

DAIRY MANURE MANAGEMENT

RUNOFF AND ODOR CONTROL

Pollution control for many dairies involves little or no change in manure handling. Others may have no alternative but to move. But even the ideally located dairy, with elaborate and automated manure handling equipment, requires management to prevent pollution and to operate smoothly. The following ideas are listed to guide your operation of a manure handling system.

1. Unload storages on a schedule. Plan an alternative schedule in case of bad weather, flooding or machinery breakdown. Size storages to allow extra room in case unloading is delayed. Have machinery in good repair and labor ready before starting.

2. Carry daily spread manure to the least accessible and most distant fields during fair weather. Use short term storage during bad weather.

3. Keep manure from spilling on public roads. Clean the road promptly if a spill does occur. Also keep the barn area clean, especially the manure loading area.

4. Determine the maximum yearly manure application rates for each field and insure that no one field is over manured.

5. Keep manure **out** of streams.

Barnyards

The Federal Water Pollution Control Act and its Amendments are enforced by the Environmental Protection Agency (EPA). Most states have adopted the federal regulations and, in most cases, enforcement is a state responsibility. Basically the law states that no livestock operation can be a source of pollution to any surface water caused by runoff from rain to the maximum rainfall that may occur in a 24 hour period once in 25 years.

Presently some barnyards straddle small streams. It is important to keep manure out of the stream. Improvement and corrective recommendations are:

- Divert all surface waters (including roof water) around or away from the barnyard. Make terraces or ditches large enough to carry runoff from the heaviest 1 hour storm that is expected every 10 years.

- Rechannel the waterway. A legal permit may be required so check with state or local authorities.

- Relocate the barnyard.
- Channel the stream through a culvert; divert and spread contaminated surface waters over several hundred feet of cultivated vegetative covering.
- Clean hard surfaces frequently, especially during rainy seasons.
- Store contaminated surface waters and pump, if necessary, to vegetative crop areas.
- Slow down lot runoff to encourage setting of solids in the lot.

These suggestions do not apply to pastures where animal density is low (2 or 3 cows per acre).



Storing Runoff

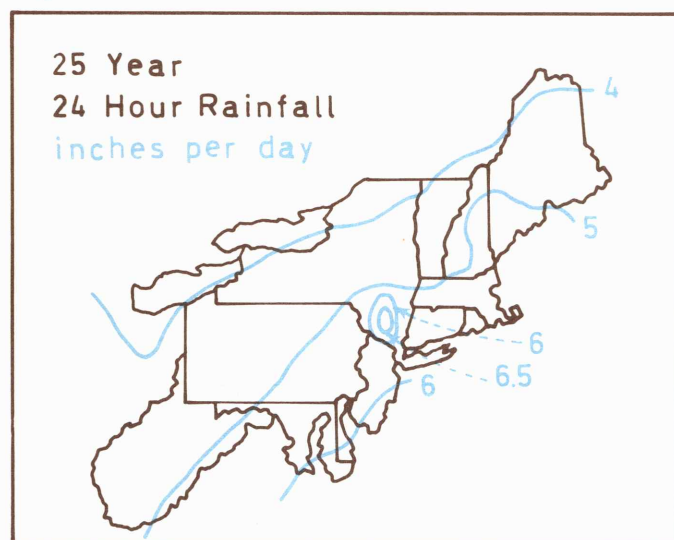
Fortunately most dairies are small enough that water from the surrounding land can be diverted from the open lot. Then runoff from the lot itself can be allowed to sheet flow onto nearby crop or pastureland with no danger of polluting nearby streams.

Occasionally a system to temporarily hold runoff from the lot is required. But do not design or construct a system until you have checked with local environmental officials as many states have specific construction requirements.

The Soil Conservation Service or other qualified specialists can also help. A system usually has four components: (1) the holding pond, (2) a settling basin or channel, (3) a collecting and transporting "ditch" between the feedlot and the settling basin, and (4) a designated method and area for disposal.

The settling basin settles out the solids. They are removed with a tractor and loader. Runoff temporarily stored in the holding pond is spread on the land by sprinkler irrigation, liquid spreader, or gravity. The holding pond, if needed is sized to hold at least the runoff from a 25 year, 24 hour storm (figure 1). Any water accumulated from previous storms and 1' to 2' of freeboard is added.

Figure 1. Rainfall for the Northeast



Settling Solids

If possible, contour the cowyard to slow the runoff, so solids will settle in the yard. A few dairies may find a settling tank, basin or channel necessary. Keep systems to a minimum to avoid work for cleanout and repair.

