Appendix for Livestock Waste Management Guidelines




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APPENDIX A

Submittal Requirements and Guidelines for Waste Management Plans

Submittal Requirements and Guidelines for Waste Management Plans

I. Site Plan

A. Submittal Requirements

The following project site information should be included in the submittal to the Department.

1. The name, mailing address, and telephone number of the owner or operator or the authorized representative/technical adviser and the legal description of the livestock operation including the facility;

2. The tax map key and a topographic map of the geographic area in which the AFO will be located. It is suggested that the map shows spatial location of the facility, the land application areas if applicable, the source of water supply, the slope of the area, the drainage pattern and the surface slow direction;

3. Include a brief description of the confinement facilities, waste system (i.e. collection, transfer, treatment, storage, reuse/disposal) and pollution measures or other waste management options under consideration;

4. Provide information on the type of animals and the number (adult/mature and growing – estimate weight if possible) and whether it is housed under a roof or open confinement;

5. The type of storage and treatment for the wastewater e.g. constructed wetlands, facultative lagoon, anaerobic lagoon, roofed storage shed, storage tanks or ponds or below ground storage, concrete pad, etc. and estimates of the amount of wastewater produced;

6. Amount of land available for land application, its cropping system, and methods of manure, litter and/or processed wastewater application;

7. Estimated amounts and characteristic of manure, litter and wastewater generated per year (tons or gallons);

8. Estimated amounts (tons or gallons) and characteristic of manure, litter and wastewater that would be transferred/sold to others;

9. Nutrient and water mass balance calculations supporting the land application on site and the agronomic practices for the manure, litter, and/or wastewater;

10. Geological data for the site (if possible soil depth to bedrock, ground water and permeable layers) including soil types;

11. Site data describing and identifying contours, drawn to scale, of the location and its designated boundaries, state surface water, agriculture and drinking water wells, roads, accesses paved or unpaved, adjacent parcels (indicating private or public land parcels) and other significant features on the within 1,500 feet of the proposed or existing AFO production facility. The submission should distinguish between proposed and existing facilities;

12. Map showing the existing land use;

13. Wind rolls for the proposed site if applicable;

14. A brief description of the planned construction and operation phases;

15. Proposed variance or exceptions (if applicable); and

16. Weather data (average precipitation, evaporation, 25 year 24 hour rainfall event for the site or closest proximity to the site.

B. Site Guidelines

The following are general guidelines for the site of the animal feeding operation.

1. Animal feeding operations and the collection, transfer, treatment and storage facilities for animal wastes should provide a minimum buffer

distance of 1,000 feet from public drinking water resources and 50 feet from surface water resources and/or state waters;

2. Livestock waste products should not be applied to land within 50 feet of public drinking water resources and/or 50 feet from surface water resources;

3. Surface drainage should be diverted around the livestock production area;

4. Owners/operators should have a goal to operate their facility in a manner which minimizes the frequency, intensity, and duration of offensive odors that would irate their neighbors;

5. All facilities must be consistent with the appropriate State and County land use ordinances; and

6. Livestock facilities should not be located, if at all possible, over critical water aquifers and sources of drinking water.

II. Design Plan

A. Submittal Requirements

The following design plan information should be included in the submittal to the Department for review.

1. General Layout - Construction plan drawn to scale showing the location of the proposed and existing livestock operation and the various components of the facility, treatment systems, storage or containment lagoons and land application area. This should include a schematic drawing showing the flow diagram for manure, litter, and process wastewater through the various units in the site.

2. Detailed Construction Drawings - At a minimum, the following should be shown in the construction drawings

   a. Lift or pumping stations, distribution and irrigation systems;

b. Location, dimensions and elevations of all existing and proposed treatment systems, storage or containment lagoons;

c. Type, size, pertinent features and rated capacity of all pumps, bar screens, solid/liquid separators, blowers, motors and other mechanical devices; and

d. Conveyance structures, pipe inlets and outlets, pipe penetrations into or out of the containment or conveyance structures and liner details (include soil liner testing).

3. A description of the methods which will be implemented to insure the facility is constructed in accordance with the applicable design criteria, these Guidelines, and the state and federal regulations.

4. Design calculations for sizing of conveyances, treatment units and storage facilities; and

5. Identify variances or exceptions.

B. Guidelines

1. Designing Lagoons

All open surface impoundment such as lagoons shall be designed to contain all wastewater, manure, clean water, sludge accumulation, net surface rainfall including runoff, and the direct precipitation of a 25 year 24 hour rainfall event. Storage provisions should also consider land application or nutrient utilization practices for a given cropping rotation and season. Rainfall runoff from outside the production area and roof runoff that does not come into contact with the generated waste does not require containment. It should be diverted to minimize collection, storage, or erosion of the soils.

The design and construction of a lagoon shall include the installation of a depth marker such as liquid level board or staff gauge which clearly indicates that minimum capacity necessary to contain the runoff and direct precipitation of the 25 year, 24 hour rainfall event. It is also suggested that on this board, there should be a mark before the 25 year, 24 hour rainfall event indicating the critical level is

reached. This mark should serve as a guide for the operator to start pumping or removal to allow a buffer for the containment structure. In event that a 25 year, 24 hour storm capacity is used, the containment must be restored as soon as favorable weather and site conditions permit.

Live stock waste lagoons shall be lined with a synthetic liner if the AFO is located:

a. within 1,000 feet from public drinking water resources;

b. within 50 feet from surface water resources and/or state waters; and

c. over critical water aquifers and sources of drinking water as determined by the Department.

Any synthetic liner used in the construction of a livestock waste lagoon shall meet the following standards:

a. the liner shall be chemically compatible with the process wastewater, manure or litter being stored and the supporting soil materials;

b. the liner shall be supported by a properly compacted soil sub-base free from sharp objects and with a minimum of thickness of 6 inches;

c. the liner shall have sufficient strength and durability to function at the site for the design period under the maximum expected loadings imposed by the waste and equipment stresses imposed by settlement, temperature, construction and operation;

d. the liner seams shall be made in the field according to the manufacturer's specification. All sections shall be arranged so that the use of field seams is minimized and seams are oriented in the direction subject to the least amount of stress; and

e. the synthetic material shall be resistant to or otherwise protected from damage from construction or operation and degradation by ultraviolet light.

2. Waste Storage Structures

Waste storage structures designed to receive contaminated runoff or designed for overflow during a catastrophic or chronic rainfall precipitation event should be provided with an overflow spillway and flow contour so as to provide the best overflow discharge location, flow direction and outfall area having the least public and environmental impact.

3. Impervious Soil Surfaces

Rainfall diversion drainage and overflow discharge contours subject to scouring should be provided with soil erosion and sediment control measures.

Soil surfaces serving the confined feeding operation or the waste system collection, transfer conduit, treatment, or storage foundation for process-generated waste containing drainable liquids should be of material "impervious" to liquids infiltration. The following conditions shall be met when using in-situ soil, borrowed clay, or clay/bentonite mixtures:

a. minimum thickness shall be 2 feet;

b. placement and compaction shall be done in lifts not to exceed 6 inches in compacted thickness;

c. liquid discharge velocity shall be 1×10^{-7} cm/sec or less; and

d. construction and compaction shall be carried out to reduce void spaces and allow the soil to support the loadings imposed by the waste disposal operation without settling.

A compacted soil layer having a liquid discharge velocity less than 1×10^{-7} cm/sec. is determined to be practically impervious to liquid infiltration. Assuming the soil layer will naturally seal over time, the

initial discharge velocities may be allowed to exceed 1 x 10^{-7} cm/sec. The primary consideration will be the site proximity to surface and drinking water resources. Special considerations will apply to operations located near a critical aquifer.

The discharge velocity is determined using the Darcy's equation:

$$v = k(h/l)$$

where, v = discharge velocity
k = coefficient of permeability
h = hydraulic head
l = soil liner thickness

As an alternative to the foregoing, existing soil permeability data may be utilized;

a. the hydraulic gradient (h/l), should not exceed 8;

b. the impervious soil layer should be at minimum 1 foot thick;

c. the impervious soil layer should be constructed above the ground water table;

d. use of soil that tend to shrink or crack if allowed to dry should be avoided or the soil prevented from drying; and

e. the construction and compaction of the soil layer should be carried out to reduce void spaces and allow the liner to support loadings imposed by the waste disposal operation without settling.

Soil surfaces serving heavy use areas such as dry lots, manure storage/composting areas or other waste system collection, transfer, treatment or storage foundations for livestock waste residuals exposed to weather should be of material restrictive to liquid infiltration. The following conditions should be considered when designing and constructing a soil surface restrictive to liquid infiltration:

a. Most of Hawaii's clay soil with proper compaction may provide an adequate restrictive layer. Suitable site soil should be compacted

to a minimum of 90% of it maximum dry density at the dry optimum to optimum moisture content prior to use. Rocky or sandy soils or soils unable to provide a reasonable restrictive surface may require amending or suitable soil imported for placement;

b. The restrictive soil layer should be graded to prevent ponding. A 2-8% slope is recommended; and

c. All leachate and runoff that comes into contact with pollutants must be collected and managed as process generated waste.

4. Proposed facilities must be consistent with applicable building and land use ordinances.

III. Nutrient Management Plan (NMP)

A. Submittal Requirements

The NMP submittal to the Department should address the following items.

1. Ensure adequate storage of manure, litter and wastewater, including procedures to ensure proper operation and maintenance of the storage facilities;

2. Ensure proper management of mortalities (dead animals) e.g. that they are not disposed into liquid storage system, storm drains, lagoons or any wastewater treatment systems;

3. Ensure that clean water is diverted from production areas to avoid increase volumes of contaminated water;

4. Prevent the direct contact of confined animals with state waters;

5. Ensure that chemicals and other contaminants handled on-site are not disposed into any manure systems (litter or wastewater) or storm water storage unless specifically designed to treat such chemicals or contaminants;

6. Identify appropriate site specific conservation practices to be implemented including buffers to prevent runoffs of pollutants to state waters; and

7. Develop a record keeping system that would contain information on nutrients from manure and wastewater analyses, soil testing and subsequent land application and agronomics practices and be able to make the information available when circumstance would require of it.

The NMP should include a description of the land application areas including the number of useable acres, slope, soil type and cropping practices. The owner/operator is advised against applying manure or litter or wastewater in excess of normal agronomic rates for nutrients. A water and nutrient balance computation is encouraged and one can seek assistance from the University of Hawaii Cooperative Extension Service (CES). The method of determining the agronomic rates for nutrients should be included in the NMP.

B. Guidelines

1. Animal feeding operation shall be operated to contain all processed and/or generated waste plus the runoff from a 25 year, 24 hour rainfall event for the location of the point source. The full 25 year, 24 hour rainfall storage capacity should always be restored as soon as favorable weather and site conditions permit.

2. Management of all process or generated waste and runoff, including dead animals or animal parts, should be provided on a reliable basis until its final disposal, reuse, or removal and transfer to a legitimate secondary party recipient.

3. Waste disposal, reuse, or transfer to a second party recipient should be recorded. Records should include the date, waste volume, waste description (i.e. solid, slurry, liquid, etc.), and its destination or recipient's name or business entity. It is advised that second party recipients should keep their own records of use or land application.

4. Storage structures receiving process generated waste and/or rainfall runoff should be provided with a level indicator which can readily determine the volume in storage, storage volume available and the critical 25 year 24 hour rainfall event. There should be a mark on the level indicator before the 25 year, 24 hour rainfall event indicating the critical level is reached. This mark should serve as a guide for the operator to start pumping or removal to allow a buffer for the containment structure.

5. Equipment and equipment operators capable of performing waste system management and operation tasks without causing damage to the pollution prevention plan components should be readily available.

6. Soil erosion and sediment control measures should be maintained on soil surfaces subject to scouring and runoff effects.

7. Waste residues should be transported in spill proof vessels.

8. Reuse or land application:

    a. Crop system practices should consider soil, water, nutrient and pesticide management measures which minimize runoff and root zone leaching;

    b. Waste effluent application methods shall not create ponding or runoff and spray drift that exceeds the application site boundary;

    c. Process generated waste residues shall not be applied to land if it is likely to adversely affect human health;

    d. Dual waste effluent and potable water irrigation systems shall have approved back-flow prevention devices installed in accordance with HAR 11-21 (State Rules);

    e. Waste stockpiles and reuse application areas shall not harbor or breed flies, rodents, mosquitoes or other pests;

f. Waste residues should be incorporated into the soil profile within crop root zone in a timely manner. Exceptions to the foregoing are pastures land or crop side-dress application; and

g. Crop selection and management practices should consider the risks of food chain contamination. Crop systems producing vegetables for human consumption that ordinarily consumed raw are of the greatest concern. The HAR Section 11-11-8 provides that "…it shall be unlawful to offer for sale or to sell for human consumption watercress, lettuce, spinach and other vegetables ordinarily eaten raw which are grown in areas subjected to contamination from water used in irrigation or from animals." The following measures may allow the beneficial reuse land application of reclaimed livestock wastes for food crop production:

   i. pre-planting application – solid waste residue should be incorporated into the soil profile prior to planting. Liquid waste residue should be applied prior to crop germination; and

   ii. mid-growth side-dress application – waste residue should be treated through a "process to further reduces pathogens" prior to application e.g. proper composting.

h. Waste from livestock known or likely to be infected with a transmissible human pathogen(s) should be treated through a "process to further reduce the pathogens" prior to its sale, give away or reuse application.

IV. Operation and Maintenance Plan

A. Submittal Requirements

The following project operation and maintenance plan information should be included in the submittal to the Department for review.

1. Description of the operation and maintenance requirement for each component of the waste system i.e. collection, transfer, treatment, storage and disposal/removal/reuse of the nutrient generated. A schedule of maintenance and the corresponding methods is suggested;

2. Identify critical site conditions, waste storage capacity allowing of safe freeboard, equipment needed and cropping systems if applicable;

3. Describe dead animal disposal and management;

4. Describe sludge management and periodic monitoring plans for accumulated solids and removal schedules;

5. Describe emergency action plan in event of any spill, large storms events, leaks or break in the system or component failures. Any major spill (>1,000 gallons) should be reported immediately to the Department. For major spills or discharges, the Department may request the operation to supply rainfall, land application, records on nutrient management and analyses, etc. for up to 12 previous months. And

6. Identify specific records that would be kept and maintained and be available for review in the NMP.

B. Guidelines

1. Animal feeding operations shall be operated to contain all generated waste plus runoffs from a 25 year, 24 hour rainfall event for the location of the point source.

2. The full 25 year, 24 hour rainfall storage capacity should always be restored as soon as favorable weather and site condition permit.

3. Management of all process or generated waste and runoff, including dead animals or animal parts, should be provided on a reliable basis until its final disposal, reuse or removal and transfer to a legitimate secondary party recipient.

4. Monitor the irrigation distribution system and related equipment to ensure that the system operates as intended. When required, the equipment shall be repaired to its original design condition as soon as possible.

V. Additional Measures

Each new CAFO must implement additional requirements. Although these measures are not required of AFOs, where possible and economical, these practices may be good husbandry practices to have:

A. Visual inspections

There must be routine visual inspections of the production area by the operator. At minimum, the inspection should cover a) weekly storm drains, runoff diversion structures, devices channeling contaminated storm water to the wastewater collection site or storage, manure storage areas and water lines (drinking and cool water lines);

B. Depth markers

All open surface liquid impoundment must have a depth marker clearly indicating the minimum capacity necessary to contain the runoff and/or direct precipitation of a 25 year 24 hour storm event;

C. Corrective measures

Any deficiencies found as a result of these inspections should be corrected as soon as possible and

D. Mortality handling

Mortalities must not be disposed of in any liquid manure or wastewater system. It must be handled in such a manner that would prevent the discharge of pollutants of surface water.

VI. CAFO Production Area Requirements

A. Records documenting the inspections required under Section V. Additional Measures;

B. Weekly records of the depth of the manure and wastewater in the lagoon or containment as indicated by the depth marker;

C. Records documenting any actions taken to correct deficiencies required from the inspection in Section V. Additional Measures (It is advised that

the operator should correct any deficiencies identified be corrected within 30 days.);

D. Records of mortalities management and practices used by the CAFO;

E. Records documenting the current design of any manure (solids) or wastewater storage facilities, design of the treatment system, total volume and storage capacity; and

F. Record of the date, time and estimate of any overflow

VII. CAFO Land Application Area Requirements

A. Date(s) manure, litter or wastewater was applied on each filed;

B. Weather conditions at time of application and for the day prior to and the day following application;

C. Records documenting any deficiencies corrected. Deficiencies should be corrected within 30 days following inspection;

D. Analyses of manure, litter, wastewater and soils and place where these analyses were performed;

E. Crops planted at the site where the manure, litter, and wastewater were applied;

F. Explanation for the basis of determining the rate of manure, litter, and/or wastewater application;

G. Estimation of the total nitrogen and phosphorus applied on the field; and

H. Method of application and the equipment used to perform the tasks. Maintenance records of the equipment may be required to ensure consistent and accurate application rates.

VIII. CAFO Annual Report Requirements

The annual report must include but not limited to:

A. The number and type of animals, whether in open or housed under a roof;

B. Estimated amount (tons or gallons) of total manure, litter, and wastewater generated by the CAFO in the past 12 months period;

C. Estimated amount (tons or gallons) of total manure, litter, and/or wastewater transferred to other person(s) by the CAFO in the previous 12 months period;

D. Total number of acres of land covered by the nutrient management plan;

E. Total number of acres of land controlled by the CAFO that had manure, litter, or wastewater applied over the previous 12 months;

F. Summary of all manure, litter and wastewater (including processed wastewater) discharged from the operation that have occurred in the past 12 months with date, time, and approximate amount each time; and

G. A statement indicating whether the current version of the CAFO's nutrient management plan was developed or approved by a certified nutrient management planner.

IV. Closure Requirements

For AFOs and CAFOS without a NPDES permit, upon abandoning, retiring, or permanently discontinuing use of livestock production operation, the owner should render it safe and free of vectors. All waste residues should be removed and properly disposed/reused. Excavated facilities such as waste conveying ditches, separators and storage structures should be dewatered, dislodged and filled completely with soil, sand, gravel or similar non-organic matter. Appropriate vegetation should be established for erosion and sediment control purposes. A notice of abandonment should be filled with the Department. The notice should include a report of measures performed to complete the abandonment.

CAFOs with NPDES permits shall the closure requirements listed in the permit.

APPENDIX B

Agricultural Waste Management Field Handbook

United States Department of Agriculture
Soil Conservation Service

Guidelines for Livestock Waste Management
January 19, 2010

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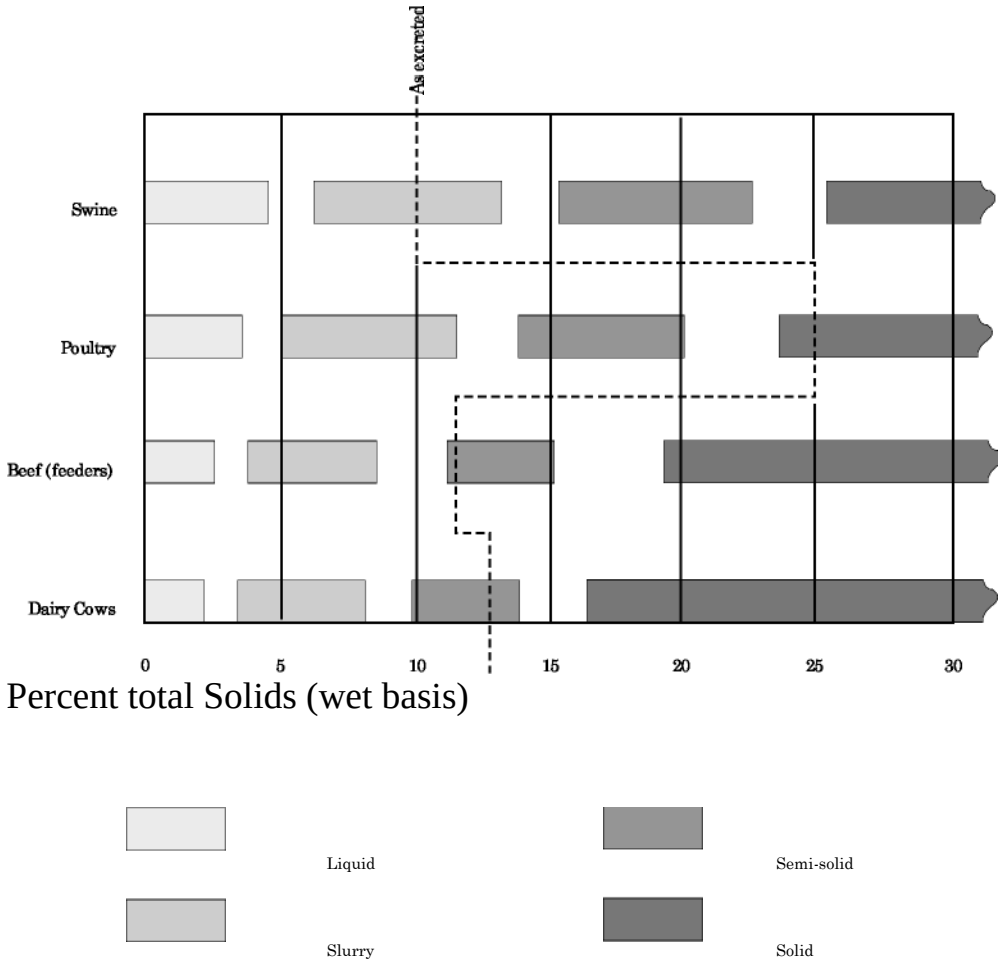
651.0900 Introduction

An agricultural waste management system (AWMS) is a planned system in which all necessary components are installed and managed to control and use by-products of agricultural production in a manner that sustains or enhances the quality of air, water, soil, plant, and animal resources.

651.0901 Total systems

Agricultural waste management systems must be developed using the total systems approach. A total system accounts for all the waste associated with an agricultural enterprise throughout the year from production to utilization. In short, it is the management of all the waste, all the time, all the way.

Figure 9–1 Relative handling characteristics of different kinds of manure and percent total solids



651.0902 Interface with other systems

The primary objective of most agricultural enterprises is the production of marketable goods. To be successful the farm manager must balance the demand on limited resources among many complicated and inter-dependent systems, often including, but not limited to:

- cropping system
- livestock management system
- irrigation and drainage system
- nutrient management system
- pest control system
- resource conservation system
- equipment maintenance and replacement system
- produce storage, transport, and marketing system
- financial management system

For an AWMS to be practical, it must interface with these other systems. Chapter 2 of this handbook gives detailed descriptions of the factors to consider when planning an agricultural waste management system.

651.0903 Waste consistency

Waste of different consistencies require different management techniques and handling equipment. Agricultural waste may be in the form of a liquid, slurry, semi-solid, or solid. Waste, such as manure, can change consistency throughout the system or through-out the year. The total solids (TS) concentration of manure is the main characteristic that indicates how the material can be handled. Factors that influence the TS concentration of excreted manure include the climate, type of animal, amount of water consumed by the animal, and the feed type. In most systems the consistency of the waste can be anticipated or determined. The TS concentration of the waste can be increased by adding bedding to the waste, decreased by adding water, and stabilized by protecting it from additional water. Figure 9–1 illustrates how varying the TS concentration for different animal manures affects consistency. Additional information is in chapter 4.

The consistency of the waste should be selected and controlled for several reasons. Solid waste management systems have a reduced total volume of waste because of the reduction in the amount of water. Solid waste handling

equipment may have lower cost and power requirements; however, the labor required for operation and management generally is greater than that for other methods.

Liquid waste management systems are often easier to automate and require less daily attention than those for solid wastes. However, the additional water needed increases the volume of waste requiring management, and the initial cost of the liquid handling equipment may be greater than that for solid waste systems.

Operator preference is also a factor. A landowner may select a method for managing waste because that method is popular in the community. It will be easier to learn from and share experiences with neighbors and, in case of equipment failure or other emergencies, the landowners can more easily assist each other.

651.0904 Waste management functions

An agricultural waste management system consists of six basic functions (fig. 9–2):

Production Collection Storage
Treatment Transfer
Utilization

For a specific system these functions may be combined, repeated, eliminated, or arranged as necessary.

A. Production

Production is the function of the amount and nature of agricultural waste generated by an agricultural enterprise. The waste requires management if quantities produced are sufficient enough to become a resource concern. A complete analysis of production includes the kind, consistency, volume, location, and timing of the waste produced.

The waste management system may need to accommodate seasonal variations in the rate of production.

The production of unnecessary waste should be kept to a minimum. For example, a large part of the waste associated with many livestock operations

includes contaminated runoff from open holding areas. The runoff can be reduced by restricting the size of open holding areas, roofing part of the holding area, and installing gutters and diversions to direct uncontaminated water away from the waste. A proverb to re-member is, "Keep the clean water clean."

Leaking watering facilities and spilled feed contribute to the production of waste. These problems can be reduced by careful management and maintenance of feeders, watering facilities, and associated equipment.
A record should be kept of the data, assumptions, and calculations used to determine the kind, consistency, volume, location, and timing of the waste produced. The production estimates should include future expansion.

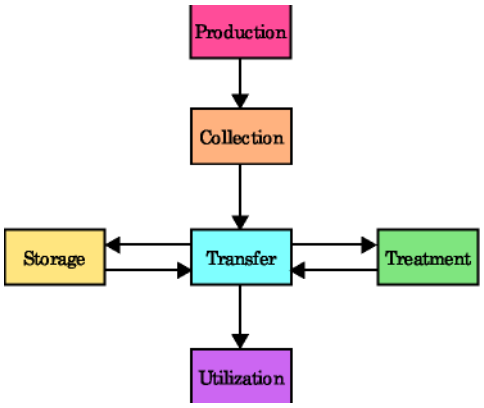
B. Collection

This refers to the initial capture and gathering of the waste from the point of origin or deposition to a collection point. The AWMS plan should identify the method of collection, location of the collection points, scheduling of the collection, labor requirements, necessary equipment or structural facilities, management and installation costs of the components, and the impact that collection has on the consistency of the waste.

C. Storage

Storage is the temporary containment of the waste. The storage facility of a waste management system is the tool that gives the manager control over the scheduling and timing of the system functions. For example, with adequate storage the manager has the flexibility to schedule the land application of the waste when the spreading operations do not interfere with other necessary tasks, when weather and field conditions are suitable, and when the nutrients in the waste can best be used by the crop. The storage period should be determined by the utilization schedule.

Figure 9–2 Waste management functions



The waste management system should identify the storage period; the required storage volume; the type, estimated size, location, and installation cost of the storage facility; the management cost of the storage process; and the impact of the storage on the consistency of the waste.

D. Treatment

Treatment is any function designed to reduce the pollution potential of the waste, including physical, biological, and chemical treatment. It includes activities that are sometimes considered pretreatment, such as the separation of solids. The plan should include an analysis of the characteristics of the waste before treatment; a determination of the desired characteristics of the waste following treatment; the selection of the type, estimated size, location, and the installation cost of the treatment facility; and the management cost of the treatment process.

E. Transfer

This refers to the movement and transportation of the waste throughout the system. It includes the transfer of the waste from the collection point to the storage facility, to the treatment facility, and to the utilization site. The waste may require transfer as a solid, liquid, or slurry, depending on the total solids concentration.

The system plan should include an analysis of the consistency of the waste to be moved, method of transportation, distance between points, frequency and scheduling, necessary equipment, and the installation and management costs of the transfer system.

F. Utilization

Utilization includes recycling reusable waste products and reintroducing non-reusable waste products into the environment. Agricultural wastes may be used as a source of energy, bedding, animal feed, mulch, organic matter, or plant nutrients. Properly treated, they can be marketable.

A common practice is to recycle the nutrients in the waste through land application. A complete analysis of utilization through land application includes selecting the fields; scheduling applications; designing the distribution system; selecting necessary equipment; and determining application rates and volumes, value of the recycled products, and installation and management costs associated with the utilization process.
Refer to chapter 10 for detailed discussion of the collection, storage, treatment, and transfer functions, and refer to chapter 11 for information on utilization through land application.

651.0905 Waste management systems design

An agricultural waste management system design will:

- Describe the management, operation, and maintenance of the waste from production to utilization
- List the practices to be installed
- Locate the major components on a plan map
- Include an installation schedule

Agricultural waste management systems are highly varied, and many alternatives are available. The various processes mentioned above are usually interdependent. For example, if a landowner wants to store waste as a dry material, the waste cannot be collected using a flush system. If limited land is available for utilization, the landowner may need to select a treatment process that reduces the nitrogen content of the waste.
Because of the variety of situations into which an AWMS must be incorporated, no one procedure can be followed to arrive at a system design; however, the following guidelines may be helpful.

Determine decision maker's concerns and needs. Landowner objectives along with social concerns must guide the planning of the AWMS.

Determine the characteristics and annual production of the waste requiring management. The waste characteristics and amount could limit alternatives and influence management decisions. Future changes in operation size and management must also be considered.

The nitrogen and phosphorus content of the waste, including heavy metals, toxins, pathogens, oxygen demanding material, or total solids, must be known. Knowing what is produced, how much is produced, when it is produced, and where it is produced helps the planner understand the existing agricultural enterprise into which the waste management system must be integrated.

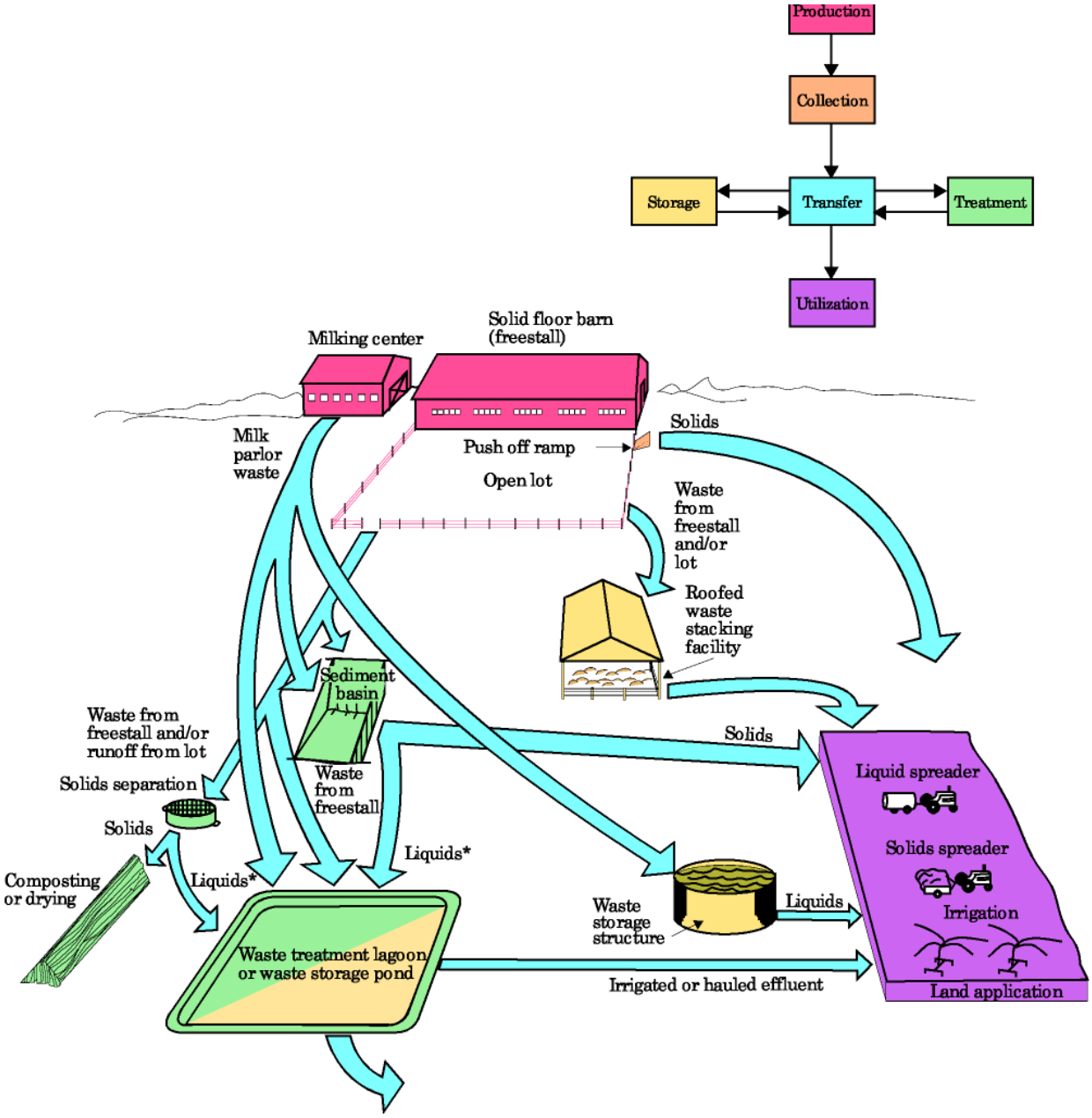
Determine the alternatives the decision maker is willing to consider for utilization. This helps the planner know what to work toward. Some alternatives may have specific limitations or requirements for the characteristics of the waste, and the system must be designed to deliver waste with those characteristics. If the utilization alternative involved land application, a quick check needs to be made to determine if sufficient land is available and when the spreading operations can take place. This helps determine whether treatment will be necessary and what the storage period should be.

