



# Water Use on Ohio Dairy Farms

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*How many gallons of water per day does a cow require?*

*How many gallons of water per cow per day are used on a modern dairy farm?*

*How many gallons of water per day should the water system be designed for?*

*How many gallons of water per day per cow are pumped from the ground on a dairy farm?*

*How many gallons of water per day leave the watershed?*

*Each question is important. Each answer is different.*

Understanding water use on modern, efficient dairies is important to farmers and their neighbors. The farmer needs the information for sizing and developing an efficient, cost-effective water system. The neighbors need the information to make informed decisions on the dairy's impact on the water table. Accurately estimating and monitoring water use is key to minimizing costs and protecting water supplies.

Most of the water used on a dairy can be classified as cow water or waste water. Cow water requirements, which include water pumped from the ground as well as water included in feed, vary with ambient air temperature and milk production. Waste water use is fairly constant and is used for cleaning equipment and cleaning rooms. Modern dairy farms use a heat exchanger to partially cool the milk by transferring some of the heat from the milk to water flowing from the well through the heat exchanger. This water is collected and used again as cow drinking water. This approach reduces energy use and saves on water pumped from the ground. Some water leaves the farm in the milk, by evaporation, and in the animals that are shipped. The remaining water is applied to the land within the watershed. This approach keeps more water in the watershed than a business that discharges waste water through a treatment plant to a stream.

## Monitoring water use

To more accurately evaluate total water usage on dairies, water meters and recording equipment were installed at key locations on a dairy farm in northwest Ohio. The thirteen meters, installed in 2004, were GF Signet Model 2536 Paddlewheel Rotor-X Flow Sensor with a GF Signet Model 8550 ProcessPro™ Flow Transmitter and ABB SM3000 Multipoint Videographic Recorder\*. The equipment was selected to provide accurate readings over a long period of time in less than ideal environments. The recorder allowed for monitoring of all meters at one location, storing of data and access of data via the Internet.

Water flow was measured and recorded at key locations to determine both the total flow and specific flows for key uses (Table 1). The highest volume flows were for

**Table 1. Location of meters for measuring water use.**

Meter	Water Use
1	Parlor Wash Water: used for cleaning parlor floors, walls, and milking equipment
2	Cow Drinking Water: directly consumed or mixed with feed
3	Well Water: pumped from the well
4	Soft Water: used in commercial operations
5	Hot Water: used in commercial operations
6	Hot Water, Cleaning in Place (CIP)
7	Cold Water, CIP
8	All CIP Water
9	Plate Cooler Water
10	Cold Water, Bulk Tank
11	Hot Water, Bulk Tank
12	Cold Water, Domestic
13	Hot Water, Domestic

\* Mention of specific equipment does not imply endorsement of the equipment.

**Table 2. Monthly average water use for 2005 and 2006.**

Month	Total Cows (average 2005 and 2006)	Average Daily Drinking Water (gal/day)	Average Daily Drinking Water/Cow <sup>1</sup> (gal/day/cow)	Average Daily Waste Water (gal/day)	Average Daily Waste Water/Cow <sup>1</sup> (gal/day/cow)
January	854	17,204	20.1	6,074	7.1
February	859	17,623	20.5	6,058	7.1
March	875	17,526	20.0	5,866	6.7
April	913	21,024	23.0	5,647	6.2
May	919	21,004	22.9	5,537	6.0
June	940	27,925	29.7	5,674	6.0
July	951	29,109	30.6	5,684	6.0
August	950	27,025	27.6	5,688	5.8
September	999	25,792	25.8	6,108	6.1
October	999	23,141	23.2	6,262	6.3
November	998	21,176	21.2	6,372	6.4
December	1005	18,959	18.9	6,129	6.1

<sup>1</sup>Average based on total number of cows in the barn.

cow drinking water, parlor washing, milking equipment and bulk tank cleaning, and restroom and break room use (domestic water).

After calibrating the meters and adjusting some of the equipment, water use was measured during 2005 and 2006. Water flow data and cow numbers obtained from the farmer were used to determine the two year monthly average water usage per cow as shown in Table 2. Drinking water is the water that went to the waterers and does not include water in the feed. The average drinking water per cow is based on the total number of lactating and non-lactating cows in the barn. Waste water is the water used for cleaning the parlor, milking equipment and bulk tank. The waste water used per cow is based on the total number of cows.

For the two years, the average daily drinking water per cow was 23.6 gallons and the average waste water per cow was 6.3 gallons for an **average total water use of 29.9 gallons per cow per day**. The individual monthly average drinking water varied from 11.6 gallons per cow per day for December 2005 to 33.8 gallons per cow per day for June 2005. Based on records of feed analysis and feeding amount, the cows consumed about 6 additional gallons of water per day in the feed resulting in total water consumption ranging from 17.6 to 39.8 gallons per day. Since this average includes all cows from the highest producer to the dry cow, it provides a more accurate picture

of water use on the farm than projecting water use from the consumption of the highest producing cows.

The data show a direct correlation between drinking water consumed and ambient air temperature. During hotter months, the drinking water use was higher. Even for the same month, the drinking water varied greatly with temperature. A good example is the average December drinking water consumption. In 2005, December was cold and the average drinking water consumption was 11.6 gal/day/cow. December 2006 was much warmer and the average drinking water was 26.0 gal/day/cow. However, the annual average for each year was much closer, 22.1 gal/day/cow for 2005 and 23.1 gal/cow/day for 2006.

Waste water usage was calculated by combining data from the CIP pipeline, bulk tank and parlor water (meters 1, 8, 10 and 11). The waste water use per cow is more consistent throughout the year as the needs, with the exception of misting water for cow cooling, are independent of temperature. In 2005, water used for misting cows was 1,120 gal/day for June, 1,708 gal/day for July and 1,213 gal/day for August, an increase of approximately 1.5 gal/day/cow. The average waste water use for 2005 and 2006 was 6.3 gal/day/cow.

### Significance of monitoring water use

Metering can be an effective tool to manage water use on dairies, resulting in reduced costs and more efficient

systems. An example of increasing efficiency was demonstrated in water used for the plate cooler. Initial flows were measured at 42 gallons per minute (gpm), a rate that was eventually lowered to 16 gpm without compromising the effectiveness of the cooling plate. In one year, the total water saved will be 8 million gallons. In addition, a faulty valve that resulted in a loss of 8,640 gallons per day was identified and the timing of wash down of the milking parlor was standardized. The study also led to a visual observation that a water trough float was not functioning, allowing significant water loss due to overflowing.

## Summary

Sizing and developing a water system on a modern dairy farm requires knowledge of the amount used for different purposes; the primary ones include consumption by cows, milk cooling, and equipment and room washing. Careful metering of well water use on an Ohio dairy indicated that average water usage is 29.9 gal/day/cow, lower than the 40 to 50 gal/cow/day cited in literature. For 2005, with an

average milk production of 80 pounds per day, the study farm averaged approximately 4.5 gallons of water used for each gallon of milk produced.

Although additional data will be collected from this and other farms to allow for statistical analysis, the two year study provides information that can help dairy farmers use water more efficiently and provides a clearer answer to how much water is really used on Ohio dairy farms. Understanding how much water should be consumed allows for comparison of actual use and helps to identify practices, such as reusing milk cooling water as a drinking water supply for the cows, that have the potential to reduce water use.

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