PERMEABILITY OF A BURIED PREGLACIAL VALLEY NEAR THE HAMILTON LAKE FIELD

by: D.H. Lennox

1968

March 21, 1968.

Mr. Norman Orr,
James A. Lewis Engineering Co. Ltd.,
736 Eighth Avenue S.W.,
CALGARY, Alberta.

Dear Mr. Orr:

I enclose a rough sketch map based on our HYDRODAT shallow well-log information showing the inferred position of a buried preglacial valley lying to the north and east of the Hamilton Lake oil field. Reported bedrock depths inside and outside the buried-valley boundaries are indicated. The course of the valley in range 9 is uncertain but is probably more tortuous than is indicated on the map. The valley makes its way through the gap between Nose Hill and the Neutral Hills and then, presumably, through the gap between Nose Hill and the prominent hill lying to the north of Nose Hill and centered in the southern part of township 38, range 9. This would give the valley course in range 9 a pronounced S shape.

With respect to water-supply potential of the buried valley, our HYDRODAT information suggests this may be very limited. Except in a few cases, no wells or test holes located over the buried valley encountered permeable materials lying on the valley floor. Where such materials were encountered, the well logs indicate them to be fine grained and in only two instances were they reported to yield water. In both cases drilling was carried into bedrock and eventual production was from bedrock aquifers.

Reported bedrock yields for the area represented on the map range up to 52 igpm (imperial gallons per minute) but fewer than 10 per cent exceed 20 igpm and over 70 per cent are 10 igpm or less. A concentration of the higher-yield bedrock wells is found in the Hamilton Lake oil field area as defined by the Oil and Gas Conservation Board. This concentration reflects the experience of the operators with deeper bedrock aquifers and their efforts to construct efficient high-yield wells.

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Outside the Hamilton Lake oil field area reported yields are significantly less: approximately 80 per cent of the wells have reported yields of 10 igpm or less and nearly 95 per cent reported yields of 20 igpm or less. These yields are indicative of what may be expected from the Bulwark Sandstone, although some increase might be effected by careful well design, construction, and development. Analysis of data from the only available properly conducted aquifer test for the Bulwark Sandstone gives an estimated 20-year single-well safe yield of 22 igpm. This well — located in Lsd. 2, Sec. 12, Tp. 35, R. 9, W. 4th Mer. — had an open-hole completion and produced from a sandstone interval lying between 115 and 140 feet. The well has been in operation for about 9 years now and has behaved essentially as predicted.

We have examined the aquifer test data you provided and copies of the drawdown graphs, showing the results of our analyses, are attached. In one case (W.W. 4-4-36-10-W.4 M.) the buildup data are also analyzed on the assumption that pumping was stopped immediately after the last pump-test drawdown measurement was taken. Buildup data were also provided for W.W. 10-32-35-10-W.4M but no analysis could be made in this case since the data were apparently not associated with the pump test for which detailed drawdown observations were given.

Results of the aquifer test analysis are listed below:

Water Well No.	Test date	Hydraulic conductivity (igpd/ft^2)	Safe yield (bph)
A-2-5-36-10	26/9/67	4	19
10-32-35-10W.4M	27/9/67	5	80
2-5-36-10	28/9/67	0.5	10
	13/10/67	0.4	6
4-4-36-10W.4M	12/10/67	7	91
	12/10/67*	6	..

*Buildup test.

Except in the case of well 2-5-36-10, the safe yields are perhaps over-estimated. Whether they are or not depends on the explanation for the decreased logarithmic rates of drawdown which become apparent toward the ends of these three tests. There is some possibility that reduction in the drawdown rate is related to delayed yield of water from beds of relatively low permeability contained within the producing zone — a phenomenon which is under investigation here at the present time. If so, the drawdown rate could subsequently increase leading to a corresponding decrease in safe yields. Production histories for these wells might give some indication,

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even now, concerning the importance of delayed yield and I would be pleased to obtain any information of this type that you could send me.

The hydraulic-conductivity (permeability-to-water) figures serve mainly as a check on the plausibility of the analyses. Conductivities should be about the same for similar deposits or for the same deposit sampled at different locations. The three shallow completions give about the same conductivities and the values are those to be expected for fine sandstones or siltstones. The conductivity results also suggest that the deeper layer from which water is produced in W.W. 2-5-36-10 consists of finer materials that the shallower layers utilized in the other three holes.

