United States Department of Agriculture
Natural Resources Conservation Service
Montana

Operation and Maintenance Guide For Your Water Well

Operator:_____
Project: _____ Date:_____
Farm No._____ Tract No._____ Field No._____
NRCS Office:_____ Phone:_____
NRCS Personnel:_____

A properly operated and maintained water well is an asset to your operation. All wells will eventually require some degree of maintenance or rehabilitation, regardless of construction methods or materials used. This time span depends upon many factors including:

* *Aquifer characteristics*
* *Ground water quality*
* *Well design and materials*
* *Well installation procedures*
* *Pumping rates and equipment quality*

Timely maintenance specifically designed for the well will sustain performance and prolong the life of the installation. This checklist is provided for your convenience in order to help you develop a good maintenance plan.

OPERATION CHECKLIST

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☐ Follow all manufacturer's instructions on operation and maintenance for the pump and any additional appurtenances installed.

☐ Keep accurate, detailed records which should be filed with the copy of the Montana Well Log Report (DNRC form 603). High capacity wells require much more extensive and detailed records than low-yielding stockwater or domestic wells.

☐ Monitor output, looking for variations in volume, turbidity, color and sand content. Also monitor pump for any unusual noise, vibrations or increased temperature.

☐ Check concrete pad and any visible grout seals for cracking or settlement.

☐ Check condition and security of well cap, air vent and power line.

☐ Test water quality at regular intervals, depending on the local water quality and intended use of the water.

☐ Check level of aggregate in filter-packed wells, refill material if necessary.

- If the well flows at the surface, check shut-off valves and freeze protection. Exercise valves periodically so that they remain functional. Monitor the ground surface in vicinity of well for wet spots or seeps. Check flow rate periodically. Keep well shut off when not being used to maintain pressure and conserve resources.

- Inspect frost pits (if used) for hazards such as gasses, venomous animals, rodents, electrical hazards, fall hazards, trapped animals, and contamination hazards. The use of gas detection equipment is recommended. Disinfection of the pit is recommended if rodents have been present. Prevent flooding of pits by runoff by maintaining proper surface drainage.

WATER WELL MAINTENANCE

The most common water well problems include:

1. Reduction in well yield due to lowering of the water surface
2. Plugging of the well screen or formation around the well screen
3. Sand pumping
4. Structural collapse of the well casing or screen
5. Damaged pump.

The necessity for well rehabilitation will depend on the effectiveness of the maintenance program. Keeping detailed, accurate records can reduce wasted money and effort by allowing the appropriate rehabilitation procedures to be selected. The following tables contain the information which should be included in the well's permanent record.

TABLE 1: INFORMATION TO BE PERMANENTLY RECORDED FOR HIGH CAPACITY WELLS

1.	Name and address of drilling contractor and pump installer.
2.	Date well completed and pump installed.
3.	Datum point from which all well measurements are made.
4.	Method of well construction, including the type and dimension of well casing, depth of any casing reductions.
5.	Driller's well log (Montana Well Log Report, DNRC for 603). They should include a diagram showing major geologic features or formation changes which can be complied from samples and geophysical logs. Include any supporting geologic or engineering reports and aquifer tests.
6.	Filter-pack dimensions and materials.
7.	Method of filter-pack installation and depth and extent of grout.
8.	Dates and methods of well development.
9.	Specific capacity after development.
10.	Pump motor electrical data.
11.	Number of pump stages.
12.	Depth of pump intake setting.
13.	Composition of major pump parts (bowl, shaft, impellers, etc.)
14.	Pump performance data (as tested as well).
15.	Power source and line voltage input.
16.	Description and dates of maintenance performed on pump, casing and screen.
17.	Well and pump performance before and after each maintenance job.
18.	Results of diagnostic tests conducted prior to, during and after each maintenance job.
19.	Corrective measures taken on pump, casing or screen.
20.	Results of all water quality tests.
21.	State and local permit numbers.

