

ILL DRAINED AREAS and their RECLAMATION



ILL-Drained Areas and Their Reclamation

EDITOR:
W. B. RAHUDKAR,
Agricultural Information Officer.

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P R E F A C E

Importance of Soil and Water Conservation cannot be over-emphasized. All life except perhaps fish depend on food grown on land. It is, however, a law of nature that good things are accompanied with-evil things. In proof of this law, soil and water conservation measures are accompanied by problems of water-logging and land drainage.

The Sub-committee of the Deccan Agricultural Association in its "WORKING-PAPER" prepared in July 1960, has estimated the acreage of about 15 lakh acres that has been affected by ill-drained conditions in rainfed areas of this State. The distribution of this acreage carrying ill-drained conditions and consequently thrown out of cultivation, as has been pointed in the said 'Paper' is as under:—

(i) Purna Valley:—A tributary of Tapti itself accounts for 12 lakh acres.

(ii) Remaining three lakh acres area is spread over in patches in the river valleys of Katepurna, Nalganga, Bhima, Godawari and Purna (Tributary of Godawari).

These ill-drained areas need immediate attention and installation of suitable drainage measures for restoration of their prospective productive capacity and in view of the recent promulgated State Government's policy of attaining self sufficiency in respect of food within next 2 years, they cannot be offered to be neglected over a single season hereafter.

Reclamation of the affected areas stated above need a community approach on sub-catchment basis. Reclamation measures are costly and cannot be undertaken by individual cultivators. The problems of ill-drained conditions and damaged lands have passed beyond the stage of small scale and laboratory research. Under these circumstances, and in view of the urgency of attaining self-sufficiency of the State, in respect of food, reclamation measures are necessarily to be taken up the State-sector.

In order to enable the departmental officers to successfully take up these new type of works, there has been a long felt need of a technical bulletin on the subject of reclamation of ill-drained areas. Dr. N. K. Ghumare, who had recently been deputed to States, has specialised himself in 'Reclamation of Saline-Alkaline Soils'. He has prepared this bulletin, based on the relevant literature, both from this country and U. S. A., supplemented by his personal observations and experience gained by him on our soils.

This bulletin is intended primarily for soil conservation Engineers and also for officers working in related fields. It includes principles of drainage, a review of the fundamentals needed and different methods of surface drainage that are backed up by latest research findings in U. S. A. and are successfully been practised and therefore have gained confidence of cultivators in American Agricultural Field. It is hoped that officers in Soil Conservation Section will find much of the technical matter in this bulletin useful for designing and installation of drainage schemes to meet the ever increasing demands for reclamation of ill-drained soils.

Poona-1

The 24th November, 1965.

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M. B. GHATGE,

Director of Agriculture,
Maharashtra State, Poona.

In arid and semi-arid regions, it is usually necessary to supply irrigation to accomplish this leaching. The reclamation of saline soils can usually be achieved through some type of leaching without the addition of chemical amendments. Adequate sub-surface drainage is, of course, a prerequisite.

Drainage of non-saline soils

The treatment of these soils is different from that for saline soils, as it may be impossible to leach the soil until after certain chemical amendments are added. Through alkalisation soil undergoes certain textural changes. These soils tend to destroy original soil texture and leave the soil as deflocculated mass. Alkali soils have the consistency of tar or heavy machine grease, which is smooth and without texture. Spots of alkali soils in fields are called 'Slick-spots', meaning that they are denude of vegetation and are textureless. As the alkalisation progresses, the soil becomes less and less permeable. Strongly alkaline soils become virtually impermeable, and impracticable to drain under most conditions.

It is highly important that non-saline alkali soils be recognised as such before attempting to establish surface drainage, because these soils have lost some of their internal drainage characteristics and may not drain properly, regardless of the type of the drainage system installed. Where it is economically feasible to reclaim

these soils, chemical and agronomical treatments may be necessary to flocculate the soil particles and restore the soil permeability before leaching and drainage. Some of the chemical amendments commonly used are calcium chloride, gypsum (calcium sulfate), sulphur, and sulphuric acid.

Drainage of saline-alkali soils

The treatment of saline-alkali soils is much the same as for non-saline-alkali soils. Certain chemical amendments may be required, based on laboratory analysis of soil samples. In so far as the field technician is concerned, the difficult problem with saline-alkali soils is their identification as they may exhibit characteristics of both saline and non-saline-alkali soils. As pointed out in the definition of saline-alkali soils, they may be flocculated due to the presence of excess salts and may have a permeability equal to or higher than non-saline soils. This is often misleading and may give the impression that soils can be reclaimed through simple leaching. Actually this may not be the case because leaching will remove the soluble salts, thereby causing the soils to become strongly alkaline and the permeability will be materially reduced.

For this purpose it is absolutely essential to get soil samples chemically analysed before drafting a drainage plan for any area.

APPENDIX

Statistics for ill-drained soils acreage in Sholapur District

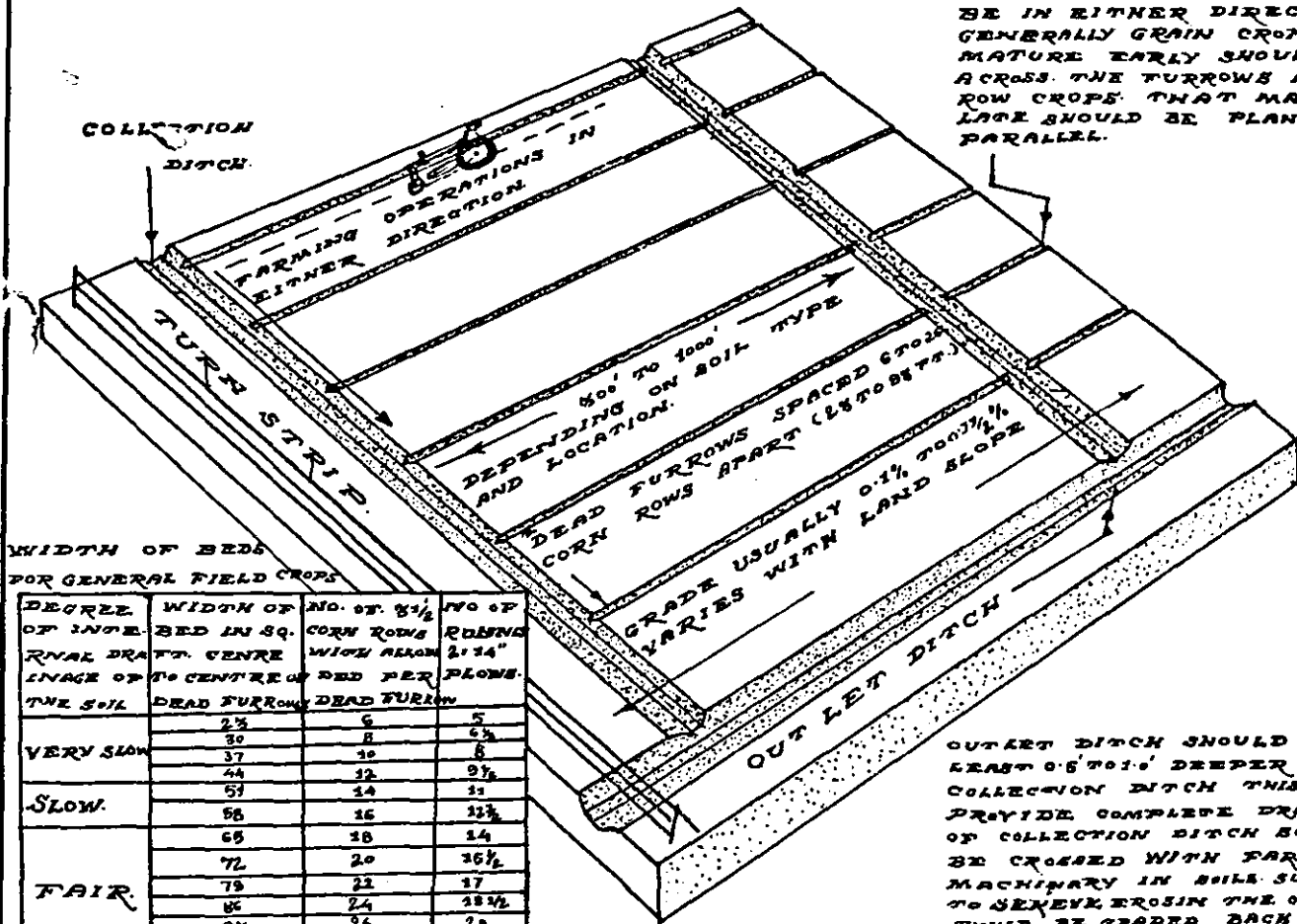
Sr. No	Name of taluka	Area in acres	Remarks
1	Sholapur South	2,081—19	
2	Sholapur North	1,471—01	
3	Barsi	4,397—00	
4	Akalkot	1,878—23	
5	Mohol	7,565—13	
Total		17,393—16	
6	Pandharpur		Information concerning to these talukas is not received from Pandharpur Division.
7	Malsiras		
8	Mangalwedha		
9	Sangola		
10	Karmala		
11	Madha		