Determine the landowner's preferences for equipment and location of facilities. The landowner may desire specific features in the system or may have specific equipment available. These features and site characteristics detailed in chapter 2 should be identified and discussed with the landowner so that their impact on the total agricultural enterprise and their effect on onsite and offsite natural resources are fully understood. Existing equipment and the opinions of the decision maker should not limit the discussion and consideration of other alternatives.

Design the system beginning with production and ending with utilization. At this point the entire system begins to take shape. The management requirements and safety concerns should be fully addressed and understood. The previous decisions may need to be adjusted or refined.

A good way to document the decisions of the land-owner is to list the major processes in the order in which they occur in the system and then record under each heading the pertinent information associated with that process.

Figure 9–3 Waste handling options—dairy



651.0906 Typical agricultural waste management systems

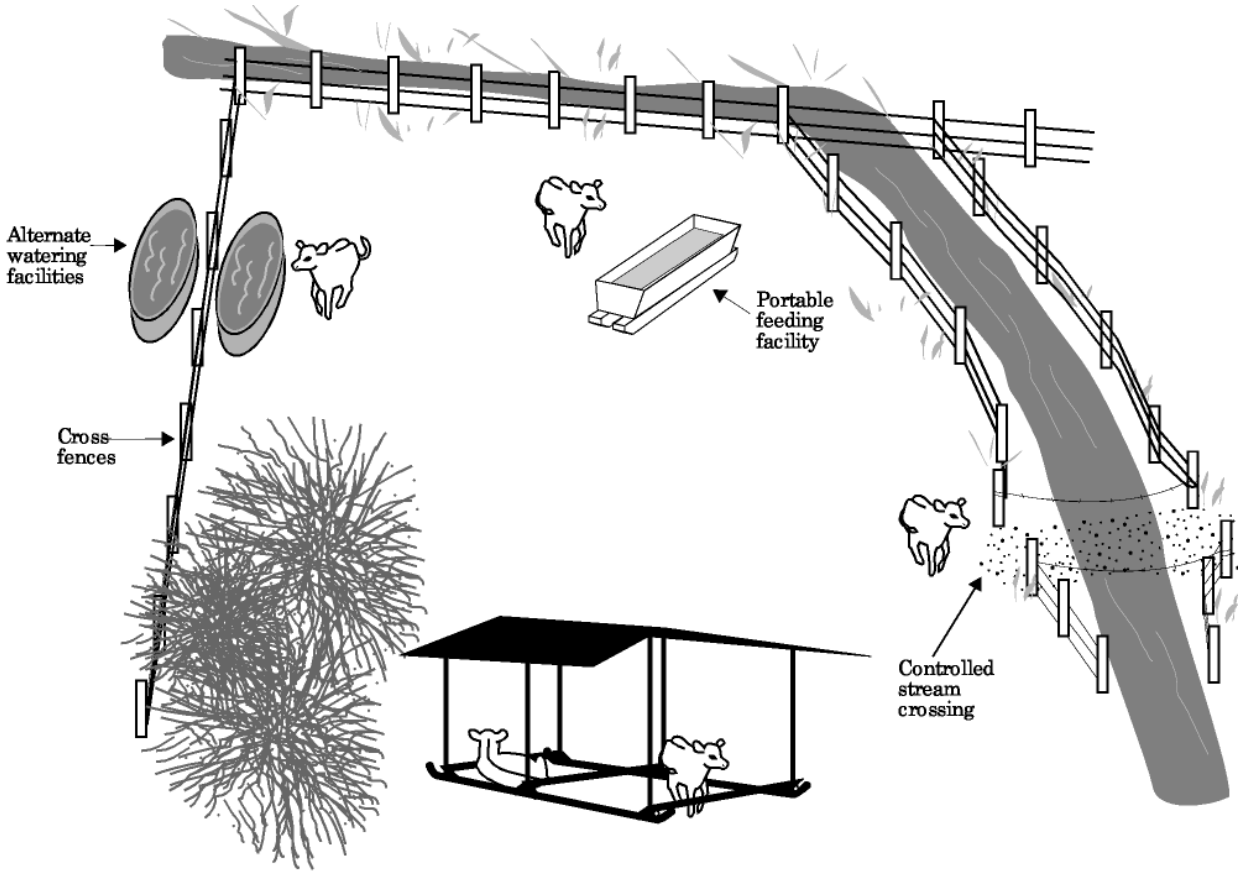
A. Dairy waste management systems

Dairy operations vary, and each operation presents its own unique problems (fig. 9–3). Many older dairy operations were not designed with sufficient consideration given to waste management. As a result, the design of a waste management system may require major modifications or alterations of existing facilities.

The dairy industry generally is concerned with the overall appearance of the dairy farms. Dairy operations require high standards of sanitation and must prevent problems associated with flies. Operations near urban areas must manage the waste in a manner that minimizes odors.

Dairy animals are typically managed on pastures in partial confinement. While animals are on pasture, their waste should not be a resource concern if stocking rates are not excessive, grazing is evenly distributed, manure from other sources is not applied, and grazing is not allowed during rainy periods when the soils are saturated. To prevent waste from accumulating in feeding, watering, and shade areas, the feeding facilities can be moved, the number of watering facilities can be increased, and the livestock can be rotated between pastures. To reduce deposition of waste in streambeds, access to the stream may be restricted to stable stream crossings and access points (fig. 9–4).

Figure 9–4 Livestock waste management on pasture includes cross fences for rotation, portable feeding facilities, shade areas away from streams, alternate water facilities, and controlled stream crossing.



The manure in paved holding areas generally is easier to manage, and the areas are easier to keep clean. If the holding areas are unpaved, the traffic of the livestock tends to form a seal on the soil that prevents the downward movement of contaminated water. Care must be taken when removing manure from these lots so that damage to this seal is minimized.

1. **Production**

Waste associated with dairy operations includes manure, contaminated runoff, milking house waste, bedding, and spilled feed.

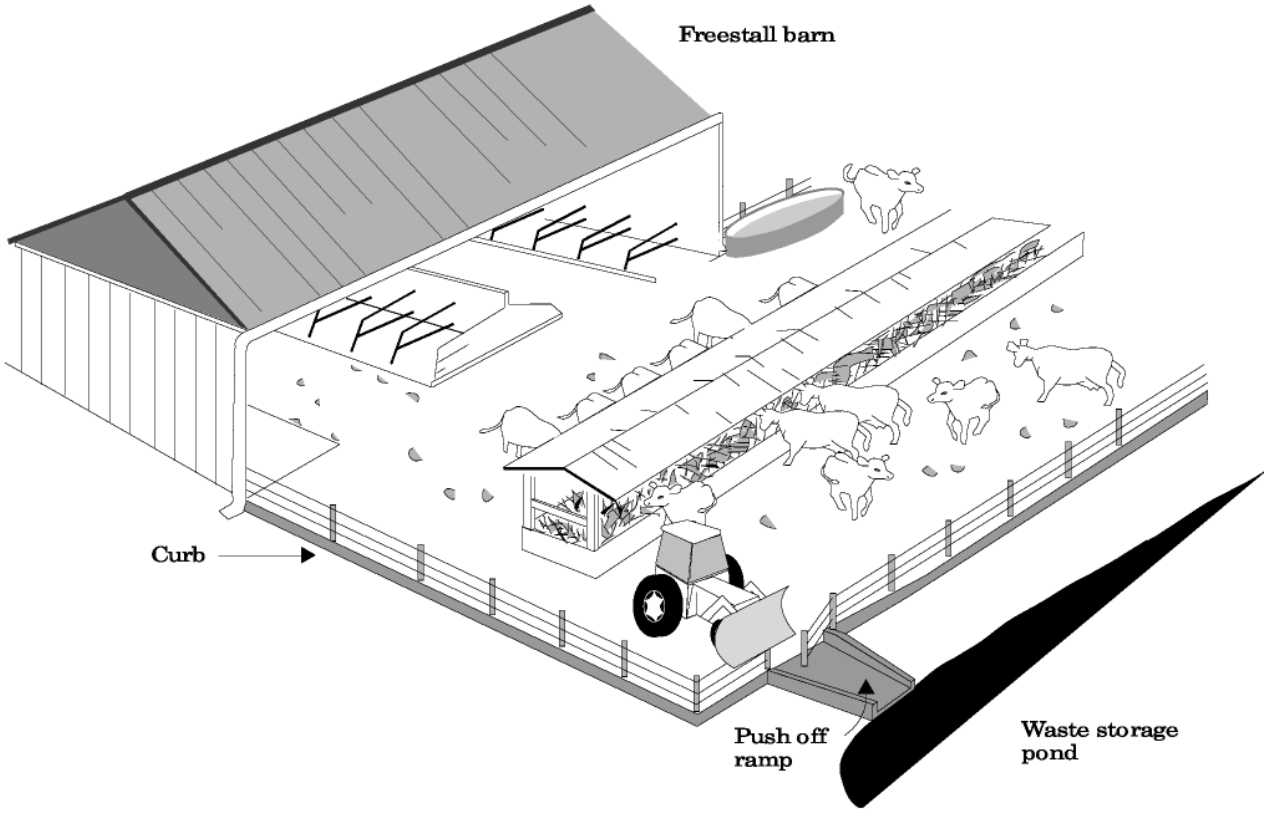
2. **Collection**

The collection methods for dairy waste vary depending on the management of the dairy operation. Dairy animals may be partly, totally, or seasonally confined. Manure accumulates in confinement areas and in areas where the dairy animals are concentrated before and after milking.

Unroofed confinement areas must have a system for collecting and confining contaminated runoff. This can be accomplished by using curbs at the edge of the paved lots (fig. 9–5) and reception pits where the runoff exits the lots. Paved lots generally produce more runoff than unpaved lots. On unpaved lots, the runoff may be controlled by diversions, sediment basins, and underground outlets. The volume of runoff can be reduced by limiting the size of the confinement area, and uncontaminated runoff can be diverted if a roof runoff management system and diversions are used.

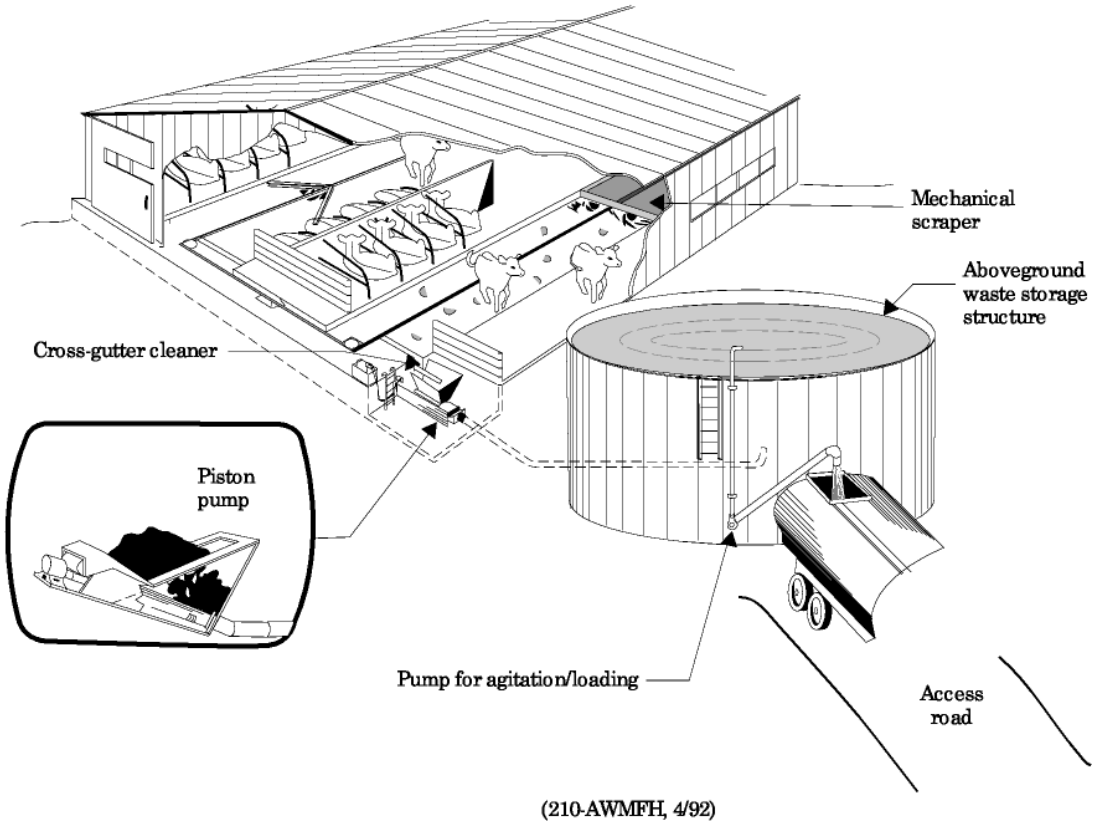
The manure and associated bedding accumulated in roofed confinement areas can be collected and stored as a solid. The manure can also be collected as a solid in unroofed lots in humid climates where the manure is removed daily and in unroofed lots in dry climates. Manure can be removed from paved areas by a flushing system. The volume of contaminated water produced by the system can be greatly reduced if provisions are made to recycle the flush water.

Figure 9–5 Confinement area with curbing



9–8 (210-AWMFH, 4/92)

Figure 9–6 Aboveground waste storage structure



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3. **Storage**

Milking house waste and contaminated runoff must be stored as a liquid in a waste storage pond or structure. Manure may be stored as a slurry or liquid in a waste storage pond designed for that purpose or in a structural tank (figs. 9–6 & 9–7). It can be stored as a semi-so lid in an unroofed structure that allows for the drainage of excess water and runoff or as a solid in a dry stacking facility. In humid areas the stacking facility should have a roof.

4. **Treatment**

Liquid waste can be treated in an aerobic lagoon, an anaerobic lagoon, or other suitable liquid waste treatment facilities. Solids in the waste can be composted.

5. Transfer

The method used to transfer the waste depends largely on the consistency of the waste. Liquid and slurry wastes can be transferred through open channels, pipes, or in a portable liquid tank (fig. 9–8).

Pumps can be used to transfer liquid waste as needed. Solid and semi-solid waste can be transferred by mechanical conveyance equipment, in solid manure spreaders, and by pushing them down curbed concrete alleys. Semi-solid waste has been transferred in large pipes through the use of gravity, piston pumps, or air pressure.

6. Utilization

Dairy waste is used as bedding for livestock, marketed as compost, and used as an energy source, but the most common form of utilization is through land application. Waste may be hauled and distributed over the land in a dry or liquid manure spreader. Liquid waste can be distributed through an irrigation system. Slurries may be distributed through an irrigation system equipped with nozzles that have a large opening (fig. 9–9).

Figure 9–7 Storage facilities

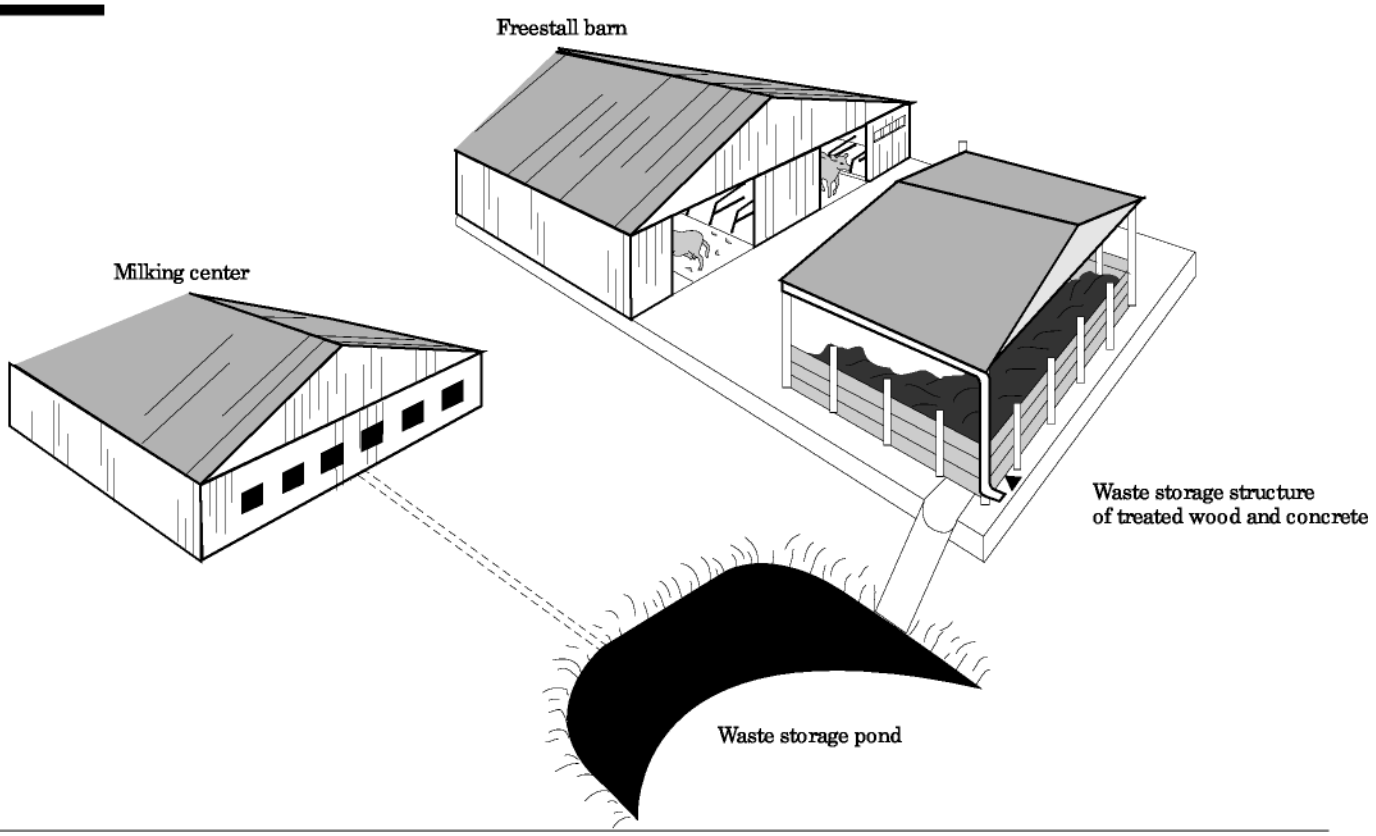


Figure 9–8 Tank wagon used to spread liquid wastes from below ground storage structure

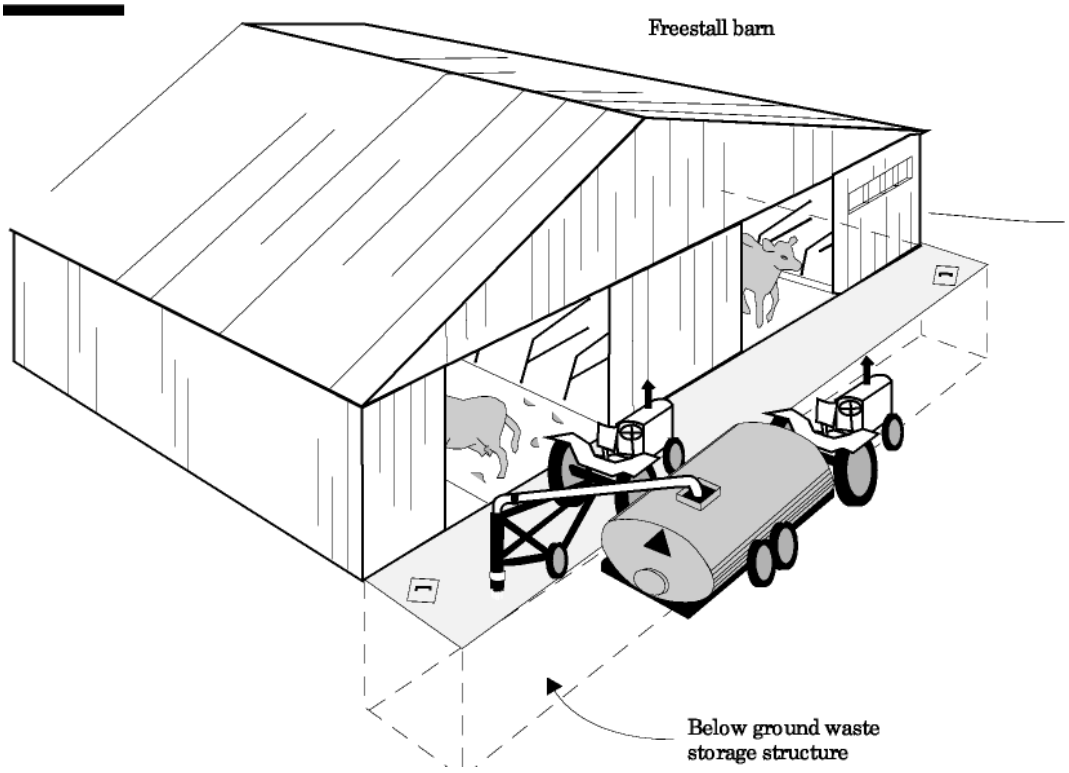


Figure 9–9 Freestall barn with flushing alleyway and irrigation system

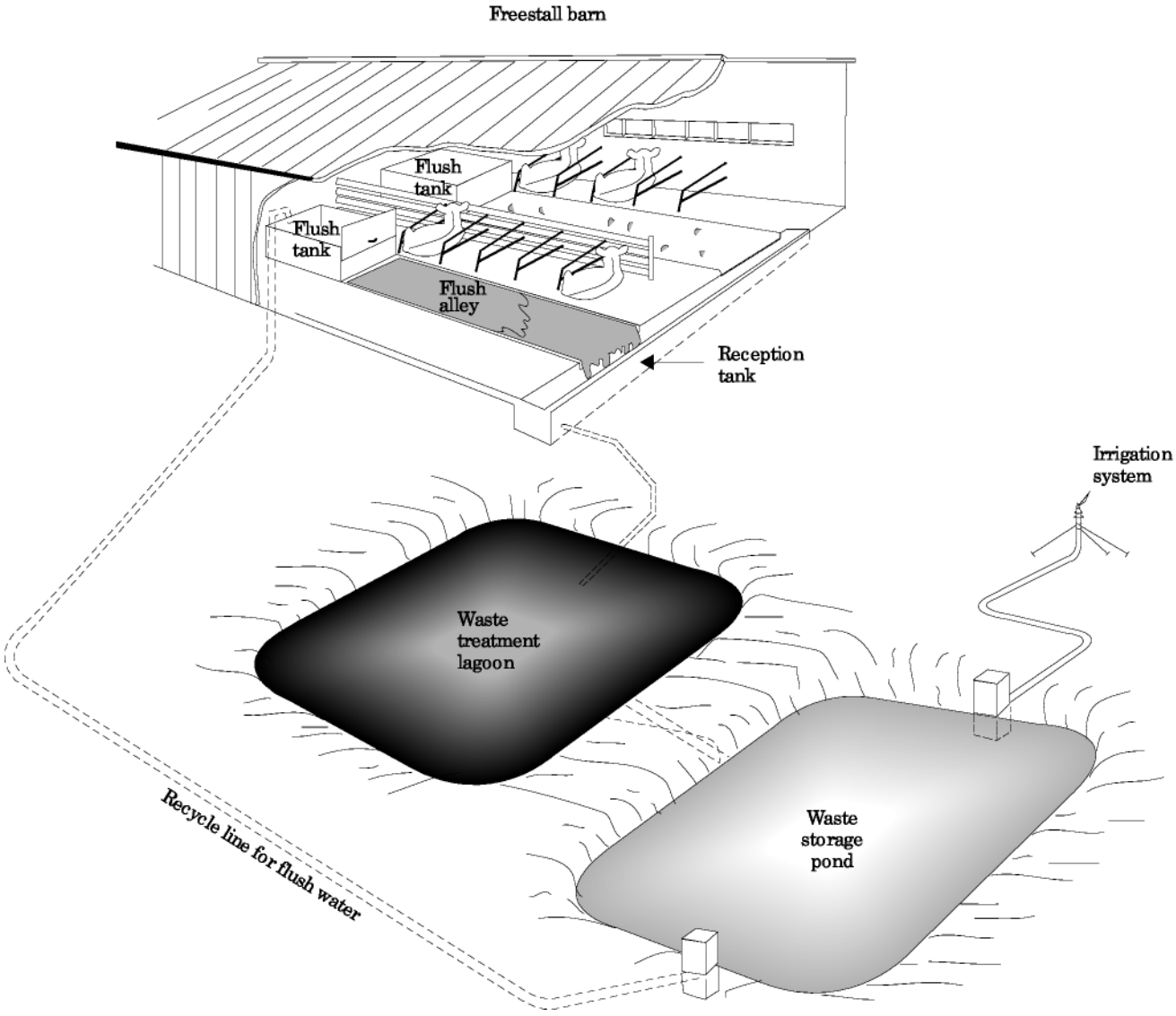
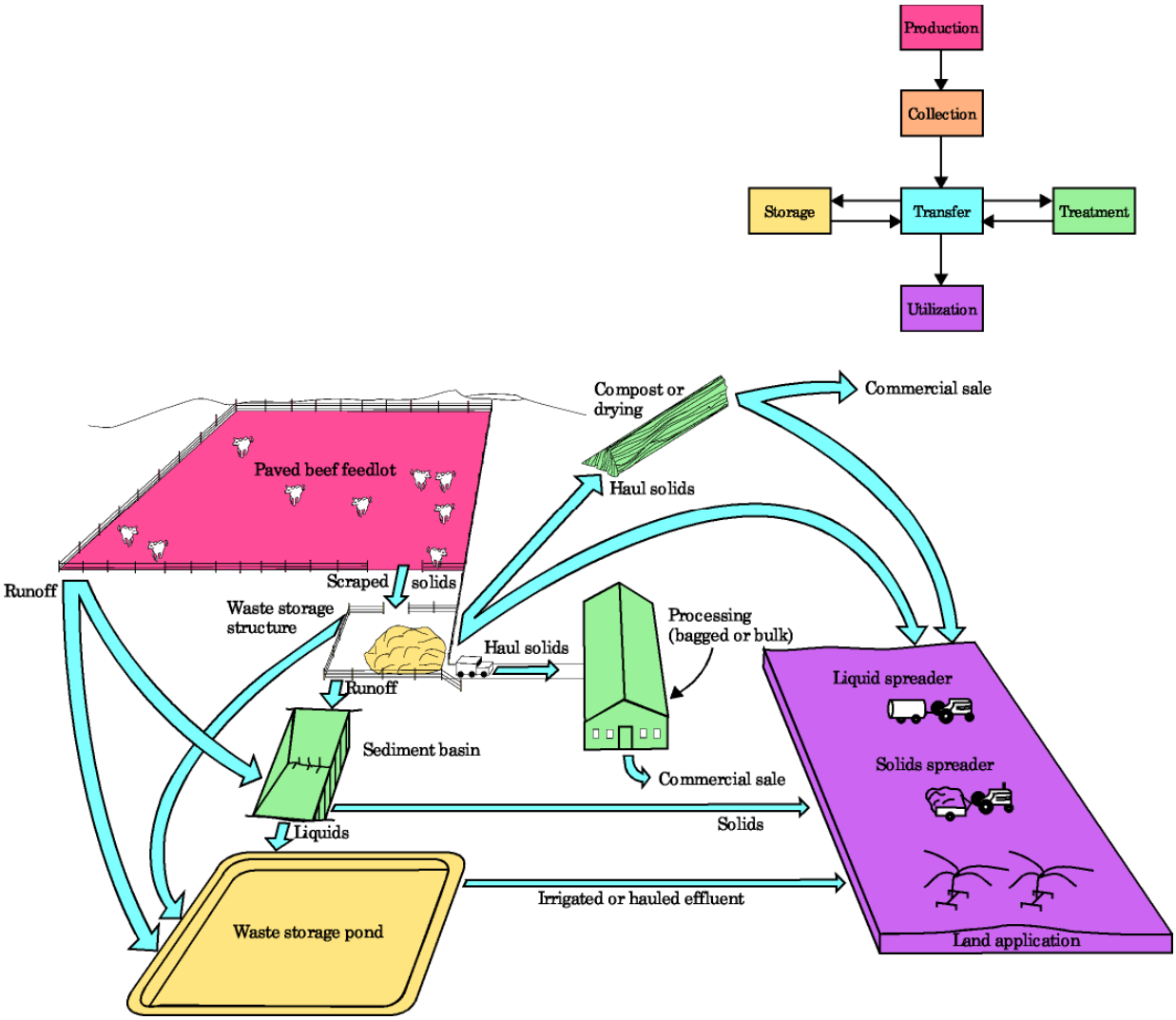


Figure 9–10 Waste handling options—beef



B. Beef waste management systems

Beef brood cows and the calves less than a year old are usually held on pastures or range. The calves are then finished in confined feeding facilities. While the animals are on pastures, their waste should not be-come a resource concern if the stocking rates are not excessive and the grazing is evenly distributed. To prevent waste from accumulating in feeding, watering, and shade areas, the feeding facilities can be moved, the number of watering facilities can be increased, and the livestock can be rotated between pastures. To reduce deposition of waste in streambeds, access to the stream may be restricted to stable stream crossings and access points. Figure 9–10 shows a paved beef feedlot operation.

1. Production

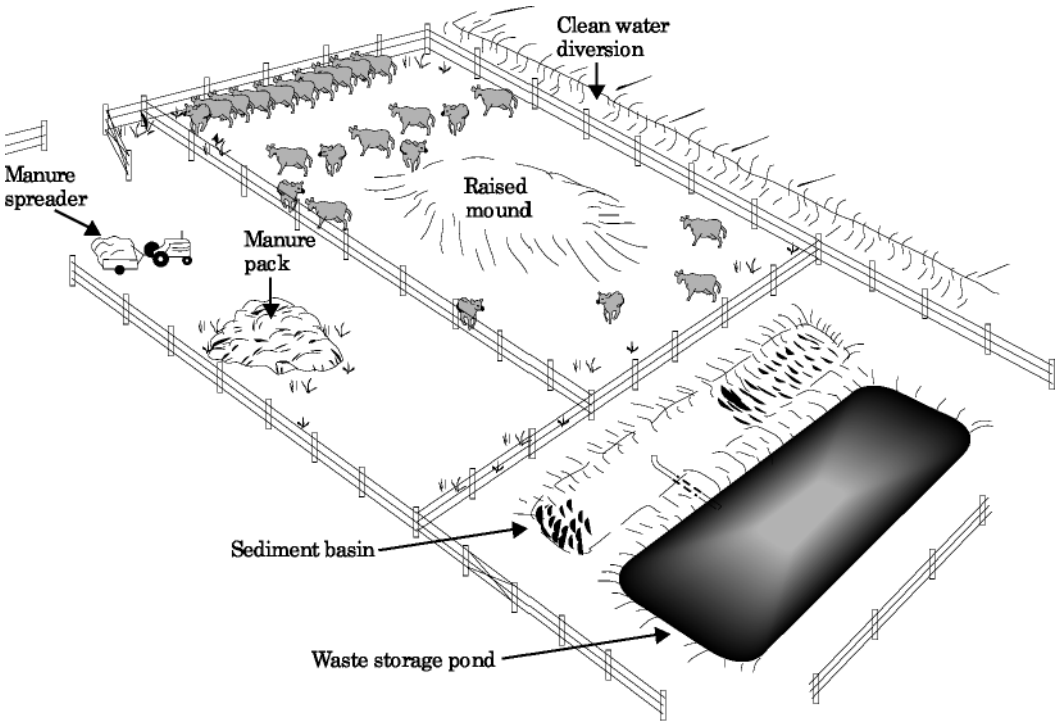
Waste associated with confined beef operations include manure, bedding, and contaminated runoff.

2. Collection

Beef cattle can be confined on unpaved (fig. 9–11), partly paved, or totally paved lots. If the cattle are concentrated near wells, adequate protection must be provided to prevent well contamination. Because much of the waste is deposited around watering and feeding facilities, paving these areas, which allows frequent scraping, may be desirable.

On unpaved lots, the traffic of the livestock tends to form a seal on the soil that prevents the downward movement of contaminated water. Care must be taken when removing manure from these lots so that damage to this seal is minimized. The seal tends to break down after livestock are removed from the lot. To prevent possible contamination of ground water resources, all the manure should be removed from an abandoned lot.

