GL07358

RRGE2 TO RRG1-6

SUSTAINED 21 DAY TEST

RRGE-2 RESPONSE

Q = 600 gpm

RRGE-2 RESPONSE

PUMPING RATE: Initial attempt and recovery.

Apparently reasonably steady at 600 gpm with exception of 12 minute interruption on 3-27 due to lightning.

TEMPERATURE:

Apparently reasonably constant at approx 284°F after 100 minutes. initial temperature 279. Only a 3-4° rise in temperature at wellhead.

PRESSURE/HEAD.

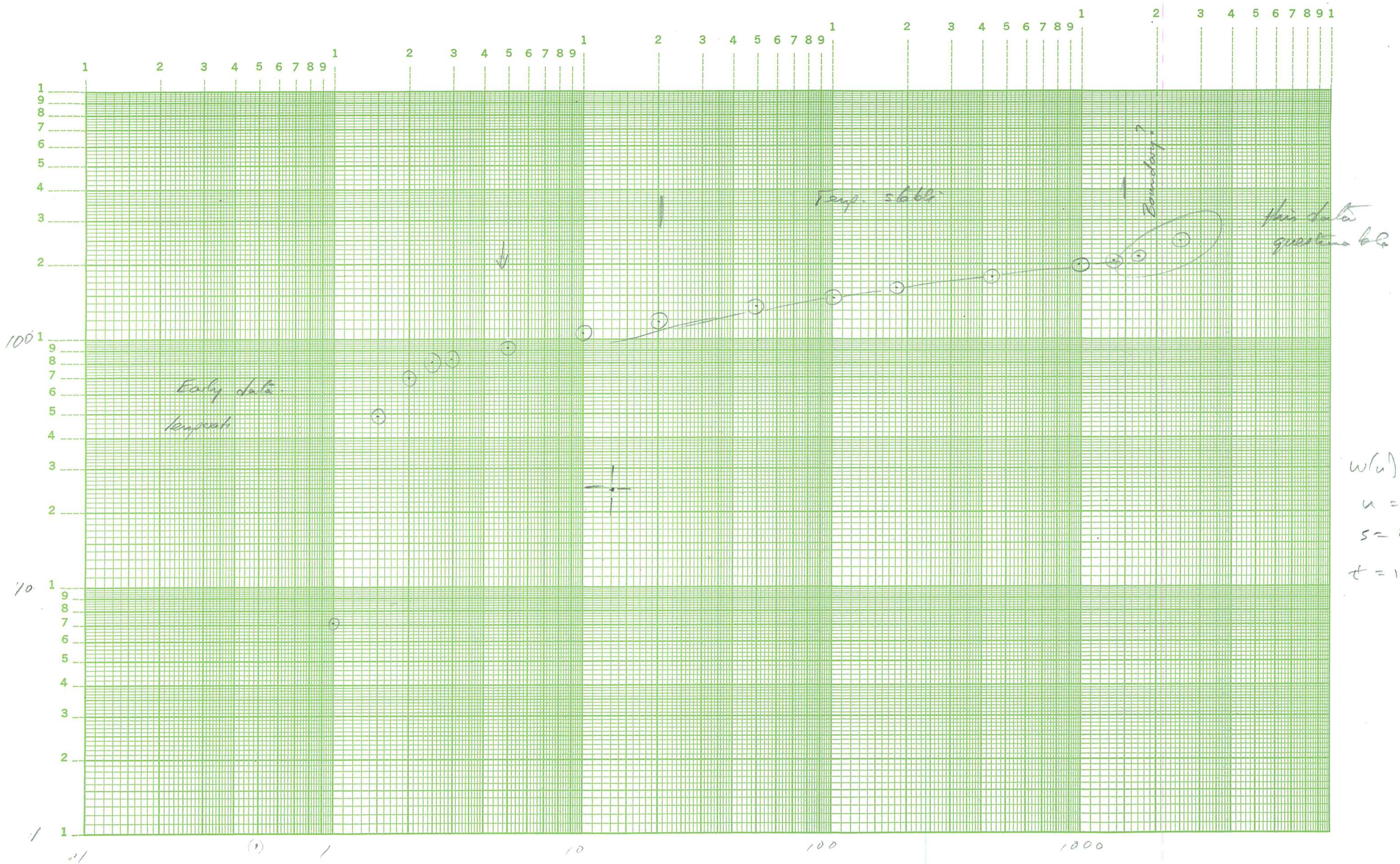
Bubbler tube readings made per digiquartz. Initial bubbler pressure 440 psia (.1016 ft). Measurements also by Heise guage

Pump set at 802 feet in RRGE-2.