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SURFACE DRAINAGE BEDDING SYSTEM.....

THE FURROWS DRAIN TO COLLECTION DITCHES PLANTING SEEDING AND CULTIVATING CAN BE IN EITHER DIRECTION GENERALLY GRAIN CROPS THAT MATURE EARLY SHOULD BE WORKED ACROSS THE FURROWS AND WORKED ROW CROPS THAT MATURE LATE SHOULD BE PLANTED PARALLEL.

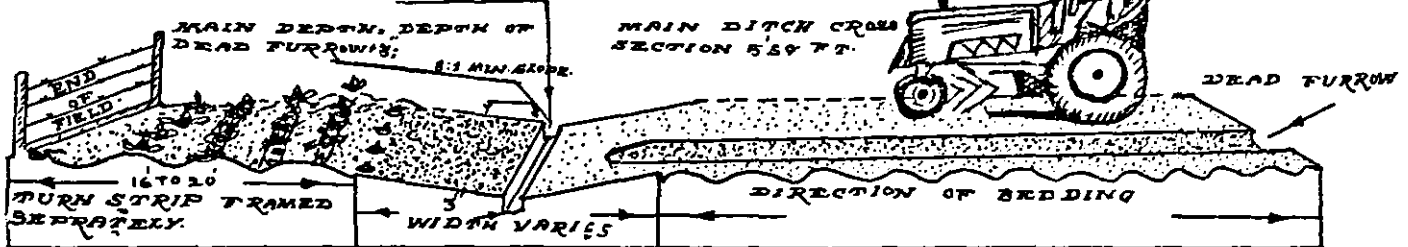


WIDTH OF BEDS FOR GENERAL FIELD CROPS

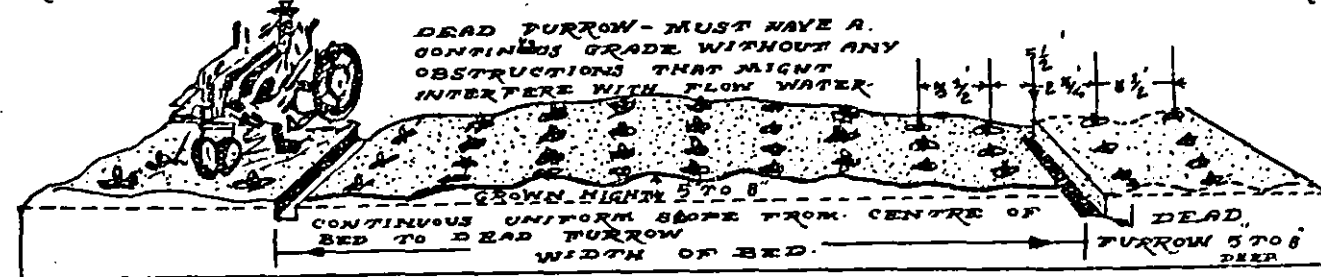
DEGREE OF INFLUENCE OF RAIN DRAINFAGE OF THE SOIL	WIDTH OF BED IN SQ. FT. CENTRE TO CENTRE OF DEAD FURROW	NO. OF 3 1/2" CORN ROWS WHICH ALLOW 2" 1/4" SPACE PER FURROW	NO. OF ROWS PER FURROW
VERY SLOW	25	5	5
	30	6	6 1/2
	37	8	8
SLOW	44	10	9 1/2
	51	14	11
	58	16	12 1/2
FAIR	65	18	14
	72	20	16 1/2
	79	22	17
	86	24	18 1/2
	98	26	20

OUTLET DITCH SHOULD BE AT LEAST 0.5 TO 1.0' DEEPER THAN COLLECTION DITCH THIS WILL PROVIDE COMPLETE DRAINAGE OF COLLECTION DITCH SO IT CAN BE CROSSED WITH FARM MACHINERY IN SOIL SUBJECT TO SEVERE EROSION THE OVERALL SHOULD BE GRADED BACK ON A NON EROSION GRADE.

THE U SHAPED SECTION IN THE BOTTOM OF THE DITCH IS OPTIONAL IT PERMITS MAIN PART OF DITCH TO DRY QUICKLY SO THAT TRACTORS CAN PASS OVER EVEN THOUGH THE BOTTOM OF THE U SECTION IS WET.



