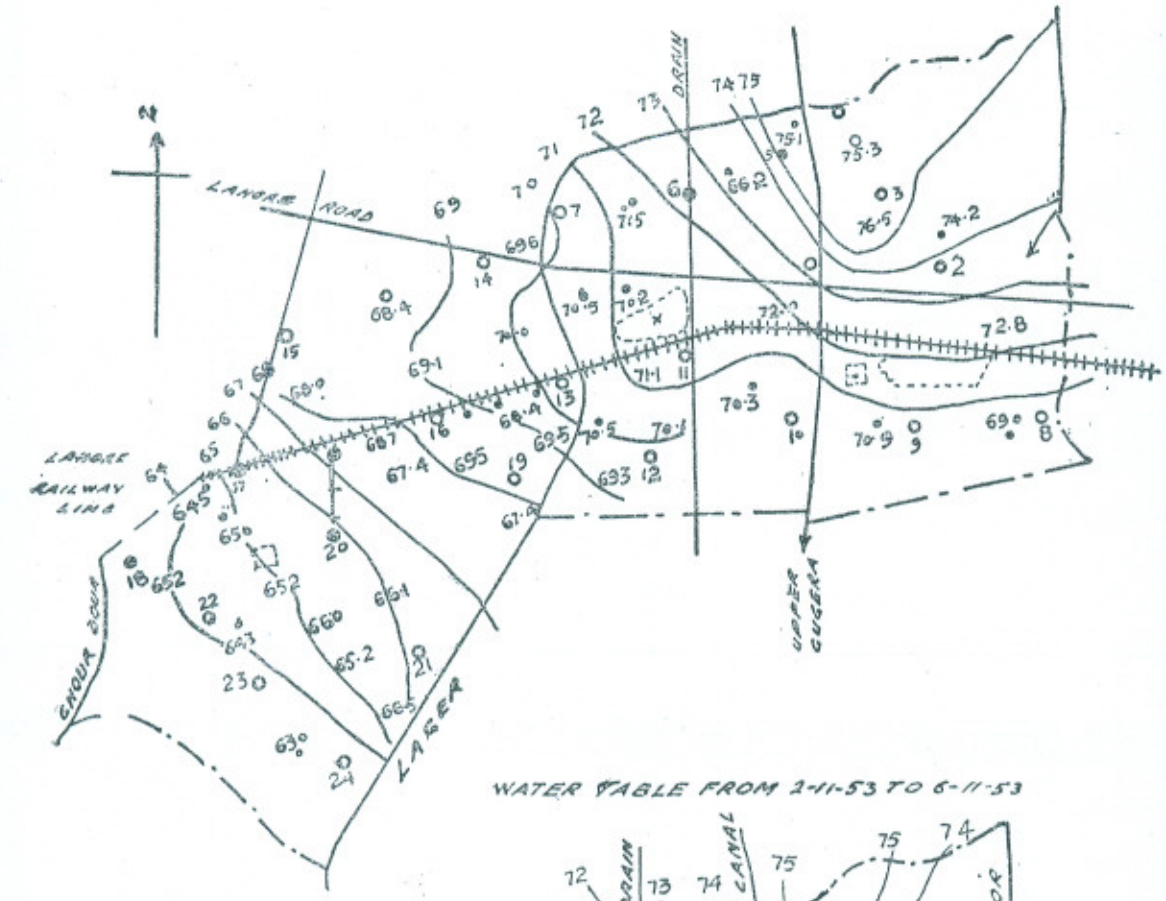
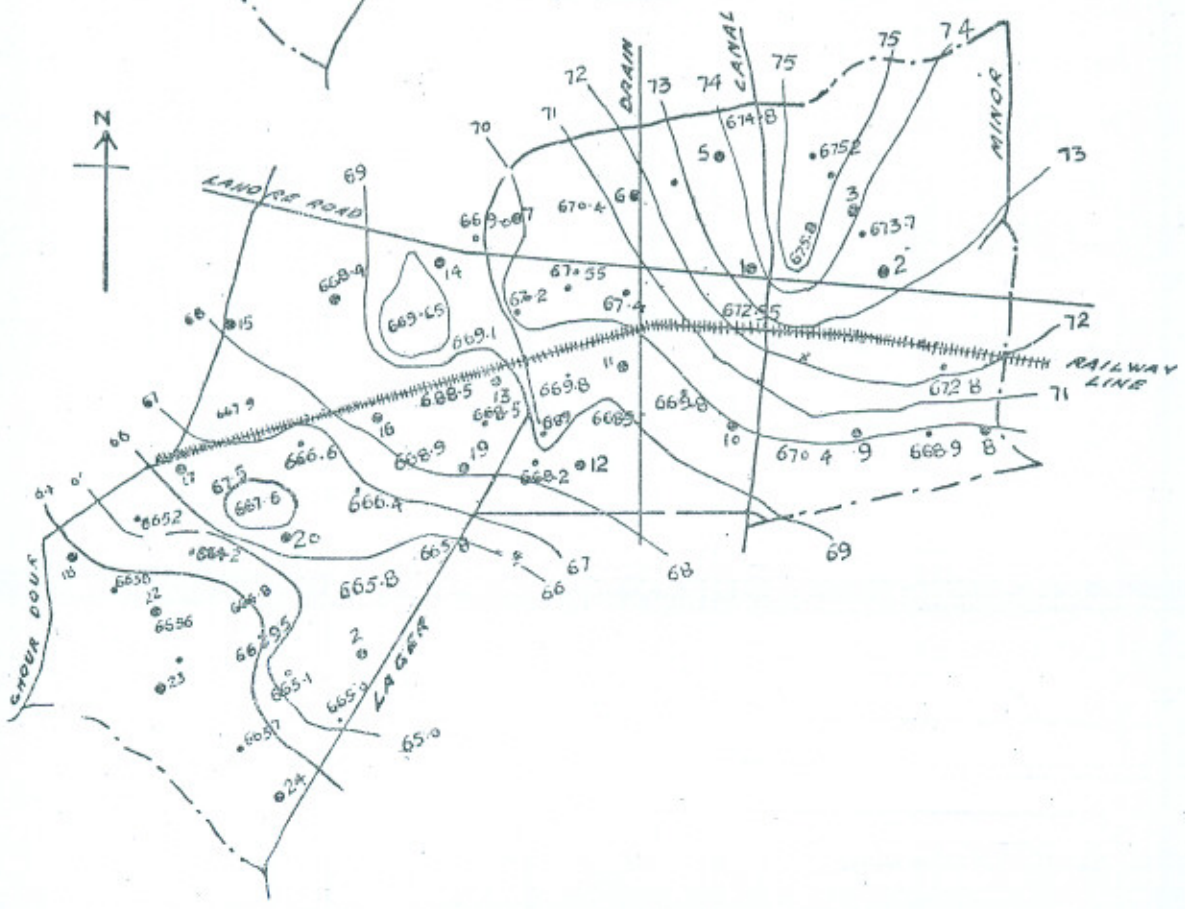