Figure 9–11 Waste collection from an unpaved beef feedlot



Unroofed confinement areas must have a system for collecting and confining contaminated runoff. On unpaved lots the runoff can be controlled by using diversions, sediment basins, and underground outlets. Paved lots generally produce more runoff than unpaved lots, but curbs at the edge of the lots and reception pits where the runoff exits the lots help to control the runoff. Solid/liquid separators or settling basins can be used to recover some of the solids in the runoff. The volume of runoff can be reduced by limiting the size of the confinement area, and uncontaminated runoff can be excluded by use of diversions.

The manure in confinement areas that have a roof can be collected and stored as a solid. It may also be collected as a solid or semi-solid from open lots where the manure is removed daily and from open lots in a dry climate.

3. Storage

Manure can be stored as a bedded pack in the confinement area if bedding is added in sufficient quantities. Manure removed from the confinement area can be stored as a liquid or slurry in an earthen pond or a structural tank, as a semi-solid in an unroofed structure that allows drainage of excess water and runoff to a waste storage pond, or as a solid in a dry stacking facility designed for storage. In areas of high precipitation, dry stacking facilities should be roofed (fig. 9– 12). Contaminated runoff must be stored as a liquid in a waste storage pond or structure.

4. Treatment

Treatment of the waste in a lagoon is difficult for some livestock systems because of the volume of solids in the waste, but many of the solids can be removed before treatment. Liquid waste may be treated in an aerobic lagoon, an anaerobic lagoon, or other suitable liquid waste treatment facilities. Solid waste can be composted.

5. Transfer

The method used to transfer the waste depends largely on the consistency of the waste. Liquid waste and slurries can be transferred through open channels or pipes or in a portable liquid tank. Pumps can be used as needed. Solids and semi-solids may be transferred by using mechanical conveyance equipment, by pushing the waste down curbed concrete alleys, and by transporting the waste in solid manure spreaders.

Piston pumps or air pressure can be used to transfer semi-solid waste through large pipes.

6. Utilization

Beef cattle waste can be used as bedding for livestock, as an energy source, or it can be marketed as compost, but the most common form of utilization is land application. The waste can be hauled and distributed over the land in appropriate spreading devices. Liquid waste can be distributed through an irrigation system, and slurries can be applied using irrigation equipment with nozzles that have a large opening.

Figure 9–12 Storage facilities for wastes from paved feedlot in high precipitation area

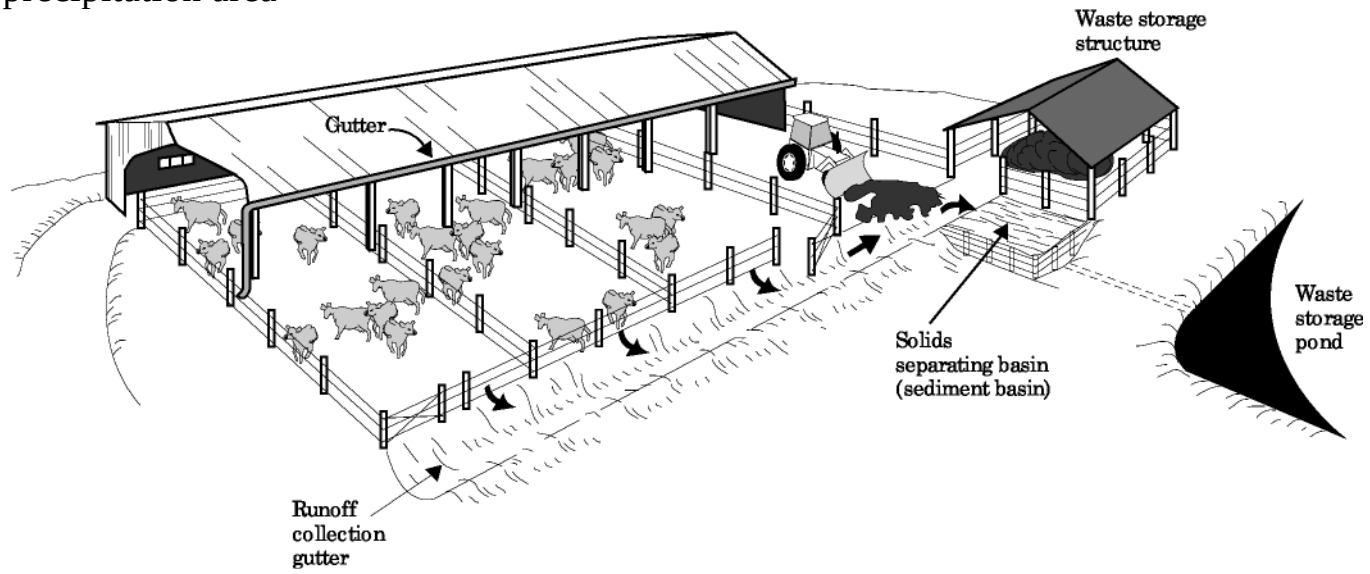
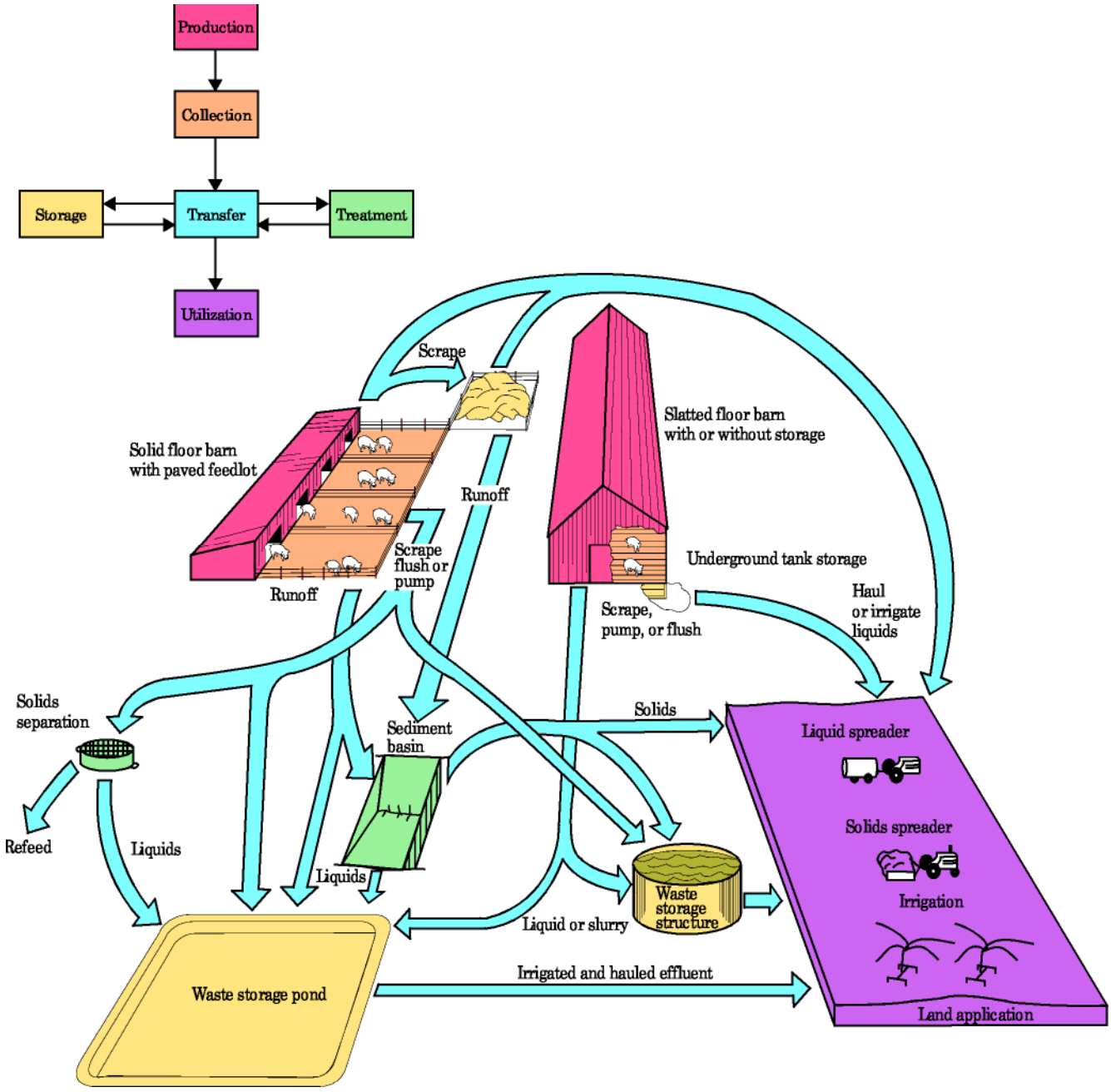


Figure 9–13 Waste handling options—swine



C. Swine waste management systems

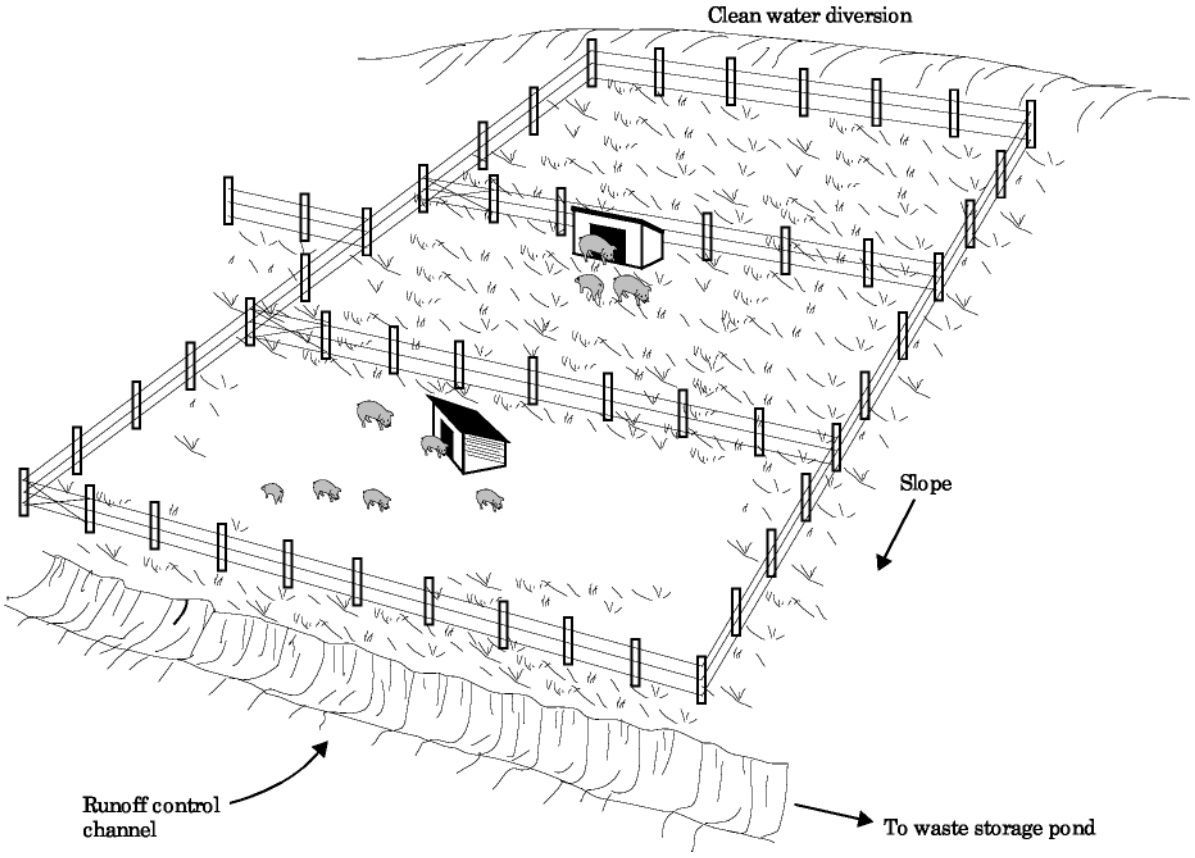
Open systems (pastures, woodlots, and wetlands), feedlot systems, confinement systems, or a combination of these, are used for raising swine (fig. 9–13).

Raising hogs in an open system may appear to have a low initial investment, but often results in animal health and pollution control problems. Even if sufficient land is available, hogs tend to congregate and concentrate their waste. This can be prevented by moving the feeding, watering, and housing facilities and by rotating the hogs through a series of open lots. Hogs raised in an open system should not have unrestricted access to streams. Runoff is difficult to man-age in an open system because of the large area and topographic limitations. Rather than invest the capital and time necessary to install and manage an extensive runoff management system, it may be more efficient to convert to a more concentrated operation.

Manure in feedlot systems can be handled as a solid if the feedlots are cleaned regularly, sufficient bedding is added to the manure, and the collected manure is protected from excessive precipitation. It can also be handled as a slurry or liquid, but measures must be taken to manage contaminated runoff (fig. 9–14). Total confinement systems eliminate the need to manage contaminated runoff and may allow for more automation in waste management.

Undesirable odors are often associated with swine operations. A swine waste management system should incorporate odor control measures where possible. A clean, neat appearance; efficient management system (fig. 9–15); and positive public relations with those affected by the odors eliminates many complaints.

Figure 9–14 Runoff control



1. Production

Waste associated with swine operations include manure and possibly contaminated runoff. In some systems provisions must be made to manage flush water. Hogs tend to play with watering and feeding facilities, which can add to the waste load. The disposal of dead pigs may be a resource concern in some operations.

2. Collection

Swine manure can be collected by scraping or flushing. Scraped manure is collected as a solid or slurry, and flushed manure must be handled as a liquid. The flush water should be recycled if possible so that the volume of contaminated water is kept to a minimum. The collection process can use automated equipment, or it can be as simple as raising swine on slatted floors over waste storage pits (fig. 9–16).

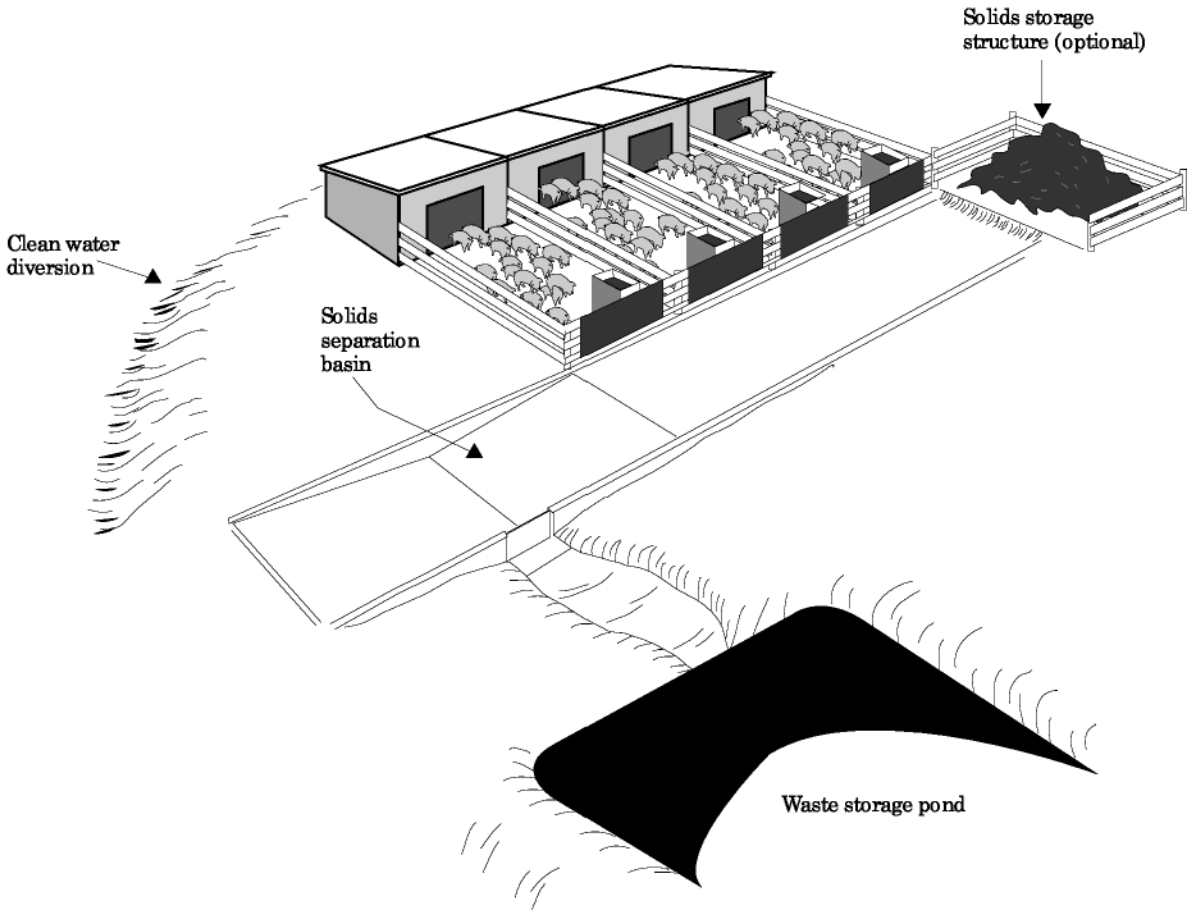
3. Storage

Swine manure can be stored as solid, slurry, or liquid. If stored as a solid, it should be protected from precipitation. Above or below ground tanks (fig. 9–17) or an earthen waste storage pond can be used to store slurries or liquid waste.

4. Treatment

Liquid waste from a swine operation is commonly treated in an anaerobic lagoon, but it can also be treated in an aerobic lagoon (fig. 9–18) or oxidation ditch. Solid waste and dead pigs can be composted.

Figure 9–15 Manure scraped and handled as a solid on paved lot operation



9–18 (210-AWMFH, 4/92)

5. Transfer

The method used to transfer the waste depends largely on the consistency of the waste. Liquid waste and slurries may be transferred through open channels, pipes, or in a portable liquid tank. Pumps can transfer liquid waste as needed. Solids and semi-solids can be transferred by mechanical conveyance equipment. Piston pumps or air pressure can be used to transfer semi-solid waste through smooth pipes.

6. Utilization

Swine waste is used as a feed supplement and an energy source through methane production. With proper ventilation and sufficient bedding, the solid manure can be composted in confinement facilities, and the heat

generated from the composting process can be used to supplement heat in the buildings.

The most common use of the nutrients in swine waste is through land application. The waste can be hauled and distributed over the land by spreading devices. If odors are a problem, liquid waste can be injected below the soil surface. It can also be distributed through an irrigation system. Slurries can be distributed through an irrigation system equipped with nozzles that have a large opening.

Figure 9–16 Confined housing with farrowing crates, partly slatted floor, pit storage, and liquid manure handling

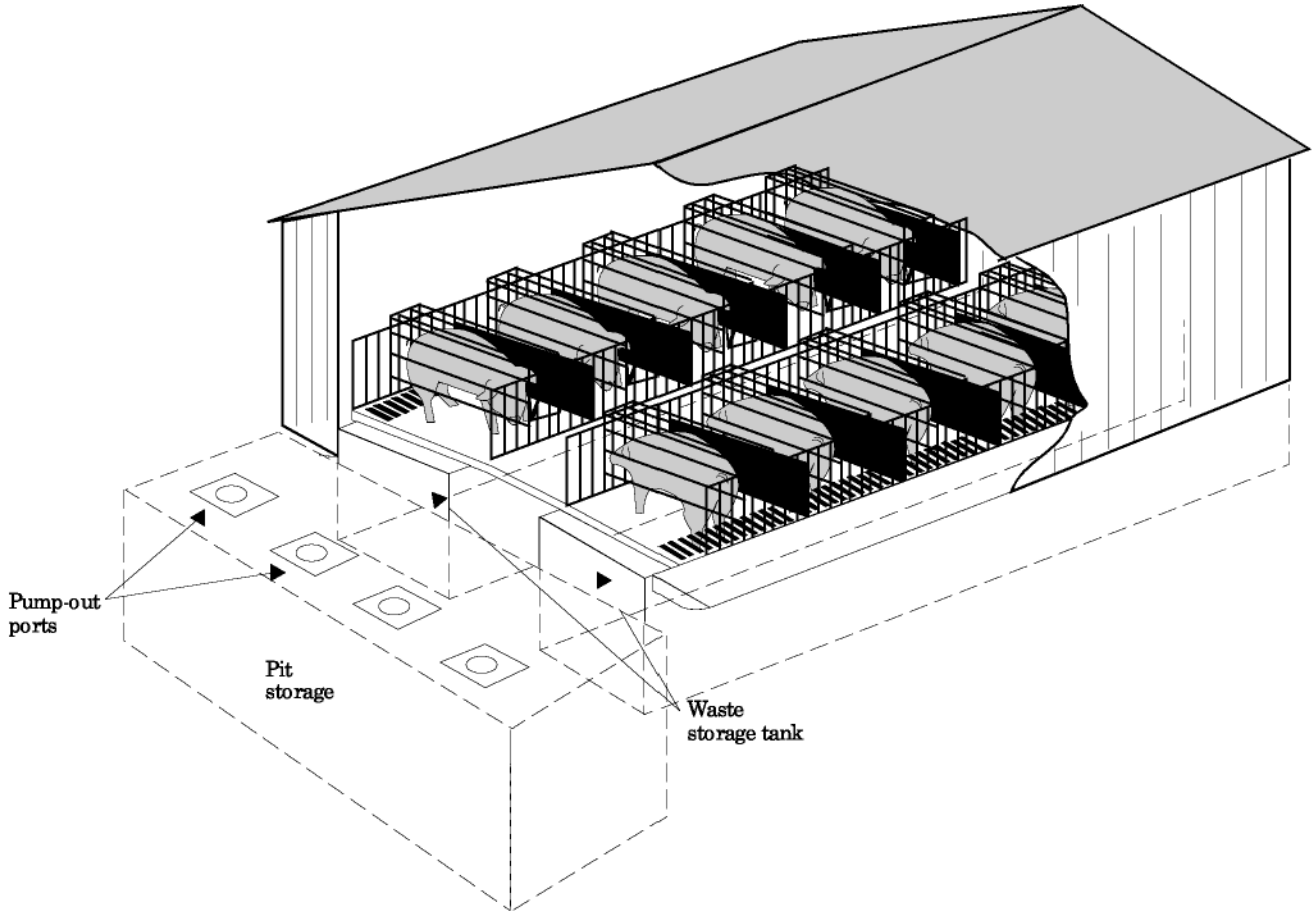


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Figure 9–17 Fed hogs in confined area with concrete floor and tank storage liquid manure handling

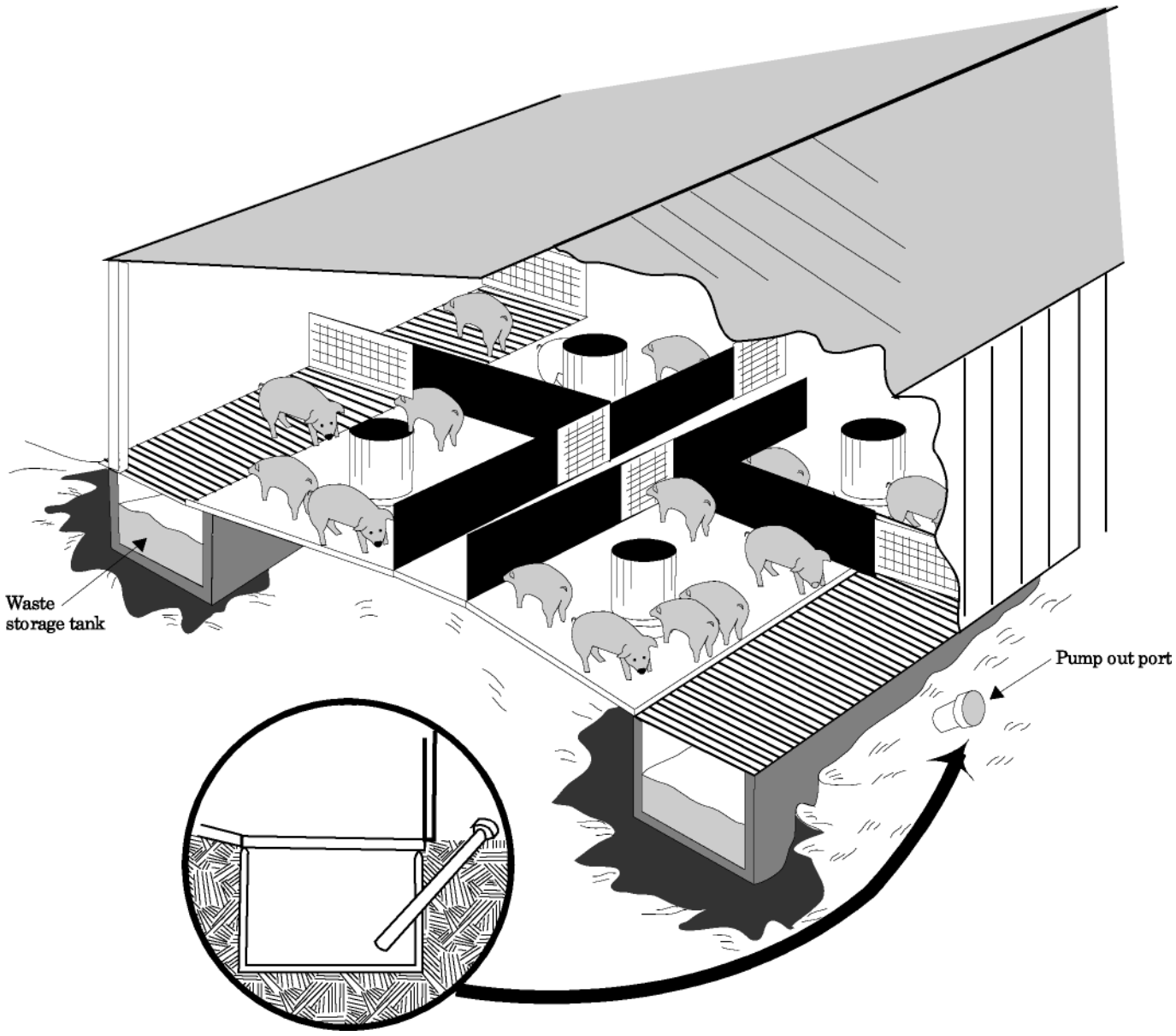


Figure 9–18 Two stage aerobic lagoon system for treatment of waste flushed from swine building

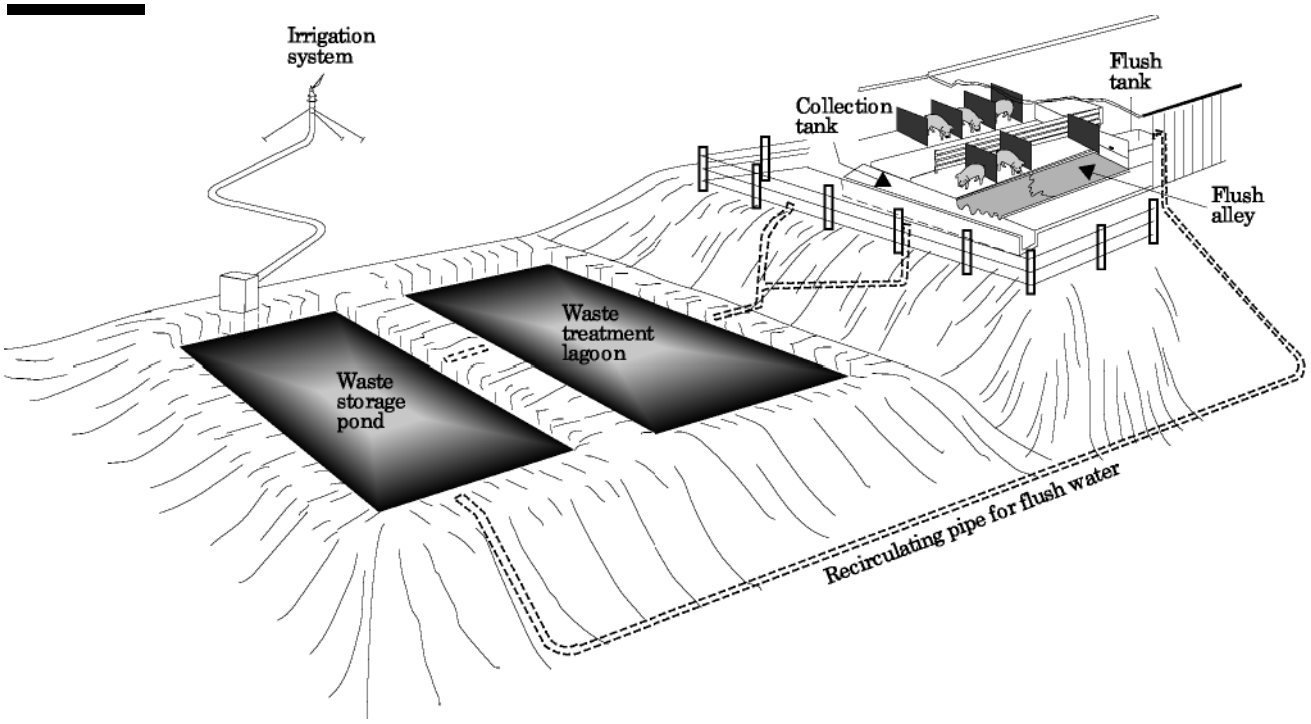
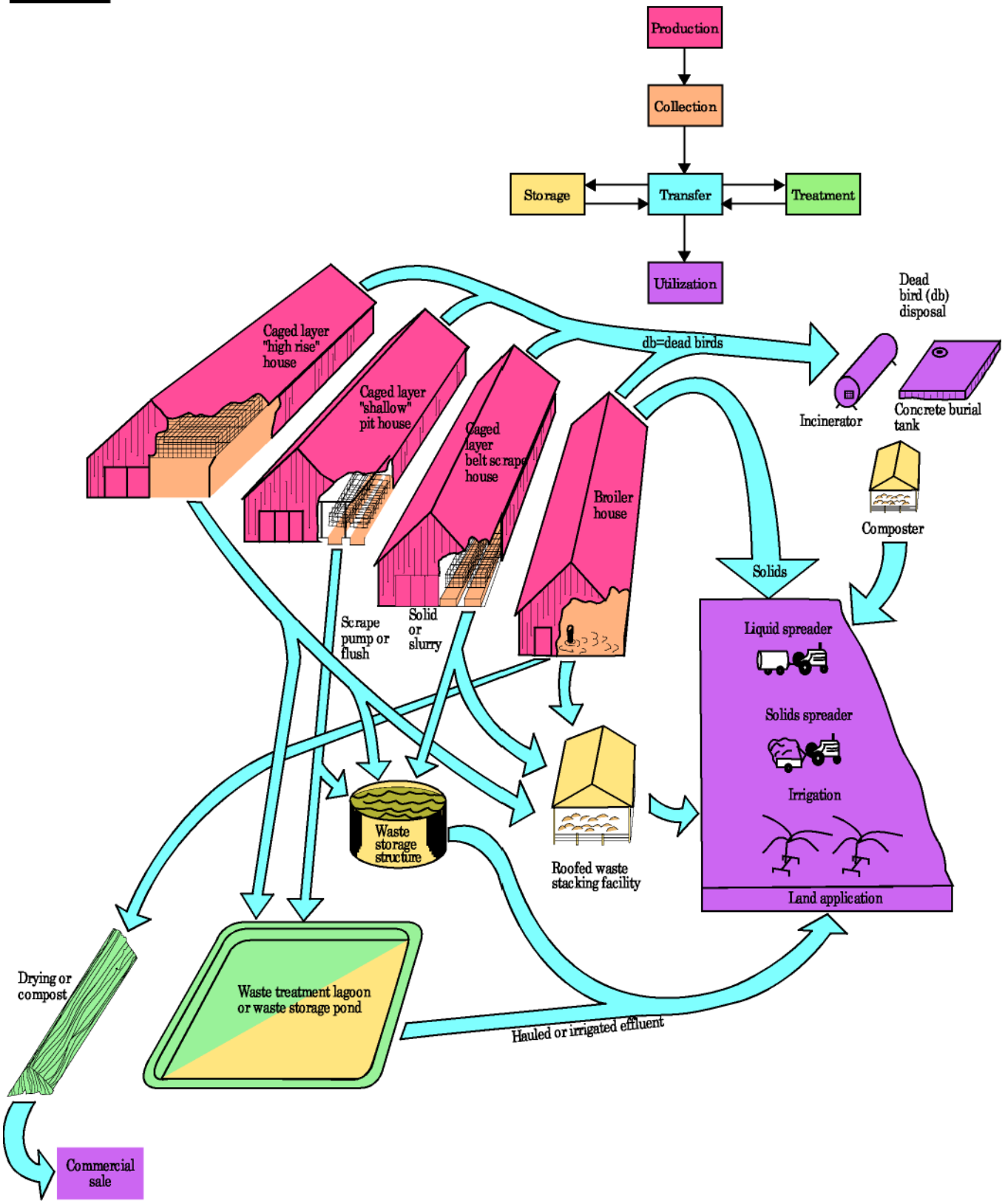


Figure 9–19 Waste handling options poultry



9–22 (210-AWMFH, 4/92)

D. Poultry waste management systems

The two basic poultry confinement facilities include those to raise turkeys and broilers used for meat (fig. 9–19) and those to house layers. Broilers and young turkeys are grown on floors on beds of litter shavings (fig. 9–20), sawdust, or peanut hulls. Layers are con-fined to cages. Fly control around layers is important to prevent spotting of the eggs. Disease control is important in both systems.