Earth bottomed settling basins are not recommended in humid areas (most of the Northeast) because they do not dry enough for cleanout. Size the basin to hold runoff from a high intensity, short duration storm; typically a 10 year frequency, 1 hour storm (figure 2).

Figure 2. Rainfall Intensity for the Northeast

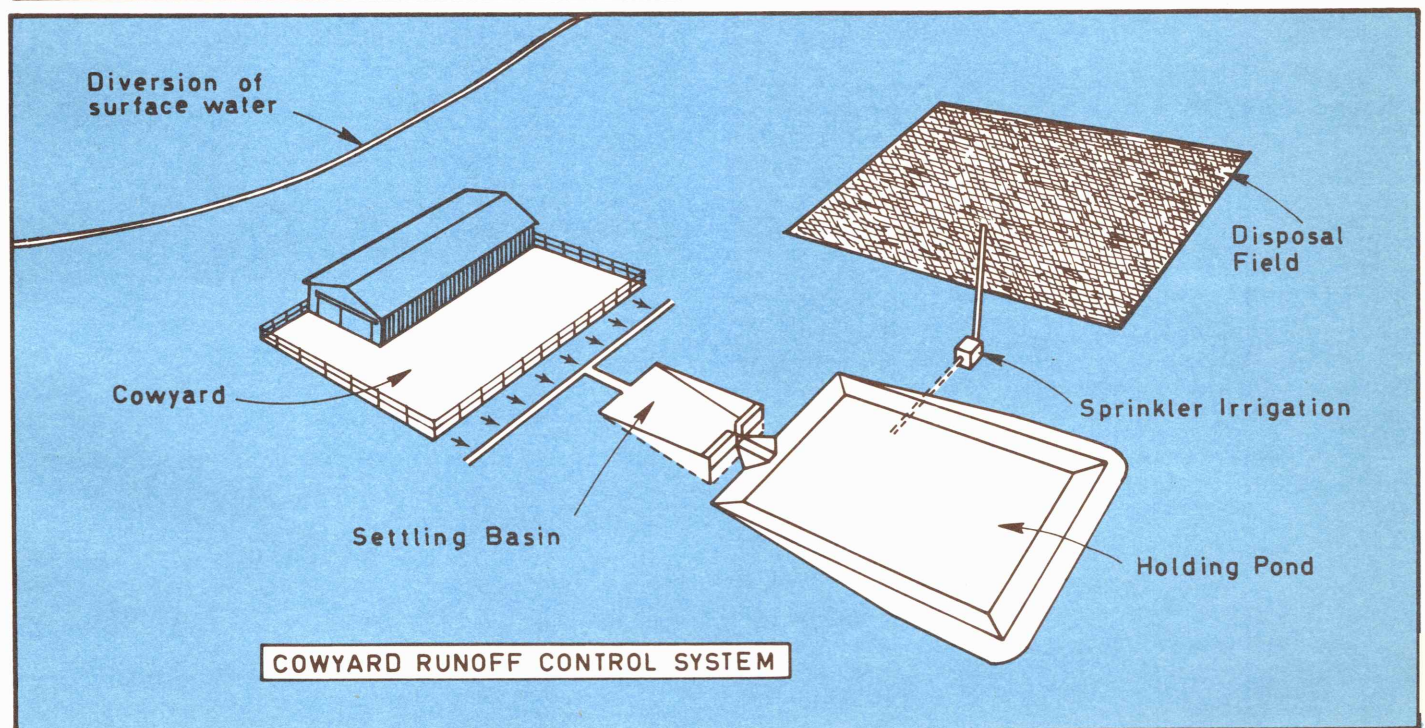
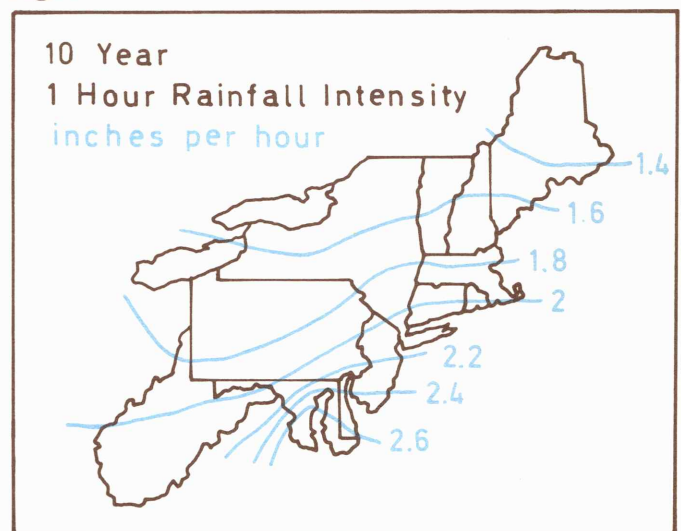
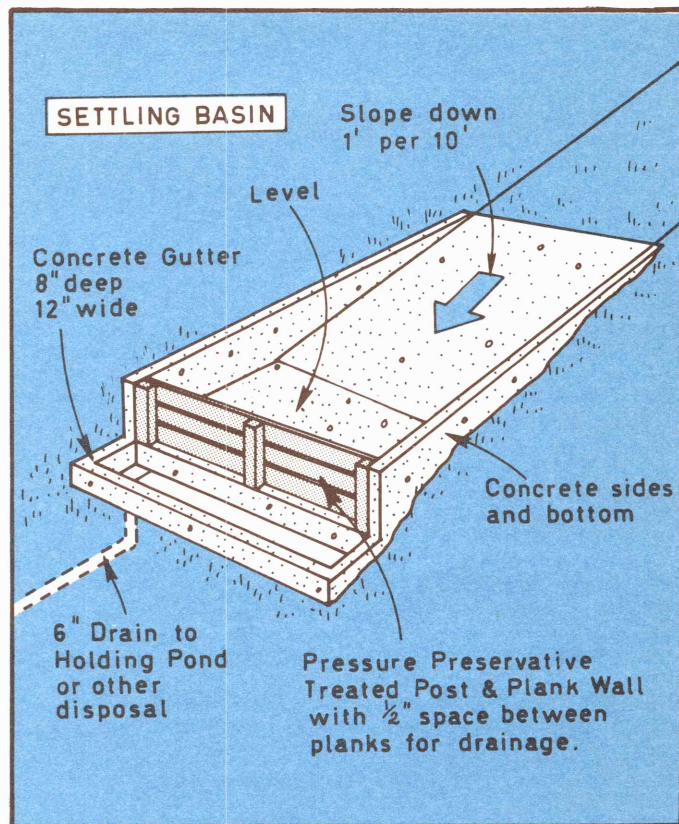
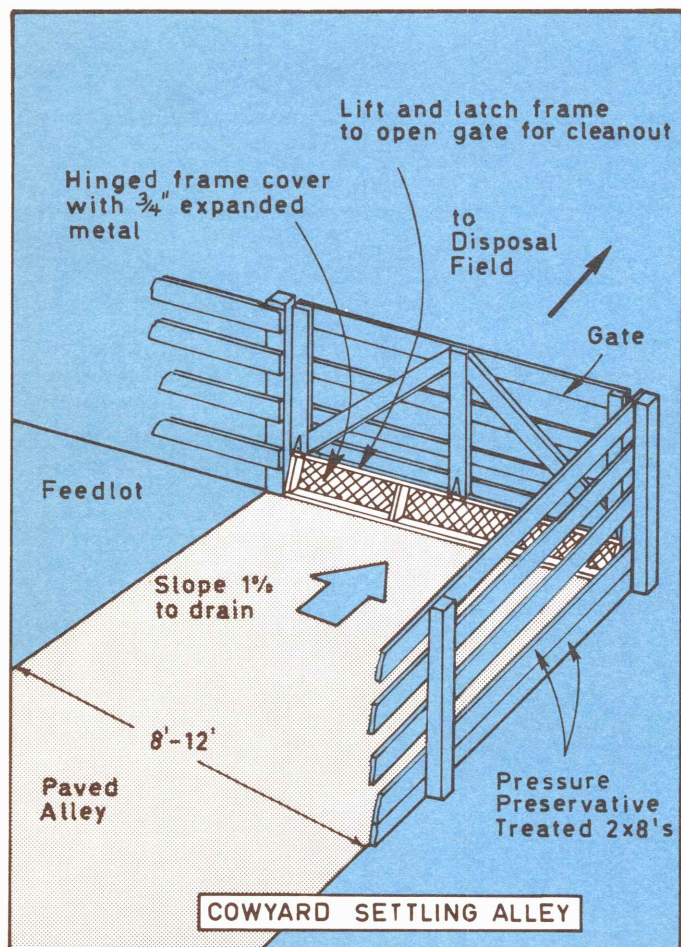


