Planning a Dairy Waste Handling System

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More than 99 percent of all manure gets back on the land through one system or another. Between the cow and the land exist many possibilities and combinations for manure disposal systems. There is no "one best system" for all dairies.

First you must develop waste management goals; define what you want the system to accomplish and how. Consider:

- the number of years you plan on operating your dairy,
- future plans for expanding herd size,
- land availability for spreading manure,
- quality and quantity of available labor,
- proximity to housing or public facilities, and
- amount of operating and investment capital required and available.

Waste characteristics

The characteristics of the material to be managed will influence the selection of the specific handling components. The average herd size in Oregon is nearly 100 milking cows, so the total number of animals may be nearly double that.

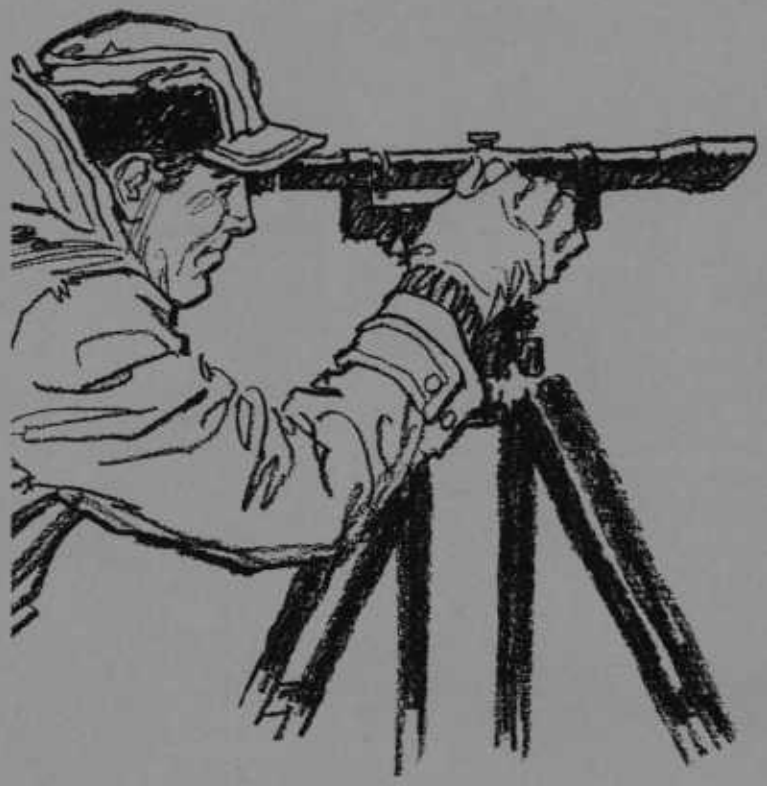
The manure production estimates shown in Table 1 are for a herd of 191 animals, with 100 of them lactating cows.

In addition to the manure produced on the dairy farm, several other wastes are commonly handled with the manure. These include bedding, soil, waste feed, and milkroom and parlor wastewater. Quantities vary widely. Influencing variation of waste water are type of cow preparation used, type and number of milking units, size of milking herd, buildings, use of a flushing collection system, season, and individual operator preference. Table 2 lists some of the values that can be used to estimate the additional waste volume that must be included in the waste management system. Assume the non-milking herd will use bedding at about half the quantity used for milking herd, and that waste water from the system flushing will vary depending on whether fresh or recycled water is used, the number, and volume of water released —and manager's choice.

Physical components

Knowing the management goals (where the operation is going) and the characteristics of all the waste to be handled, you should then assess the physical components of the dairy.

Review the existing facilities, noting their location, condition and size. Also, consider any planned expansion. Evaluate what components of the present waste handling system and equipment might be used in the expansion or new unit. The production area will vary with the type and size of facility; your appraisal may include free-stall barn, loafing shed, exercise lot, holding corral, calf pens, dry lot, traffic lanes, milking parlor, and milk house. An additional 15 percent may be added to



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the above area for alleyways, feed bunks, and the animal shipping and receiving area. Mills, scales, feedrooms, office, driveways and parking space also require additional land.

Knowing the total farm size, location, and present land uses may help you to identify some areas that may serve as part of the livestock production unit. The topographic features (lay of the land), including slopes and natural drainageways, will be important in locating storm water run-off diversion ditches. This information also will be helpful in placing storm water runoff collection and retention structures.

Study of the soil type and geologic features will provide information on permeability, internal drainage, water table location, erosion potential and trafficability. This will influence the crops grown and the rate and frequency of manure application.