I hope this information will be useful to you. If you have any questions or comments, I will be pleased to hear from you.

Sincerely,

D. H. Lennox, P.Geoph.,
Head, Groundwater Division.

DHL/dc
c.c. G. M. Gabert
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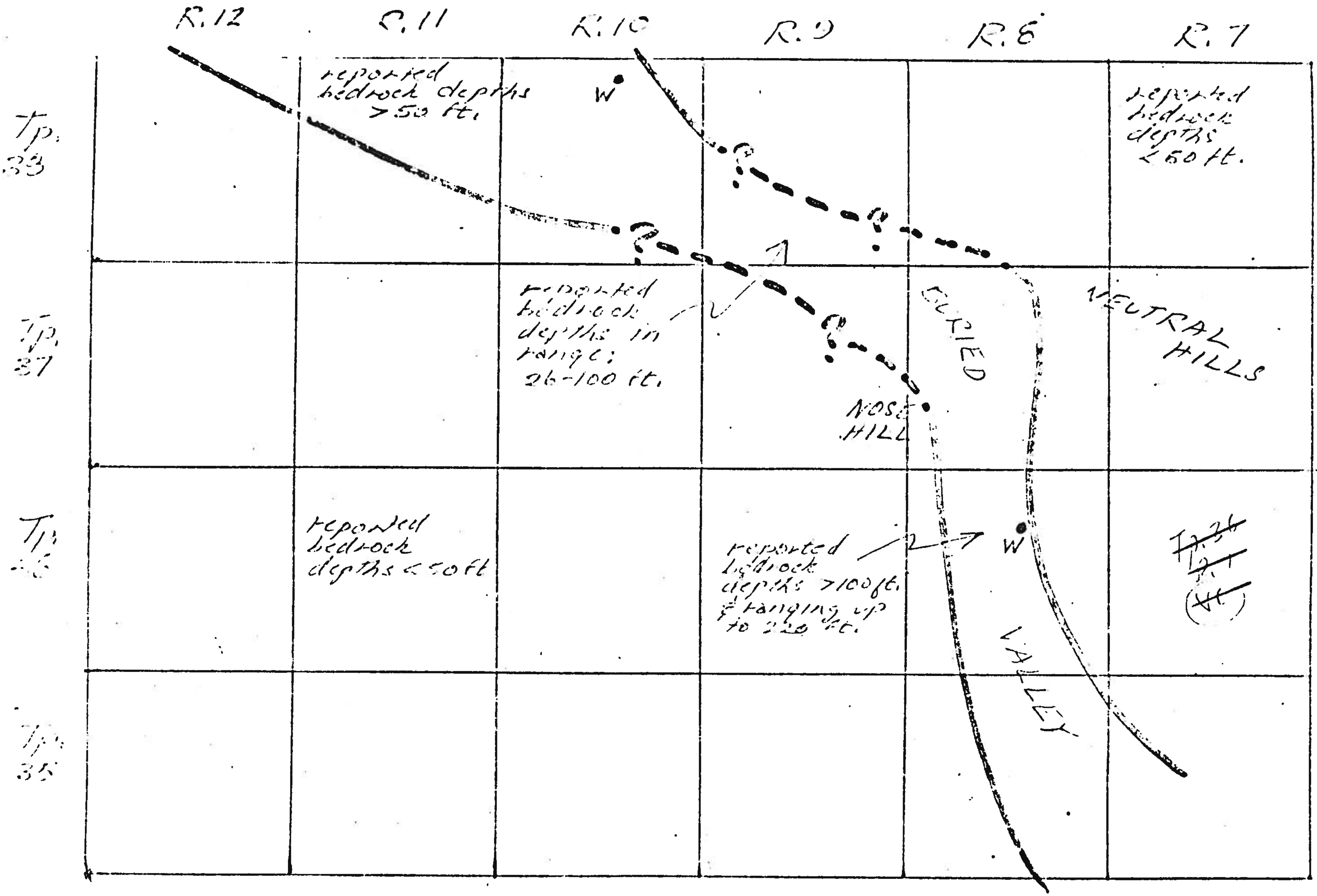
