

# Pumping Tests: Production and Efficiency Determinations

## Introduction

Pumping tests provide very useful information that is needed to properly select pumping equipment, assess aquifer conditions, and evaluate well performance. Truth be told, the importance of pumping tests is not always fully appreciated, particularly by those who consider them an unnecessary expense. This memorandum provides a brief overview of two key pumping tests: the step-drawdown test and the constant-rate pumping test. Expanded descriptions of these tests are provided in the suggested reference.

## Step-Drawdown Test

Also referred to as a variable-rate test, the step-drawdown test is one of the most useful assessment tools. It is a short-term test that can be used to determine: 1) a pumping rate for a constant-rate test, 2) specific capacity (defined as the ratio of the production rate or yield of a well to the drawdown required to produce that yield), and 3) well efficiency. The test procedure is straightforward, easy to execute, and requires no monitoring wells.

The test is typically performed by pumping the well at 3 or 4 discharge rates (i.e., steps) over a period of 6 to 8 hours (or longer); the steps are generally 2 hours in length. Beginning at the lowest discharge rate as the first step, the well is pumped and measurements of the pumping water level are made. Then, discharge rate is increased and another set of measurements are made. It should be noted that the pumping water level may not have stabilized by the end of a step. Though there is no set "rule" for testing, the discharge rate of the final step is often the design pumping rate. If so, the water level(s) for final step should give tester an approximation of how the well may respond during the constant-rate test. For instance, the results might indicate that a deeper pumping setting is needed or a lower pumping rate should be considered.

## Constant-Rate Pumping Test

The constant-rate, a long-term pumping test, can be conducted for any length of time; normally this test period is from 6 to 24 hours. However, some tests continue for several days. Most newly constructed municipal production wells are pumped for 24 hours at the design rate to simulate actual operating conditions. This test provides pumping level data that are needed to properly select capacity and horsepower of the permanent pump.

## Well Efficiency from Pumping Tests

Determining the efficiency of a well is important because it indicates how freely the well allows ground water to pass through the well screen or perforations. The indicator is the head loss or drawdown. Well efficiency is calculated as the ratio of actual specific capacity to theoretical specific capacity. Actual specific capacity can be calculated from step-drawdown and constant-rate tests. However, it is more common to base well efficiency on the step-drawdown test because the calculation is made without the use of monitoring well(s). Calculating well efficiency from constant-rate testing is based on distance-drawdown testing. From either approach the investigator can assess various conditions or aspects of the

well. Most operators are interested in the effects of well development and 2) well design, construction, which can be interpreted from well efficiency results.

**References**

- Roscoe Moss Company, 1990, *Handbook of Ground Water Development*, John Wiley and Sons, New York, NY.

**About the Author**

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