Local climates vary in Oregon, and must be taken into account in the design process. Amount and seasonal distribution of precipitation affect most components in a waste management system. Because of the wide range of precipitation in Oregon, no values have been included. Extended freezing temperatures may prevent some operations, such as flushing, or require other building components to temper cold weather. Evaporation rate is important in sizing liquid storage units and frequency for discharge. Odors and prevailing winds and nearness of neighbors may affect the building site selection, perhaps using a more remote area on the farmstead.

Before construction, check to insure that your system will meet the regulations of the Federal Environmental Protection Agency (EPA), State of Oregon Department of Environmental Quality (DEQ), and any local, city, or county requirements.

The DEQ must review all plans to begin a new livestock facility or to substantially modify or expand an existing operation. Since several steps are involved in completing this review, 6 months lead time should be allowed. Your local government may require a building permit, public hearing, or other permits. Your Extension agent can advise you as to permit requirements and sources.

With the evaluation completed, the planning process is transformed into component selection and system design. While an evaluation of waste

Table 1. Average Manure Production from a 100 Milking Cow Dairy.

Animal	Number of animals	Average wt./head	Manure production					
			Per animal day			Per group year		
		Pounds	*Pounds*	*Cubic feet*	*Gallons*	*Tons*	*Cubic feet*	*Gallons*
Lactating cow[1]	100	1,400	115	1.85	13.9	2,099	67,525	507,350
Dry cow[2]	16	1,400	103	1.65	12.4	308	9,636	72,416
Replacement calves[3]	37	500	41	0.66	5	277	8,913	67,525
Replacement heifers[4] ..	37	1,000	82	1.32	9.9	554	17,827	133,700
Cleanup bull[5]	1	1,400	115	1.85	13.9	21	675	5,073
Total, herd/yr						3,259	104,576	786,064
Total, herd/day						8.9	288	2,154

[1] The average cow is kept for 3 lactations. For Jerseys and other small cows (weighing about 1,000 pounds), multiply values in the table by 0.7 or 70 percent.
[2] A calving interval-lactation cycle includes being dry for 60 days.
[3] Sell bull calves the first week and lose 18 percent of heifers the first year.
[4] This stock freshens at 27 months.
[5] Artificial insemination is used for most dairy breeding. A single bull on premises will help identify and settle the heifers that did not conceive.

Table 2. Dairy Waste Water Volume of Milkhouse, Parlor and Bedding Wastes for a 100 Milking Cow Dairy.

Operation	Water volume	Example, per day
Bulk tank	*Gallons*	*Gallons*
automatic, per wash	50 to 60	
manual, per wash	30 to 40	80
Pipeline		
in parlor, per wash[1]	75 to 125	200
Pail milkers, per wash	30 to 40	
Miscellaneous equipment, per day	30	30
Cow prep		
automatic, per cow wash	1 to 4½	
average, per cow wash	2	400
manual, per cow wash	¼ to ½	
Parlor floor, per day	40 to 75	60
Milkhouse floor, per day	10 to 20	20
Toilet, operator's, per flush	5	15
Bedding (sawdust)		
milking cows, animal day	4	400
non-milking cows, animal day	2	182
Flushing, per cow day	50 to 1,000	
milking cows, animal day	250	25,000
non-milking cows, animal day	150	13,650
Total		39,037

Source: Milkhouse and parlor wastes from livestock Waste Facilities Handbook, Midwest Plan Service #18.
[1] Increases for barns with long lines.

handling components is beyond the scope of this publication, a few comments may help get you started.

In the design process you may break the system down into the following possible four components: collection, storage, treatment, and utilization. The order may change, or one of the components (such as treatment) may be unnecessary in your system. Usually transportation or handling links of some kind are required to move the waste from one component to another.

Most dairy waste handling systems involve one of three types of systems: (1) handling the waste dry, (2) collecting the waste dry and adding enough waste water to reach a 5 percent total-solids level (to pump the slurry into tankers or sprinkler), or (3) collecting and handling the waste and waste water entirely as a liquid, all the way to the soil-plant filter. Table 3 will give you some idea of the relative volumes to be handled by each of these systems. Remember that in many systems rainfall and lot runoff also will be handled with the wastes, and will need to be added to your system design.

By reviewing the items to be evaluated during the planning process, a satisfactory dairy waste management system can be developed to meet your handling goals. Assistance can be obtained through your Extension agent, the Soil Conservation Service, and the Soil and Water Conservation District.

Table 3. Daily Volume of Waste and Wastewater Use in Three Types of Dairy Waste Management Systems, for Herd of 191 Animals (100 milking).

Source of waste	Dry collection and spreading	Dry collection and pumping	Liquid collection and pumping
	Cubic feet	*Cubic feet*	*Cubic feet*
Manure	290	290	290
Milking operation	110	110	110
Bedding	80	80	80
Dilution water		450	
Flushing collection			5,820
Total	480	930	7,300

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