

Farm Structures FACTSHEET

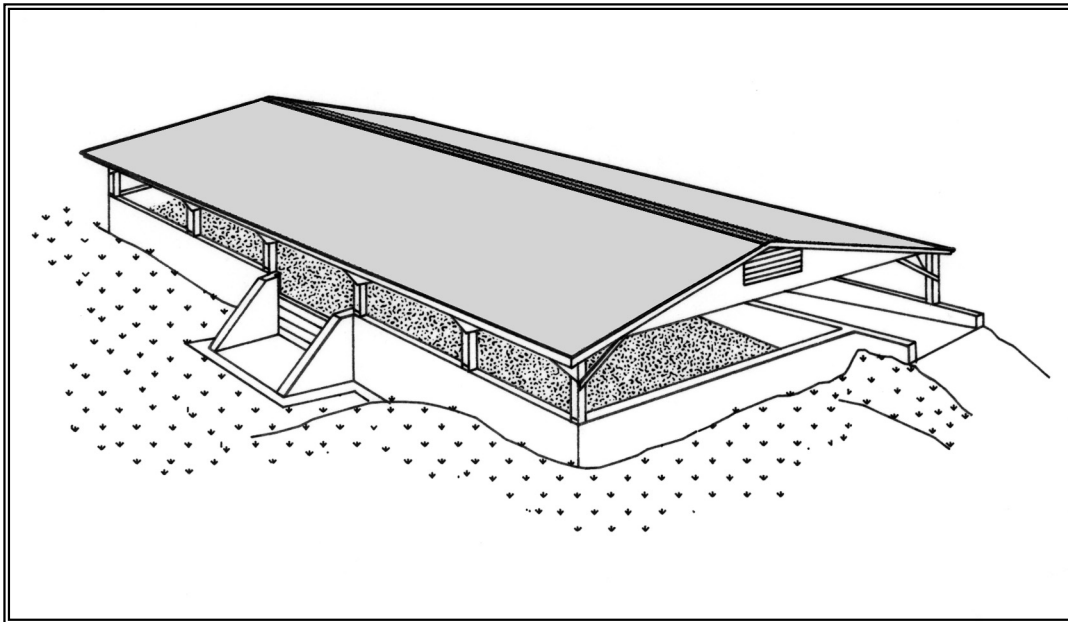


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SIZING DAIRY MANURE STORAGE FACILITIES



As herds grow larger, many dairy farmers are experiencing the need for a well-planned manure storage structure. Manure storage will provide greater flexibility of labour and will enable the operator to avoid spreading manure during times when runoff to surface waterways may occur.

The first section of this leaflet shows how to calculate the manure storage capacity required for your dairy operation. The necessary tables are given and hypothetical case is worked through as an example.

In the second section of the leaflet, a table is given showing the required manure storage capacities for various sizes of free stall dairy operations. Many dairy farmers will be able to use these tables rather than working through the detailed calculations.

CALCULATING THE STORAGE CAPACITY

STEP 1: Storage Requirement Per Cow

The volume of manure produced per day by a mature dairy cow weighing 1200 lbs is shown in **Table 1** for three common types of housing. The tabulated values are not valid in cases where manure is diluted excessively for liquid handling.

STEP 2: Number of Cow Equivalents

The average sized dairy cow is considered to be approximately 1200 lbs. The storage capacity required for replacement stock can be determined by converting to mature cow equivalents as shown in **Table 2**.

STEP 3: Storage Period

The number of days for which storage of manure is required will be affected by the availability of equipment, current cropping practices, restraints imposed by rain, snow or other climatic conditions and economics. For many areas of BC, however, 120 days should be considered a minimum.

STEP 4: Calculating Storage Capacity

Once the above information is known, manure storage capacity may be calculated as follows:

$$\begin{array}{|c|} \hline \text{Total Manure Storage Capacity (cubic feet)} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Daily Storage Required Per Cow Equivalent (cubic feet per day) Table 1} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{No. of Mature Cow Equiv. Table 2} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Desired Length of Storage (days)} \\ \hline \end{array}$$

TABLE 1 DAILY MANURE PRODUCTION BY A MATURE DAIRY COW	
Type of Housing	Volume of Manure (cu. ft./day)
Free Stall	2.0
Tie Stall	2.2
Loose Housing	2.4

TABLE 2 MATURE COW EQUIVALENTS FOR REPLACEMENT STOCK	
Age Group	No. of Head Per Cow Equivalent
10 mo. to freshening	2
Calves (3 mo. – 10 mo.)	4
Calves (birth – 3 mo.)	8

EXAMPLE 1 60 COW MILKING HERD

DETERMINE THE MANURE STORAGE CAPACITY NEEDED FOR A 60 COW MILKING HERD AVERAGE WEIGHT 1200 LBS WITH FREE STALL HOUSING FACILITIES. DRY COWS AND REPLACEMENT HEIFERS ARE HOUSED IN FREE STALLS WHILE CALVES ARE KEPT IN BEDDED PENS.

