

CONSTRUCTION SPECIFICATION 200

STEP-DRAWDOWN PUMPING TEST for WATER WELLS

1. SCOPE

The work consists of a step-drawdown pumping test to determine water level drawdown at the design production rate. A Step-Drawdown Test is an accelerated pumping test for a single well, designed to estimate the aquifer characteristics and performance of a pumped well under three successively higher pumping rates or steps under controlled flow.

Work includes the mobilization of a temporary pump and equipment to measure water level drawdown and flow rate. The work also includes water level and flow rate measurements. Measurements are recorded on the attached pumping test data sheets.

2. QUALITY OF WORK

Measure flow rates within +/- 1-gpm and water levels to within +/- 1 foot.

Discharge pumped water onto the ground surface at least 300 feet from the well and without eroding the ground surface or creating flood damage to the well site.

3. STEP-DRAWDOWN PUMPING TEST PROCEDURE

The following materials are required for a Step-Drawdown Test.

Materials:

1. Truck hoist
2. Pump with check valve and adequate horsepower to lift 150% of the design production rate to the top of the casing.
3. Riser pipe
4. Submersible electrical cable
5. Water level measurement device.
6. Generator
7. Flow meter and throttle valve for controlling the flow rate. If a flow meter is not available, a bucket and stopwatch are acceptable.

Pumping Test Procedure:

Measure the static water level before installing the pump. Install the pump immediately above the screen and pump the well until achieving a clear discharge. Once the discharge is clear, allow the well to recover to static conditions. The test can then start.

The test consists of 3 pumping rates at 50%, 100%, and 150% of the design production rate that provided by the NRCS. Use a throttle valve to maintain each pumping rate to within +/- 1-gpm for about 100 minutes, while reading and recording incremental water level (drawdown) measurements. Run each pumping rate for more or less than 100 minutes, until there is no drawdown for 15 minutes or water level stabilizes within ± 1 foot for 15 minutes.

For each pumping rate, measure water levels at the time increments (listed for each step) on the pumping test data sheets. If water level measurements at the indicated times becomes difficult, record the actual times in the column provided on the data sheets. Inconsistent or poor monitoring will result in repeating the test after recovery of the static water level.

Do not over pump the well. Drawing the water level below the pump intake will cause a test failure, i.e. the pump starts to suck air. Stopping the test for any reason is a test failure. When failure occurs, restart the test at a reduced flow rate after recovery of the static water level. After completion of water level measurements for the three pumping rates, start the recovery test.

Recovery Test Procedure:

Do not remove the pump until the recovery test is completed. Shutoff the pump and start the stopwatch at the same time. Measure recovery levels at the time increments shown on the recovery test data sheet until water level is within 95% of initial static water level. If water level measurements at the indicated times becomes difficult, record the actual times in the column provided on the data sheets.

If problems occur during the pumping or recovery tests, contact NRCS.

Name and phone number: _____

4. MEASUREMENT AND PAYMENT

(Used only if applicable) For established unit prices, measure each work item to the nearest unit applicable, and make payment at the agreed-to unit price. For work items with established lump sum prices, make payments at the lump sum price.

Payment will include full compensation for all materials, labor, equipment, tools, and all other items necessary and incidental to completion of the work.

Compensation for items of work shown on the drawing or described in the special provisions but not listed on the bid schedule are incidental to and included in the pay listed on the bid schedule.

5. REFERENCES

Administrative Rules of Montana, Title 36, Chapter 21. ASTM D5786, Standard Practice for (Field Procedure) for Constant Drawdown Tests in Flowing Wells for Determining Hydraulic Properties of Aquifer Systems.

Dross, P. 2011. Technical Review Practical Guidelines for Test Pumping in Water Wells. International Committee of the Red Cross (ICRC).

Hantush, M. S., "Nonsteady Flow to Flowing Wells in Leaky Aquifer," *Journal of Geophysical Research*, Vol 64, No. 8, 1959, pp. 1043-1052.

http://nevada.usgs.gov/tech/excelforhydrology/Listing_and_Description.htm for Excel Workbooks used in analyzing time-drawdown data.

Jacob, C. E., and Lohman, S. W., "Nonsteady Flow to a Well of Constant Drawdown in an Extensive Aquifer," *American Geophysical Union Transactions*, Vol 33, No. 4, 1952, pp. 552–569.

Lohman, S. W., "Ground-Water Hydraulics," *Professional Paper 708*, U.S. Geological Survey, 1972.

Montana Codes Annotated, Title 37, Chapter 43.

Montana Stockwater Pipeline Manual. U.S. Department of Agriculture, Natural Resources Conservation, 2004, pp. 2-6.

**Choc-Pea & Middle AL Watershed Irrigation Projects:
Contact Marlon Cook @ Cook Hydrogeology prior to
performing pump tests. He may require to be on site for the test.**

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PUMPING TEST DATA SHEET

Initial Static Water Level: _____, Number of Pumping Steps: _____				
Depth to pump intake: _____				
Water measurement device: _____				
Total Well Depth: _____, Driller's Production Estimate: _____				
Casing Diameter: _____, Depth to screen interval: _____				
Notes: Drawdown = Initial static water level - pumping water level				
Initial Static Water Level: _____ Pumping Water Level: _____				
STEP ONE 50% of design production	Date _____	Start Time _____		
Time Since Start (minutes)	Actual Time Since Start (minutes)	Depth to Pumping Water Level (ft.)	Drawdown (ft.)	Pumping Rate (gpm)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
17				
19				
21				
23				
25				
27				
29				
30				
35				
40				
45				
50				
55				
60				
70				
80				
90				
100				
115				
130				
145				
160				
180				
210				
240				
270				
300				
Field Notes:				

STEP TWO 100% of design production	Date_____	Start Time_____		
Time Since Start (minutes)	Actual Time Since Start (minutes)	Depth to Pumping Water Level (ft.)	Drawdown (ft.)	Pumping Rate (gpm)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
17				
19				
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35				
40				
45				
50				
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70				
80				
90				
100				
115				
130				
145				
160				
180				
210				
240				
270				
300				

Field Notes:

STEP THREE 150% of design production	Date_____	Start Time_____		
Time Since Start (minutes)	Actual Time Since Start (minutes)	Depth to Pumping Water Level (ft.)	Drawdown (ft.)	Discharge (gpm)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
17				
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240				
270				
300				

Field Notes:

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