CROSS SECTION AT END OF FIELD SHOWING COLLECTION DITCH AND TURN STRIP

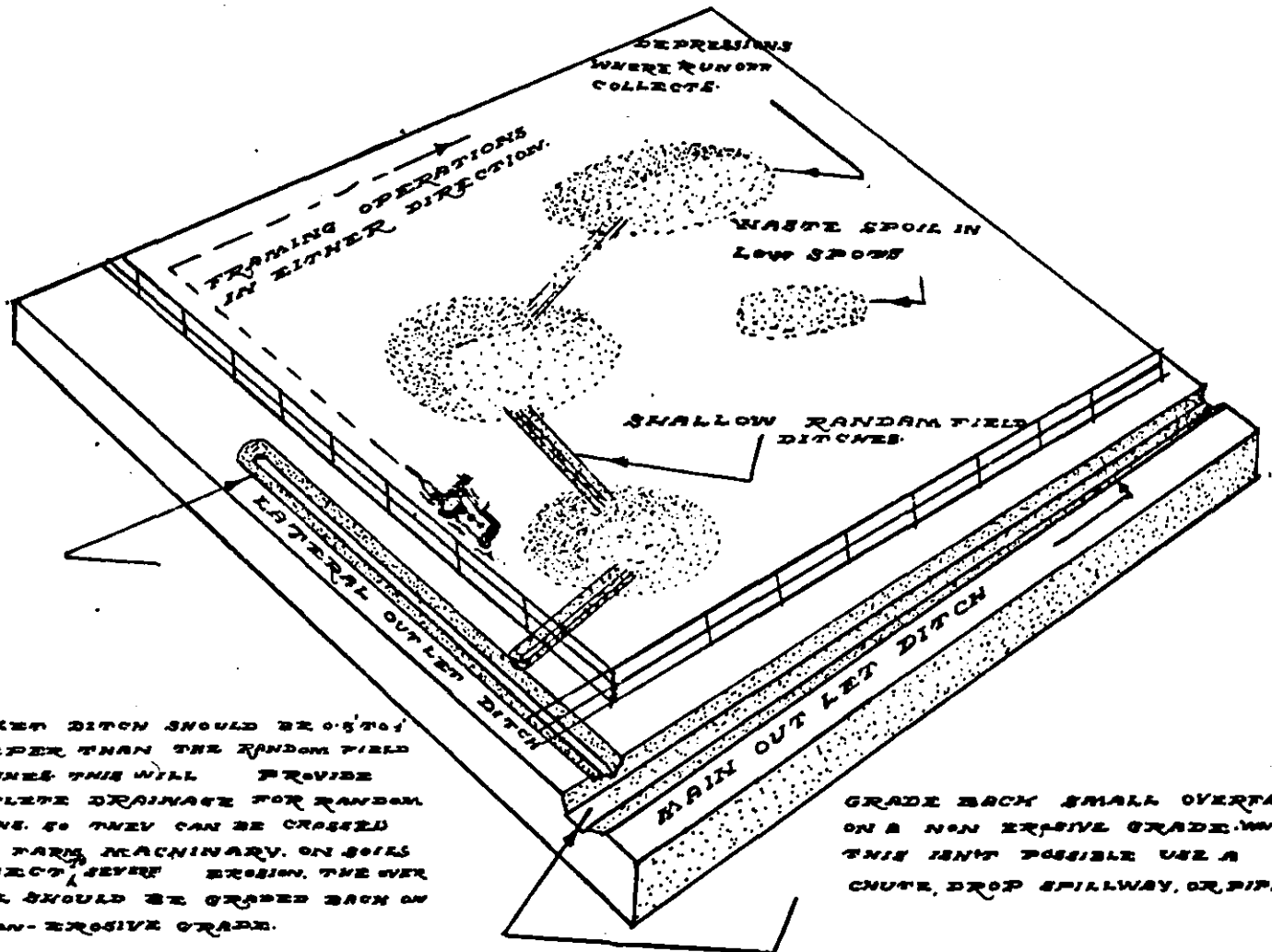


CROSS SECTION OF BED SHOWING CROWN EFFECT AND PROPER SPACING OF CORN ROWS.

COURTESY: AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

RANDOM DITCH SYSTEM OF SURFACE DRAINAGE

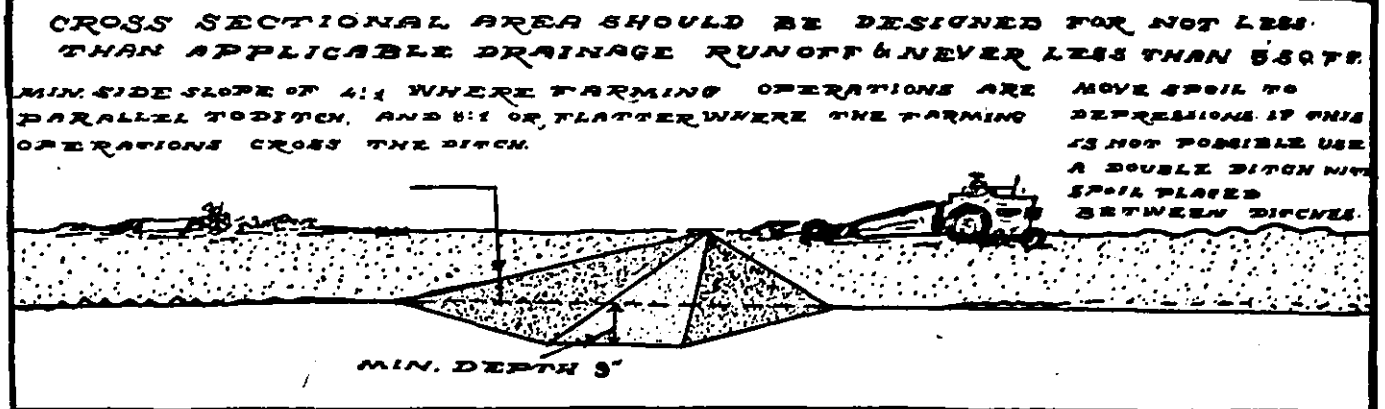
REMOVE MINOR DEPRESSIONS BY LAND SMOOTHING WITH LAND PLANE OR LEVELER SMOOTH AREA SO LAND WILL DRAIN TO THE LARGE DEPRESSIONS OR RANDOM DITCHES.



OUTLET DITCH SHOULD BE 0.5 TO 1 DEEPER THAN THE RANDOM FIELD DITCHES THIS WILL PROVIDE COMPLETE DRAINAGE FOR RANDOM DITCHES SO THEY CAN BE CROSSED WITH FARM MACHINERY. ON SOILS SUBJECT TO SEVERE EROSION THE OVER FILL SHOULD BE GRADED BACK ON A NEW-EROSIVE GRADE.

GRADE BACK SMALL OVERTAKS ON A NON-EROSIVE GRADE. WHERE THIS IS NOT POSSIBLE USE A CHUTE, DROP SPILLWAY, OR PIPE.

CROSS SECTION OF RANDOM DITCH



COURTESY: AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

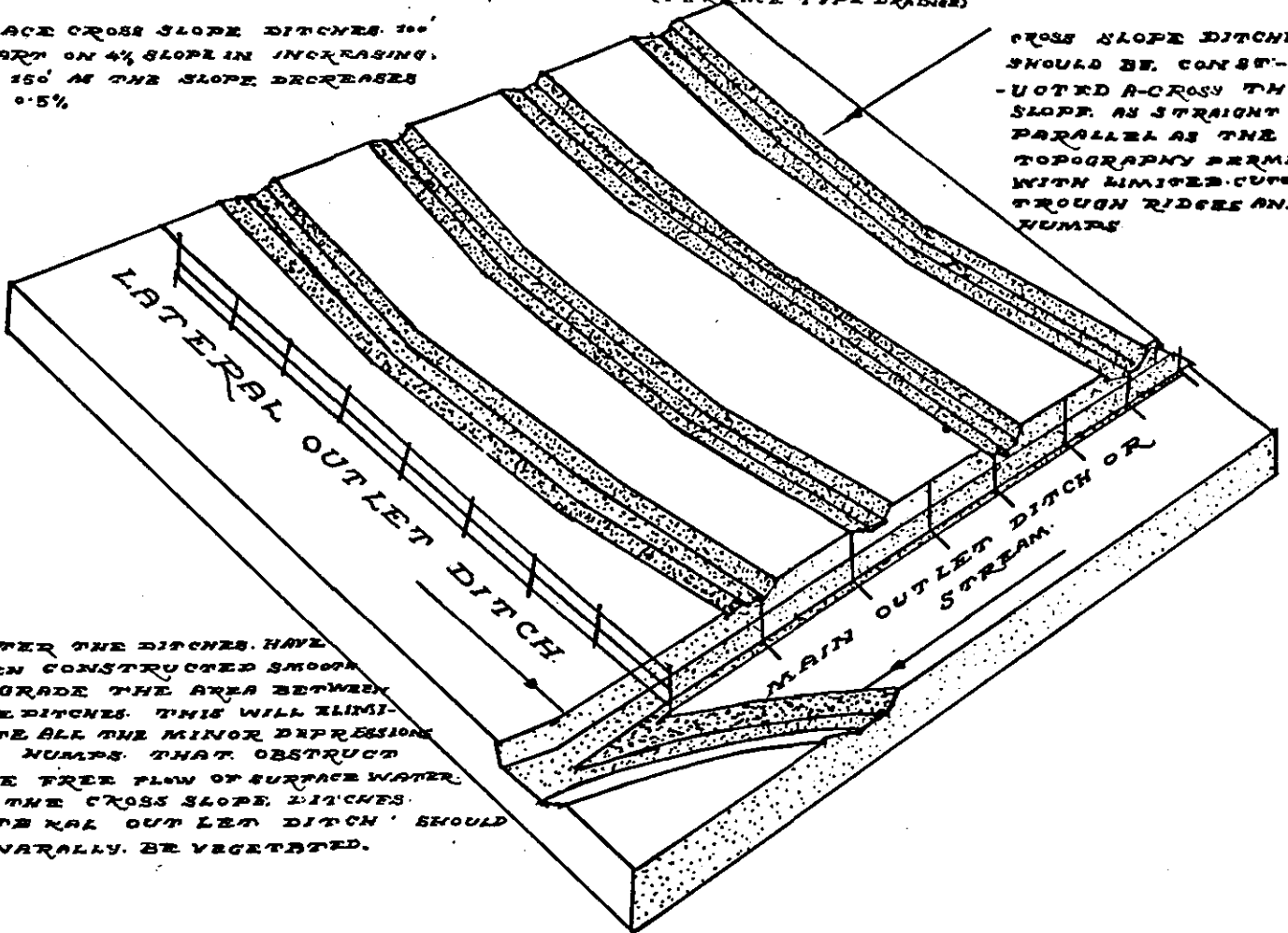
FIG. 2

CROSS SLOPE DITCH SYSTEM OF SURFACE DRAINAGE

(REFURGE TYPE DRAINAGE)