1. Production

Waste associated with poultry operations includes manure and dead poultry. Depending upon the system, waste can also include litter, wash-flush water, and waste feed.

2. Collection

The manure from broiler and turkey operations is allowed to accumulate on the floor where it is mixed with the litter. Near watering facilities the manure-litter pack forms a “cake” that generally is removed between flocks. The rest of the litter pack generally has low moisture content and is removed once a year in the spring. The litter pack can be removed more frequently to prevent disease transfer between flocks.

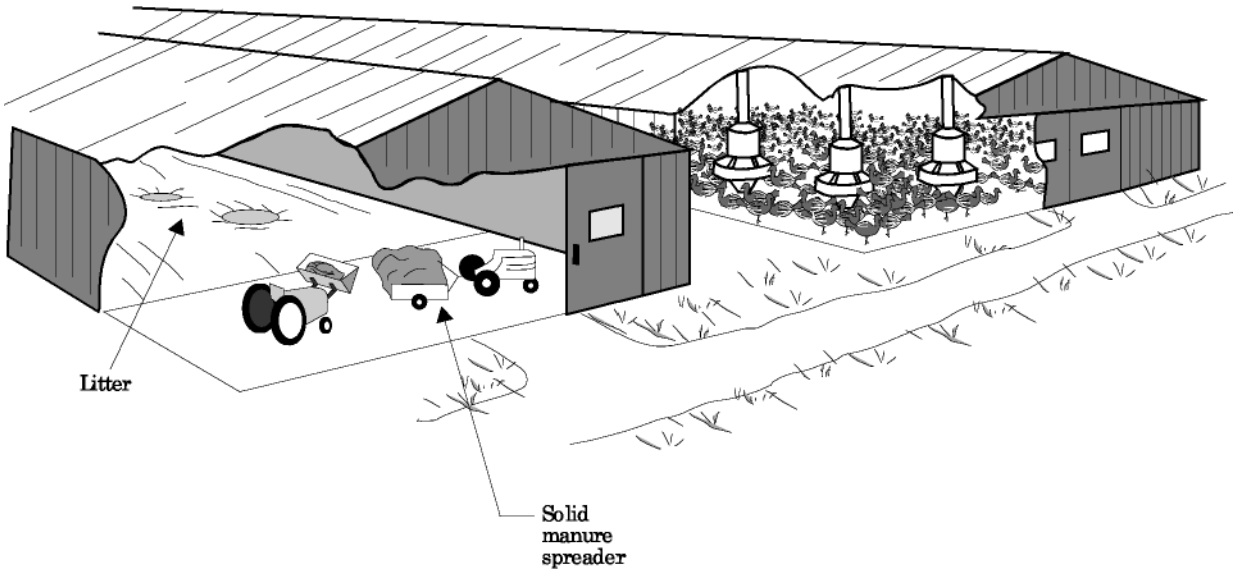
In layer houses, the manure that drops below the cage collects in deep stacks (fig. 9–21) or is removed frequently using either a shallow pit located beneath the cages for flushing or scraping or belt scrapers positioned directly beneath the cages.

3. Storage

Litter from broiler and turkey operations is stored on the floor of the housing facility (fig. 9–22). When it is removed, it can be transported directly to the field for land application. If field conditions are not suitable or spreading is delayed for other reasons, the litter must be stored outside the housing facility. In some areas the litter may be compacted in a pile and stored in the open for a limited time; however, it generally is better to cover the manure with a plastic or other waterproof cover until the litter can be used. If the spreading is to be delayed for an extended period of time, the litter should be stored in a roofed facility.

If the manure from layer operations is kept reasonably dry, it can be stored in a roofed facility. If it is wet, it should be stored in a structural tank or an earthen storage pond.

Figure 9–20 Litter system for broilers and turkeys



4. Treatment

Broiler and turkey litter can be composted. This stabilizes the litter into a relatively odorless mass that is easier to market and also helps to kill disease organ-isms so that the litter can be reused as bedding or supplemental feed to livestock. The litter can also be dried and burned directly as a fuel.

Liquid manure may be placed into an aerobic digester to produce methane gas or it can be treated in a la-goon. The high volatile solid content of the layer manure may require an anaerobic lagoon of consider-able size. If odors are a problem, the lagoon can be aerated.

5. Transfer

The method used to transfer the waste depends on the TS content of the waste. Liquid waste can be transferred in pipes, gutters, or tank wagons, and dried litter can be scraped (fig. 9–23), loaded, and hauled as a solid. If the distances between the poultry houses and the fields for application are great, the litter may need to be transported in a truck.

6. Utilization

The waste from poultry facilities can be applied to the land. If the owners of the poultry houses do not have enough land suitable for application, they should arrange to apply the waste to their neighbors' land. Because of the high nutrient value of the litter, many landowners are willing to pay for the litter to be spread on their land. Whether on the owner's land or the neighbor's land, the waste must be spread according to an appropriate waste utilization plan. Poultry waste can also be used for the production of methane gas, buried directly as a fuel, reused as bedding, or used as a feed supplement to livestock.

7. Dead poultry disposal

Because of the large numbers of dead birds associated with large poultry operations, the disposal of dead birds is a resource concern. Poultry facilities must have adequate means for disposal of dead birds in a sanitary manner. To prevent spread of disease, the dead birds are often collected daily by hand. Disposal alternatives include incineration, rendering, burial, dropping into a buried disposal tank, or composting. The dead birds are mixed with litter and straw, composted, and the composted material is stored until it can be applied to the land.

Figure 9–21 Manure accumulates under cages in "high-rise" house for layers

Figure 9–21 Manure accumulates under cages in "high-rise" house for layers

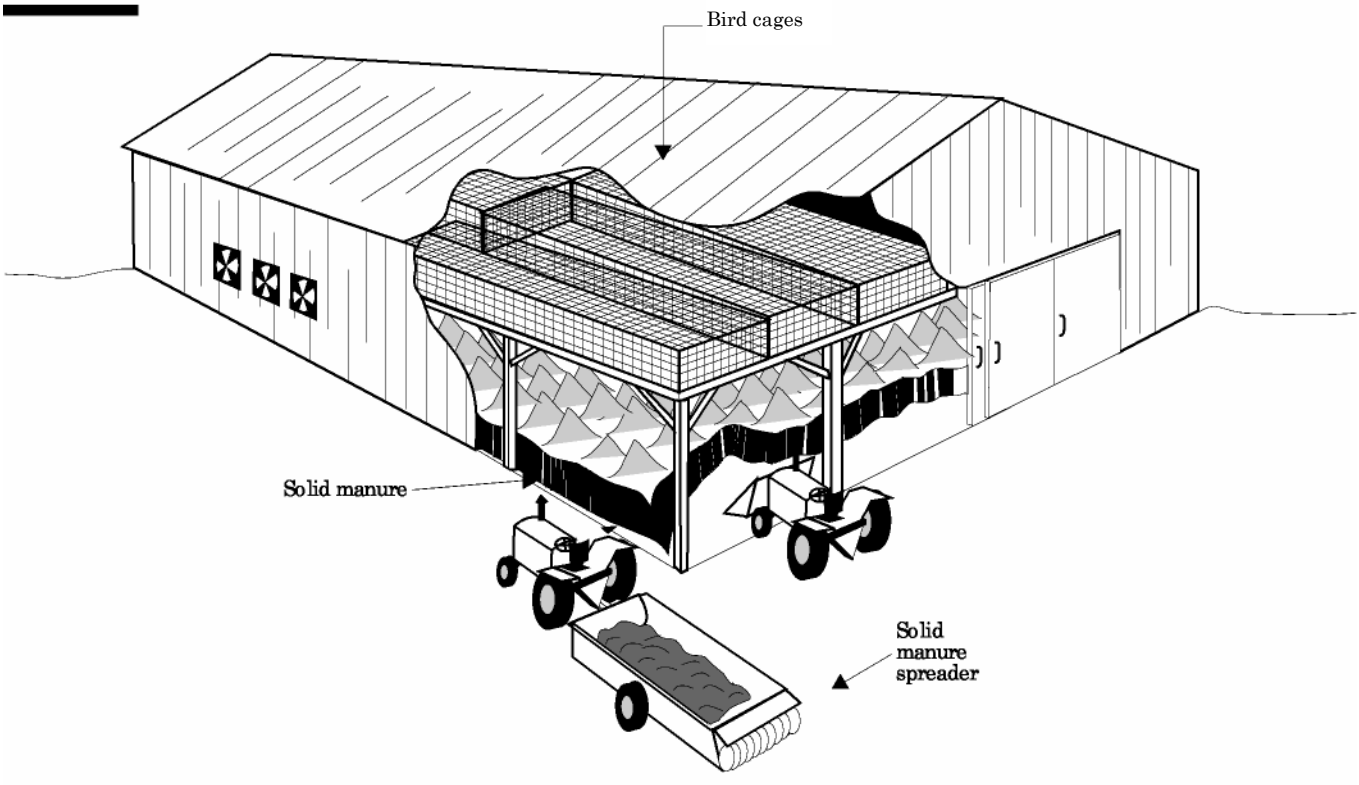


Figure 9–22 Litter from poultry operations may be stored on the floor of the facility until scraped after several cycles of birds

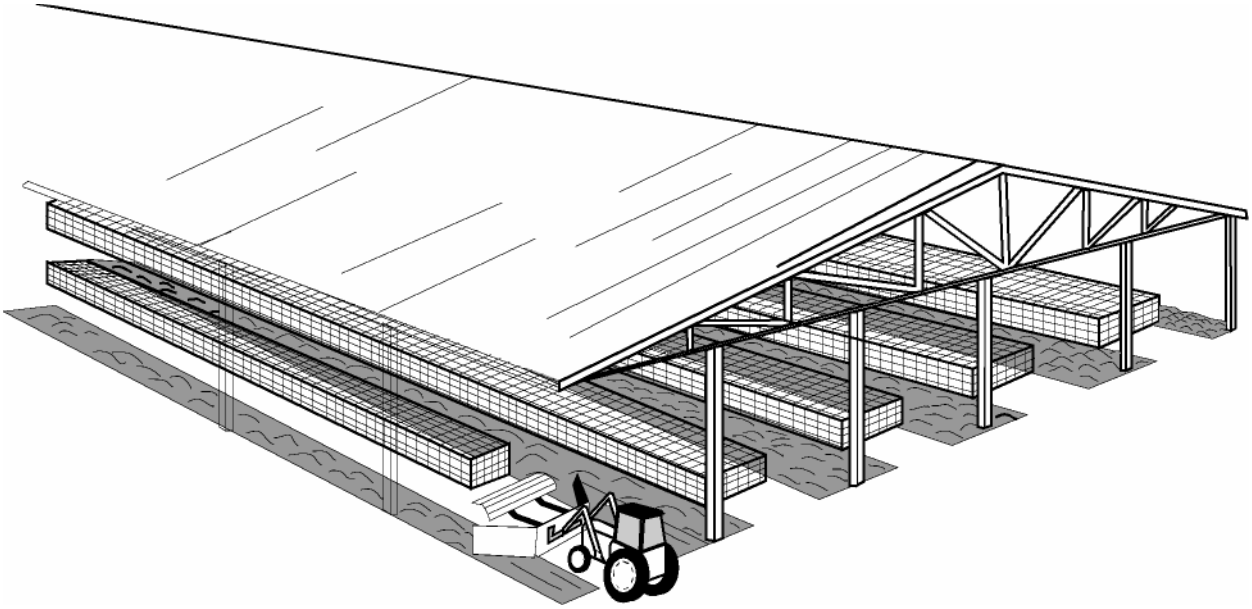


Figure 9–23 Solid waste may be scraped regularly (possibly by mechanical scraper) from facility for transport to the field

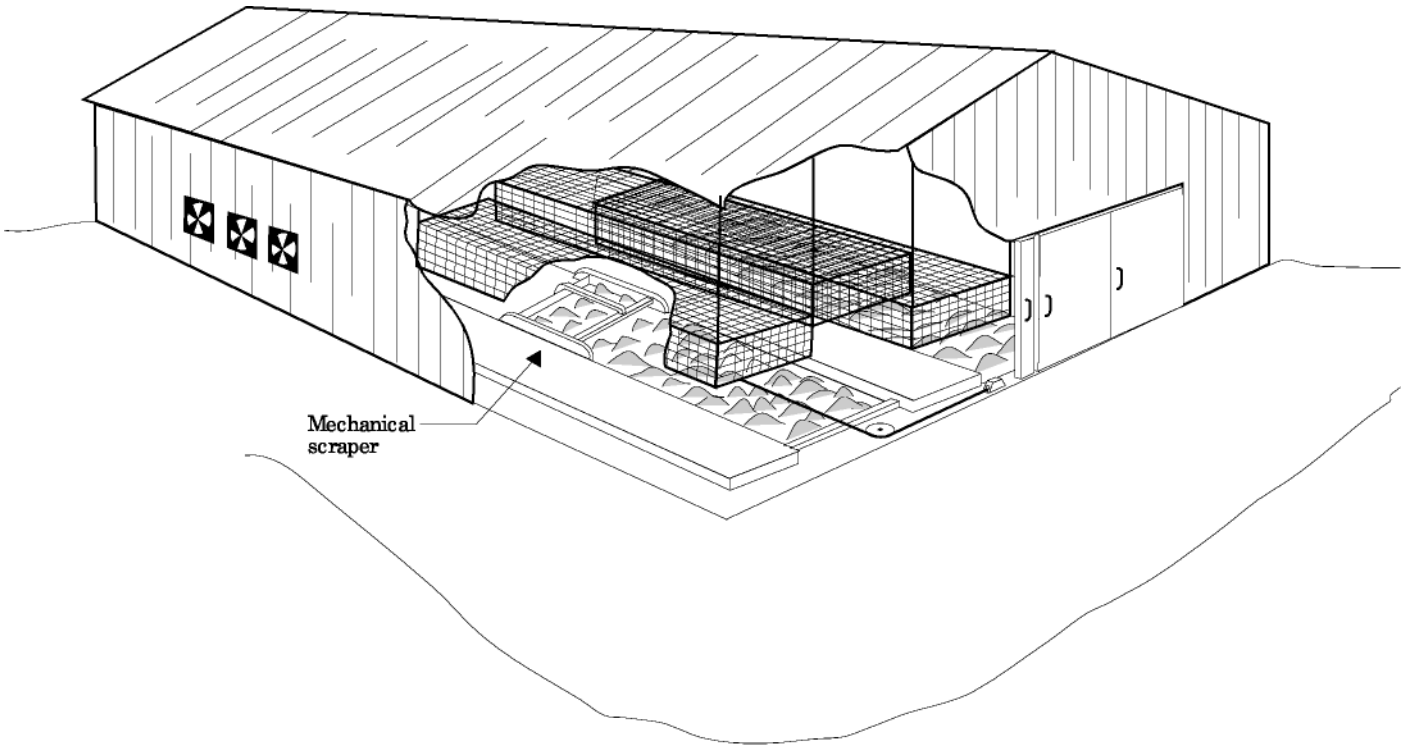
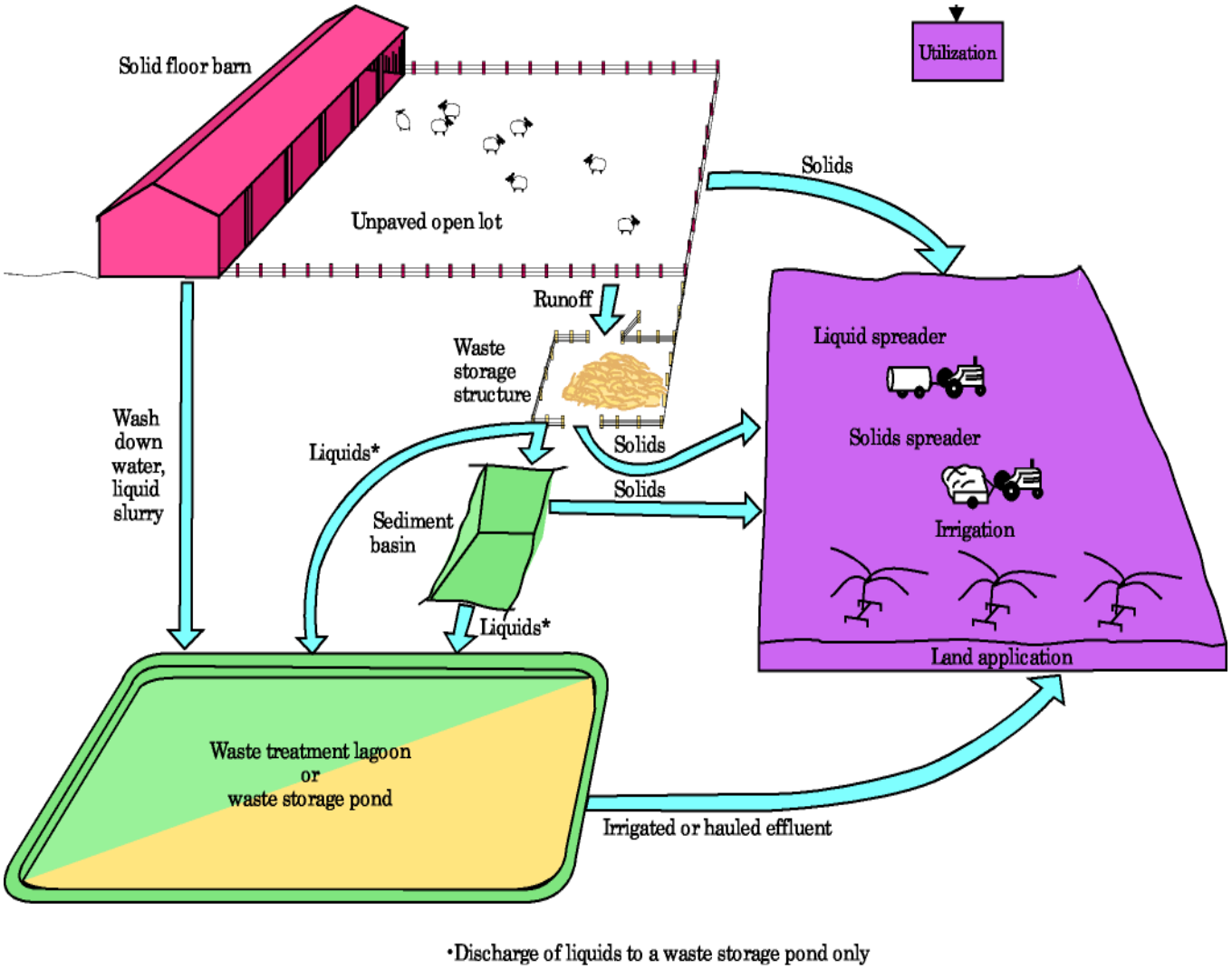


Figure 9–24 Waste handling options—sheep



E. Other animals

1. Sheep and goat waste management systems

Sheep or goats produced in confinement are grown either on paved lots or pasture (fig. 9–24). Their manure can be managed as a solid material. Where the animals are on pasture, waste management includes controlling stocking rates and periodic pasture renovation. On paved lots, the manure is periodically re-moved by scraping for immediate land application, storage in a solid manure storage facility, or treatment in a lagoon.

2. Horse waste management systems

Management of a horse operation near urban areas must include methods to keep flies and odors to a minimum. Horses are housed in confinement in paddocks or they are on pasture. Horse paddocks or stalls receive liberal amounts of bedding; therefore, most horse manure is handled as a solid. It should be removed from stalls daily if possible and can be land applied, stored in solid manure storage structures, or processed by composting. Some precautions should be taken if the manure is land applied to pastures be-cause this can result in internal parasites spreading to other horses. The manure can be used in gardens, greenhouses, nurseries, and by mushroom growers.

3. **Veal waste management systems**

Veal calves are produced using a liquid diet; therefore, their manure is highly liquid. It is typically removed from housing facilities by scraping or flushing from collection channels. The manure is then flushed or pumped into either liquid waste storage structures or ponds or into lagoons.

4. Small animals

Small animals include dogs, cats, rabbits, commercial furbearing animals, and laboratory animals. Keeping waste material dry and regular clean-out and disposal of waste help to prevent odor and pest problems. The system should not allow the accumulation of waste materials that can become breeding, feeding, or nesting sites for rodents or insects. Waste from small animals may contain disease organisms that can be transmitted to humans.

F. Municipal and industrial sludge and wastewater application systems

The application of sludge is regulated by State, Federal, and, in some cases, local laws. Only sludge that meets certain criteria regarding degree of treatment can be applied. Sludge must be treated to kill pathogens before it is land applied. The sludge and waste-water should not be stored on the farm, but should be applied immediately to the land.

Municipal sludge (and wastewater to a much smaller degree) contains heavy metals that can be detrimental to crops and human and livestock health. (See table 6–2 in chapter 6). The sludge needs to be analyzed for certain metals, such as mercury, lead, zinc, cadmium, and nickel. The annual application rate for cadmium is regulated. Specific cumulative applications for the life of the site have been established by the U.S. Environmental Protection Agency for all of these metals.

The application rates are dependent on the soil characteristics. State regulations should be consulted for specific metal loadings.

The production of certain crops, such as root crops, is prohibited on land receiving sludge. Because sludge and wastewater can have objectionable odors, caution should be exercised during application to minimize offensiveness.

G. Food processing waste

Food processing facilities produce large amounts of waste, some of which are suitable for land application. Food processing waste can be either solid, slurry, or liquid. The chemical properties of the waste must be determined before a waste handling system can be designed. If the waste is biological in nature, it can be treated and handled much the same as livestock waste.

Waste treatment lagoons can be used for some food processing waste. The material must be analyzed for its volatile solids content or its BOD concentration so that volumetric or areal loading rates can be deter-mined. Because some canneries are seasonal, lagoons may need to be oversized to accept anticipated periodic heavy organic loading.

State and local regulatory personnel must be contacted and necessary permits obtained before land application. Many permits require ongoing monitoring of ground water and possibly soil and plant matter. Hydraulic loading is often ignored. If the site has a high water table or low permeability, the amount of water that can be applied generally is reduced. In some food processing waste, the level of salt is too high or the pH is too high or too low for land application. Most food processing waste land application sites should be designed by a professional who has experience in these type systems.

H. Agricultural chemical waste management

Many agricultural enterprises use large amounts of agricultural chemicals. The use of these chemicals seems to increase as the cost of labor increases. With this increased usage comes the potential for surface and ground water contamination as a result of improper storage of chemical residue, rinse water, and unused chemicals and the improper disposal of empty containers. Considerable research is being conducted in this area; however, to date few easily managed, cost-effective alternatives have been identified. State and local regulations should be considered before planning any chemical handling system.

The chemicals and solids in rinse water should be concentrated. This can be done by collecting the material in an evaporative pond. Once the sludge has dehydrated, it should be placed in a leak proof container. If possible the container should be disposed of by local or state officials or by private businesses that specialize in this activity. Proper clothing and breathing equipment should be used when handling spent chemicals and sludge from settling/drying basins. Precaution should be taken to prevent animals and children from gaining access to such facilities.

Rinse water may be collected in below ground pits. This liquid can then be used as a part of the make-up water when the chemical is needed again. Separate pits are needed for different chemicals.

Purchase and use only the amount of material actually needed. This requires accurate determination of the amount of pesticide solution needed and careful calibration and operation of application equipment. Once a chemical solution is prepared, all of the material needs to be used for the purpose intended. This reduces the amount of waste material to be processed.

Chemical containers can be disposed of properly in one of two ways. They can be turned over to authorities or businesses that have the responsibility of handling them, or they can be buried. Before the containers are buried, they must first be triple rinsed, opened, and the liquid allowed to evaporate. Burial is practical only in locations where the burial site will always be above the ground water level.

APPENDIX C

Portable Dry-Litter Pig Pen

Cooperative Extension Service
College of Tropical Agriculture and Human Resources
University of Hawaii at Manoa

Cooperative Extension Service
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

Animal Waste Management
April 2004
AWM-2

A Portable Dry-Litter Pig Pen

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Water, too often taken for granted, is of critical importance in island ecosystems. Water bodies, such as streams and coastal ocean areas, as well as underground drinking water sources, need to be protected from the many pressures and contaminations created by increasing human and livestock populations. The goal of the small-scale swine waste management system described here is to help island communities by developing beneficial uses of pig manure while protecting water resources from being polluted by the nutrients in pig wastes that may run off or leach from pig pens. The system is applicable for backyard or small-farm pig husbandry, where allowable under local zoning regulations, in Hawaii and other regions of the Pacific.

This portable dry-litter (PDL) pen system was introduced by the authors in American Samoa in 2002. It is easy to install, and it helps recycle plant residues by transforming them into nutrient-rich compost. The pigs are provided a bedding of compostable material such as yard trimmings, crop residues, or shredded municipal green-waste from tree trimming. The bedding helps to absorb pig waste liquids, while the action of the pigs' hooves and rooting helps to break down the solid pig waste and mix it with the bedding. No wash water is used. Bedding material is added on a regular basis to keep the animals in a relatively clean environment. For each pen cycle of 4–6 months, up to four animals may be raised until the desired market or slaughter weight is achieved. After each cycle, the pen is moved to a new site, and the process can start again.

This pen system was developed using materials that were available from hardware suppliers in American Samoa. The rigid, galvanized fence panels used are products of the Behlen Manufacturing Co., Columbus, Nebraska, USA; they may not be available everywhere. Such panels are suggested because of their rigidity and durability, but other fencing materials may be substituted.

Materials and tools needed

- four 8-ft pen side fence panels*
- fencing for floor (8 ft x 8 ft)**
- four 6-ft T-posts
- one corrugated galvanized roof panel (10 ft long)
- one 2 x 4-inch piece of lumber (10 ft long)
- coil of tie wire
- post pounder
- drill and 1Ú4-inch bit
- hacksaw or heavy-duty wire cutter
- pliers

*Behlen Mfg. Co. makes various sizes of fencing panels in 16-ft lengths. Panels for pig enclosures usually have the horizontal wires closer together at the bottom; Behlen markets a 42-inch "Combo" panel and a 34-inch "Hog" panel in this style. The panels shown in the photographs are 60-inch "Security" panels with a uniform mesh grid.

**The floor fencing does not need to be rigid or heavy gauge. Pigs usually stop rooting once they encounter a barrier, and the floor is designed to keep them from digging under the side panels and to prevent them from making depressions in the soil that might collect water. Light fencing materials (such as chicken-wire) used for the pen floor may need to be replaced with each pen cycle. Behlen markets a "Handy Panel" with a grid of about 6 x 8 inch mesh, which at 4 x 8 ft would be a convenient dimension; regular construction reinforcing wire used in poured concrete slabs will work as well.

Ideal location for a PDL pen

The location of a PDL pen is important from both an operations and management standpoint. Choose a site that is level and shaded so that the pigs are protected

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from the sun. If possible, the site should be close to or within the area from which the bedding materials are obtained and also where the compost will be applied. This makes it easier to collect the bedding materials and distribute the compost. Make sure the PDL pen site is set back far enough from any streams and well heads—normally 50 feet from streams and up to 1000 feet from wells (allowable set-back distances will vary according to local environmental protection regulations).

Building the pen

1. Use the hacksaw or wire cutter to cut the side-panel fencing to 8-ft lengths.
2. Lay the floor wire on the ground chosen for the pen site.
3. Drive the first T-post into the ground at one corner of the floor wire.
4. Attach one fence panel to the T-post with tie wire.
5. Determine the location of the next T-post, drive it, and attach the fence panel to it.
6. Repeat steps 4 and 5 for the remaining T-posts and fence panels.
7. Square up all four sides as you work with each panel; tying the floor wire to the side panels will add greater security from escape.
8. Drill holes near the ends of the 2x4 and wire it to the T-posts on one side of the pen.
9. Drill or punch holes in the corners of the roofing material; attach one edge to the 2x4 and tie the corners of the opposite side directly to the side panels. The roof provides shade and protection from rain.
9. Cover the entire pen floor with 6–8 inches of dry bedding material.
10. Access the pen through a corner opposite the roof.

How the PDL pen works

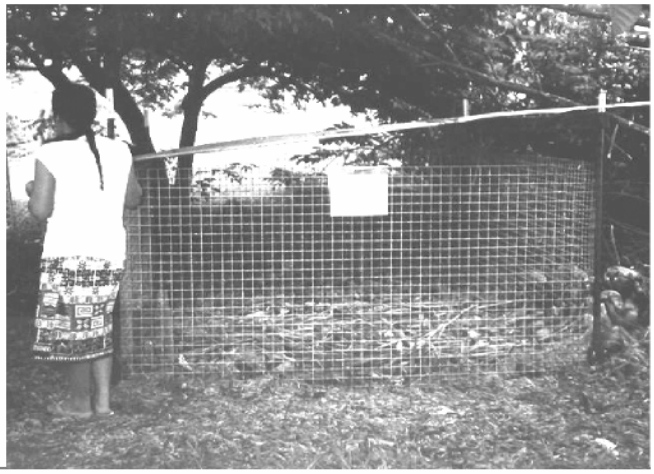
Once the pen is built and the bedding has been added, it is ready to house pigs. The 8-ft square pen area (64 square feet) will accommodate up to four weaned pigs, figuring on at least 15 square feet per pig. The pigs will root through the dry litter material looking for bugs and worms, but the wire floor will prevent them from digging themselves out of the pen and escaping. The wire base also helps to prevent the pigs from creating depressions in the soil that can collect water and breed mosquitoes.

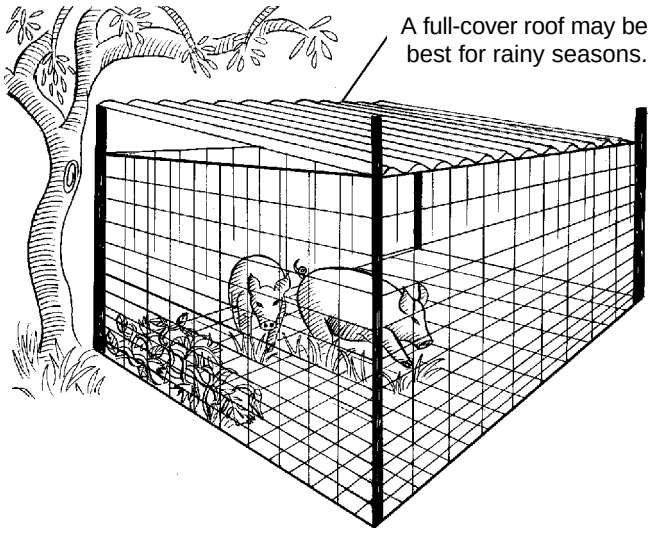
At least twice a week, add new, dry litter to the pen to cover any exposed pig manure. The pigs will use one corner or end of the pen as a dunging area rather than excreting wastes everywhere in the pen. Over time, as more dry litter is added, the material in the pen will build up, and the floor of the pen will rise. With the active stomping and rooting of normal pig behavior, the material becomes a mixture of pig waste and green-waste that will begin to compost.

The PDL pen cycle

Pigs can be kept in the PDL pen for from 4 to 6 months. Once the pigs are slaughtered, the pen cycle is complete. The cycle should not be longer than six months. The pen should be moved, and the mixture of manure

Portable dry-litter pig pens in American Samoa.





and bedding material should be piled and composted.

The pen should be moved after each cycle to prevent concentration and build-up of nutrients from the waste in the soil beneath the pen. Moving the pen allows the site to recover.

To move the pen, remove the 2x4 and roofing material. Scoop out the manure and green-waste mixture to a nearby site prepared for composting. Move the wire base and place it in the new pen location.

If setting up the new pen just next to where it was previously, leave two posts and one side of the pen standing. Remove the other two T-posts and three fence panels. Set up the posts and panels on the opposite side of the standing fence panel. Reattach the 2x4 piece of lumber and roofing material. The pen has thus been moved to a new site and is ready to begin the next pen cycle. This system can be used in four-cycle rotations as shown in the diagram on page 4.

The manure and green-waste mixture

After completion of each pen cycle, the mixture of pig manure and green-waste is ready for composting. For details on the composting process, read CTAHR's publication HG-4 1, *Backyard Composting: Recycling a Natural Product* (see *References).* Following are some basic instructions.

The compost pile should be about as high as its diameter, but usually not more than 3–4 ft high. The pile should be protected from heavy rain and kept moist but not wet.