K+E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

KRGE-2 (DRAWDOWN)



$W(u) = 1$

$u = 10^{-2}$

$s = 25$

$t = 13$

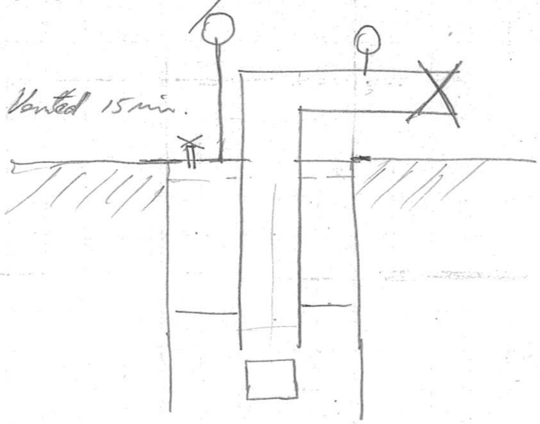
$$T = \frac{114.6\, Q(W(u))}{s} = \frac{68760}{25}$$

$$= 2750 \text{ gpd/ft.}$$

DEMUTH CORRECTION TO RECOVERY DATA RRGE-2

1. Assume formation face temperature at end of test is 284°F

2. How is recovery measured?



Venting the annulus during early recovery is necessary but what effect will this have. The annular space surrounding the pump column is vented until fluid return to surface then shut in. The venting ports are several feet below casing head leaving opportunity for compression.

The correction (Demuth) for temperature influences requires the following assumptions.

1. The interval exhibiting temperature change will be from casing head to pumping water level. Pumping water level is 160 psig above pump. (water temp is 284°F, 57.82 lb/ft³ head above pump is therefore 160 × 2.31 × .97 = 358.5 feet

Pump is set at (reported) 1868' This would suggest about 1500 ft drawdown, but available S is in fact only

(450 - 120) = 330 psig or 763 feet. and s used during the test is (450 - 120) - 160 = 170 × 2.31 = 393. (say 400')

The column of water subject to significant temperature variance during recovery is therefore approximately 400 ft, the borehole below this depth is assumed to be in quasi-equilibrium with respect to temperature at least for the initial period of recovery. The initial period is taken as the initial 10 hours elapsed after pumping stopped (ratio elapsed time of approximately 50.) During this time, the greatest temperature-induced changes in wellhead pressure will be density changes in the fluid occupying the upper 400 feet of borehole.
An approximation of the magnitude of this influence can be estimated by the Dermuth midpoint assumption method (REF.) The mid point of the displaced fluid column is 200 ft. The change in wellhead pressure attributable to density change is given by the expression:

$$\Delta P_{wh} = \Delta \overline{w} \; \frac{200}{144} \text{ psi} \quad \text{where}$$

1.39

$\Delta \overline{w}$ average specific weight change in response to temperature change

Specific weight of water at 284°F is 57.82 lb/ft³. Specific weight of water at 200°F is 60.13 lb/ft³. Even if the entire 400 ft column cooled to 200°F in the initial 10 hours of recovery, the correction to wellhead pressure which this would induce is.

$$\Delta p_{wh} = 2.31 \times \frac{400}{144} = 6.42 \text{ psi.}$$

A change of this magnitude will not significantly change the slope of early recovery data.

There is evidence from LK61-6 temperature profiles that the rate of borehole cooling is very slow at undisturbed depths.

the displaced

Extremely early recovery data (to ratio elapsed times 2000) may be influenced by air or vapour compressibilities and

HYDRAULIC PROPERTIES TABLE (x)

Q = 600 gpm = 37.8 lps

SOURCE	S_{10}	Q/S_{10}	REMARKS
drawdown initial try.	59 psi/cycle. 406.81 Kpa/cycle	10.17 gpm/psi/cycle. 0.09 lps/Kpa/cycle.	✓
recovery initial try.	64 psi/cycle 441.28 Kpa/cycle.	9.38 gpm/psi/cycle. 0.09 lps/Kpa/cycle.	✓
drawdown sustained test EARLY DATA	42 psi/cycle. 289.59 Kpa/cycle	14.29 gpm/psi/cycle 0.13 lps/Kpa/cycle.	
drawdown sustained test LATER DATA.	61 psi/cycle. 420.60 Kpa/cycle.	9.84 gpm/psi/cycle. 0.09 lps/Kpa/cycle.	✓
recovery sustained test.	48 psi/cycle. 330.96 Kpa/cycle.	12.50 gpm/psi/cycle. 0.11 lps/Kpa/cycle.	

The Transmissivities (intrinsic) included in table (x) were computed using the relationships shown below:
(REF Allman GP AP 004, Feb, 1979)

$$kh = \frac{5759\ Q\ \mu}{S_{10}}$$

where kh is in md·ft
Q/S_{10} is in gpm/cycle
μ is viscosity in centipoises (0.195 at 284°F)

and $T = \frac{Kh}{1000} \times .3284147 \frac{\gamma}{\mu}$

where T is in gpd/ft
Kh is in md-ft.
γ is specific gravity in lb/ft^3 (57.82 lb/ft^3 at 284°F)
μ is viscosity in centipoises. (0.195 at 284°F)

CALCULATIONS OF INTRINSIC TRANSMISSIVITY (RRGE-2)

$$kh = \frac{5759\ Q\ u}{S_{10}}$$ range of Q/S_{10} is 9.38 to 14.29 gpm/psi/cycle.

kh = 10,534 to 16,047 md-ft.

$$T = \frac{kh}{1000} \times .3284147\ \gamma/u$$

$$T = \frac{10,534}{1000} \times .3284147\ \frac{57.82}{0.195}$$

T = 10.534 × .3284 × 296.51 = 1025 gpd/ft.

to T = 16.047 × .3284 × 296.51 = 1562 gpd/ft.

Uncorrected data analyzed by the non-leaky curve-fitting method emphasizing the 100 to 1000 minutes elapsed time data provides a value for Transmissivity of 2750 gpd/ft.