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THESIS
DRAINAGE SYSTEM FOR
ED. WILLIAMS' FARM
PETOSKEY MICHIGAN
F. T. WILLIAMS
1898

THESIS



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Senior Agricultural Thesis

on

"DRAINAGE SYSTEM FOR ED. WILLIAMS' FARM, PETOSKEY, MICHIGAN."

by

F. T. Williams,

Class of '98.

Michigan Agricultural College,

Agricultural College, Mich.

THESIS

DRAINAGE SYSTEM FOR ED. WILLIAMS' FARM, PETOSKEY, MICHIGAN.

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Survey.

The land to be drained is in Emmet Co., Mich., Township of Resort. It is a part of the E $1/2$ of the S. E. $1/4$ of Sec. 14. This eighty is crossed by a narrow swamp about midway its length. In the S. W. corner of the south forty there are three small ponds, which contain water during the wet seasons. The object of this thesis is to lay out a drainage system to drain these ponds and the swamp, and to determine what it would cost to construct a tile drain for this purpose.

The land in this region is for the most part a rolling, sandy loam, and is naturally well drained. In this particular case, however, the soil is a heavy clay loam, and retains the water so as to prevent cultivation to any extent.

During the holiday vacation of '97-'98 R. E. Morrow and I made a survey for this drain. This survey consisted in traversing the portion of the farm drained, running the drain lines and taking the levels on these lines.

The country is rolling, therefore in the spring of the year, and during the wet seasons, the water runs down from the hill sides and collects in these ponds and the swamp. To find out the greatest amount of water the drain would have

to carry at any one time it was necessary for me to make a traverse survey of the portion of the farm from which the surface water would flow toward this drain. No great precision was used in making this traverse, as it was at the best merely an approximate. The notes for this traverse survey will be found in the notes appended, and following them the area is computed to be 38.6 A.

Having completed the traverse, we next laid out the main drain. We began at a culvert situated on the road running along East side of farm, and proceeded along the natural water course up to the ponds. The bearings and lengths of every course were taken, and the principal turning points were located by surrounding objects. A stake driven at the west end of the culvert was designated Sta. 0, and, beginning with this, hub stakes were driven every 100 ft.

The next thing was to take the levels along these lines. The top of a large stone under the S. E. corner post of the barn was taken as our benchmark. Our datum plane was 100 ft. below this B. M. Levels were taken every 100 ft. and recorded by both Mr. Morrow and myself, to avoid mistakes.

This completed our survey. The next step was to make a profile map, which will be found appended. This map also furnishes all necessary information regarding surface levels, grade lines and cuts.

One of the most perplexing questions presented was where to have the outlet of the drain. The land adjoining on the East side of the farm is a continuation of this swamp, and is not drained. At present it is an old slashing, grown up to second growth. There being no good outlet at the road,

the only feasible way to drain the farm was to have the outlet at Sta. 3. By observing the profile it will be seen that there is quite an abrupt rise here.

There is some difference of opinion as to how deep a drain should be. This depends on the quality of soil and width one wishes to drain. A tile drain four feet deep will carry the free water away from a larger area than one two and one-half feet deep. The best authorities say a tile drain should not be less than three feet deep; the deeper the better, though it may cost more. In drawing the grade lines shown on the profile maps I have endeavored, as far as possible, to have them at least three feet below the surface.

Construction of the Drain.

The principal point in the constructing of a drain is the method of opening the trench and laying the tiles on the grade line. To do this systematically requires a measuring rod six or eight feet in length, divided into feet, tenths and hundredths of a foot. A cord or wire is also needed to stretch above the line of the drain, parallel to the grade line. This cord or wire is best held in position by driving stakes or posts every fifty feet on each side of ditch, and connected by a cross-bar. These cross-bars being adjusted to the proper height, the wire or cord is stretched directly above the center line of the drain. By some such means the ditch is readily dug to just the proper depth, and the tile laid to grade with comparative accuracy.

The size of tile to be used depends on the quantity of

water to be removed and the fall available. The area drained is 38.6 A. The fall for the main is 1 foot in 158 feet. Considering the rainfall to be one-half inch in depth in 24 hours, by table computed by R. C. Carpenter, Lansing, Mich., and given in Hodgman's Surveying, it will take 8 in. tile to carry away the water. This size of tile will be required only for the lower part of the main drain. Above this one has to use ~~their~~^{his} judgment as to the size of tile required. The following ~~is~~^{are}, to the best of my knowledge, the size^s tile to be used.