FIG. 6

CHUHARKANA PROJECT AREA GROUND WATER R.L
IN OBSERVATION PIPE FROM
11-8-53 TO 16-8-53



WATER TABLE FROM 2-11-53 TO 6-11-53



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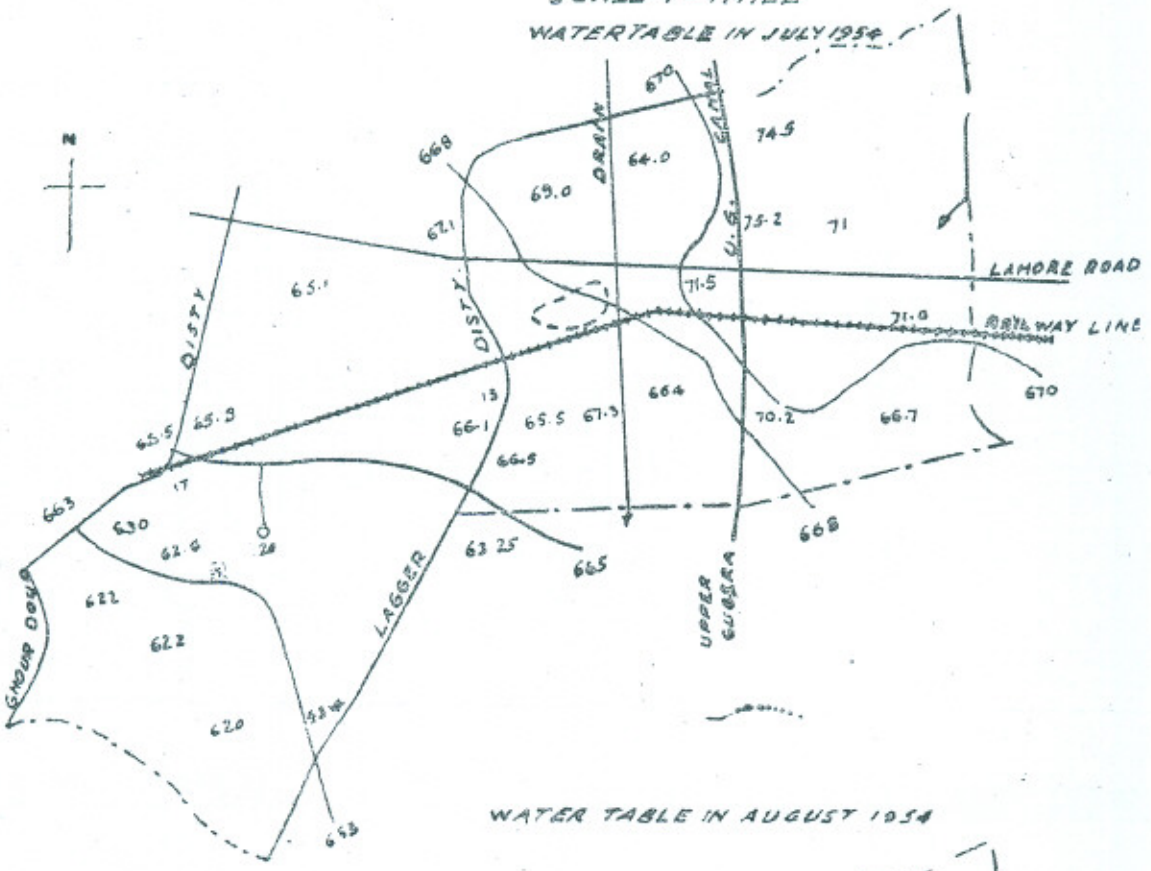
FIG. 7