Table 1. Settling basin volume for a well managed, contoured, unpaved cowyard. Detention time is 30 minutes. Double the volumes for a paved yard.

| Rainfall from 10 yr, 1 hr storm, in/hr | Basin volume per 100 sq ft unpaved lot, cu ft |
|--|---|
| 1.4 | 1.9 |
| 1.6 | 2.3 |
| 1.8 | 2.7 |
| 2.0 | 3.3 |
| 2.2 | 4.0 |
| 2.4 | 4.6 |
| 2.6 | 5.2 |
| 2.8 | 5.8 |

Manure plugs even large openings. Settling basin outlets must be cleaned after each runoff event. Spaced planks, welded wire fabric, or expanded metal are used because they are easily cleaned.



Odors

Along with the advantages of manure storage is a potential disadvantage — objectional odor. Odor is caused by microbes that, in the absence of air (anaerobically), decompose the manure. Odor control is difficult. What works on one dairy may not work at another similar dairy. More information on how odor is formed and spread is needed before fully effective control methods can be recommended. Presently the surest control method is daily cleanup of areas where manure collects and daily spreading.

But what can be done to reduce odor problems from stored manure? Again, daily cleanup of all areas where manure collects is essential. Locate new operations a mile from housing developments and one-quarter mile from neighbors. Odor can be a serious problem when the storage is unloaded and the manure is spread. Some ways to reduce the odor are to:

- Spread manure as often as possible.
- Avoid spreading when wind would blow odors toward populated areas.

- Do not spread just before and during weekends and holidays when people are likely to be in nearby outdoor and recreational areas.
- Avoid spreading near heavily travelled highways.
- Spread in morning when air is warming and rising rather than in late afternoon.
- Use weather reports. Sunny, low humidity days reduce odors. Turbulent breezes will dissipate and dilute odors. Rain removes odors from the atmosphere. Still warm days with a temperature inversion concentrate, rather than disperse, odors.
- If possible, incorporate manure into the soil during or immediately after application by 1) soil injection or 2) plowing or discing the soil during or after application. These practices reduce odors, preserve nutrients and reduce water pollution potential.
- Apply manure uniformly and in a layer thin enough to insure drying in five days or less to reduce odors and to prevent fly propagation.

Treatment

Many techniques are available to eliminate or mask manure odors, but most are too expensive for dairies. Equipment that **aerates** or adds oxygen to the manure prevents odor-causing anaerobic decomposition. Liquid composting, oxidation ditches and aerobic lagoons all greatly reduce odor. Equipment and operating costs are high, but these systems may be necessary in dairies near cities.

Dehydration to lower manure moisture content to 50% or less inhibits odor. The Northeast has too much rain and too little sun for natural drying, so it is not economical.

Composting by periodically stirring piles or rows of manure and bedding prevents disagreeable odors by dehydration and aeration; but composting requires careful control and shelter from rain and snow.

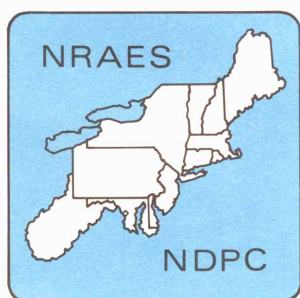
Chemicals have been used to control odor with limited success. Large amounts, applied frequently are required for effective control; so, generally, they are too expensive. **Disinfectants** - chlorine, lime or formaldehyde are a temporary cure that stop biologic activity. **Masking agents** are volatile oils that have a stronger odor than the manure. They cover the objectionable odor with a more acceptable one. A properly selected **counteractant** cancels out a selected odor so the intensity of both is less. **Deodorants** eliminate or change the odorous material to eliminate the odor. May change or reduce biological breakdown of the manure.

Nutrient Conservation

Storages will conserve plant nutrients, but they will be lost unless manure is properly applied. To obtain maximum benefits from storage:

1. Spread just before spring planting when crops can best use the manure nutrients. Weather, other jobs, and wet fields may prevent this. Incorporate the same day to save volatile nutrients and reduce odors.
2. Reduce the amount of commercial fertilizer added to compensate for the manure's nutrient value.
3. Plan two acres of corn per cow (10 ton manure/acre) if the ammonia form of nitrogen is saved and manure is incorporated into the soil on the same day it is spread. Spread manure at the rate of one acre per cow if ammonia is not conserved.

Spreading manure in the fall does not save the volatile, ammonia form of nitrogen for next spring's crop. In fact, fall plowing on erosive soils may cause harmful loss of topsoil. Where fall plowing is a normal management practice, it is often simpler to apply manure then; but to conserve the volatile nitrogen for plant use, manure must be incorporated in the spring.



This guideline was developed jointly by the Northeast Dairy Practices Council and the Northeast Regional Agricultural Engineering Service (NRAES). The Northeast Dairy Practices Council is a non-profit organization comprised of control agency, education, and industry personnel concerned with the dairy industry. NRAES is an activity of the Cooperative Extension Services of the Northeast Land Grant Universities and the United States Department of Agriculture.

The cooperating states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia.

Contact your local cooperative extension office or health and regulatory agencies for additional copies of this guide.