The interior of the pile should heat up to the point where it is uncomfortable to put your hand into it; this means the decomposition process is proceeding. As the interior of the pile cools, turn it with a spading fork, pitchfork, or shovel so that the parts on the outside are moved to the center of the pile; it should heat up again. Once the pile no longer heats up, the compost process has run out of "fuel."

"Finished" compost is brown and crumbly, and the plant materials that went into it should no longer be recognizable. If this is not the case, screen out the fine material to use as fertilizer and save the coarse material for the next compost cycle, or use it as mulch.

The finished compost is relatively free of disease pathogens if the pile got hot enough. Avoid adding fresh manure to the pile while it is composting, because this may add pathogens that will not be killed in the heating process. Finished compost can be used in the garden or crop field or sold to neighbors and other farmers.

See ADAP publication 2003-3, *Treatment, Storage and Use of Swine Waste Solids,* for ideas on composting swine waste solids. See CTAHR publication AWM- 1, *Composted Animal Manures: Precautions and Processing,* for more information about animal waste management.

Benefits of the PDL pen system

Advantages of the PDL pen system include:

- uses no water for pen cleaning
- discharges no effluent from the pen when properly managed
- low construction cost compared to concrete, cinderblock, or wooden structures
- requires minimal effort or cost to operate and maintain
- produces a beneficial organic fertilizer byproduct to improve the soil and aid crop growth
- requires only a small land area
- reduces fly and mosquito breeding.

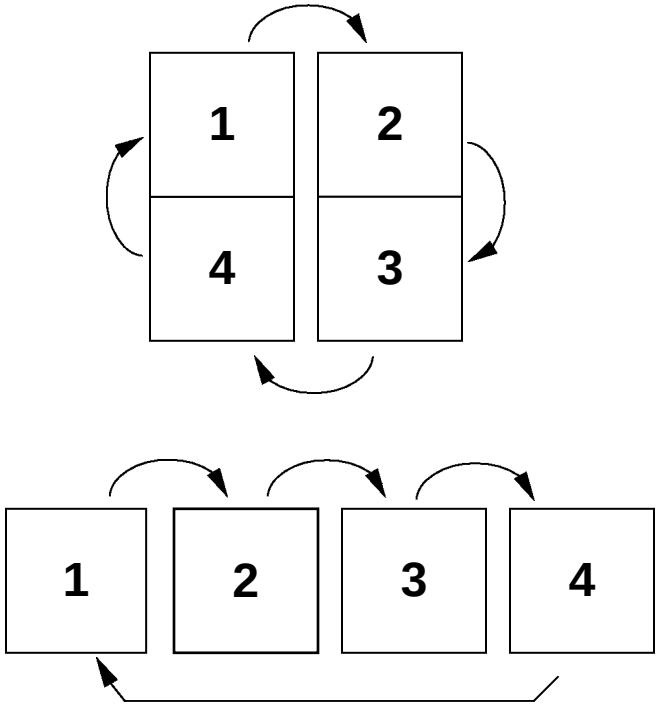
Considerations about the PDL pen system

Here are some things to keep in mind when using a PDL pen system to manage the solid and liquid swine wastes:

- You need a consistent supply of bedding material. A mixture of different materials is preferable. Do not use poisonous plants. Avoid adding weed seeds unless you know how to manage the composting process effectively so that seeds are killed.

- This system is best for small-scale operations.
- It requires relocation after each 4–6-month cycle.
- Flat land is best; it cannot be used on steep or rough terrain.
- It should not be placed over or near groundwater recharge areas (wells, streams, springs) or within a natural drainage area (ditch, stream channel).
- Composting is required to produce a fertilizer that can be used without "burning" sensitive crops.
- The composting process should reach temperatures between 130 and 155F for a couple of weeks to destroy disease organisms in the manure, and weed seeds.
- Local regulations on sites, set-backs, and other guidelines for piggery operations should be followed.

Two examples of a four-cycle PDL pen rotation.



Benefits of using compost include:

- increased soil fertility, aeration, and water-holding capacity
- increased soil organic matter content and microbial activity
- increased soil resistance to erosion
- suppressed levels of plant pathogens and soil nematodes.

Summary

The portable dry-litter pen system is a practical option for small-scale piggery operations. It adapts the concept of the dry-litter waste management system developed for commercial swine operations in Hawaii, combining it with rotational grazing and cropping strategies and the goal of recycling through composting. The system is relatively inexpensive and adaptable to locations with limited land area. No water is used for pen cleaning, thus reducing the threat of pollution of groundwater sup-plies and surface water bodies.

Acknowledgment

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For additional information

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APPENDIX D

Composting

Types of Regulatory Oversight on Agricultural Composting/Reclamation Facilities
Related to Greenwaste and Animal Waste (Manure)[1]

Facilities and Sources of Materials	Application of Finished Product: Onsite	Application of Finished Product: Offsite
Agricultural Farms		
onsite green only	listed exemption[2]	minor source exemption (1)[3]
onsite manure only	listed exemption[2]	minor source exemption (2)[3]
onsite green and manure	listed exemption[2]	minor source exemption (2)[3]
onsite green, offsite manure	minor source exemption (1)[3]	general permit
offsite green only	if <3,000 tons/year - permit by rule if >3,000 tons/year - general permit	if <3,000 tons/year - permit by rule if >3,000 tons/year - general permit
offsite manure only	general permit	general permit
offsite green, onsite manure	minor source exemption (2)[3]	minor source exemption (2)[3]
offsite green, offsite manure	general permit	general permit
use of "other" feedstock	general permit	general permit

Notes:

1. This regulatory oversight is for agricultural composing/reclamation facilities only. Solid waste rules only apply to solid waste recycling, reclamation, salvage, transfer or disposal facilities. Thus, placement of reclaimed materials as soil amendment is not considered a solid waste activity, unless it is done as a disposal activity, including open dumping.
2. Facilities under listed exemption do not need obtain a permit for composting, provided that the greenwaste and manure resulted from the production of agricultural products. If animal manure is used, facilities must meet the "Guidelines for Livestock Waste Management", which is overseen by Waste Water Branch.
3. Permit exemption based on minor source determination is provided on a case-by-case basis. Facilities under permit exemption (1) and (2) must contact Solid Waste Section at (808)-586-4226 to obtain exemption. Facilities under permit exemption (2) must meet the "Guidelines for Livestock Waste Management", which is overseen by Waste Water Branch.

*Department of Health does not evaluate and approve the use or sale of the compost produced in these listed or minor source exemption facilities. These facilities should ensure proper composting and pathogen reduction and alert user or purchaser of the compost that it contains animal manure.

Composting Livestock or Poultry Manure

Compost not only describes the completed degradation of a mixture of materials; it also denotes the process that materials undergo before becoming compost. A workable definition for compost is that it is an organic soil conditioner that has been stabilized to a humus like product, is free of viable human and plant pathogens and plant seeds, does not attract insects or vectors, can be handled and stored without nuisance, and is beneficial to the growth of plants. A more useful explanation of the process of composting is the controlled biological process of the decomposition of organic materials into a humus rich product that can be used beneficially as a soil amendment or in erosion control techniques.

Compost is produced through the activity of aerobic microorganisms that require oxygen, moisture and food. These microorganisms generate heat, water vapor and carbon dioxide as they transform raw materials into a compost product. Effective composting begins with a basic knowledge of the material or feedstock properties, the general principles of decomposition and a method for controlling the process.

What Factors Influence Composting?

There are a few feedstock characteristics that are most influential in the composting process. These include carbon to nitrogen ratio (C:N ratio), moisture content, and the size and distribution of the feedstock particles. Raw materials blended to provide a C:N ratio between 25:1 and 30:1 is ideal for active composting, although initial C:N ratios from 20:1 to 40:1 consistently give good composting results.

High quality mature compost

When ratios fall outside this range, odor problems and longer composting times can be the result. Too little moisture, as well as too much moisture, can lead to poor composting conditions and decreased microbial activity. A moisture content ranging between 40-60% usually provides the water levels needed by microbes without saturating the required air pore space within the

compost matrix . With regard to particle size distribution, a size of 90 percent cumulative passing through 2 to 3 inch openings usually is sufficient to provide a composting substrate with adequate surface area for microbial degradation and with adequate porosity for the storage of oxygen.

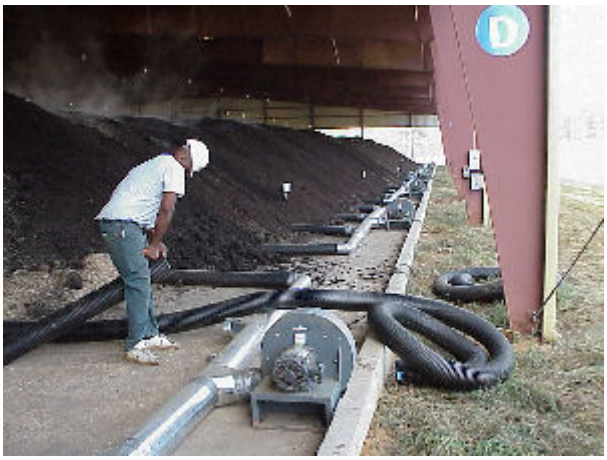
Methods of Manure Composting

Harnessing the natural process of decomposition to best serve a purpose within a set of specific parameters is the basis for composting systems. There are four general composting groups or methods commonly used by the composting industry:

- Aerated Manure Composting
- Composting Manure in Windrows
- In Vessel Composting of Manure
- Passive Composting of Manure
- Vermicomposting Animal Manure

Aerated Composting

Aerated static pile composting modifies the passive composting technique by using blowers to supply air to the composting feed stocks. This process does not involve turning and/or agitation of the piles after the initial mixture of feed stocks. Bulking agents are often used to help maintain the porosity structure of the piles, which aids in pile aeration. Electronic feedback controls are often used to monitor the pile temperature and control the operation of aerating blowers.



Windrow composting

Windrow composting is similar to passive composting although the piles of materials are turned or aerated by mechanical equipment to maintain optimum conditions. Materials are placed in long rows where the actual size and shape of the windrow are dependent upon the feed stocks

and type of turning equipment. Dimensions of the windrow normally range from three feet to twelve feet high and anywhere between eight to twenty feet wide. Mechanical turning is usually done with a front-end loader or a machine specifically designed for turning windrows

In-Vessel Composting

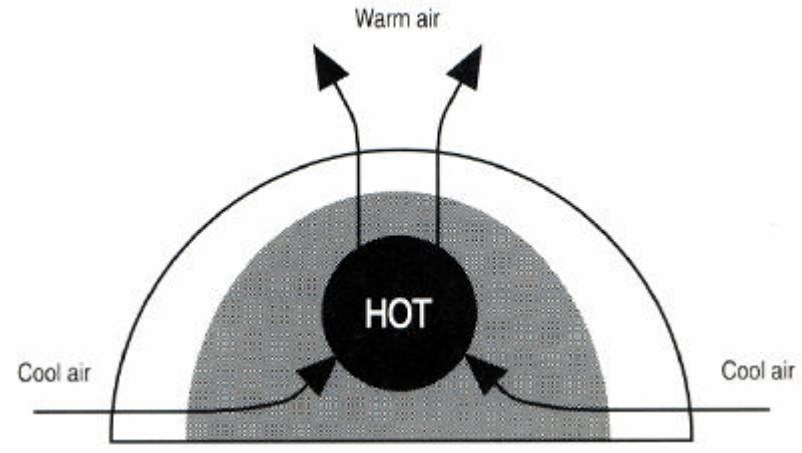
In-vessel composting refers to any type of composting that takes place inside a structure, container or vessel. Each type of system relies upon mechanical aeration and turning to enhance and decrease the duration of the composting process. The goal of in-vessel composting systems is to combine various composting techniques into one controlled environment, which utilizes the strength and minimizes the weakness inherent to other forms of composting.

Farmers Automatic composting system – mechanically aerated in-vessel

In-vessel composting system used for poultry manure

Passive Composting

Passive composting is probably the most common method used today because it involves simply stacking feed stocks and leaving them to compost over a long period of time. Very little, if any activity is performed on the pile once it has been constructed. Initial composting parameters can be controlled but are not usually maintained during the entire process. This process relies on mother nature to draw cool air and oxygen into the pile as the warm air is released. This process is commonly referred to as the chimney effect.



Worm Composting

Vermicomposting is a process that relies on earthworms and microorganisms to help stabilize active organic materials and convert them to a valuable soil amendment and source of plant nutrients. Earthworms will consume most organic materials, including animal manure, agricultural crop residues, organic byproducts from industries, yard trimmings, food preparation scraps and leftovers, scrap paper, and sewage sludge.

Of the more than 4,000 species of earthworms, only half a dozen are used for vermicomposting worldwide. The earthworm species most frequently used for vermicomposting is *Eisenia fetida*, which is commonly called Red Wiggler.

How To Choose A Vermicomposting System

A variety of methods may be used to process large volumes of organic residuals with earthworms, ranging from land and labor-intensive techniques to fully automated high-tech systems. Types of systems include windrows, beds, bins, and automated raised bioreactors. Choosing which vermicomposting system to use will depend upon:

- Amount of feedstock to be processed
- Funding available
- Site and space restrictions
- Climate and weather
- State and local regulatory restrictions
- Facilities and equipment on hand
- Availability of low-cost labor

Swine Manure Vermicomposting, Vermicycle Organics, Tarboro, NC

Dairy Manure Vermicomposting, Worm Power, Geneseo, NY

What Are the Advantages In Using Vermicompost?

Earthworm casts are covered with mucus from their intestinal tract; this layer provides a readily available carbon source for soil microbes and leads to a flush of microbial activity in fresh casts. Vermicompost improves soil structure, reduces erosion, and improves and stabilizes soil pH. In addition, vermicompost increases moisture infiltration in soils and improves its moisture holding capacity.

Plant growth is significantly increased by vermicompost, whether it is used as a soil additive, a vermicompost tea, or as a component of horticultural soilless container media. Vermicompost causes seeds to germinate more quickly, seedlings to grow faster, leaves grow bigger, and more flowers, fruits or vegetables are produced. These effects are greatest when a smaller amount of vermicompost is used—just 10-40 percent of the total volume of the plant growth medium in which it is incorporated. Vermicompost also decreases attacks by plant pathogens, parasitic nematodes and arthropod pests.


Turnips: 0%, 10%, 20% vermicompost by volume added to field plots, Biological & Agricultural Engineering, NC State University

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College of Tropical Agriculture & Human Resources
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AWM-1

Composted Animal Manures: Precautions and Processing

Compost is made by recycling organic materials such as yard trimmings, wood chips, food scraps, and animal manures in a controlled process. The process employs microorganisms to transform the raw materials so that they are no longer recognizable. Finished compost is a crumbly, earthy-smelling, dark material that looks like a commercial potting-soil mixture. Used as a soil amendment, compost can

- improve soil structure, making the soil easier to cultivate and encouraging root development
- provide plant nutrients and enable their increased uptake by plants
- aid water absorption and retention by the soil, reducing erosion and run-off and thereby protecting surface waters from sedimentation
- help bind agricultural chemicals, keeping them out of waterways and protecting groundwater from contamination
- increase levels of beneficial soil organisms

Quality compost is thoroughly decomposed and pathogen-free. Pathogens hazardous to human health can be introduced to compost when animal manures (urine and feces) are used as raw materials. Various kinds of animal manures are available in Hawaii, and this publication is written to inform those who might be considering the use of animal manures in composting.

Indiscriminate use of compost products that contain pathogens can create health risks for humans and animals by dispersing pathogens into the environment. Therefore, it is important that when animal manures are used, the resulting compost products have been sufficiently sanitized to reduce pathogen contents to levels lower than those normally considered "risk levels."

Composting and sanitization

In composting, many types of nonpathogenic microorganisms transform complex organic materials into simpler compounds through the decomposition processes of mineralization and humification. When a compost pile is correctly constructed and managed, the activity of these decomposer microorganisms generates heat sufficient to kill pathogenic microorganisms. If the right conditions are not present for the decomposition activity to generate heat, the process may not result in sanitization.

For sanitization to take place during the composting process, the entire mass of organic material must be exposed to lethal temperatures for a suitable length of time. Because these temperatures develop in the interior of the pile, turning the pile is an important part of compost management. Undecomposed material from the top and sides of the pile are rotated toward its center by turning the pile. After several turnings, usually at intervals ranging from one to three weeks, all of the materials in the pile should have been exposed to the conditions that result in sanitization.

Composting is completed when the pile no longer generates heat and the original organic materials are no longer recognizable. The composting process has then reached an endpoint and is more or less biologically stable. Finished compost is not a good substrate for growth of pathogens, but if it has been recontaminated with fresh manure, it may act as a carrier for pathogens.

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Departments of [1]Animal Sciences and [2]Agricultural and Resource Economics

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General guidelines for attaining sanitization of composts that include animal manures are the following:

- If composting materials are contained in a vessel and temperatures are uniform throughout the mass of composting materials, a minimum of three consecutive days with compost temperature above 55C (131F) is required to achieve sanitization.
- If composting materials are in a turned pile or turned windrow system, the requirement is a minimum of 15 days in which temperatures in the pile are above 55C and five turnings during that high-temperature composting period.
- The finished compost must be biologically stable so that pathogen regrowth from the pile itself does not occur.
- Finished compost must not be reinoculated by contaminated equipment (loaders and turning devices), by the addition of unprocessed feedstock (fresh or partially composted animal manures), or by leachate run-off from another pile.

Temperature of a compost process can be quantitatively measured and controlled to ensure an adequate level of sanitization. Although there are no federal regulations on composting manures, the U.S. Environmental Protection Agency's "503" regulations for biosolids composting provide guidelines on monitoring temperatures for pathogen reduction.

Because a rise in temperature during composting is the direct result of bio-oxidation activity by microbes, conditions promoting bio-oxidation should be encouraged by careful planning and management of the composting process. These conditions include adequate moisture and aeration, as well as a sufficiently low carbon-nitrogen ratio of the aggregate raw materials of the compost pile. The carbon-nitrogen ratio is low for materials such as fresh lawn clippings and animal manures (around 20 parts carbon to 1 part nitrogen). The carbon-nitrogen ratio is high in materials such as sawdust or wood chips (where the ratio may be 400 parts carbon to 1 part nitrogen). The composting process is slowed—and microbial heat generation is inhibited—by insufficient amounts of materials rich in nitrogen (such as fresh, green plant materials, food scraps, or animal manures) in relation to the amounts of carbon source (such as wood chips, shredded paper, dry vegetation like straw or palm fronds, and other such organic materials high in lignin and cellulose).

The finished compost product should be analyzed to determine the extent of sanitization before it is marketed. Laboratories use two general methods to determine the pathogen content of composts, waters, and other media suspected to be sources of pathogens. The first method is to search for a particular pathogen, such as *Salmonella* species. Finding such a pathogen indicates a problem. The second method is to measure the populations of particular "indicator" groups of pathogens, such as total coliforms (of which *E. coli* is one) or fecal streptococci. If the populations of these indicator groups are low, it is statistically probable that the numbers of individual pathogens of particular concern that are known to be associated with these groups (although in much smaller numbers, proportionally) is also low. Low numbers of an indicator group allows the assumption that the associated pathogens of particular health concern are not present.

Pathogenic microorganisms

A different group of pathogens is present in human wastes (Table 1) than is present in animal manures (Table 2). A comparison of these lists reveals the following:

- Viruses that infect humans are not found in animal manures.
- Few fungal diseases of importance to humans are found in animal manures, although some pathogenic fungi found in the environment can take up residence in excreted animal manures and thus get into compost.
- Bacterial diseases are present in animal manures, and among them the most important threat to human health is *Salmonella* sp.

Protozoan and helminth parasites may be present in animal manures and are a potential public health problem. Infection by these organisms mainly occurs when fresh animal manures are handled. Composting greatly reduces their numbers, although if lethal temperatures are not reached in the process, eggs of some helminth parasites can survive to pose a health threat. The threat of helminth parasites is virtually eliminated if the feces of dogs, cats, and carnivores in general are not included for composting.

What happens to pathogenic microorganisms after they leave their host?

When fecal pathogens leave their host, they are exposed to the rigors of the external environment. Most pathogens cannot survive long or reproduce outside of their host, but under favorable environmental conditions, there are some that can endure. Composting conditions are not a suitable environment for pathogens and make their survival more difficult. Managing the conditions of the composting process to eliminate pathogens involves manipulating the compost pile's contents, moisture level, and oxygen supply to favor development of decomposing microorganisms that create an environment in which it is difficult for pathogens to survive. Factors affecting the composting process as related to pathogen survival are discussed in the following paragraphs.

Available organic material and nutrients. The survival of pathogens in animal waste depends on the availability of suitable food—organic materials that they can metabolize. Pathogenic bacteria and fungi generally can metabolize readily available organic compounds such as the simpler alcohols, organic acids, and sugars, whereas they generally cannot metabolize complex compounds such as cellulose, lignin, and humic compounds. This limitation places the pathogens present in animal manures in an unfavorable competitive position with respect to the nonpathogenic, decomposer microorganisms that are indigenous to the rest of the materials normally present in a compost pile and are normally present in far greater numbers. Pathogen metabolism and growth are thus limited by shortage of utilizable organic materials and nutrients.

Moisture. The moisture level in fresh animal manures is usually adequate to support pathogen growth. Moisture levels suitable for composting to proceed also are suitable for pathogen survival. However, at moisture levels lower than 25 percent, all microbial growth slows and eventually ceases. If the moisture content of cured, stabilized compost remains lower than 25 percent, conditions are not conducive to regrowth of pathogens. Unfortunately, compost at such moisture levels is difficult to use because it is too dry, and its dust may cause allergic reactions in some people. For practical use of finished compost, its optimum moisture content is 40–60 percent. Therefore, manipulating the moisture

Table 1. Possible pathogens found in human waste.

Pathogen	Disease
Virus	
Enterovi rus	Gastroenteritis
Rotavirus	Gastroenteritis
Parvovirus	Gastroenteritis
Adenovirus	Respiratory infections
Hepatitis A virus	Viral hepatitis
Polio virus	Poliomyelitis
Coxsackie virus	Meningitis
Bacteria	
Salmonella (1700 serotypes)	Salmonellosis
Shigellae	Shigellosis
Mycobacterium tuberculosis	Tuberculosis
Vibrio cholerae	Cholera
Escherichia coli	Gastroenteritis
Yersinia enterocolica	Gastroenteritis
Clostridium perfringens	Gastroenteritis, gangrene
Clostridium botulinum	Botulism
Listeria monocytogenes	Encephalitis
Fungi	
Candida sp.	Mycoses (skin and systemic)
Tricosporon cutaneum	Skin mycosis
Aspergillus fumigatus	Lung mycosis
Trichophyton sp.	Skin mycosis
Epidermophyton sp.	Skin mycosis
Microsporum sp.	Skin mycosis
Protozoa	
Entamoeba sp.	Amoebic dysentery
Giardia lamblia	Giardiasis
Balantidium coli (rare)	Dysentery
Naegleria fowleri	Primary amoebic meningoencephalitis
Acanthamoebe (rare)	Meningoencephalitis
Helminths	
Ascaris lumbricoides	Human large round worm
Ancylostoma sp.	Hookworm
Necator amaricanus	Common hookworm of man
Enterobius vermicularis	Human pinworm
Strongyloides stercoralis	Small roundworm
Trichuris trichiura	Human whipworm
Taenia solium	Human tapeworm
Hymenolepsis nana	Dwarf tapeworm

level during the composting process is not a convenient method for affecting pathogen survival.

Temperature. The ability of pathogenic microorganisms to survive under high temperatures varies from one group to another and with the prevailing environmental conditions. The most dangerous of the pathogens in animal manures, such as *Salmonella* sp. and some serotypes of *E. coli,* are not thermophilic (heat-loving), do not form heat-resistant spores, and can be eliminated by heat treatment. The threshold of heat resistance, or tolerance, of an individual type of pathogen must be surpassed for sanitation to be effective. Whether a particular heat level is lethal is a function of both the temperature reached and the duration of exposure to that temperature.

Oxygen supply. Decomposition occurring during composting is primarily the result of aerobic microorganisms performing biological oxidation reactions, so an adequate air supply is required. The increased temperatures resulting from such reactions in a compost pile cannot occur unless sufficient oxygen is available. In the absence of oxygen, anaerobic microorganisms are

Table 2. Possible pathogens found in animal waste.

Pathogen	Disease	Host
Virus	None	
Bacteria		
Salmonella (1700 serotypes)	Salmonellosis	Animals and birds
Shigella sp	Bacillary dysentery	Nonhuman primates
Escherichia coli	Gastroenteritis	Many animal hosts
Mycobacterium sp. (very rare)	Tuberculosis	Cattle, via milk
Yersinia enterocolica (rare)	Gastroenteritis	Animals and poultry
Clostridial diseases	Gastroenteritis, gangrene, botulism	Normal intestinal flora and soil
*Leptospira interrogans**		
Listeria monocytogenes	Encephalitis	Animals, birds and soil
Campylobacter (Vibrio)	Gastroenteritis	Cattle and sheep
Chlamydia psittaci	Psittacosis	Birds
Fungi		
Candida sp.	Mycoses (skin and systemic)	Animals,birds,fruit,environment
Aspergillus fumigatus	Lung mycosis	Environment
Protozoa		
Giardia lamblia	Giardiasis	Animals, esp. beaver and muskrat
Balantidium coli (very rare)	Dysentery	Swine and primates
Cryptosporidia	Dysentery	Animals, esp. calves
Toxoplasma	Toxoplasmosis	Cats
Helminths		
Ascarids *(A. suum)*	Large round worm	Swine
Toxocara *(T.canis and T.cati)*	Visceral larva migrans Ocular larva migrans	Dogs and cats
Ancylostoma sp.	Hookworm disease	Dogs and cats
Echinococcus (tapeworm)	Hydatid disease	Dogs
Strongyloides stercoralis	Small roundworm	Dogs and cats

**Leptospira interrogans* is shed from the animal via the urine and may contaminate the feces. However, these organisms do not survive in dry environments nor do they survive the composting process.

favored, and their activities do not cause heat to be generated to the extent needed for sanitation. Therefore, compost piles should be prevented from becoming too wet and should be turned to improve aeration.

Microbial competition and antagonism. The number of indigenous (native, or natural) microorganisms involved in composting is enormous. By contrast, the population of pathogenic microbes in a compost pile is usually numerically small. When the conditions of composting mentioned in the preceding paragraphs are ideal for decomposer microorganisms, they are less than ideal for pathogenic microorganisms. By their sheer numbers, the decomposers can effectively compete for food sources, starving out the pathogens. Pathogens also can come under direct attack and be consumed by certain decomposers.

How are pathogens measured and monitored?

To avoid the necessity of analyzing compost for all types of pathogens, it is common to analyze for "indicator" microorganisms. Because of the wide array of pathogens that could be present in raw animal manures, a thorough analysis of a compost pile for its entire pathogen content would be expensive. It is more practical to select a few representative pathogens that are easy to identify and quantify and are likely to be present in most animal manures. However, one of the most controversial aspects of the production of safe compost is the degree to which indicator organisms must be reduced in order to have an adequate level of sanitization.

Research has shown that counts of total coliforms, fecal streptococci, enterobacteria, certain viruses, and parasite ova can serve as indicators. For an indicator microorganism to be reliable, it must satisfy four requirements:

- It must be present in sufficiently great numbers in the raw material being composted.
- It must have the same reactions to conditions (for ex-ample, the same heat-resistance threshold) as the pathogen or group of pathogens it is being used to indicate.
- It must have a resistance threshold greater than that of the targeted pathogens.
- Tests for its presence and counts of its numbers must be simple and inexpensive.

The methodology which seems to be increasingly used by laboratories for pathogenicity evaluation of compost products is to test for the presence of *Salmonella* species, a particularly important pathogen, or to test for two indicator groups microorganism, total coliforms and fecal streptococci.

Summary

The possible presence of pathogenic microorganisms in compost is a major challenge for compost producers. Composted animal manures can be used in many beneficial products, but they must be properly processed. By *not* using wastes from dogs, cats, and other carnivores (including used bedding materials and "litter" products), a substantial part of the potential risk to human health from composting animal manures can be avoided. The most important conditions with respect to sanitization are

- The composting process must be thorough: all parts of the compost pile—the entire mass of organic materials—must be exposed to temperatures of 55C (131F) or more and maintained at that level for at least three days.
- The composting process must be complete: finished compost is biologically stable and no longer conducive to the growth of pathogens.
- The finished compost must not be reinoculated with pathogens.

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Composted Swine Manure for Vegetable Crop Application

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Swine waste or crop fertilizer?

One way to manage swine waste is to spread it on agricultural land, but few swine producers have enough land to which to apply all the waste generated by their operation. Crop producers wishing to use swine waste on their land must address issues such as the cost of transporting liquid waste and the limits on waste use imposed by food safety certification requirements. Composting can help address these concerns. Processing the liquid waste by composting it eliminates the need to transport and apply liquids. Food safety certification for vegetable crops does not allow use of raw manure but does allow the use of properly composted livestock waste. Composting thus has the potential to allow the recycling of swine waste nutrients in a sustainable and environmentally friendly manner.

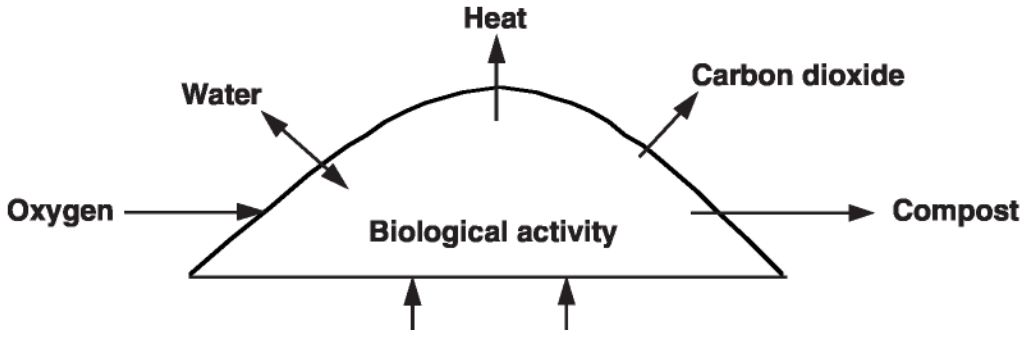
What is composting?

Composting is the biological breakdown of organic matter. It starts with a mixture of materials such as manure, food processing or yard wastes, or waste silage, which decompose in the presence of oxygen. Properly done, with a suitable mixture of carbon and nitrogen source materials and adequate moisture and aeration, composting forms a rich, humus-like material valued for its soil-conditioning qualities. Temperatures in the pile above 130°F, generated by microbiological activity, will kill many disease organisms.

Compost is known to increase nutrient retention and soil water-holding capacity and improve soil structure. Compost added to the soil provides organic matter, macronutrients (N, P, and K), and micronutrients.

A demonstration of composting in Hawai'i

The development and implementation of best nutrient management practices appropriate to Hawai'i farms is important to protect our waters. Our swine waste composting project was designed to demonstrate this alternative livestock waste management practice, using the facilities of the largest swine production operation in the Waimanalo Stream watershed, by diverting some waste from their anaerobic lagoon to composting.



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Composting was followed by a demonstration of land application of compost at agronomic rates on an adjoining vegetable farm using radishes and corn as test crops. The location for the project was selected because Waimanalo Stream on O'ahu, among others in Hawai'i, has been identified as an impaired water body.

Making compost

Two composting piles were made at the Waimanalo swine farm. A sheet of high-density polyethylene was used to line the composting area, and the edges of the liner were raised over a 3-inch diameter PVC pipe to create a berm. Leachate and excess runoff drained from the liner through a screen and were collected in a 45-gallon plastic drum set in the ground below the level of the composting area. Leachate collected in the drum was pumped back to the existing waste collection system.

About 2.7 tons of coarse (drum-chipped) tree trimmings formed each pile (11 ft long x 10 ft wide). We calculated that adding enough nitrogen to obtain a carbon to nitrogen (C:N) ratio of 30:1 would require 2700 gallons of the swine waste effluent. To avoid applying excessive liquid resulting in runoff, we applied approximately 750 gallons of swine effluent to each pile.

The piles differed in the manner of aeration. The static (unturned) pile was aerated through a perforated 4-inch pipe under the pile; a household vacuum cleaner was used to push air through the pipe. A front-end loader was used to mix and aerate the active (turned) pile.

Composting results

Five essential components are needed for composting: the proper decomposing organisms, and the water, carbon, nitrogen, and oxygen needed by the organisms. We assessed our experiment in relation to these components.

Decomposing organisms produce heat by their activity. This heat in turn energizes them, and the whole process goes faster if adequate food sources are present. Using a thermometer to take pile temperature, the level of composting activity was easily determined.

Water should keep a compost pile moist but not too wet. During the first two months of composting, the piles tended to be too dry. This was followed by a very rainy period, which resulted in wet piles, cooler than optimal temperatures, and a slower composting process.

