PHASE I
PUMPING TEST OF THE
GROUNDWATER PUMPING SYSTEM WELLS AT
PERSON STATION

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INTRODUCTION

During January and February, 1995 Phase I pump testing of the Person Station Groundwater Pumping System was conducted. As a part of that testing the system was run continuously for 37 days. During that period well drawdown data and discharge rates were collected from two pumped wells (VW-1 and PSMW-16) supplying ground water to the groundwater treatment system. Well drawdown data was also collected from ten observation wells (PSMW-1R, 2, 3, 10, 12A, 17, 18, 19X, 22 and 24) located in the vicinity of the pumped wells (see PLATE 1). The purpose for collecting the well drawdown data was to estimate the capture zone for each pumping well and to site additional pumping wells. This report provides an analysis of the well drawdown data collected over the 37 day test period and proposes sites for additional groundwater pumping wells.

PUMP TESTING METHOD

Two groundwater pumping wells (VW-1 and PSMW-16) were pumped continuously for a period of 37 days. Each well consists of a 4-inch diameter PVC well screened through the upper 15 feet of the saturated zone. The wells are equipped with permanent 4-inch diameter electric submersible pumps which were used for the pumping test. Well VW-1 was pumped at an average rate of 5.6 gpm during the test, and well PSMW-16 was pumped at 13.3 gpm.

Water levels in the pumped and observation wells were measured with electronic sounders to the nearest 0.01 feet. Instantaneous discharge rates were calculated from totalizing water meters timed over a one minute period. Average discharge rates were

calculated from initial and final water meter readings. The water level and discharge data are presented in APPENDIX A.

The data were analyzed using the Jacob Solution (semi-log plots) to the Theis equation. The time-drawdown plots and residual-drawdown plots are presented in APPENDIX B. From the APPENDIX B plots, it can be noted that the time-drawdown data exhibit some scatter. While discharge rates were not held completely constant, it is believed that barometric pressure changes during the test are largely responsible for the scatter. The data for well PSMW-19X exhibits more scatter than the other data, and as a result was not analyzed. In addition to exhibiting scatter from barometric pressure changes, the data for well PSMW-24 exhibited no net drawdown during the test, indicating it is beyond the radius of influence of well PSMW-16. As a result, that data was not analyzed.

The time-drawdown data was evaluated to determine the validity of using the Jacob Solution using the criteria in Johnson, 1974 (i.e. $u \leq 0.05$). The results are shown in TABLE 1. While the measured drawdowns (S) at the observation wells are not, strictly speaking, large enough to validate the use of the Jacob Solution, it is assumed that they are close enough to allow useful conclusions to be drawn from the results. During long term operation of the groundwater pumping system, water levels can be measured over a longer time period to verify this assumption.

In order to estimate the radius of influence (or capture zone) for each pumped well, distance-drawdown graphs were constructed for wells VW-1 and PSMW-16. They are presented in FIGURES 1 and 2.

RESULTS

Apparent transmissivity values, computed from the time-drawdown and residual-drawdown graphs, are presented in TABLE 2. Hydraulic conductivity ranges were subsequently computed assuming a saturated thickness of 15 feet. These are presented in TABLE 3.

TABLE 1

VALIDITY OF JACOB SOLUTION

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WELL	DISCHARGE (Q) (gpm)	TRANSMISSIVITY (T) (gpd/ft)	CALCULATED DRAWDOWN (S) (ft)	MAXIMUM MEASURED DRAWDOWN (ft)
PSMW 1R	5.6	3110	0.50	0.47
PSMW 2	5.6	5480	0.29	0.27
PSMW 3	5.6	6160	0.25	0.31
PSMW 10	13.3	7800	0.48	0.53
PSMW 17	13.3	8170	0.46	0.50
PSMW 18	13.3	4880	0.77	0.52
PSMW 22	13.3	5020	0.75	0.53

$u \leq 0.05$ (Acceptable criterion for validity of Jacob solution)

$W(u) = 2.468$ (From Theis well function tables; i.e. W as a function of u)

$(S)(T) = W(u)(114.6)(Q)$

$$S = \frac{W(u)\ (114.6)\ (Q)}{T} = \frac{(2.468)\ (114.6)\ (Q)}{T} = \frac{(283)\ (Q)}{T}$$

TABLE 2

APPARENT TRANSMISSIVITIES

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WELL	DISCHARGE (gpm)	PLOT USED	TRANSMISSIVITY (gpd/ft)
VW-1	5.6	R-D	14,800
PSMW 1R	5.6	T-D	3,110
PSMW 2	5.6	T-D	5,480
PSMW 3	5.6	T-D	6,160
PSMW 16	13.3	R-D	10,000
PSMW 10	13.3	T-D	7,800
PSMW 17	13.3	T-D	8,170
PSMW 18	13.3	T-D	4,880
PSMW 22	13.3	T-D	5,020

TABLE 3

APPARENT TRANSMISSIVITY AND HYDRAULIC CONDUCTIVITY RANGES PHASE I PUMPING TEST OF THE GROUNDWATER PUMPING SYSTEM WELLS AT PERSON STATION

PUMPED WELL	TRANSMISSIVITY RANGE (gpd/ft)		HYDRAULIC CONDUCTIVITY RANGE (ft/day)	
	Low	High	Low	High
VW-1	3,110	14,800	27	131
PSMW 16	4,880	10,000	43	89

$$K = \frac{T}{b} X \frac{ft^3}{7.48\ gal}$$

b = 15 ft = Aquifer thickness

It is anticipated that these parameters may be incorporated into the groundwater flow and containment transport models of the site.