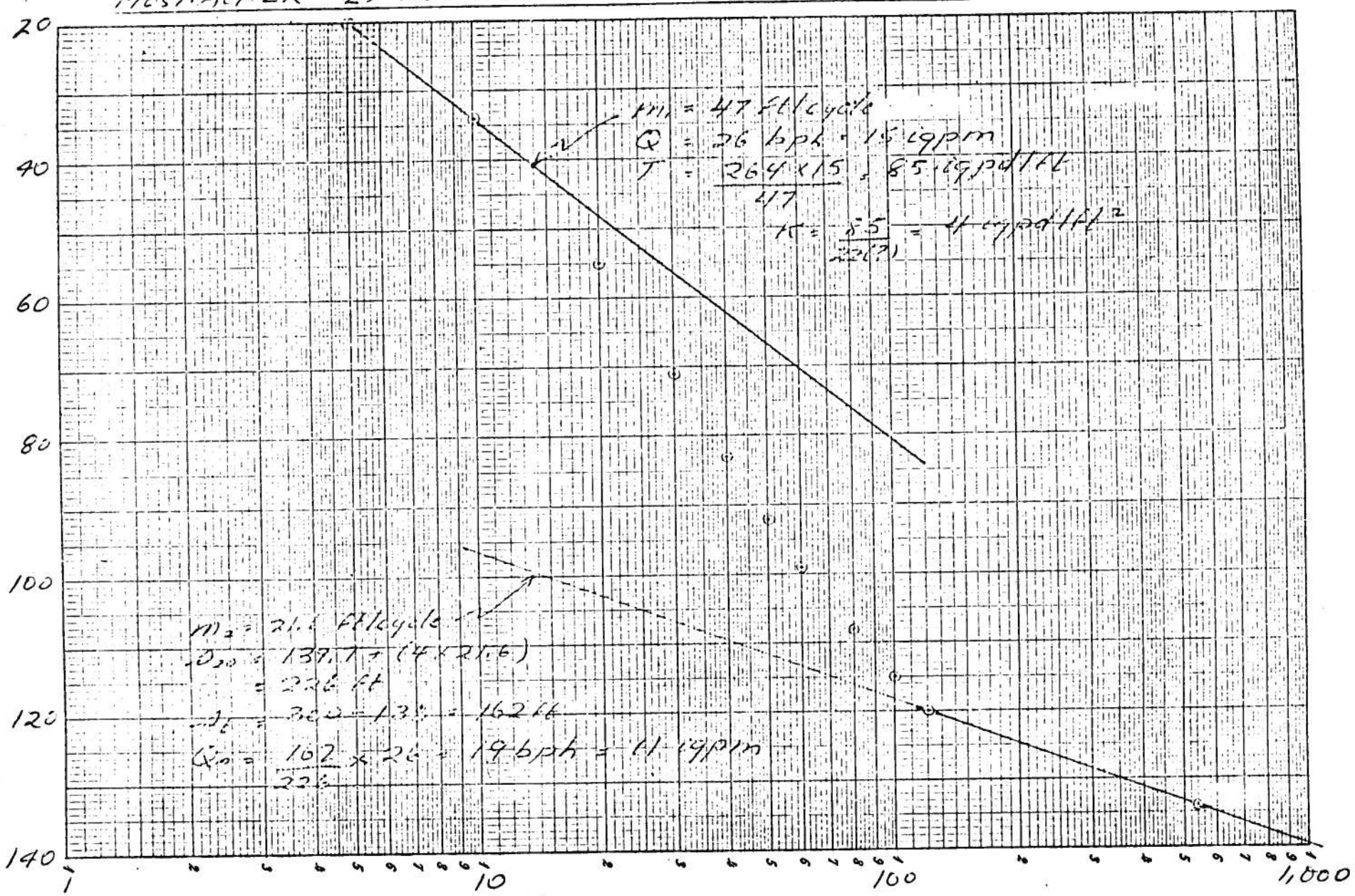
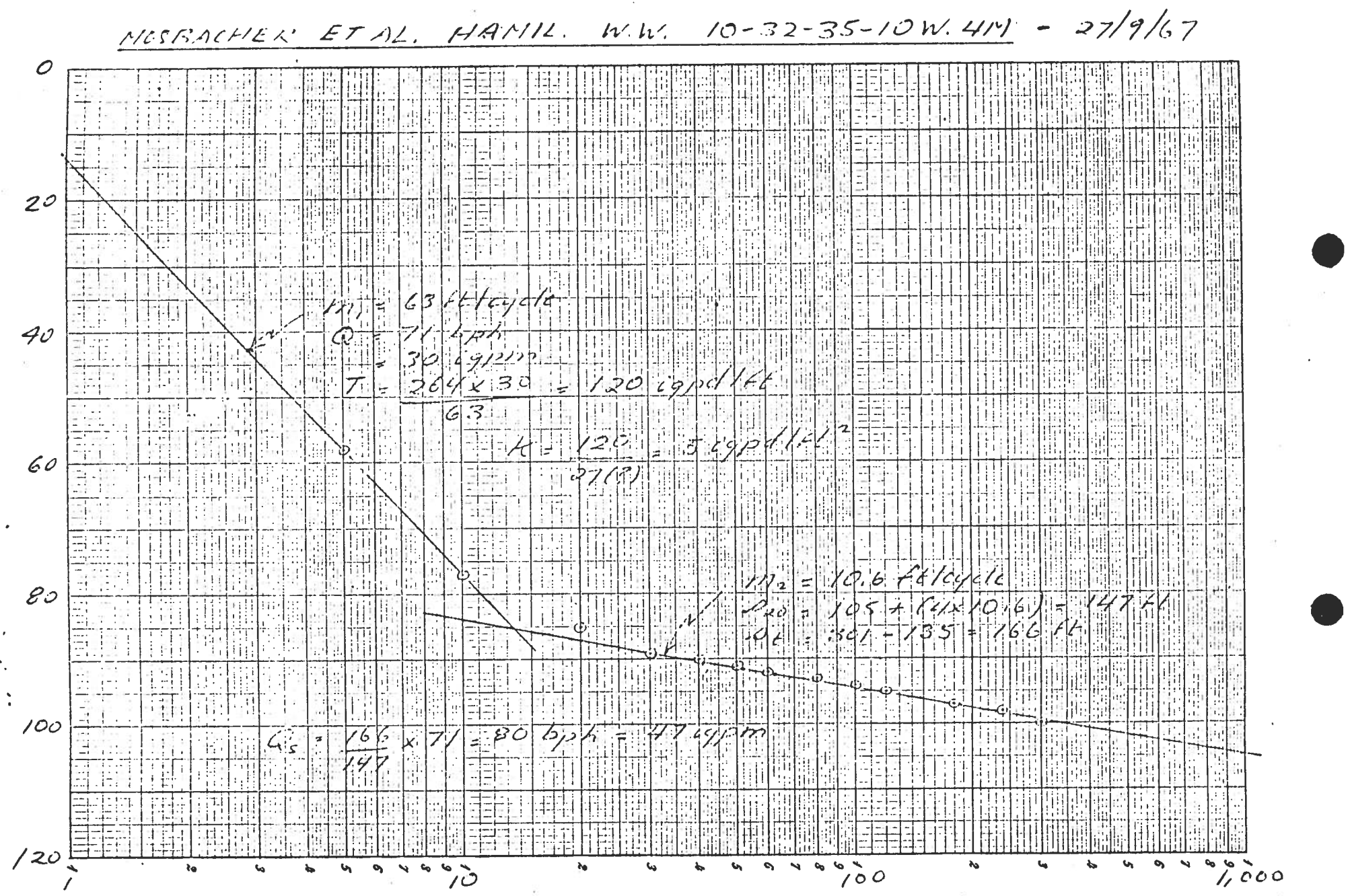
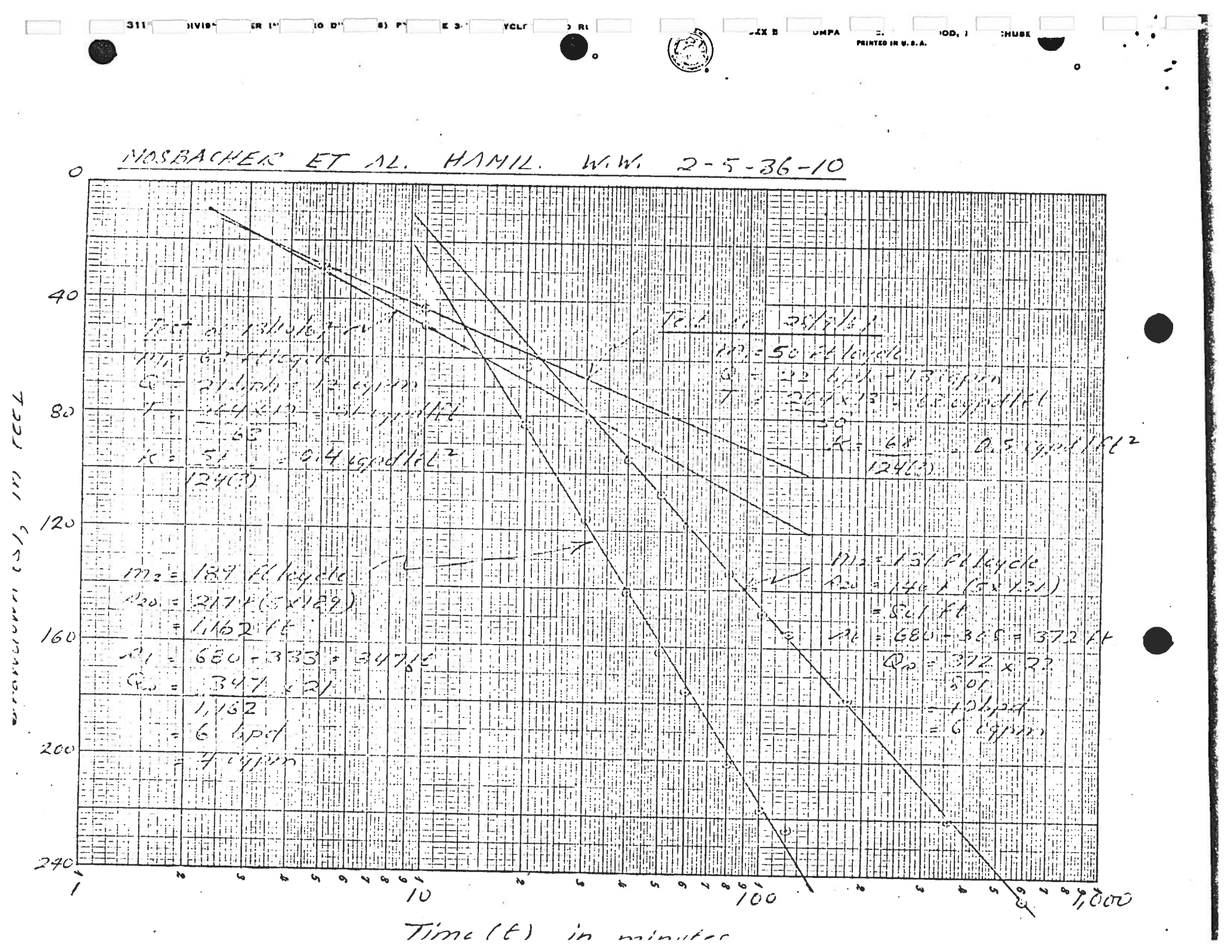


• W - some water obtained during drilling from permeable materials immediately overlying bedrock

MOSBACHER ET AL. HAMIL. WIN. A-2-5-36-10 - 26/9/67




NOSBACHER ET AL. HAMIL. W.W. 10-32-35-10W.4M - 27/9/67
0
20
40
60
80
100
120
Drawdown (s), in feet
1
10
100
1,000
Time (t), in minutes
m_1 = 63 ft/cycle
Q = 71 bph
= 30 gpm
$T = \frac{264 \times 30}{63} = 120$ gpd/ft
$K = \frac{120}{27(9)} = 3$ gpd/ft^2
m_2 = 10.6 ft/cycle
r_{20} = 105 + (21 × 10.6) = 147 ft
Δt = 301 - 135 = 166 ft
$G_s = \frac{166}{147} \times 71 = 80$ bph = 47 gpm


NOSBACHER ET AL. HAMIL. WI. 2-5-36-10
Drawdown (s), in feet
Time (t) in minutes
0
40
80
120
160
200
240
1
10
100
1,000

MOSBACHER ET AL, HAMIL. W.W. 4-4-36-10W.4M - 12/10/67