Carbon (C) is abundant in most organic materials and is used as food by decomposing organisms to create energy. The coarsely chopped tree trimmings were high in carbon but had little nitrogen compared with grass clippings, green leaves, or animal manure. The coarseness (up to 8 inches long) of the material kept the piles fluffy and allowed natural air flow through the compost but necessitated longer composting times.

Nitrogen (N) is required by decomposers. The low nitrogen content of the swine effluent made it impossible to apply nitrogen in the amounts needed by decomposers. The low amount of effluent (nitrogen source) increased the C:N ratio well above the optimum 20–30 parts carbon for each part nitrogen and slowed the composting process.

Oxygen is essential to most decomposers. After turning, the turned pile's temperature increased dramatically due to the increased aeration. With the unturned, blower-aerated pile, the anticipated composting process was limited, as indicated by low pile temperatures. When the blower was turned off, the pile temperature greatly in-creased, suggesting that the added air might be cooling and drying the pile too much.

Safety

Safety of the composted product is important when applying it to vegetables, such as radishes, that are normally eaten raw. Both compost piles reached a temperature higher than 130ûF for more than the 3 days needed to destroy disease organisms. Compost from both piles was negative when tested for salmonella bacteria, confirming its suitability for application on land used to grow vegetables.

Turning the compost pile.

Applying compost to cropland

Frequent rains delayed land application of the compost and crop planting. Compost and soil samples were analyzed for nutrients at the UH-CTAHR Agricultural Diagnostic Service Center. Because soil phosphorus was adequate, compost application rates were based on estimated crop phosphorus removal. Compost was applied at 10 tons of compost per acre, or about ₁Ú₂ pound per square foot, and tilled into the soil. Compost application was compared with the farmer's standard commercial fertilizer application. The field was made into beds with each bed planted with two rows of radishes and one row of corn between them. The crops were irrigated following normal farm practice.

The test planting.

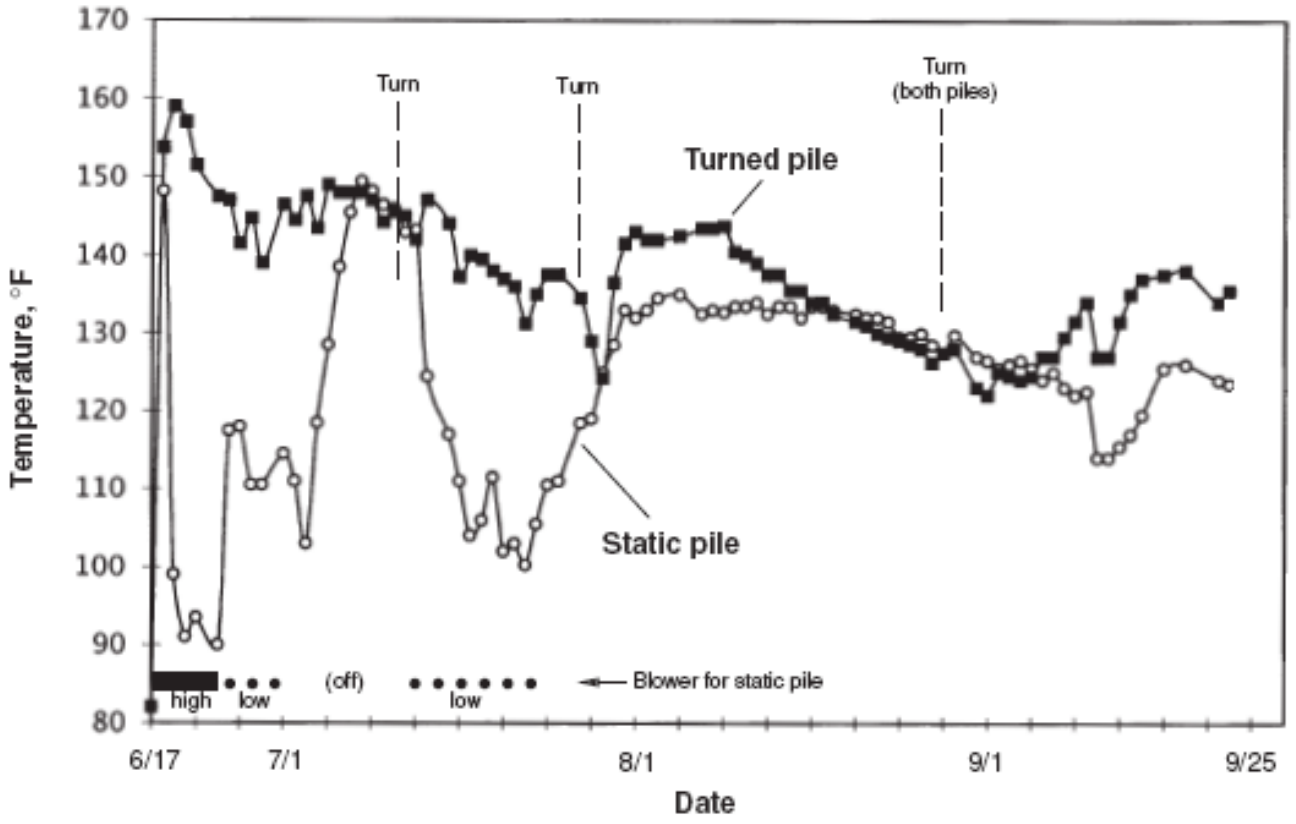
Cropping results

Soil nutrients and the yield response of radishes and corn to the compost were evaluated.

Pre-plant soil tests showed sufficient soil phosphorus for the crops to be grown. By having the soil test results, the farmer was able to save money by not applying inorganic phosphorus.

Radishes grown with compost had a greater total yield but a lower saleable yield because of cracking. High

Average internal compost pile temperature.



rainfall and planting of a susceptible variety contributed to the cracking problem.

Corn grown with compost had 20% higher mean cob weight and total yield per acre than corn without compost.

Postharvest soil tests showed final soil nutrient levels (except magnesium) were lower in composted rows than in rows treated with inorganic fertilizer, possibly due to increased plant nutrient uptake.

Summary and recommendations

- Turned-windrow composting performed much better than static piles.
- The compost was easy to handle and did not require specialized equipment. Operating costs were low, making composting affordable for a small-scale swine producer.
- Assessing moisture with a hay moisture tester in addition to measuring temperature would provide better monitoring of the composting process.
- Composting time could be reduced by using finer tree trimmings and by applying more swine effluent to the compost pile.
- Composting under a roof or cover would protect the piles from rainfall but would greatly increase start-up costs, so composting may be better suited for leeward-area swine farms receiving less rainfall.
- Where the soil is suitable, making the compost pile on compacted soil would reduce costs compared to using a plastic liner.
- There was very little unpleasant odor except during effluent addition. The compost produced had an earthy odor and texture and was judged to be a marketable product.
- Ensuring three days of internal pile temperature over 130°F destroyed disease-causing organisms such as salmonella.
- Soil testing can assist farmers in reducing fertilizer costs.
- Applying compost is recommended for farmers growing corn.
- When designing livestock waste management systems, the products should be tested to ensure suit-ability for land application and to determine crop response.

APPENDIX E

Applicable
Federal and State Regulations

Applicable Federal and State Regulations.
There are three levels of regulative administration: 1) The Code of Federal Regulation, Title 40, Protection of Environment (40 CFR); 2) Hawaii Revised Statutes (HRS) and 3) Hawaii Administrative Rules (HAR), Title 11, Department of Health. The provisions provided herein are condensed and should not be viewed that it is in their entirety.

40 CFR (Part 122)
Authority: The Clean Water Act, 33 U.S.C. 1251 *et seq*.
Source: Nov. 2008 Compiled CAFO NPDES Regulations and Effluent Limitations Guidelines and Standards

§122.23(a) Scope
Concentrated animal feeding operations (CAFOs), as defined in paragraph (b) of §122.23 or designated in accordance with paragraph (c) of §122.23, are point sources, subject to NPDES permitting requirements as provided in this section. Once an animal feeding operation is defined as a CAFO for at least one type of animal, the NPDES requirements for CAFOs apply with respect to all animals in confinement at the operation and all manure, litter, and process wastewater generated by those animals or the production of those animals, regardless of the type of animal.

§122.23(b)(2) Concentrated animal feeding operation ("CAFO")
CAFO means an AFO that is defined as a Large CAFO or as a Medium CAFO by the terms of §122.23, or that is designated as a CAFO in accordance with paragraph (c) of §122.23. Two or more AFOs under common ownership are considered to be a single AFO for the purposes of determining the number of animals at an operation, if they adjoin each other or if they use a common area or system for the disposal of wastes.

§122.23(b)(4) Large concentrated animal feeding operation ("Large CAFO").
An AFO is defined as a Large CAFO if it stables or confines as many as or more than the numbers of animals specified in any of the following categories:
(i) 700 mature dairy cows, whether milked or dry;
(ii) 1,000 veal calves;
(iii) 1,000 cattle other than mature dairy cows or veal calves. Cattle includes but is not limited to heifers, steers, bulls and cow/calf pairs;
(iv) 2,500 swine each weighing 55 pounds or more;
(v) 10,000 swine each weighing less than 55 pounds;
(vi) 500 horses;
(vii) 10,000 sheep or lambs;
(viii) 55,000 turkeys;
(ix) 30,000 laying hens or broilers, if the AFO uses a liquid manure handling system;
(x) 125,000 chickens (other than laying hens), if the AFO uses other than a liquid manure handling system;
(xi) 82,000 laying hens, if the AFO uses other than a liquid manure handling system;
(xii) 30,000 ducks (if the AFO uses other than a liquid manure handling system); or
(xiii) 5,000 ducks (if the AFO uses a liquid manure handling system).

§122.23(b)(6) Medium concentrated animal feeding operation ("Medium CAFO").
The term Medium CAFO includes any AFO with the type and number of animals that fall within any of the ranges listed in paragraph (i) of this section and which has been defined or designated as a CAFO. An AFO is defined as a Medium CAFO if:

(i) The type and number of animals that it stables or confines falls within any of the following ranges:
  (A) 200 to 699 mature dairy cows, whether milked or dry;
  (B) 300 to 999 veal calves;
  (C) 300 to 999 cattle other than mature dairy cows or veal calves. Cattle includes but is not limited to heifers, steers, bulls and cow/calf pairs;
  (D) 750 to 2,499 swine each weighing 55 pounds or more;
  (E) 3,000 to 9,999 swine each weighing less than 55 pounds;
  (F) 150 to 499 horses;
  (G) 3,000 to 9,999 sheep or lambs;
  (H) 16,500 to 54,999 turkeys;
  (I) 9,000 to 29,999 laying hens or broilers, if the AFO uses a liquid manure handling system;
  (J) 37,500 to 124,999 chickens (other than laying hens), if the AFO uses other than a liquid manure handling system;
  (K) 25,000 to 81,999 laying hens, if the AFO uses other than a liquid manure handling system;
  (L) 10,000 to 29,999 ducks (if the AFO uses other than a liquid manure handling system); or
  (M) 1,500 to 4,999 ducks (if the AFO uses a liquid manure handling system); and

(ii) Either one of the following conditions are met:
  (A) Pollutants are discharged into waters of the United States through a man-made ditch, flushing system, or other similar man-made device; or
  (B) Pollutants are discharged directly into waters of the United States which originate outside of and pass over, across, or through the facility or otherwise come into direct contact with the animals confined in the operation.

40 CFR, Part 123, State Program Requirements

§123.25 Requirements for permitting.

(a) All State Programs under this part must have legal authority to implement each of the following provisions and must be administered in conformance with each. In all cases, States are not precluded from omitting or modifying any provisions to impose more stringent requirements:
  (6) §122.23 – CAFO
  (7) § 122.24 – Concentrated aquatic animal production facilities;
  (8) § 122.25 – Aquaculture projects.

40 CFR, Part 144, Underground Injection Control Program

Authority: Safe Drinking Water Act, 42 U.S.C. 300f et seq.;
Resources Conservation and Recovery Act, 42 U.S.C. 6901 et seq.;
Source: 48 FR 14189, April 1, 1983.

§144.12 Prohibition of movement of fluid into underground sources of drinking water.
No owner or operation shall construct, operate, maintain, convert, plug, abandon or conduct any other injection activity in a manner that allows the movement of fluids containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons. The applicant for a permit shall have the burden of showing that the requirements of this paragraph are met.

40 CFR, Part 412, CAFO Point Source Category

Authority: 33 U.S.C. 1311, 1314, 1316, 1317, 1318, 1342, and 1361.
Source: Nov. 2008 Compiled CAFO NPDES Regulations and Effluent Limitations Guidelines and Standards

Subpart A-Horses and Sheep

§412.10 Applicability.
This subpart applies to discharges resulting from the production areas at horse and sheep CAFOs. This subpart does not apply to such CAFOs with less than the following capacities: 10,000 sheep or 500 horses.

§412.13 Effluent limitations guidelines

(a) Except as provided in 40 CFR 125.30 through 125.32 and when the provisions of paragraph (b) of this section apply, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BAT: There shall be no discharge of process waste water pollutants into U.S. waters.

(b) Whenever rainfall events cause an overflow of process wastewater from a facility designed, constructed, operated, and maintained to contain all process-generated wastewaters plus the runoff from a 25-year, 24-hour rainfall event at the location of the point source, any process wastewater pollutants in the overflow may be discharged into U.S. waters.

Subpart B-Ducks

§ 412.20 Applicability.
This subpart applies to discharges resulting from the production areas at dry lot and wet lot duck CAFOs. This subpart does not apply to such CAFOs with less than the following capacities: 5,000 ducks.

§ 412.22 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).
(a) Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart shall achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the (BPT):

Regulated parameter	Maximum daily [1]	Maximum monthly average [1]	Maximum daily [2]	Maximum monthly average [2]
BOD5	3.66	2.0	1.66	0.91
Fecal coliform	(3)	(3)	(3)	(3)

[1] Pounds per 1000 ducks.
[2] Kilograms per 1000 ducks.
[3] Not to exceed MPN of 400 per 100 ml at any time.

Subpart C-Dairy Cows and Cattle Other Than Veal Calves

§ 412.30 Applicability.

This subpart applies to operations defined as concentrated animal feeding operations (CAFOs) under 40 CFR 122.23 and includes the following animals: mature dairy cows, either milking or dry; cattle other than mature dairy cows or veal calves. Cattle other than mature dairy cows includes but is not limited to heifers, steers, and bulls. This subpart does not apply to such CAFOs with less than the following capacities: 700 mature dairy cows whether milked or dry; 1,000 cattle other than mature dairy cows or veal calves.

§ 412.31 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BPT:

(a) For CAFO production areas. Except as provided in paragraphs (a)(1) through (a)(2) of this section, there must be no discharge of manure, litter, or process wastewater pollutants into waters of the U.S. from the production area.

(1) Whenever precipitation causes an overflow of manure, litter, or process wastewater, pollutants in the overflow may be discharged into U.S. waters provided:

(i) The production area is designed, constructed, operated and maintained to contain all manure, litter, and process wastewater including the runoff and the direct precipitation from a 25-year, 24hour rainfall event;

(ii) The production area is operated in accordance with the additional measures and records required by § 412.37(a) and (b).

(2) Voluntary alternative performance standards. Any CAFO subject to this subpart may request the Director to establish NPDES permit effluent limitations based upon site-specific alternative technologies that achieve a quantity of pollutants discharged from the production area equal to or less than the quantity of pollutants that would be discharged under the baseline performance standards as provided by paragraph (a)(1) of this section.

(i) Supporting information. In requesting site-specific effluent limitations to be included in the NPDES permit, the CAFO owner or operator must submit a supporting technical analysis and any other relevant information and data that would support such site-specific effluent limitations within the time frame provided by the Director. The supporting technical analysis must include

calculation of the quantity of pollutants discharged, on a mass basis where appropriate, based on a site-specific analysis of a system designed, constructed, operated, and maintained to contain all manure, litter, and process wastewater, including the runoff from a 25-year, 24-hour rainfall event. The technical analysis of the discharge of pollutants must include:

(A) All daily inputs to the storage system, including manure, litter, all process waste waters, direct precipitation, and runoff.

(B) All daily outputs from the storage system, including losses due to evaporation, sludge removal, and the removal of waste water for use on cropland at the CAFO or transport off site.

(C) A calculation determining the predicted median annual overflow volume based on a 25year period of actual rainfall data applicable to the site.

(D) Site-specific pollutant data, including N, P, BOD5, TSS, for the CAFO from representative sampling and analysis of all sources of input to the storage system, or other appropriate pollutant data.

(E) Predicted annual average discharge of pollutants, expressed where appropriate as a mass discharge on a daily basis (lbs/day), and calculated considering paragraphs (a)(2)(i)(A) through (a)(2)(i)(D) of this section.

(ii) The Director has the discretion to request additional information to supplement the supporting technical analysis, including inspection of the CAFO.

(3) The CAFO shall attain the limitations and requirements of this paragraph as of the date of permit coverage.

(b) For CAFO land application areas. Discharges from land application areas are subject to the following requirements:

(1) Develop and implement the best management practices specified in § 412.4;

(2) Maintain the records specified at § 412.37 (c);

(3) The CAFO shall attain the limitations and requirements of this paragraph by December 31, 2006.

§ 412.32 Effluent limitations attainable by the application of the best conventional pollutant control technology (BCT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BCT:

(a) For CAFO production areas: the CAFO shall attain the same limitations and requirements as § 412.31(a).

(b) For CAFO land application areas: the CAFO shall attain the same limitations and requirements as § 412.31(b).

§ 412.33 Effluent limitations attainable by the application of the best available technology economically achievable (BAT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BAT:

(a) For CAFO production areas: the CAFO shall attain the same limitations and requirements as § 412.31(a).
(b) For CAFO land application areas: the CAFO shall attain the same limitations and requirements as § 412.31(b).

Subpart D-Swine, Poultry, and Veal Calves

§ 412.40 Applicability.

This subpart applies to operations defined as concentrated animal feeding operations (CAFOs) under 40 CFR 122.23 and includes the following animals: swine; chickens; turkeys; and veal calves. This subpart does not apply to such CAFOs with less than the following capacities: 2,500 swine each weighing 55 lbs. or more; 10,000 swine each weighing less than 55 lbs.; 30,000 laying hens or broilers if the facility uses a liquid manure handling system; 82,000 laying hens if the facility uses other than a liquid manure handling system; 125,000 chickens other than laying hens if the facility uses other than a liquid manure handling system; 55,000 turkeys; and 1,000 veal calves.

§ 412.43 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BPT:

(a) For CAFO production areas.
    (1) The CAFO shall attain the same limitations and requirements as § 412.31(a)(1) through (a)(2).
    (2) The CAFO shall attain the limitations and requirements of this paragraph as of the date of permit coverage.
(b) For CAFO land application areas.
    (1) The CAFO shall attain the same limitations and requirements as § 412.31(b)(1) and (b)(2).
    (2) The CAFO shall attain the limitations and requirements of this paragraph by December 31, 2006.

§ 412.44 Effluent limitations attainable by the application of the best conventional pollutant control technology (BCT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BCT:

(a) For CAFO production areas: the CAFO shall attain the same limitations and requirements as § 412.43(a).
(b) For CAFO land application areas: the CAFO shall attain the same limitations and requirements as § 412.43(b).

§ 412.45 Effluent limitations attainable by the application of the best available technology economically achievable (BAT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BAT:

(a) For CAFO production areas: the CAFO shall attain the same limitations and requirements as § 412.43(a).

(b) For CAFO land application areas: the CAFO shall attain the same limitations and requirements as § 412.43(b).

HRS, Chapter 165, Hawaii Right To Farm Act

§165-4 Right To Farm.

(a) No court, official, public servant or public employee shall declare any farming operation a nuisance for any reason if all of the following have been proven:
  (i) That during the 12 month period preceding the filing of the nuisance complaint with a court or other adjudicative public body, the farming operation complied with statutes, ordinances, regulations or rules relevant to the nuisance complaint and
  (ii) That the farming operation has used reasonable care in conducting its operation.

(b) Notwithstanding a farming operation's satisfaction of subsection (a)(i) and (ii), a farming operation may be declared a nuisance if:
  (i) The farming operation or any aspect thereof has been previously determined to be injurious to public health or safety by the department of health, the department of agriculture or a court of competent jurisdiction and
  (ii) The complainant establishes by a preponderance of the evidence that the alleged nuisance resulted from the injurious operation or aspect thereof. Any determination of injuriousness shall be in writing and shall set forth the bases for the determination.

HRS, Chapter 322, Nuisances; Sanitary Regulations

§322-1 Removal, prevention. The DOH and its agents shall examine into all nuisances, foul or noxious odors, gases or vapors, waters in which mosquito larvae exist, sources of filth and all causes of sickness or disease, on shore and in any vessel which may be known to them or brought to their attention, which in their opinion are dangerous or injurious to health and into any and all conditions created or existing which cause or tend to cause sickness or disease or to be dangerous or injurious to health and shall cause the same to be abated, destroyed, removed or prevented.

HRS, Chapter 340E, Safe Drinking Water

§340E-2 Drinking water standards.

(e) The director shall promulgate regulations establishing an underground injection control program. Such program shall prohibit any underground injection which is not authorized by a permit issued by the director except that the director may authorize underground injection by regulation.

Underground injection authorized by regulation shall not endanger drinking water sources. Any underground injection control program shall:

(1) Set standards and prohibitions controlling any underground injection if such injection may result in the presence of any contaminant in underground water which supplies or may be expected to supply any public water system, and if the presence of such contaminant may result in such system's not complying with any national primary drinking water regulation or otherwise adversely affect the health of persons.
(2) Require, in the case of a program which authorizes underground injection by permit, that applicant for the permit satisfy the director that the underground injection will meet the requirements of item (1) of this subsection.
(3) Include inspection, monitoring, record keeping and reporting requirements.

§340E-7 Prohibited Acts.

(f) No person shall cause a public water system to violate the state primary drinking water regulations,
(g) No person shall violate underground injection control rules adopted pursuant to this part,
(i) No person shall install or repair any public water system or any plumbing in a residential or non-residential facility providing water for human consumption which is connected to a public water system with any pipe, solder or flux that is not lead free. "Lead free" with respect to pipe, solder or flux means containing not more than 0.2 percent lead. This subsection shall not apply to leaded joints necessary for the repair of cast iron pipes.

HRS Chapter 342D, Water Pollution

§342D-4 Duties; rules.

The director shall prevent, control and abate water pollution in the State. The director may establish by rule, water quality standards, effluent standards, treatment and pretreatment standards and standards of performance for specific areas and types of discharges in the control of water pollution, thereby allowing for varying local conditions.

§342d-50 Prohibition.

(a) No person, including any public body, shall discharge any water pollutant into state waters, or cause or allow any water pollutant to enter state waters except as in compliance with this chapter, rules adopted pursuant to this chapter, or a permit or variance issued by the director,
(b) No person, including any public body, shall knowingly establish, extend or alter any system of drainage, sewage or water supply without first securing approval in writing from the director,
(c) No person, including any public body, shall discharge any water pollutant or effluent into a publicly own treatment work or sewerage system in violation of:
(1) A pretreatment standard established by the department or the publicly owned treatment works or

(2) A pretreatment condition in a permit issued by the department or a publicly owned treatment works.

§342D-51 Affirmative duty to report discharges.
Any person who has caused an unlawful discharge under section 342D-50(a) has an affirmative duty to report the incident to the director within 24 hours of the discharge, unless a valid permit issued under section 342D-6 specifies another reporting period for the specific discharge.

HAR, Title 11, DOH, Chapter 11, Sanitation
§11-11-6 Livestock, poultry and stables.

(a) Animal manure, refuse, etc.
(1) Every person in custody or control of any kennel, stall, stables or place in which the manure of dogs, horses, cattle, swine or any other animal manure, stable refuse or any liquid discharge of such animals accumulates or originates, shall cause such manure, stable refuse or liquid, to be promptly removed there from as often as necessary and shall keep or cause to be kept, such stables, stalls or places and the drains, yard and appurtenances thereof, clean and sanitary. All such liquid and solid waste discharges shall be disposed of in a sanitary manner.
(2) No stable manure or refuse or both, while awaiting removal, shall be held for longer than 24 hour unless it is kept in a dung pit, refuse bin, or like storage container that is both fly-proof and rodent-proof and so constructed that objectionable odors will not emanate.
(3) No stable manure, animal or vegetable refuse, night soil or garbage of any nature, which is dangerous to the public health, shall be sued for grading or filling any lot, parcel or other tract of land except for sanitary fills approved by the director.

(b) Animal enclosures; construction, location and maintenance.
(1) All poultry houses, yards, pigeon lofts, rabbit hutches, dog kennels, pens or enclosures for any animal shall be kept clean and free from accumulation of excreta, decayed food and filth of every kind. The enclosures shall be kept free of rodents, fleas, lice and other insect pest and maintained in a clean and sanitary condition. Enclosures shall be constructed as to exclude rodents and prevent the harboring of rodents. All food products, goods, waters or merchandise on the premises which are liable, in the opinion of the director to attract or become infested with rodents, whether kept for sale or for any other purpose, shall be protected as to prevent rodents from gaining access.
(2) Floors, assorting boards, feeding troughs, gutters and leaders shall be of material impervious to moisture so laid and graded that they may be properly flushed with water.
(3) False floors or loose boards shall not be sued unless laid flush on impervious material and capable of being easily removed.
(4) Feed shall be stored only in rodent-proof boxes, bins or rooms.
(5) Mangers shall be of single wall construction at least 18 inches deep and in

areas where the opinion of the director there is danger of the existence of plague or typhus, shall be kept free from food except when the animal is feeding.

(6) Lofts and coops housing pigeons raised for domestic use or for commercial purposes shall comply with all spacing and zoning requirements and county codes and ordinances. All enclosures shall be maintained in a clean and sanitary condition and kept in good repair.

(c) Disposal of dead animals: Animals carcasses and organs affected with diseases transmissible or possibly transmissible to humans or animals and carcasses of animals that die before slaughter shall be destroyed and not used for feeding any animals.

§11-11-7 Garbage and swill.

(a) On premises, removal of:

(1) No persons shall have on his premises any offal, swill, garbage, decayed meat, fish, animal or vegetable matter whether solid or liquid except as herein provided.

(2) The person, firm or corporation occupying any premises upon which garbage and rubbish containing food wastes are created shall place all such garbage and rubbish containing food wastes in a water-tight receptacle of metal or other impervious material. Receptacles shall be kept closed by a tight-fitting cover, except while being filled or emptied. The casting aside or throwing about of unconsumed food, rubbish containing food wastes or of any garbage anywhere in the State is prohibited.

(b) Transportation of:

(1) No person shall transport on any street any offal, swill, garbage, decayed meat, fish, animal or vegetable matter whether solid or liquid unless the same shall be in water-tight containers with tight-fitting cover. The operator of every vehicle or vessel used to transport another type of offensive refuse in bulk form shall cover the said refuse.

(2) Vehicles used for conveying offal, swill or other offensive substances shall not be used in the conveyance of any other food items which are to be sold for human consumption.

(c) Boiling or other treatment. All garbage, offal and swill regardless of previous processing, shall, before being fed to any animal, be thoroughly boiled for at least thirty minutes and then slowly cooled so that every part shall have been at the boiling point of water for at least 30 minutes, unless treated in a manner which shall be approved in writing by the director as being as effective as such boiling and cooling in protecting the public health.

§11-11-8 Vegetables.

(c) Vegetables, raw. It shall be unlawful to offer for sale or to sell for human consumption watercress, lettuce and other vegetables ordinarily eaten raw which are

grown in areas subjected to contamination from water used in irrigation or from animals.

HAR, Title 11, DOH, Chapter 21, Cross-Connection and Back-Flow Control

§11-21-7 Irrigation systems.

(a) The following guidelines relating to back-flow prevention devices for irrigation systems shall apply:

(1) Atmospheric vacuum breakers shall be installed after the last control valve of each sprinkler circuit and at a minimum of 6 inches above the highest irrigation head. The atmospheric vacuum breaker shall be installed only on irrigation circuits with heads that will not return any pressures in the circuit when the circuit control valve is closed.

(2) Pressure vacuum breakers shall be installed at the beginning of each irrigation circuit and at a minimum of 12 inches above the highest irrigation head on the circuit. Individual irrigation circuits having quick coupling valves or other similar type heads that will permit pressure to be retained in the circuit shall have a pressure vacuum installed as a minimum requirement for each circuit. Irrigation systems using the subsurface drip method shall have a pressure vacuum breaker on each circuit. A pressure vacuum breaker may not be installed where a double check valve assembly, reduced pressure principle back-flow prevention device or air gap separation is required.

(3) A double check valve assembly may be installed to serve multiple irrigation circuits in lieu of vacuum breakers on each individual irrigation circuit.

(4) A reduced pressure principal back-flow preventer or air gap separation shall be required before any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system. [Eff. December 26, 1981] (Auth: HRS 340E-2, 340E-9) (Imp.: HRS 340E-2, 340E-9)

§11-21-8 Maintenance requirements.

(a) It shall be the responsibility of water users to maintain all back-flow preventers and vacuum breakers within the building or on the premises in good working order. No piping or other arrangement for the purpose of bypassing back-flow devices shall be permitted.

(b) Periodic testing and inspection schedule shall be established by the director for all back-flow preventers intervals between such testing, inspection and overhauls of each device shall be established in accordance with age and condition of the back-flow prevention device. Inspection intervals should not exceed one year. Back-flow prevention devices should be inspected frequently after initial installation to assure that the devices are properly installed and debris resulting from the installation has not interfered with the functioning of the device. The inspection and testing shall be performed by a certified tester approved by the director. In those instances where the director deems the hazard

to be great, inspection may be required at more frequent intervals. Records of any tests, repairs and overhauls shall be kept and made on forms prescribed by the director. Should the water user fail to make the proper test and provide all records on the tests, the director at his discretion may perform the necessary tests, needed repairs and replacements and charge the cost thereof to the water consumer. [Eff. December 26, 1981] (Auth.: HRS 340E-2, 340E-9) (Imp.: HRS 340E-2, 340E-9)

HAR, Title 11, DOH, Chapter 23, Underground Injection Control

§11-23-04 Classification of exempted aquifers and underground sources of drinking water.

(a) Upon request and with concurrence of the director, the department shall review the aquifer designations. The aquifer designations shall be reviewed at least every three years. In its review, the department may amend the status of an aquifer in accordance with Chapter 91, HRS. The criteria for exempting aquifers from underground sources of drinking water (USDW) status are as follow:

(1) The aquifer does not currently serve as a source of drinking water and

(2) The aquifer cannot now and will not in the future serve as a source of drinking water because of any of the following criteria:

(a) It is situated at a depth or location which currently makes recovery of water for drinking water purposes economically or technologically impractical or

(b) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption or

(c) The Total Dissolved Solids (TDS) concentration of the ground water is more than 5,000 mg/l, and it is not reasonably expected to supply a public or private drinking water system.

(b) The UIC maps shall indicate exempted aquifers and USDW in plan view, by use of the UIC line and such maps are an integral part of this chapter. The department's UIC maps shall be the final authority for the identification of the aquifer boundaries on land surface. Copies of the maps and this chapter are available for examination at an office of the department's environmental protection and health services division, the district health offices and other department offices on each island.

(c) Unless expressly exempted all aquifers are considered to be USDW.

§11-23-05 Identification of exempted aquifers and USDW.

(a) The department has designated the following formation as exempted portions of aquifers: in the horizontal dimension, lands which are makai of the UIC line and in the vertical dimension:

(1) Where the volcanic formation is a non-artesian aquifer, the entire geologic column, or

(2) Where the volcanic formation is an artesian aquifer, from the subaerial ground surface down to fifty feet above the contact between the artesian volcanic aquifer and the overlying confining materials

(b) Unless an aquifer is expressly exempted as described above or depicted on the department-issued UIC maps, it is an USDW.

(c) In areas where the UIC line is defined by a roadway, a setback of one lot or 150 feet, whichever is less, from the mauka property line of that roadway may be considered

to be within the exempted area. If the roadway is within a property, the setback shall extend to the mauka property line or to 150 feet from the mauka edge of said roadway, whichever is less. This interpretation of the UIC line shall be subject to all other conditions of this chapter. The applicant on the permit application shall request this interpretation, approval of which shall be based on the proximity and sensitivity of drinking water source.

HAR, Title 11, DOH, Chapter 26, Vector Control

§11-26-11 Flies; protection against breeding.

(a) No person, firm or corporation shall use untreated animal waste for soil enrichment unless the same waste is managed to prevent fly breeding by an approved pest management method.

(b) No animal or poultry farm waste, vegetable refuse, night soil or garbage of any nature which is dangerous to the public health shall be used for grading or filling any lot, parcel or other tract of land except for sanitary landfills approved by the director.

§11-26-22 Mosquitoes; protection against breeding.