TABLE 2: INFORMATION TO BE PERMANENTLY RECORDED FOR LOW CAPACITY STOCKWATER AND DOMESTIC WELLS

1. Location of well and reference point from which all measurements are made.
2. Name of owner.
3. Driller's well log (Montana Well Log Report, DNRC form 603). Include any supporting geologic reports and aquifer tests.
4. Elevation of land surface, and elevation of highest local flood of record.
5. Description and dates of maintenance performed on pump, casing and screen, size and type of pump and production tubing, and depth of pump installation.
6. Well and pump performance before and after each maintenance job.
7. Results of diagnostic tests conducted prior to, during and after each maintenance job.
8. Corrective measures taken on pump, casing or screen.
9. Results of all water quality tests.

WATER QUALITY AND IRON BACTERIA

Groundwater in the Great Plains is relatively mineralized, and much of it has elevated concentrations of iron. Solid deposits of iron hydroxide can plug off water wells and their plumbing and creates a suitable environment for the growth of iron bacteria. Iron bacteria accumulations occur in a large percentage of wells with high iron concentrations in eastern and central Montana.

These bacteria cause plugging, encrustation, and corrosion problems in wells and are usually not recognized or treated until the well is seriously damaged. Once a severe bacterial infestation becomes established, experience shows that it is almost impossible to eliminate it. Infestations which are treated early and on a regular basis can almost always be controlled.

Aquifers with the highest severity of iron problems include glacial and alluvial aquifers. The Fort Union and Kootenai formations have intermediate levels of severity. Water should be analyzed in all wells when drilling is complete. If elevated iron levels are found, it is recommended to treat for iron bacteria immediately. The most common treatment is chemical disinfection using a strong chlorine solution, which is repeated at regular intervals.

MAINTENANCE PLAN

Inspection and routine maintenance schedules should be established, based on the individual characteristics of the well and pump. Evaluations are particularly important for high yield irrigation wells and those wells where even a temporary interruption in water supply would have serious economic consequences.

The evaluation should include a careful inspection of the site and equipment and the performance of a pumping test. Normally, high-capacity wells should be pump tested annually. Every few years may be sufficient for low-capacity wells pumped intermittently at low rates. Follow manufacturer's instructions for high capacity wells.

A pumping test is normally performed immediately after completion of a well to establish yield and determine the placement of the pump. Testing procedures (time and rate of pumping) are

established during the initial test, and should be followed in each successive test. The following information should be recorded after this specified period of continuous pumping. In subsequent pumping tests, significant changes in any of the first six conditions below indicate that the well is in need of attention.

PUMPING TEST DATA

Static water level_____

Pumping rate_____

Pumping water level_____

Specific capacity_____

Sand content in a water sample ☐ Yes ☐ No

Total depth of well_____

Normal pumping rate _____ hours per day _____

General trend in water levels of other wells in area_____

Amount of drawdown attributed to pumping of nearby wells_____

ANALYSIS

Data derived during each pumping test should be compared with the initial values, and specific capacity and available drawdown should be calculated and plotted. The following graphs may be used to chart the performance of your well over time. If there is a decline in a well yield over time, these graphs can be used to evaluate the problem. For example:

* if there is a decline in specific capacity but no change in available drawdown, there may be plugging of the screen slot openings, or there may be sediment built up in the bottom of the hole.

* if there is a decline in available drawdown but no change in specific capacity, the aquifer may be subject to declines in storage due to reduced recharge or excessive withdrawals.

