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MEMORANDUM ON PUMPING TESTS AT JEFFERSON, WISCONSIN

by

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Pumping tests of the sandstone aquifers underlying the Jefferson
Junction area, Wisconsin, were made during the period June 28 to 30,
1948, at the request of the Wisconsin State Board of Health and as
a part of studies of the hydrology of the artesian aquifers of eastern
Wisconsin in cooperation with the State Geological and Natural History
Survey.

Four of the five wells available for the tests are owned by the
Ladish Malting Company; the fifth well is owned by the Chicago and
Northwestern Railway Company. The Ladish wells were cased through
the drift only and all completely penetrate the sandstones, entering
the pre-Cambrian granite at depths ranging from 879 to 888 feet. The
railroad well, 716 feet deep, was cased to a depth of 326 feet through
the drift, dolomite of the Platteville limestone, the St. Peter sand-
stone, dolomite of the Prairie du Chien group ("Lower Magnesian"), and
sandstone of the "Trempealeau" formation, and 96 feet into the Franconia
sandstone.

The coefficients of transmissibility and storage were computed by
applying the nonequilibrium formula _/ to the drawdown and recovery of

_/Theis, C. V., The relation between the lowering of the piezometric
surface and the rate and duration of discharge of a well using ground-
water storage: Am. Geophys. Union Trans., pp. 519-524, 1935.

Ladish well No. 2 pumping about 1,330 gpm; the interference of Ladish well

No. 2 with wells Je 9 (railroad well), Ladish No. 3, and Ladish No. 4;
and the drawdown and recovery of Je 9. (See table 1.) Two low values of
transmissibility obtained from drawdown and recovery tests of well Je 9
were discarded because the well was cased to a depth of 326 feet, which
excluded a part of the aquifer.

TABLE 1.

Pumped Well	Observation Well	[1] r (ft.)	Coefficient of Transmissibility T (gpd/ft.)	Coefficient of Storage S
2 on	-------	-------	45,800	-------
2	4	983	91,000	0.00076
2	9	752	65,100	.00064
2 off	-------	-------	65,000	-------
2	3	494	71,100	.00148
2	4	983	87,000	.00030
2	9	752	82,600	.00046
9 on	-------	-------	(32,000)[2]	-------
9 off	-------	-------	(21,000)[2]	-------
Average			72,600	.00073