As used in this subchapter "mosquitoes" include mosquitoes, midges and gnats. It shall be unlawful to have, keep, maintain, cause or permit any collection or standing or flowing water:

(1) In which mosquitoes propagate; or
(2) In which mosquitoes may propagate unless such water is treated or managed to prevent breeding.

§11-26-31 Rodents; construction of new buildings.

(a) Buildings intended for restaurants, markets, stables, slaughterhouses, piers, theaters and storehouses for foodstuffs shall have the floor of the lower storey constructed of concrete or other material impervious to rodents.

(b) Residences and other buildings not having the floor of the lower storey of concrete or other material impervious to rodents shall have an unobstructed crawl space of at least 20 inches between the bottom of the joists of the lower floor of the building and the highest point of ground. Such space shall not be secured by excavation, except when authorized by the director in cases where proper drainage, ventilation and access can be secured.

(c) All parts of all buildings shall be rat-proof.

§11-26-32 Rodents, repair and maintenance of existing buildings.

(a) Buildings which do not have the floor of the lower storey of material impervious to rodents, shall be altered so as to conform to the requirements in §11-26-31 of these rules. Buildings with floors of wood or other material pervious to rodents shall not be used for the storage of foodstuff unless a separate room or enclosure is provided for storage. Such storage shall be completely lined with hardware cloth with openings

not larger than one-quarter inch or other material equally impervious to rodents and protected from rodent excrement.

(b) Buildings, sidewalks and retaining walls shall be maintained to exclude rodents and prevent the harboring of rodents.

(c) No person shall remove or alter the existing rat-proofing of any building or make any new opening that are not closed or sealed against the entrance of rodents.

§11-26-33 Rodents; control on premises.

Every owner or occupant of any premises that has rodents shall promptly eradicate or in good faith continually endeavor to eradicate the rodents by poisoning, trapping or by other appropriate means. Foodstuffs, animal feed and other edible materials upon which rodents may feed shall be kept in rat-proof structures and locations inaccessible to rodents. Windfalls, garbage and other materials which may serve as food for rodents shall be removed promptly and stored in rat-proof containers for proper removal and disposal.

§11-26-34 Rodents; rubbish and loose materials.

(a) No rubbish of any description shall be placed, left, dumped or permitted to be stored in the vicinity of any building in such a manner as to afford a harboring or breeding place for rodents.

(b) Indiscriminate dumping of rubbish or waste is prohibited.

(c) Firewood, scrap lumber and other loose usable materials on any premises shall be orderly piled on platforms or stands with sufficient clearance to prevent rat harborage and also to facilitate inspection and cleaning.

§11-26-35 Rodents; demolishing of structure and clearing of sites and vacant lots.

(a) No person, firm or corporation shall demolish or clear any structure, site or vacant lot without first ascertaining the presence or absence of rodents which may endanger the public health by dispersal from such premises.

(b) Should such inspection reveal the presence of rodents, the person, firm or corporation shall eradicate the rodents before demolishing or clearing the structure, site or vacant lot.

(c) The department may conduct an independent inspection to monitor compliance or request a written report.

(d) Vacant lots and ground not built upon shall be kept free of harborage.

§11-26-61 Fleas, mites and ticks.

Premises shall be kept free from fleas, mites and ticks to prevent occurrence of a public health disease or nuisance.

§11-26-62 Cockroaches.

Premises shall be kept reasonably free of cockroach infestation to prevent hazards to public health, welfare and comfort.

§11-26-63 Venomous arthropods.

(a) As used in this section, "venomous arthropods" means those animals that can inflict injurious or fatal bites or stings to humans and include centipedes, scorpions, spiders, ants, bees and wasps.

(b) Premises shall be kept reasonably free of venomous arthropod infestation to prevent hazards to public health, welfare and comfort.

HAR, Title 11, DOH, Chapter 54, Water Quality Standards

§11-54-01.1 General policy of water quality anti-degradation.

Waters whose quality are higher than established water quality standards shall not be lowered in quality unless it has been affirmatively demonstrated to the director that the change is justifiable as a result of important economic or social development and will not interfere with or become injurious to any assigned uses made of or presently in, those waters.

HAR, Title 11, DOH, Chapter 55, Water Pollution Control

§11-55-02 General policy of water pollution control.

(a) It is the public policy of this State:
  (1) To conserve state waters;
  (2) To protect, maintain and improve the quality of state waters:
    (i) For drinking water supply and food processing;
    (ii) For the growth, support and propagation of shellfish, fish and other desirable species of marine and aquatic life;
    (iii) For oceanographic research;
    (iv) For the conservation of coral reefs and wilderness areas and
    (v) For domestic, agricultural, industrial and other legitimate uses.
  (3) To provide that no waste be discharged into any state waters without first being given the degree of treatment necessary to protect the legitimate beneficial uses of such waters;
  (4) To provide for the prevention, abatement and control of new and existing water pollution and
  (5) To cooperate with the federal government in carrying out these objectives.

(b) Any industrial, public or private project or development which could constitute a new source of pollution or an increased source of pollution shall in its initial project design and subsequent construction, provide the highest and best degree of waste treatment practicable under existing technology.

(c) Permits issued under this chapter and the related applications, processing, issuance and post-issuance procedures and requirements shall be at least as stringent as those required by 40 CFR §123.25(a).

§11-55-04 Application for NPDES permit.

Before discharging any pollutant or substantially altering the quality of any discharges or substantially increasing the quantity of any discharge, a person shall file a complete NPDES application (which shall include a BMP program if necessary under 40 CFR §125.102) or submit a complete notice of intent. Submission of notice of intent shall comply with and be regulated by §§11-55-34.08 through 11-55-34.1

HAR, Title 11, DOH, Chapter 58.1, Solid Waste Management Control

§11-58.01-04 Permit

(i) Permit by rule for certain solid waster handling and disposal facilities of limited impact.

(1) Permit by rule: Notwithstanding any other provisions of these rules, the convenience centers, composting facilities handling not more than 3,000 tons per year of green wastes, clearing and grubbing landfills, certain agriculture landfills and recycling drop-off facilities shall be deemed to have a solid waste handling and disposal permit if the following conditions are met:

(A) Notification. At least 30 days prior to commencing solid waste handling activities which are covered under a permit by rule, written notification of such activity must be made to the director. Written notification shall be made on such forms as are provided by the director. Persons failing to notify the director of such activities shall be deemed to be operating without a permit.

(B) General conditions of every facility.

(i) No regulated hazardous waste in accordance with 40 CFR Part 261may be collected, transported or disposed at any of the facilities.

(ii) Nuisance control. Suitable means shall be employed to prevent solid wastes from scattering; control of litter, odors and vectors such as rodents and insects.

(iii) Suitable means shall be provide to prevent and control fires, including emergency response plan when appropriate.

(iv) It is the responsibility of the owner and/or operator to comply with all the local rules, regulations and ordinances and the director may add additional conditions deemed appropriate.

(v) Each facility shall be supervised, secured and have a permanent sign identifying the facility, hour and days of operation, materials accepted or not accepted, the owner and/or operator, a person to contact and other pertinent information

(vi) An annual report shall be prepared and submitted to the director.

(D) Green wastes. (Landscapes wastes) composting facilities.

(i) Composting facilities accepting only green waste, less than 3,000 tons per year, a re permitted by rule unless exempted. [ ]

(ii) The finished compost must be sufficiently stable that it can be stored or applied on land without producing a nuisance.

(iii) An annual report shall be prepared and submitted to the department, reporting the tonnage of green waste accepted, the composted tonnage produced and residual disposed.
(iv) The department shall reserve the right to add additional requirements.

(E) Land clearing, grubbing and certain agricultural landfills and inert waste landfills.
(i) All persons exempted under §11-58.1-4(b) (3) and land-filling more than 150 tons per year shall be permitted by rule.
(ii) Only waste that will not or is not likely to produce leachate of environmental concerns shall be disposed of in the landfill. Acceptable materials for disposal in the land clearing, grubbing and certain agricultural landfill are earth and earth-like products, and land clearing debris such as stumps, limbs (of trees) and leaves. Acceptable materials for disposal in the inert waste landfill are earth and earth-like products, concrete, cured asphalt, rocks and bricks.
(iii) Materials placed in the landfill shall be generated on site and spread in layers and compacted to the smallest practicable volume.
(iv) Public access to the landfills shall be limited to authorized entrances which shall be closed when the site is not in operation.
(v) The final cover shall consist of 18 inches of earthen material to minimize infiltration and 6 inches of earthen material to minimize erosion or as approve by the director. A vegetative cover shall be placed over the final lift, not later than 1 month following final placement of waste within that lift. The vegetative cover must be maintained a minimum of a year after the closure of the landfill.
(vi) A written notice of final closure must be provided to the director within 180 days of receiving the final load of material. A site not receiving waste for in excess of 180 days shall be deemed abandoned and in violation of these rules unless properly closed. Notice of closure must include the date of final material receipt and an accurate legal description of the boundaries of the landfill.
(vii) A permanent notation of the landfill location shall be added at the bureau of conveyances to the facility property and on any other instrument that would normally be examined during the title search and note any land use restrictions from the closure plans. The notation shall notify any potential purchaser of the property that the area has been used for land clearing and grubbing and agricultural solid waste landfills.
(viii) All other applicable federal, state and local laws, rules and ordinances including erosion and sediment control and any applicable federal wetlands permits must be fully complied with prior to commencement of land-filling operations.

§11-58.1-41 Composting facilities.

(a) Applicability. This section regulates the construction and operation of composting facilities for sewage sludge, green waste (yard waste) and other solid wastes.

(A) Exemption. Composting facilities processing less than 3,000 tons of green wastes per year are permitted by rule.

(b) Permit requirements:

(1) Site analysis. A site analysis shall be submitted and shall include a least a site plan, description of the equipment and machinery, public access and turnaround areas. The site analysis shall include surrounding land uses and where determined necessary by the director, describe mitigative measures taken to reduce the impact of the facility upon neighboring properties.

(2) Design requirements.

(A) Provide engineering plans and specifications for the entire composting facility, including manufacturer's performance data for the selected equipment.

(B) The composting facility must have sufficient temperature monitoring to ensure that the pathogen reduction criteria are met. For a windrow and an aerated static pile process, the may include monitoring 6-8 inches below the pile surface and for an aerated static pile process, 6-8 inches from the outlet of the aeration pipe. For an enclosed vessel system, this may include monitoring 6-8 inches inside the vessel wall and 6-8 inches from the aeration piping (when operating in the positive aeration mode). Temperature monitoring must occur, at a minimum, on a daily basis.

(C) Nuisance, health and safety control. Design methods to control litter, insects, odors and vectors. Develop a fire plan to prevent and minimize fire hazards. The transfer station shall maintain a neat and orderly appearance and must be screened and buffered to minimize nuisances to neighboring properties.

(D) The waste storage area and the active composting, curing and compost storage areas must be located on surfaces capable of minimizing leachate release into the ground water under the site and the surrounding land surface.

(E) All leachate must be collected and treated by a method (in the engineering report) approved by the department.

(G) Adequate drainage. Adequate drainage to prevent standing water and to control "run-on" and "run-off" of rainwater shall be provided.

(3) Operation plan.

(A) Provide a description of the type and size of the facility, detention times for handling and processing the material, a process flow diagram of the entire process and all the major equipment required. Include in the report monitoring information such as the locations of all the temperature monitoring points and their frequency of reading.

(B) Provide a detailed description of the source, quality and quantity of the solid waste to be composted, including the source, quality and the expected quantity of any bulking agent to be used.

(C) The compost from composting operations shall be non-pathogenic, free of offensive odors, biologically and chemically stable and free of injurious components or particles and able to sustain plant growth. Rejects generated by the composting process shall be disposed of in accordance with these rules.

(D) Solid waste that possess a pathogen concern, shall be composted and meet the criteria for reducing pathogens. Three acceptable methods are:
  i) Using the windrow composting method, the solid waste is maintained under aerobic conditions during the composting process. A minimum of 5 turnings is required during a period of 15 consecutive days with the temperature of the mixture being 55^0C or greater within 6-8 inches below the surface pile composting.
  (ii) Using the aerated static pile composting method, the compost pile must be insulated and a temperature of not less than 55^0C or greater must be maintained throughout the compost pile for at least 3 consecutive days.
  (iii) Using the enclosed vessel composting method, the mixture must be maintain at a temperature of not less than 55^0C or grater throughout the mixture for at least 3 consecutive days.
  (iv) Other methods may be submitted to the director and they will be approved on a case-by-case basis.

(E) Provide a description of the ultimate use for the finished compost and the method of removal from the site. Include a plan for disposal of the finished compost that cannot be used.

(4) Closure Plan. As part of the application for a permit, the owner and/or operator shall develop a closure plan to ensure no adverse environmental impacts.

(c) Reporting requirements. At a minimum, an annual report shall be submitted to the department, not later than 30days after June 30th of each year. The report must include:
  (A) The type and quantity, by weight or volume after primary processing, of solid waste received by the facility.
  (B) The quantity, by weight or volume of compost produced and removed from the facility.
  (C) A summary of monitoring done during the operation.

HAR, Title 11, DOH, Chapter 62, Wastewater Systems

§11-62-05 Critical wastewater disposal areas.

(a) On a county-by-county basis, the director may establish critical wastewater disposal areas based on one or more of the following concerns:
  (1) High water table;
  (2) Impermeable soil or rock formation;
  (3) Steep terrain;
  (4) Flood zone;
  (5) Protection of coastal waters and inland surface waters;
  (6) High rate of cesspool failures and
  (7) Protection of groundwater resources.

(b) The director may impose more stringent requirements than those specified in these rules for proposed wastewater systems located within designated critical wastewater disposal area. Requirements that the director may impose include, but not limited to, meeting

higher effluent standards for wastewater systems, limiting the method of effluent disposal and requiring flow restriction devices on water fixtures.

(c) Proposed cesspools shall be severely restricted or prohibited in any designated critical wastewater disposal area.

§11-62-06 General requirements.

(d) Buildings generating non-domestic wastewater shall meet the specific requirements of this chapter as determined to be applicable by the director. Whenever applicable, the director shall use the effluent requirements for non-domestic wastewater as set forth by the EPA. Construction plans and engineering reports for proposed non-domestic wastewater systems shall be sufficient in scope and depth for determining the adequacy of compliance with the provisions of section 11-62-02.

(e) Any building or facility which is located within the state agricultural land use district, county agriculture zoned districts or conservation districts may be exempt from the provisions of subchapters 2 and 3, provided that such building or facilities are essential to the operation of an agricultural enterprise or are consistent with the conservation district use intent. However, the owner shall submit for the director's approval plans or engineering reports or both for the wastewater systems proposed to accommodate the wastewater generated from any building or facility in the category. Such information submitted shall be sufficient in scope and depth for determining the adequacy of performance of the wastewater system in meeting the provisions of §11-62-02.

(f) A holding tank except for public facilities in areas where the subsurface disposal of wastewater is prohibited or privy shall not be considered as an acceptable wastewater system.

(g) No person or owner shall cause or allow any wastewater system to create or contribute to any of the following:
(1) Human illness
(2) Public health and safety hazard
(3) Nuisance
(4) Unsanitary condition
(5) Wastewater spill, overflow or discharge onto the ground or into surface waters
(6) Contamination or pollution of state surface waters
(7) Harborage of vectors including insects and rodents
(8) Foul or noxious odors
(9) Public safety hazard and
(10) Contamination, pollution or endangerment of drinking waters.
If any of the conditions exits, the own shall immediately notify the director.

(h) In case of a violation of this chapter, the director shall initiate enforcement action against the owner(s) of the wastewater system and initiate enforcement action against other persons to have the offending condition abated, corrected, resolved, destroyed or prevented. In addition, once a violation of this chapter occurs, the director shall order

the owner of the wastewater system to take immediate actions to protect public health and safety.

(i) Upon request by the director, proposed wastewater systems in critical wastewater disposal areas shall be approved in writing or by rule by the respective county board of water supply or department of water supply.

(j) The construction of any wastewater system involving the subsurface disposal of wastewater shall be in compliance with applicable provisions of chapter 11-23.

(k) If the appropriate county does not issue a building permit for a private building within 12 months after the director approves construction of a wastewater system to serve the building or if the appropriate county revokes or rescinds a building permit and the building is to be served by a wastewater system, the director's approval to construct the wastewater system is automatically rescinded unless a request for an extension is made 30days before the expiration of the 12 month period. One extension of 6 month may be approved by the director. Reapproval of any wastewater system for which the director's approval has been rescinded pursuant to this paragraph shall be based on the applicable rules in effect at the time the request for reapproval is made.

(l) Whenever a building modification is proposed, the wastewater system serving the building shall be required to meet the applicable requirements of this rule if:
   (1) The existing wastewater system has created or contributed to any of the conditions noted in the subsection (g);
   (3) The existing wastewater system disposes untreated wastewater directly into the groundwater table.

§11-62-07 Wastewater sludge disposal.

(a) This section describes the acceptable disposal methods for wastewater sludge. The director shall approve each wastewater sludge disposal plan including the necessary treatment and transportation of the sludge. The plan shall specify the manner of sludge disposal to be used pursuant to subsection (c).

(b) No person shall place or dispose of wastewater sludge into pits, subsurface disposal systems, state waters or onto the ground except as provided by subsection (c).

(c) Wastewater sludge shall only be disposed of in the following manner:
   (1) By a private, county or state solid waste disposal facility which has a permit pursuant to chapter 11-58, to accept wastewater sludge;
   (2) By reclamation or reuse for agricultural purposes as set forth by EPA regulations;
   (3) By incineration which meets all applicable requirements of chapter 11-60 or
   (4) By a private, county or state wastewater system which has been given specific written authorization to accept and dispose of sludge.

§11-62-08 Specific requirements for wastewater systems.

(a) Intent.
   (1) It is the intent of this section and subchapters 2 and 3 to set forth minimum requirements for the following purposes:

(A) To clarify responsibilities of owners, engineers and the departments;
(B) To set minimum distance requirements so that minor nuisances are avoided;
(C) To set the minimum requirements to protect public health, safety and welfare and to protect the wastewater systems from malicious damage or unauthorized entry, and
(D) To emphasize the need for proper installation, operation and maintenance.

(b) No person shall construct or expand a wastewater system without the approval of the director. The following documents shall be submitted to the director prior to such approval:
(1) Construction plans prepared by or under the supervision of an engineer indicating the following:
(A) Acreage and tax map key number(s) of the project site;
(B) Plot plan drawn to scale showing the location of the proposed and any existing wastewater system and its distances from exiting and proposed buildings, structures, legal boundaries, property lines, adjacent surface bodies of water, drinking water sources and existing public sewers within 2,000 feet of the nearest property line, and
(C) Sufficient details to show compliance with all applicable requirements of this chapter.
(2) Sludge disposal plan prepared in accordance to section §11-62-07.

(d) Measures to control public accessibility to proposed and existing treatment units shall be provided to prevent accidents, drowning, vandalism and interference with the treatment process. At a minimum, the provisions shall include:
(1) Fencing or other secured enclosures at least 6 feet in height for treatment units with exposed water surfaces or equipment or
(2) Completely enclosed treatment units with unexposed water surfaces and equipment. Access opening to completely enclosed treatment unit(s) and equipment shall be secured and properly indentified and be large enough to remove equipment from the facility.

(e) No person shall use the area adjacent to or directly above proposed and existing wastewater systems for purposes or activities which may hinder or interfere with the operation and maintenance of the wastewater system.

(f) No person shall operate a wastewater system unless that person or the owner of the wastewater system is authorized by the director in accordance with the applicable provisions of §11-62-23.1 (e) and 11-62-31.1(f) and the applicable provisions of chapter 11-61, Mandatory certification of operating personnel in wastewater treatment facilities.

(g) All wastewater systems shall be constructed or expanded by a person meeting the requirements of section 444, HRS and any pertinent rules promulgated by the Department of Commerce and Consumer Affairs, State of Hawaii.

§11-62-31.1 General requirement for proposed individual wastewater systems.

(f) No person shall operate an individual wastewater system until authorized in writing by the director.

(1) Written approval by the director shall be issued if, upon inspection of the installed individual wastewater system and before being back-filled, the system complies with these rules and the approved plans and specifications.

(A) Before operation of the system the owner shall resolve all discrepancies recorded as a result of the inspections conducted.

(B) Any changes to the approved plans and specifications shall be submitted to the director for approval before final inspection.

(2) If the inspection is waived by the director, the engineer or contractor shall furnish a written statement to the director within 30 days after the completion of the construction certifying that the individual wastewater system was installed in accordance with the approved plans and specifications. Any deviations shall be noted and approved by the director before the individual wastewater system can initiate operation.

APPENDIX F

Hawaii's Coastal Nonpoint Pollution Control Program Agriculture Management Measures

Source: ***Updated Management Measures for Hawaii's Coastal Nonpoint Pollution Control Program*, June 2009. Department of Health, Clean Water Branch, Polluted Runoff Control Program.**

http://hawaii.gov/health/environmental/water/cleanwater/prc/pdf/updatedmgtmeasures_final_30june09.pdf

I. Introduction

There are six management measures that apply to agriculture, all of which have been approved by NOAA and EPA. These management measures address the management of polluted runoff from all types of agricultural operations in Hawaii.

The following table provides a summary of authorities that apply to the agriculture management measures. A written description of the specific authorities and implementation tools are provided under each management measure in Section B. Appendix A contains tables providing the relevant language for each regulatory and non-regulatory mechanism for each management measure.

The documentation of the implementation of the management measures is critical if associations are to be drawn between the coastal nonpoint pollution control program implementation and water quality improvements. Indicators for tracking management measure implementation are identified below. Specific precautions will be taken to ensure that sensitive data, such as specific names and locations of practices, is maintained in full confidence. If detailed information is required due to violation of water quality standards, this information may be acquired by formal request in accordance with the Freedom of Information Act.

Indicators for Tracking Implementation

County DPWs	for erosion and sediment control, number of permits for agricultural grubbing and grading issues for each fiscal year by island; number of violations reported
SWCDs/NRCS	number of conservation plans related to agricultural operations approved annually by watershed, with acreage covered; BMPs for erosion and sediment control, confined animal facilities wastewater management, nutrient and pest management, grazing management and irrigation management reported by acreage; results of periodic inspections to ensure both technical specifications and maintenance standards have been met
DOH	number of plans approved for livestock feeding or processing operations and waste systems under Chapter 11-62, HAR, for each fiscal year by island
DOH	number of water quality violations that were caused by erosion from agricultural lands

Authority		Responsible Agency	Erosion & Sed. Control	Confined Animals	Nutrient Mgt.	Pesticides Mgt.	Grazing Mgt.	Irrigation Mgt.
Local	Chapter 22-7, KCC, Grading, Grubbing and Stockpiling	Kauai County DPW	X					
	Chapter 10 HCC, Soil Erosion and Sediment Control	Hawaii County DPW	X					
	Chapter 20.08, MCC, Soil Erosion and Sedimentation Control	Maui County DPW	X					
	Chapter 14-13 to 14-16, ROH, Grading, Soil Erosion and Sediment Control	City and County of Honolulu	X					
State	Chapter 149A, HRS Hawaii Pesticides Law	DOA				X		X
	Chapter 171, HRS Mgt and Disposition of Public Lands	DLNR	X	X	X	X	X	X
	Chapter 180, HRS Soil and Water Conservation Districts	local SWCDs	X	X	X	X	X	X
	Chapter 342D, HRS Water Pollution	DOH	X	X	X	X	X	X
	Chapter 340E, HRS Safe Drinking Water	DOH		X	X	X		X
	Chapter 342H, HRS Solid Waste Pollution	DOH		X	X			
	Chapter 4-66, HAR Pesticides	DOA				X		X
	Chapter 11-21, HAR Cross Connection and Back-Flow Control	DOH		X	X	X		X
	Chapter 11-23, HAR Underground Injection Control	DOH		X	X	X		X
State	Chapter 11-26, HAR Vector Control	DOH		X				

Authority		Responsible Agency	Erosion & Sed. Control	Confined Animals	Nutrient Mgt.	Pesticides Mgt.	Grazing Mgt.	Irrigation Mgt.
	Chapter 11-62, HAR Wastewater Systems	DOH		X				
	Farm*A*Syst Program, University of Hawaii Cooperative Extension Svc.	Univ. of Hawaii CES	X	X	X	X	X	X
	DOH Guidelines for Livestock Waste Management (1996)	DOH		X				
	Plant Nutrient Management in Hawaii's Soils: Approaches for Tropical and Subtropical Agriculture (2000)	Univ. of Hawaii CES			X			
Federal	NRCS's *Hawaii Field Office Technical Guides* (eFOTG)	NRCS	X	X	X	X	X	X

II. Management Measures

A. Erosion and Sediment Control Management Measure

Apply any combination of conservation structural and management practices based on U.S. Department of Agriculture – Natural Resources Conservation Service standards and specifications to minimize the delivery of sediment from agricultural lands to surface waters, or

Design and install a combination of management and structural practices to settle the settleable solids and associated pollutants in runoff delivered from the contributing area for storms of up to and including a 10-year, 24-hour frequency.

Status of Measure: APPROVED

Applicability: This management measure applies to activities that cause erosion on agricultural land and on land that is converted from other land uses to agriculture. Agricultural lands include:

- Cropland;
- Irrigated cropland;
- Range and pasture;
- Orchards;
- Permanent hayland;
- Managed forests;
- Specialty crop production; and
- Nursery crop production.

The intent of the management measure is to protect surface and ground water quality. Some waterbodies, such as farm ponds, have been created to water livestock. Protecting the water quality of these artificial water storage areas does not have the same priority as protecting natural streams and waterbodies.

Responsible Agencies and Authorities

The county departments of public works are the lead agencies for implementing this management measure because they administer the county grading ordinances (Chapter 10, HCC; Chapter 22-7 KCC; Chapter 20.08 MCC; Chapters 14-13 to 14-16, ROH). The local Soil and Water Conservation Districts (SWCDs) are also major players because they develop and approve conservation plans which allow agricultural operations to receive an exemption from the county grading ordinances (Chapter 180, HRS).

Significant amounts of lands in agriculture are State lands leased to agricultural operators. The Department of Land and Natural Resources (DLNR) Land Division is responsible for leasing these lands under Chapter 171, HRS. One of these lease conditions is that the operators work with the local soil and water conservation districts to develop and implement a conservation plan.

Pursuant to Act 90, SLH 2003, beginning on January 1, 2010, the authority to manage, administer, and exercise control over any public lands that are designated important agricultural lands pursuant to Section 205-44.5, HRS, shall be transferred from DLNR to the State Department of Agriculture (DOA) (Section 171-3(b), HRS). Several leases have already been approved for transfer, which will occur in phases.

U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) usually assists in developing conservation plans to treat existing and potential resource problems and has funding available to assist with the installation of best management practices. NRCS primarily develops plans for operators seeking funding under Federal Farm Bill programs. NRCS's *Hawaii Field Office Technical Guide* (eFOTG) outlines conservation practice standards and specifications for erosion and sediment control.

The University of Hawaii Cooperative Extension Service (CES) can also provide technical assistance. One of the publications developed under its Farm*A*Syst program is entitled *Minimizing Pollution Risk from Land Management* (HAPPI-Farm 3; December 2000). The four-page publication helps land users assess how their land management practices can impact the quality of both Hawaii's groundwater and surface water bodies. It describes practices to reduce water runoff and erosion, improve soil quality, and minimize nutrient losses from crop fields.

Hawaii Department of Health (DOH) has regulatory authority over water pollution control (Chapter 342D, HRS).

Management Practices

NRCS's *Hawaii Field Office Technical Guide* (eFOTG) contains many standards related to erosion and sediment control, among them: channel bank vegetation (322); deep tillage (324); conservation cover (327); conservation crop rotation (328); residue and tillage management (329); contour farming (330); cover crop (340); critical area planting (342); diversion (362); field border (386); filter strip (393); grade stabilization structure (410); grassed waterway (412); mulching (484); sediment basin (350); streambank and shoreline protection (580); strip-cropping (585); terrace (600); water and sediment control basin (638).

B. Management Measure for Wastewater and Runoff from Confined Animal Facility

Limit the discharge from the confined animal facility to surface waters by:

(1) Containing both the wastewater *and* the contaminated runoff from confined animal facilities that is caused by storms up to and including a 25-year, 24- hour frequency storm event. Storage structures should be of adequate capacity to allow for proper wastewater utilization and constructed so they prevent seepage to groundwater; and

(2) Managing stored contaminated runoff and accumulated solids from the facility through an appropriate waste utilization system.

Status of Measure: APPROVED

Applicability: This management measure applies to all new confined animal facilities regardless of size and to all existing confined animal facilities that contain the following number of head or more:

	Head	Animal Units[1]
Beef Feedlots	50	50
Stables (horses)	100	200
Dairies	20	28
Layers	5,000	50[2] 165[3]
Broilers	5,000	50 165
Turkeys	5,000	900
Swine	100	40

except those facilities that are required by Federal regulation 40 CFR 122.23 to apply for and receive discharge permits. That section applies to "concentrated animal feeding operations," which are defined in 40 CFR Part 122, Appendix B. In addition, 40 CFR 122.23(c) provides that the Director of a National Pollutant Discharge Elimination System (NPDES) discharge permit program may designate any animal feeding operation as a concentrated animal feeding operation upon determining that it is a significant contributor of water pollution. This has the effect of subjecting the operation to the NPDES permit program requirements. If a confined animal facility has a NPDES permit, then it is exempt from this management measure.

Facilities containing fewer than the number of head listed above are not subject to the requirements of this management measure.

A *confined animal facility* is a lot or facility (other than an aquatic animal production facility) where the following conditions are met:

- Animals (other than aquatic animals) have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and
- Crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

Two or more animal facilities under common ownership are considered, for the purposes of these guidelines, to be a single animal facility if they adjoin each other or if they use a common area or system for the disposal of wastes.

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[1] *Animal unit: A unit of measurement for any animal feeding operation calculated by adding the following numbers: the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 25 kilograms (approximately 55 pounds) multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0 (40 CFR Part 122, Appendix B).*

[2] *If facility has a liquid manure system, as used in 40 CFR Section 122, Appendix B.*

[3] *If facility has continuous overflow watering, as used in 40 CFR Section 122, Appendix B.*

Confined animal facilities, as defined above, include areas used to grow or house the animals, areas used for processing and storage of product, manure and runoff storage areas, and silage storage areas.

Wastewater and runoff from confined animal facilities are to be controlled under this management measure. Runoff includes any precipitation that comes into contact with any manure, litter, or bedding. Wastewater is water discharged in the operation of an animal facility as a result of any or all of the following: animal or poultry watering; washing, cleaning, or flushing pens, barns, manure pits, or other animal facilities; washing or spray cooling of animals; and dust control.

Responsible Agencies and Authorities

Hawaii Department of Health (DOH) is the lead agency for implementing this management measure because it implements programs for wastewater management, water pollution control, safe drinking water, sanitation and solid waste management. DOH uses its *Guidelines for Livestock Waste Management* (1996) to require specific best management practices for siting, design, and pollution prevention for confined animal facilities.

The approval to construct and operate a livestock feeding or processing operation and its waste system is obtained through a plan review and approval process conducted by DOH under Chapter 11-62, HAR. Before construction, landowner must submit a site plan, design plan, and pollution prevention plan for review and approval by DOH. Prior to the introduction of livestock, DOH must conduct a site inspection of the completed construction and be satisfied that the facilities, waste systems, and pollution control measures are constructed in accordance with the approved plans and specifications.

Normally, operators of a confined animal facility will work with the local soil and water conservation district (SWCD) to develop a conservation plan for approval by the district. NRCS usually assists in developing conservation plans to treat existing and potential resource problems and has funding available to assist with the installation of best management practices, under the Federal Farm Bill.

The University of Hawaii Cooperative Extension Service (CES) can also provide technical assistance. One of the publications developed under its Farm*A*Syst program is entitled *Minimizing Pollution Risk from Livestock Operations* (HAPPI-Farm 7; December 2000). The four-page publication helps land users assess how their land management practices can impact the quality of both Hawaii's groundwater and surface water bodies. It describes practices to properly locate livestock, manage and store manure, maintain livestock facilities, prepare for emergency action, and minimize waste.

Significant amounts of lands in agriculture are State lands leased to agricultural operators. DLNR's Land Division is responsible for leasing these lands under Chapter 171, HRS. One of these lease conditions is that the operators work with the local soil and water conservation districts to develop and implement a conservation plan. Pursuant to Act 90, SLH 2003, beginning on January 1, 2010, the authority to manage, administer, and exercise control over

any public lands that are designated important agricultural lands pursuant to section 205-44.5, HRS, shall be transferred from DLNR to the State Department of Agriculture (DOA) (Section 171-3(b), HRS). Several leases have already been approved for transfer, which will occur in phases.

Hawaii Department of Health (DOH) has regulatory authority over water pollution control and ensuring safe drinking water (Chapter 342D, HRS; Chapter 340E, HRS; Chapter 342H, HRS; Chapter 11-11, HAR; Chapter 11-21, HAR; Chapter 11-23, HAR; Chapter 11-26, HAR).