STEP 1: Storage Requirement Per Cow

In this example, the majority of the animals are housed in free stalls. Therefore, the value for dairy manure production is read from **Table 1** as 2.0 cu. ft. per cow equivalent.

STEP 2: Number of Cow Equivalents

Normally, a farmer will know how many dry cows, replacement heifers and calves for which manure storage is required. In this example, however, the numbers of these animals can only be estimated.

The number of cow equivalents for each group of animals is calculated by dividing the number of animals by the correct figure from **Table 2** for number of head per cow equivalent. In the case of 3 mo. to 10 mo. old calves, 12 calves ÷ 4 calves per cow equivalent = 3 mature cow equivalents.

The number of cow equivalents for a 60 cow milking herd works out to be 90 head as shown by the accompanying table.

AGE	NO. OF ANIMALS	NO. OF COW EQUIVALENTS
Milking cows	60	60
Dry cows	8	8
Heifers, 10 mo. to freshening	35	18
Calves, 3 mo. to 10 mo.	12	3
Calves, birth to 3 mo.	8	1
Totals	123	90

STEP 3: Storage Period

For purposes of this example, a storage period of 120 days is assumed.

STEP 4: Calculate Storage Capacity

Using the formula from Page 1, and the data determined in Steps 1, 2 and 3.

$$\begin{aligned}
 \text{Storage capacity} &= 2.0 \text{ cu. ft. per cow equiv.} \\
 &\quad \times 90 \text{ mature cow equiv.} \\
 &\quad \times 120 \text{ days} \\
 &= \boxed{21,600 \text{ cu. ft.}} \\
 &\quad (54 \text{ ft.} \times 50 \text{ ft.} \times 8 \text{ ft.}) \\
 &\quad \text{Roofed storage}
 \end{aligned}$$

TABLES FOR SIZING MANURE STORAGE

The required manure storage capacity can always be calculated using the method previously described. However, most dairy operations will involve similar numbers of replacement stock and dry cows making possible the preparation of tables of required storage capacities. Knowing the number of milking cows and the length of the storage period, the appropriate storage capacity may be read directly from **Table 3**.

TABLE 3 MANURE STORAGE CAPACITY FOR FREE STALL DAIRY FACILITY WITH A GIVEN NUMBER OF MILKING COWS					
No. of Milking Cows	Required Storage Capacity for the Given Storage Period (cubic feet) *				
	30 days	60 days	90 days	120 days	180 days
20	1,800	3,600	5,400	7,200	10,800
30	2,700	5,400	8,100	10,800	16,200
40	3,600	7,200	10,800	14,400	21,600
50	4,500	9,000	13,500	18,000	27,000
60	5,400	10,800	16,200	21,600	32,400
70	6,300	12,600	18,900	25,200	37,800
80	7,200	14,400	21,600	28,800	42,200
90	8,100	16,200	24,300	32,400	48,800
100	9,000	18,000	27,000	36,000	54,000
200	18,000	36,000	54,000	72,000	108,000

* Based on 1200 pound cows and an average number of replacement stock as given by Canada Code for Farm Buildings, 1977.

EXAMPLE 2 60 COW MILKING HERD

GIVEN THE SAME INFORMATION AS FOR EXAMPLE 1 AND USING TABLE 3, DETERMINE THE REQUIRED MANURE STORAGE CAPACITY.

Reading directly from **Table 3** for a 60 cow milking herd (using free stall housing) and a required storage period of 120 days, the total storage capacity required

= 21,600 cu. ft.

DAIRY WASH WATER

The volume of wash water used in modern parlour-milking operations can vary from 5 to 10 gallons per milking cow per day. Storage of this wash water with the manure will reduce the effective storage capacity of the manure tank by at least 50 percent. As such, except with liquid manure handling systems where dilution of the manure is required, parlour wash water should not be directed to the manure storage tank. The Resource Management Branch should be consulted for information on acceptable dairy wash water disposal systems.

NOTE: See [Factsheet #383.000-1](#) for design for [Manure Storage Structures](#).

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