FIGURES 1 and 2 indicate that the radii of influence of wells VW-1 and PSMW-16 are about 80 feet and 600 feet respectively (see PLATE 1) after 30 days of pumping. It is anticipated that the ultimate radii will be somewhat larger because drawdowns at the observation wells were still increasing after 37 days of pumping (see APPENDIX B).

It is also anticipated the pumping discharges can be increased at both wells which would also tend to increase the radii of influence. The long term discharge at well VW-1 may be increased from 5.6 gpm to about 6 gpm, and the discharge at well PSMW-16 may be increased from 13.3 gpm to about 15 gpm.

RECOMMENDATIONS

Based on the results of the above described pumping test, it is our recommendation that one new groundwater recovery well be installed between wells PSMW-1R and PSMW-10 at the location shown on PLATE 1 and that existing monitoring wells PSMW-24, PSMW-25 and PSMW-26 be converted to recovery wells. Based on the fact that the drawdowns in the observation wells were continuing to increase at the end of the 37 day pumping test, we also recommend that the groundwater pumping system be operated in a continuous mode rather than a pulse mode to allow the system to influence as much of the plume area as possible.

FIGURE 1

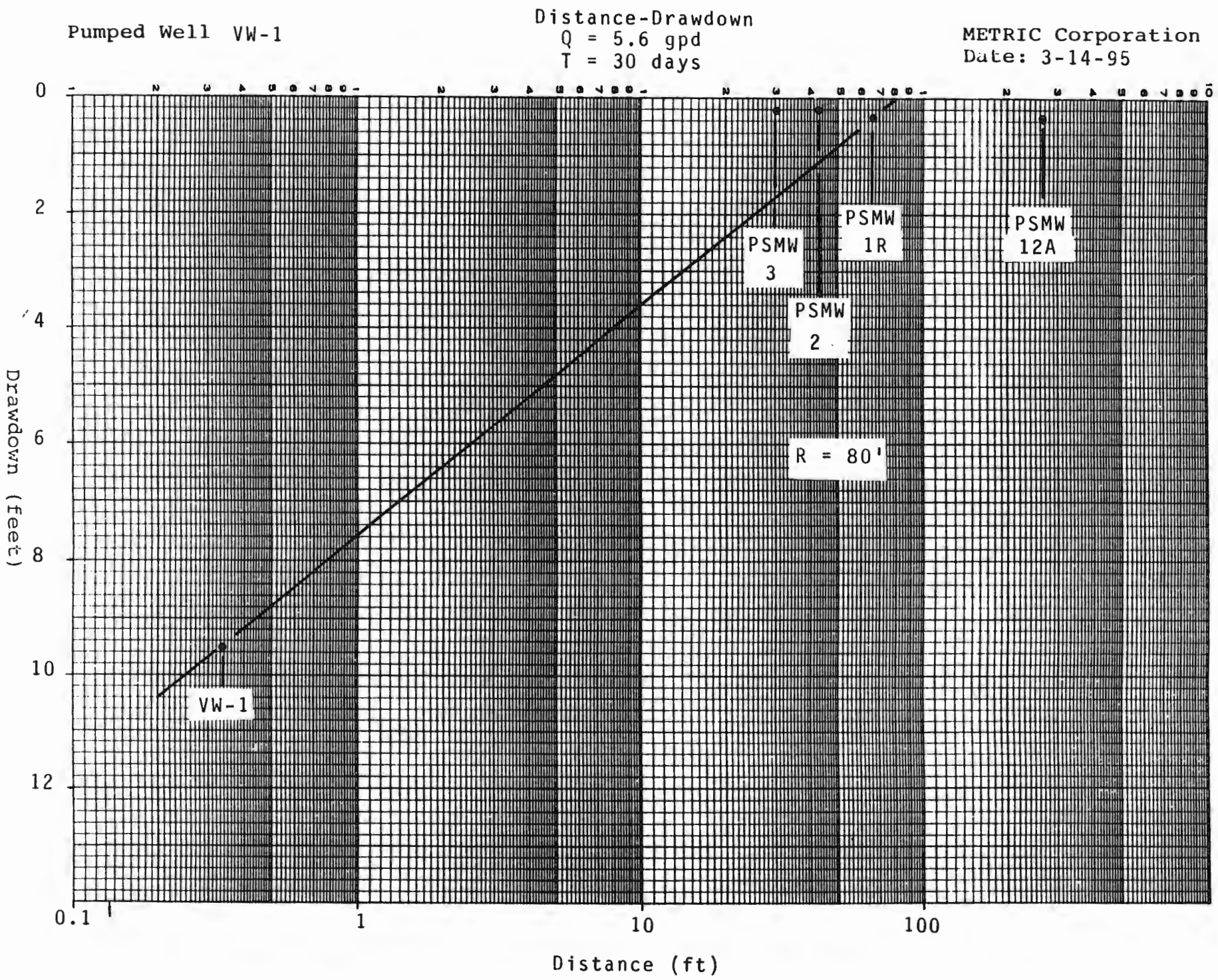
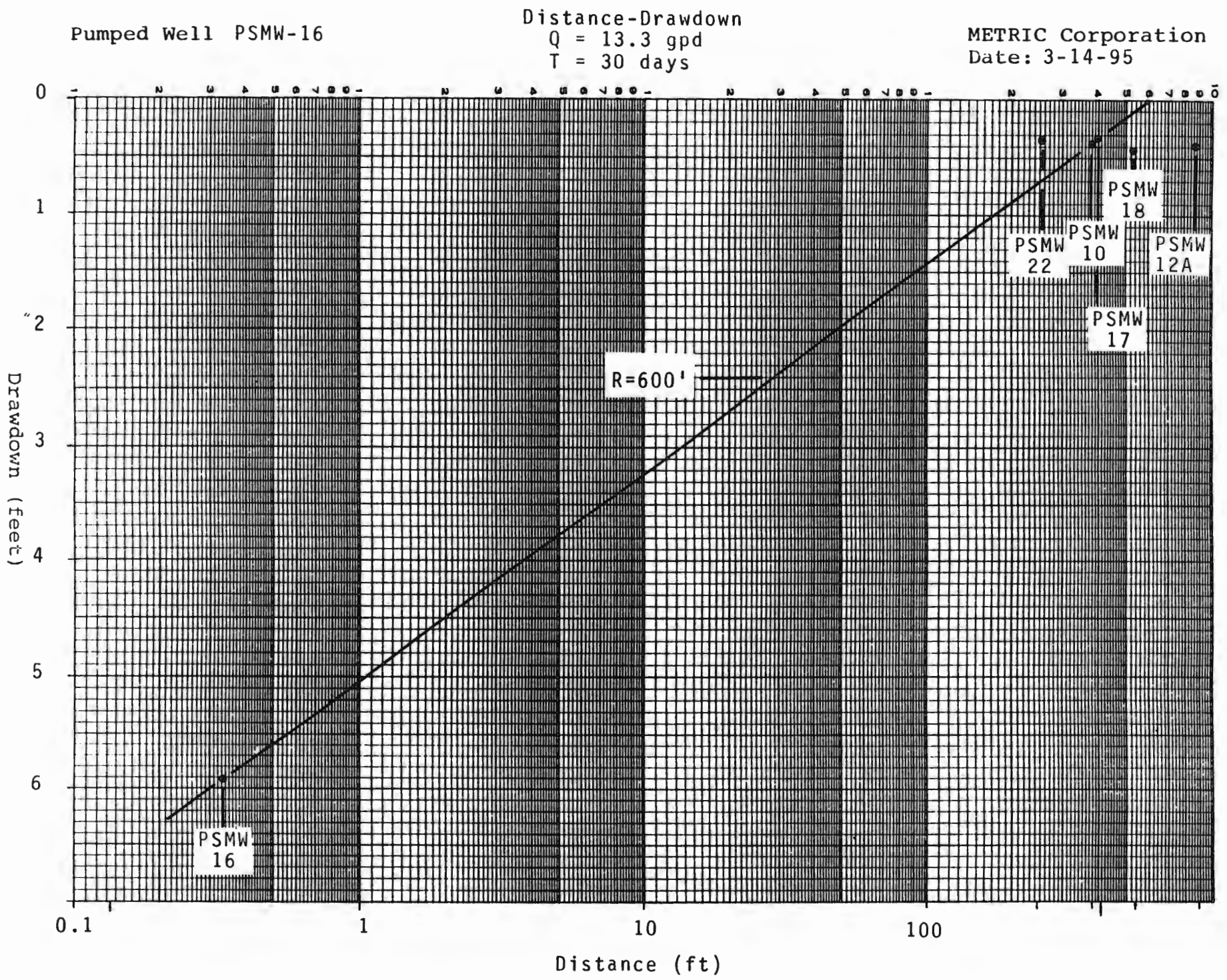

Pumped Well VW-1
Distance-Drawdown
Q = 5.6 gpd
T = 30 days
METRIC Corporation
Date: 3-14-95
0
2
4
6
8
10
12
Drawdown (feet)
0.1
1
10
100
Distance (ft)
VW-1
PSMW 3
PSMW 2
PSMW 1R
PSMW 12A
R = 80'

FIGURE 2


Pumped Well PSMW-16
Distance-Drawdown
Q = 13.3 gpd
T = 30 days
METRIC Corporation
Date: 3-14-95
0
1
2
3
4
5
6
Drawdown (feet)
R=600'
PSMW 16
PSMW 22
PSMW 10
PSMW 18
PSMW 17
PSMW 12A
0.1
1
10
100
Distance (ft)