Management Practices

NRCS's *Hawaii Field Office Technical Guide* (eFOTG) contains many standards related to confined animal facilities, among them: waste storage facility (313); composting facility (317); waste treatment lagoon (359); waste facility cover (367); roof runoff structure (558); heavy use area protection (561); amendments for treatment of agricultural waste (591); waste treatment (629); solid/liquid waste separation facility (632); waste utilization (633); and manure transfer (634).

C. Nutrient Management Measure

Develop, implement, and periodically update a nutrient management plan to: (1) apply nutrients at rates necessary to achieve realistic crop yields, (2) improve the timing of nutrient application, and (3) use agronomic crop production technology to increase nutrient use efficiency. When the source of the nutrients is other than commercial fertilizer, determine the nutrient value. Determine and credit the nitrogen contribution of any legume crop. Soil and/or plant tissue testing should be used at a suitable interval. Nutrient management plans contain the following core components:

(1) Farm and field maps showing acreage, crops, soils, and waterbodies.
(2) Realistic yield expectations for the crop(s) to be grown, based on achievable yields for the crop. Individual producer constraints and other producer's yields would be considered in determining achievable yields.
(3) A summary of the soil condition and nutrient resources available to the producer, which at a minimum would include:
- **An appropriate mix of soil (pH, P, K) and/or plant tissue testing or historic yield response data for the particular crop;**
- **Nutrient analysis of manure, sludge, mortality compost (birds, pigs, etc.), or effluent (if applicable);**
- **Nitrogen contribution to the soil from legumes grown in the rotation (if applicable); and**
- **Other significant nutrient sources (e.g., irrigation water).**

(4) An evaluation of field limitations based on environmental hazards or concerns, such as:
- **Lava tubes, shallow soils over fractured bedrock, and soils with high leaching or runoff potential,**
- **Distance to surface water,**
- **Highly erodible soils, and**
- **Shallow aquifers.**

(5) Best available information is used in developing recommendations for the appropriate mix of nutrient sources and requirements for the crops.
(6) Identification of timing and application methods for nutrients to: provide nutrients at rates necessary to achieve realistic crop yields; reduce losses to the environment; and avoid applications as much as possible during periods of leaching or runoff.
(7) Methods and practices used to prevent soil erosion or sediment loss.
(8) Provisions for the proper calibration and operation of nutrient application equipment.

Status of Measure: APPROVED

Applicability: This management measure applies to activities associated with the application of nutrients, including both manures and commercial fertilizers, to agricultural lands.

Responsible Agencies and Authorities

Normally, operators of a confined animal facility will work with the local soil and water conservation district (SWCD) to develop a conservation plan for approval by the district. NRCS usually assists in developing conservation plans to treat existing and potential resource

problems and has funding available to assist with the installation of best management practices, under the Federal Farm Bill.

The University of Hawaii Cooperative Extension Service (CES) can also provide technical assistance. Scientists within the University of Hawaii College of Tropical Agriculture and Human Resources (CTAHR), where the CES resides, developed a document entitled *Plant Nutrient Management in Hawaii's Soils: Approaches for Tropical and Subtropical Agriculture* (J.A. Silva and R.S. Uchida, eds., 2000, http://www.ctahr.hawaii.edu/acad/PIO/FreePubs/PlantNutrient.asp) for use by extension agents, NRCS and District personnel, and growers to address issues particular to nutrient management in Hawaii. The chapters are intended to help farmers and technical personnel understand how soil and plant tissue analyses are interpreted to diagnose plant nutrition problems, and how soil management recommendations are developed to prevent or correct those problems. The approach is a scientific one, based on methods and processes used by faculty of CTAHR.

Another publication developed by CTAHR under its Farm*A*Syst program is entitled *Minimizing Pollution Risk from Nutrient Management* (HAPPI-Farm 4; December 2000). The four-page publication provides information on nutrient management for agricultural activities, and helps land users identify the level of risk from current practices and develop an action plan to establish practices that reduce the risks of contamination to surface and ground waters.

Significant amounts of lands in agriculture are State lands leased to agricultural operators. DLNR's Land Division is responsible for leasing these lands under Chapter 171, HRS. One of the requirements of these leases is that the operators work with the local soil and water conservation districts to develop and implement a conservation plan, as a lease condition. Pursuant to Act 90, SLH 2003, beginning on January 1, 2010, the authority to manage, administer, and exercise control over any public lands that are designated important agricultural lands pursuant to section 205-44.5, HRS, shall be transferred from DLNR to the State Department of Agriculture (DOA) (Section 171-3(b), HRS). Several leases have already been approved for transfer, which will occur in phases.

Hawaii Department of Health (DOH) has regulatory authority over water pollution control and ensuring safe drinking water (Chapter 342D, HRS; Chapter 340E, HRS; Chapter 342H, HRS; Chapter 11-21, HAR; Chapter 11-23, HAR).

Management Practices

NRCS's *Hawaii Field Office Technical Guide* (eFOTG) contains a standard related to nutrient management (590), intended to help operators manage the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.

Plant Nutrient Management in Hawaii's Soils: Approaches for Tropical and Subtropical Agriculture (2000) also describes best management practices that can be used to assure proper management of nutrients.

D. Pesticide Management Measure

To eliminate the unnecessary release of pesticides into the environment and to reduce contamination of surface water and ground water from pesticides:

(1) Use integrated pest management strategies where available that minimize chemical uses for pest control.

(2) Manage pesticides efficiently by:

- **(a) calibrating equipment;**
- **(b) using appropriate pesticides for given situation and environment;**
- **(c) using alternative methods of pest control; and**
- **(d) minimizing the movement of pest control agents from target area.**

(3) Use anti-backflow devices on hoses used for filling tank mixtures.

(4) Enhance degradation or retention by increasing organic matter content in the soil or manipulating soil pH.

Status of Measure: APPROVED

Applicability: This management measure applies to activities associated with the application of pesticides to agricultural lands.

Responsible Agencies and Authorities

Under the authority of Chapter 149A, HRS, Department of Agriculture (DOA), Pesticides Branch, is the lead agency for implementing those measures that relate to regulating pesticides. Chapter 4-66, HAR, administered by DOA, relates to the registration, licensing, certification, recordkeeping, usage, and other activities related to the safe and effective use of pesticides. It requires that those who apply or directly supervise others who apply restricted use pesticides be certified. Certification requires some understanding of the environmental concerns of using pesticides. This requirement is implemented under the CES/DOA Pesticide Applicator Program. Certification is not required for those using pesticides that are not classified as "restricted use."

The local soil and water conservation district (SWCD) normally works with an agricultural landowner to develop a conservation plan for approval by the district. An approved conservation plan enables the landowner to be exempted from the county grading ordinances for any earthmoving activities. NRCS usually assists in developing conservation plans to treat existing and potential resource problems and has funding available to assist with the installation of best management practices, under the Federal Farm Bill. NRCS's *Hawaii Field Office Technical Guide* (eFOTG) outlines conservation practice standards for pest management.

Significant amounts of lands in agriculture are State lands leased to agricultural operators. DLNR's Land Division is responsible for leasing these lands under Chapter 171, HRS. One of these lease conditions is that the operators work with the local soil and water conservation districts to develop and implement a conservation plan. Pursuant to Act 90, SLH 2003, beginning on January 1, 2010, the authority to manage, administer, and exercise control over any public lands that are designated important agricultural lands pursuant to section 205-44.5,

HRS, shall be transferred from DLNR to the State Department of Agriculture (DOA) (Section 171-3(b), HRS). Several leases have already been approved for transfer, which will occur in phases.

The University of Hawaii Cooperative Extension Service (CES) can also provide technical assistance. One of the publications developed under its Farm*A*Syst program is entitled *Minimizing Pollution Risk from Pest Management* (HAPPI-Farm 15; December 2000). The six-page publication provides information on pest management planning and proper pesticide use, and promotes the use of integrated pest management. It helps land users assess the water pollution risks from their activities and develop action plans to establish practices that reduce pollution risks.

Hawaii Department of Health (DOH) has regulatory authority over water pollution control and ensuring safe drinking water (Chapter 342D, HRS; Chapter 340E, HRS; Chapter 11-21, HAR; Chapter 11-23, HAR).

Management Practices

NRCS's *Hawaii Field Office Technical Guide* (eFOTG) contains several standards related to pesticides, including pest management (595). This standard outlines practices to utilize environmentally-sensitive prevention, avoidance, monitoring and suppression strategies to manage weeds, insects, diseases, animals and other organisms (including invasive and non-invasive species) that directly or indirectly cause damage or annoyance.

E. Grazing Management Measure

Protect range, pasture and other grazing lands:

(1) By implementing one or more of the following to protect sensitive areas (such as streambanks, wetlands, estuaries, ponds, lake shores, near coastal waters/ shorelines, and riparian zones):
- **(a) Exclude livestock,**
- **(b) Provide stream crossings or hardened watering access for drinking,**
- **(c) Provide alternative drinking water locations,**
- **(d) Locate salt and additional shade, if needed, away from sensitive areas, or**
- **(e) Use improved grazing management (*e.g.*, herding) to reduce the physical disturbance and reduce direct loading of animal waste and sediment caused by livestock; and**

(2) By achieving either of the following on all range, pasture, and other grazing lands not addressed under (1):
- **(a) Implement range and pasture conservation and management practices that apply the progressive planning approach of USDA-NRCS following the standards and specifications contained in the FOTG that achieve an acceptable level of treatment to reduce erosion, and/or**
- **(b) Maintain range, pasture, and other grazing lands in accordance with activity plans established by the Division of Land Management of DLNR, federal agencies managing grazing land, or other designated land management agencies.**

Status of Measure: APPROVED

Applicability: The management measure applies to activities on range, irrigated and non-irrigated pasture, and other grazing lands used by domestic livestock. Range is those lands on which the native vegetation (climax or natural potential plant community) is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing use. Range includes natural grassland, savannas, many wetlands, some deserts, tundra, and certain forb and shrub communities. Pastures are those lands that are primarily used for the production of adapted, domesticated forage plants for livestock. Other grazing lands include woodlands, native pastures, and croplands producing forages.

The major differences between range and pasture are the kind of vegetation and level of management that each land area receives. In most cases, range supports native vegetation that is extensively managed through the control of livestock rather than by agronomy practices, such as fertilization, mowing, irrigation, etc. Range also includes areas that have been seeded with introduced species, but which are extensively managed like native range. Pastures are represented by those lands that have been seeded, usually with introduced species or in some cases with native plants, and which are intensively managed using agronomy practices and control of livestock.

The intent of the management measure is to protect surface and ground water quality. Some waterbodies, such as farm ponds, have been created to water livestock. Protecting the water quality of these artificial water storage areas does not have the same priority as protecting natural streams and waterbodies.

Responsible Agencies and Authorities

Normally, agricultural operators will work with the local soil and water conservation district (SWCD) to develop a conservation plan for approval by the district. NRCS usually assists in developing conservation plans to treat existing and potential resource problems and has funding available to assist with the installation of best management practices, under the Federal Farm Bill. NRCS's *Hawaii Field Office Technical Guide* (eFOTG) outlines conservation practice standards and specifications for grazing management.

Significant amounts of lands in agriculture are State lands leased to agricultural operators. DLNR's Land Division is responsible for leasing these lands under Chapter 171, HRS. One of the requirements of these leases is that the operators work with the local soil and water conservation districts to develop and implement a conservation plan, as a lease condition. Pursuant to Act 90, SLH 2003, beginning on January 1, 2010, the authority to manage, administer, and exercise control over any public lands that are designated important agricultural lands pursuant to section 205-44.5, HRS, shall be transferred from DLNR to the State Department of Agriculture (DOA) (Section 171-3(b), HRS). Several leases have already been approved for transfer, which will occur in phases.

The University of Hawaii Cooperative Extension Service (CES) can also provide technical assistance. A couple of the publications developed under its Farm*A*Syst program are entitled *Minimizing Pollution Risk from Pasture Management* (HAPPI-Farm 8; December 2000) and *Minimizing Pollution Risk from Livestock Operations* (HAPPI-Farm 7; December 2000). These

publications provide information on how land users can reduce the risk of nonpoint source pollution from pastures and livestock.

Hawaii Department of Health (DOH) has regulatory authority over water pollution control (Chapter 342D, HRS).

Management Practices

Of particular interest to the implementation of this management measure is NRCS's standard and specifications for Prescribed Grazing (528). This specification provides guidance for developing a grazing plan that conforms to all applicable federal, state, and local laws. It seeks measures to avoid adverse effects to endangered, threatened, and candidate species and their habitats; and identifies periods of grazing, resting, and other treatment activities for each management unit. It also recommends developing a (1) contingency plan that details potential problems (*e.g.*, severe drought, flooding, wildfire) and serves as a guide for adjusting the grazing prescription to ensure resource management and economic feasibility without resource degradation and (2) monitoring plan with appropriate records to assess whether the grazing strategy is meeting objectives.

F. Irrigation Water Management Measure

To reduce nonpoint source pollution of surface waters caused by irrigation:

(1) Operate the irrigation system so that the timing and amount of irrigation water applied match crop water needs. This will require, as a minimum: (a) the measurement of soil-water depletion volume and the volume of irrigation water applied; (b) uniform application of water; and (c) application rate which does not exceed infiltration rate in the field.

(2) When chemigation is used, include backflow preventers for wells, minimize the harmful amounts of chemigated waters that discharge from the edge of the field, and control deep percolation. In cases where chemigation is performed with furrow irrigation systems, a tailwater management system may be needed.

The following limitations and special conditions apply:

(1) In some locations, irrigation return flows are subject to other water rights or are required to maintain stream flow. In these special cases, on-site reuse could be precluded and would not be considered part of the management measure for such locations.

(2) By increasing the water use efficiency, the discharge volume from the system will usually be reduced. While the total pollutant load may be reduced somewhat, there is the potential for an increase in the concentration of pollutants in the discharge. In these special cases, where living resources or human health may be adversely affected and where other management measures (nutrients and pesticides) do not reduce concentrations in the discharge, increasing water use efficiency would not be considered part of the management measure.

(3) The time interval between the order for and the delivery of irrigation water to the farm may limit the irrigator's ability to achieve the maximum on-farm application efficiencies that are otherwise possible.

(4) In some locations, leaching is necessary to control salt in the soil profile. Leaching for salt control should be limited to the leaching requirement for the root zone.

(5) Where leakage from delivery systems or return flows supports wetlands or wildlife refuges, it may be preferable to modify the system to achieve a high level of efficiency and then divert the "saved water" to the wetland or wildlife refuge. This will improve the quality of water delivered to wetlands or wildlife refuges by preventing the introduction of pollutants from irrigated lands to such diverted water.

(6) In some locations, sprinkler irrigation is used for crop cooling or other benefits (*e.g.*, watercress). In these special cases, applications should be limited to the amount necessary for crop protection, and applied water should not contribute to erosion or pollution.

Status of Measure: APPROVED

Applicability: This management measure applies to activities on irrigated lands, including agricultural crop and pasture land (except for isolated fields of less than 10 acres in size that are not contiguous to other irrigated lands); orchard land; specialty cropland; and nursery cropland. Those land users already practicing effective irrigation management in conformity with the irrigation water management measure may not need to purchase additional devices to measure soil-water depletion or the volume of irrigation water applied, and may not need to expend additional labor resources to manage the irrigation system.

Responsible Agencies and Authorities

Hawaii Department of Health (DOH) is the lead agency for implementing this management measure because it implements programs for water pollution control and safe drinking water. Chapter 11-21, HAR, Cross-Connection and Back-Flow Control, administered by DOH, requires that a reduced pressure principal back-flow preventer or air gap separation be installed as part of any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system (§11-21-7(a)(4), HAR).

The local soil and water conservation district (SWCD) normally works with an agricultural landowner to develop a conservation plan for approval by the district. An approved conservation plan enables the landowner to be exempted from the county grading ordinances for any earthmoving activities. NRCS usually assists in developing conservation plans to treat existing and potential resource problems and has funding available to assist with the installation of best management practices, under the Federal Farm Bill. NRCS's *Hawaii Field Office Technical Guide* (eFOTG) outlines conservation practice standards for irrigation.

Significant amounts of lands in agriculture are State lands leased to agricultural operators. DLNR's Land Division is responsible for leasing these lands under Chapter 171, HRS. One of the requirements of these leases is that the operators work with the local soil and water conservation districts to develop and implement a conservation plan, as a lease condition. Pursuant to Act 90, SLH 2003, beginning on January 1, 2010, the authority to manage, administer, and exercise control over any public lands that are designated important agricultural lands pursuant to section 205-44.5, HRS, shall be transferred from DLNR to the State Department of Agriculture (DOA) (Section 171-3(b), HRS). Several leases have already been approved for transfer, which will occur in phases.

The University of Hawaii Cooperative Extension Service (CES) can also provide technical assistance. One of the publications developed under its Farm*A*Syst program is entitled *Minimizing Pollution Risk from Irrigation Management* (HAPPI-Farm 6; December 2000). The four-page publication helps land users assess the water pollution risks associated with their irrigation practices and develop action plans to reduce those risks.

Hawaii Department of Health (DOH) has regulatory authority over water pollution control (Chapter 342D, HRS; Chapter 340E, HRS; Chapter 11-23, HAR).

Management Practices

NRCS's *Hawaii Field Office Technical Guide* (eFOTG) contains many standards related to irrigation water management, among them: irrigation water conveyance, high pressure (430DD); irrigation water conveyance, low pressure (430EE); irrigation water conveyance, steel pipeline (430FF); irrigation storage reservoir (436); irrigation system, micro-irrigation (441); irrigation system, sprinkler (442); irrigation system, surface and subsurface (443); irrigation water management (449); irrigation land leveling (464); irrigation regulating reservoirs (552); spring development (574); structure for water control (587); and water harvesting catchment (636).

APPENDIX G

Aquifer Identification and Classification

Aquifer identification and classification.

In response to the need to identify and describe aquifers for each island to serve as a framework for ground water protection strategy, a program was initiated to classify and assign codes to the principal aquifers of the State. A fundamental objective of the ground water protection strategy is to classify aquifers according to hydrogeologic parameters, ground water by quality characteristics relative to beneficial uses and ground water vulnerability to contamination. The following University of Hawaii, Water Resources Research Center technical reports were published for this program:

No. 179, Oahu
No. 185, Maui
No. 186, Kauai
No. 187, Molokai
No. 190, Lanai
No. 191, Hawaii

APPENDIX H

Government Agencies

Government Agencies

Hawaii Association of Conservation Districts (HACD).

The HACD is an organization of soil and water conservation districts in the State of Hawaii. The HACD pools district experience and develops state policies on a continuing basis. The soil and water conservation districts are legally constituted subdivisions and self-governing units of the Hawaii State government. They are organized under Chapter 180, Hawaii Revised Statutes (HRS).

There are 16 districts in Hawaii. Their primary function is to conduct soil and water conservation activities, including non-point source pollution control. The conservation districts promote the conservation, wise use and orderly development of the land, water and natural resources of the State.

Department of Agriculture (DOA)

The DOA understands that animal waste regulations must be relevant to Hawaii's environmental situation. The unique character of our island state places the livestock industry almost entirely within the CZM and to a large extent the ground water protection areas, which compounds Hawaii's problems.

The DOA seeks compliance. However, these guidelines proposals should be economically feasible and realistic to our conditions. Moreover with the high cost of feed, land and operation, Hawaii's farmers can least afford to be over-regulated. Hence, we should design our regulations to conform to the unique character of our land.
The DOA's position is that changes made must ensure a viable livestock industry while not affecting the health and welfare of the people of our state.

Department of Health, Environment Management Division (DOH).

The mission of the DOH is to provide leadership to monitor, protect and enhance the health and environmental well-being of all the people of Hawaii. The DOH-EMD is responsible for Federal programs to implement the Clean Air Act, Clean Water Act, Safe Drinking Water Act and Resource Conservation and Recovery Act, State programs to enforce Hawaii Revised Statutes and implementing and maintaining the statewide programs for Air Pollution Control, Water Pollution Control, Safe Drinking Water, Solid Waste Management and Wastewater Management.

Hawaii Farm Bureau Federation (HFBF)

The purposes for which the HFBF is formed are:

1. To work for the solution of the problems of the farm, the farm home and the rural community by use of the recognized advantages of organized action, to the end

that those engaged in various branches of agriculture may have the opportunity for happiness and prosperity in their chosen work.

2. To represent, protect and advance the social, economic and educational interests of the farmers of Hawaii.

The University of Hawaii Cooperative Extension Service (CES).

The CES is the organized extension unit of the College of Tropical Agriculture and Human Resources at the University of Hawaii-Manoa campus, the seat for the land grant mission of the state. The mission of the CES is to provide educational programs on all aspects of agricultural systems and on the use of related physical and human resources in the communities which it serves.

Regarding confined livestock feeding operations and waste management systems, the CES can assist ranchers and farmers by acquiring, disseminating and applying useful and practical research generated knowledge in tropical agricultural systems. The CES can also facilitate public policy through its link with the land-grant colleges and interagency collaborations.

USDA Consolidated Farm Service Agency (CFSA).

State and County CFSA offices serve as focal points for the administration of the Agricultural Conservation Program (ACP). The ACP is designed to: help prevent soil erosion and water pollution; protect and improve productive farm and ranch lands; conserve water used for agriculture; preserve and develop wildlife habitat and encourage energy conservation measures. It is a joint effort by agriculture producers, Federal and State agencies and other groups to restore and protect the Nation's agricultural land and water resources and preserve the environment. Cost-sharing is provided to farmers and ranchers to encourage the carrying out of approved conservation and environmental protection practices on agricultural land that will result in long-term public benefits. Farmers or ranchers may also enter into pooling agreements to cooperatively solve mutual conservation problems. The Federal Government may share up to 755 of the cost to install practices under the annual agreements or up to 80% for certain low-income producers.

USDA National Resources Conservation Service (NRCS)

The NRCS helps individuals, groups, organization, cities and towns and county and state governments reduce the costly waste of land and water resources and put these national assets to good use. The guiding principle is the use and conservation treatment of the land in harmony with its capabilities and needs.

The NRCS mission covers three major areas: a) soil and water conservation, b) natural resource surveys and c) community resource protection and management. To carry out its mission, the NRCS has a nationwide network of conservation specialists to help people understand and protect the land and water resources while they use them beneficially. The NRCS-Hawaii, with field offices in each county, provides technical assistance through the conservation districts in

the planning and designing of animal waste management facilities and systems.

US Environmental Protection Agency (USEPA)

EPA leads the nation's environmental science, research, education, and assessment efforts. The mission of the Environmental Protection Agency is to protect human health and the environment. Since 1970, EPA has been working for a cleaner, healthier environment for the American people.

APPENDIX I

Definitions

Definitions
The definitions listed below are for these guidelines only. These definitions are from various sources and are not intended to be used to interpret other documents, regulations, or otherwise. Should the reader require further clarification of the definitions as they apply to these guidelines, they should contact the Department of Health.

"Animal Feeding Operation (AFO)" means a lot, facility or pursuit conducted on land zoned by the county for the commercial agricultural production of livestock or livestock products where the following conditions are met:

a) Animals (other than aquatic animals) have been, are or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period;
b) Crops, vegetation, forage growth or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility and
c) Two or more animal feeding operations under common ownership are considered, for the purpose of these regulations, to be a single animal feeding operation if they adjoin each other or if they use a common area or system for the disposal of wastes.

"Agronomic rates" means the applications of nutrients (nitrogen and phosphorus), from all sources, to meet the estimated nutrient requirements of the crop being produced based on past or projected yields. In determining the agronomic rate, the applicant shall consider the nutrient content of the livestock waste, available nitrogen and phosphorus in the soil and if applicable, the nitrogen content of the irrigation water and the amount of nitrogen and phosphorus from commercial fertilizer.

"Aquifer" means a geological formation, group of formations or part of a formation that is capable of yielding a significant amount of water to a well, tunnel or spring.

"Back-flow" means the flow of water or other liquids, mixtures or substances into the distribution pipes of a potable supply of water from any source or sources other than its intended source.

"Chronic" means marked by long duration or frequent recurrence.

"Clean Water Act" means Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq., Public Law 92-500, enacted by the congress, October 18, 1972, as amended by Public Law 93-217, enacted December 27, 1977, as amended.

"Concentrated Animal Feeding Operation (CAFO)" means an "animal feeding operation" which meets the criteria in 40 CFR 122, Appendix B, or which the director designated under 40 CFR 122.23(c).

"Critical Water Disposal Area (CWDA) maps" means the maps indicating the boundaries of the critical disposal wastewater areas established pursuant to Hawaii Administrative Rules (HAR) Section 11-62-05(a) and dated March 16, 1990.

"Director" means the director of health or the director's duly authorized agent.

"Discharge" means any addition of any pollutant or combination of pollutants to the state waters. This includes:

a. runoff from corrals, stock piled manure, or silage piles;
b. overflow from storage ponds and animal watering systems which are contaminated by manure; and
c. overflow from irrigated fields in which wastewater is applied at greater than the agronomic rate.

"Effluent" means any substance including but not limited to, sewage, waste, garbage, feculent matter, offal, filth, refuse, any animal, mineral or vegetable matter or substance and any liquid, gaseous or solid substance.

"Established date of operation" means the date on which the livestock operation commenced operations. If the livestock operation's facilities, whether land or improvements, are subsequently expanded, the date of commencement of the expansion shall be a separate and independent established date of operation. The commencement of any expansion of an operation shall not divest the operation of a previously established date of operation.

"Existing livestock operation" means any livestock facility or waste system construction or operation approved prior to the effective date of this guideline.

"Expansion" means the increase in land used by the animal feeding operation or any increase in buildings, equipment that is fixed in place, or other permanent structures. Expansion does not include a change or addition to the type of livestock provided such change or addition exhibits the use of reasonable care.

"Feedlot" means an animal feeding operation in the following subcategories: Beef cattle – open lots; beef cattle – housed lots; dairy cattle – stall barn (with milk room); dairy – freestall barn (with milking center); dairy – cow yards (with milking center); swine – open dirt or pasture lots; swine – housed, slotted floor; swine- solid concrete floor, open or housed lots; horses – stables (race tracks); chickens – broilers, housed; chickens – layers (egg production), housed; chickens – layers breeding or replacement stock, housed.

"Feedlot run-off" means contaminated liquid flowing from any animal feeding operation caused by precipitation or other water sources falling on, passing over, across or through an animal feeding operation or otherwise coming into direct contact with the animals confined in an animal feeding operation.

"Formation" means a body of rock characterized by a degree of lithologic homogeneity or similarity which is prevailingly, by not necessarily, tabular and is mappable on the earth's surface of traceable in the subsurface.

"Ground water" means water below the land surface in a zone of saturation.

“Holding pond” (may also be known as an oxidation pond or lagoon) means any excavated, diked or walled structure or combination of structures designed for the interception and temporary storage of feedlot run-off or process-generated wastewater.

“Holding tank” means a non-portable, watertight closed vault to temporarily hold wastewater.

“Impermeable” means a not permitting significant passage of fluids under the usual pressure differences found in constructed livestock feedlot facilities and waste system.

“Lagoon” means any excavated, diked or walled structure or combination of structures designed for biological stabilization and storage of livestock waste and process-generated wastewater.

“Land application area” means land under the control of an AFO owner or operator, whether it is owned, rented or leased to which manure, litter or processed wastewater from the production area is or may be applied.

“Leachate” means fluids containing materials removed from livestock waste.

“Livestock” means animals kept or raised for use or profit to include the fowl, sheep, goat, cattle, swine, horse and other commercially-produced animals.

“Livestock facility” means any animal feeding operation, feedlot, livestock shelter, feed storage and preparation area, shelter, on-farm milking and accompanying milk-handling area.

“Livestock operation” see “animal feeding operation”.

“Livestock shelter” means any covered or open structure, including but not limited to livestock house, barns or lots in which livestock are confined at any time.

“Manmade ditch” means a discrete fissure or channel excavated in the earth for the purpose of transporting livestock waste. This is not be confused with a vegetative filter or acceptable disposal area which is a treatment device or system and may take the form of a man-made terrace or grassed waterway system.

“Manure” means manure, bedding, compost and raw materials or other materials commingled with manure or set aside for disposal.

“Manure storage structure” means any permanent area or structure used for stacking, storing or containing of livestock waste.

“Modification” means any addition or alteration to the approved operational or structural plan(s) of any livestock production or processing facility and its waste system which can ultimately have an impact to either groundwater or surface water resources.

“New Livestock management/waste-handling facility” mans any livestock management or

livestock waste-handling facility that is constructed or modified commencing on or after the effective date of this guideline.

"NPDES" means the National Pollution Discharge Elimination System for issuing, establishing conditions for and denying permits under Section 402 of the Clean Water Act. All terms used in connection with NPDES which have been defined in the CWA or regulations adopted thereunder shall have the meanings specified therein, unless specifically noted otherwise.

"NPDES permit" means a permit issued pursuant to the NPDES program.

"Owner" means any person who own, leases, controls or supervises a livestock facility or waste system.

"Person" means any individual, partnership, co-partnership, firm, company, trust, estate, political subdivision, state agency or any other legal entity or their legal representative, agent or assigns (as the same meaning as defined in section 342D-1, HRS).

"Pest management" means the utilization of a coordinated multiple control approach to secure the precision control of vectors, which includes but is not limited to a combination of chemical, biological, physical, mechanical and environmental control measures.

"Pet" means a domesticated animal that is kept for amusement, enjoyment, and/or pleasure.

"Process wastewater" means water directly or indirectly use in the operation of the AFO for any or all of the following: spillage or overflow from animal or poultry watering systems; washing, cleaning or flushing pens, barns, manure pits, or other AFO facilities; direct contact swimming, washing or spray cooling of animals; or dust control. Process wastewater also includes any water which comes into contact with any raw materials, products or byproducts including manure, litter, feed, milk, eggs or bedding.

"Production areas" means that part of an AFO that includes the animals confinement area, the manure storage area, the raw materials storage area and the waste containment area. The animal confinement area includes but not limited to open lots, housed lots, feedlots, confinement houses, stall barns, freestall barns, milk rooms, milking centers, cowyards, barnyards, medication pens, walkers, animal walkways and stables. The manure storage area includes but not limited to lagoons, runoff ponds, storage sheds, stockpiles, under house or storage runoff ponds, storage sheds, stockpiles, under house or storage pit, liquid impoundments, static piles and composting piles. The raw materials storage area includes but is not limited to feed silos, silage bunkers, and bedding materials. The waste containment area includes but not limited to settling basins and areas within berms and diversions which separate uncontaminated storm water. Also included in the definition of production area is any egg washing or egg processing facility and any area used in the storage, handling, treatment or disposal of mortalities.

"Putrescible waste" means those waste materials of organic origin capable of breeding, harboring or serving as nutrient sources for vectors.

"Solids" means livestock excreta or matter containing both particulate and dissolved organic and inorganic solids which does not contain excessive moisture. A "funnel" test should not result in the drainage of liquid from the manure mass.

"Sludge" means animal excreta or matter there from derived with contain dissolved and particulate organic and inorganic solids that have a characteristic of fluid.

"Standard of Performance" means a standard for the control of the discharge of pollutants which reflects the greatest degree of effluent reduction which the director determines to be achievable through application of the best demonstrated control technology, processes, operating methods or other alternatives, including, where practicable, a standard permitting no discharge of pollutants.

"State waters" means all waters, fresh, brackish, or salt, around and within the State, including, but not limited to, coastal waters, streams, rivers, drainage ditches, ponds, reservoirs, canals, ground waters, and lakes; provided that drainage ditches, ponds, and reservoirs required as a part of a water pollution control system are excluded.

"Vector" means an organism, usually an insect or other arthropod, rodent or other animal, capable of transmitting the causative agents of diseases or affecting public health and well-being.

"Wastewater" means any liquid waste, whether treated or untreated and whether animal, mineral or vegetable including agricultural, industrial and thermal waste.

"Waste system" means individually or collectively, those constructions or devices, except sewers, used to collect, store, treat, transfer, dispose, recover or agriculturally-utilized livestock waster or livestock processing waste. Such a facility includes acceptable disposal areas, such as pasture or other suitable agricultural land in active production, which can serve as an adequate filtering device to settle out and/or assimilate pollutants from livestock and livestock processing waste.

"Water pollutant" means dredged soils, solid refuse, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical waste, biological materials, radioactive materials, heat wrecked or discarded equipment, rock, sand, soil, sediment, cellar dirt and industrial, municipal and agricultural waste.

"Water pollution" means such alteration of the physical, thermal, chemical, biological or radioactive properties of any waters of the State, or such discharge of any contamination into any waters of the State, as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to public health, safety or welfare or to domestic, commercial, industrial, agricultural, recreational or other legitimate uses or to humans, livestock, wild animals, birds or fish or other aquatic life.

APPENDIX J

References

References

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