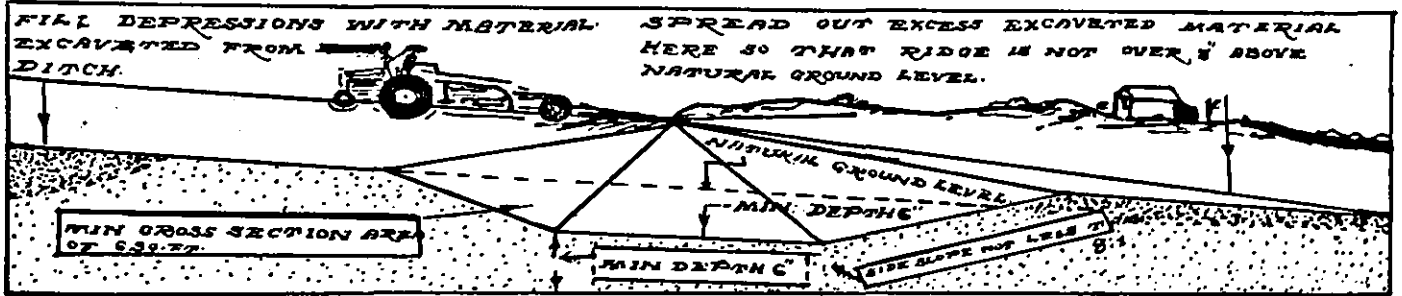
SPACE CROSS SLOPE DITCHES 100' APART ON 4% SLOPE IN INCREASING TO 150' AS THE SLOPE DECREASES TO 0.5%.

CROSS SLOPE DITCHES SHOULD BE CONSTRUCTED ACROSS THE SLOPE AS STRAIGHT & PARALLEL AS THE TOPOGRAPHY PERMITS WITH LIMITED CURVING THROUGH RIDGES AND HUMPS.

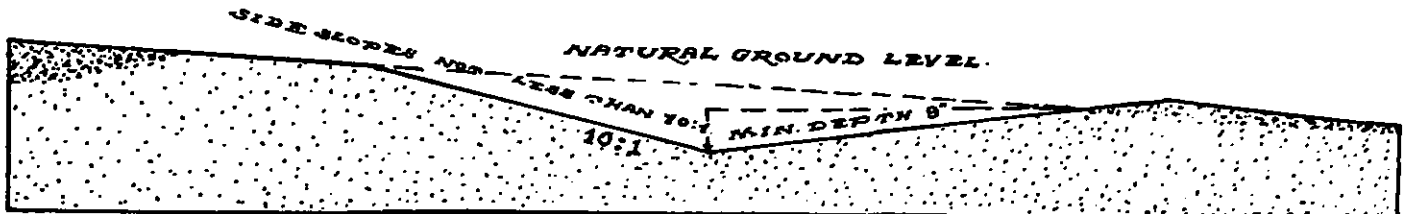


AFTER THE DITCHES HAVE BEEN CONSTRUCTED SMOOTH OR GRADE THE AREA BETWEEN THE DITCHES. THIS WILL ELIMINATE ALL THE MINOR DEPRESSIONS AND HUMPS THAT OBSTRUCT THE FREE FLOW OF SURFACE WATER TO THE CROSS SLOPE DITCHES. LATERAL OUTLET DITCH SHOULD GENERALLY BE VEGETATED.

TYPICAL FLAT BOTTOM SECTION



TYPICAL V-CANNEL SECTION

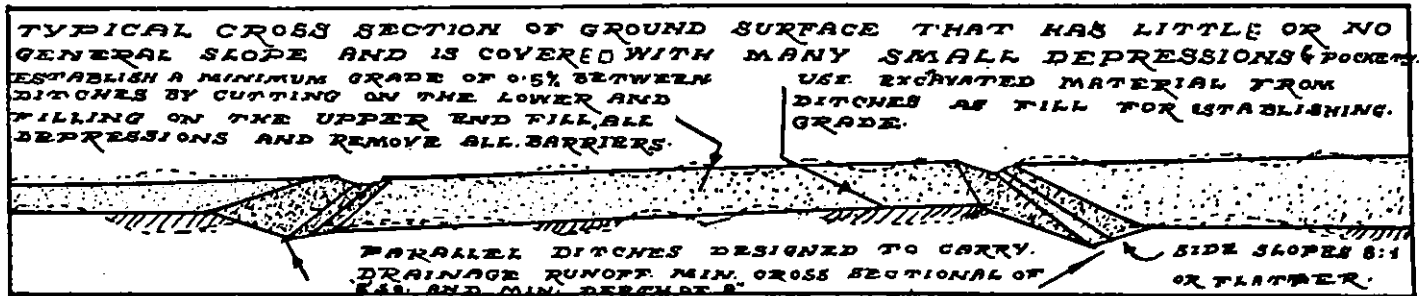
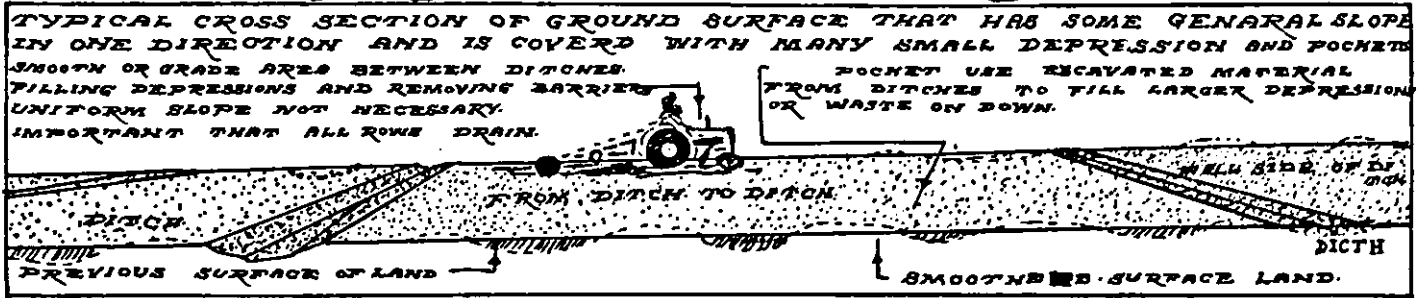
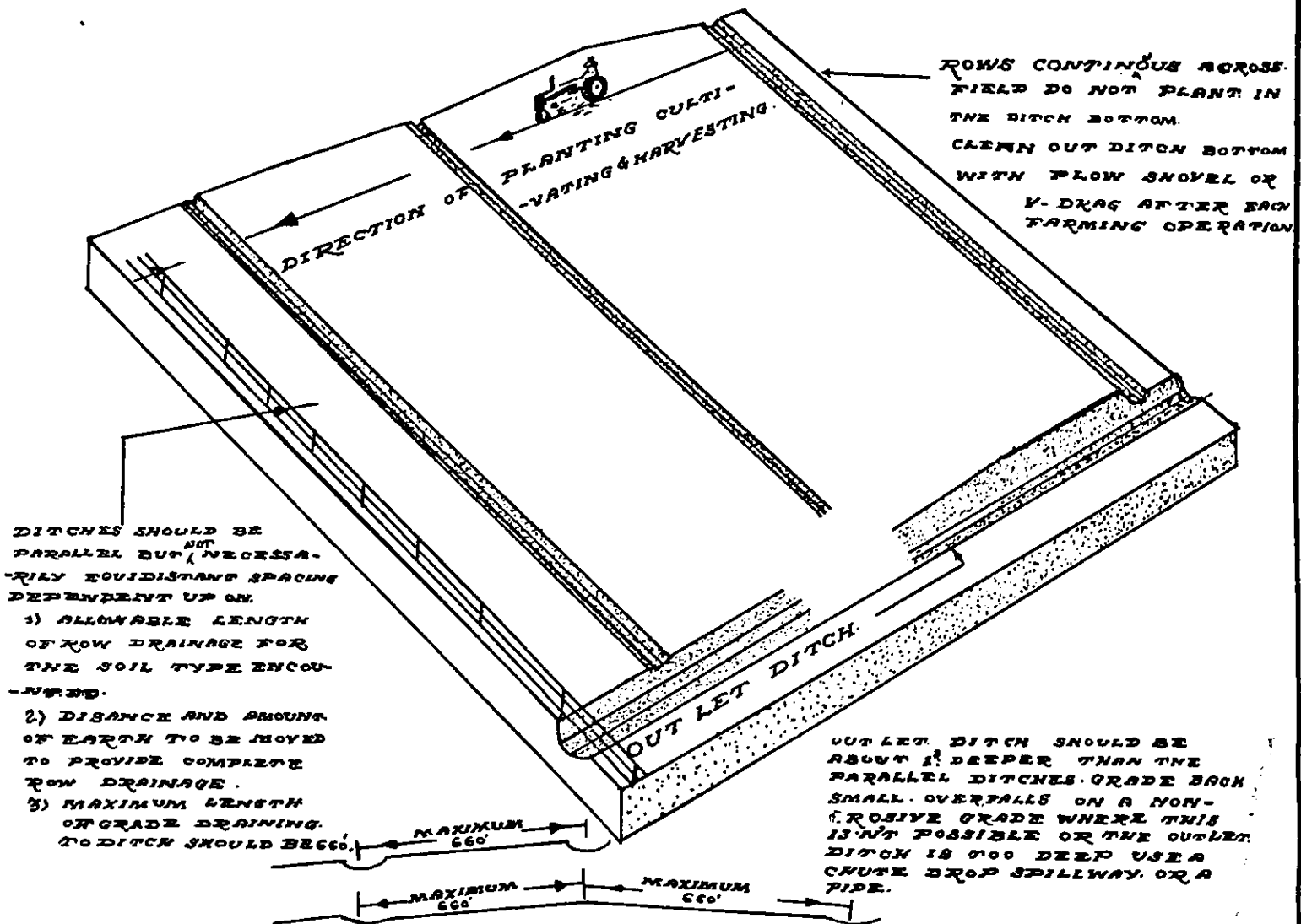