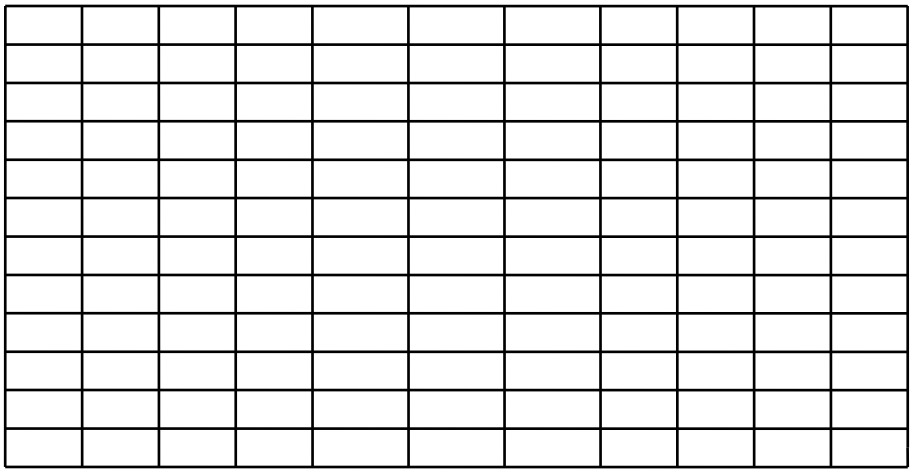
* if yield has been declining but there is no change in either specific capacity or available drawdown, the pump may be deteriorating.

FIGURE 1: GRAPH OF SPECIFIC CAPACITY VS. TIME

Specific capacity is defined as yield per unit drawdown and expressed in gpm per foot of drawdown. On this graph it is plotted against time (annually for low-capacity wells). To set the vertical scale, use the initial specific capacity value determined in the first pumping test for the highest point. Set the lowest point at zero and divide the interval evenly between them. The first value on the horizontal scale should be the year the well was drilled.

SPECIFIC CAPACITY

gpm/ft of drawdown



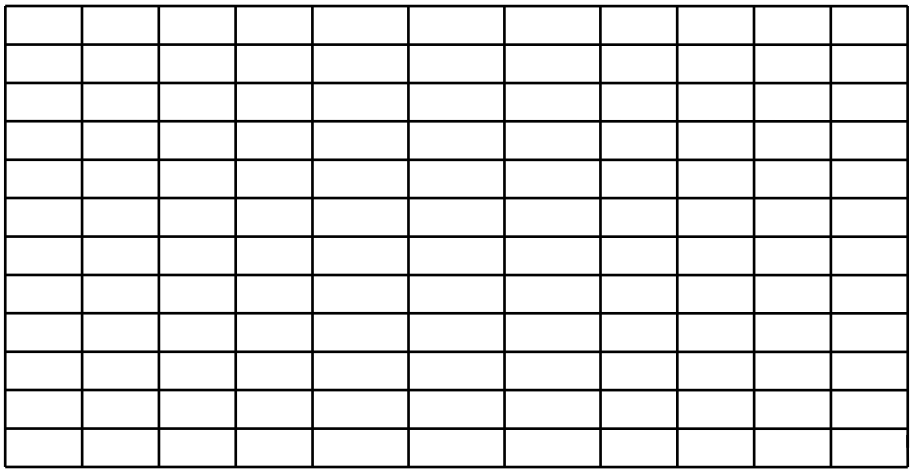
TIME

FIGURE 2: GRAPH OF AVAILABLE DRAWDOWN VS. TIME

Available drawdown is defined as the difference between the static water level and the depth to the pump intake, and is plotted against the date measured (annually for low-capacity wells). To set the vertical scale, use the initial value determined in the first pumping test for the highest point. Unless the drawdown is very deep, set the lowest point at zero and divide the interval evenly between them. The first value on the horizontal scale should be the year the well was drilled.

AVAILABLE DRAWDOWN

(feet)



TIME

When the specific capacity of the well has declined by 25%, the well should be rehabilitated. Postponing rehabilitation beyond this point may result in significantly increased costs, and the well may be impossible to restore. A contractor experienced in well rehabilitation should be used as these methods can require specialized chemicals and equipment. When rehabilitation techniques have been completed, the essential information should be recorded on the following form:

WATER WELL MAINTENANCE RECORD

PROBLEM	CORRECTIVE ACTION	DATE	SPECIFIC CAPACITY gpm/ft of drawdown	
			BEFORE	AFTER