CHUHARKANA PROJECT AREA GROUND WATER R.L

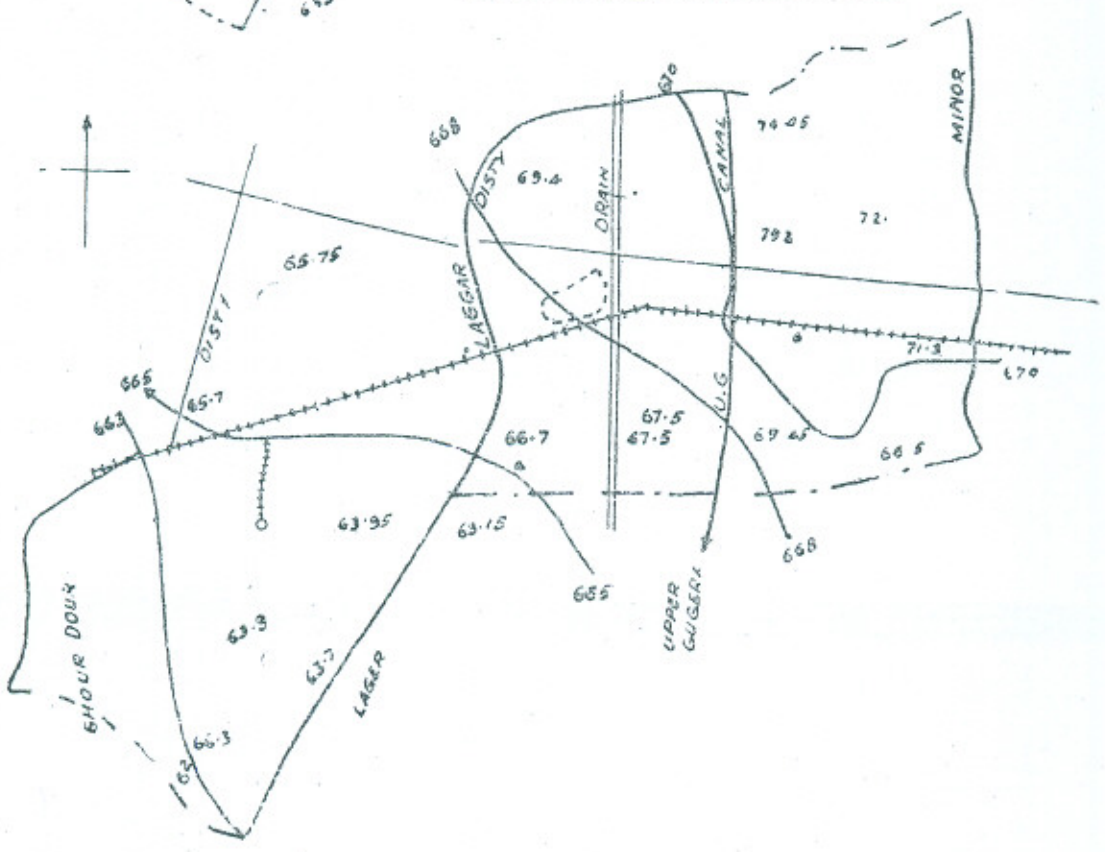
IN OBSERVATION PIPE

SCALE 1" = 1 MILE

WATERTABLE IN JULY 1954



WATER TABLE IN AUGUST 1954



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FIG. 8

TUBE WELL EXPERIMENTS ON VERTICAL STRAINERS

DISCHARGE AND EFFICIENCY CURVES FOR DIFFERENT LENGTHS OF STRAINERS