COURTESY: AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

FIG. 3

PARALLEL DITCH SYSTEM OF SURFACE DRAINAGE

PARALLEL DITCHES TO INTERCEPT AND RAPIDLY REMOVE SURFACE WATER FROM THE FIELD AND REDUCE THE LENGTH OF ROW DRAINAGE.



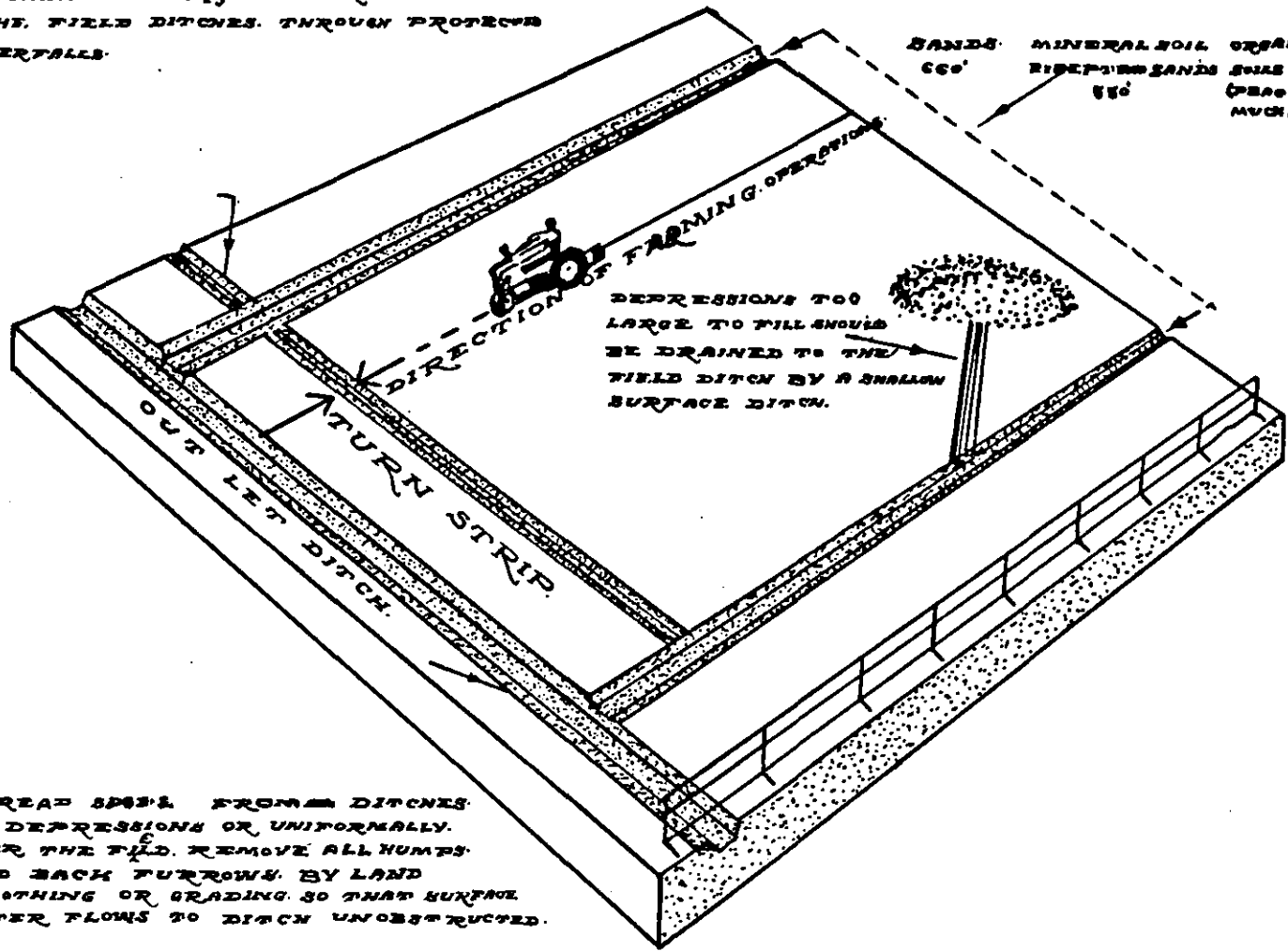
COURTESY: AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

FIG. 4

FIELD DITCH SYSTEM FOR WATER TABLE CONTROL AND SURFACE WATER REMOVAL

CROP ROWS DEAD FURROWS AND FLOW FURROWS SHOULD BE INTERCEPTED BY SHALLOW DITCHES AND DIRECTED IN TO THE FIELD DITCHES THROUGH PROTECTED OVERTALLS.