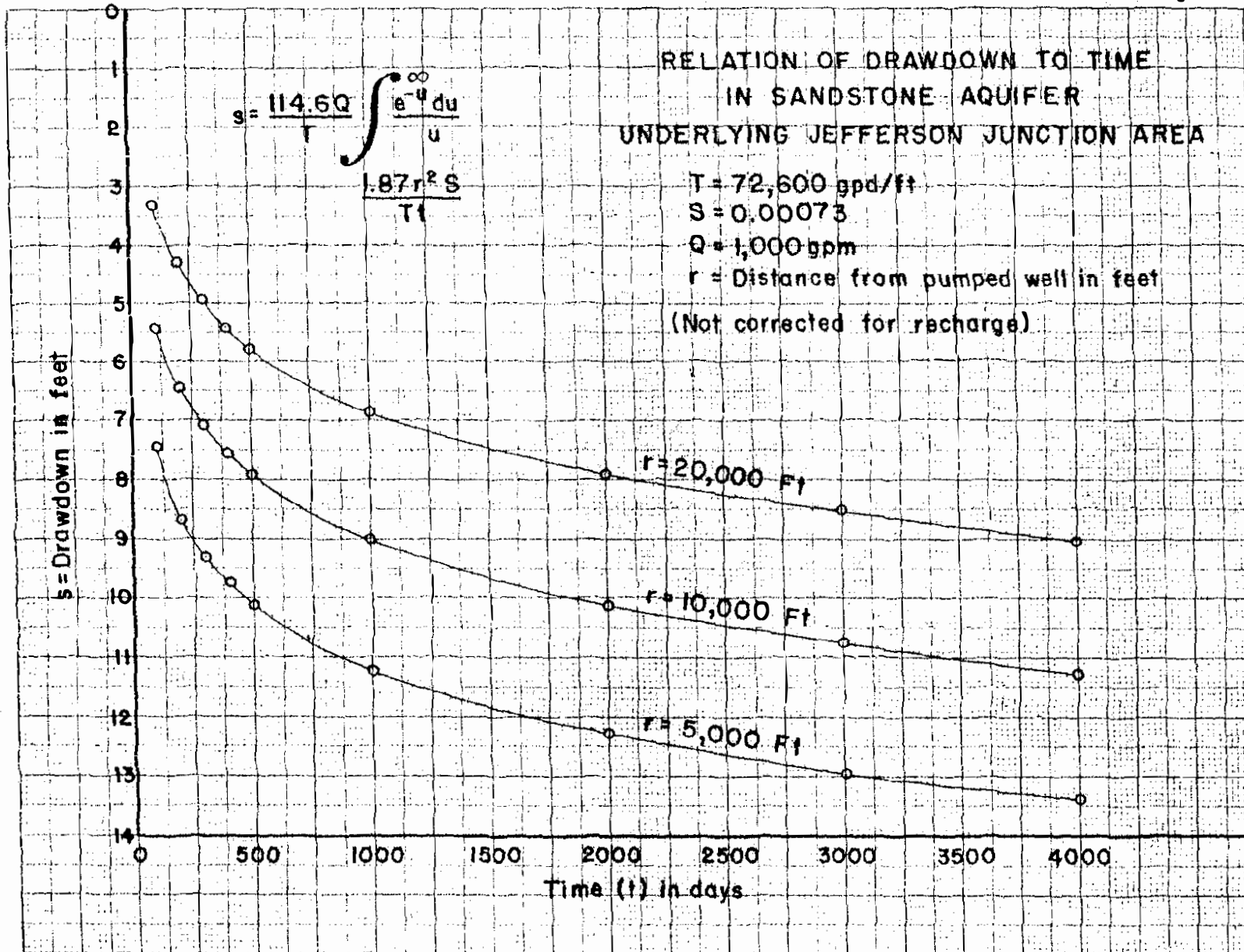[1] r - Distance from pumped well to observation well.

[2] Not included in average.

Figure 1 shows the computed relation of drawdown to time, using the average values of transmissibility and storage and without correction for recharge. It indicates that pumping a well continuously at the rate of 1,000 gpm will cause a lowering of the water levels of approximately 7 feet in 1 year and 10 feet in 10 years at a distance of $2\frac{1}{2}$ miles.

Figure 2 shows the computed relation of drawdown to time, assuming a recharge area about 10 miles west where the St. Peter sandstone crops out in sec. 33 and 34, T. 8 N., R. 13 E., and in sec. 4, T. 7 N., R. 13 E. This correction for recharge indicates a lowering of the water levels of approximately 6 feet in 1 year and 7 feet in 10 years under the same pumping conditions as given in figure 1.

Future work in the area should include a study of pumpage at Jefferson and Johnson Creek and further detailed geologic studies in an effort to determine the exact locations of possible recharge areas. Observation wells should be located between the well fields at Jefferson, Jefferson Junction, and Johnson Creek and the probable recharge area to the west to determine the direction and rate of movement of water.

Figure I

RELATION OF DRAWDOWN TO TIME
IN SANDSTONE AQUIFER
UNDERLYING JEFFERSON JUNCTION AREA

$$s = \frac{114.6Q}{T} \int_{u}^{\infty} \frac{e^{-u}\, du}{u}$$

$$\frac{1.87r^2 S}{Tt}$$

T = 72,600 gpd/ft
S = 0.00073
Q = 1,000 gpm
r = Distance from pumped well in feet
(Not corrected for recharge)

r = 20,000 Ft
r = 10,000 Ft
r = 5,000 Ft

s = Drawdown in feet

Time (t) in days

Figure 2

RELATION OF DRAWDOWN TO TIME
IN SANDSTONE AQUIFER
UNDERLYING JEFFERSON JUNCTION AREA
(Corrected for recharge at outcrop 10 miles away)

$$s = \frac{114.6Q}{T} \int_{\frac{1.87r^2S}{Tt}}^{\infty} \frac{e^{-u} du}{u}$$

r = 20,000 Ft

r = 10,000 Ft

r = 5,000 Ft

T = 72,600 gpd/ft
S = 0.00073
Q = 1,000 gpm
r = Distance from pumped well in feet

s = Drawdown in feet

Time (t) in days