Main Drain.

Outlet to 2nd. Lateral	357 feet	8 inch
2nd. Lateral to Branch to Ponds	643 "	6 "
Upper part main	200 "	3 "
Lateral No. 1	300 "	3 "
Lateral No. 2	650 "	4 "

Branch to Ponds.

Outlet to 2nd. Lateral	1080 feet	4 inch
Lateral No. 1	150 "	2 "
Lateral No. 2	350 "	3 "
Sub. Lateral to No. 2	160 "	3 "
Upper part main	320 "	3 "

In the construction of this drain I have designed to have four silt⁺-wells at the following places, viz: The junctions of Lateral No. 1 and the main, Lateral No. 2 with the main, branch to ponds with the main and where the Lateral from large pond joins the branch. These silt⁺-wells will not only furnish places for the deposit of silt⁺, but also

places to inspect the drain. The outlet is to be protected by a stone wall, through which the last tile will extend.

Cost of Construction.

Tile.

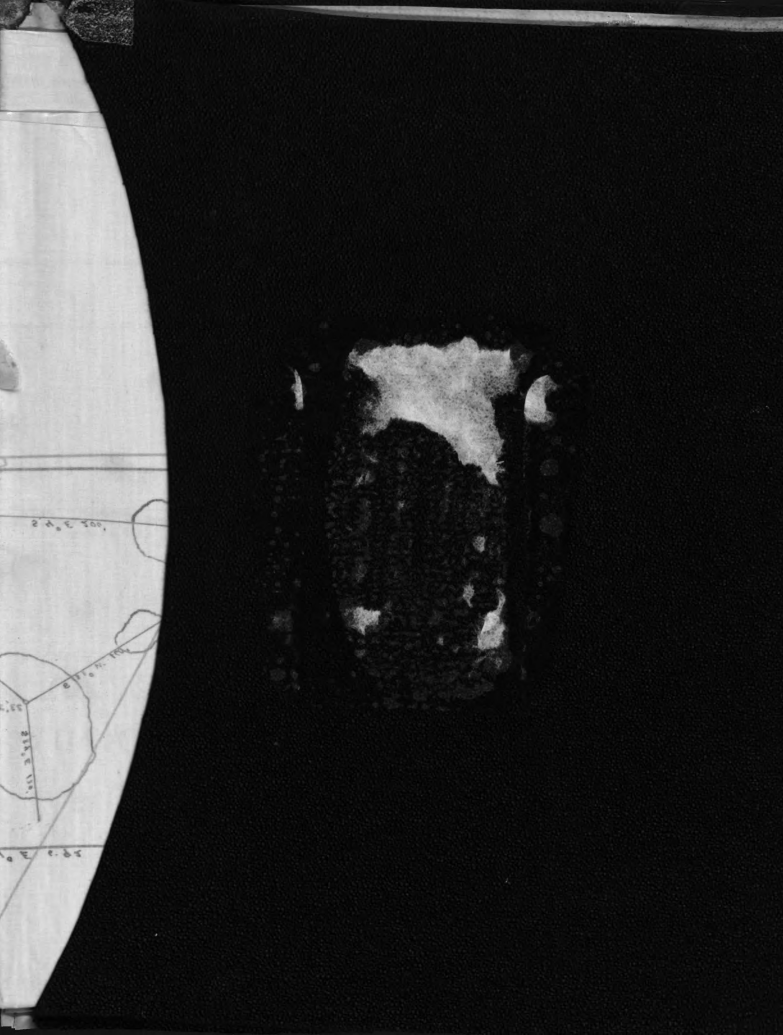
360 ft.	8" tile	at	\$81.00	M.	\$29.16
650 "	6" "	"	42.40	M.	27.56
1730 "	4" "	"	23.40	M.	40.48
1330 "	3" "	"	15.30	M.	20.30
150 "	2" "	"	10.00	M.	1.50

Estimated cost of digging trench, laying tile, etc. 110.00

Total cost. \$229.00

Pocket has:
3 maps
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