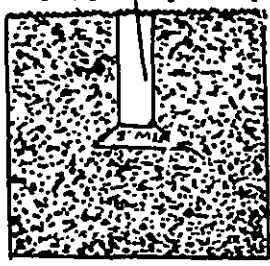
MAXIMUM SPACING OF PARALLEL FIELD DITCHES



SPREAD SPILL FROM DITCHES IN DEPRESSIONS OR UNIFORMLY OVER THE FIELD. REMOVE ALL HUMPS AND BACK FURROWS BY LAND SMOOTHING OR GRADING SO THAT SURFACE WATER FLOWS TO DITCH UNOBSTRUCTED.

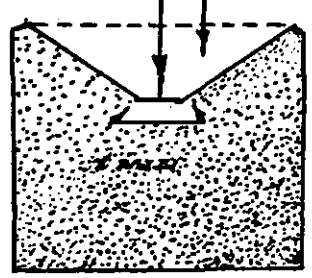
TYPICAL MINIMUM DITCH CROSS SECTION

MIN. SLOPE VERTICAL FOR RAW PEAT AND 3:1 FOR DECOMPOSED PEAT AND MUCK. MIN. D. 2'-6"



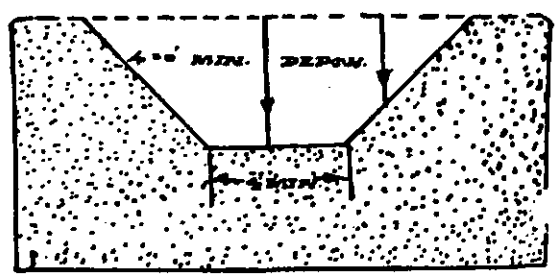
ORGANIC SOILS (PEAT & MUCK)

MIN. SLOPE OF 1 1/2:1 2'-6" MIN. DEPTH.



MINERAL SOILS EXCEPT SANDS

MIN. SLOPE OF 1:1 4'-0" MIN. DEPTH.



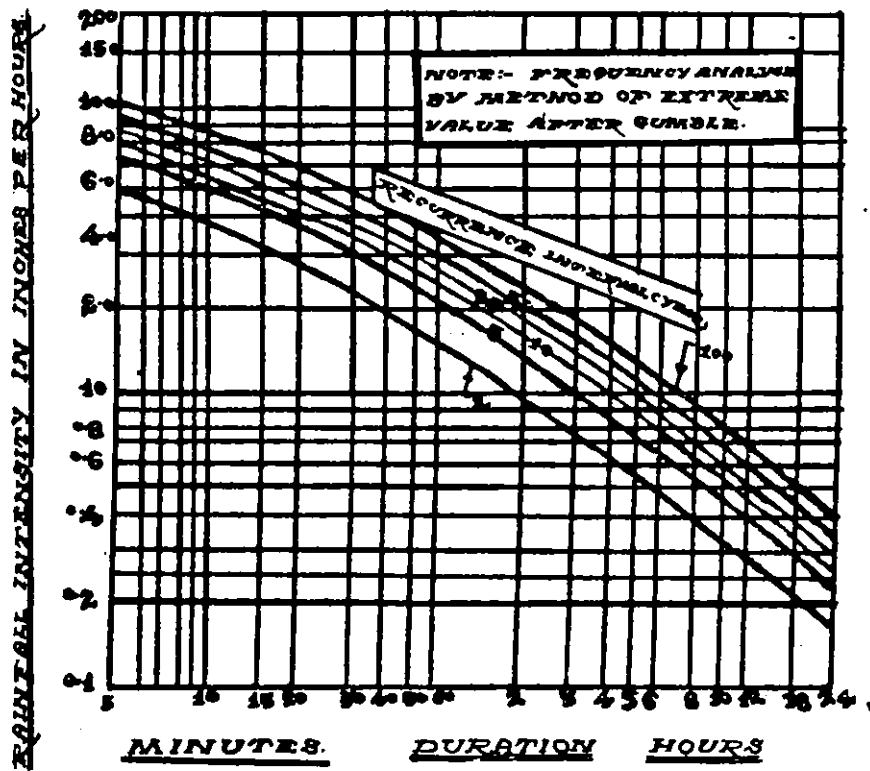
SANDS

COURTESY: AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

TYPICAL RAINFALL INTENSITY

DURATION RECURRENCE INTERVAL

RELATIONSHIP



FARM- U.S. DEPARTMENT OF COMMERCE

FIG. 6

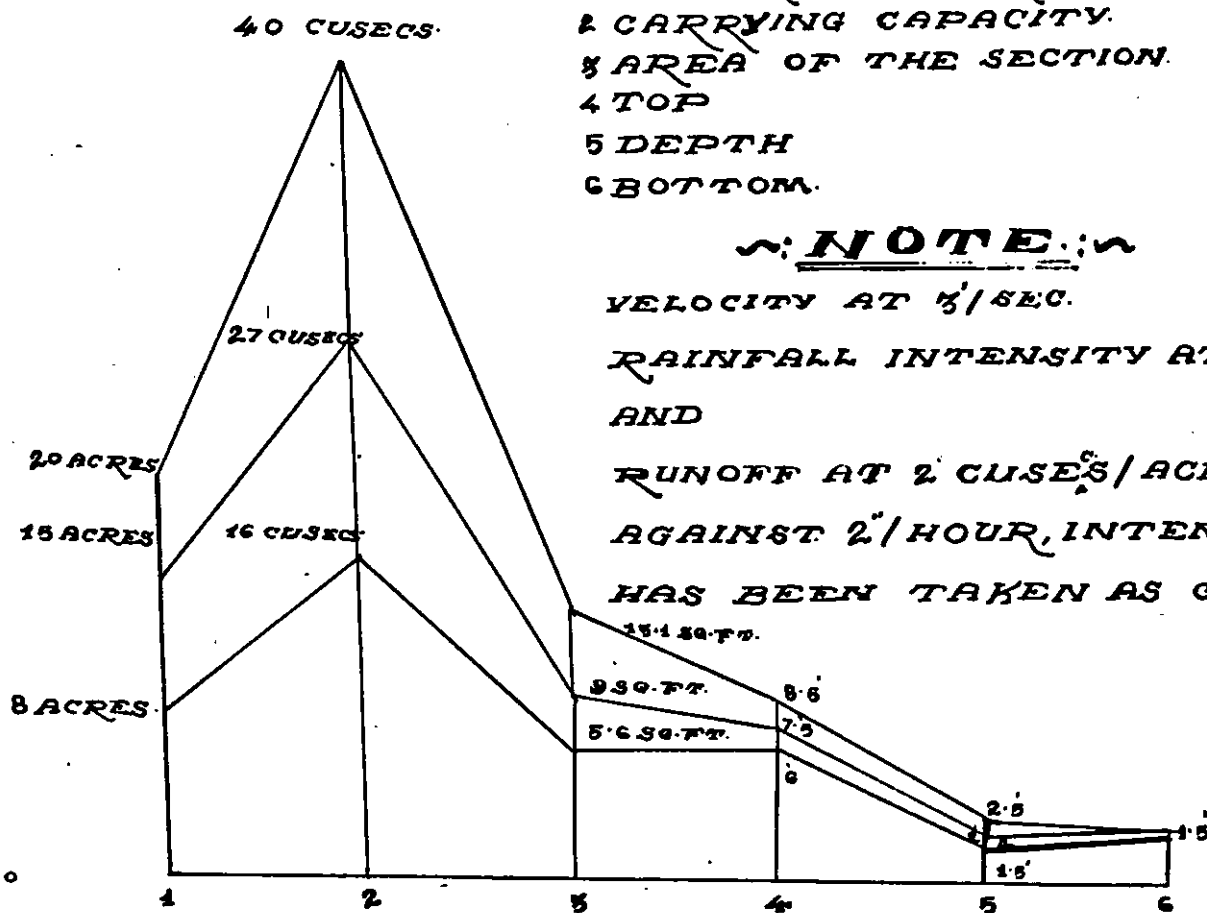
A GRAPH SHOWING SPECIFICATIONS LATERAL DRAINS

NOT TO SCALE

- 1 WATER SHED AREA.
- 2 CARRYING CAPACITY.
- 3 AREA OF THE SECTION.
- 4 TOP
- 5 DEPTH
- 6 BOTTOM.

NOTE

VELOCITY AT $\frac{1}{3}$ /SEC.
 RAINFALL INTENSITY AT 2"/HOUR
 AND
 RUNOFF AT 2 CUSECS/ACRE
 AGAINST 2"/HOUR, INTENSITY.
 HAS BEEN TAKEN AS CONSTANT



WATER SHED	CARRYING AREA OF	TOP	DEPTH	BOTTOM
AREA IN ACRES	CAPACITY	THE SECTION.	IN FT.	IN FT.
	IN CUSECS	IN SQ. FT.		

FIG. 7

GRAPH SHOWING
SPECIFICATION OF
DRAINS FOR TROPICAL
SECTION FOR
DIVERSION DITCHES

NOT TO SCALE

- 1 WATERSHED AREA
- 2 CARRYING CAPACITY
- 3 AREA OF THE SECTION
- 4 TOP
- 5 DEPTH
- 6 BOTTOM

NOTE :-

VELOCITY AT 3'/SEC.
RAINFALL INTENSITY AT 2"/HOUR,
AND
THE RUNOFF AT 2 CUSECS/ACRE
AGAINST 2"/HOUR, INTENSITY HAS
BEEN TAKEN AS CONSTANT.

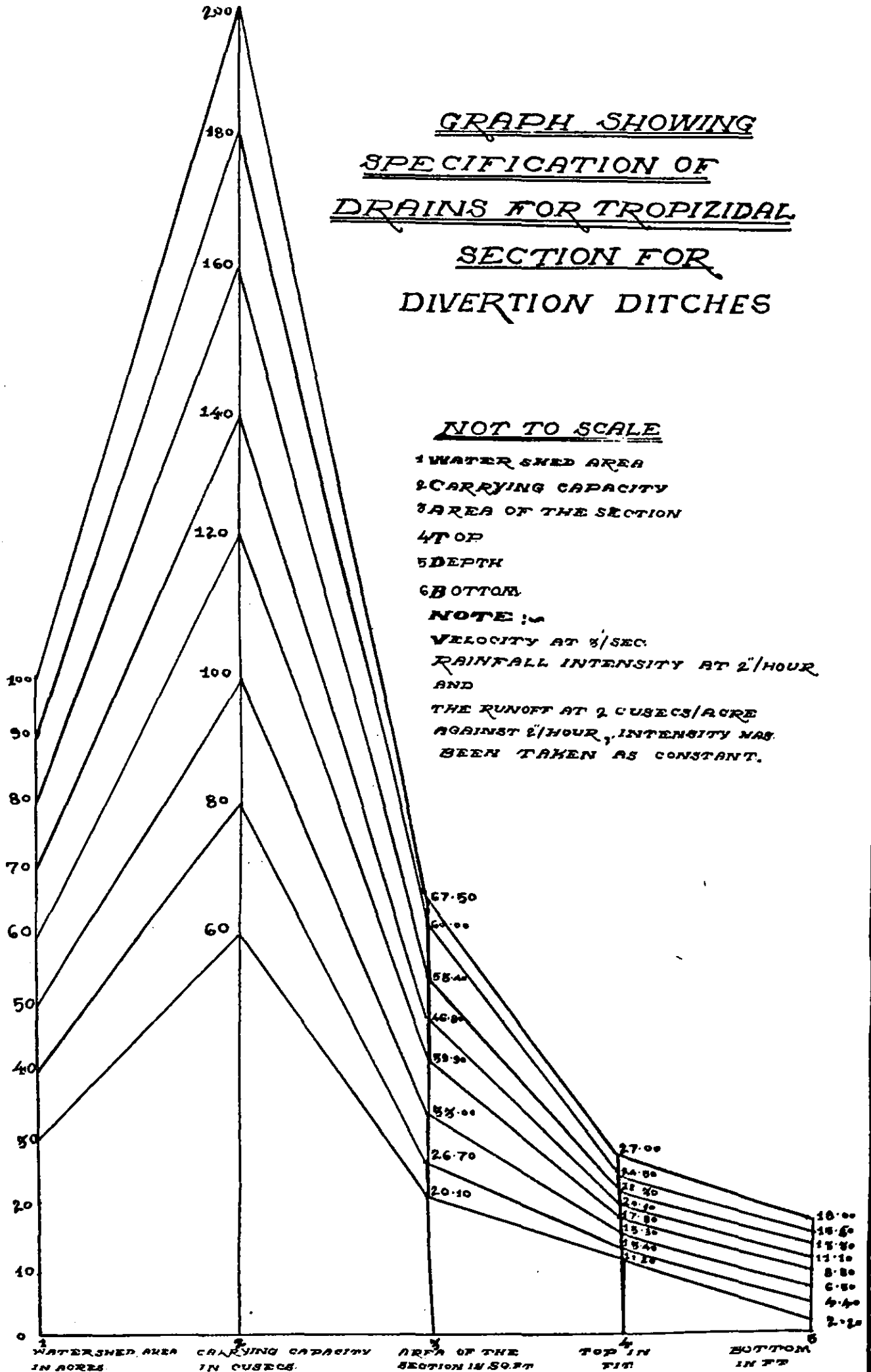
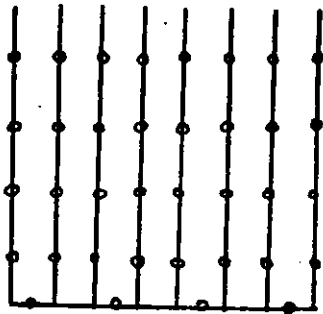
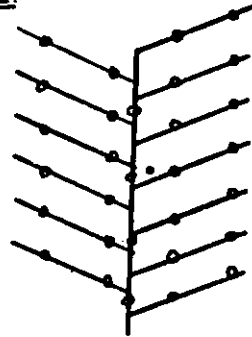


FIG. 6

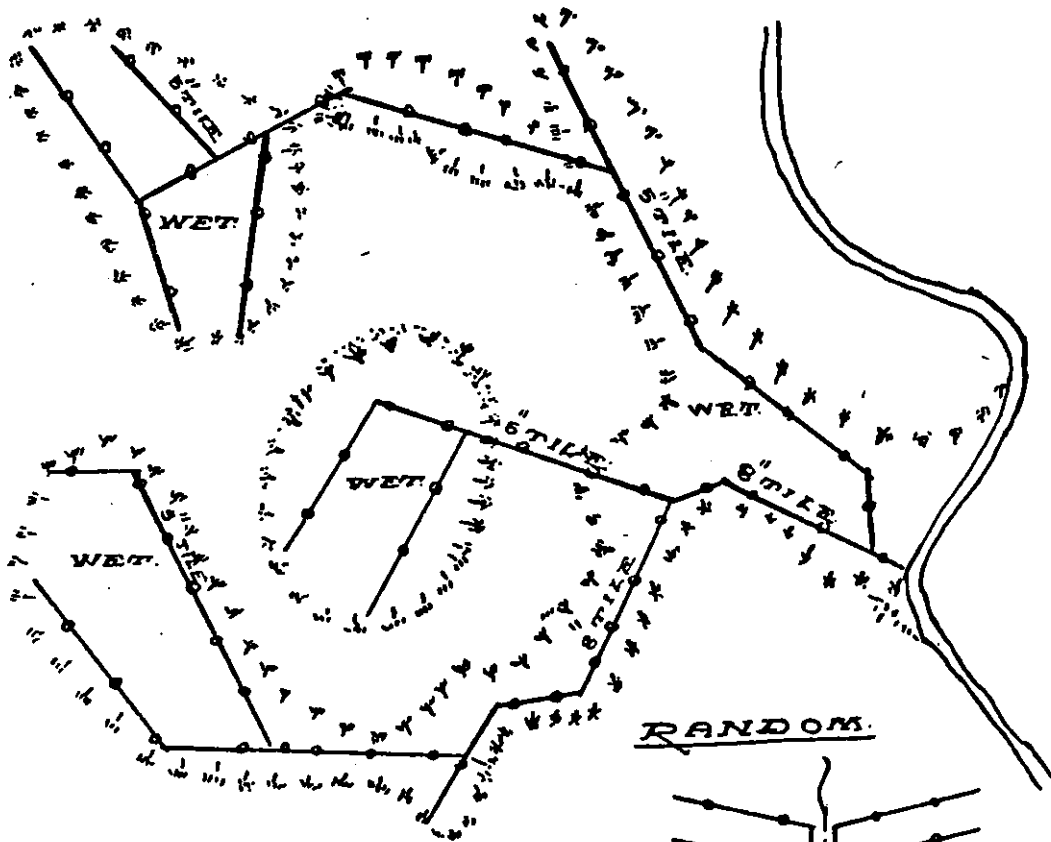
TYPES OF TILE-DRAINAGE SYSTEMS



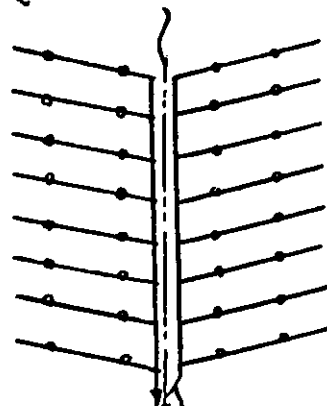
GRIDIRON OR PARALLEL



HERRING BONE

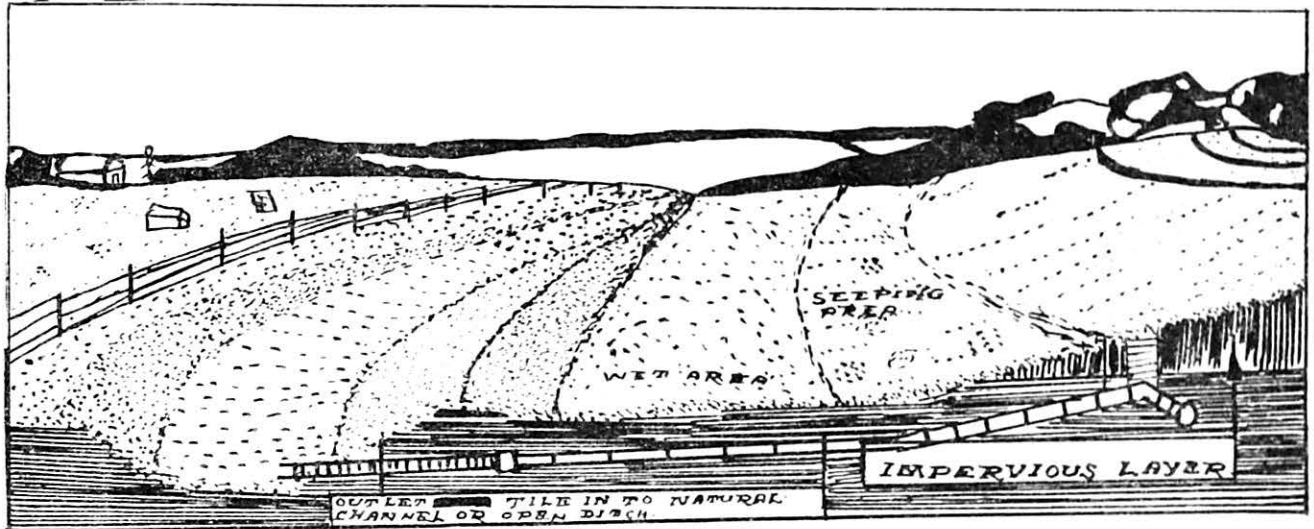


RANDOM

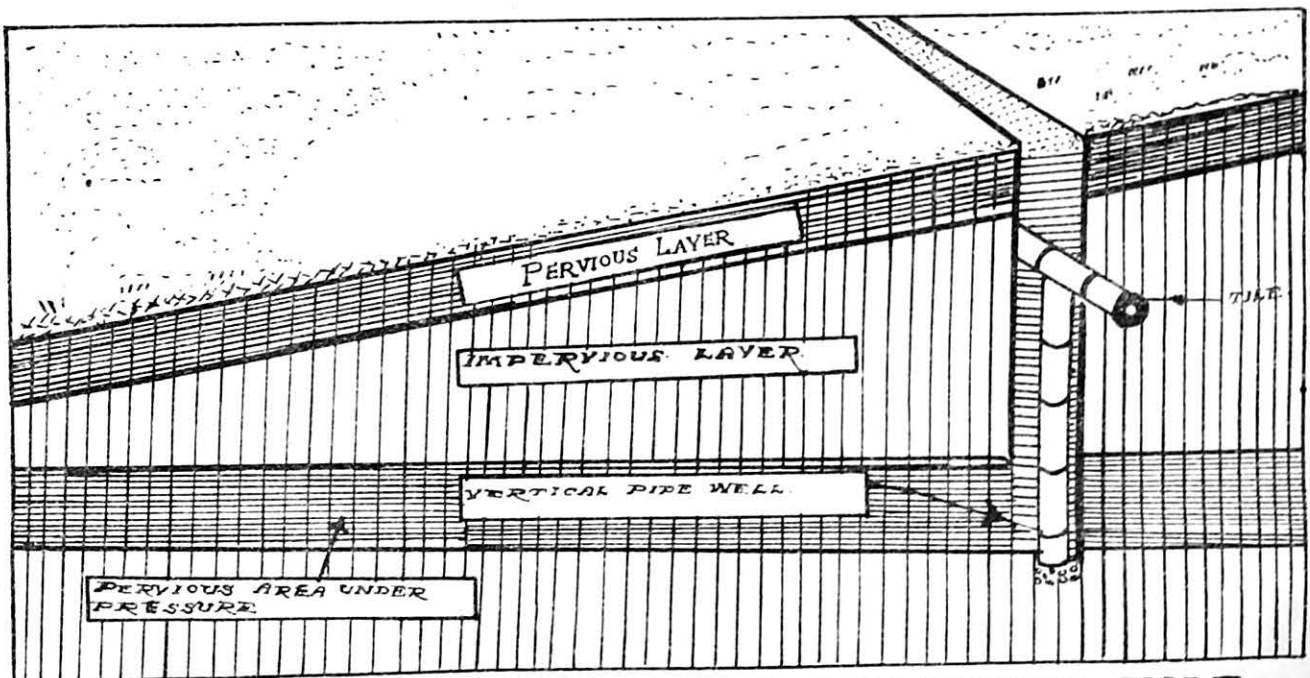


DOUBLE MAIN

SOURCE: "FARM DRAINAGE" FARMERS BULL. No. 2046 U.S.D.A.



INTERCEPTION OF SEEPAGE UNDER BARRIER CONDITIONS.



RELIEF WELL AND INTERCEPTOR TILE.

SOURCE: DRAINAGE NATURAL ENGINEERING HANDBOOK SECTION '16, U.S.D.A.
SOIL CONSERVATION SERVICE.

FIG. 10

G.P.Z.P. POONA, 66-Q-799.

